Environment Management Plan

Imperial 2019 Drilling Program
NT Exploration Permit (EP) 187

This document has been prepared for Imperial Oil & Gas by:

InGauge Energy Australia
E: admin@ingauge.co
ABN: 51 164 429 190

EXECUTIVE SUMMARY

Introduction

Imperial Oil & Gas is the operator of Exploration Permit (EP) 187 which is located approximately 85 km south-west of Borroloola within the Carpentaria and Macarthur Basin in the Northern Territory (Figure E-1). EP187 is situated in the upper reaches of the McArthur River, lies to the west of the Tablelands Highway, and is crossed east to west by the Carpentaria Highway.

Imperial is proposing an exploratory 40 day drilling campaign commencing in quarter 4 – 2019 in order to increase its understanding of the future potential development of EP187. Therefore, under the Petroleum (Environment) Regulations (The Regulations), Imperial Oil & Gas is obliged to prepare and submit an Environmental Management Plan (EMP) covering all the proposed activities.

The drilling program considered as part of this EMP will not involve any fracture stimulation activities. Any future consideration of hydraulic fracturing would form part of a completely separate EMP process.

Description of the Activity.

This project involves the drilling of up to two wells on two separate locations within EP187 for Imperial Oil & Gas. The drilling of these wells follows the acquisition of seismic survey data which will be used to confirm our understanding of stratigraphy and to confirm the drilling location. This seismic survey is the subject of a separate EMP.

Whilst there is a preferred location for the first well, the location may need to change subject to the seismic data being received. To address the uncertainty around the seismic results and the impact on well location, in addition to the one preferred location (SL-4) an additional 4 alternative locations have been reviewed and incorporated in to this EMP, as optional drilling locations, if the preferred location is not acceptable. The alternative locations are titled SL-4 Alt 1, Alt 2, Alt 3 and Alt 4. Only one of the proposed drilling locations for this well will be cleared and used for this well. The other optional locations will be left in their current condition, with no clearing or other work carried out on them.
The intention is that once the seismic results have been reviewed, then the location of the first well will be confirmed and civils work can commence. The second well will be drilled on location SL-3. This well is contingent on project timing, to ensure that drilling of both SL-4 and SL-3 can be completed before the wet season. Both of the new wellpad locations require access tracks that will come from the Carpentaria Highway, the access track for SL-3 is new disturbance, the access track to SL-4 is mainly along the recent seismic track alignment but deviates for ~2km to avoid Gilgai country. The total disturbance for the activities under this EMP is 14Ha.

The proposed Drill Sites, access tracks, Camp Location and Existing Roads are presented in Figure E-2.

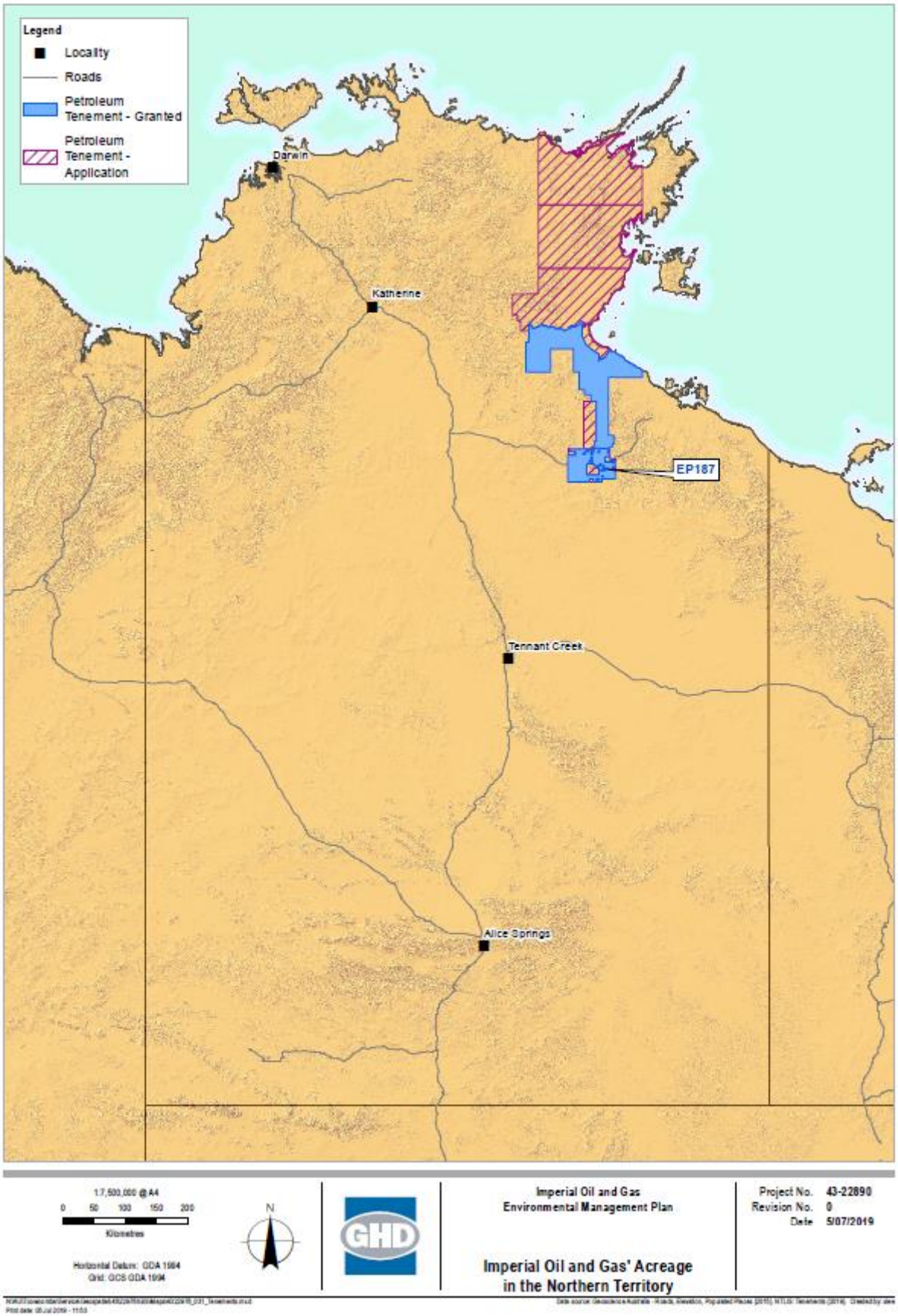


Figure E-1. Imperial 's Oil & Gas Acreage in the NT



Figure E-2. Proposed Drill Site (SL-4 preferred location), Camp Location and Existing Roads.

Existing Environment

The proposed activities are located between two bioregions, The Sturt Plateau and the Gulf Fall and Uplands Bioregion. Plateaus, sandstone outcrops and undulating plains outline the landscape. The vegetation is comprised in majority by open forests and woodlands dominated by Darwin Stringybark (E. tetrodonta). There are also patches of monsoon forest scattered throughout the woodlands, particularly where there are permanent springs. The climate of the project area is described as a tropical savannah climate within the humid Zone with a distinct wet and dry season which can experience an average rainfall of between 600 – 800mm per year over the summer wet. The seasonal contrast between the wet and the dry has significant implications for water resources. The summer monsoon season brings rain and cyclones and during this period the project area can experiences significant rainfall events. The main ground water resource in the region is the Cambrian Limestone Aquifer (CLA).

There are 13 threatened species listed as potentially occurring within the project area, which includes a range of birds, mammals and reptiles. There are seven migratory species which are moderately likely to occur within the study area and 15 weed species identified in the bioregion. As part of the initial investigation activities, Imperial Oil & Gas conducted a pre and post 2018/19 wet season weed survey over the area in conjunction with a Senior Weeds Officer of the Department Environment Natural Resources (DENR). Following this joint survey, a comprehensive weed management plan has been developed. No protected areas or places with historical or cultural significance were found to be within a 50km radius of the project area.

The environmental values and/or sensitivities with the potential to occur in the vicinity of the project area are provided in Table E-1 below.

Table E-1: Summary of Environmental Values and Sensitivities

Area	Environmental Factors	Environmental Values and Sensitivities	Summary
Land	Terrestrial Flora and Fauna	Sensitive or significant vegetation	Fox & Co, 2019 recorded riparian vegetation in the study area, present as predominantly sparse woodland.
		Groundwater dependent ecosystems	There is low potential for terrestrial GDEs and aquatic GDEs in the Project Area (BoM, 2019)
		Threatened fauna species and their habitat	The EPBC PMST identified 13 threatened species that have the potential to occur in the Project Area. Of these, the Gouldian Finch have a high potential to occur but a low risk to be impacted and Yellow-Spotted Monitor has a moderate likelihood of occurrence.
		Listed migratory species	The EPBC listed 15 migratory species that were potentially occurring in the Project Area. They are all scored a low potential to occur.
		Listed threatened flora species and ecological communities	There are no Threatened Ecological Communities (TECs) or threatened flora listed under the EPBC Act and/or TPWC Act known to occur within the 50km of the Project Area.

Area	Environmental Factors	Environmental Values and Sensitivities	Summary
Water	Terrestrial Environmental Quality	Soils	The Project Area lies within a region of soils that are considered to be in their second cycle of erosion which has produced infertile soils with a near neutral reaction. These 'soils' are akin to alluvial soils in that they show no profile development.
	Inland water environmental quality	Groundwater	The Chambers River Formation and Cambrian Limestone provide regional scale aquifers for groundwater resources available for pastoral enterprises, domestic bores at homesteads and town water supplies several communities across the region.
		Surface water	The McArthur River is the primary water drain of the exploration area. This water course drains the whole area into the Gulf of Carpentaria. The Glyde is the main tributary to the McArthur River and lies to the east of the study area.
	Hydrological processes	Supply and quantity of water	The study area is part of the Gulf Fall and Uplands region and part of the catchment of the McArthur River and its tributaries. The McArthur River and its major tributary the Glyde River drain a significant portion of the Barkly tablelands and the low-lying country of the Southern McArthur Basin. The geology of this region does influence the drainage system and provides an extensive network of ephemeral creeks and streams.
Air	Air Quality and Greenhouse Gases	Air quality conducive to suitability for the life, health and wellbeing of humans and ecosystems	The Beetaloo Basin methane baseline monitoring program conducted by the CSIRO in 2018 is applicable across the operational area of EP187. No significant impact or risks anticipated
People and Communities	Social, economic and cultural surroundings	Cultural heritage, sacred sites.	An AAPA Authority Certificate has been applied for the activities covered under this EMP and will be provided to DPIR once received. An extensive anthropological survey of the land area was conducted in May 2015 by the Anthropology Division of the Northern Land Council (NLC) in conjunction with the Traditional Owners of the land prior to grant of the tenement (Appendix 16).
	Human Health	People and communities	There are a number of pastoral properties with livestock and infrastructure in the vicinity or the Tenement. The nearest property is OT Downs Homestead located approximately 20km North-West of the proposed area.

Environmental Impacts and Environmental Risks of the activity

An environmental risk assessment was undertaken. A summary of the Environmental Factors and key risks are given below in Table E-2.

Table E-2. Summary of the Environmental Factors and key risks

Aspect	Risk Impacts
Air quality	• Dust emissions from vehicle movements in unsealed roads, • Excessive exhaust emissions, fugitive emissions from well, Drilling activities • Reduction of air quality and climate – Increased in dust particles (increased greenhouse gas emissions) • Flora stress and/or dieback due to dust covering of foliage by civil works
Land	• Disruption on landform and soils from erosion and sediment control failure • Change in natural waterways and drainage channels • Loss of soil productivity due to rehabilitation failure and poor topsoil management • Soil contamination from poor waste and chemical management • Impact on flora, fauna and loss of habitat due to civil works, or vehicle strikes • Bushfire due to drilling activities • Introduction and spread of weeds due to vehicle movements
Groundwater	• Impact to groundwater quality and groundwater dependent ecosystems due to well integrity failure
Surface water	• Impact to hydrological systems due to chemical spills, lack of appropriate bunding and poor fuel, oil and chemical handling. • Contamination of water bodies due to storage (tank/vessels) failure • Impact to surface water due to inappropriate management of waste
People and community	• Road users, landholders discontent due to loss of visual amenity • Increased potential for accidents and damage to infrastructure due to vehicle movements • Land biodiversity impact due to heavy machinery movements • Increased intensity of flooding from land clearing and drilling activities • Noise and vibration due to vehicles movements, civil works and drilling activities • Light pollution due to artificial lighting required for safe operations • Impact to onsite indigenous heritage site not previously identified • Disturbance to heritage sites due to works conducted out of the approved areas

An acceptable risk has been achieved by the implementation of control measures that allowed all risk to be reduced to ALARP.

Stakeholder Engagement

Imperial Oil & Gas has established and continues to maintain enduring and mutually beneficial relationships with the stakeholder groups. Imperial endeavours to generate positive economic and social benefits for and in partnership with the communities.
The key relevant stakeholder groups include:

- Community,
- Landholders,
- Traditional Owners and Aboriginal People,
- Northern Territory Government departments and statutory authorities including AAPA,
- Pipeline operators,
- Other land users.

Imperial Oil & Gas maintain a record of all past and future interactions and communications with stakeholders and affected parties for the project.

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2. Traffic Management Plan
3. Spill Management Plan
4. Full groundwater survey including appendixes
5. Cultural Induction Program
6. Safety Management Plan
7. Anthropological Report

ABBREVIATION AND UNITS

Abbreviation – Acronym & Units	Description
AAPA	Aboriginal Areas Protection Authority
ALRA	Aboriginal Land Rights Act
ALARP	As low as reasonably practicable
AAPEA	Australian Petroleum Production and Exploration Association
BoM	Bureau of Meteorology
CEO	Chief Executive Officer
CLA	Cambrian Limestone Aquifer
cm	Centimetres
Code (COP)	Code of practice
DD	Data Deficient
DENR	Department of Environment and Natural Resources
DFIT	Diagnostic Fracture Injection Test
DoEE	Department of the Environment and Energy
DLPE	Department of Lands, Planning and the Environment
DPIR	Department of Primary Industry and Resources
EMP	Environment Management Plan
EP	Exploration Permit
EPA	Environment Protection Authority (NT)
EPBC Act	Environment Protection and Biodiversity Conservation Act
ERA	Environmental Risk Assessment
ERS	Erosion and Sediment Control
ESD	Ecologically Sustainable Development
EVNT	Endangered, Vulnerable or Near Threatened
GDE	Groundwater Dependent Ecosystems
GIS	Geographic Information System
HSEMS	Health Safety Environment Management System
ITV	Intention to Visit
kg	Kilograms
LACA	Land Access and Compensation Agreement

Abbreviation – Acronym & Units	Description
LAG	Local Aboriginal Groups
LCP	Land Clearing Permit
LoR	Level of Reporting
lt	Litres
m	Metres
mm	Millimetres
ML	Megalitres
MNES	Matters of National Environment Significance
NARFI	North Australia Fire Information website
NEPM	National Environment Protection Measure
NGERS	National Greenhouse Energy Reporting Scheme
NLC	Northern Land Council
NT	Northern Territory
NT NRM	Northern Territory Natural Resource Management
NVIS	National Vegetation Information System
PM	Project Manager
PMST	Protected Matters Search Tool
PPE	Personal Protection Equipment
SC	Site Coordinator
TAO	Traditional Aboriginal Owners
TEC	Threatened Ecological Communities
TPWC	Territory Parks and Wildlife Conservation Act
TVD	True Vertical Depth
WBIV	Well Barrier Integrity Validation
WMP	Weed Management Plan
WWMP	Wastewater Management Plan

REVISION HISTORY

Revision #	Revision Date	Revision Details	Author(s)
Rev A	12/07/2019	Informal submission to DENR	InGauge
Rev B	18/07/2019	Internal update to reflect first comments	InGauge
Reb C	23/07/2019	Pre-submission to DENR	InGauge
Rev D	07/08/2019	Internal update to reflect comments	InGauge
Rev 0	19/08/2019	Pre- Formal submission to DENR	inGauge
Rev 1	22/08/2019	Formal submission to DENR	inGauge

APPROVALS

Role	Position	Date
Author(s)	Environmental Engineer	22/08/2019
Reviewed by	Project Manager	22/08/2019
Reviewed by	Principal Engineer	22/08/2019
Approved by	Alex Underwood - CEO	22/08/2019

CONTRIBUTORS

For the development of this EMP, Imperial has used various professional organisations and individuals to provide technical information, proposed mitigations and compile this document on behalf of the project. Imperial would like to acknowledge the contribution of the following organisations:

1 Introduction

1.1 Background and Purpose

Imperial Oil & Gas Pty Limited ("Imperial") is the operator and 100% owner of Exploration Permit (EP) 187 which is located approximately 85 km south-west of Borroloola within the Carpentaria and Macarthur Basin in the Northern Territory (Figure 1). EP187 is situated in the upper reaches of the McArthur River, and lies to the west of the Tablelands Highway, and is crossed east to west by the Carpentaria Highway.

Imperial is proposing an exploratory drilling campaign program commencing in quarter 4 2019 that is covered by this EMP. Imperial may request approval to undertake additional exploration activities following the completion of the activities covered under this EMP. The purpose of this exploration and appraisal activity is to increase our understanding of the future development potential of EP 187.

Imperial is committed to undertake site activities in a manner that minimises and controls the impact on the environment, including potential impacts to Traditional Owners and pastoral lessees. To meet this program, the exploration and supporting activities in 2019 include:

- Civil engineering– upgrading and/or creation of new access tracks, lease pads,
- Exploration drilling – vertical.
- Well evaluation – including wireline logging, logging while drilling formation testing, core acquisition, fluid sampling, open-hole formation integrity testing and other standard evaluation techniques as appropriate
- Cased hole DFIT (DFIT will be performed once well integrity has been checked off by DPIR via the WBIV report),
- Inflow and production testing,
- Environmental monitoring,
- Well suspension and/or well decommissioning, and
- Ongoing site and well maintenance and monitoring, including work-over and re-entry, and evaluation as required

Not all activities listed above will be the subject of this EMP and the Scope of this EMP is described in section 1.2 below.

We confirm that the drilling program considered as part of this EMP will not involve any fracture stimulation activities.

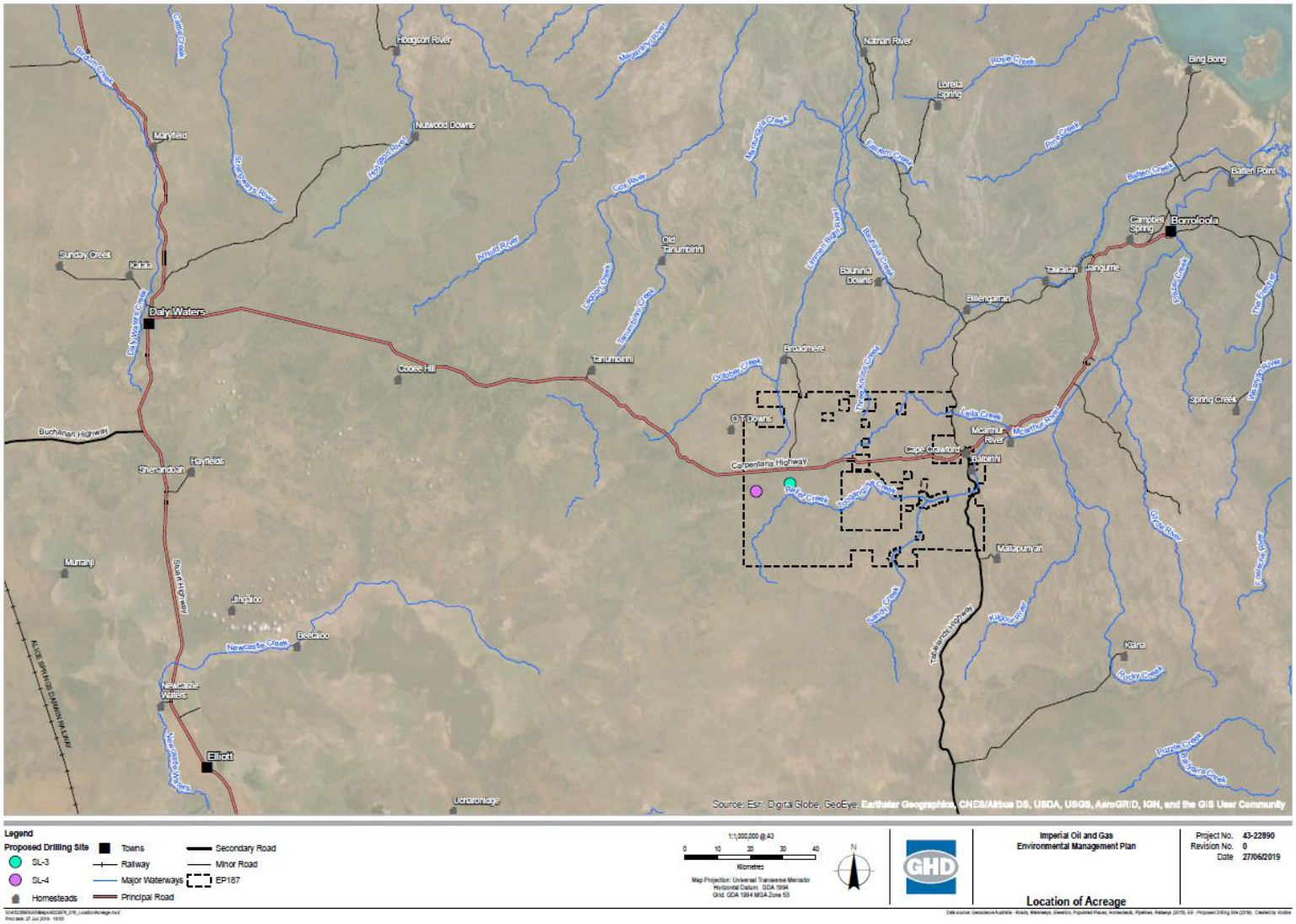


Figure 1. Location of EP187

1.2 Scope of this EMP

Under the Petroleum (Environment) Regulations (the Regulations), interest holders in petroleum titles are required to develop and submit an Environment Management Plan (EMP). Approval of an EMP is necessary for all activities that have an environmental impact or risk. The EMP is one of several approvals required for the activity to proceed. An approved EMP is an enforceable statutory document.

Imperial proposes to undertake a Drilling Program in 2019 at the Exploration Permit EP187 in the NT, drilling up to two wells, named as Imperial 187 SL-4 and Imperial 187 SL-3. This EMP covers these proposed works. A full description of the proposed activities is provided in Section 3.

1.3 Titleholders Details

Table 1 below provides details of the permit titleholder and the titleholder nominated liaison person.

Table 1. Titleholder and Liaison Person

Titleholder Details	Liaison Contact Details
Mr Alexander Underwood Chief Executive Officer Imperial Oil & Gas Pty Ltd Level 7, 151 Macquarie St., Sydney, NSW 2000 Email: info@empiregp.net	Mr Alexander Underwood Chief Executive Officer Imperial Oil & Gas Pty Ltd Level 7, 151 Macquarie St., Sydney, NSW 2000 Email: info@empiregp.net

If there is a change in the contact details for the titleholder or liaison person; Imperial will notify and provide the updated details to the Department of Primary Industry and Resources (DPIR) and the Department of Environment and Natural Resources (DENR).

2 Environmental Legislation and Other Requirements

2.1 The Petroleum Act 2016 (NT)

The Petroleum Act 2019 (NT) is the governing legislation for onshore petroleum activities in the NT and the Petroleum (Environment) Regulations (the Regulations) govern environmental management. The objectives of the Regulations are to ensure that:

- Onshore oil and gas activities are carried out in a manner consistent with the principles of ecologically sustainable development (ESD); and
- Environmental impacts and risks associated with onshore oil and gas activities are reduced to a level that is as low as reasonably practicable (ALARP) and acceptable.

The approval criteria for an environment management plan is shown below:

(1) The approval criteria for an environment management plan are that the plan must:

(a) include all the information required by Schedule 1; and

(b) be appropriate for the nature and scale of the regulated activity to which the plan relates; and

(c) demonstrate that the activity will be carried out in a manner by which the environmental impacts and environmental risks of the activity will be reduced to a level that is:

(i) as low as reasonably practicable; and

(ii) acceptable.

(2) When considering whether an environment management plan meets the approval criterion mentioned in subregulation (1)(c), the Minister must take into account:

(a) the principles of ecologically sustainable development; and

(b) if an environmental report or statement has been prepared, or is required to be prepared, in relation to the regulated activity to which the plan relates – each environmental assessment recommendation in the assessment report made about the activity.

(3) In this regulation:

environmental report or statement means a public environmental report or environmental impact statement mentioned in section 7(2) of the Environmental Assessment Act.

The requirements of Schedule 1 of the Petroleum (Environment) Regulations and where they are addressed in this EMP, are listed in Table 2

Table 2. Requirements of this EMP

Part	Section	Requirement	Section in this plan
1.1	Description of a regulated activity	A plan must give a comprehensive description of the regulated activity to which it relates and include: (a) the location (or locations) of the activity; and (b) general details of the construction and layout ofany facility associated with the activity; and an outline of, and proposed timetable for, the operational details of the activity.	Section 3.0
1.2	Description of existing environment	A plan must include: (a) a description of the existing environment that may be affected by the regulated activity described in the plan; and (b) details of any particular values and sensitivities of that environment relevant to the activity; and details of any uncertainties or lack of understandingin relation to that environment	Section 4.0

Part	Section	Requirement	Section in this plan
1.3	Assessment of environmental impacts and environmental risks	(1) A plan must include: (a) details of all environmental impacts and environmental risks of the regulated activity described in the plan and an assessment of those impacts and risks; and (b) details of all environmental impacts and environmental risks of the regulated activity described in the plan and an assessment of those impacts and risks; and (c) a description of the process used to assess the environmental impacts and environmental risks. (2) The assessment mentioned in subclause (1)(a) must be of: (a) all the environmental impacts and environmental risks arising directly or indirectly from: (i) all aspects of the regulated activity; and (ii) potential emergency conditions, whether resulting from an incident or any other reason; and (b) the cumulative effects of those impacts and risks when considered with each other and in conjunction with any other activities or events that occurred or may occur in or near the permit area for the regulated activity. ○ Example for clause 3(2)(b) of other activities or events Activities or events associated with: (a) other exploration for, or production of, petroleum; or (b) the exploration for, or extraction of, minerals or extractive minerals.	Section 5.0
1.4	Environmental outcomes and Environmental Performance Standards	A plan must specify: (a) the Environmental Outcomes in relation to the regulated activity described in the plan; and (b) the Environmental Performance Standards against which the performance of the interest holder in achieving the Environmental Outcomes can be measured; and (c) the measurement criteria to be used to ensure the Environmental Outcomes and Environmental	Section 6.0

Part	Section	Requirement	Section in this plan
		Performance Standards are met.	
1.4A	Chemicals used in the course of hydraulic fracturing	If the activity is hydraulic fracturing, a plan must specify the following information in relation to any chemical or other substance that may be in, or added to, any treatment fluids to be used in the course of the activity: (a) the identity of the chemical or other substance; (b) the volume of the chemical or other substance; (c) the concentration of the chemical or other substance; (d) the purpose of the chemical or other substance; (e) details regarding how the chemical or other substance will be managed; (f) details regarding how the chemical or other substance will be transported on-site; details regarding any action proposed to be taken to prevent a spill of the chemical or other substance; (h) the requirements in relation to the management of the chemical or other substance of the prescribed chemical legislation. Note for clause 4A(e) Managed includes handling, collecting and storing any chemical or other substance	Not Applicable
2.5	Requirement for implementation strategy	A plan must include an implementation strategy, in accordance with this Part, for the regulated activity described in the plan.	Section 8.0
2.6	Details of systems, monitoring, tests etc.	(1) An implementation strategy must provide for: (a) ongoing monitoring and review of the strategy; and (b) monitoring, recording, audit and management of non- conformance with the plan and review of the interest holder's environmental performance. (2) The implementation strategy must give details of: (a) the specific systems, practices and procedures to be used to ensure that the Environmental Outcomes and Environmental Performance Standards in the plans are met, and (b) the following, as relevant to the regulatory activity described in the plan:	Section 8.2 Section 8.9

Part	Section	Requirement	Section in this plan
		(i) the monitoring of its environmental impact, (ii) the monitoring of emissions and discharges (whether occurring during normal operations or otherwise) (iii) the carrying out and recording of the monitoring mentioned in this paragraph in a manner that is accurate and can be audited against the Environmental Performance Standards and measurement criteria specified in the plan, and the intervals at which each type of monitoring will be carried out; (iv) tests to be carried out to assess the performance and accuracy of the equipment used for the monitoring mentioned in this paragraph, and the intervals at which the tests are to be carried out.	
2.7	Personnel	An implementation strategy must: (a) establish a clear chain of command, including during emergencies or potential emergencies; and (b) set out the roles and responsibilities of personnel in relation to the implementation, management and review of the plan; and (c) specify measures to ensure that each employee or contractor working on, or in connection with, the regulated activity described in the plan: (i) is aware of his or her responsibilities or potential emergencies, and (ii) has the appropriate competencies and training	Section 8.2 Section 8.3
2.8	Emergency contingency plan	An implementation strategy must include: (a) a contingency plan that specifies arrangements for the response to emergencies or potential emergencies, and provisions for the implementation and maintenance of the contingency plan.	Section 8.5
		(1) A plan must include information about the stakeholder engagement carried out by the interest holder that includes the following:	

Part	Section	Requirement	Section in this plan
3.9	Stakeholder engagement	(a) a list of the stakeholders and the stakeholder's contact details; (b) a copy of the information provided to the stakeholders by the interest holder; (c) if written responses have been received from stakeholders – a summary and copy of each response; (d) an assessment of the merits of any objection or claim made by a stakeholder about the anticipated environmental impact of the proposed regulated activity; (e) a statement of the interest holder's response, or proposed response, to each objection or claim made by a stakeholder; (f) a record of communications with stakeholders that is not mentioned in paragraph (b), (c) or (e), (for example, telephone discussions); (g) details of changes the interest holder made as a result of the stakeholder engagement. (2) A plan must also include information about future stakeholder engagement to be carried out by the interest holder.	Section 9.0
3.10	Legislative requirements	A plan must: (a) specify any legislative requirements applicable to the regulated activity described in the plan that are relevant to the practices and processes used to manage the environmental aspects of the activity; and (b) demonstrate how those requirements will be met.	Section 2.0
3.11	Recording, monitoring and reporting	(1) A plan must specify arrangements for: (a) recording, monitoring and reporting information about the regulated activity to which the plan relates in a manner that will enable the Minister to determine whether the Environmental Outcomes and Environmental Performance Standards in the plan are being met; and (b) giving the Minister a report about the matters mentioned in paragraph (a), at approved intervals, but not less often than annually. (2) the information mentioned in subclause (1) includes information required to be recorded, monitored or reported under these regulations or any other law in force in the	Section 8.9 Section 8.10

Part	Section	Requirement	Section in this plan
		territory applying to the regulated activity.	
3.12	Notifying commencement of construction, drilling or seismic survey	A plan must specify arrangements for the interest holder to notify the following persons before the proposed date of commencement of construction, drilling or seismic surveys: (a) the Minister; (b) the occupier of the land on which the activity is to be carried out; (c) the owner of the land on which the activity is to be carried out (unless the owner is also the occupier).	Section 8.6

Other legislation, agreements and codes of practice relevant to the project are detailed below.

2.2 Key Legislation Overview

The legislation and associated approvals relevant to environmental management of drilling activities at the proposed appraisal well site is listed in Table 3.

Table 3. Key relevant Commonwealth and Northern Territory Legislation

Policy Jurisdiction	Legislation	Description
Commonwealth	Aboriginal and Torres Strait Islander Heritage Protection Act 1984	Protects areas and objects in Australia that are of significance to Aboriginals in accordance with Aboriginal tradition. The Act allows the Commonwealth Environment Minister, on the application of an Aboriginal person or group of persons, to make a declaration to protect an area, artefacts or class of objects from a threat of injury or desecration.
	Aboriginal Land Rights (Northern Territory) Act 1976	This Act is the key mechanism for the creation of Aboriginal-owned freehold land in the NT. It also includes provisions for the establishment of Land Trusts (over which the Land Councils have oversight).
	Australian Heritage Council Act 2003	Establishes the Australian Heritage Council that is the principal adviser to the Australian Government on heritage matters. The Council's main role is to assess the heritage values of places nominated for the National Heritage List and the Commonwealth Heritage List, and to advise the Minister on promotion, research, education, policies, grants, conservation and other matters.

Policy Jurisdiction	Legislation	Description
Northern Territory	Environment Protection and biodiversity Conservation Act 1999 (EPBC Act)	Provides for the protection of the environment and the conservation of biodiversity. It regulates a development or activity if it is likely to have a significant environmental impact on matters of national environmental significance (MNES). This Act is administered by the Commonwealth Department of the Environment and Energy (DoEE). It is considered that the proposed activities will not adversely impact MNES therefore; the project has not been referred for assessment nor approval under the EPBC Act.
	National Environment Protection Council Act 1994	Provides national standards for ambient air quality, movement of controlled wastes and contaminated sites. This Act is administered by DoEE.
	National Greenhouse and Energy Reporting Act 2007	Titleholders are required to report emissions and energy use annually in accordance with this Act.
	Native Title Act 1993	This Act provides statutory recognition and protection for the concept of native title, including provisions for reaching Indigenous land use agreements.
	Biological Control Act 2016	Makes provision for the biological control of pests in the NT, and related purposes.
	Bushfires Management Act 2016	Provides for the protection of life, property and the environment through the mitigation, management and suppression of bushfires, and for related purposes.
	Control of Roads Act 1953	Provides for the administration and control of public or gazetted roads, including the maintenance of roads and opening and closing of roads.
	Dangerous Goods (Road and Rail Transport Act) 2012	Makes provision for safety in the transport of dangerous goods by road as part of the system of nationally consistent road transport laws and makes provision for safety in the transport of dangerous goods by rail. Establishes common guidelines so that dangerous goods can be transported between states and territories.
	Energy Pipelines Act 1981	Makes provision for the construction, operation, maintenance and cessation of use or abandonment of pipelines for the conveyance of energy-producing hydrocarbons.

Policy Jurisdiction	Legislation	Description
	Environmental Assessment Act 1982	Establishes the framework for the assessment of potential or anticipated environmental impacts of developments and provides for protection of the environment. The NT Environment Protection Authority (NT EPA) is responsible for administering the Act. The NT EPA also determines the appropriate level of assessment for new developments or material changes to existing operations, based on the sensitivity of the local environment, the scale of the proposal and its potential impact upon the environment.
	Environmental Offences and Penalties Act 1996	Establishes a penalty structure for environmental offences based around four offence levels. Penalties are defined in a variety of environmental statutes such as the Waste Management and Pollution Control Act and the Water Act.
	Fire and Emergency Act 1996	The Act provides for the establishment of the Northern Territory fire and rescue service, the operational and emergency response activities of the service, the protection of life, property and the environment against fires and other emergencies and for related purposes.
	Heritage Act 2011	Establishes the Heritage Council and the NT Heritage Register. It sets the process by which places become heritage places, allows for interim protection of places and sets out the process for getting permission to do work to heritage places and allows for fines and imprisonment for offences against the Act.
	Northern Territory Aboriginal Sacred Sites Act 1989	Establishes the Aboriginal Areas Protection Authority (AAPA) as the body responsible for overseeing the protection of sacred sites in the NT. The AAPA provides a process for avoidance of sacred sites and/or entry onto sacred sites and the issue of Authority Certificates, which indemnify the holder against prosecution under the Act for damage to sacred sites in the certificate area, provided works or use has occurred in accordance with the conditions of the Authority Certificate.

Policy Jurisdiction	Legislation	Description
	Pastoral land Act 1992	The Pastoral Land Act 1992 (NT) is an Act to make provision for the conversion and granting of title to pastoral land and the administration, management and conservation of pastoral land, and for related purposes. In particular, the Act provides for: (i) the monitoring of pastoral land so as to detect and assess any change in its condition; (ii) the prevention or minimisation of degradation of or other damage to the land and its indigenous plant and animal life; and (iii) the rehabilitation of the land in cases of degradation or other damage
	Petroleum Act 1984 (supported by the Schedule of Onshore Petroleum Exploration and Production Requirements 2017 (The Schedule), The Petroleum (Environment) Regulations 2016 and Petroleum (Prospecting and Mining) Regulations 2001)	The Petroleum Act is the principal legislation dealing with petroleum tenure, exploration and production activities onshore and in inland waters of the NT. The Act provides a legal framework to undertake exploration for petroleum and to develop petroleum production so that the optimum value of the resource is returned to the NT. The Act and Requirements are administered by the Northern Territory Petroleum Registry (Registry) which forms part of the DPIR. The Minister for Primary Industry and Resources (Minister) is the applicable Minister for the purposes of the Act.
	Petroleum (Environment) Regulations 2016	The Petroleum (Environment) Regulations aim to ensure that: a. onshore oil and gas activities are carried out in a manner consistent with the principles of ESD; b. environmental impacts and risk associates with onshore oil and gas activities are reduced to a level that is ALARP and acceptable. The regulations achieve these objectives by requiring interest holders to have an approved EMP in place before a "regulated activity" can be undertaken. The Regulations also provide that the EMP will also form the basis of a Notice of Intent under the Environmental Assessment Act.

Policy Jurisdiction	Legislation	Description
	Plant Health Act 2008	The Plant Health Act aims to ensure: a. appropriate actions can be taken for the control of pests, and b. to facilitate the production and trading certification of plants and plant products that are free from pests. .
	Public and Environmental Health Act 2011 (supported by Public and Environmental Health Regulations 2014)	Makes provision to protect and promote the health of individuals and communities in the Territory, and to monitor, assess and control environmental conditions, factors and factors and agents, facilities and equipment and activities, services and products that impact on, or may impact on, public and environmental health.
	Soil Conservation and Land Utilisation Act 1969	Makes provisions for the prevention of soil erosion and soil conservation and reclamation. It makes provisions for restricting construction activities that may damage or further damage land that is not environmentally stable, such as areas suffering soil erosion or areas that have the potential to erode.
	Territory Parks and Wildlife Conservation Act 1976	Makes provision for the establishment of Territory Parks and other Parks and Reserves and the study, protection, conservation and sustainable utilisation of wildlife. It sets aside areas of the NT as parks and conservation areas that may not be developed. Flora and fauna can also be declared as threatened species under the Act.
	Waste Management and Pollution Control Act 1998 (WMPC Act)	Aims to protect, and where practicable, restore and enhance the quality of the NT environment; encourage ecologically sustainable development; and facilitate the implementation of National Environmental Performance Measures established by the National Environment Protection Council. It is designed to prevent contamination of the surrounding environment, including soil, air, and water, and imposes a general duty on conducting an activity or action that causes or is likely to cause pollution resulting in environmental harm, or that generates or is likely to generate waste. The disposal of listed waste and discharge of water to the environmental requires a licence under the Act.

Policy Jurisdiction	Legislation	Description
International Agreements	Water Act 1992	Provides for the investigation, allocation, control, protection, management and administration of water resources in the NT. The Act prohibits waste to come in contact with water or water to be polluted unless under authorisation. The Water Act requires proponents to obtain a water extraction licence prior to the extraction of any groundwater that exceeds 5ML per annum. Based on our water usage expectations this does not apply to this project scope.
	Weeds Management Act 2001	Aims to prevent the spread of weeds throughout the NT, ensuring the management of weeds is an integral component of land management. It is designed to ensure there is community consultation in the creation of weed management plans and that the landholder or interest holder takes responsibility in implementing weed management plans. If a weed is declared, all landholders, land managers and land users must comply with the declaration classification. The following are the three classes of declared weeds in the NT: • Class A – to be eradicated • Class B – growth and spread to be controlled • Class C – not to be introduced into the NT. All Class A and Class B weeds are also Class C weeds.
	Work Health and Safety (National Uniform Legislation) Act 2011	The WHS Act is part of the nationally harmonised work health and safety laws, which aim to provide all workers in Australia with the same standard of health and safety protection regardless of the work they do or where they work as well as to provide guidelines for hazardous chemical handling at sites.
	Migratory species: • Japan-Australia Migratory Bird Agreement • China-Australia Migratory Bird Agreement • Republic of Korea-Australia Migratory Bird Agreement	Australia is party to many international agreements to protect and conserve migratory species and their habitat. Migratory species listed on the annexes to these Agreements are placed on the migratory species list under the EPBC Act.

Policy Jurisdiction	Legislation	Description
	• Convention on the Conservation of Migratory species of Wild Animals (Bonn Convention)	
	Ramsar Convention on Wetlands	The Ramsar Convention's broad aims are to halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain. Ramsar wetlands within Australia are listed as a MNES and protected under the EPBC Act.

2.2.1 Summary of Legislative Requirements

A summary of legislative requirements, associated project environmental approvals and Imperial's actions and intent for each are provided in Table 4.

Table 4. Summary of Legislative Requirements

Legislative Requirements	Relevant Legislation	Administrator	Proposed Actions
Commonwealth			
Exploration permit	Petroleum Act 2016 Petroleum (Environment) Regulations 2016	DPIR	Activities operated under Exploration Permit 187
Approved Environmental Management Plan	Petroleum (Environment) Regulations 2016	DENR	Imperial will ensure this document is approved prior regulated activities occurring.
Minister's approval	Environment Protection and biodiversity Conservation Act 1999	DOEE	Imperial does not consider the scope of the EMP likely to have any significant impacts on matters of national environmental significance and will not be referring the activities for assessment at this stage. Refer to Section 6.2.1 "Significant Impact Test for EPBC listed species"
Notice of Intent and Formal Environmental Assessment	Environmental Assessment Act 2013 and Administrative Procedures	NT EPA	This EMP does not constitute any material change of use. Imperial, therefore, considers it unnecessary to refer the activity for assessment. Refer to Section 6.2.2.

Legislative Requirements	Relevant Legislation	Administrator	Proposed Actions
Must not enter, damage or interfere with a Sacred Site (even if not registered)	Northern Territory Aboriginal Sacred Sites Act 2013	AAPA	Imperial has applied for an AAPA Sacred Site Clearance Certificate for the proposed lease at EP187.
AAPA Authority Certificate	Northern Territory Aboriginal Sacred Sites Act 2013	AAPA	An Authority Certificate application (doc. 20190486) has been submitted to the AAPA. Imperial understands that no activities can commence until a valid Authority Certificate is obtained.
Work approval (for removal or damage of archaeological sites)	Heritage Act 2016	DNER	An anthropology survey has been completed in May 2015, (Appendix 16). Archaeological survey has been undertaken in August 2019; report will be submitted to the DPIR and DENR once received. As a result, Imperial does not anticipate a work approval will be required.
Groundwater Extraction Licence	Water Legislation Amendment Act 2018	DENR	As confirmed by DENR, a licence is not required for petroleum activities unless amount of water required is equal to or exceeds 5ML per annum.
Reporting under National Greenhouse and Energy Reporting Scheme (NGERS)	National Greenhouse and Energy Reporting Act 2007	Australian Government – Clean Energy Regulator	Imperial is obligated to report under the scheme.
Dangerous Goods Business Licence	Dangerous Goods Act 2012	NT Worksafe	Imperial will ensure a licence is held by Imperial or contractor if applicable
Dangerous Goods Vehicle Licence	Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act	NT Worksafe	Imperial will ensure a licence is held by Imperial or contractor if applicable
Land Access and Compensation Agreement (LACA)	Petroleum Act 2016 and Petroleum Act Stakeholder Engagement Guidelines Land Access (Land Access Guidelines)		Existing LACAs are in place for ongoing work in EP187. This agreement covers the activities referenced in this EMP.

2.3 Relevant Agreements and Operating Consents

Land access guidelines under the Petroleum Act require Imperial to reach agreement with the landholder prior to the commencement of exploration activities. Prior to commencement of the new works proposed in this EMP, necessary consents and approvals have been identified, obtained and agreed.
Regulations stipulate a process for stakeholder engagement when a company proposes to undertake a regulated activity. Stakeholder engagement undertaken as part of this project are discussed in Section 9.

Traditional owners under the Native Title Act, and Aboriginal owners under the Aboriginal Land Rights Act (ALRA) are given the opportunity to negotiate an agreement denoting how petroleum activities must occur in accordance with statutory processes described in each Act.

The agreement, Co-operation and Exploration Agreement - Exploration Permit Application EP187, Northern Territory, executed on 28th February 2019, is a legal agreement between AAPA, the Northern Land Council (NLC) (the body corporate representing the Traditional Owners) and Imperial. All works will be undertaken in accordance with the terms and conditions as detailed in the NLC Agreement.

2.4 Codes of Practice and Relevant Guidelines

The Australian exploration oil and gas industry in conjunction with APPEA takes seriously the responsibility for environmental management, committing to the conservation and environment protection practices as an integral part of the industry operations.

Therefore, the Code of Practice: Petroleum Activities in the Northern Territory (Northern Territory Government, 2019) applies to all activities involved in both conventional and unconventional oil and gas exploration, appraisal, development and production and ancillary activities in the Northern Territory. The Code covers all petroleum activities including all petroleum well types including exploration, appraisal, development, monitoring, injection and production wells.

Imperial Oil & Gas adheres to the APPEA Environmental Code of Practice, containing substantial detail on all aspects of industry operations and in particular the APPEA Environmental Policy.

Contractors undertaking activities will be required to comply with the following environmental standards, guidelines and codes of practice:

- The Imperial Oil & Gas Pty Ltd Health Safety Environment Management System (HSEMS).
- Australian Petroleum Production and Exploration Association (APPEA) Code of Conduct and Environmental Practice (2008).
- Draft Guideline for the preparation of an Environmental Management Plan under the Petroleum (Environment) Regulations (draft Guidelines) (Northern Territory Government, 2019).
- NT EPA Environmental Factors and Objectives (NT EPA, 2018)
- Code of Practice: Petroleum Activities in the Northern Territory (May 2019).
- NT Petroleum (Environment) Regulations 2019: Explanatory Guide.
- Vegetation Retention Technical Note No. 12 Erosion and Sediment Control Guidelines. DLRM
- Clearing Methodology Technical Note No. 18 Erosion and Sediment Control Guidelines DLRM

2.5 Referrals under NT and Commonwealth legislation

2.5.1 Referral under the Environment Protection and Biodiversity Conservation Act

The *Environment Protection and Biodiversity Conservation Act 1999* enables the Australian Government to join with the states and territories in providing a national scheme of environment and heritage protection and biodiversity conservation. The objective of the EPBC Act is to provide for the protection of the environment, especially matters of national environmental significance, conserve Australian biodiversity, enhance the protection and management of important natural and cultural places etc. Referral of the project to the Department of Environment and Energy is required if the proposed action will have or is likely to have a significant impact, which is discussed in Section 6.2.1.

2.5.2 Referral under the Environmental Assessment Act (EA Act)

The object of the *Environmental Assessment Act* is to ensure, to the greatest extent practicable, that each matter from the proposed activities that could reasonably be considered of having a significant effect on the environment, is fully examined. This activity should be referred to the NT EPA, pursuant to Section 7 of the Act (EA Act). Section 6.2.2 of this EMP presents a detail review of the proposed Drilling Program against each prescribed Environmental Objective and Factor.

3 Project Description

This project involves the drilling of up to two wells on two separate locations within EP187 for Imperial Oil and Gas. The drilling of these wells follows the acquisition of seismic survey data which will be used to confirm our understanding of stratigraphy and to confirm the drilling location. This seismic survey is the subject of a separate Seismic EMP.

Whilst there is a preferred location for the first well, the location may need to change subject to the seismic data being received. To address the uncertainty around the seismic results and the impact on well location, in addition to the one preferred location (SL-4) an additional 4 alternative locations have been reviewed and incorporated in to this EMP, as optional drilling locations, if the preferred location is not acceptable. The alternative locations are titled SL-4 Alt 1, Alt 2, Alt 3 and Alt 4. Only one of the proposed drilling locations for this well will be cleared and used for this well. The other optional locations will be left in their current condition, with no clearing or other work carried out on them.

Once the seismic results have been reviewed, then the location of the first well will be confirmed and civils work can commence. The second well will be drilled on location SL-3. This well is contingent on project timing, to ensure that drilling of both SL-4 and SL-3 can be completed before the wet season.

The location and infrastructure plan for the Drilling Program is shown in Figure 1. Proposed Drill Site, Camp Location and Existing Roads in Figure 2. A general lease layout plan is provided in Figure 3. A summary of the proposed well activities is provided in Table 4. Other activities planned during the drilling program will include:

- Well integrity monitoring
- Evaluation of well including mudlogging, wireline logging, coring and leak off test
- Suspension and/or plug and abandonment
- Rehabilitation of the area

3.1 Well site and access track route selection

The wellpads and access track routes have been designed to minimise new disturbance where practicable, with consideration to the likelihood of flooding, sheet flow pathways, soil drainage, proximity to watercourses and site slope as well as to prevent spills of potentially harmful chemicals or those that may cause environmental harm to the ground surface or their release from the site.

- Wellpad Sl-3 is located on the crest of a rise with pea gravel at surface, there is no catchment area for this wellpad for overland flow.
- Wellpad SL-4 is located on a flat area with some small gravel at surface away from all watercourses, there is no indication of concentrated overland flow on this location.
- Wellpad SL-4 Alt 1 is located on a flat area away from all watercourses, there is no indication of concentrated overland flow on this location.
- Wellpad SL-4 Alt 2 is located on a flat area away from all watercourses, there is no indication of concentrated overland flow on this location.
- Wellpad SL-4 Alt 3 is located on a flat area away from all watercourses, there is no indication of concentrated overland flow on this location.
- Wellpad SL-4 Alt 4 is located on a flat area with some small gravel at surface away from all watercourses, there is no indication of concentrated overland flow on this location.

All locations have been chosen to allow construction on natural grade without cut and fill and to ensure that they are not at risk of overland flow inundation.

Photos of the existing conditions of all wellpads are in Appendix 9.

The wellpads are located away from any sensitive receptors and should not impede the movement of wildlife. The access track to SL-4 (and alternates) follows the seismic line for the majority of the alignment and derivates from the latter on the western side for approximately 3km to avoid a watercourse. The access track to SL-3 is a dedicated alignment to avoid intersecting multiple watercourse crossings.

The wellpads are both located more than 2km from an existing dwelling including schools, permanent sporting facilities and community medical facilities, there are no schools, permanent sporting facilities and community medical facilities within EP 187; as well as 1km from any existing water supply bore used for domestic or stock consumption. None of the wellpads are visible from any major public road.

Table 5 below presents the summary of the appraisal well data.

Table 5. Appraisal Well Data Summary

Well Name and Number:	Imperial SL-4	
Permit:	EP187 (Northern Territory)	
Basin:	MacArthur / Beetaloo Basin	
Well name Proposed Location: (MGA94, Zone 53)	Latitude Longitude Easting Northing	S 16.79450 E 135.12306 513112 8143174
Drill Pad area:	Approximately 120m x 120m	
Anticipated Spud Date:	October 2019	
Anticipated Total Well Days:	40 days	
Primary Objective:	Evaluation of Kyalla and Velkerri Formations	
Estimated Total Depth:	2100m TVD	
Well Name Alternative location 1: (MGA94, Zone 53)	Latitude Longitude Easting Northing	S 16.77721 E 135.11908 512690 8145087
Welll Name Alternative location 2: (MGA94, Zone 53)	Latitude Longitude Easting Northing	S 16.81243 E 135.12726 513559 8141190
Welll Name Alternative location 3: (MGA94, Zone 53)	Latitude Longitude Easting Northing	S 16.74210 E 135.11108 511840 8148971
Welll Name Alternative location 4: (MGA94, Zone 53)	Latitude Longitude Easting Northing	S 16.83627 E 135.13214 514077 8138553

Well Name and Number:	Imperial SL-3	
Permit:	EP187 (Northern Territory)	
Basin:	MacArthur / Beetaloo Basin	
Well name Proposed Location: (MGA94, Zone 53)	Latitude Longitude Easting Northing	S 16.77282 E 135.221136 523591 8145563
Drill Pad area:	Approximately 120m x 120m	
Anticipated Spud Date:	October 2019	
Anticipated Total Well Days:	40 days	
Primary Objective:	Evaluation of Kyalla and Velkerri Formations	
Estimated Total Depth:	2100m TVD	

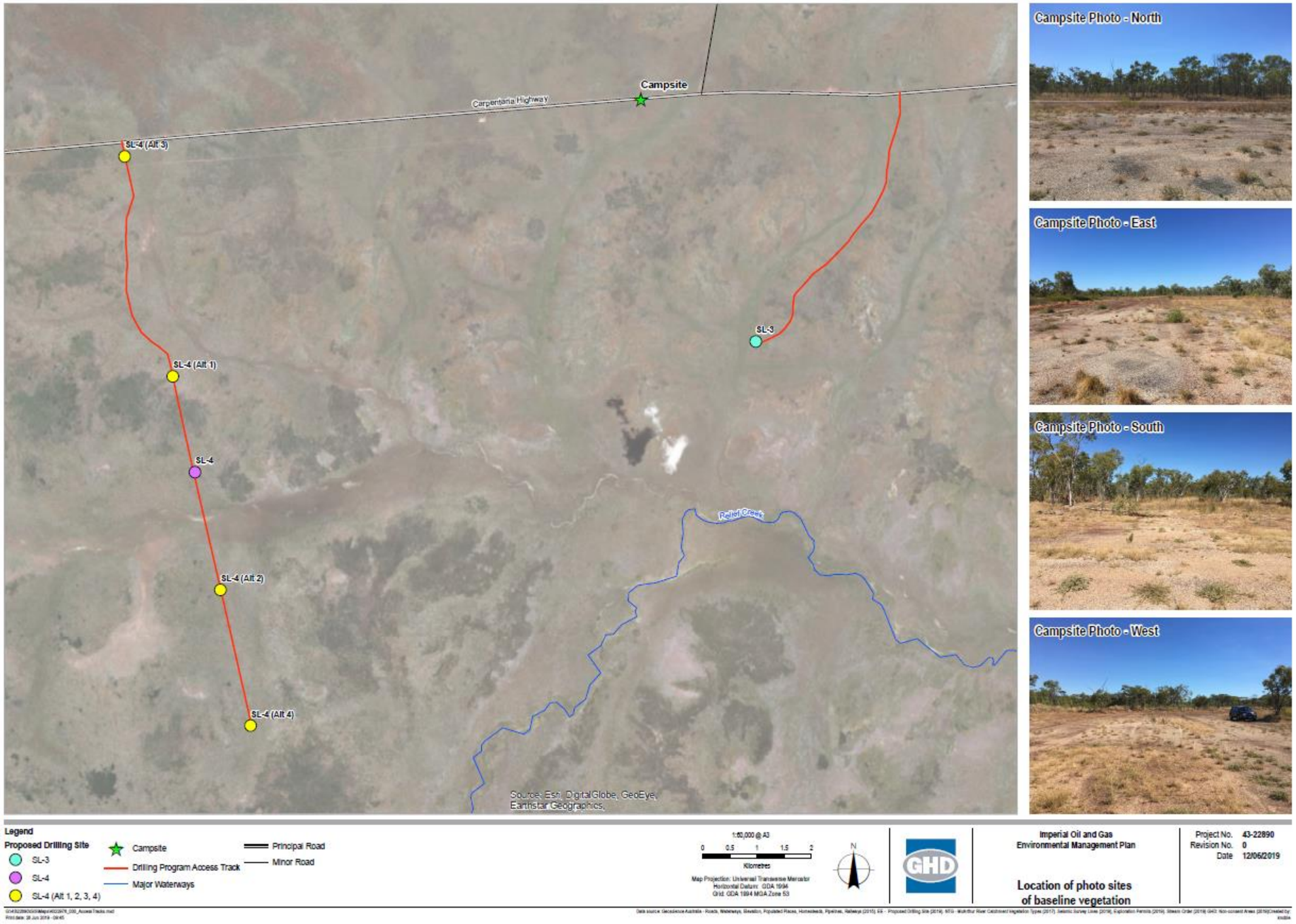


Figure 2. Proposed Drill Site, Camp Location and Existing Roads

3.2 Timing

The Drilling Program is expected to take up to 10 weeks with activities planned to be undertaken during 2019 dry season. A preliminary project schedule is provided in Table 6 below. The project is currently planned to be carried out on 24 hour split shifts.

Table 6. Indicative Project Schedule

Activity	Estimated duration	Estimated commencement
Mobilisation of drilling equipment	2 weeks	Oct 2019
Drilling, well evaluation and suspension plugging or abandonment	4 - 7 weeks	Oct – Dec 2019
Demobilisation of equipment	2 weeks	Dec 2019
Rehabilitation post well suspension	1-2 weeks	Dec 2019
Rehabilitation post-decommissioning of wells	2-4 weeks	Commence within 12 months of decommissioning
Post-rehabilitation monitoring	1 weeks per monitoring event	• After rehabilitation • Following first wet season event • Immediately after rehabilitation works completed post decommissioning • Following first wet season • Three years after decommissioning

3.3 Workforce

Civil works proposed under this EMP will be carried out by a local earthmoving company employing local operators.

Drilling activities proposed under this EMP are of short duration and will be carried out by contracting companies, the majority of the workforce will be FIFO via Cape Crawford.

3.4 Civil works

Both the wellpads and access tracks will be constructed with a “Minimal disturbance” methodology, the wellpads will be built on grade with no cut and fill outside the hardstand area, all access tracks will be constructed of in situ material with minimal forming up so as to not concentrate water flow paths.

Greater detail of construction methodologies can be found in the Erosion and Sediment Control Plan (appendix 7). The total disturbance for the activities under this EMP is 14Ha.
The Civil works required for the Drilling Program include:

- Upgrading of existing roads,
- Construction of access tracks,
    - The access track for SL-3 is new disturbance to avoid multiple water course crossings.
    - The access track to SL-4 is mainly along the recent seismic track alignment but deviates for ~2km to avoid Gilgai country.
    -
    -
- Construction of well pads:
    - Hardstand area,
    - Bunded and Lined sumps (engineered pits, lined with an impermeable membrane with coefficient of permeability of less than 10-9 m/s tested in accordance with AS 1289.6.7.2 and with resistance to tearing >0.5kN (ASTM D 4073); static puncture >0.5kN (ASTM D 4833) and tensile strength >20 kN/m (ASTM D 7275),
    - Water storage ponds,
    - Fencing and installation of fauna ladders in the cutting's sump and open water storages,
    - Installation of signage showing:
- Grading of an existing campsite location to avoid new disturbances.

Refer to Appendix 11 for Well Pad elevations.

3.5 Drilling and Completion

3.5.1 Drilling Program

The proposed exploration well(s) will appraise the western boundary of EP187a of the Beetaloo Sub-basin, approximately 55km south of Broadmere-1. Table 7 outlines the expected formations and depths that will be intersected.

The well(s) is expected to be drilled using a mobile rotary drilling rig to a proposed Total Vertical Depth of 2,100m (mTVD), targeting the Kyalla and Velkerri Formations. The proposed locations and target intervals of the well(s) are shown in Figure 5 and Figure 6 respectively.

Among the various formations to be intersected during drilling, the Gum Ridge Aquifer is expected to be encountered at an approximately depth of 100-150m which will be isolated by a minimum of two verified barriers; until that happens:

- only air, water or water-based drilling muds will be used, and
- chemicals or other substances that could leave a residual toxic effect in the aquifer will not be added to the drilling mud.

In order to ensure verified isolation from the aquifers and well integrity; the following controls will be implemented:

- Critical controls and hold points throughout the well construction,
- Verification of each stage of the process by a drilling expert and approval received prior to proceeding to the next stage,

- Barrier verifications and monitoring throughout well construction, maintaining primary and secondary well control measures,
- A cemented production casing string to provide additional protection barrier between producing hydrocarbon bearing zones and shallow aquifers,
- Pressure testing of the cement to ensure overall integrity of the production casing,
- Multiple strings of steel casing and
- cement grouted to the surface and multiple engineered and system mitigations to adequately detect water quality threats to the CLA,
- Well barrier integrity validation reporting (WBIV report) for each well demonstrating compliance with the Code and to be provided to the regulator (DPIR) for approval,
- DFIT of wells will not be conducted until the WBIV Report has been approved by the regulator.

Key features include:

- shallow aquifers isolated from hydrocarbon bearing zones with more than two verified barriers
- Gum Ridge aquifer isolated with cemented 13-3/8" casing
- Bukalara Sandstone isolated with cemented 9-5/8" casing

The description of the drilling process to be conducted at each well is as followed:

- Drilling of vertical pilot well to the basement Velkerri Formation, with a total vertical depth (TVD) of 2100 +/- 50 m for SL-4 (or alternates) and 2100 TVD +/- 50 m for SL-3,
- open-hole formation integrity testing (FIT) at each casing shoe during drilling,
- well evaluation during and/or on completion of drilling the pilot well by:
    - mud sampling to ensure drilling mud is optimised while drilling,
    - continuous monitoring for loss zones,
    - continuous monitoring for gas zones in deeper strata,
    - mudlogging while drilling to assess cuttings brought to surface for creation of a detailed record or well log,
    - logging while drilling using an array of techniques such as gamma and resistivity
    - wireline logging which involves making a detailed record of the geologic formations penetrated by the borehole,
    - formation testing and core acquisition of rock samples in formations of interest.
- drill cutting samples and/or core will be collected for geological assessment and analysis and wireline logs will be acquired over the open hole,
- well integrity assessment of Petroleum Well SL-3 and SL-4 including conducting cement bond logging (CBL) if DFIT intended,
- conducting a DFIT
- suspension of the Petroleum Well SL-3 and SL-4 well in accordance with the Code.

Following completion of the drilling activities, the well(s) will be suspended for future assessment. The utilised aquifers expected at this location are all within the Gum Ridge formation which has a depth of 159m at the proposed drilling sites. Therefore, a minimum vertical separation of 921m is expected between the base of the deepest utilised aquifer and the top of the primary target of the well. All encountered aquifers will be isolated behind cemented casing. Figure 5 below shows the anticipated well schematic, while Figure 6 illustrates the modelled formation and subsurface basin geology.

Table 7. Expected formation depths and thickness

Stratigraphy Tops	Expected depth (Top Formation) (m)	Thickness (m)
Undifferentiated Cretaceous	GL	110
Gum Ridge Formation	110	159
Bukalormi Sandstone	269	74
Kyalla	343	400
Moroak Sandstone	743	337
Velkerri Upper	1080	410
Velkerri Middle	1490	460
Dolerite Sill	1490	n/a
Velkerri Lower	1950	
Total depth	2100	

A summary of the drill rig specifications is provided in Table 8.

Table 8. Drilling Rig Specifications

GENERAL RIG SPECIFICATIONS	
Mast:	Minimum 200,000 lbs hook load capacity
Substructure:	Ability to drill up to 17 ½"hole Ability to accommodate 11"BOP equipment
Draw works:	350 HP minimum rated
Top drive:	17,500 ft-lbs continuous drill torque
Mud pump:	Minimum 2 x 800 HP – minimum 800 GPM at 2500 psi
Mud Mixing:	Agitators in all active and reserve tanks Mud guns in all active and reserve tanks
Mud cleaners:	Desander, desilter
Shale shaker:	2 x linear motion
BOP requirements:	Rating: 11", 5,000 psi 1 x Annular Preventer (3,000 psi) 1 x Blind Ram 1 x Pipe Ram
Pipe Handling Capability:	Handling of range 2 drill pipe and range 3 casing Sizes: 2⅜", 2⅞", 3 ½", 4, 4½", 4 ¾", 5", 5¼", 5½", 6¼", 6½", 6⅝", 7⅝", 8⅝" and 9⅝" OD tubulars
Data Acquisition:	Pason or equivalent

Legend information Figure 3

Item	Description	Qty.
1	Mobile Drilling Rig	1
2	Dog House	1
3	Mudtank general arrangement	1
4	Batch/Mud pump skid assembly	1
5	Generator skid	1
6	Generator & Fuel tank skid	1
7	Drive House	1
8	Pipe Handler	1
9	Pipe Tub	4
10	Extra load skid assembly	1
11	Office Skid	1
12	Fire extinguisher/Signage basket assembly	2
13	Tool shack skid	1
14	Sleeper	1
15	Smoko shack/spu	1
16	Lighting tower	3
17	Gernie skid general arrangement	1
18	Lube skid	1
19	Loader skid general arrangement	1
20	Pipe rack	2
21	Rig signage	1
22	Tele handler skid	1
23	Wire line unit	1
24	Cuttings bin.	1

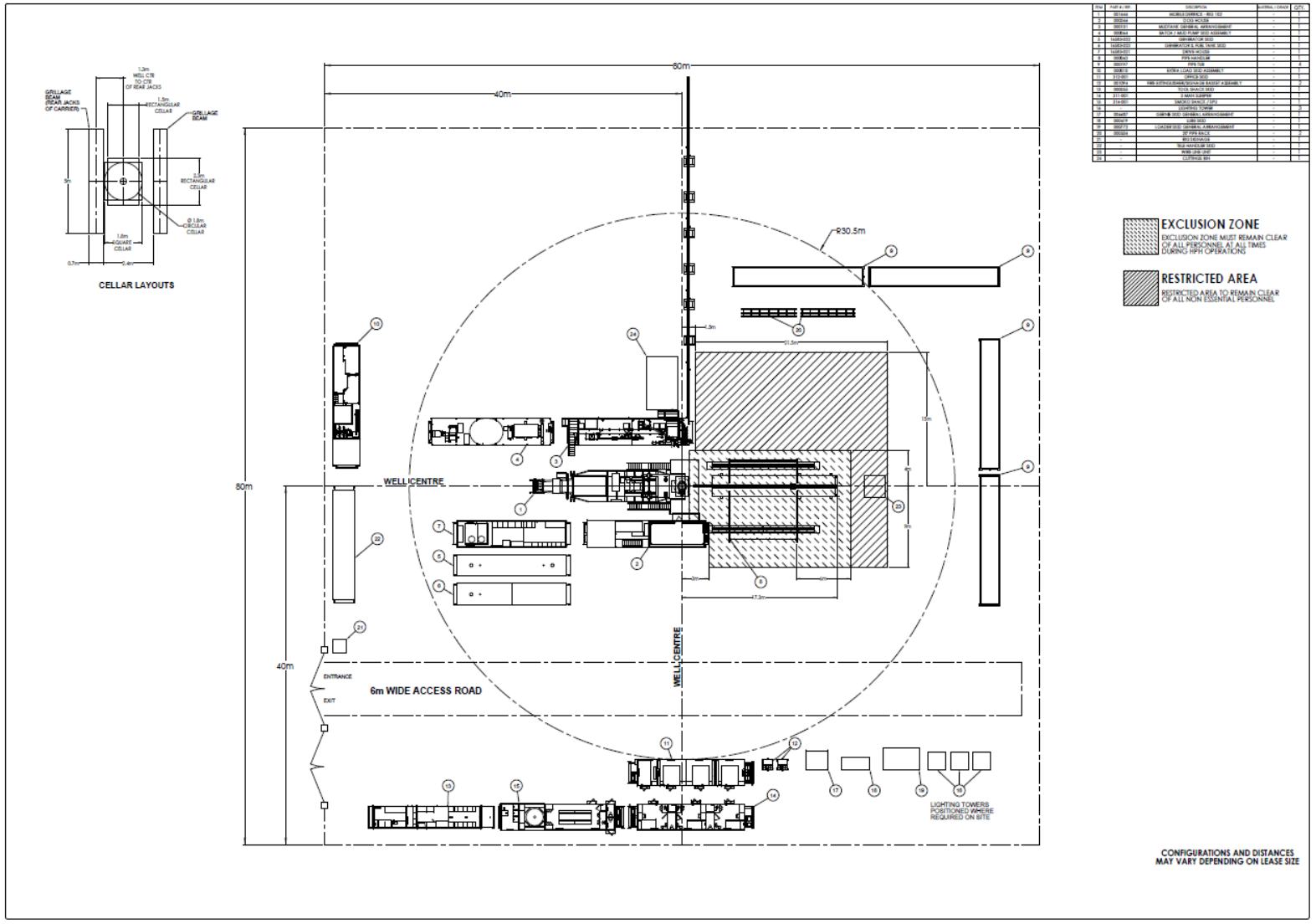


Figure 3. General Rig Layout

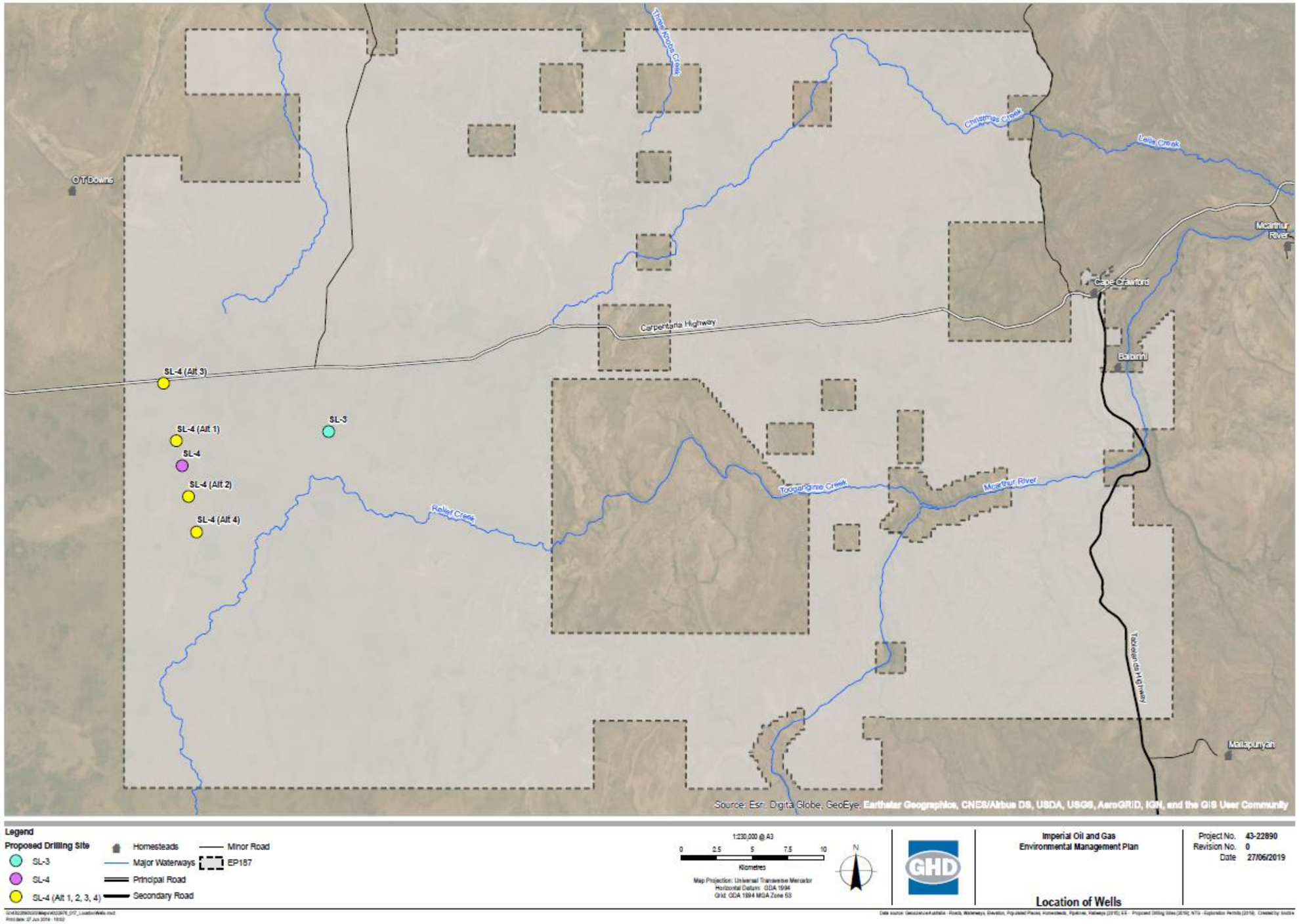


Figure 4. Map showing location of proposed wells

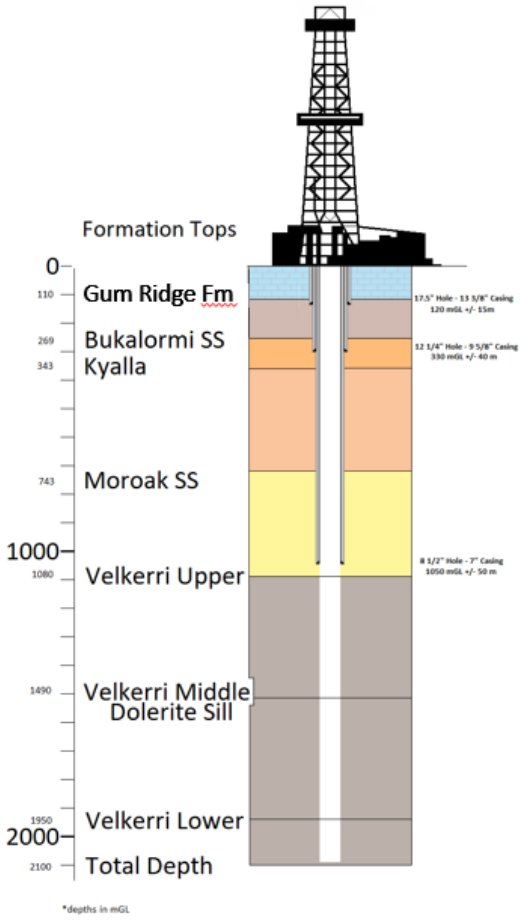


Figure 5. Anticipated well lithology

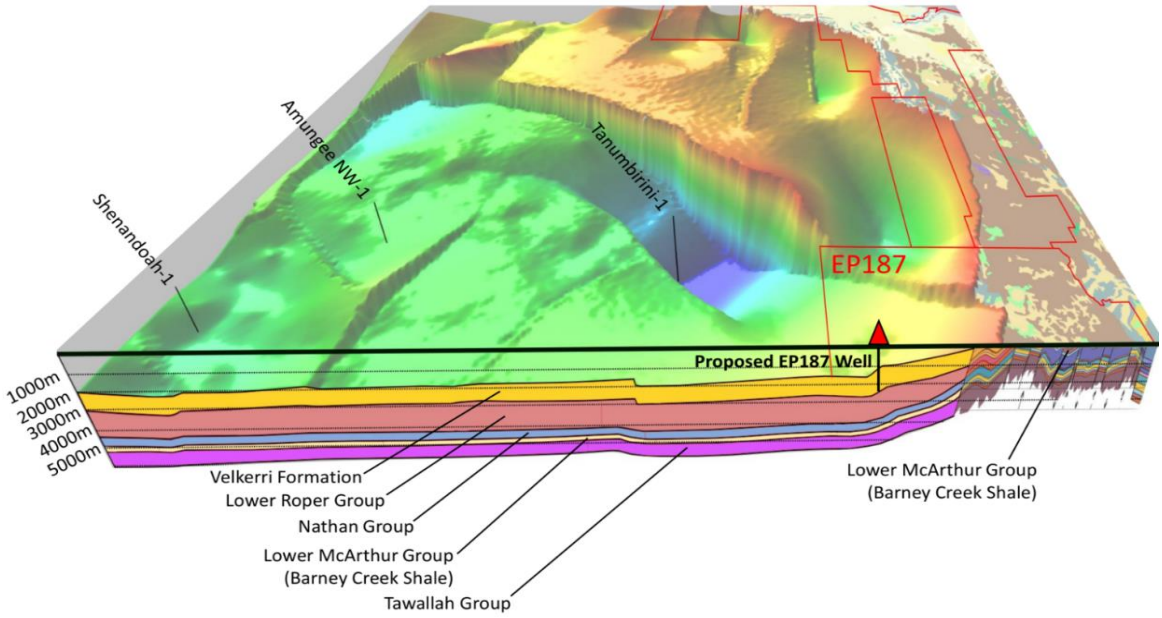


Figure 6. Modelled formation and subsurface basin geology

The Bukalara Sandstone, which is stratigraphically deeper that the Top Spring Limestone, is recognised as an aquifer on a regional basis. However, based on the Geological Map of the Northern Territory and surrounding well data, the Bukalara Sandstone is not considered to be of sufficient quality (porosity and permeability) to constitute an aquifer at this location and is not utilised. The base of the Bukalara Sandstone is expected to be intersected 269 mTVD. Thus, even if the Bukalara Sandstone were regarded as an aquifer at this location, the vertical separation to the top of the target interval (1080 mTVD) would still be 815 mTVD, which exceeds the minimum offset required under the Code of 600m. If an aquifer is discovered during drilling that was not identified prior to commencement of drilling, the Minister will be notified.

3.5.1.1 Hydrogen Sulfide (H2S)

Hydrogen Sulfide (H2S) is a gas commonly found during the drilling and production of crude oil and natural gas. The gas is produced as a result of the microbial breakdown of organic materials in the absence of oxygen. Some of its characteristics is that it is colorless, flammable, poisonous, corrosive, and has a noticeable rotten egg smell.

An offset well review has found no indication of H2S in the area. Nonetheless, H2S sensors, that provide audible and visual alarms, will be installed and functioning testing while drilling. Sensors are triggered when detecting 5 ppm (by volume) of H2S in the atmosphere.

3.5.1.2 Drilling mud/fluid composition and Drill Cuttings

Wells are designed to be drilled utilising water-based muds and drilling fluids. For a description of the drilling fluid refer to Appendix 12. All sources of water, including volumes used will be recorded.

All chemicals to be used have been approved for use in drilling petroleum wells by the Commonwealth Government, Department of Health and listed on the Australian Inventory of Chemical Substances which is maintained under the National Industrial Chemicals Notification and Assessment Scheme. No drilling fluid additives that are used in the process contain benzene, toluene, ethylbenzene or xylene. Drilling fluids will be selected and managed to ensure all products used during well operations on petroleum wells are used in accordance with the manufacturer's recommendations and relevant safety data sheets. The name, type and quantity of each chemical used on each well throughout the well construction process will be recorded. The combined chemicals or other substances used at their maximum possible concentrations for a particular drilling or stimulation will not increase BTEX levels of the overall fluid above the BTEX content of the base water of the fluid by more than those levels prescribed in Table 16.

During mud drilling operations, the fluid is re-circulated down the hole and the returned fluids, including drill cuttings, are sent to the shale shakers where the mud is separated from the cuttings. Of the total volume of drilling mud used, only small volumes have the potential to move beyond the well bore to the formations due to the filter cake properties of the mud and their design. In addition, when drilling through local aquifers and until these aquifers are isolated by a minimum of two verified barriers, chemicals or other substances that have potential to leave a residual toxic effect in the aquifer, will not be added to the drilling mud in compliance with the Code. The drilling fluid and surface gas handling system for drilling operations will allow for the removal of gas from the drilling fluid. Following the removal of drill cuttings from the returns the fluid is brought to the mud tanks on the rig which have a capacity of approx. 600bbls. Drilling mud will be recycled during the drilling operation to minimise the quantity of water and chemicals required and reduce disposal

requirements. The cuttings that have been removed from the returned drill fluid will be directed into the drilling sumps.

Drilling sump will be designed, constructed and operated with 1m of freeboard to prevent overtopping due to the total rainfall anticipated. Drilling sumps will be designed and constructed with 0.5m high bunds to prevent water entry from overland flow. The drilling sumps have a combined capacity of 360m³ (allowing 1m Freeboard), cuttings volume will be ~85 m³, drilling fluids volume will be ~150 m³ leaving ~125m³ of capacity without encroaching on the 1m of freeboard.

Testing of the active drilling fluid will be carried out in accordance with API RP 13B a minimum of twice per day.
Drilling fluids will be monitored during all drilling operations in a manner that:

- allows the determination of drilling fluid volume gains and losses
- allows the determination of drilling fluid volumes required to fill the hole on trips
- allows the determination of density in/out of the well to ensure the correct weight is being maintained to control the well
- allows the monitoring and recording of gas readings in the return fluid flow once gas bearing strata are intersected

As the drilling muds are very basic with biodegradable additives, this fluid is also discharged at the end of the well as per standard industry practice into the lined drilling sumps. Baseline soil samples will be taken prior to sump construction. The quality and quantity of drilling fluid and drill cuttings will be recorded on site.

At the completion of the drilling operations, a suitably qualified independent third party approved by DENR, will undertake sampling for laboratory testing of the drill cuttings and residual drilling muds to;

- Determine the suitability of in-situ disposal in compliance with the Code and in accordance with the following criteria:
    - pH of 6-10.5 (prior to mixing with soil)
    - Electrical conductivity of 20,000 uS/cm (prior to mixing with soil)
    - Chloride of 8000 mg/L (prior to mixing with soil)
    - Metals as per the NEPM 2013 (once mixed with soil).
    - Leachability testing of heavy metals
    - Naturally Occurring Radioactive Materials (NORMs)
    - Other contaminants of potential concern
- Determine if the waste is classified under the Radiation Protection Act 2004 (NT); and
- as required by the Waste Management and Pollution Control (Administration) Regulations 1998 (NT), which may require testing to classify the waste.

A subsequent decision on an acceptable final disposal of the drill cuttings and drilling mud will be made by DENR on receipt of an assessment report of environmental impacts and environmental risks posed by the drill cuttings and residual drilling mud. The laboratory report on leachability testing of drill cuttings and drilling mud is provided to DENR within three months of completion of the drilling program.

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

- the dried drilling mud will be mixed with subsoil in the sump and covered
- the subsoil and drilling mud will be mixed at least three parts subsoils to one-part waste (v/v)
- a minimum of one metre of clean subsoil will be placed over the subsoil and muds mixture
- top soil is re-spread over the area to encourage vegetation regrowth.

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

In situ burial of drilling cuttings where appropriate quality criteria can be met is considered to represent an acceptable and low as reasonably practical environmental risk when considered holistically. Other options such lining ponds and removing the drilling muds for off-site disposal generate more waste such as plastic, more greenhouse gases and importantly adds significantly to the road usage which represents one of the largest safety risks to staff and the community associated with onshore oil and gas activities. If certification and DENR approval cannot be obtained for on-site disposal then this waste will be disposed of to a licensed facility in Queensland. Residual drilling mud in the drill cuttings sump that does not evaporate, and fails to meet disposal requirements as outlined in the Code will be removed from site, before the onset of monsoon rains for disposal at a licensed facility in Queensland.

3.5.1.3 Air Drilling

If drilling operations are carried out with air as a drill fluid the following conditions will be met;

- Compressors and boosters must be located to prevent the ingestion of flammable gasses from drilling activities and fuel stores.
- All pressure lines and manifolds will be identified with appropriate signage, positioned so that it does not interfere with vehicular access to the drilling location or cross areas on the drilling location frequented by vehicles and persons, constructed using hoses, pipes, fittings and connections that have a rating sufficient to withstand the maximum supply pressure, and properly restrained to prevent dangerous movement in the event of coupling or hose failure.
- A check valve will be installed on the delivery line at or near the standpipe.
- The main air or gas supply line shall have at least two valves; one on the standpipe and accessible from the rig floor and one located at the compressors and boosters, each valve shall be rapid acting, clearly labelled and readily accessible.
- In relation to blooey, diverter or bleed-off lines:
    - they will only be used during underbalanced drilling
    - where used, they will be run to a pit or tank capable of catching any drill cuttings produced
    - they will extend at least 45 metres from the wellhead and shall, where practicable, be laid downwind of the well, or at right angles to the direction of the prevailing wind
    - they will include adequate dust suppression to reduce risks to human health and the environment to a level that is ALARP and acceptable
    - reservoir liquids will not be produced to the pit or tank
    - any geological sample catcher installed on a blooey line will be designed to avoid flashback and to protect persons from dust
    - a continuous purge of any blooey, diverter or bleed-off diverter line will be conducted using a primary jet during circulation, start-up and shut-down, and when making connections

- For well control during air drilling operations, all equipment will be lined-up for a soft shut-in at all times. It is safety critical to avoid a rapid pressure build-up within the well when the well is known to contain hydrocarbons and air
- Drilling crew from the Assistant Driller and above will be well-control certified and be trained on soft shutting techniques applicable for underbalanced drilling operations
- Explosive limits or mist injection will be established for circulating media that can introduce O2 into the circulating system. If explosive limits are not clearly defined, systems which could introduce O2 should not be used
- Explosive limits will be documented and posted next to the O2 monitoring system for all circulating systems that contain O2. Monitoring stations will include the rig floor, inside the substructure next to the BOP stack, and near separation vessels / storage / circulating tanks.
- All gas influxes will be checked for H2S. If any H2S is detected, the well must be circulated to a kill fluid immediately. The impact of H2S to the flammability limits (e.g., LEL) is unpredictable during reservoir inflow flush production events, therefore, with any detection of H2S air drilling operations shall be terminated.
- Sufficient firefighting equipment and systems will be available at the drilling rig to extinguish an ignition at the wellhead or on the rig floor
- Enough kill fluid of sufficient density to be able to kill the well in an emergency must be available on site.
- At least one portable gas detector, of a kind acceptable to an Inspector as appointed under the Petroleum Act 1984, will be available for use where air or gas drilling is in progress.
- A downhole float valve will be fitted in the drilling string. Top and bottom kelly cocks must also be installed.
- The rig substructure will be kept adequately ventilated (either by natural ventilation or by fans).

3.5.1.4 Wellhead Casing and Tubing.

Wellhead equipment and running tools used under this EMP will be specified in accordance with API Spec 6A/ISO 10423 and NACE MR0175/ISO 15156. Wellhead and Christmas tree pressure ratings will exceed all reasonably expected loads for the entire life of the well. Wellhead product specification level (PSL) and trim will be matched to the fluid properties, pressure and temperature of flowing conditions, all components on the hanger and Christmas tree and valves must be rated to the well pressure envelope. Wellheads will be fitted with adequate valve outlets accessible and operational for all annuli to allow for monitoring of annuli. Any change of usage of a wellhead will be fully risk assessed ensure the compatibility of the existing equipment with the proposed usage.

All casing and tubing used will be manufactured to the latest edition of API 5CT, casing, casing connections, wellheads, and valves used in petroleum wells must be designed to withstand the loads, pressures and temperatures that may act on them throughout the entire well life cycle using an appropriate safety factor which will be specified in the WOMP. Casing and tubing stress analysis will be carried out on all reasonably foreseeable load scenarios that may be imposed on the wells drilled under this EMP. All casing strings will be pressure tested prior to drilling out for the next hole section. The wellhead will be fenced off; with signage reflecting well name and Imperial contacts, all valve handles will be either removed, or chained and padlocked.

3.5.1.5 Casing Centralisation and Cementing.

Centralisers will be selected to suit the application in accordance with API requirements, casing centralisation simulation will be undertaken for the proposed casing centralisation plan to achieve a

minimum of 70% standoff across the entire cementing interval using the actual deviation at casing depth; or where the actual deviation is not known, a deviation of three degrees from vertical at casing depth.

The cement slurry density for the wells drilled under this EMP will be designed to maintain well control, prevent gas channelling and achieve the required compressive strength while avoiding losses during cement placement. Cement laboratory testing for slurry density, rheology, thickening time, free water, fluid loss (if required), and compressive strength development with time will be carried out (as per ISO 10426-2, API RP 10B-2 - Recommended Practice for Testing Well Cements) on representative samples of the mix water, cement and additives to confirm the resulting slurry used for primary cementing meets the requirements of the well design. Calcium chloride or other chloride-based accelerants will not be added to the cement mix unless the free water content of the cement is specified as <2%.

The top of cement will be brought to surface on all sections, where cement to surface is not possible due to downhole losses top up operations will be performed.

Wiper plugs or cementing darts will be used for production casing to prevent contamination of cement, and to enable plug bump and pressure test of the casing before cement cures.

Wait on cement time prior to slacking off or removing BOPs will be based on the cement achieving a minimum of 700 kPa (100 psi) compressive strength at the temperature of any potential flow zone in the annulus just cemented. Alternatively, Imperial may use an annulus pack-off or mechanical barrier that is compliant with API Standard 65-2 and tested to verify a pressure seal prior to removing BOPs. When a hydrocarbon bearing zone is intersected during drilling and subsequently cemented, a Cement Bond Log will be performed as a verification of hydraulic isolation from aquifers, the surface and other formations where cross flow is prohibited.

A minimum 3.5 MPa (500 psi) compressive strength on the tail cement shall be achieved prior to pressure testing of casing and/or drilling out the shoe track for a subsequent hole section.

3.5.1.6 Well Control

Wherever drilling fluid is being used as a primary barrier, sufficient reserves of drilling fluid and supplies of drilling fluid materials will be available at the well site for immediate use so that the well can be maintained full of drilling fluid.

Two verified barriers will used unless one or more of the following circumstances applies:

- during top hole or surface hole drilling where shallow hydrocarbon or water flow risk has been assessed as being negligible
- during diverter drilling
- during well decommissioning when two formations need to be isolated from one another and two barriers are not feasible, and a continuous cement plug extending minimum 50m above to 50m below the interface is placed instead
- in other circumstances during well life cycle activities when a risk assessment demonstrates that the same level of risk can be achieved as if two verified barriers were in place

The kick tolerance of the formation being drilled will be known, this will be demonstrated through a Formation Integrity Test or data from offset wells.

During well construction activities, well control equipment (e.g. BOP stack and wellhead) that is suitable for the well will be installed for all operations prior to drilling below the surface casing string. This well control equipment will be used and operated compliant with API Specifications. A gas detection system will be used on the well site to identify hydrocarbon bearing zones and potential gas influx. When undertaking underbalanced drilling or managed pressure drilling activities, well control measures will be in place to counter the absence of weighted drilling fluid as the primary well control method, Rotary Control Devices and non-return valves will be used and operated compliant with API Specifications. Other than annular BOPs, all well control equipment will be rated to exceed maximum anticipated shut-in surface pressure. Well control equipment will be function tested and pressure tested in accordance with API Standard at least every 3 weeks, working temperature rating for well control equipment must meet the maximum anticipated continuous exposure temperature for rubber/elastomer components. Methods will be established for early identification of fluid influx, the surface gas handling system for drilling operations will be fit for purpose and used within operating limitations, so that the potential risks of fire and explosion from free gas are identified and managed. Prior to drilling below the conductor casing a system will be installed to safely divert hydrocarbons and other fluids in the event of pressurised fluids occurring below the shoe of the conductor string. Control methods will be in place to prevent blowouts up the drill pipe in case unexpected subsurface pressures are encountered. Regular drills pertaining to on-going or up-coming operations will be conducted to train involved personnel in detection, prevention and recovery of a lost barrier.

In order to continue operating a well which has, or is believed to have, a compromised well barrier, a risk assessment will be conducted in line with the interest holder's risk assessment process and where required remediation action undertaken.

3.5.1.7 Associated Water

Due to well designs and the use of overbalanced drilling, water is not expected to be produced during drilling. The potential for associated water to flow to surface would be managed with the use of the overbalanced drilling fluid (water-based mud).

3.5.1.8 Environmental controls for the Drilling Program

Imperial has implemented control measures to manage environmental risks associated with this drilling program. These controls manage the risk to the environment and aquifers and mitigates its impacts to ALARP and acceptable level. A full assessment of the project's environmental risks is provided in Section 6. All drilling activities will follow the Northern Territory Code of Practice for Onshore Petroleum activities, May 2019.

3.5.2 Well Evaluation, logging testing and coring

Well evaluation techniques including mudlogging, wireline logging, formation testing, core acquisition, fluid sampling, testing (i.e. leak-off tests, formation integrity tests,) and other standard oilfield evaluation techniques as deemed appropriate will be implemented during drilling activities.

Drill core and/or cutting samples will be collected for geological assessment.
When coring operations are conducted, the testing for gas using hand held sensors at the rig floor will be conducted while retrieving the inner core barrels as well as when opening the core barrel and examining the cores.

Wireline logs will be acquired over the open hole section as per Imperial and Regulatory requirements.

When carrying out wellbore logging or survey activities equipment will be available to attempt recovery of survey or logging equipment lost down hole in a timely manner. If a radiation source cannot be retrieved from down hole, all relevant information will be submitted in writing and an approval will be sought in relation to disposal of a radiation source under the Radiation Protection Act 2004 (NT).

During subsurface open hole tests, the following will be applied:

- Well & tool schematic must be prepared and included in the well test program
- All well test equipment must be located in appropriate hazardous classification areas.
- Clear and accurate definitions of temperature and pressure ratings must be provided for all surface equipment. Any pressure de-rating due to elevated temperatures must be addressed in the emergency shutdown and monitoring systems.
- The line to the testing choke manifold must be rated and pressure tested to the maximum expected surface pressure as calculated from reservoir pressure less the hydrostatic of a gas column to surface plus any kill or surface treatment pressure.
- Pressure monitoring capability must be available at the wellhead. During the well test, actual flowing conditions must be recorded and compared to predicted values.
- The well test surface equipment must be designed, prepared and operated in accordance with API Specification 6A, NACE MR-01-075, ASME B31.3 (Spools & X-Over).

3.5.3 Well suspension / plugging and abandonment

The well(s) is part of an exploration program with uncertainty on reservoir performance. The following activities may occur post evaluation:

- The well will be suspended with cemented casing and a pressure suitable well head for re-entry; or
- Full decommissioning with permanent cement plugs installed in the well as per regulatory and industry best practice requirements.

As part of the well suspension process, two validated well barriers will be put in place as per Imperial and Northern Territory regulatory requirements. A Well Integrity Monitoring Plan will be put in place for any suspended well to address monitoring of wellbore barriers. Upon long term suspension, the well pad will be decreased in size to facilitate natural rehabilitation and revegetation process.

During the decommissioning stage All aquifers will be isolated from each other and the surface by a minimum of one well barrier and from any permeable hydrocarbon bearing zones by a minimum of two well barriers.

Cement plugs will be permanently placed in the well and verified as follows;

- Off bottom open hole cement plugs will be verified by tagging the plug with a minimum 2270 kg (5000 lb) drill string weight,
- For consecutive stacked cement plugs with the first plug set on bottom or solid base (e.g. mechanical packer, other verified cement plug) validation of the top of good quality cement will be carried out by tagging the top plug with a minimum 2270 kg (5000 lb) drill string weight. If using a sacrificial stinger to set open hole plugs, no tag is necessary where no losses are observed during cement placement.

- For a cased hole cement plug with the bottom of the plug exposed to open hole validation will be done by tagging the top plug with a minimum 2270 kg (5000 lb) drill string weight and by pressure testing to 3.5 MPa (500 psi) above the estimated (or previously recorded) leak-off pressure (within the limits of the casing and wellhead pressure ratings).
- For a cased hole cement plug supported by a pressure tested bridge plug, validation may be by post cement job report and calculations, or by tagging the plug with a minimum 2270 kg (5000 lb) drill string weight.
- For an unsupported cased hole cement plug barrier not exposed to open hole below, validation will be done by tagging the plug with a minimum 2270 kg (5000 lb) drill string weight.
- When a sacrificial string is used to place a cement plug, validation may be via a combination of pressure testing to confirm isolation and validation of the conduct of the cement job.

Before the wellhead is removed zero pressure on any casing or annulus will confirmed. Wellheads will be removed, and the casing will be cut.

A steel marker plate cut from corrosion resistant alloy or similar grade steel for corrosive environments will be installed after the wellhead has been cut off detailing the following:

- the identifying name of the well;
- the total depth in metres of the well;
- the date the well was decommissioned; and
- the marker plate shall be covered with soil to ground level.

Complete and accurate records of the entire decommissioning procedure will be kept and submitted as part of the legislative reporting requirements for the decommissioning of petroleum wells.

The potential for accumulation of NORM in well equipment will be assessed and appropriate measures put in place to reduce risks to the health and safety of people and the environment.

Leases and roads will be rehabilitated or left in place subject to an agreement with landholders.

3.6 Operations Support Facilities for the Program

3.6.1 Traffic Management

A Traffic Management Plan and an application for a Permit to Work Within a Road Reserve are being prepared for the activities covered under this EMP are being prepared for lodgement.
Both the Traffic Management Plan and the Permit to Work Within a Road Reserve will require approval prior to any works being carried under this EMP. These applications will include spatial data including the locations of the proposed access tracks, and the existing site proposed to be utilised for the campsite.

All mobilisation of the selected rig, accommodation camp and other equipment required for the Drilling program will be followed the traffic management measures that meets the Department of Infrastructure, Planning and Logistics; and will be shared with relevant NT Government agencies and other stakeholders prior to mobilisation. Refer to Table 27 for further details on Traffic and Transport Management.

A rig mobilisation plan will be prepared prior to mobilisation to ensure the move is done safely and in consultation with all stakeholders.

3.6.2 Accommodation Camp

The drilling camp will be located along the Carpentaria Highway (Latitude: 16°43'56.13", Longitude: 135°12'0.30"E) (Figure 2) with a capacity to accommodate 30 people. The camp will be equipped with a compliant sewage treatment process.

The waste water system will require DoH waste water works design approval, being prepared by a hydraulic consultant that must include but not be limited to:

- System design & management plan allowing for secondary treatment and disposal of effluent
- Management of trade waste from any food preparation area
- Land capability assessment for effluent disposal area
- OWMS decommissioning plan

The WWDA application will be submitted to and approved by DoH prior to the commencement of any wastewater works.

The full discharge specifications of the sewage system will comply with relevant legislative requirements. This may include an irrigation sprinkler system or storage and treatment offsite. Waste will be managed in accordance to Imperial's Waste Management Plan (Section 7.5 and Appendix 13). Below is a general site layout illustrating the camp and associated equipment. (Figure 7)

Because of the short duration of the works potable water will be purchased from a supplier which complies with the Department of Health Guidelines for private water supplies.

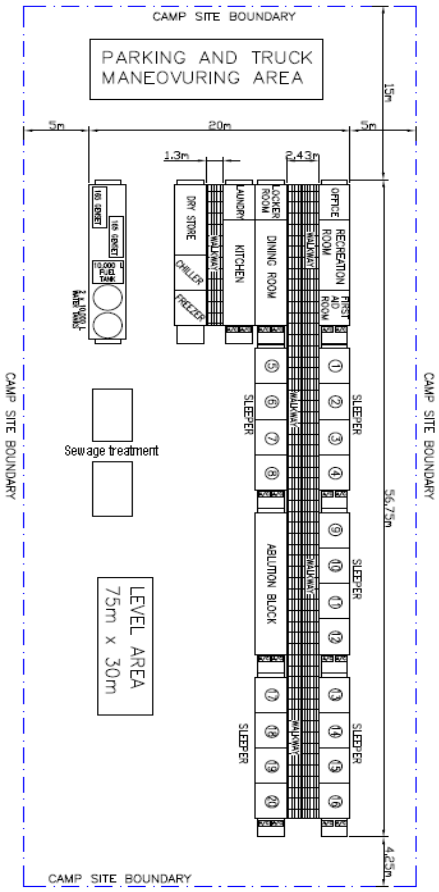


Figure 7. General site layout illustrating potential temporary camp and associated equipment.

3.6.3 Airstrip

Imperial will seek agreement with the nearby properties, including the Heartbreak Hotel, to use their airstrip as part of the emergency response evacuations and possibly crew change services for the rig.

The distance between the well site and the Heartbreak Hotel airstrip is approximately 60km by sealed road. The 1,100m airstrip is regularly used to deliver landowner mail and other private aircraft.

3.6.4 Waste Management

Waste will be managed at each of the project sites including the two drilling locations and the camp location. Waste will be segregated into listed and non-listed waste as determined in Schedule 2 of the Waste Management and Pollution Control (Administration) Regulations before final disposal. Non-listed waste will be transported off-site and disposed of at the appropriate waste transfer stations. All listed waste will be transported off-site by an NT EPA approved and registered waste contractor for disposal at the closest appropriately licenced waste management facility. (Refer to Wastewater management plan for further details Appendix 13)

Where transport is required across state or territory borders, the NEPM 2013 guidelines will be adhered to as well as local regulations. If required, waste will be placed in sealed containers for transport to the locations indicated in Table 9. All waste will be removed as required.

Table 9. Waste disposal management.

Type of Waste	Indicative Volumes (kg/d)	Disposal Method	Disposal Location
Food waste, paper and plastic	10m^3	Collected in dedicated waste bins for transport to an approved landfill	Katherine or Darwin, NT
Glass and cans	2m^3	Collected in dedicated waste bins for transport to an offsite facility	Katherine or Darwin, NT
Chemicals bags and cardboard packaging materials	10m^3	Compacted and collected at rig site for transport to a licenced recycling centre	Katherine or Darwin, NT
Used chemicals and fuel drums	5m^3	Collected in designated skip for recycling at an approved location	Katherine or Darwin, NT
Chemical wastes	5m^3	Collected in approved containers for disposal at approved landfill or returned to supplier or recycled.	Katherine or Darwin, NT
Sewage, grey and storm water	50m^3	All sewage to be collected and transported offsite at a licenced disposal facility. Grey water disposed of on-site in accordance with Department of Health requirements. All stormwater will be released to grade in compliance with the following: • Is uncontaminated with hydrocarbons or other chemicals • Is not released to watercourses or waterways • The release will not cause environmental harm (soil erosion or vegetation damage) • All contaminated stormwater will be captured and disposed of offsite at a licenced facility.	Katherine or Darwin, NT
Empty IBCs	5m^3	Collected in designated area for recycling or returned to supplier or recycled.	Katherine or Darwin, NT
Metal and plastic drums	5m^3	Collected in designated skip for recycling at an approved location	Katherine or Darwin, NT
Timber pallets	2m^3	Recycled at an approved facility	Katherine or Darwin, NT
Batteries and Tyres	1m^3	Disposed of at an approved landfill	Katherine or Darwin, NT
Oily rags, oil contaminated material, filters and other hydrocarbon material	5m^3	Oil from machinery or encountered during drilling will be collected in suitable containers for disposal at approved landfill or recycled at an approved recycling facility	Katherine or Darwin, NT

Type of Waste	Indicative Volumes (kg/d)	Disposal Method	Disposal Location
Listed Waste	$2m^3$	Collected in designated area for disposal according to the *Waste Management and Pollution Control Act*.	Any waste prescribed wastes under the *Waste Management and Pollution Control Act* as specified as a listed waste by the NT EPA as found at https://ntepa.nt.gov.au/waste-pollution/approvals-licences/listed-waste, will be disposed of in accordance with the regulations and by a company licensed to handle and dispose of this waste.
Residual drill fluids	$150m^3$	Initially recycled. Volume reduced further via evaporation. May be transferred to the cuttings pit for temporary storage and to encourage evaporation of water. Any residual drilling fluids will be removed from the drill pit and transported for disposal off site prior to the onset of the wet season. Residual solid waste (from evaporated drill fluids) will be mixed in with drill cuttings	Katherine, Darwin, NT or Mt Isa
Drilling cuttings	$90m^3$	Cuttings and solid drilling residue initially stored in a lined pit. Subject to sampling and testing results drill cuttings will be buried and disposed in-situ. Certification will be sought from a suitably qualified third party that the material is of acceptable quality for disposal to land by the proposed method, and that environmental harm will not result from the proposed disposal. Approval of the certified method must be provided by DPIR/DENR. If approval cannot be granted, then waste may be disposed of to a licenced facility	In-situ disposal, if proven feasible. Otherwise Katherine, Darwin, NT or Mt Isa

Refer to Wastewater Management Plan in Section 7.5 and Appendix 13 for further details.

3.7 Project Water Use

Water will be sourced from potable water suppliers or utilise existing water bores as shown in Figure 12. Imperial Oil and Gas is in consultation with the owners of the planned water bores to establish agreements for the use of the bores. Water will be stored in temporary water storage facilities within the proposed drill site. All standing water will be fenced to deter fauna.

It is anticipated that 2.5ML of water will be required for drilling activities. Following correspondence with DENR, Imperial does not anticipate that a water licenced is required as the amount of water needed is not expected to exceed 5ML per annum as per the Water Act. A breakdown of the water

use volumes is provided in Table 10. Water usage for personnel will be approximately 0.06ML over 10 weeks of the anticipated duration of the Drilling Program. Water usage is calculated based on approximately 200L/day per person. Water for dust suppression is required and will be likely sourced from the existing bore Hwy 1 (Figure 12). Volumes of water required for dust suppression will depend on the weather conditions and the potential for dust production. Water consumptions and extraction amounts will be metred at the bore and submitted to the DPIR and DENR upon completion of the drilling program.

Table 10. Estimated Water Use Volumes (ML)

Use	Scope	Total Use (ML)
Well drilling and maintenance	2 vertical wells (1 ML per month)	2.5
Operational activities	Road and site maintenance (1.5 ML for the duration of the drilling activities)	1.5
Total		4.0

3.8 Wastewater Management

3.8.1 Grey water disposal

Any grey water produced from the temporary camp and office facilities at the drill rig will be dispersed into the surrounding environment with a movable temporary sprinkler. The sprinkler will be moved on a regular basis to avoid pooling of water which may attract pest and fauna. Any detergents or cleaning fluids used will be biodegradable and low-nutrient formulations where possible.
The waste water systems will require DoH waste water works design approval, being prepared by a hydraulic consultant that must include but not be limited to:

- System design & management plan allowing for secondary treatment and disposal of effluent
- Management of trade waste from any food preparation area
- Land capability assessment for effluent disposal area
- OWMS decommissioning plan

The WWDA application will be submitted to and approved by DoH prior to the commencement of any wastewater works.

3.8.2 Sewage Water disposal

All sewerage water produced at the camp will be treated by an onsite treatment plant for ultimate disposal in accordance or transported offsite as required. All treatment will be meet the legislative requirements for treatment, handling, transport and disposal of sewage.

Any discharge from the Drilling rig temporary camp will be treated. The effluent treatment process may involve storage and treatment on site or removal off site. If treated on site, once the liquid has reached the predetermined level of decontamination, the water is sprayed 50-100m away from the camp location to the surrounding environment using a sprinkler system. The estimated volume of treated water released per day is approximately 8000 litres. The discharge sprinkler system and treated water will be managed so that there will be no pooling, no runoff, no vegetation die off and no releases within 100m of watercourses or drainage features.

3.9 Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions for this EMP were estimated using the threshold calculator developed for the National Greenhouse and Energy Reporting scheme. Emissions associated with fuel combustion, site vehicles, generators, and drilling rig, were estimated using factors and formulas in the Emissions and Energy Threshold Calculator – 2018. Extended Flaring or venting operations are not expected on the wells covered under this EMP, in the event of produced gas it will be flared rather than vented. As there are no pipelines or other equipment planned under this EMP so no Greenhouse gas emissions have been calculated related to this equipment. This was based on the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (NGER Determination).

Emissions reporting will be in accordance with Section D.5.6. The natural gas industry is required to estimate and report all greenhouse gas emissions to the Australian Government's Clean Energy Regulator on an annual basis. Hence emissions associated with venting and flaring as described in Section D.5.9 must be consistent with the reporting requirements of the Clean Energy Regulator but must be provided separately to the Northern Territory Government in accordance with this Code. In cases where Imperial Energy is below the reporting threshold specified by the Commonwealth National Greenhouse and Energy Reporting Act (2007), emissions will still be reported to the Northern Territory Government under this Code. Emissions reported to the Northern Territory Government will be made available for subsequent open publication.

The estimates for drilling program are provided in Table 11 below.

Table 11. Gas emissions estimates for the drilling program

Source of Emission	Inputs	Assumptions	tCO2-e
Transport fuel combustion	6 kL Diesel oil (post-2004 vehicles)	Site Transport - Diesel volumes estimated at 150L/day for 40 days. Estimate based on the Emissions and Energy Threshold Calculator – 2018.	16
Non-transport fuel combustion	140 kL Diesel oil	Average fuel consumption at SL-4 1 is 3,500L/day for 40 days. Estimate based on the Emissions and Energy Threshold Calculator – 2018.	432
Electricity/energy produced	6 kL Diesel oil	Based on site generators for lighting and power 150L/day	16
		Total	450

3.10 Rehabilitation

Rehabilitation is discussed in the Rehabilitation Management Plan Section 7.3. All rehabilitation will be conducted in accordance with the Code.

4 Description of the Existing Environment

4.1 Physical Environment

4.1.1 Climate

The project area experiences a tropical savannah climate within the humid Zone with a distinct Wet and Dry season which can experience an average rainfall between 600 – 800mm per year over the summer wet. The seasonal contrast between the Wet and the Dry has significant implications for water resources. The summer monsoon season brings rain and cyclones and during this period the project area experiences significant rainfall events. These rainfall events can cause flooding which is determined by the volume, duration and spatial distribution of the rainfall. It is these flooding events that provide the recharge to the aquifers. In contrast, the Dry season between April and December experiences negligible rain which results in many of the rivers ceasing to flow.
The weather station 14704 exists at the McArthur River Mine and this station identifies that most of the rain falls during the Wet season between November and April, while the Dry season from May to October brings negligible rainfall and is characterized by very dry southeast to east winds, generated by migratory winter high pressure systems to the south.

The mean daily minimum temperatures at the McArthur River mine range from 12.1 to 25.1°C and a maximum mean daily temperature range from 29.9 – 38.6 °C. Average annual evaporation is approximately 2,400mm for the region which, even in the wettest of years, exceeds the annual rainfall (NT Gov't., 2009). Available data shows a mean maximum monthly rainfall ranging between 182 - 252mm (January) and a mean minimum monthly rainfall ranging between 0.1 – 1.6mm (October). Table 12 displays the mean monthly rainfall and temperature data for the McArthur River region with the data drawn from this weather station.

Table 12. McArthur River long term averages

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean Max (°C)	35.9	35.2	35.0	34.7	32.4	29.8	29.9	32.1	35.3	37.8	38.6	37.8	*34.5*
Mean Min (°C)	24.9	24.7	23.4	20.5	16.7	12.7	12.1	13.4	17.2	21.0	24.1	25.1	*19.6*
Mean Rain (mm)	210.3	184.4	153.8	33.5	7.7	1.7	2.4	0.3	5.1	20.3	62.2	129.9	*819.2*
Median Rain (mm)	170.0	162.1	109.2	14.4	0.4	0.0	0.0	0.0	0.0	1.6	37.2	88.6	*669.5*
Mean Rain Days	13.6	13.3	10.8	3.5	1.2	0.5	0.4	0.3	0.7	2.0	5.7	9.7	*59.2*

From http://www.weatherzone.com.au/climate/station.jsp?lt=site&lc=14704

4.1.2 Geology

Organically rich source rocks with the potential to generate and host both oil and gas are present in several intervals within thick Meso and Palaeo-Proterozoic age formations of the McArthur Basin such as the Velkerri and Barney Creek Formations. Additional targets may be present within the tenement such as the Yalco Formation and Caranbirini Member of the Lynott Formation; and, the Upper Roper Group Velkerri and Kyalla Formations. A chronostratigraphic column indicating sequence of these formations is shown in Figure 8 below.

The Velkerri Formation and the Barney Creek Formation are the major organic rich source rocks and the primary unconventional targets for hydrocarbon generation. These formations have been proven to be gas-bearing in exploration wells drilled during 2012 and 2013 by Armour Energy, Santos/Tamboran in 2014 in the Tanumbirini 1 well in EP161 which is immediately adjacent to Imperial's EP187 tenement, and by Origin Energy in the Amungee NW-1 well within the Beetaloo Sub-Basin. In addition, the Lynott and Yalco formations are considered to have good hydrocarbon generating potential and are also possible unconventional targets while the Bessie Creek Sandstone may be a suitable conventional target. These formations are reported to be currently in the oil thermogenic window of hydrocarbon generation.

Recognised conventional reservoirs are developed at various levels within carbonates of the McArthur Group and are potentially sealed by shales in Barney Creek and Lynott Formations or by thick evaporites at the base of the Balbirini Dolomite.

The uppermost unit, the Roper Group varies between 1,500 and 4,000 m in thickness. The Roper Group thickens to the northwest from EP187 as it develops across the Beetaloo Sub-Basin of the McArthur Basin. It consists of alternating quartz arenites, siltstones and shales. The Roper Group unconformably overlies the McArthur and the Nathan Groups.

The sedimentary sequences within the Roper Group have significant lateral extent, with more uniform facies when compared to the underlying successions of the Nathan, McArthur and Tawallah Groups. The estimated age of the Roper Group is at least 1,430 Ma. An un-named succession of sandstones and shales of probable Neo-Proterozoic age overlies the Roper Group. These formations have a maximum thickness in excess of 600 m. The Tawallah Group is the lowermost of the four major sequences present in the McArthur Basin and is up to 4,500 m thick and represents the economic or effective basement. However it also contains shales with hydrocarbon generating potential in the Wollogorang and McDermott Formations.

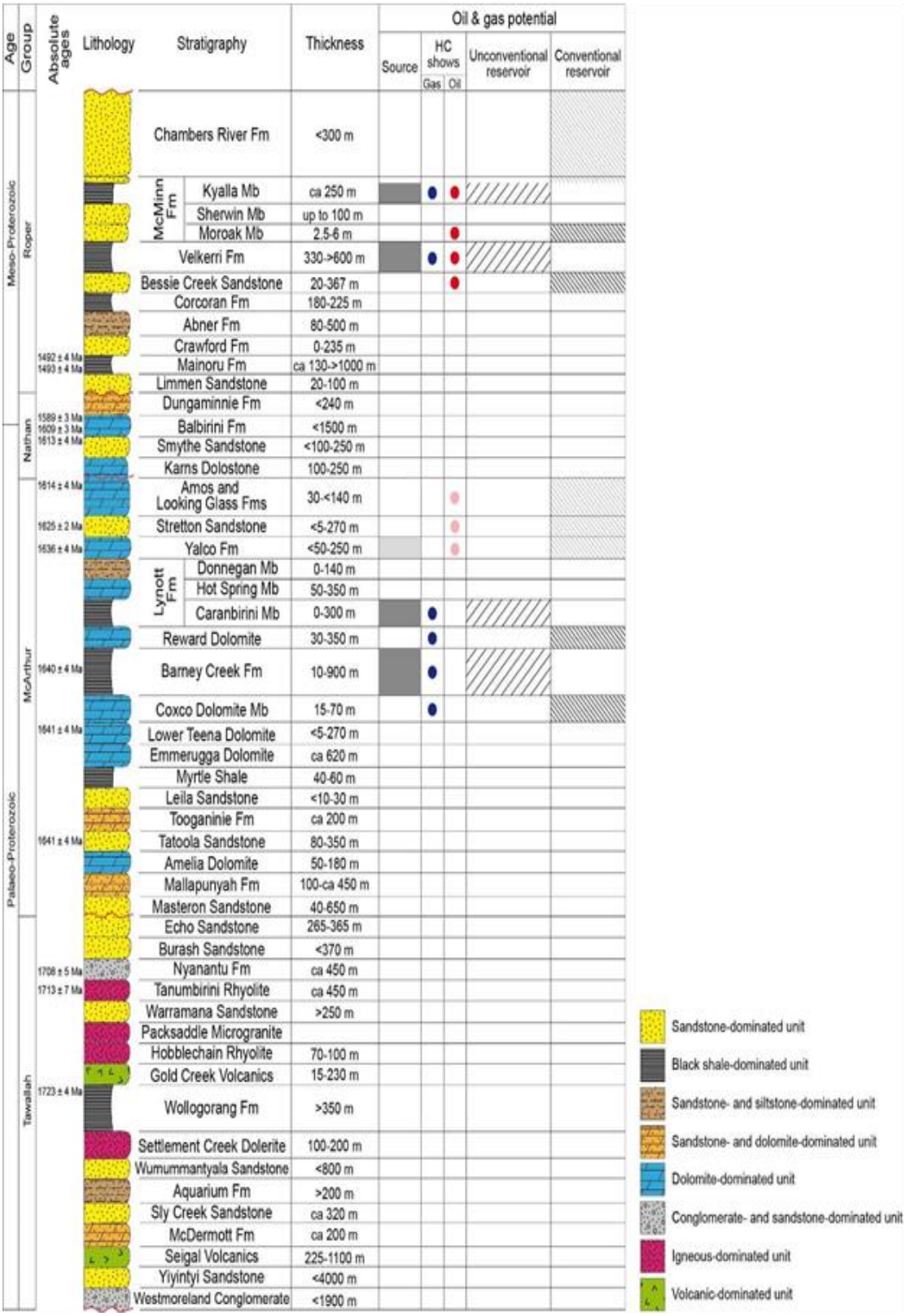


Figure 8. Chronostratigraphic framework of formations within the McArthur Basin

Based on Ahmed et. al. (in prep). Ages from Lindsay (2001) and Ahmed et al. Oil & Gas potential from Powell et al. (1987) and Pegum (1979)

4.1.3 Topography and Regional Soils

4.1.3.1 Topography

The region comprises predominantly gently sloping terrain with scattered low hills and breakaways. The northern edge of the bioregion includes Proterozoic age quartz sandstones, shale and chert of the lower McArthur and Tawallah Group. (Figure 9)

The Sturt Plateau, to the south-west of the area, has been described as an ancient uplifted erosion surface of some 250m elevation. It is a flat to gently undulating plain that is deeply weathered, covered by thick laterite and associated soils and supports predominantly savannah vegetation (Day *et al.*, 1985). A total of 19 land systems were mapped and described as part of the 'Land Resources of the Sturt Plateau' survey (Day *et al.*,1985); eight of these land systems comprise gently sloping to almost level plains and four comprise alluvial plains on the Sturt Plateau.

Geologically the area is complex. Precambrian sandstones, siltstones, shales and volcanics are predominant amongst the older rocks. Calcareous, cherty sediments with stromatolites and oolites also occur. All these are widely intruded by volcanic sills to the west and north. Palaeozoic rocks including sandstones, siltstones, volcanics and limestones overlie the older rocks. Lateritized Lower Cretaceous sediments (the Mullaman Beds) which were formerly extensive, and now occur only as isolated residual mesas. Cainozoic deposits blanket most low lying areas. Erosion of these provides some evidence of a recent change to a drier climate.

According to Zaar (2009) the greater region of the McArthur River contains rocks primarily from the McArthur Basin which include the Roper, McArthur and Tawallah Groups. These are rocks from the Proterozoic eon. The oldest rocks lie at the bottom of the basin and comprise the Tawallah Group. The Tawallah group rock formations outcrop in areas to the north east of the tenement with McArthur Group formations outcropping in the east of the tenement and Roper Group formations (Kyalla and Velkerri) outcropping in the middle of the tenement.

The Tawallah and the McArthur Group of rocks are associated with the north trending Batten Fault Zone which runs through the centre of the McArthur River Region map and continues into the eastern sector of the Limmen Bight Region map. The zone is about 50 – 80 km wide. The trough is a sedimentary depression controlled by faults that were active during sediment deposition in the Batten Fault Zone. There is considerable faulting throughout this Zone (Haines et al., 1993) which is important because faults and fractures can increase the permeability of aquifer rocks and hence bore yield.

The rock formations of the Nathan Group overly the rocks in the McArthur River Group. These include the Karns Dolomite which is located in the eastern part of the McArthur River Region and the Balbirini Dolomite located in the northern area of the Limmen Bight Region (outside the tenement). Younger Roper Group Sediments consisting of sandstones, siltstones and mudstones overly Nathan Group sediments and can be found in the middle portion of the EP187. The Bukalara Sandstone, a younger rock from the overlying Georgina Basin, is plateau forming and outcrops of the formation lie in the

south east of the McArthur River map sheet. This is the dominant rock formation on the proximal Abner Range to the east of EP187.

The Gum Ridge Formation and Anthony Lagoon Beds are limestone formations younger than the Bukalara Sandstone. They are situated in the southwest of the McArthur map region and are overlain by Cretaceous sediments. Cretaceous sediments can also be found in pockets overlying various rock formations throughout the region. The most recent deposits are from the Cenozoic primarily consisting of sands and clays. The Gulf Coastal bioregion, within which some of the north eastern part of EP187 lies, is composed of gently undulating coastal plains with scattered rugged areas of Proterozoic sandstones and Tertiary sediments. The map of the dominant soil types underlying the project is presented in Figure 10.

The Northern Territory Natural Resource Management report (NT NRM) identifies that the soils of the Upper McArthur River catchment are dominated by Kandosols and calcareous earths (40.29%); Tenosol loams (38.27%), Rudosol loams (19.12%) and Vertosols (2.32%). (NT NRM Report (2015) 187 Soils and Vegetation). According to Aldrick et al (1992) the topography of the region has developed by erosion of a post Cretaceous lateritized peneplain. The main tributary streams are superimposed consequent streams, but the minor streams and the topography of the area are controlled by the structure and differential resistance to erosion of the exposed underlying strata as previously stated.

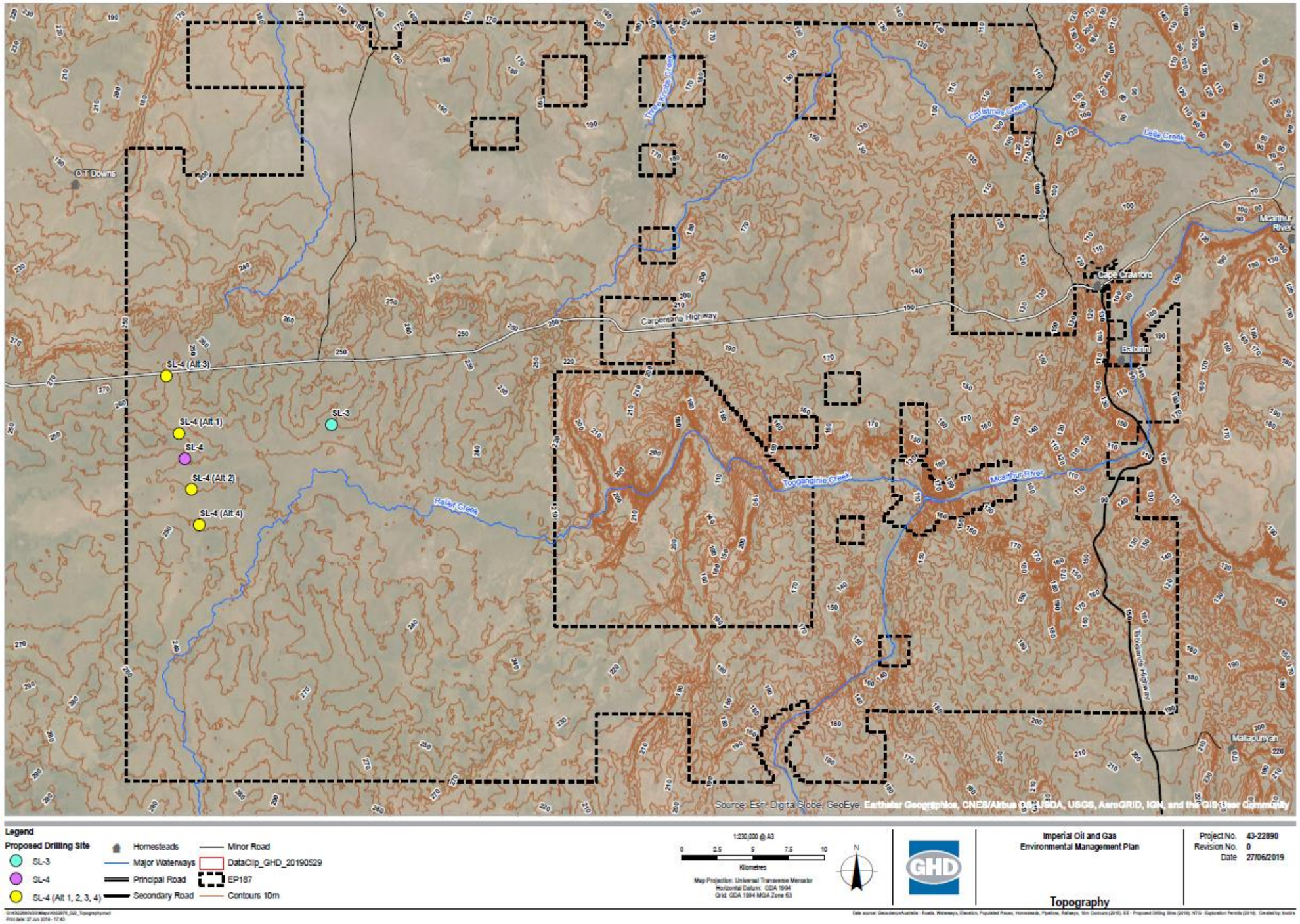


Figure 9. Topography of the Area

4.1.3.2 Soils

The exploration area within EP187 is bounded by the Barkly tablelands to the south with the bulk of the Beetaloo Basin to the west and the Abner Range to the east. The Tablelands Highway and Nathan River Road mark the eastern boundary of the Tenement. This region lies within the Greater McArthur Basin, which consists of quartz sandstone, conglomerate, siltstones, limestone and volcanic rocks of the Mid - Late Proterozoic and forms the on-lap region of the McArthur Basin Central Trough to the Beetaloo Sub basin including the OT Downs Sub basin and the Broadmere Sub basin. (Figure 10)

Within the region, the parent rocks of most of the soils are generally considered to be in their second cycle of erosion and typically display deeply weathered sand sized particles. This has produced mainly infertile soils with a near neutral reaction. Large areas are underlain by a laterite sheet, and the laterite is exposed or at shallow depth over some of the area. These 'soils' are akin to alluvial soils in that they show no profile development.

Tenosols have only weak soil profile development and are often shallow. In the Australian Soil Classification, they are defined as having limited subsoil (B horizon) development (less than 15% clay content). These soils may merge with Kandosols as the clay content can be slightly higher than specified as the upper limit for Tenosols (i.e. 15%). Kandosols soils lack strong texture contrast and have massive or only weakly structured B horizons. The B2 horizon is well developed and has maximum clay content in some part of the Horizon which exceeds 15%. They are also not calcareous throughout.

Aldrick et al. (1992) also states that shallow stony soils with a low moisture holding capacity are widespread in the region. Most of the soil chemical limitations are due to low soil fertility, and soil physical problems are mostly due to sandy or massive and brittle topsoils.

To protect the fragile soils the well site locations selected will be located along existing seismic tracks. These tracks will be upgraded to accommodate heavy vehicles and increased site activity during drilling operations. The roads will be designed to traverses open country utilizing generally flat to gently sloping areas of clear native pasture or lightly wooded land.

It is not anticipated that any trees of significance will need removal. To reduce surface runoff risk, a sediment erosion control plan for site activities has been developed and can be found in Appendix 7.

4.1.4 Land Systems

Land systems are defined because of their distinct differences from the surrounding areas and by the recurring pattern of geology, topography, soils and vegetation. Land system information for the permit area is described in Table 13 and shown in Figure 11.

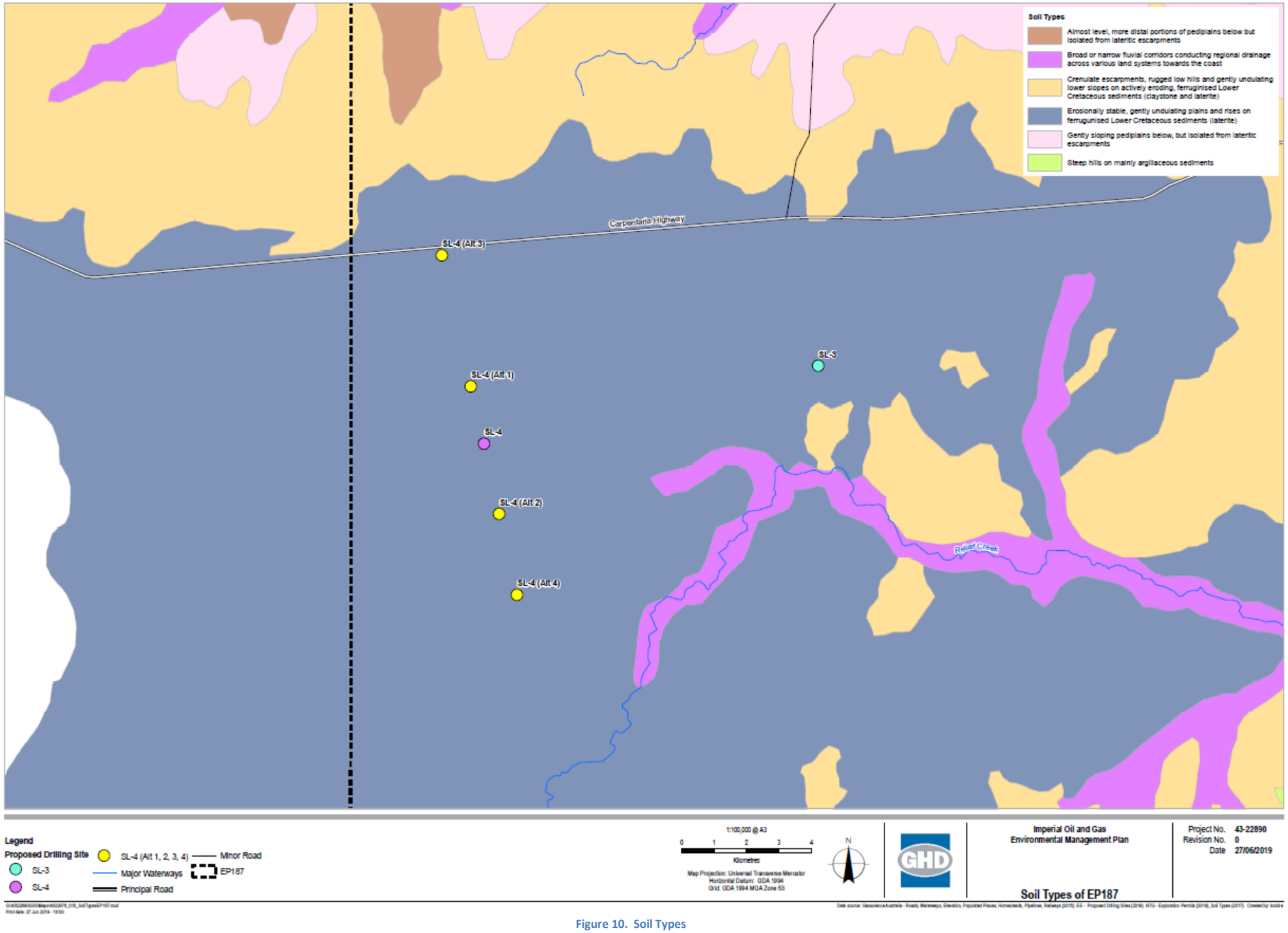


Figure 10. Soil Types

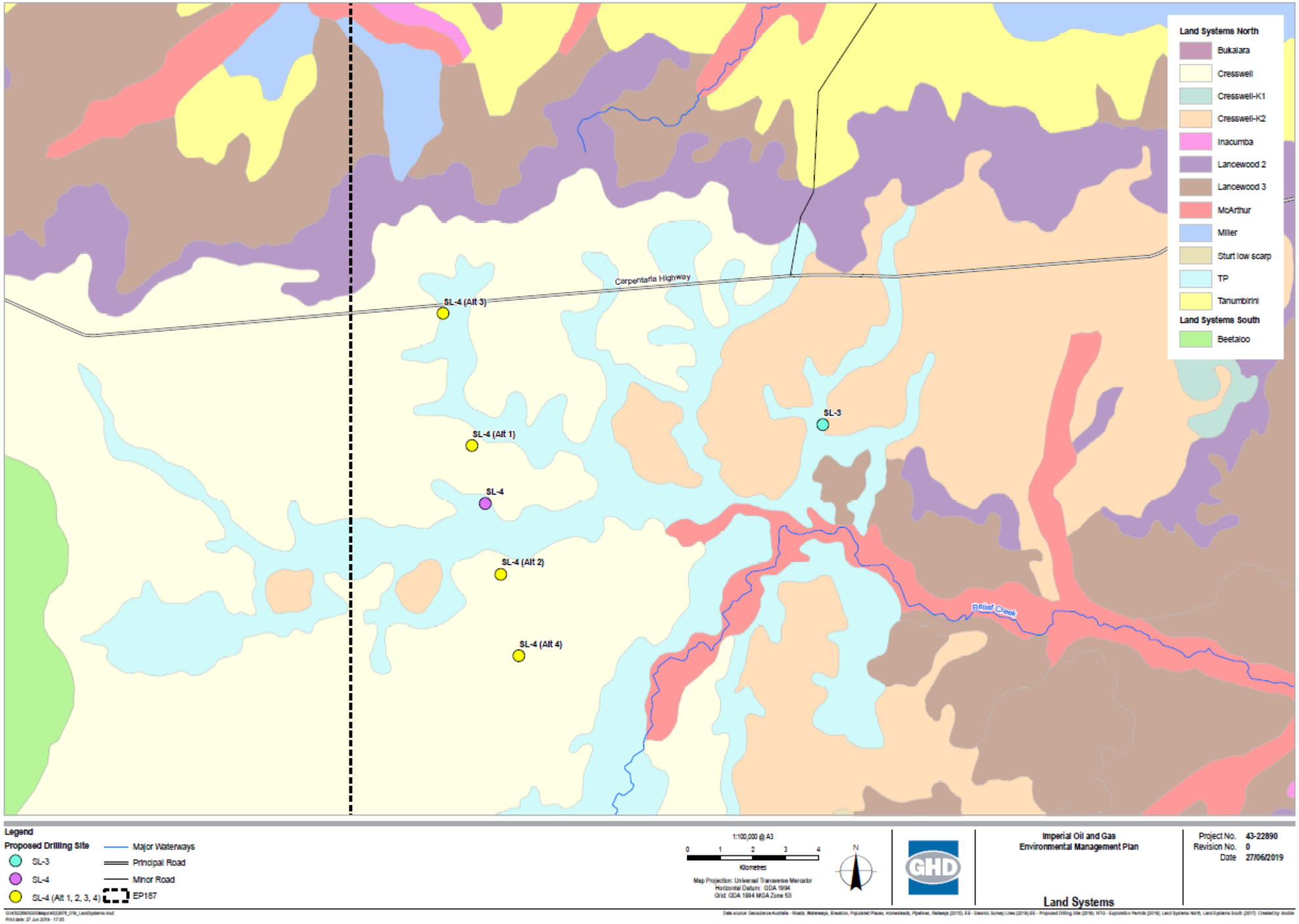


Figure 11. Land system map for SL4 and SL3 (two identified Land systems)

Table 13. Description of the Land Systems

Land System	Landscape class	Class Description	Landform	Soil description	Vegetation Description
Bukalara	Rugged quartz sandstone plateaux and hills	Steep rocky plateaux and hills on quartz sandstone and sandstone; shallow sandy soils and rock outcrop	Rugged rocky plateaux and steep, linear ridges, on massive sandstones such as the Bukalara and Komolgie Sandstones	Lithosols and shallow siliceous sands	Mid high open woodland of C. dichromophloia, E. miniate, E. tetrodonta, Erythrophleum chlorostachys over Plectrachne pungens, Chrysopogon fallax, Eriachne obtuse.
Cresswell	Lateric plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils.	Erosionally stable, gently undulating plains and rises on ferrugunised Lower Cretaceous sediments (laterite)	Ferruginous lithosols, lateritic podsolics, red and yellow earths, earthy sands and brown clays.	Mid-high open woodland of C. dichromophloia, C. bleeseri, E. tetrodonta, Erythrophleum chlorostachys with isolated stands of A. shirleyi on crests over Chrysopogon fallax, Plectrachne pungens, Sorghum plumosum
Favenc	Sandstone hills	Low hills, hills and stony plateaux on sandstone, siltstone, quartzite and conglomerate (deeply weathered in places); outcrop with shallow stony soils.	Steep hills on mainly argillaceous sediments	Lithosols and brown earths	Mid-high open woodland of C. dichromophloia, E. miniate, E. tetrodonta, Erythrophleum chlorostachys over Plectrachne pungens, Chrysopogon fallax, Heteropogon triticeus.
Lancewood 2	Lateritic plateaux	Plateaus, scarps and some rises on deeply weathered sediments; shallow soils with rock outcrop	Plateau margins, escarpments and rugged low hills and plateaux	Lateritic lithosols	Mid-high open forest of Acacia shirleyi over Schizachyrium fragile, Chrysopogon fallax, Triodia bitextura.
Lancewood 3	Sandstone plains and rises	Plains, rises and plateaus on mostly on sandstone, siltstone, claystone, shale and some limestone; commonly	Gently undulating plains and drainage floors on claystone	Grey and brown clays	Tall open grassland of Chrysopogon fallax, Eulalia aurea, Iseilema vaginiflorum

Land System	Landscape class	Class Description	Landform	Soil description	Vegetation Description
		shallow soils with surface stone and rock outcrop			
McArthur	Alluvial floodplains	Alluvial floodplains, swamps, drainage depressions and alluvial fans; sandy, silty and clay soils on Qaternary alluvium	Broad or narrow fluvial corridors conducting regional drainage across various land systems towards the coast	Grey and brown clays, red and yellow earths and siliceous sands	Mid-high open woodland of C. terminalis, E. microtheca, Excoecaria parvifolia, Lysiphyllum cunninghami, C. papuana over Chrysopogon spp, Eulalia fulva, Iseilema vaginiflorum

4.1.5 Groundwater

The Table 14 below summarises the regional hydrostratigraphy of the Beetaloo Basin.
https://frackinginquiry.nt.gov.au/?a=410609

EP 187 is not within a water allocation plan area and lies immediately to the east of the Daly Roper Beetaloo Water Control District, straddling the north east boundary of the Georgina Basin. It partially overlies the aquifer known as the Gum Ridge Formation, part of the extensive regional Cambrian Limestone Aquifer which includes the Tindall Limestone Aquifer to the north in the Daly Basin.

Any guidelines published by the Northern Territory Government relating to groundwater monitoring parameters, methodologies, frequencies, reporting and data submission for petroleum operations will be followed. This includes the Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin

Table 14. Summary of Beetaloo Basin Hydrostratigraphy (taken from Fulton and Knapton, 2015)

PROVINCE	PERIOD / AGE	FORMATION		AQUIFER STATUS	THICKNESS (m)	YIELD (l/s)	AVE. EC (µs/cm)
CARPENTARIA BASIN	CRETACEOUS 145 – 66 Ma	Undifferentiated		*Local Aquifer*	0 - 130	0.3 - 4	1800
GEORGINA BASIN	CAMBRIAN 497-630 Ma	Cambrian Limestone Aquifer (CLA)	Anthony Lagoon Beds	REGIONAL AQUIFER	0 – 200	1 - 10	1600
			Gum Ridge Formation	REGIONAL AQUIFER	0 – 300	0.3 - >20	1400
		Antrim Plateau Volcanics		REGIONAL AQUITARD *Local Aquifer*	0 – 440	0.3 - 5	900
		Bukalara Sandstone		*Local Aquifer*	0 – 75	0.3 - 5	1000
BEETALOO BASIN (ROPER GROUP)	NOT KNOWN	Hayfield Mudstone		REGIONAL AQUITARD *Local Aquifer*	0 – 450	-	32000
		Jamison Sandstone		*Local Aquifer*	0 – 150	-	138000
	MESO-PROTEROZOIC 1430-1500 Ma	Kyalla Formation		REGIONAL AQUITARD	0 – 800	-	-
		Moroak Sandstone		*Local Aquifer*	0 – 500	0.5 - 5	131000
		Velkerri Formation		REGIONAL AQUITARD	700 – 900	-	-
		Bessie Ck Sandstone		*Local Aquifer*	450	0.5 - 5	-

4.1.5.1 Regional Groundwater within the Cambrian Limestone Aquifer (CLA)

The regional groundwater pattern in the EP187 area is presented in Figure 12, insufficient data is available to map flow direction in the local aquifers. The Beetaloo Basin straddles the basement divide that separates regional groundwater flow systems in the Georgina and Wiso Basins. Groundwater flow in the Georgina Basin emanates approximately 300km south-east of the Beetaloo Basin where a major flow divide occurs in the CLA. Groundwater south-east of this divide flow toward discharge points in the Lawn Hill Creek and the Gregory River in Queensland. Groundwater north-west of the divide flows through the Beetaloo Basin and discharges in the Roper River region. Recharge to the CLA forms a local flow component where the aquifer outcrops along the flanks of the Ashburton Ranges. The regional flow direction within the Beetaloo Basin is to the north-west. Gradients in the CLA are flat-lying averaging around 10m per 100km (gradient of 0.0001) and flow rates are in the order of

metres/year (Tickell, 2003). Along the northern edge of the basin groundwater flow in the CLA is channelled between outcropping Proterozoic rocks to the east and a zone of lower permeability Antrim Plateau Colcanis to the west. Groundwater flow emerges from the CLA in the Roper River 100km north-west of the Beetaloo Basin and provides a major flow component of spring discharge in the Roper River between Matarkanka and Elsey National Park. High sulphate concentrations in the Bukalara Sandstone aquifer immediately north of the Beetaloo Basin suggests there is a component of flow north into local Proterozoic aquifers.

As per the Department of Environment and Natural resources (NR Maps) the regional groundwater stratigraphy is presented in Table 15.

Table 15. Groundwater Aquifer Boundaries

Aquifer	Aq Scale	Rock Type	Stdyld Min	Stdyld Max	Actyld Ra	Geo Region
Fractured and Weathered Rocks	Local	Sandstone	5	5	0.5 - 5.0 L/s	McArthur Basin
Fractured and Karstic Rocks	Intermediate	Dolostone/ shale/sand stone	0.5	5	0.5 - 5.0 L/s	McArthur Basin
Fractured and Karstic Rocks	Regional	Dolostone, sandstone, siltstone	5	10	5.0 - 10.0 L/s	Georgina Basin

Relatively minor groundwater extraction occurs in the McArthur River basin for small community supplies. A review of the available historical bore data has indicated the water drawn from bores for this region is from aquifers shallower than 100m deep.

A baseline groundwater monitoring program was undertaken within the western portion of EMP187. The objectives of the baseline assessment were to:

- Comply with recommendations from the *Scientific Inquiry into Hydraulic Fracturing in the Northern Territory, April 2018*
- Establish a baseline groundwater quality profile prior to proposed exploration works on EP187.

Groundwater samples were collected from five (5) existing bores; HWY-1 (RN027848), 4B-1 (RN007696), 5B-1 (RN007699), HB-1 (RN039575), and, RCB-1 (RN027945) which are shown in Figure 12. Bores were selected based on their location within the extent of the proposed exploration activities. Samples were analysed for a range of characterisation parameters relevant for exploration purposes. Table 16 provides the laboratory results. Results were consistent across all groundwater bores sampled, and where comparison was possible, also consistent with historical groundwater bore data. Refer to Appendix 14 for full detail of groundwater survey. Ongoing monitoring samples will be conducted from the nearby water supply bores, (RN027848 and RN039574) south of the highway, near location SL3, to demonstrate a baseline of water quality data for the area.

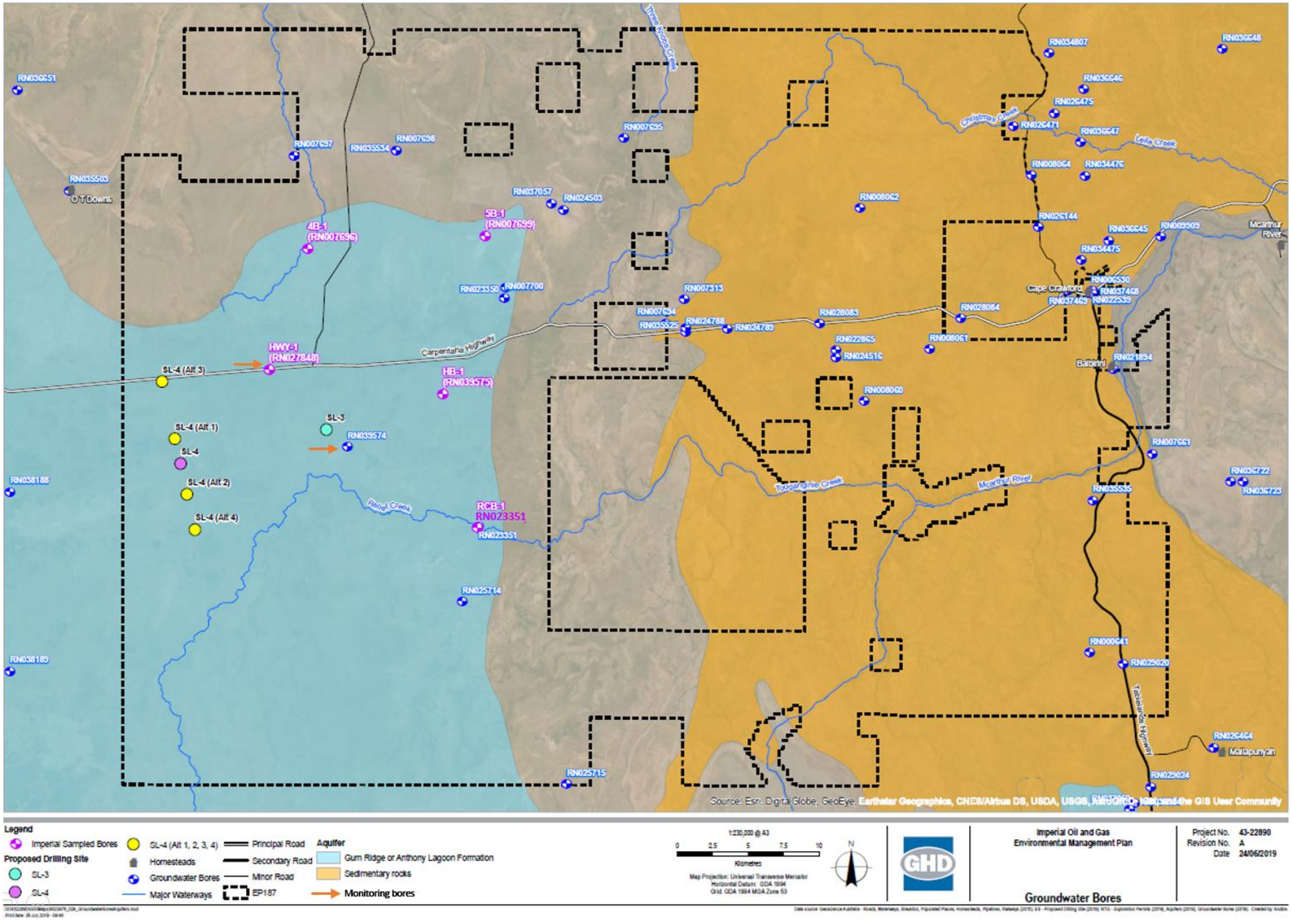


Figure 12. Location of groundwater bores in the area and proposed monitoring bores (RN027848 & RN039574).

Naturally occurring elevated heavy metal concentrations (zinc) above trigger levels were reported in House Bore (HB-1), No.5 Bore (5B-1) and No.4 Bore (4B-1). This is consistent with the natural ore bodies in the area and is expected. Total Petroleum Hydrocarbons (TPH), Total Recoverable Hydrocarbons (TRH) fractions of benzene, toluene, ethyl-benzene and xylenes (BTEX) were less than the laboratory level of reporting (LoR) from all samples collected. Physical parameters (pH, conductivity and TDS), major cations and total hardness were consistent with historical results.

The groundwater monitoring program undertaken provides a baseline understanding of the groundwater aquifer in the western portion of EP187. It provides a sound basis on which to conduct further groundwater monitoring and assessment. The groundwater bores were selected to provide a representative spread across the western portion of EP187 where drilling activities are proposed.

Table 16. Laboratory results

		Sample date	9/4/19	9/4/19	9/4/19	9/4/19	10/4/19
Analyte grouping Analyte	**Units**	**Investigation Level**	**HWY-1**	**HB-1**	**RCB-1**	**5B-1**	**4B-1**
EA025: Total Suspended Solids dried at 104 ± 2°C							
Suspended Solids (SS)	mg/L		<5	<5	<5	17	23
EA065: Total Hardness as CaCO3							
Total Hardness as CaCO3	mg/L		528	495	439	537	576
ED093F: Dissolved Major Cations							
Calcium	mg/L	700[3]	124	114	100	126	120
Magnesium	mg/L	2000[4]	53	51	46	54	67
Sodium	mg/L	180[3]	45	36	4	44	45
Potassium	mg/L		8	8	3	8	8
EG020F: Dissolved Metals by ICP-MS							
Arsenic	mg/L	0.007[1]	0.001	<0.001	0.001	<0.001	<0.001
Cadmium	mg/L	0.002[1]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.05[1]	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	2[1]	<0.001	<0.001	0.002	<0.001	<0.001
Lead	mg/L	0.01[1]	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	mg/L	0.02[1]	<0.001	<0.001	0.001	<0.001	<0.001
Zinc	mg/L	0.008[2]	<0.005	**1.53**	<0.005	**0.581**	**0.126**
EG035F: Dissolved Mercury by FIMS							
Mercury (total)	mg/L	0.001[1]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Nitrite + Nitrate as N	mg/L	0.005[5]	**0.11**	**0.05**	**0.13**	**0.03**	**0.05**
EK061G: Total Kjeldahl Nitrogen by Discrete Analyser							
Total Kjeldahl Nitrogen as N	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser							
Total Nitrogen as N	mg/L	0.2-0.3[5]	0.1	<0.1	0.1	<0.1	<0.1
EK067G: Total Phosphorus as P by Discrete Analyser							
Total Phosphorus as P	mg/L	0.01[5]	<0.01	<0.01	<0.01	<0.01	**0.03**

		Sample date	9/4/19	9/4/19	9/4/19	9/4/19	10/4/19
Analyte grouping Analyte	**Units**	**Investigation Level**	**HWY-1**	**HB-1**	**RCB-1**	**5B-1**	**4B-1**
EP080/071: Total Petroleum Hydrocarbons							
C6 - C9 Fraction	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	µg/L		<50	<50	<50	<50	<50
C10 - C36 Fraction (sum)	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
C6 - C10 Fraction	µg/L		<20	<20	<20	<20	<20
C6 - C10 Fraction minus BTEX (F1)	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	µg/L		<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	µg/L		<100	<100	<100	<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN							
Benzene	µg/L	950[2]	<1	<1	<1	<1	<1
Toluene	µg/L	800[1]	<2	<2	<2	<2	<2
Ethylbenzene	µg/L	300[1]	<2	<2	<2	<2	<2
meta- & para-Xylene	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	µg/L	350[2]	<2	<2	<2	<2	<2
Total Xylenes	µg/L	600[1]	<2	<2	<2	<2	<2
Sum of BTEX	µg/L		<1	<1	<1	<1	<1
Naphthalene	µg/L	16[2]	<5	<5	<5	<5	<5
EN055: Ionic Balance							
Total Anions	mq/L		13.2	10.8	8.11	12.4	12.4
Total Cations	mq/L		12.7	11.6	9.03	12.8	13.7
Ionic Balance	%		2.07	3.98	5.36	1.76	4.86
Field Measurements							
Temperature	0C		35.2	34.1	32.5	31.1	32.0
Electrical Conductivity	µS/cm	20-250	1236	1134	864	1250	1285
pH		6-8.0	6.60	6.65	6.78	6.50	6.50
TDS	ppm		-	737	562	810	839

[1] – Investigation Level for Drinking Water. Schedule B(1) – Guideline on Investigation Levels for Soil and Groundwater (NEPM, 2013).

[2] - Investigation Level for Fresh Water (95% species protection). Schedule B(1) – Guideline on Investigation Levels for Soil and Groundwater (NEPM, 2013). Used in absence of IL for Drinking Water ([1])

[3] –Groundwater, Explanatory notes to the Groundwater Map of the Northern Territory (DNREAS, 2008)

[4] - In high doses magnesium can cause scouring and diarrhoea in cattle. Levels up to 2000 mg/L have been observed to have no adverse effects. There is insufficient information available at present to set a guideline value (DNREAS, 2008)

[5] - ANZECC Water Quality Guidelines (2000) for belowland streams of Tropical North Australia.

The hydrology and water bore study conducted by Imperial supports the contention that the Gum Ridge Aquifer is expected to be the only aquifer encountered, at an approximately depth of 100-150m which will be isolated by a minimum of two verified barriers. Due to this it is unlikely that local aquifers will be impacted by the proposed vertical drilling exploration program.

4.1.6 Surface water

The study area is part of the Gulf Fall and Uplands region and part of the catchment of the McArthur River and its tributaries. The McArthur River catchment is in the wet/dry tropics and experiences a true monsoonal climate regime. The River flows generally in a northerly direction from the upland of the Barkly land to the Southern Gulf in the region of the Sir Edward Pellew Islands. The McArthur River and its major tributary the Glyde River drain a significant portion of the Barkly tablelands and the low-lying country of the Southern McArthur Basin. The geology of this region does influence the drainage system and the extensive cap of the Bukalara Sandstone outcrop in the south of the region provides an extensive network of ephemeral creeks and streams that follow significant faults and joints within the rock formation.

The McArthur River is the major surface water feature in the region and is relatively large for the tropical north of Australia, with the catchment covering approximately 18,000 km2. The river falls more than 250 m in elevation over its 330 km length. Major tributaries in the McArthur River Catchment include the Glyde River, Kilgour River, Tooganginie Creek, and Batten Creek (figure 13).

Within the McArthur Basin there is no major infrastructure for surface water extraction. However, the McArthur River Mine has diverted a section of the McArthur River for a distance of approximately six kilometres around the mine

The McArthur River is the primary water drain of the exploration area. This water course drains the whole area into the Gulf of Carpentaria. The Glyde is the main tributary to the McArthur River and lies to the east of the study area. The Glyde is not affected by any proposed exploration operations within EP187.

The EP187 tenement includes the floodplains associated with the Upper McArthur River catchment, the Leila Creek Catchment, Tooganginie Creek, Christmas Tree Creek and the upper reaches of the Balbirini Creek (Figure 13). Only limited freshwater flood plain habitat is associated with the Upper McArthur River and as reported in the Biodiversity Assessment - Gulf Coastal report (2009) no wetlands of significance occur in this bioregion. The remaining wetland systems are outside the tenement area and away from areas of influence, and no ecosystems in this region are formally recognized as threatened, however outside the tenement area to the east in the vicinity of the Abner Range rainforest patches and riparian areas have been subject to degradation through livestock grazing, and these processes remain uncontrolled.

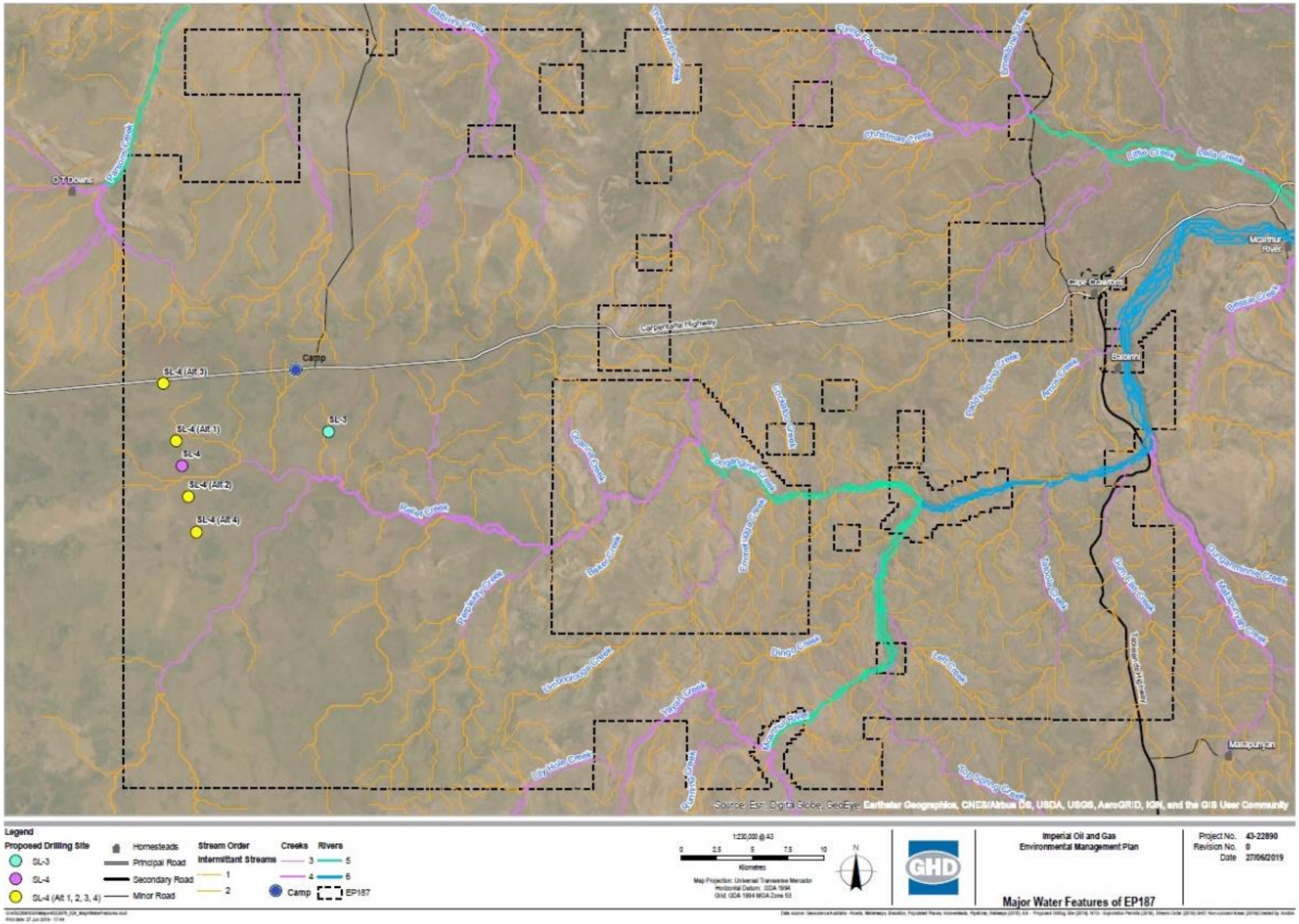


Figure 13. Major water features of EP187

Since there is little or no rain over the dry season the waters which flow in permanent streams are in connection with the local water table. In some parts of the upper reaches of the McArthur River, Balbirini Creek and Toongannie Creek permanent surface water pools persist throughout the year as waterholes, springs and minor swamps.

Most of the lagoons waterholes and swamps have an average depth which is less than the losses to be expected from evaporation, these features are expected to be groundwater fed.

The other broad group of surface waters are ephemeral in nature, which is to say that they hold water for only part of the year. This group is also made up of streams, waterholes, lagoons and swamps but they receive insufficient groundwater recharge to sustain them for the whole year. The region also includes minor floodplains associated with the upper reaches of the McArthur River.

4.1.7 Air Quality

Imperial has studied the available CSIRO report (Ong C., Myers M., Mainson M., Maney B., & Day S. 2018) on baseline methane values across the Beetaloo Sub basin in consideration of compliance with the requirements of the NT Scientific Inquiry into Hydraulic Fracturing (the 'Inquiry'). Imperial consider The Beetaloo Basin methane baseline monitoring program conducted by the CSIRO in 2018 applicable across the operational area of EP187. Data collected of this monitoring are available online.

Imperial will aim to preserve and/or minimise the adverse effect on air quality by ensuring there is no:

- No uncontrolled release of gas
- No unauthorised flaring of gas
- No open flames
- Smoking restricted to designated areas
- All vehicles running at optimum performance
- No increase in levels of airborne soil particulate matter
- No loss of air quality due to fire.

4.2 Natural Environment

A description of the natural environment in the areas surrounding the project are detailed below. In addition, an ecological assessment report was conducted on the proposed area and is provided in Appendix 5.

4.2.1 Bioregions

Bioregions provide a consistent and robust framework for biodiversity assessment and planning. The classification is based on common climate, geology, landform, native vegetation and species information. As described in Table 17 and shown in Figure 14, the EP187 area occurs over two bioregions the Sturt Plateau bioregion and the Gulf Fall and Upland Bioregions.

Table 17. Biodiversity Bioregion Products

Name	Description	Themes	Coverage
Gulf Fall and Uplands Bioregion	The Masterplan maps display biogeographic regions; wetlands: feeding, breeding and roosting sites	Bioregions, Fauna, Flora, Park	Gulf Fall and Uplands Bioregion

Name	Description	Themes	Coverage
Conservation Values and Environmental Resources	for waterbirds, shorebirds and seabirds; turtle sites; vulnerable, endangered, and critically endangered flora and fauna	Planning, Vegetation	
Sturt Plateau Bioregion Conservation Values and Environmental Resources	The Masterplan maps display biogeographic regions; wetlands: feeding, breeding and roosting sites for waterbirds, shorebirds and seabirds; turtle sites; vulnerable, endangered, and critically endangered flora and fauna	Bioregions, Fauna, Flora, Park Planning, Vegetation	Sturt Plateau Bioregion

The Sturt Plateau Bioregion

The Sturt Plateau bioregion mostly comprises a gently undulating plain on lateritised Cretaceous sandstones. Soils are predominantly neutral sandy red and yellow earths. The most extensive vegetation is eucalypt woodland (dominated by variable – barked bloodwood *Eucalyptus dichromophloia)* with spinifex understorey, but there are also large areas of lancewood (*Acacia shirleyi*) thickets, bullwaddy (*Macropteranthes keckwickii*) woodlands, Acacia shurblands on deep sands, and eucalypst open forest (dominated by a range of species including Darwin stringybark *Eucalyptus tretodonta*) over tussock grass understorey.

The Sturt Plateau bioregion includes the most extensive areas of the distinctive lancewood-bullwaddy vegetation associations, with associated fauna including spectacled hare-wallaby. There are a range of small wetlands associated with sinkholes and minor depressions in the generally flat landscape.

The Gulf Fall and Uplands Bioregion

The Gulf Falls and Uplands bioregion comprises undulating terrain with scattered low, steep hills on Proterozoic and Plaeozoic sedimentary rocks, often overlain by lateritised Tertiary material. Soils are mostly skeletal or shallo sands. The most extensive vegetation is woodland dominated by Darwin Stringybark *Eucalyptus tetrodonta* and Variable-barked Bloodwood *C. dichromophloia* with spinifex understorey, and woodland dominated by Northern Box *Eucalyptus tectifica* with tussock grass understorey. The Matarank Thermal Pools (wetland type B17 – freshwater springs, oases and rock pools) occurs on the border of the Gulf Fall and Uplands bioregion and Sturt Plateau bioregion. (*Fulton and Knapton, 2015). (https://frackinginquiry.nt.gov.au/?a=410609*)

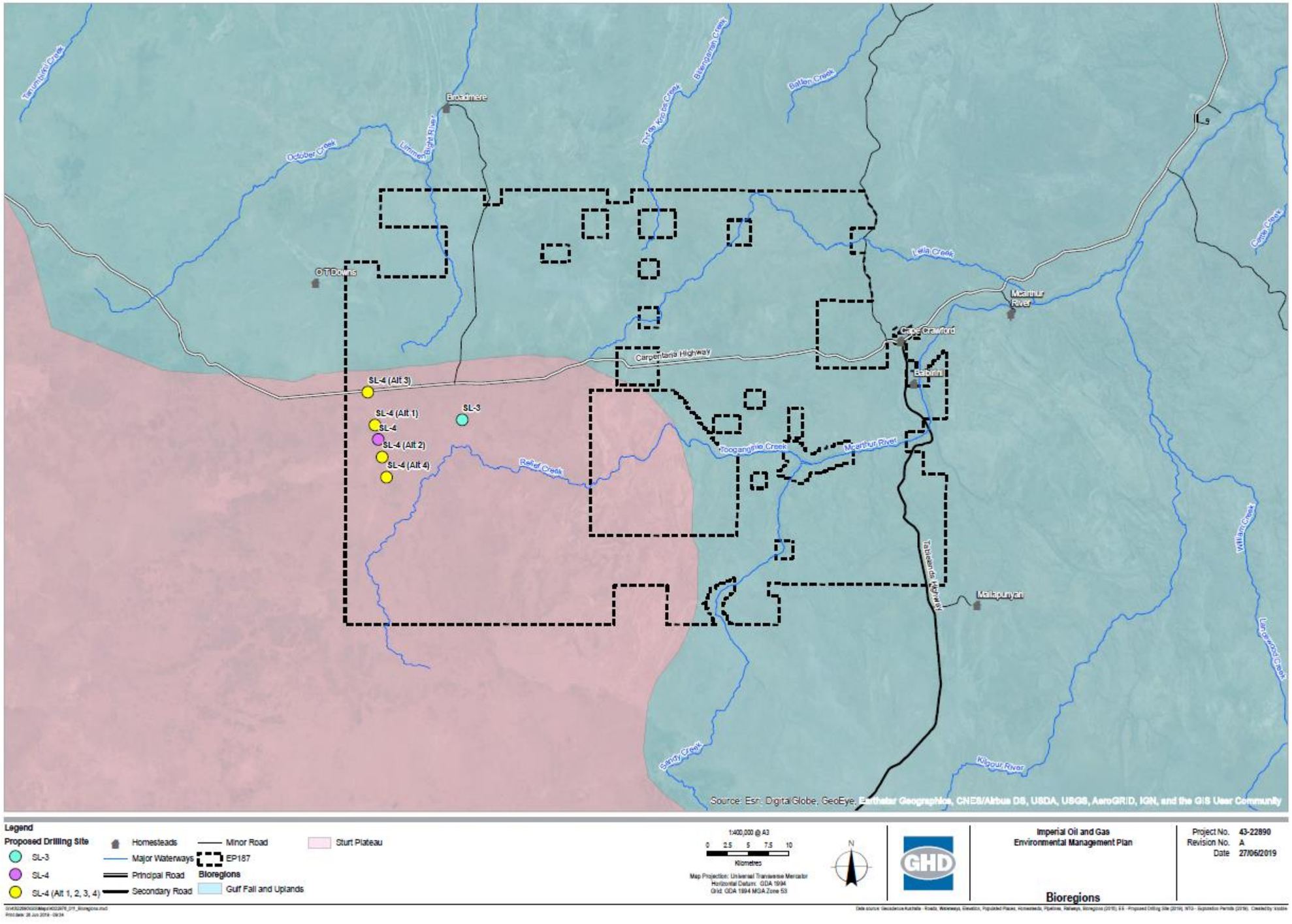


Figure 14. Bioregions

4.2.2 Vegetation

Plant surveys in this bioregion have been limited. Connors, *et al.,* (1996) identifies 852 plant species within the region, including 20 rare and threatened species. These are listed at: www.nt.gov.au/paw/fauna/bau/intro.htm. Figure 15 provides a visual representation of the spread of major vegetation types through the region. Imperial has undertaken a weed management survey of the area of planned activity in conjunction with the weeds officers of the Department Environment and natural Resources (DENR) Katherine branch.

The National Vegetation Information System (NVIS) provides information on the extent and distribution of vegetation types in Australian landscapes. The NVIS framework enables the compilation of data collected by States and Territories into a nationally consistent vegetation dataset. It provides descriptions of structural and floristic patterns of groups of plants in the landscape. There are 41 NVIS Level 4 community descriptions mapped over the tenements. The vegetation communities mapped over the tenements include woodland, tussock grassland, sparse samphire shrub land and forest. Eucalyptus woodland dominates the area (57%), followed by Corymbia low open woodland (11%), Eucalyptus low woodland (7%) and Chrysopogon (mixed) tussock grassland (6%).

The majority of this region is covered by open forest and woodland dominated by Darwin Stringybark (*E. tetrodonta*). There are also patches of monsoon forest scattered throughout the woodlands, particularly where there are permanent springs.

The woodland communities vary according to topography. The most common community which occurs on the undulating plains is a Darwin Stringybark (*E. tetrodonta*) / Darwin woolly butt (*E. miniata*) open forest with a sparse to open shrub layer and a dense ground layer dominated by sorghum species. Other woodland species may include ironwood (*Erythrophleum chlorostachys*), cypress pine (*Callitris intratropica*), northern box (*E. tectifica*) and round-leaved bloodwood (*Corymbia latifolia*). Mid storey species include fan palm (*Livistona humilis*) and zamia palm (*Cycas armstrongii*).

On the rugged sandstone plateaus and rocky outcrops there is low open woodland of variable-barked bloodwood (*Corymbia dichromophloia*) and Darwin woolly butt, with a variable mid layer and ground layer dominated by curly spinifex (*Plectrachne pungens*). Stringy bark and rusty bloodwood (*Corymbia ferruginea*) may also occur.

In the poorly drained soils and riverine areas communities of paperbark (*Melaleuca viridiflora*), screw palm (*Pandanus spirilis*) and river pandanus (*Pandanus aquaticus*) occur. On the saline tidal flats along the coast chenopod shrub lands (samphire) exist.

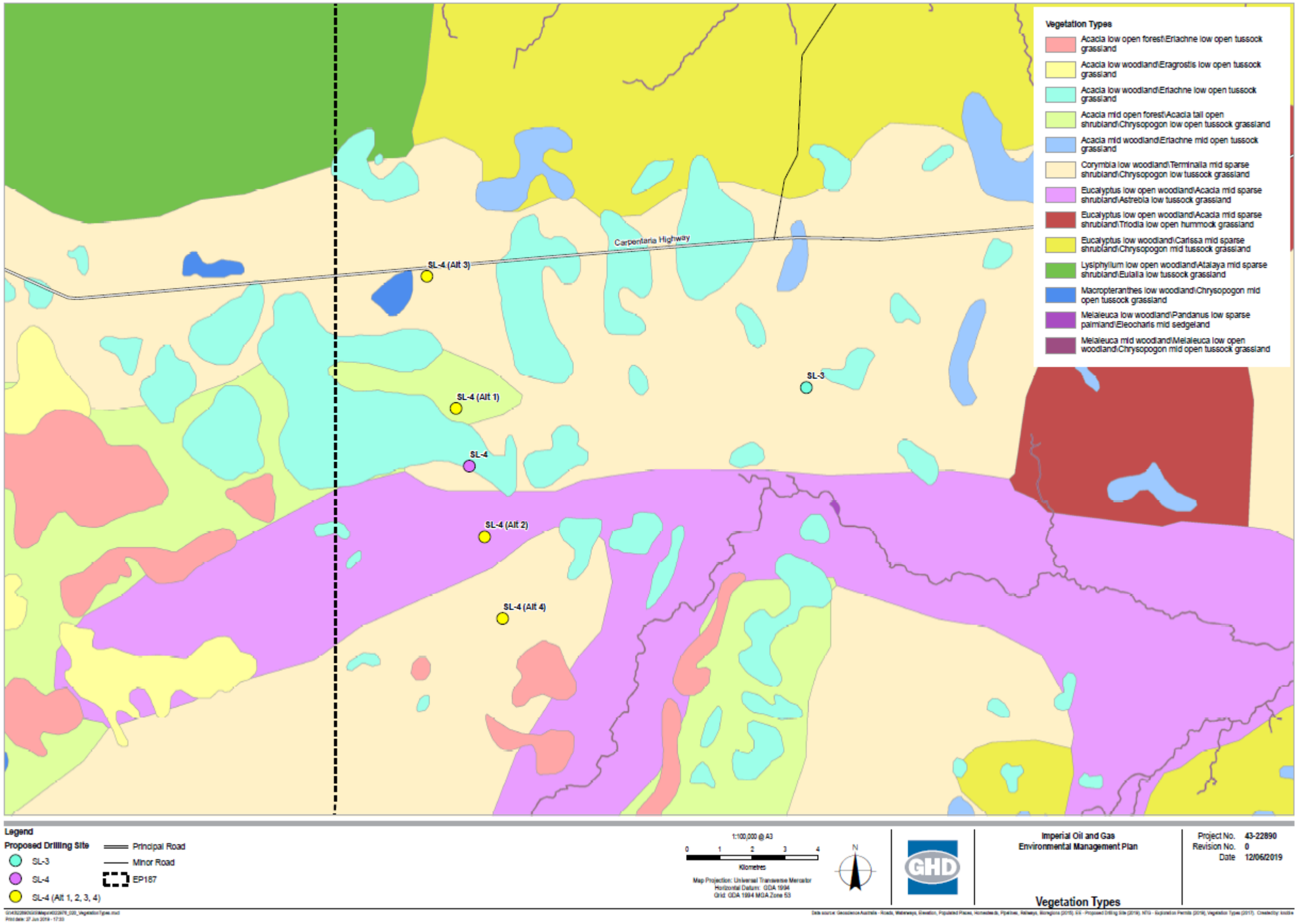


Figure 15. Dominant Vegetation

4.2.3 Conservation Significant Species

Conservation significant flora and fauna species are those species listed under the provisions of the *Commonwealth EPBC Act* and/or the *Territory Parks and Wildlife Conservation Act 2000* (TPWC Act) including threatened species as well as internationally protected wildlife and migratory species. Threatened species include those with conservation status listed as Endangered, Vulnerable or Near Threatened (EVNT) under the EPBC Act or Extinct in the Wild, Critically Endangered, Endangered or Vulnerable under the TPWC Act.

The following sections summarise findings from each of the databases. Appendix 5 provides a more detailed ecological study with tables of the species reported and results with an assessment of their likelihood of occurrence within the drilling area. Near Threatened (NT) and/or DD species are not included in the threatened species table.

- **EPBC Protected Matters**
  The EPBC PMST available in Appendix 1, identified the search area as having potential habitat for no nationally threatened flora species, 13 threatened terrestrial species and 15 migratory species listed under the EPBC Act. Nine (9) of the 15 migratory species are specialist marine species and have therefore been excluded from the assessment (including estuarine crocodiles as no suitable habitat exists within the project area).

  No Threatened Ecological Communities (TEC), World Heritage Properties, National Heritage Places, Wetlands of International Importance or Commonwealth Marine Area's occur within the study area.

- **Birdata**
  BirdLife Australia's Birdata shows records of 92 bird species observed within the search area. Of those, 1 species *Ardeotis australis* (Australian bustard) is listed as Near Threatened (DD) under TPWC Act and 1 species *Merops ornatus* (Rainbow Bee-eater) is a migratory species under the EPBC Act.

- **Atlas of Living Australia**
  The ALA database returned records for 3 significant and/or threatened fauna species *Ardeotis australis* (Australian bustard), *Onychogalea unguifera* (Northern nailtail wallaby) and *Mesembriomys macrurus* (golden-backed tree rat) listed under the EPBC Act and/or TPWC Act within the search area

- **DENR NR Maps**
  A query of the DENR NR Maps database returned 5 Data Deficient (DD) plant species and 8 fauna species (9 fauna listed in the below table due to anecdotal observation of Gouldian Finch) that have been historically recorded within the study area. There are no historical records for threatened flora species within the search area. Data Deficient species while not considered threatened species under the EPBC Act or TPWC Act, they are considered Significant Species under the TPWC Act

4.2.3.1 Listed Threatened Species

No threatened flora species have been previously recorded within the search area. Two (2) threatened fauna species have previously been recorded within the study area. One (1) species (*Mesembriomys*

macrurus (golden-backed tree rat)) was recorded over 100 years ago and is now considered locally extinct. The second threatened fauna species (*Erythrura gouldiae* (Gouldian Finch)) was not identified through NT or Commonwealth database searches, but rather is included due to anecdotal evidence.

Not all of the threatened species indicated through desktop information are expected to occur within the study area due to the absence of suitable habitat for some species. For instance, occurring species within the marine environment like whale and seahorse species.

Table 18 lists the threatened (or significant) fauna and flora species that have previously been recorded within the study area. Appendix 5 includes a likelihood of occurrence table which includes an assessment on the level of impact/risk to threatened species.

Table 18. Threatened species previously recorded in the proposed area

Class	Species Name	Common Name	EPBC Act Status	TPWC Act Status
Birds	*Erythrura gouldiae*	Gouldian finch[1]	E	V
Birds	*Ardeotis australis*	Australian bustard	-	NT
Birds	*Merops ornatus*	Rainbow bee-eater	migratory	LC
Birds	*Malurus coronatus macgillivrayi*	Purple-crowned fairy-wren	-	NT
Birds	*Burhinus grallarius*	Bush Stone-curlew	-	NT
Mammals	*Onychogalea unguifera*	Northern nailtail wallaby	-	NT
Mammals	*Mesembriomys macrurus*	Golden-backed Tree-rat[2]		CE
Reptiles	*Demansia quaesitor*	Sombre whipsnake	-	DD
Reptiles	*Tiliqua scincoides*	Common blue-tongued lizard	-	DD
Plant	*Eriachne squarrosa*	Eriachne, Wanderrie Grass		DD
Plant	*Ammannia crinipes*	Nesaea		DD
Plant	*Eriocaulon carpentariae*	Eriocaulon		DD
Plant	*Polygala petrophila*	Polygala		DD
Plant	*Dodonaea barklyana*	Distichostemon		DD

EPBC Act (species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Aust.): CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory, Ma = Marine
TPWC Act (species listed under the *Territory Parks and Wildlife Conservation Act 2000* (TPWC Act), NT): CE = Critically Endangered, E = Endangered, V = Vulnerable, NT=Near Threatened, DD = Data Deficient
[1] – anecdotal.
[2] – records from 1901 and presumed locally extinct

4.2.3.2 Listed Migratory Species

Table 19 list the migratory fauna species that are at least moderately likely to occur within the study area based on the likelihood of occurrence assessment. Species which are specialists of tidal areas are not included.

Table 19. Migratory species likely to occur within the proposed area

Class	Species Name	Common Name	EPBC Act Status	TPWC Act Status
Birds	*Apus pacificus*	Fork-tailed swift	Ma, M	-
Birds	*Cecropis daurica*	Red-rumped swallow	M, Ma	-
Birds	*Cuculus optatus*	Oriental cuckoo	Ma	-
Birds	*Hirundo rustica*	Barn swallow	M, Ma	-
Birds	*Motacilla cinerea*	Grey wagtail	M, Ma	-
Birds	*Motacilla flava*	Yellow wagtail	M, Ma	-
Birds	*Merops ornatus*	Rainbow bee-eater	Ma, M	-

EPBC Act (species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Aust.): M = Migratory, Ma = Marine
TPWC Act (species listed under the *Territory Parks and Wildlife Conservation Act 2000* (TPWC Act), NT): NT=Near Threatened

4.2.3.3 Pest Species and Weeds

Identified pests in the study area are as follows; cane toads, feral pigs, donkeys, horses, water buffalo and cats are present in the bioregion and have a significant impact on the natural environment. Unfenced cattle grazing also causes additional bank erosion. Pigs and buffalos may be considered a resource by local Aboriginal people.

In addition to pest fauna species, weeds are a major threatening processes in the region. Connors, et al., (1996) identified 15 weed species in the bioregion, these include bellyache bush (Jatropha gossypifolia), spinyhead sida (Sida acuta), devil's claw (Martynia annua), grader grass (Themeda quadrivalvis), Hyptis (Hyptis suaveolens), coffee senna (Senna occidentalis) and notably mimosa (Mimosa pigra).

A pre and post 2018/19 wet season weed survey (Appendix 6) has been conducted over the area in conjunction with a Senior Weeds Officer of the Department Environment Natural Resources (DENR) and a weed management plan has been developed from the findings of these surveys.

The table below (Table 20) provides the weeds recorded during 2018 and 2019 surveys and the Project Weed Management Plan is found in Appendix 6.

Table 20. Weeds recorded in the proposed surveyed area

Species	Common Name	Weeds of National Significance	NT Class
Hyptis suaveolens	Hyptis	-	B
Parkinsonia aculeata	Parkinsonia	-	B
Tribulus sp.	Caltrop	-	B

4.2.3.4 Protected Areas

There are no Parks, World Heritage Properties, National Heritage Places, Wetlands of International Importance or conservation areas or Sites of Conservation significance within the Project Area (Figures 16 and 17 - Appendix 15). The only area identified as site of significance adjacent to the proposed project is located in a different catchment which is:

The Limmen National Park is located approximately 50km North-East of the project area. The National Park covers an area of approximately 12,300 square kilometres. The Limmen Bight Marine Park and the adjoining Federal Limmen Marine Park are located within the Gulf of Carpentaria and are adjacent to the Limmen National Park.

Imperial doesn't foresee any impact to the park neither to visitors that may be travelling through to and passing along the exploration permit. All traffic, transport and possible community and people impact will be managed in accordance to Table 27.

4.2.3.5 Significant vegetation

The majority of this region is covered by open forest and light density woodland dominated by Darwin Stringybark (*E. tetrodonta*). To the east in proximity to the Abner Range there are also patches of monsoon forest scattered throughout the woodlands, particularly where there are permanent springs.

Significant vegetation on site is only associated with the riparian areas. See Figure 18 for a visual representation of the spread of major vegetation types through the region. Riparian vegetation is primarily cantered around the Relief Creek and is the closest major water course to proposed well site.

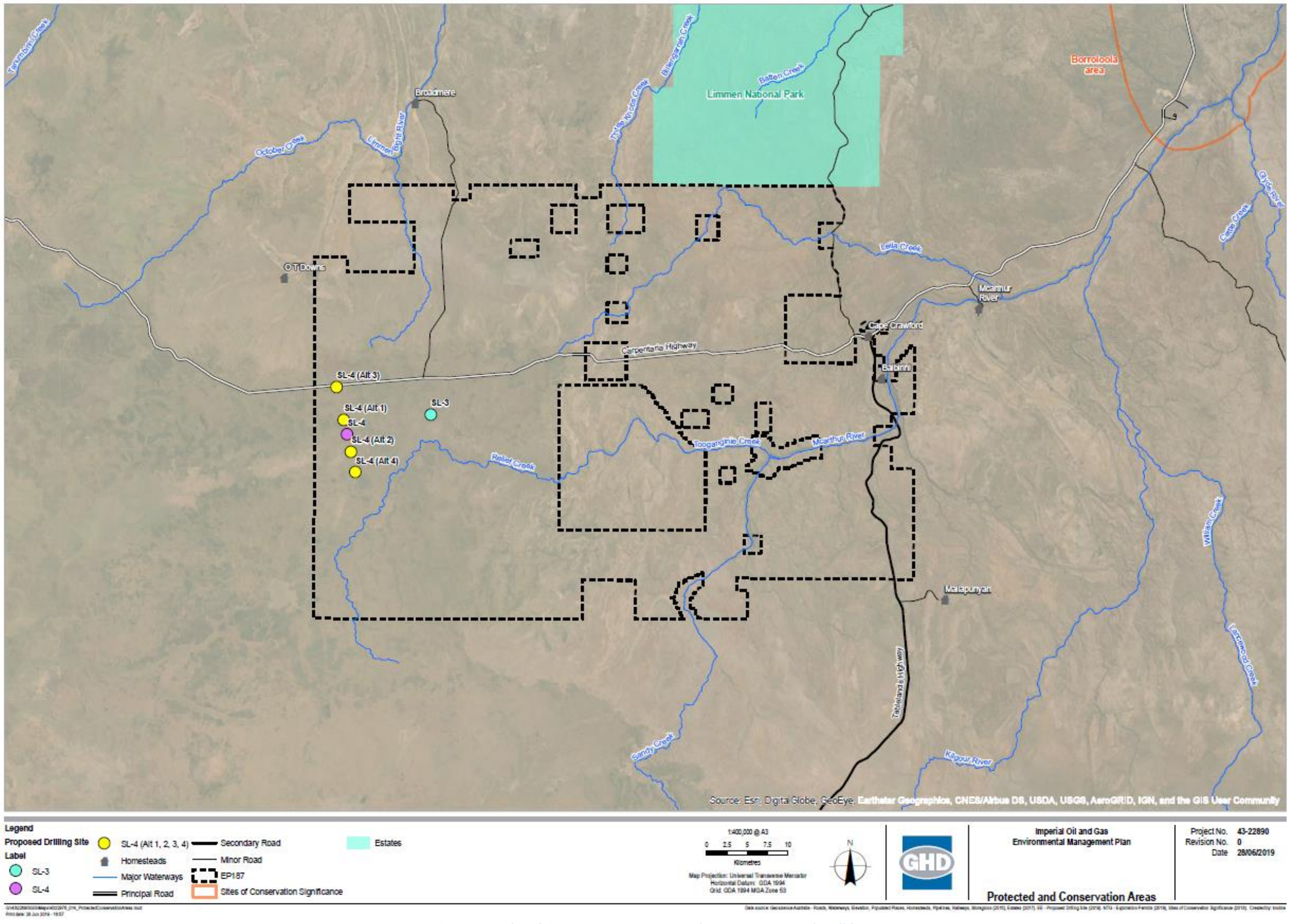


Figure 16. Protected and Conservation areas in relation to proposed well location

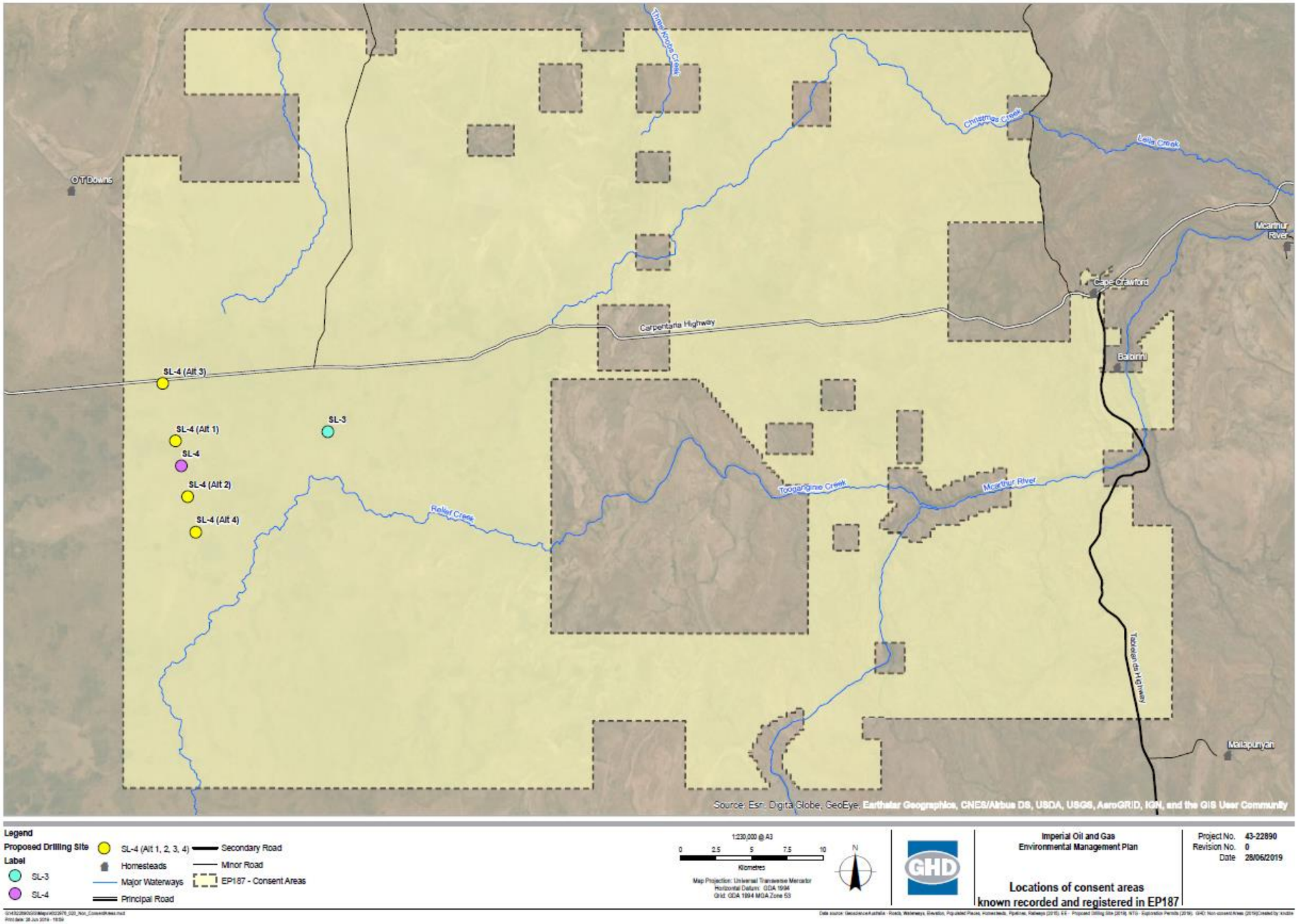


Figure 17. Known and recorded consent areas EP187.

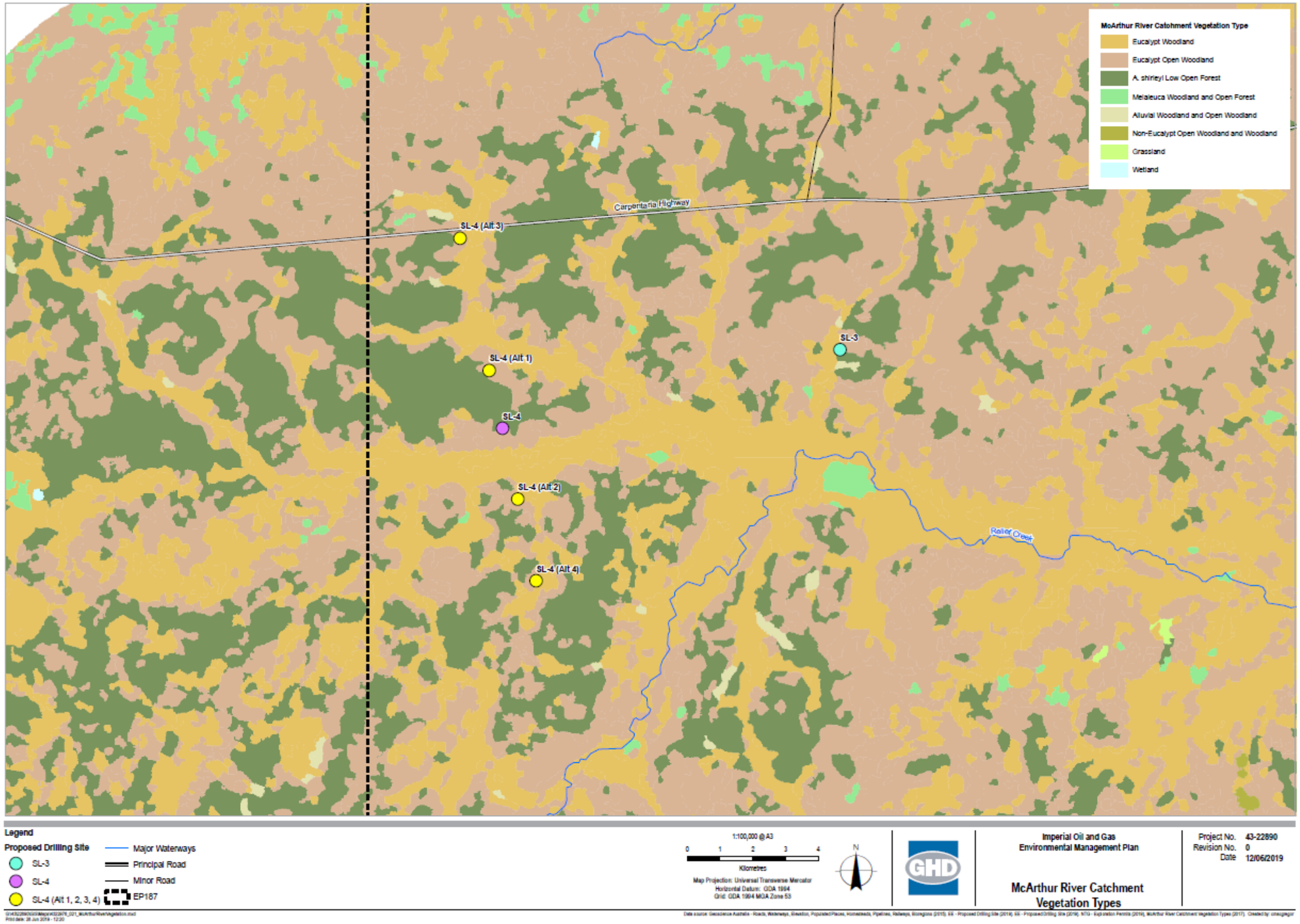


Figure 18. Vegetation Types

4.2.3.6 Groundwater Dependent Ecosystems (GDEs)

GDEs are complex dynamic 'natural ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis, so as to maintain their communities of plants and animals, ecosystem processes and ecosystem services' (Richardson et al., 2011). These diverse ecosystems are primarily driven by temporal groundwater flow variability contingent on climate, geology and landuse (Alfaro and Wallace, 1994, Bertrand et al., 2012, Kløve et al., 2014). *(https://www.sciencedirect.com/science/article/pii/S2214581817300319#fig0005)*

A search of the National Groundwater Dependent Ecosystems (GDEs) Atlas did not identify any terrestrial or aquatic GDEs within the project area. The Journal of Hydrology: Regional Studies, April 2017 supports the findings from GDEs. The riparian vegetation communities present along the watercourse, particularly those dominated by *Eucalyptus camaldulensis* may rely on rainfall stored in alluvial sediments and therefore may be the groundwater dependent. However, Imperial Oil & Gas is confident that the project activities are unlikely to have any impact on these communities.

To verify the above information, other materials such as The National Map (nationalmap.gov.au) and test results conducted to the bore groundwater levels in the area were accessed on 19th August 2019. Results did not identify terrestrial or aquatic GDEs within the Project area.

4.2.4 Fire

The area of planned drilling program within EP187 is generally an open grassland savannah area lightly timbered. The area is regularly burnt using aerial fire bombing and traditional owner cultural fire management practices.

More recently the area has been increasingly utilized for cattle grazing and therefore many new fence lines and fire breaks have been constructed through the exploration area. As a part of grazing management practices towards the end of the dry season the area is regularly burnt to reduce fuel load and to promote new pasture growth through the following wet season. The practice of regular burns reduces the risk of significant hot fires and allows for a cooler less intense burn; however, the risk of bush fires and wildfires remains in some areas.

Mapping obtained from the North Australia Fire Information website (NARFI) indicates that the proposed well site was last burnt in 2017 covering an area of 785.10km2 (Figure 19).

A bushfire Management Plan was developed as part of the Exploration Program and is provided in Appendix 10.

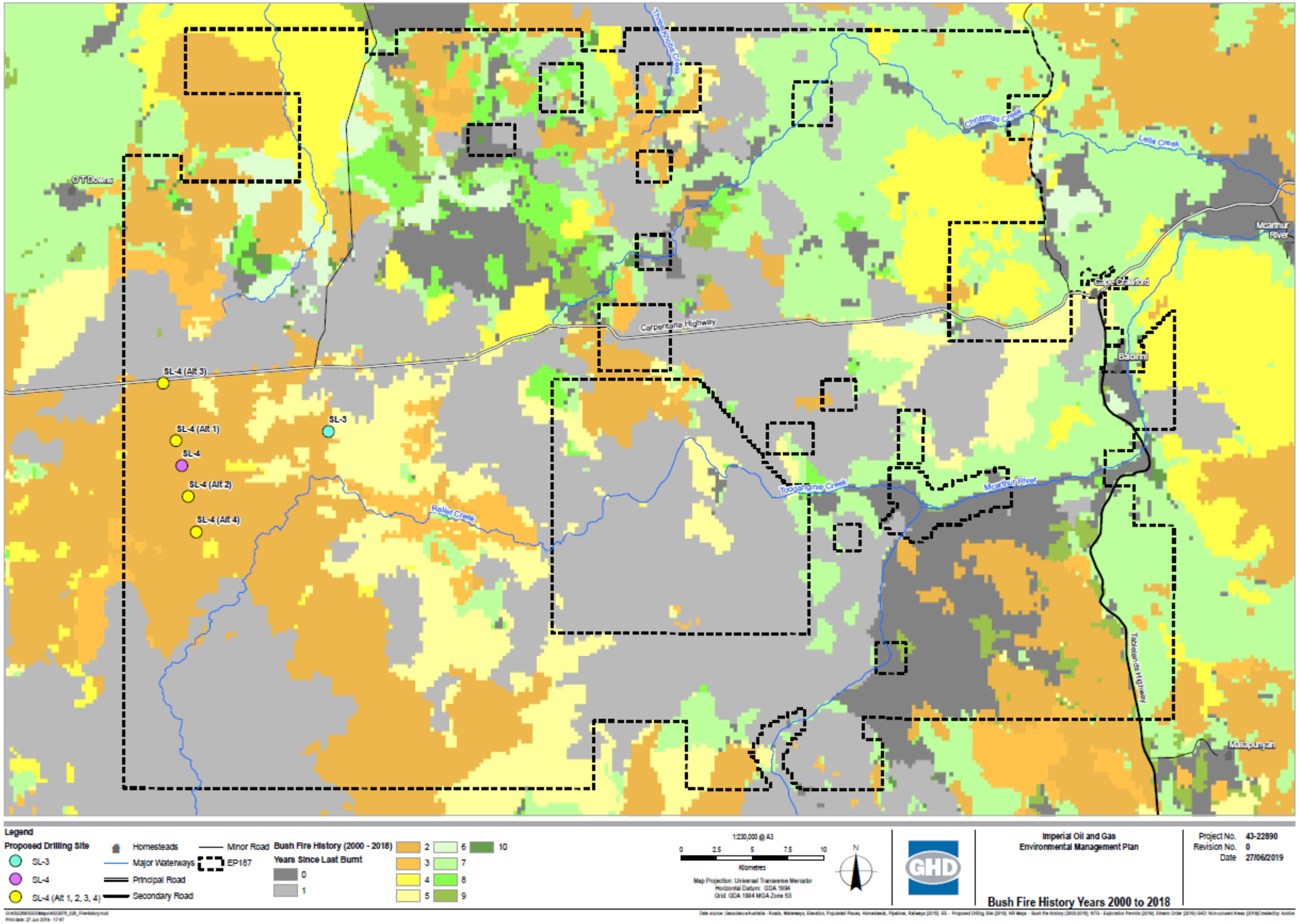


Figure 19. Fire History 2000 to 2018

4.3 Cultural environment

4.3.1 Historic and Natural Heritage

A search of the EPBC PMST database (DoEE 2018) showed no World Heritage Properties or National Heritage Places are registered within 50 km of the Project Area.

In addition, a search of the NT Heritage Register (Department of Tourism and Culture 2018) for NT Portion 5706 was conducted and no recorded NT heritage items or places to be present in the Project Area.

To ensure there are no archaeological artefacts or sites of significance that could be impacted by the Drilling Program, an anthropological survey conducted in May 2015 by NLC across the tenement area and a permission obtained to conduct the works (Appendix 16) and archaeological survey was conducted in August 2019 by Ellengowan Enterprises an approved NT archaeological consultant; report will be submitted to the DPIR and DENR once received. An application for an Authority Certificate for the planned activities and work area has been submitted to the AAPA (application doc. 201904186). An acknowledgement of the request has been received and Imperial is awaiting a further response. The certificate will be forwarded once received (Appendix 15).

The drilling activities will not be conducted within the vicinity of any known Aboriginal cultural or heritage sites. Therefore, Imperial consider that the risk of contamination or damage to these sites is considered to be extremely low to negligible.

4.3.2 Sacred Sites

An application for an Authority Certificate for the planned activities and work area has been submitted to the AAPA (application doc. 201904186). An acknowledgement of the request has been received and Imperial is awaiting a further response. The certificate will be forwarded once received (Appendix 15). This process aims to prevent damage to, and interference with sacred sites, by identifying and setting out the conditions for entering and working on the land. This certificate is based on a report provided by the NLC generated from consultation of the NLC with the relevant Traditional Owners of the land to review the proposed route and the possible presence of sites of cultural, archaeological and anthropological significance that may be impacted.

4.3.3 Northern Land Council

As required under the Exploration Agreement; Imperial has obtained the consent from NLC, the TOs and a written landowner approval from the Mambaliya Rrumburriya Wuyaliya Aboriginal Land Trust for submission of the Vegetation Clearing Permit required under the Planning Act to conduct the planned work activities. During the consultation, it was agreed that a number of traditional owners with knowledge of the country will accompany all work activities to provide relevant cultural advice during the program. If any artifact is found that may potentially be impacted by the work program, work should cease until the local government Heritage Officer and/or Aboriginal Land Council nominee are notified and advice sought.

Furthermore, Imperial has developed a cultural induction program (refer to Attachment 5) for all company employees and contractors in conjunction with the Local Aboriginal Groups (LAG). The purpose of the program is to ensure cultural sensitivity of all personnel when operating on site and an awareness of the types of cultural and ethnographic objects that may be encountered. The Northern Land Council and the LAG have provided contact details should expert local advice be required at short notice

4.3.4 AAPA

An application for an Authority Certificate for the planned activities and work area has been submitted to the AAPA (application doc. 201904186). It will be provided to the DPIR when received.

Figure 20 shows an abstract of Records map provided by the Authority to the Australian Mining and Exploration Title Services in 2013.

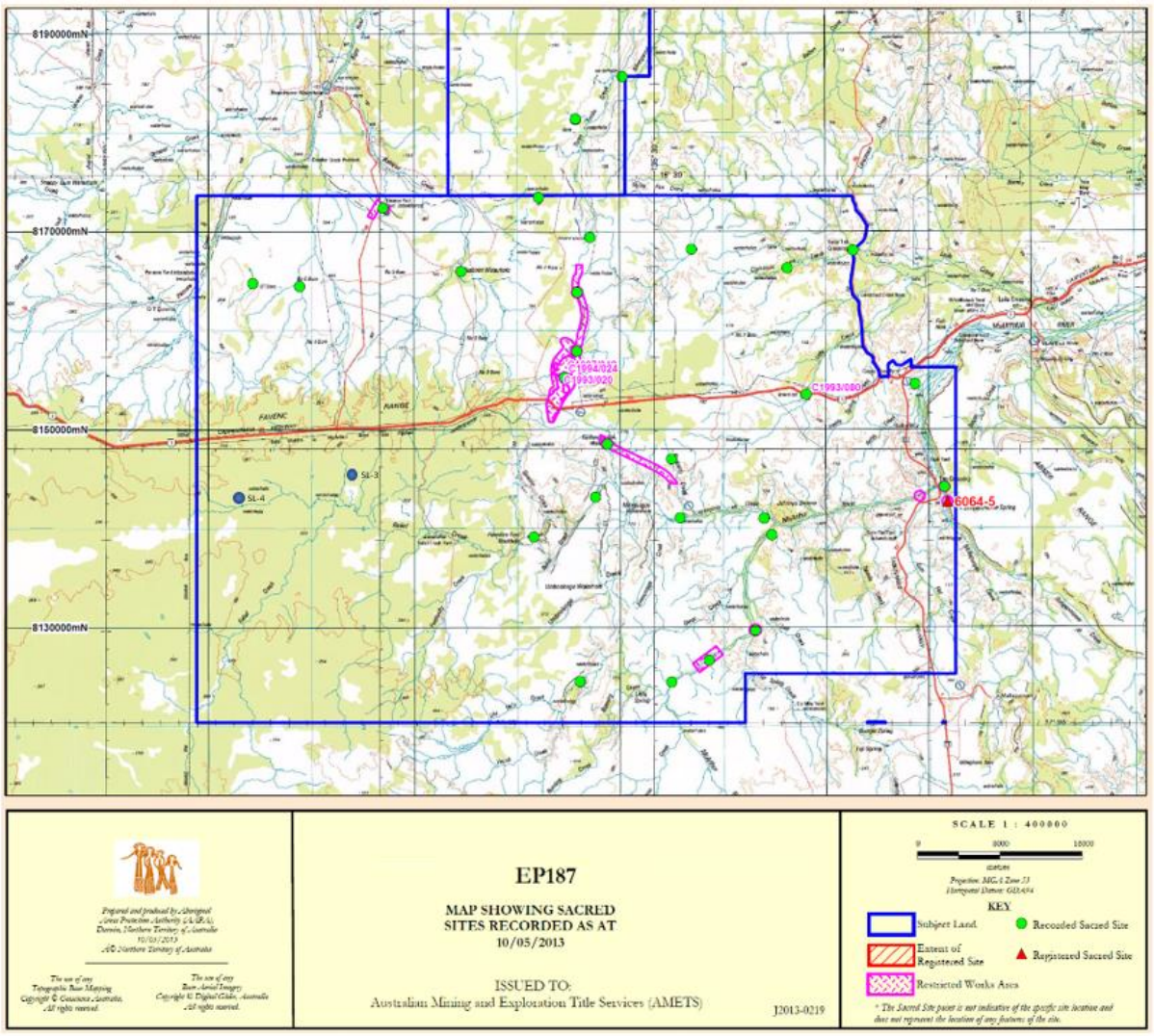


Figure 20. Sacred Sites (map overlain with well location)

4.4 Socioeconomic Environment

The tenement is Aboriginal freehold land and held by the Mambaliya Rrumburriya Wuyaliya Aboriginal Land Trust. The deed of agreement for access to the land is held with the Northern Land Council.

Borroloola is the nearest township community to the proposed area and is the key service centre for the McArthur River and Robinson River Southern gulf region.

The land within the tenement mainly supports Indigenous use with pastoral grazing rights awarded across the tenement area divided into a number of blocks to pastoralists under section 19 agreements. Other than mining at McArthur River and pastoral activities, there are no major industries within the bioregion. There is some limited tourism at the site of Paradise Pools done by helicopter tours.

The local area remains generally undeveloped in terms of infrastructure and roads. Major infrastructure within the EP 187 includes the Carpentaria Highway and the Daly Waters to McArthur River gas pipeline which run approximately parallel with one another east-west through the middle of the tenement, Imperial Oil and Gas has a permit in place with the pipeline owner to construct the access tracks required. The McArthur River Mine is located approximately 100km east of the Project Area.

4.4.1 Settlements

The area is sparsely populated with no communities present on the proposed area and one outstation existing on the Nathan River Road on the western boundary of the tenement. The nearest Aboriginal community is the township of Borroloola and the associated outstations at Campbell Springs, Devil Springs and Cow Lagoon. Each of these residential locations lies approximately 100km to the North East of the tenement.

The Aboriginal community of Minyerri (Hodgson Downs) lies approximately 180 km to the North West of the tenement.

Figure 21 shows the stations and communities in the vicinity of the project area.

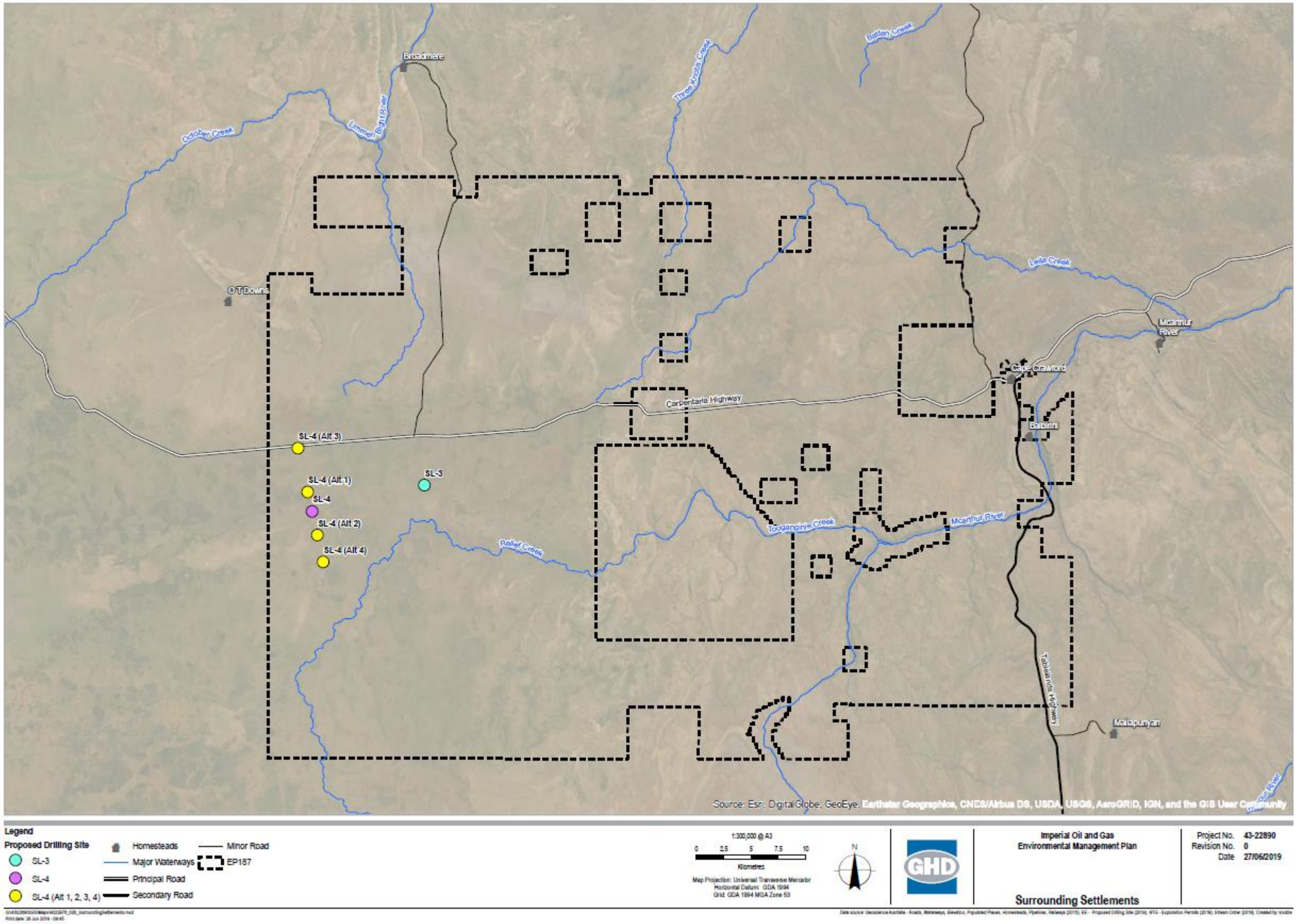


Figure 21. Stations and Communities

4.5 Environmental Values as defined under the Environmental Assessment Act

The Environmental Assessment Act requires that any operator conducting an activity that has a potential environmental impact to fully assess all the matters and evaluates the effectiveness of the proposed safeguards to mitigate these impacts and recommends actions to ensure the development and operational phases of the project are managed in an environmentally sound manner.

To describe the existing environmental values of the area a combination of desktop assessment and field surveys were conducted. The assessment determines the likelihood of occurrence for threatened fauna and flora species identified. Section 5.4 in conjunction with Table 21 shows the environmental values and likelihood of occurrence as well as the specific control measures put in place to mitigate any impact to ALARP.

Table 21. Environmental Values and/or Sensitivities that may be affected by the project.

Area	Environmental Factors	Environmental Values and Sensitivities	Summary
Land	Terrestrial Flora and Fauna	Sensitive or significant vegetation	Fox & Co, 2019 recorded riparian vegetation in the study area, present as predominantly sparse woodland.
		Groundwater dependent ecosystems	There is low potential for terrestrial GDEs and aquatic GDEs in the Project Area (BoM, 2019)
		Threatened fauna species and their habitat	The EPBC PMST identified 13 threatened species that have the potential to occur in the Project Area. Of these, the Gouldian Finch have a high potential to occur but a low risk to be impacted and Yellow-Spotted Monitor has a moderate likelihood of occurrence.
		Listed migratory species	The EPBC listed 15 migratory species that were potentially occurring in the Project Area. They are all scored a low potential to occur.
		Listed threatened flora species and ecological communities	There are no Threatened Ecological Communities (TECs) or threatened flora listed under the EPBC Act and/or TPWC Act known to occur within the 50km of the Project Area.
	Terrestrial Environmental Quality	Soils	The Project Area lies within a region of soils that are considered to be in their second cycle of erosion which has produced infertile soils with a near neutral reaction. These 'soils' are akin to alluvial soils in that they show no profile development.

Area	Environmental Factors	Environmental Values and Sensitivities	Summary
Water	Inland water environmental quality	Groundwater	The Chambers River Formation is a regional scale aquifer that provides groundwater resources for pastoral enterprises, domestic bores at homesteads and town water supplies several communities across the region.
		Surface water	The McArthur River is the primary water drain of the exploration area. This water course drains the whole area into the Gulf of Carpentaria. The Glyde is the main tributary to the McArthur River and lies to the east of the study area.
	Hydrological processes	Supply and quantity of water	The study area is part of the Gulf Fall and Uplands region and part of the catchment of the McArthur River and its tributaries. The McArthur River and its major tributary the Glyde River drain a significant portion of the Barkly tablelands and the low-lying country of the Southern McArthur Basin. The geology of this region does influence the drainage system and provides an extensive network of ephemeral creeks and streams.
Air	Air Quality and Greenhouse Gases	Air quality conducive to suitability for the life, health and wellbeing of humans and ecosystems	The Beetaloo Basin methane baseline monitoring program conducted by the CSIRO in 2018 is applicable across the operational area of EP187. No significant impact or risks anticipated
People and Communities	Social, economic and cultural surroundings	Cultural heritage, sacred sites.	An application for an Authority Certificate (doc. 201904186) has been submitted to the AAPA for the activities covered under this EMP and will be provided to DPIR once approved. An extensive anthropological survey of the land area was also undertaken in May 2015 by the Anthropology Division of the Northern Land Council (NLC) in conjunction with the Traditional Owners of the land prior to grant of the tenement. (Available in Appendix 16)

Area	Environmental Factors	Environmental Values and Sensitivities	Summary
	Human Health	People and communities	There are a number of pastoral properties with livestock and infrastructure in the vicinity or the Tenement. The nearest property is OT Downs Homestead located approximately 20km North-West of the proposed area.

5 Overview of the Environmental Risk Assessment Process

Environmental risk can be defined as "the actual or potential threat of adverse effects on living organisms and the environment by effluents, emissions, wastes, resource depletion, etc., arising out of an organization's activities" This assessment is measured in terms or environmental consequences and likelihood of occurrence". Furthermore, an Environmental Impact can be described as any possible adverse effects caused by a project.

Imperial acknowledge that environmental risks are inherent to onshore oil and gas activities and without control, environmental impacts may arise. As such, Imperial has committed to assess, reduce and control the environmental risk and impacts associated to the implementation of this EMP for the project.

5.1 Process Overview

An environmental risk assessment involves the analysis of the activities (or elements of activities) that have the potential for environmental impact. In that process, the EMP must demonstrate that all activities associated with the proposed activity will be reduced to a level that is ALARP and acceptable.

A risk can be considered to have been reduced to ALARP when all reasonably practicable control measures have been identified and implemented to reduce the risk of identified hazards. As described in numerous ALARP guidance documents, ALARP is demonstrated when good practice is followed, where good practice is defined as the recognised risk management practices and measures that are used by competent organisations to manage well understood hazards arising from their activities.

It is important to note when discussing ALARP and risk acceptance that practicability and the reasonability of control measures can change over time due to changes in technology, industry standards and community acceptance.

To determine whether potential environmental risks and inputs are "acceptable" at the time of evaluation is a matter of judgment that depends on issues such as the nature and scale of impacts and the social or economic benefits. As part of this process, The Regulations requires that the environmental management approach includes the principles of ESD; in order to ensure that all works conducted does not impact the future amenity of the environment.
The summary of this approach is:

- Identification of all environmental hazards associated with operations;
- Consideration of the pathway of impact upon environment receptors for each hazard and the potential maximum consequence if no control measures are implemented;

- Identification of the particular values and sensitivities
- Determination of the inherent risk ranking without controls
- Define severity of consequence.
- Consideration of controls that are appropriate, industry best practise and implemented to manage each hazard;
- Assessment to determine if the risk is ALARP. If it is not, then consideration of further risk control measures to be implemented to reduce the risk to ALARP or to an otherwise acceptable risk level.
- Consideration of the likelihood (probability) of the consequence occurring with these controls in place;
- Re-consideration of the final maximum consequence (residual environmental risk) that is credible once controls are implemented; and
- Determination of acceptability;

Section 6 Environmental Risk Assessment details the outcomes of this process.

5.2 Identification of risk events

Imperial identify the sources of risk i.e. those activities or incidents that could result in an environmental impact and categorised the hazards into those arising from routine operations and those arising from incidents.

5.3 Identification of the Environment that may be affected

Once the likelihood of an activity or event occurring has been identified and assessment of the magnitude of the environmental consequence is defined. The potential environment to be affected is categorised by the EPA Factors (2018).

5.4 Identification of Particular Values and Sensitivities

A review of the existing environment was performed using Imperial's and publicly available information. This allowed for identification of the environmental values and/or sensitivities and their potential to occur within the project area. Table 21 provides a summary of these values and sensitivities which were used to inform the risk assessment as they provide the potential worst-case consequence.

5.5 Identification and Evaluation of Potential Environmental Impacts

The known and potential impacts to the identified receptors were evaluated based on the environmental findings of Imperial's on ground research of the region and the publicly available information. Specifically, consideration was given to:

- Receptor sensitivity to identified aspect
- Extent and duration of the potential impact.

5.6 Pre-treatment Risk Ranking – Before controls applied

Risk evaluation prioritises the risks in terms of likelihood and consequence (Section 5.8 - 5.9) of the impact occurring and helps to define the management actions required to reduce the risk to ALARP.

5.7 Control Measure Identification and ALARP Decision Framework

As part of Imperial's risk assessment process, each risk is mitigated to ALARP. A risk can be considered to have been reduced to ALARP when all reasonably practicable control measures have been identified and implemented to reduce the risk of identified hazards. As described in numerous ALARP guidance documents; ALARP is demonstrated when good practice is followed, where good practice is defined as the recognised risk management practices and measures that are used by competent organisations to manage well understood hazards arising from their activities. ALARP is not a final position over the life of a project.

As part of Imperial's risk process, risk acceptance is completed following each ALARP assessment. In order to achieve the outcomes and meet the community expectations; Imperial's risk acceptance considers:

- the impact of the hazard on the environment (nature and extent),
- the overall social or economic benefits of the operation,
- feasibility of new technologies, and
- effectiveness of the mitigation measures

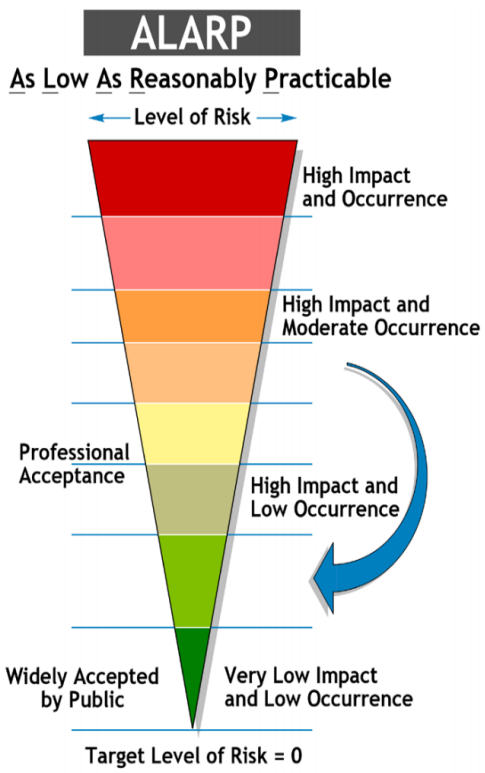


Figure 22. Risk Acceptance Model

It is important to note when discussing ALARP and risk acceptance that practicability and the reasonability of control measures can change over time due to changes in technology, industry standards and community acceptance.

5.8 Determination of Severity of Consequence

The potential level of impact (consequence) is evaluated and assigned in line with potential hazards and receptors, using Imperial's Consequence Classification" (Table 22) from Imperial's Risk Matrix, the consequence level for each identified hazard is disclosed in the risk assessment table in Section 6.

Table 22. Imperial Environmental Consequence Classification

Consequence	Environment
Slight	Negligible financial consequences; local environmental risk; within containment area. Release to environment (lt/kg) <10
Minor	Contamination; minor environmental damage. Single incidence of statutory or prescribed criteria; single complaint; no permanent effect on the environment. Release to environment (lt/kg) <100
Considerable	Localized damage to environment or repeated incidence of statutory or prescribed limit. Release to environment (lt/kg) <1,000

Consequence	Environment
Major	Severe environmental damage; the company is required to take extensive measures to restore the contaminated environment to its original state. Extended incidence of statutory or prescribed limit. Release to environment (lt/kg) <10,000
Massive	Persistent severe environmental damage or severe nuisance extending over a large area. In terms or commercial or recreations use or nature conservancy, a major economic loss for the company. Constant high incidence of statutory or prescribed limit. Release to environment (lt/kg) <10,000

5.9 Determination of Likelihood

Likelihood relates to the potential for a consequence to occur. This includes the likelihood of an event occurring and the subsequent potential consequence. This is defined using Imperial's Likelihood Descriptors (Table 23) from Imperial Operational Risk Matrix.

Table 23. Imperial Likelihood Classification

Level	Criteria
Practically Impossible	Rare or practically impossible, not known incidence or rare. Frequency >10 years
Unlikely	Not likely, uncommon Frequency 1-10 years
Possible	Could happen or possible; has happened in the past but not common. Frequency > 1 year
Likely	Has happened or likely, recent history indicates has happened. Frequency >1 month
Almost Certain	Common or almost certain; expected to occur in most circumstances Frequency > 1 week.

5.10 Residual Risk Ranking

Risk is expressed in terms of a combination of the consequence of an impact and the likelihood of the impact occurring. Imperial uses the Corporate Risk Matrix (Table 24) and its components (Table 22 & 23) to measure the hazard probability (chance of occurrence), consequence severity (seriousness of consequences) and the risk ranking associated to it.

The risk ranking identified (Table 25) assists with the determination of the level of controls required to reduce the risk or impact. Based on the identified impacts and the ranking of their pre-treatment risk; control measures are determined to eliminate, prevent, reduce or mitigate consequences associated with each of the associated environmental impacts. When determining whether the risk or impact has been reduced to ALARP it must be asked whether the environmental risk can be lowered further without a disproportionate increase in impost.

Table 24. Imperial Risk Matrix

Consequence		Likelihood				
		1	2	3	4	5
		Practically Impossible	Unlikely	Possible	Likely	Almost Certain
1	Slightly	Low	Low	Low	Moderate	High
2	Minor	Low	Moderate	Moderate	High	High
3	Considerable	Moderate	Moderate	High	High	Extreme
4	Major	Moderate	High	High	Extreme	Extreme
5	Massive	High	High	Extreme	Extreme	Extreme

Table 25. Imperial Risk Significance Rating

Risk Level	Mitigation/Investigation Focus
Low	Risk in this category should be handled by the normal manager structure
Medium	Risk in this category should be handled by the Risk Committee (through the management structure)
High	Risk in this category should be handled by the Board (through the management structure and Risk Committee) on a monthly basis
Very High Risk	Risk in this category should be handled by the Board (through the management structure and Risk Committee) on a monthly basis

5.11 Determination of Impact and Risk Acceptability

To determine whether potential environmental risks and inputs are “acceptable” is a matter of judgement that depends on issues such as the nature and scale of impacts and the social or economic benefits. In determining acceptability, the Regulations require consideration of the principles of ESD and the Precautionary Principle, and the risk assessment performed by suitable qualified people.

Impact and risk identification must include consideration of uncertainty, which is qualitatively assessed using a generic means of ranking data available in accordance with Figure 22 and Table 27 below.

Table 26. Acceptability and Scientific Uncertainty

Score (Uncertainty Type)	Acceptability	Uncertainty Description (DEFRA, 2013)
Low (A)	Residual risk is acceptable, and it is assumed that ALARP has been achieved	• Comprehensive data with strong evidence in multiple peer reviewed data • Little disagreement between authors or experts • Considerable and consistent on-ground experience and/or monitoring
Moderate High (B)	Residual risk is acceptable provided that ALARP has been achieved and demonstrated	• Some or incomplete data available • Evidence provided based on a small number of references • Authors or experts' conclusions vary • Limited on-ground experience and/or monitoring
Extreme (C)	Residual Risk is intolerable and must not be accepted or approved by Management.	• Scarce or no data available; evidence provided in unpublished reports • Few on-ground observations • Authors and experts' conclusions vary considerably

In addition to the requirements detailed above, for the purposes of petroleum activities, impacts and risk to the environment are considered broadly acceptable if:

- The residual risk is determined to be Low and ALARP Uncertainty Type (A) selected and good practice control measures applied; or
- The residual risk is determined between Moderate and High and ALARP can be demonstrated;
- The following have been met:
  - Principles of ecologically sustainable development
  - Legal and other requirements.
  - Imperial policies and standards
  - Stakeholder expectations

5.11.1 Risk Determination and the Code

In the NT context, ALARP and the definition of acceptable risk levels was a key feature of the NT Inquiry Final Report. For each aspect, acceptability criteria were defined with recommendations outlined to reduce the potential risk to below the acceptable level. With the adoption of all recommendations by the NTG, the new Codes of Practice and associated regulatory changes provides a high level of inherent protection to ensure activities are undertaken in a safe and consistent manner.

6 Environmental Risk Assessment

An environmental risk assessment was undertaken by suitably qualified personnel for the proposed activities using the methodology outlined in Section 5 and the result are reported in Table 27 below.

Table 27. Risk Assessment for proposed activities

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
Air quality	• Dust emissions from vehicle movements in unsealed roads, • Excessive exhaust emissions, fugitive emissions from well, • Drilling activities • Civil works • Flared testing	Reduction of air quality and climate – Increased in dust particles (increased greenhouse gas emissions)	• Terrestrial Flora and Fauna • Human Health • Release of atmospheric contaminants from exhausts • Release of greenhouse gases from gas pipe fittings • Dust emissions	3	2	Moderate	***Air quality protection*** • Implement Work Program staging and minimize total area of disturbance at any one time. Preference to use previously disturbed areas • Reduce speed on unsealed roads in the project area to 60km/hr • Crew mobilisation by dual cab vehicles, avoid extra vehicle movement when possible • Minimise haul / travel distances where practicable • Monitoring of all flaring events and record for greenhouse gas calculations and reported through the National Greenhouse Energy Reporting system. • Flaring only used during testing, in case of an emergency and into designated flare pit. • No burning on site • Vehicles and equipment will be switched off when not in use • Utilise meteorological information and weather forecast to confirm suitability of conditions for the proposed work program activities and assess fire danger. • Watering of roads when appropriate and as required • Dust control for civil works where appropriate • Monitor road conditions to ensure deterioration with possible increase in dust creation does not occur and undertake road rehabilitation as required • Vehicles and equipment maintained and regularly service • Refer to ""Asset Integrity Surface facilities"" control" • Refer to “Traffic and Transport Management”	2	1	Low	A	A.3.1 Site Selection and Planning A.3.5 Biodiversity protection D.5.1 Baseline Methane assessment D.5.9 Venting and Flaring D.5.9.4 Other fugitive emissions
		Terrestrial fauna and human health respiratory stress		1	2	Low		1	1	Low	A	
		Flora stress and/or dieback due to dust covering of foliage		3	1	Low		2	2	Moderate	A	
Land	Soil erosion from erosion and sediment control failure: • Flow concentration points not removed • Change in natural waterways and drainage channels	Disruption on landform and soils	• Impacts on ephemeral and perennial waterways from sedimentation and change in landform • Soil erosion and sedimentation • Flooding • Impacts to flora and fauna	3	2	Moderate	***Erosion and sediment control*** • Well pads site scouted to ensure that they are not in low lying areas subject to inundation, close to watercourses or on areas of significant slope. • No driving off unformed tracks, • Active inspection and monitoring of the effectiveness of erosion and sediment control measures adopted across the site and maintained as required • Manage pooling water	2	1	Low	A	A.3.4 Erosion and sediment control

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
			• Loss of soil productivity				• Preference to use previously disturbed areas • Considering seasonal influences, such as rainfall before conducting activities • Disturbed areas will be re-contoured • Activities to be conducted during dry season • All roads and tracks required will be developed along the contour where possible. • Fence off any soft areas around the edge of water storage areas • Reduce vegetation clearance to approved areas. • No unauthorised clearing • Restrict third party access, • Erosion and sedimentation control devices installed where necessary as per IECA and DENR guidelines. Controls can include but not limited to: ○ diversion banks ○ whoa boy's ○ no windrows or concentration points ○ drainage channels ○ regular inspections ○ berms to avoid sediment run off • Diversion banks and roll over banks developed across the contour to disperse run-off away from the tracks as required • Utilise Rig mats for watercourse crossings to avoid earthworks and allow unimpeded fauna passage • Retain riparian vegetation as per LCG approval, rehabilitate as per plan. • After significant rainfall inspect areas to confirm: ○ No erosion ○ No sedimentation ○ No blocking of drainage lines and • Restore disturbed areas. Landform consistent with surrounding environment, no blocking of drainage channels or water courses. ***Rehabilitation Management*** • Collect and remediate contaminated runoff and contaminated soil if spills occur, and transport to a suitable facility for disposal					
	Rehabilitation failure ○ Poor topsoil management	Loss soil productivity	• Loss or endangerment of threatened species • Loss of fauna and flora habitat • Rehabilitation failure leads to future land degradation and flow on effects to the surrounding environment. • Increased intensity of flooding leading to vegetation degradation and habitat modification"	3	4	High		1	2	Low	A	
	Topsoil compaction ○ Compacted soils not uncompacted to allow infiltration			3	3	High		2	2	Moderate	A	A.3.9 Rehabilitation A.3.6 Weed management

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
							• Scrapes will be filled and compacted to prevent future formation of depressions or rendered shallow and self-draining • No new weeds or non-native plants introduced, and appropriate weed management implemented as per ”Biosecurity Management”” under this EMP and approved Weed Management Plan. • All infrastructure removed and cleared areas rehabilitated unless another agreement is reached with the landholder/traditional owner. • Appropriate management and control of waste materials on and off-site • Rehabilitation to be implemented 12 months post decommissioning of the infrastructure or as agreed with the relevant government departments. • Perform post rehabilitation monitoring to verify rehabilitation success and/or presence of weed species and assessment of cover and species regenerating • Photographic point monitoring established before disturbance and continued after to identify any areas requiring further rehabilitation work • Return all disturbed landforms to as close as possible the natural terrain • All compacted hardstands and laydown areas deep ripped to encourage infiltration and water retention • Topsoil to be retained for reused during rehabilitation process • Location of topsoil (30cm of soil profile) mounds clearly marked and stored around the edges of the lease area in low profiles mounds under 1.5-2m high to protect the biological activity of the topsoil and reinstatement as soon as required • Vegetation survey conducted before disturbance to provide baseline reference to determine post revegetation success. • When rehab is to occur topsoil will be spread. If germination does not occur after appropriate rainfall over several years re-seeding will be conducted. • Lightly scarify all rehabilitated surface to encourage moisture retention and seed capture" • Refer to “Waste Management” • All rehabilitation to be conducted in accordance with the Code					

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
	Soil contamination		Localised soil contamination	3	4	High	Refer to "Chemical/hazardous materials storage" and "Waste management" for the mitigation of contamination of soils.	1	2	Low	A	
	Civil works	Impact on flora and fauna	• Loss of habitat • Increased intensity of flooding leading to vegetation degradation and habitat modification • Disturbance of fauna • Loss of endangerment of threatened species • Disturbance to environmentally sensitive areas and/or flora and fauna species.	3	3	High	***Biodiversity Management*** • Induction of staff to biodiversity management and characteristics. • Adhere to permit to work system, which ensures that all activities stay within the approved drilling activities area • Ecological assessment undertaken to identify environmentally sensitive areas (flora and fauna habitat) prior to disturbance • Vehicle and machinery to undergo weed cleaning and compliance checks before mobilised to site" • Civil works avoid clearance of mature vegetation • No unauthorised clearing. • Buffer distances from riparian vegetation, waterways and drainage lines to be applied in accordance to "Recommended Widths for Riparian Buffers of the LCG (2019) ○ 1st order streams and Drainage lines = 25m buffer from outer edge of drainage depression or riparian vegetation ○ 2nd order streams = 50m buffer ○ 3rd order creeks = 100m buffer ○ There are no 4th order or higher creeks or rivers in the project area. • Larger trees (including Corymbia and Eucalypt species) with a trunk diameter greater than 25cm at 1.3m above the ground are avoided whenever practical during clearing for seismic lines, to minimise disturbance to potential nesting trees for the Crested Shrike-tit and Gouldian Finch. • Refer to "traffic and transport management" for driving control measures • Refer to "Erosion Sediment Controls" for flooding and run-off control measure	2	1	Low	A	A.3.6 Weed management A.5.3 Biodiversity protection
	Fauna Strike		• Fauna death • Fauna injury	3	3	High	• Track fauna strike/ near miss in the fauna control register to enable knowledge sharing across personnel and contractors • Refer to "Traffic and transport Management""	1	2	Low	A	A.5.3 Biodiversity protection

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
	Bushfire associated with drilling activities		• Native fauna fatality • Increased incident and intensity of bushfires leading to vegetation degradation and habitat modification	3	4	High	***Bushfire prevention*** • No open flames or fires outside of designated areas • Fire extinguishers fitted to all vehicles • Appropriate firefighting equipment available and serviced • Ensure vegetation stockpiles are stored away from ignition sources and in low profile mounds • No burning of waste • Availability of water to assist in fire control • Staff induction to include emergency response procedures and communications with neighbours maintained • Designated smoking areas with appropriate waste receptacles • Restricted flare access • Firebreaks clearly demarked (¬4m width) and available around all buildings and infrastructure • Monitor weather and fire danger to plan operations accordingly • Flaring restricted where possible to low wind conditions and low fire danger periods	1	4	Moderate	A	A.3.7 Fire management
	Introduction and spread of weeds, pathogens and invasive species		• Introduction or spread of weeds impacting native flora and fauna • Increased introduced species and predator species impacting on Flora and Fauna • Introduction of weeds impacts productivity of neighbouring properties"	5	4	Extreme	***Fauna*** • All food stored inside or in sealed containers • Personnel are prohibited from bringing domestic pets onto the exploration field area • No feeding of fauna • All standing water fenced removed if no longer required • Fauna survey to be completed prior to commencement of construction • All personnel inducted in the identification of potential threatened fauna species in the area and their obligations and responsibilities for any fauna encounters. • Native fauna is mobile. Machinery noise might help disperse vagile fauna. • Fauna ladders to be installed at all open pits • Pits and dams to be fenced • Daily checks of pits and dams throughout the drilling program • Install and maintain adequate warning signs, fences and rock bunds to exclude livestock and native animals from sensitive areas • Refer to “Waste Management” for waste storage	2	2	Moderate	A	A.3.6 Weed management

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
							Flora • Minimise clearing of new access tracks to sticks, logs and larger rocks necessary to ensure good safe access wherever possible. • Photographic monitoring before and after any disturbance • No driving off unformed tracks. • Activities will adhere to the guidelines within the NT Weed Management Handbook and "Preventing weed spread is everybody's business" (https://denr.nt.gov.au/__data/assets/pdf_file/0011/257987/preventing-weed-spread.pdf) • Weed desktop and field-based surveys undertaken to identify existing weed areas • Vehicle and machinery to undergo weed cleaning and compliance checks before mobilised to site • Vehicles and/or equipment coming from a weed invested area is required to be weed free and needs to provide a weed free certificate before entry • Major equipment moves will be planned from weed-free areas to infested areas and not the other way around • Vegetation survey conducted before and after any clearing operations to determine if new noxious species present • Baseline training for staff members responsible for preventing, identifying and managing weeds undertaken • New activities will be planned to address prevention of weed or non-indigenous plant spread • Dedicated weed officer to inspect leases and tracks on a regular basis.					
Ground Water	Well integrity failure	Activities adversely affect groundwater quality:	• Impact to groundwater dependent ecosystems	2	2	Moderate	***Asset integrity - Subsurface*** • Operate within constraints of valid extraction license, • Extraction volumes to be provided to DPIR and DENR. • Wells to be constructed and tested as per industry code of practice • Surrounding groundwater bores within 2.5km will be monitored for drawdown or gas migration. • Asset protection (e.g. Fencing, bollards and traffic controls) • Emergency Response Plan in place and all staff trained and inducted in their use • Integrity testing as part of the drilling program" • Water sampling of nearby water supply (RN027848 – RN039574) to demonstrate baseline water quality	1	2	Low	A	B.4.1 Well Integrity management B.4.2 Aquifer protection B.4.3 Well design and well barriers B.4.6 Casing and tubing B.4.7 Primary cementing B.4.9 Well control B.4.17 Groundwater Monitoring

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
Surface Water	Spill of chemicals/hazard material via: ○ Transport ○ Lack of appropriate bunding around storage and refuelling areas ○ Inappropriate storage of fuel, oil or chemical containers ○ Inappropriate handling of fuel, oil or chemicals during use	Activities adversely affect surface water (permanent and ephemeral water courses)	• Impact to hydrological systems • Contamination of soil or surface water body • Impacts to flora. • Loss of containment of chemicals and hazardous materials	4	3	High	***Chemical/hazardous material storage*** • Spill kits available on site • Trained personnel in the Spill Response Plan, • Drip trays or portable bunds to be used during refuelling, • Fuel tanks on site, where possible, to be self-bunded (double lined) and inspected weekly or daily during the wet season. • Register of hazardous chemicals to be maintained onsite, • Light vehicles and smaller trucks to be fuelled up off site as a preference (Cape Crawford is the closest fuel supply) • All hazardous materials stored in appropriately bunded areas, off the ground or designated fit for purpose storage areas. • Chemicals and hazardous goods stored in accordance with Dangerous Goods requirements, WHS legislation and appropriate standards for the type of chemicals. • Emergency response plan is in place for responding to contaminant releases • Spill areas will be Identified and remediated in accordance with the National Environment Protection Measure (NEPM) requirements • Release of chemical/hazardous materials will be reported to the DPIR as required • All chemicals used for drilling are biodegradable where possible. • During the wet season, transport of chemicals on unsealed roads won't be undertaken unless the risk of spills is demonstrated to be ALARP and acceptable.	2	1	Low	A	C.7.2 Spill management plan. A.3.8 transport and secondary containment of chemicals.
	Tank/Vessel failure		• Loss of containment • Impact to water surface dependent ecosystems • Impact to flora • Contamination of surface water body	4	3	High	***Asset Integrity - Surface facilities*** • Chemicals and hazardous goods stored in accordance with Dangerous Goods requirements, WHS legislation and appropriate standards for the type of chemicals. • Emergency Response Plan in place and all staff trained and inducted in their use • Bypass structures installed to minimise obstruction to flow wherever feasible • Utilise rig mats for creek crossing • Buffer distances from riparian vegetation, waterways and drainage lines to be applied in accordance to	2	1	Low	A	C.7.2 Spill management plan C.7.1 Wastewater management plan A.3.8 Containment of contaminants

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
							"Recommended Widths for Riparian Buffers of the LCG (2019) ○ 1st order streams and Drainage lines = 25m buffer from outer edge of drainage depression or riparian vegetation ○ 2nd order streams = 50m buffer ○ 3rd order creeks = 100m buffer ○ There are no 4th order or higher creeks or rivers in the project area. • Management of change procedure for control of drilling activities change • Operate within safe operating envelope as protected by designed safety equipment and instrumentation • Asset protection (e.g. Fencing, bollards and traffic controls) • Appropriate storage for onsite water (lined ponds or tanks) • Regular inspections of equipment, sumps and ponds to confirm integrity					B.4.16 Site material and fluids management
	• Inappropriate management of waste including: • Waste not separated and stored appropriately • Unauthorised onsite disposal • Hazardous wastes and chemicals not removed at end of use • Waste receptacles not adequately secure • Wastes not removed frequently enough, overfill • Inappropriate disposal of wastes oil or chemicals • Waste not stored in bunded area if required"		• Impacts to flora or water surface dependent ecosystems • Contamination to surface waters • Contaminated land, surface water • Encouragement of pest species to waste sites	4	3	High	***Waste Management*** • Code of Practice: Onshore Petroleum Activities (the Code) will be implemented. The Code includes requirements for wastewater management. • All sumps to have a minimum of 0.5m bund around the edge to avoid water run-off. • Spill management plan implemented • All sumps to be fenced and lined up • Licenced waste contractor will be used for offsite transfer and disposal. • Records of transport and disposal to be kept • Sewage treated and solids disposed of off-site by licensed contractor. • No incineration of waste • Relevant staff trained and inducted into the storage, handling and recycling of hazardous wastes • Segregation of oily waste including set oil, oil filters and rags in accordance to the Schedule 2 of the Waste Management and Pollution Control (Administration) Regulation 1998 and disposed of offsite in an approved disposal facility. • Storage of waste generated from work program activities in designated locations and/or receptacles that provide	2	1	Low	A	C.7.1 Wastewater management plan. A.3.8 transport of wastewater.

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
							suitable separation and minimise interaction with wildlife, stock and public. • Bunding for storage of regulated wastes material contained in drums with capacity of at least 25% of the total volume of stored material • Assess all spills and/or leaks for appropriate remediation action in conformance to NEPM 2013 guidelines. • Reuse waste material where possible • No waste or hazardous material stored with potential for overflow impact on water courses • No waste to be stored within the buffer zone of watercourse according to LCG. • Listed waste generated from a regulated activity, as prescribed in Schedule 2 of the Waste Management and Pollution Control (Administration) Regulations 1998, will be disposed of at a licence facility and in accordance with the Waste Management Plan. • All hazardous waste material separated in the appropriate area for disposal according to their SDS and the hazardous goods register • For waste transported across state or territory borders, the National Environment Protection Measure (NEPM) 2013 Guidelines for Waste Transport will be adhered to • Regular inspection of waste containers to ensure no leaks or overflow. • All drill cuttings to be contained in the lined mud sump during operations. Testing of soil before rehabilitation and drilling cuttings once fluids have evaporated from the mud sump will determine if suitable for burial on site or if disposal off site is required. (Determine salinity and heavy metals are below NEPM 2013 trigger guidelines concentrations to be buried on site without impacting surface water run-off in the area) • During the wet season, transport of wastewater on unsealed roads won't be undertaken unless the risk of spills is demonstrated to be ALARP and acceptable					
People and community	• Loss of amenity of landholders • Disturbance to native fauna causing injury or death	Sensitive receptors such as people, flora and fauna	• Social, economic and cultural (Road users, local community and landholders discontent) • Impact to terrestrial flora and fauna	3	2	Moderate	***Community Impact minimisation*** • Retain Services of Traditional Aboriginal Owners (TAO) to monitor activities and advise on culturally sensitive areas • Comply with Native Title Agreement provisions and all other legal obligations	2	1	Low	A	A.3.1 Site selection and planning A.3.3 Noise

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
	• Areas not no longer required not rehabilitated • Increased in traffic • Movements of heavy machinery on public roads • Release of waste without stakeholder engagement • Disorganised storage and appearance of the exploration area • Increased intensity of flooding from land clearing and drilling activities • Introduction and spread of weeds from vehicles and equipment not properly inspected • Noise and vibration generated during drilling activities, vehicle movements and civil works, • Artificial lighting required for safety during 24hour activities • Bushfire from drilling activities.		• Increased potential for accidents and damage to infrastructure (e.g. vehicle movements, goods transportation, driver behaviour) • Increased or introduction of weed species • Loss of visual amenity • Light pollution • Noise generation • Damage to or loss of public infrastructure, private infrastructure and equipment or community lands				• All activities to stay within the approved exploration licence • Where possible, local and/or indigenous people employed • Stakeholders to be notified of all planned activities well in advance • No operations to occur within 200m of a known Culturally Sensitive or Sacred area without prior approval from the relevant Local Aboriginal Group and other relevant stakeholders • Retention of Traditional Aboriginal Owners to monitor and advise on Culturally sensitive locations • Site specific fire management plan will be implemented for the proposed activity. See Appendix 10 for details • A community contact number will be provided in communications correspondence • Implement Imperial Oil & Gas HSEMS and develop safe work procedures for all work program activities • Noise suppression devices to be fitted where applicable, • Minimal lighting used for safe operations of the facilities • Minimise the extent to which the operations would be visible by the community or public by utilizing natural topography and vegetation and distance screening or blocking potential views of the operations • Utilize natural barriers wherever possible. Locate sites preferably behind visual barrier such as tree line or hill. • Install and maintain adequate warning signs and fences to exclude people from sensitive areas. • All work crews will contain at least one qualified senior first aid provider • Communication programs will be implemented with McArthur River Mine Emergency response personnel and local emergency services in accordance with the Emergency Response Plan Attachment 1 and Safety Management Plan Attachment 6. • All boundary lighting will be positioned to face inwards to provide adequate lighting for safe operations, reduce light leakage from site • Appropriate personal protective equipment used for safe operations • A full stakeholder communication log will be maintained. • Refer to “Bushfire prevention” control • Refer to “Waste Management” control for spills, waste storage and transport.					

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
							• Refer to "Rehabilitation management" control • Refer to "Erosion and Sediment Controls" control for disturbance • Refer to the "Biodiversity Management" control for weed impacts • Refer to "Air Quality Protection Measures" for vehicle servicing. ***Transport and Traffic Management*** • Consult with surrounding stakeholders when major activities will occur • An agreement will be reached with affected stakeholders to ensure that management strategies are agreed and adhered to on vehicle traffic • Active stakeholder engagement and complaints management which includes consultation with surrounding stakeholders when operations likely impact on lighting, noise, vibration and visual amenity values • All personnel and site visitors complete the appropriate inductions (including driving to weather and road conditions) • Engines/machinery maintained as per manufactures specifications. • Install buffer zones and distances into onsite tablets so machine operators have visual and audible alert when reaching buffer distances. Buffer distances will adhere to the LCG permit. • Drive only on designated access roads or tracks • Driving will be avoided where practical following significant rainfall • Adherence to speed limits 60km/hr in unsealed roads except in the event of an emergency • No unauthorised third-party access. • No driving under the influence of alcohol or drugs • All over-dimension loads will be moved in accordance with the traffic management plan (TMP) and Department of Transport applicable permits and escorts • Ensure vehicles are inspected regularly and have working lights and/or spotlights. • Drive fatigue management policy will be implemented as per Journey Management Plan rest stops					

Aspect	Causes	Potential Impact	Consequences/Receptors	Inherent Risk			Controls	Residual Risk			Unc. Type	Code of practice and WOMP
				L	C	R		L	C	R		
							• Limited driving at dawn and dusk • One designated spotter appointed per truck • Ensure Journey Management Plan is in place and all personnel adhered to it. • Do not disadvantage other uses of existing public roads and tracks • Only necessary vehicles will be utilized • Rig contractor to provide current and valid licence from drivers • All vehicles to drive with lights on at all times • All traffic and transport issues identified to be discussed at pre-spud meetings • Refer to “Chemical and Hazardous materials Management” for transport					
	• Bushfire from drilling and/or operation activities • Increased intensity of flooding from drilling and/or operation activities • Onsite indigenous heritage sites not previously determined during ethnographic study • Civil activities undertaken outside of the approved areas."	Indigenous heritage sites	• Disturbance to cultural heritage sites • Loss or destruction of cultural heritage sites.	4	3	High	• Cultural Heritage Clearance (and identification of artefacts of Aboriginal significance in conjunction with the NLC and TOs) will be conducted prior to commencement of disturbance activities, • Adhere to permit to work system, which ensures that all activities stay within the approved operating areas • No off road driving • First disturbance monitoring by TOs • Exclusion zones established and fenced off to not be damaged • All personnel to be inducted to highlight any no-go zones. • Refer to ""Bushfire prevention"" • No unauthorised clearing • Upon identification of a potential culturally significant object, work will cease until the supervisor has investigated and called the relevant advisor.	2	1	Low	A	

6.1 Discussion on ALARP, acceptability to Ecological Sustainable Development (ESD)

As discussed in in Section 5.10 Imperial uses a model to determine acceptance of residual risk this is specified in Imperials Residual Risk Acceptance Model. To summarise:

- A Level 5 residual risk is intolerable and must not be accepted or approved by Management.
- A Level 2 – 4 residual risk is acceptable provided that ALARP has been achieved and demonstrated.
- A level 1 residual risk is acceptable, and it is assumed that ALARP has been achieved.

In addition to the requirements detailed above, for the purposes of petroleum activities, impacts and risk to the environment are considered acceptable if:

- The residual risk is determined to be 1 (and ALARP Decision Type A selected and good practice control measures applied), or
- The residual risk is determined between 2 and 4 and ALARP can be demonstrated; and
- The following have been met:
    - Principles of ESD
    - Legal and other requirements
    - Stakeholder expectations.

All the residual risks in the risk assessment in Table 27 are between 1 and 2, which means that they are acceptable, ALARP and have considered elements of ESD. In the risk assessment, all risks have been considered a decision “Type A”, meaning that they are well understood and that are established practices in place to manage these risks.

Activities conducted under this EMP will be done in compliance with the Code of Practice: Petroleum Activities in the Northern Territory.

6.2 Referrals to DoEE and NT EPA

6.2.1 Significant Impact test for EPBC listed species

Conservation significant flora and fauna species are those species listed under the provisions of the Commonwealth EPBC Act and/or the Territory Parks and Wildlife Conservation Act 2000 (TPWC Act) including threatened species as well as internationally protected wildlife and migratory species. Threatened species include those with conservation status listed as Endangered, Vulnerable or Near Threatened (EVNT) under the EPBC Act or Extinct in the Wild, Critically Endangered, Endangered or Vulnerable under the TPWC Act. Potentially occurring threatened flora and fauna species are listed in the *EP187 Environmental Assessment Report 2019 Seismic and Drilling Program*. This document also provides an account of their likelihood of presence within the study area based on known records, species biology and ecology and habitats available within the study area.

No threatened flora species have been previously recorded within the search area. Two (2) threatened fauna species have previously been recorded within the study area. One (1) species *(Mesembriomys macrurus* (golden-backed tree rat)) was recorded over 100 years ago and is now considered locally extinct. The second threatened fauna species (*Erythrura gouldiae* (Gouldian Finch) was not identified through NT or Commonwealth database searches, but rather is included due to anecdotal evidence.

The DoE Matters of National Environmental Significance (MNES) Significant Impact Guidelines 1.1 (2013) were used to assess the potential for impacts. The proposed drill locations and access is outside of the known critical habitat for Gouldian Finch (refer Appendix 5 for likelihood of occurrence and risk assessment for impacts to MNES).

6.2.2 Significant impact test for Environmental Assessments Act

Petroleum activities that could reasonably be considered capable of having a significant effect on the environment are referred to the NT EPA. Using the guideline 'Referring a proposal to the NT EPA: A guide for proponents and referral agencies' (NT EPA 2018), a detailed review of and assessment against each prescribed Environmental Objectives for each Environmental Factor was conducted in relation to the proposed Drilling Program and is included in table 28 below. The results of the assessment demonstrate that the proposed petroleum activities have been suitably managed, and risks addressed. Section 5 and the controls proposed in Table 27 demonstrate how the objectives can be met.

Table 28. Environmental Objectives for each Environmental Factor

Aspect	Environmental Factor	Objective	Relevance to EMP
Land	Terrestrial Flora and Fauna	Protect flora and fauna so that biological diversity and ecological integrity are maintained.	The proposed activities are unlikely to result in significant impacts to vegetation or native fauna. The mitigation measures outlined in the risk assessment table will be implemented to manage these risks to a level that is ALARP and acceptable.
	Terrestrial Environmental Quality	Maintain the quality of the land and soils.	Should a release occur, the proposed activities are likely to result in only minor localised impacts to the land. The mitigation measures outlined in the risk assessment table will be implemented to manage these risks to a level that is ALARP and acceptable.
	Landforms	Conserve the variety and integrity of distinctive physical landforms.	Given the implementation of the mitigation measures outlined in the risk assessment table, it is unlikely that distinct physical landforms will be impacted. There is currently no potential for a significant effect on landforms.
Water	Aquatic Ecosystems	Protect aquatic ecosystems to maintain the biological diversity of flora and fauna.	It is unlikely aquatic ecosystems will be impacted by the purposed activities, given that no sensitive vegetation will be disturbed and there is a lack of permanent surface waters and aquatic GDEs in the Project Area. Furthermore, the mitigation measures outlined in the risk assessment table, will be employed to ensure that potential risks and impacts are managed and further mitigated.

Aspect	Environmental Factor	Objective	Relevance to EMP
Air	Water Environmental Quality	Maintain the quality of groundwater and surface water so that environmental values are protected.	Given the lack of permanent surface waters and the turbid nature of surface waters during times of flood, in conjunction with the mitigation measures outlined in the risk assessment table it is unlikely the inland water quality will be impacted.
	Hydrological Processes	Maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.	It is unlikely hydrological regimes of groundwater or surface waters will be altered by the proposed activities. The area of planned disturbance requires, minimal volumes of groundwater extraction less than 5 ML. Control measures outlined in the risk assessment will be implemented to ensure that these potential risks and impacts are managed and further mitigated.
	Air Quality and Greenhouse Gases	Maintain air quality and minimise emissions and their impact so that environmental values are protected.	The proposed activities have the potential to result in localised, short-term minor impacts to air quality through planned atmospheric emissions. The mitigation measures outlined in the risk assessment table. Based on the small nature of operations, it is unlikely there will be significant effects to air quality and greenhouse gases.
People and Community	Social, Economic and Cultural Surroundings	Protect the social, economic, cultural and heritage values of the region.	The proposed activities have the unlikely potential to result in disturbance to culturally sensitive sites and/landholders through lighting, weeds, fire, planned physical disturbance, and unplanned stakeholder interactions. The control mitigation measures outlined in risk assessment table will be implemented to manage these risks, such as the areas proposed to be disturbed have been surveyed for sacred sites and cultural heritage significance and an AAPA certificate is in place.
	Human Health	Ensure that the risks to human health are identified, understood and adequately avoided and mitigated.	The proposed activities have the unlikely potential to result in human health impacts due to inhalation of dust.

7 Management Plans

7.1 Weed Management Plan

A project specific Weed Management Plan must be developed as part of the EMP which meets the requirements of the *NT Weed Management Planning Guide: Onshore Petroleum Projects* (DENR 2019). The weed management plan is provided in Appendix 6.

7.2 Fire Management Plan

The area of planned exploration drilling within EP187 is generally an open grassland savannah area lightly timbered. The area is regularly burnt using aerial fire bombing and traditional owner cultural fire management practices.

More recently the area has been increasingly utilized for cattle grazing and as a consequence many new fence lines and fire breaks have been constructed through the exploration area. As a part of grazing management practices towards the end of the dry season the area is regularly burnt to reduce fuel load and to promote new pasture growth through the following wet season. The practice of regular burns reduces the risk of significant hot fires and allows for a cooler less intense burn; however, the risk of bush fires and wildfires remains in some areas.

7.2.1 Baseline information

Baseline fire information has been sourced from www.firenorth.org.au/nafi3/ and is presented below.

7.2.1.1 Fire Frequency

The Fire History Report indicates fire frequency in the Project Area is medium to low between 2009 and 2018. Fire frequency increases to the south (NTG 2019). The number of years burnt between the same periods is shown in Figure 23.

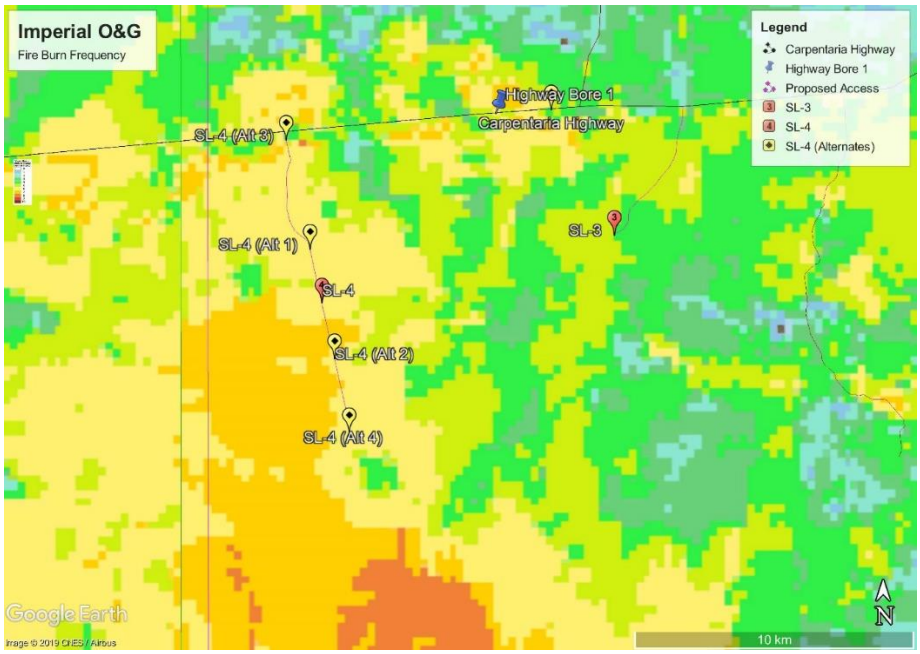


Figure 23. Fire Frequency between 2009 and 2018 at the project area

7.2.1.2 Last burn

Generally, most of the proposed area has been burnt in the last five years as shown in Figure 24.

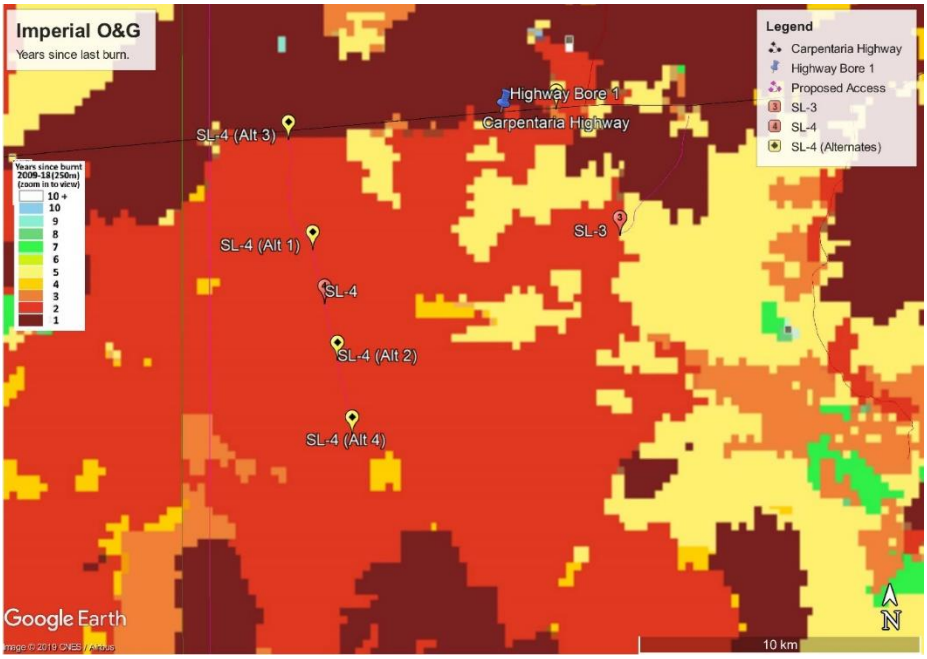


Figure 24. The year of last burn between 2009 and 2018 at the proposed area

7.2.2 Impacts of the proposed activities on the existing fire management.

The proposed activities will be located on a small size cleared area which ensures there will be no impacts on existing fire management.

Fire will be managed in accordance with the Fire Management Plan available in Appendix 10 and Tables 27 and 42 of this EMP.

7.2.3 Coordination with the landholder and other land uses

The project lies within the Savanna Fire Management Zone in the Northern Territory. The Savanna Regional Bushfires Management Plan 2018 has been developed to support community wide fire management within the Savanna Fire Management Zone in line with the Bushfires Management Act 2016. The proposed activities do not include the use of fire and fire exclusion from the lease pads is proposed. Outside of the lease pads there will be no impact on fire management. This is consistent with the Savanna Regional Bushfires Management Plan 2018 and the Fire management objectives for petroleum exploration.
The proposed development will require a Land Access Agreement with the landholder/s. Through the process, Imperial will ensure that the project does not affect the landholder's fire management obligations and strategies.

7.2.4 Annual Fire Mapping

The proposed works are expected to commence late 2019. If during the proposed exploration works a fire has occurred in and around the project footprint, Imperial in consultation with the landholder and with the landholder's approval endeavour to map the extent of the fire and provide that information to DENR.

7.2.5 Fire Mitigation Measures

The proposed works are expected to commence late 2019. The season conditions are being monitored with an onsite visit carried out in June 2019 with low fuel loads present at the time, fire load assessment will be carried out at the time of Civil Construction works. Fire access trails and fire break distances have been considered as part of the Drill Lease design. There is no current need for controlled burns for the works under this EMP. During operational periods fire outbreaks will be monitored via the NAFI website both at the worksite and remotely. As the works carried out under this EMP is of short duration Imperial will not be joining local bushfire brigades.

7.3 Rehabilitation Management Plan

All rehabilitation activities will be conducted in accordance to the Code of Practice (the code). Following completion of the rehabilitation works, Imperial will submit a final Environmental Report to DPIR and DENR in accordance with the Environmental Closeout Procedures for Petroleum Activities (DPIR 2016).

7.3.1 Scope

Limited to disturbances caused by the proposed appraisal well site operations, including:

- Decommissioning and removal of infrastructure;

- Well plug and abandonment;
- All cleared surfaces and disturbed sites;
- Residual contamination;
- Removal of access roads or leave in situ as agreed with the landholder;
- Revegetation; and
- Soil stability.

7.3.2 Progressive rehabilitation

During operations

- Topsoil stockpiles stored around the edge of the well site lease in low profile mounds (<2m), on the upslope side if terrain is sloped,
- Vegetation stockpiles stored separately in low profile mounds (<2m),
- Erosion and sediment control devices installed in accordance with DLRM and IECA best practice principles and guidelines,
- All waste stored in accordance with Appendix 13 or Section 7.5,
- Weed management measure in place in accordance with Appendix 6 or Section 7.1.

Directly after cessation of drilling operation and rehabilitation

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

7.3.3 Final land use

Ensure that all disturbed areas no longer required of the proposed well site is returned to, as close as possible, the pre-existing environmental condition.

7.3.4 Rehabilitation goals

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

7.3.5 Monitoring and maintenance program

Table 29 details the actions required to meet the environmental requirements for rehabilitation and monitoring in order to determine that these objectives have been achieved.

Table 29. Rehabilitation and Closure Plan Management Environmental Actions and Monitoring Requirements

Activity	Factors Assessed/Actions	Timing
Decommissioning	• Removal of all above ground infrastructure • Removal of rubbish • Re-spread vegetation • All RCCA items closed out to satisfaction of the DPIR	Commence within 12 months of site/infrastructure closure
Future land holders/managers	• Previous agreement for infrastructure or disturbed areas to be left for future land holders/managers (beneficial use). If the landholder does requests infrastructure to remain in place, the proposed infrastructure must be signed off with both the Pastoral Land Board and DPIR.	Before rehabilitation works commence
Soil Stability	• Return soil profile with topsoil replaced as final layer where possible • Remove any flow concentration points that may block overland sheet flow • Re-instate natural drainage channels • Ensure all cleared areas have a rough surface to aid in water catchment • All compacted areas to be deep ripped • Erosion and sedimentation devices maintained and installed as appropriate to best practise guidelines by the DENR and IECA	Commence within 12 months of site closure
Revegetation	• Allow for natural passive re-seeding • Assess within 12 months and apply active re-seeding if inadequate growth	To be assessed 12 months after initial seeding
Monitoring	• Establish photo monitoring points and vegetation survey before disturbance, so to bench mark against in later surveys. They should also be conducted at each monitoring event to compare progress. The following monitoring program is proposed: • <u>Immediately after rehabilitation works completed:</u> *Check for integrity of works and ability for future rehabilitation success*; • <u>Following first wet season:</u> ○ *Stability of soil, landform,* ○ *Vegetation establishment type and re-growth*	As prescribed

Activity	Factors Assessed/Actions	Timing
	○ *No new weeds or invasive species*; • <u>One year after rehabilitation</u>*:* ○ *No erosion or sedimentation occurring* ○ *No new weeds or invasive species* ○ *Establishment of vegetation*; • <u>Three years after:</u> *Soil stability, landscape and vegetation re-growth and type after several wet seasons*; and • <u>Five years after</u>: *Long term rehabilitation success measured by landform stability and vegetation re-growth.*	

All rehabilitation monitoring activities are scheduled around the wet season, re-entry to the lease will be subject to weather/road conditions and current activity of the region.

7.3.6 Reporting

Results of audits specified in Table 29 in relation to rehabilitation will be supplied to the DPIR with information on any corrective actions taken if required. The report should include, but is not limited to:

- Total area rehabilitated;
- Photographic monitoring points GPS locations and results;
- Any areas left in an agreement with future land holders/managers (depending on the asset and its condition at the time of rehabilitation)
- Monitoring of progressive rehabilitation, including flora type and density, fauna activity and soil stability;
- Any erosion and sedimentation issues;
- Any stakeholder consultations and results of discussions;
- Any issues noted and remedial actions taken;
- Monitoring of contaminated sites, and
- Weed monitoring

7.4 Erosion and Sediment Control Plan

The Code requires an Erosion and Sediment Control Plan (ESCP) for the activities to be developed by a suitable qualified person in accordance with the relevant guidelines including specific environmental outcomes and environmental performance standards included in the Implementation Strategy in the EMP.

The project specific ESCP is provided in Appendix 7.

7.5 Wastewater Management Plan

An EMP for a petroleum activity must include a wastewater management plan (WWMP) Refer to Appendix 13 a detailed waste management plan.

The WWMP assesses all water and wastewater management activities which are proposed including:

1. "Waste material" and material containing "contaminants" as defined in s 117AAB of the Petroleum Act 1984 (NT)
2. Wastewater meeting the definition of waste under the Waste Management and Pollution Control Act 1998 (NT)
3. Water that has been acquired or used in petroleum activities that is being disposed of.

7.5.1 Wastewater management framework

1. Estimate the quantities and quality of water and wastewater from the petroleum activity,
2. Define the methods and approaches that will be used to store, treat, and reuse water and ultimately dispose of wastewater, including what activities will be undertaken at the site of the approved petroleum activity,
3. Estimate the quantities and quality of wastewater, or wastewater derived solids, that will be removed from the petroleum site,
4. Provide for the relevant activities and the environmental risks and environmental impacts they involve in a wastewater management plan (WWMP)

7.5.2 Waste management hierarchy

This WWMP has been developed in consideration of the waste management hierarchy outlined in the National Waste Policy, 2018. Where practical, waste and wastewater management activities are designed to sequentially and preferentially avoid, reduce, reuse, recycle and treat before disposing of waste and wastewater. This is described in Section 7.5.5.

7.5.3 Management

All well site water will be managed in accordance with Part C of the Code.

7.5.3.1 Activity description

This section contains a description of the activities that will generate waste and wastewater that is proposed to be handled, stored or transported away from the area in which the activity is approved to be carried out.

Activities that will generate waste are summarised in Table 30 and described in the following sections.

Table 30. Waste generating activities

Activity – Waste Source	Waste Type
Domestic activity (camp and offices)	Putrescible and municipal waste
	Recyclables (glass and cans)
	Grey water (laundry, showers, sink wastes, etc)
	Treated sewage effluent
	Toilet waste (por-a-loos)

Activity – Waste Source	Waste Type
Activities ancillary to civils	Cardboard packaging materials
	Scrap metals
	Used fuel drums
	Timber pallets (skids)
	Vehicle tyres
	Oily rags, filters
Drilling activities	Drilling cuttings
	Drilling fluids

7.5.3.2 Domestic Activities

Sewage management practices at camp will consist of the use of port-a-loos and a fully self-contained sewage treatment plant (STP). Sewage from por-a-loos will be transported offsite by a waste management contractor.

The STP will be furnished with an irrigation sprinkler system to manage sewage and grey water wastes. All wastewater will be disposed of in accordance with the Public and Environmental Health Regulation 2018. Discharge from the camp will be treated to achieve the specifications provided in the Northern Territory's Code of Practice for On-site Wastewater Management. Treated effluent will be sprayed 50-100m away from the camp location to the surrounding environment, at a location well away from any place from which it is reasonably likely to enter any waters, and to minimise spray drift and ponding. Fencing will be installed around the irrigation area.

Wastepaper, cardboard and food scraps are disposed of into sealed bins set up in a benign area adjacent to the camp. The sealed bins will be transported for disposal of waste to a licensed landfill and recyclable materials will be managed on site and transported to an approved waste depot facility as described in Table 9.

7.5.3.3 Activities ancillary to civils

All waste streams from ancillary activities will be collected and stored on site. Waste will be transported for disposal or recycling as described in Section 7.5.5.

7.5.3.4 Drilling activities

As described in Section 3.5.1.7 water is not expected to be produced during drilling due to the well design.

All potential water to flow to surface will be water-based mud and biodegradable chemicals used for drilling. These will be recirculated during drilling and disposed of with the associated cuttings in lined sumps to let to dry out. Cuttings will be tested against NEPM 2013 guidelines to determine suitability for backfilling in situ or if removal and offsite disposal in a licenced facility is required.

7.5.3.5 Waste Characteristics

This section characterises the anticipated wastewater streams that will be generated, including chemical characteristics and volumes of each.

Table 31. Anticipated waste characteristics

Wastewater	Estimated Volume	Chemical characteristic	Management Method
Domestic waste – putrescible, municipal and recyclable	Less than 200m^3	Potentially hazardous to non-hazardous	Designated collection bins with transport off-site by licenced contractor
Domestic wastewater – grey water and treated sewage effluent	~150m^3	Non-hazardous	Reticulated collection, on-site treatment and disposal via irrigation
Domestic wastewater – grey water	~150m^3	Non-hazardous	Reticulated collection, on-site treatment and disposal via irrigation
Domestic wastewater – port-a-loo toilets	~1m^3	Potentially hazardous	Collection and storage on-site, disposal off-site by licenced contractor
Ancillary activities to civils	~1m^3	Hazardous to non-hazardous	Collection and storage on-site, and transport off-site by licenced contractor
Drilling fluids	~150m^3	Potentially hazardous to non-hazardous	Collection and storage on-site in lined sumps to let dry out. Tested for suitability to backfilled or transported off-site by a licenced contractor

7.5.4 Rainfall characteristics

Exploration Permit EP187 is located in a semi-arid, subtropical climatic region, under the influence of the monsoonal climate to the north where there is a distinctive wet and dry season. The majority of the rainfall occurs during the short, hot summer months between November and March. Rainfall events are usually associated with intense thunderstorms or widespread monsoonal activity. The local area average 50 days of rain per annum (NTG, 2018). Little rainfall occurs during the remainder of the year when the climate is characterised by mild days and cool nights (Knapton and Fulton, 2015).

EP187 is situated between the Daly Waters Airstrip weather station (#014626) and the McArthur River Mine Airport weather station (#014704). There is also a weather station (#14628) located near to the exploration permit at Tanumbirini Station capturing monthly rainfall data between 1970 and 2018. However, no other climate statistics have been recorded from the site. Table 32 shows climate averages data for Daly Waters, McArthur River and Tanumbirini Station.

The most rain during the year falls in January and February. Tanumbirini Station's maximum rainfall occurs during January, with an average of 216.2 mm recorded between 1970 and 2018. The least amount of rainfall occurs during July and August across all three weather stations however, Tanumbirini Station receives more rain during the dry season on average than Daly Waters or McArthur River Mine (Table 32). The annual rainfall pattern varies between the three weather stations however, the overall mean annual rainfall increases towards the coast.

As such activities under this EMP will be carried out in the dry season to reduce environmental and operational impacts

Table 32. Monthly rainfall at Daly Waters, McArthur River Mine Airport and Tanumbirini Station

Mean Rainfall	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daly Waters	166.1	180.1	110.4	20.5	6.5	2.9	1.8	0.4	1.9	21.5	49.2	116.1
McArthur River Mine Airport	219.4	178.2	146.0	31.4	7.1	1.6	2.1	0.3	4.9	19.7	56.8	123.4
Tanumbirini	212.4	173.5	122.9	24.3	2.3	5.3	2.5	1.2	5.6	20.3	50.7	120.8

7.5.4.1 1 in 1000 Averages

This section contains estimates for the 1 in 1000 average recurrence interval (ARI) for rainfall for the duration of activities, along with the means used for the estimation.

Annual recurrence interval (ARI) is assumed to be equivalent to annual exceedance probability (AEP). The 1 in 1000 year annual recurrence interval (ARI) for rainfall over a 2 month period in the wet and dry season at the location of the proposed petroleum activities is provided in Table 33 below. Operations will occur outside the wet season.

Table 33. The 1 in 1000 (0.1%) year AEP for rainfall (in mm) at the location of the proposed petroleum activities

0.1% AEP Rainfall	Wet season (mmm)	Dry season (mm)
1 Day	427	-
7- Day	691	-

7.5.5 Waste management methods and locations

Refer to Table 9 for type of waste, indicative volumes, disposal methods and disposal locations. Disposal options have taken into account the results of a risk assessment (See Section 7.5.7).

Control measures will be implemented to minimise interactions of all stored waste with wildlife, stock and human receptors. Control measures will comprise fencing, signage and fauna-proof containment as necessary. Waste will be segregated and stored on site and all putrescible waste material will be held in fauna proof containers. Only waste from approved wastewater systems and grey water will be disposed of to land. Licenced waste contractor will be used for any offsite transfer or disposal.

Should the proposed certified disposal method not be approved by DENR/DPIR, then it may be disposed of at an approved licenced facility. (See Table 9).

7.5.6 Proposed locations

The EMP for the proposed activities provides a layout of the proposed infrastructure for well site.

- Appendix 11 shows layouts of sump and pit location.
- Figure 2 camp layout and wastewater storage area.

7.5.7 Waste minimisation strategy

This section contains strategies to minimise or reduce the volume of wastewater that will be disposed of off-site, and the expected quality and quantity of water and wastewater that will be treated and re-used within the petroleum activity.
Imperial Oil & Gas will ensure the generation of wastewater is minimised as far as possible. Wastewater will be disposed. Water will not be re-used for any purpose due to public health restrictions. Personnel will be advised to minimise water usage when utilising showers, in the kitchen, etc; to reduce volumes of greywater generated.

7.5.8 Risk assessment.

This section contains a risk assessment in relation to the potential impact to the environment from water and wastewater management activities proposed as part of the petroleum activity.
An assessment of environmental impacts and environmental risks posed by waste has been carried out. For completeness and consistency with the environmental risk assessment of all activities, this is presented in Section 6 of the EMP.

7.5.9 Monitoring Plan

This section contains a monitoring plan that:

- Outlines the sampling locations, frequency, proposed analytical methods and analytical detection limits, and any quality assurance and quality control measures that will be implemented.
- Reflects all monitoring requirements mandated by the COP an the EMP, as well as any monitoring that is determined to be necessary as part of the risk assessment.
- Requires all field measurements and sampling to be undertaken by suitably qualified personnel and to utilise equipment that is suitably maintained, laboratory checked and calibrated
- Requires all laboratory analyses to be conducted at a National Association of Testing Authorities (NATA) accredited lab, where possible.

7.5.9.1 Baseline monitoring of soils

An assessment of physical properties of representative baseline soils at each well site will be conducted.

Three samples will be taken at equidistant depth intervals in a 0.5metre deep soil core from three locations across the well site, adjacent to:

- The proposed well,
- The proposed location for drill fluid storage tanks (e.g. on the well pad),
- Cutting pit location.

Soil test for each sample will include:

- A permeability test, such as falling head permeability testing on a sample or triaxial constant head permeability testing.

- A sample tested for:
  - Particle size distribution,
  - Total chlorides (mg/kg),
  - Exchangeable sodium (%),
  - Emmerson aggregate test.

7.5.9.2 Monitoring of Groundwater

The quality and quantity of groundwater extracted and stored will be monitored as per the below.

Quantity

Volume of water that is abstracted from the allocated water bore will be measured and recorded weekly during drilling operations.

Fluid levels in storages containing extracted groundwater will be monitored daily during well site operations. This provides a measure of the stored quantity of water.

Quality

- Quarterly reporting to DENR on the range of analytes specified in Table 7 of the Code of Practice will be undertaken from existing water bores in the area.
- Water samples from the nearby water supply bores (see Figure 12), RN027848 on Carpentaria Highway and RN039574 south of the highway, near location SL3, will be used to demonstrate a baseline of water quality data for the area
- Water samples will be taken from the proposed drill wellbores to correlate and confirm the baseline data.
- Water quality of abstracted groundwater stored in tanks will be sampled monthly. The suite will be tested as per Table 34. Testing will comprise grab samples from the tank, or a sample of water pumped from the storage tank.

7.5.9.3 Quality assurance and quality control measures

All field measurements and environmental sampling will be undertaken by suitably qualified personnel.

All samples shall be collected using suitable sample containers, preservation methods and chains of custody prior to receipt by analytical laboratories. Holding times will be met, where practical. All laboratory analyses will be conducted at a National Association of Testing Authorities (NATA) accredited lab, where possible.

Table 34. Suite of analysis for testing of stored groundwater

Analyte	ALS Method Code	Limit of reporting	Units
Electrical Conductivity (EC)	EA010-P	1	µS/cm
Total Dissolved Solids (TDS)	EA015H	10	mg/L
Total Suspended Solids (TSS)	EA025H	5	mg/L
pH	EA05-P	0.01	pH units
Sulfate (SO_4^{-2})	NT-2A	1	mg/L

Analyte	ALS Method Code	Limit of reporting	Units
Chloride (CL^-)		1	mg/L
Carbonate (CO_3^{-2})		1	mg/L
Bicarbonate (HCO_3^-) (as CaCO3 equivalent)		1	mg/L
Bicarbonate Alkalinity (as CaCO3 equivalent)		1	mg/L
Hydroxide Alkalinity (as CaCO3 equivalent)		1	mg/L
Total Alkalinity (as CaCO3 equivalent)		1	mg/L
Nitrite (NO_2^-)	NT-8A	0.01	mg/L
Nitrate (NO_3^-)		0.01	mg/L
Fluoride (F^-)	NT-2A	0.1	mg/L
Sodium (Na^+)	NT-1B	1	mg/L
Magnesium (Mg^{2+})		1	mg/L
Potassium (K^+)		1	mg/L
Calcium (Ca^{2+})		1	mg/L
Arsenic	W-3, W-3T, EG020F, EG020T	0.001	mg/L
Barium		0.001	mg/L
Boron		0.001	mg/L
Cadmium		0.0001	mg/L
Chromium		0.001	mg/L
Lithium		0.001	mg/L
Copper		0.001	mg/L
Iron		0.05	mg/L
Lead		0.001	mg/L
Manganese		0.001	mg/L
Mercury		0.0001	mg/L
Selenium		0.001	mg/L
Silica		0.1	mg/L
Silver		0.001	mg/L
Strontium		0.001	mg/L
Zinc		0.001	mg/L

7.6 Spill Management Plan

The Code of Practice for Petroleum Activities in the Northern Territory sets out that an EMP for a petroleum activity must include a Spill Management Plan (SMP). The SMP for the proposed activities is provided in Attachment 3.

7.6.1 Potential Spills Materials

A list of potential liquids that can be spilt as part of the proposed activities are described below. All spills will be managed in accordance to the Spill Management Plan. All mitigation measures will be in placed in accordance to Table 27.

7.6.1.1 Grey water and Sewage

The liquid component from the sewage system, which is composed of camp wastewater (laundry, showers and kitchen) is proposed to be disposed onto an irrigation area after sewage has been treated through a sewage treatment system. All solid waste will be transported to an approved disposal facility.

7.6.1.2 Hydraulic Fluids and Fuel and Other Oils

Hydraulic fluid and fuel drums are stored on portable bunds sufficient capacity to hold 100% of the volume of the largest container stored in the area plus 10% or within tankers equipped with safety features such as double-skin. Spill kits available on all spill potential areas as well as drip trays for refuelling operations.

8 Implementation Strategy

8.1 Environmental Outcomes, Performance Standards and Measurement Criteria

This EMP has been developed to specifically protect and ensure the integrity of the existing and surrounding environment from risks associated with the drilling activities at proposed well site EP187. This can be achieved through the establishment and implementation of:

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

The following section provides the management controls that Imperial will implement during its activities to protect environmental values associated with:

- Asset Integrity
- Chemicals and Hazardous Materials
- Waste Management
- Erosion and Sediment Controls
- Decommissioning and Rehabilitation Management
- Biosecurity Management
- Biodiversity Management
- Bushfire Prevention
- Air Quality Protection Measures
- Traffic and Transport Management
- Community Impact Minimisation
- Cultural Heritage and Sacred Sites Preservation

The tables below outline the environmental values, the environmental outcomes, the performance standards and Imperial's management controls and measurement criteria to reduce risks as identified in Section 6. Risk from each environmental value associated to the EP187 area will be managed to ALARP in order to meet Imperial's management objectives and successfully deliver the detailed environmental outcomes as detailed in each of the following tables.

Table 35. Environmental Values and Objectives – Asset Integrity

Environmental Values	Protection of the ecosystem and human health values from uncontrolled discharges associate with asset integrity failures	
Environmental Outcome	Minimise impacts to ecosystem and human health values	
Activity	**Performance Standard (Performance measure)**	**Management Controls**

Drilling activities	• No asset integrity failures
	• No uncontrolled releases
		Asset Integrity - Subsurface
		• Operate within constraints of valid extraction license,
		• Extraction volumes to be provided to DPIR and DENR.
		• Wells to be constructed and tested as per industry code of practice
		• Surrounding groundwater bores within 2.5km will be monitored for drawdown or gas migration.
		• Asset protection (e.g. Fencing, bollards and traffic controls)
		• Emergency Response Plan in place and all staff trained and inducted in their use
		• Integrity testing as part of the drilling program"
		
		Asset integrity – surface facilities
		• Chemicals and hazardous goods stored in accordance with Dangerous Goods requirements, WHS legislation and appropriate standards for the type of chemicals.
		• Emergency Response Plan in place and all staff trained and inducted in their use
		• Bypass structures installed to minimise obstruction to flow wherever feasible
		• Utilise rig mats for creek crossing
		• Buffer distances from riparian vegetation, waterways and drainage lines to be applied in accordance to "Recommended Widths for Riparian Buffers of the LCG (2019)
		  ○ 1st order streams and Drainage lines = 25m buffer from outer edge of drainage depression or riparian vegetation
		  ○ 2nd order streams = 50m buffer
		  ○ 3rd order creeks = 100m buffer
		  ○ There are no 4th order or higher creeks or rivers in the project area.
		• Management of change procedure for control of drilling activities change
		• Operate within safe operating envelope as protected by designed safety equipment and instrumentation
		• Asset protection (e.g. Fencing, bollards and traffic controls)
		• Appropriate storage for onsite water (lined ponds or tanks)
		• Regular inspections of equipment, sumps and ponds to confirm integrity

Measurement Criteria (Monitoring and records)	• Management of change records • Asset installation records • Records of inspections, monitoring testing and maintenance • Training and induction records • Emergency response plans	

Table 36. Environmental Values and Objectives – Chemicals and Hazardous Materials

Environmental Values	Protection of the ecosystem and human health values from uncontrolled releases of chemicals and hazardous materials	
Environmental Outcome	Minimise impacts to ecosystem and human health values	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Civil works • Drilling activities • Storage of chemical/hazard material • Transport of chemical/hazard material	• No uncontrolled releases of chemicals and hazardous materials • No incorrect storage and use of chemicals and hazardous materials	• Spill kits available on site • Trained personnel in the Spill Response Plan, • Drip trays or portable bunds to be used during refuelling, • Fuel tanks on site, where possible, to be self-bunded (double lined) and inspected weekly or daily during the wet season. • Register of hazardous chemicals to be maintained onsite, • Light vehicles and smaller trucks to be fuelled up off site as a preference (Cape Crawford is the closest fuel supply) • All hazardous materials stored in appropriately bunded areas, off the ground or designated fit for purpose storage areas. • Chemicals and hazardous goods stored in accordance with Dangerous Goods requirements, WHS legislation and appropriate standards for the type of chemicals. • Emergency response plan is in place for responding to contaminant releases • Spill areas will be Identified and remediated in accordance with the National Environment Protection Measure (NEPM) requirements • Release of chemical/hazardous materials will be reported to the DPIR as required • All chemicals used for drilling are biodegradable where possible. • During the wet season, transport of chemicals on unsealed roads won't be undertaken unless the risk of spills is demonstrated to be ALARP and acceptable.
Measurement Criteria (Monitoring and records)	• Hazardous materials register to be maintained • Records of inspections, testing and maintenance to be maintained • Training and induction records to be maintained • Records of releases, leaks and associated clean ups are to be managed using Imperial's incident reporting system	

Table 37. Environmental Values and Objectives – Waste Management

Environmental Values	• Maintain the integrity of ecosystems and agricultural productivity • Minimise the amount of waste generated	
Environmental Outcome	• Minimise impacts on soil, surface water, groundwater, sensitive habitat and air quality • Minimise creation of food sources or habitat for pest species • Minimise waste generation through reduce, reuse, recycle programs	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Civil works • Drilling activities • Oily water disposal • Camp and offices operations • Domestic waste production	The performance standard of waste management practices can be assessed against the performance criteria for: • Absence of domestic waste remaining onsite at completion of activities (i.e. general rubbish, waste chemicals, workshop wastes including oily rags, containers etc.). • No unregulated waste handling. • Pest species not encouraged to the site. • All waste certificates to be noted and accounted for	• Code of Practice: Onshore Petroleum Activities (the Code) will be implemented. The Code includes requirements for wastewater management. • All sumps to have a minimum of 0.5m bund around the edge to avoid water run-off. • Spill management plan implemented • All sumps to be fenced and lined up • Licenced waste contractor will be used for offsite transfer and disposal. • Records of transport and disposal to be kept • Sewage treated and solids disposed of off-site by licensed contractor. • No incineration of waste • Relevant staff trained and inducted into the storage, handling and recycling of hazardous wastes • Segregation of oily waste including set oil, oil filters and rags in accordance to the Schedule 2 of the Waste Management and Pollution Control (Administration) Regulation 1998 and disposed of offsite in an approved disposal facility. • Storage of waste generated from work program activities in designated locations and/or receptacles that provide suitable separation and minimise interaction with wildlife, stock and public. • Bunding for storage of regulated wastes material contained in drums with capacity of at least 25% of the total volume of stored material • Assess all spills and/or leaks for appropriate remediation action in conformance to NEPM 2013 guidelines. • Reuse waste material where possible • No waste or hazardous material stored with potential for overflow impact on water courses • No waste to be stored within the buffer zone of watercourse according to LCG. • Listed waste generated from a regulated activity, as prescribed in Schedule 2 of the Waste Management and Pollution Control (Administration) Regulations 1998, will be disposed of at a licence facility and in accordance with the Waste Management Plan. • All hazardous waste material separated in the appropriate area for disposal according to their SDS and the hazardous goods register • For waste transported across state or territory borders, the National Environment Protection Measure (NEPM) 2013 Guidelines for Waste Transport will be adhered to

		• Regular inspection of waste containers to ensure no leaks or overflow. • All drill cuttings to be contained in the lined mud sump during operations. Testing of soil before rehabilitation and drilling cuttings once fluids have evaporated from the mud sump will determine if suitable for burial on site or if disposal off site is required. (Determine salinity and heavy metals are below NEPM 2013 trigger guidelines concentrations to be buried on site without impacting surface water run-off in the area) • During the wet season, transport of wastewater on unsealed roads won't be undertaken unless the risk of spills is demonstrated to be ALARP and acceptable
Measurement Criteria (Monitoring and records)	• Waste registers to be maintained • Waste disposal records to be maintained (all waste certificates to be noted and accounted for) • Records of waste storage site inspections to be maintained • Incidents of uncontrolled waste releases will be reported in Imperial's incident reporting system and corrective action initiated. Reportable incident records and regulatory notifications will be maintained. • Regulatory reporting under the NPI	

Table 38. Environmental Values and Objectives – Erosion and Sediment Control

Environmental Values	• Suitability and stability of land for existing uses (Erosion and Sediment Controls implemented) • Stability of land to preserve existing water quality, landscapes and ecosystems	
Environmental Outcome	• Minimise disturbance to land and land use (including soils and terrain, flora and fauna) • Minimise erosion (via water or wind) and sediment releases • Protection of waterways • Return disturbed areas to a stable landform such that they are returned to a condition as close as practicable to the surrounding area (or pre-disturbance state) within an acceptable time frame. • Protect the productivity of the land for its intended land use	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Civil works • Drilling activities • Rehabilitation activities	• Land disturbance equal to or less than planned • Minimum incidences of erosion and sedimentation occurring • Areas left safe, stable and non-polluting	• Well pads site scouted to ensure that they are not in low lying areas subject to inundation, close to watercourses or on areas of significant slope. • No driving off unformed tracks, • Active inspection and monitoring of the effectiveness of erosion and sediment control measures adopted across the site and maintained as required • Manage pooling water • Preference to use previously disturbed areas

	• Commence to rehabilitate disturbed areas within 12 months of decommission • No new erosion flow paths originated from site • No flow on effects caused by flooding at Imperial's drilling sites	• Considering seasonal influences, such as rainfall before conducting activities • Disturbed areas will be re-contoured • Activities to be conducted during dry season • All roads and tracks required will be developed along the contour where possible. • Fence off any soft areas around the edge of water storage areas • Reduce vegetation clearance to approved areas. • No unauthorised clearing • Restrict third party access, • Erosion and sedimentation control devices installed where necessary as per IECA and DENR guidelines. Controls can include but not limited to: ○ diversion banks ○ whoa boy's ○ no windrows or concentration points ○ drainage channels ○ regular inspections ○ berms to avoid sediment run off • Diversion banks and roll over banks developed across the contour to disperse run-off away from the tracks as required • Utilise Rig mats for watercourse crossings to avoid earthworks and allow unimpeded fauna passage • Retain riparian vegetation as per LCG approval, rehabilitate as per plan. • After significant rainfall inspect areas to confirm: ○ No erosion ○ No sedimentation ○ No blocking of drainage lines and • Restore disturbed areas. Landform consistent with surrounding environment, no blocking of drainage channels or water courses
Measurement Criteria (Monitoring and records)	• The extent of disturbances will be measured and uploaded to a Geographic Information System (GIS). • Monitoring for soil erosion and related issues is best undertaken at critical stages, such as: ○ 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. ○ After more than 20 mm of rainfall if access if feasible • Where rehabilitation of a site is undertaken, rehabilitation will be monitored until the site is reinstated	

Table 39. Environmental Values and Objectives – Decommissioning and Rehabilitation Management

Environmental Values	• Maintain the integrity of significant ecosystems and agriculture productivity • Maintain habitat elements for native flora and fauna, including species protected by EPBC Act and TPWC Act	
Environmental Outcome	• A safe, stable landform consistent with surrounding land use • Rehabilitation of disturbed areas is returned to the original land use and is consistent with the adjacent analogue site	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Decommissioning and rehabilitation activities	• Successful rehabilitation to a similar condition of surrounding environment • No further habitat loss resulting from Imperial's activities • Decommissioning of redundant assets	• Collect and remediate contaminated runoff and contaminated soil if spills occur, and transport to a suitable facility for disposal • Scrapes will be filled and compacted to prevent future formation of depressions or rendered shallow and self-draining • No new weeds or non-native plants introduced, and appropriate weed management implemented as per "Biosecurity Management"" under this EMP and approved Weed Management Plan. • All infrastructure removed and cleared areas rehabilitated unless another agreement is reached with the landholder/traditional owner. • Appropriate management and control of waste materials on and off-site • Rehabilitation to be implemented 12 months post decommissioning of the infrastructure or as agreed with the relevant government departments. • Perform post rehabilitation monitoring to verify rehabilitation success and/or presence of weed species and assessment of cover and species regenerating • Photographic point monitoring established before disturbance and continued after to identify any areas requiring further rehabilitation work • Return all disturbed landforms to as close as possible the natural terrain • All compacted hardstands and laydown areas deep ripped to encourage infiltration and water retention • Topsoil to be retained for reused during rehabilitation process • Location of topsoil (30cm of soil profile) mounds clearly marked and stored around the edges of the lease area in low profiles mounds under 1.5-2m high to protect the biological activity of the topsoil and reinstatement as soon as required • Vegetation survey conducted before disturbance to provide baseline reference to determine post revegetation success. • When rehab is to occur topsoil will be spread. If germination does not occur after appropriate rainfall over several years re-seeding will be conducted. • Lightly scarify all rehabilitated surface to encourage moisture retention and seed capture" • Refer to "Waste Management" • All rehabilitation to be conducted in accordance with the Code. • Refer to "Chemical/hazardous materials storage and waste management for the mitigation of contamination of soil
Measurement Criteria (Monitoring and records)	• Records of rehabilitation monitoring • Inventory of decommissioned infrastructure • All incidents will be reported in Imperial's incident reporting system and corrective action initiated	

Table 40. Environmental Values and Objectives – Biosecurity Management

Environmental Values	• Maintain the integrity of significant ecosystems and agriculture productivity	
Environmental Outcome	• Avoid the introduction of weeds and pest fauna • Avoid the spread of existing weeds and pest fauna	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Vehicle movements • Civil works • Drilling activities • Office and camp operations • Transport of fill materials • Water and food sources available	• No introduction or spread of declared weeds and/or pest fauna resulting from Imperial's activities	***Fauna*** • All food stored inside or in sealed containers • Personnel are prohibited from bringing domestic pets onto the exploration field area • No feeding of fauna • All standing water fenced removed if no longer required • Fauna survey to be completed prior to commencement of construction • All personnel inducted in the identification of potential threatened fauna species in the area and their obligations and responsibilities for any fauna encounters. • Native fauna is mobile. Machinery noise might help disperse vagile fauna. • Fauna ladders to be installed at all open pits • Pits and dams to be fenced • Daily checks of pits and dams throughout the drilling program • Install and maintain adequate warning signs, fences and rock bunds to exclude livestock and native animals from sensitive areas • Refer to "Waste Management" for waste storage ***Flora*** • Minimise clearing of new access tracks to sticks, logs and larger rocks necessary to ensure good safe access wherever possible. • Photographic monitoring before and after any disturbance • No driving off unformed tracks. • Activities will adhere to the guidelines within the NT Weed Management Handbook and "Preventing weed spread is everybody's business" (https://denr.nt.gov.au/__data/assets/pdf_file/0011/257987/preventing-weed-spread.pdf) • Weed desktop and field-based surveys undertaken to identify existing weed areas • Vehicle and machinery to undergo weed cleaning and compliance checks before mobilised to site • Vehicles and/or equipment coming from a weed invested area is required to be weed free and needs to provide a weed free certificate before entry • Major equipment moves will be planned from weed-free areas to infested areas and not the other way around • Vegetation survey conducted before and after any clearing operations to determine if new noxious species present • Baseline training for staff members responsible for preventing, identifying and managing weeds undertaken • New activities will be planned to address prevention of weed or non-indigenous plant spread • Dedicated weed officer to inspect leases and tracks on a regular basis

Measurement Criteria (Monitoring and records)	• Records of weed distribution will be maintained within Imperial's GIS and if required provided to the Weeds Officer at DENR & DPIR • Records of weed inspections will be maintained • All weed outbreak and pest fauna incidents will be reported in Imperial's incident reporting system and corrective action initiated • It is noted that under the Weeds Management Act that: *"The owner and occupier of land must… within 14 after becoming aware of a declared weed that has not previously been, or known to have been, present on the land, notify and officer of the presence of the declared weed"*

Table 41. Environmental Values and Objectives – Biodiversity Management

Environmental Values	• Maintain the integrity of significant ecosystems and agriculture productivity • Maintain habitat elements for native flora and fauna, including species protected by EPBC Act and TPWC Act • Avoid clearing high value habitat	
Environmental Outcome	• Minimise disturbance to flora and fauna • Minimise disturbance to sensitive areas	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Clearing of vegetation and potential habitat • Civil maintenance of roads, drains, hardstands, erosion and sediment controls • Civil works including earthworks required for rehabilitation	• Monitoring EP187 area to minimise impacts to fauna habitat and sensitive vegetation. • No native fauna impacts (injury or fatality). • No loss of sensitive vegetation resulting from Imperial's activities	• Induction of staff to biodiversity management and characteristics. • Adhere to permit to work system, which ensures that all activities stay within the approved drilling activities area • Ecological assessment undertaken to identify environmentally sensitive areas (flora and fauna habitat) prior to disturbance • Vehicle and machinery to undergo weed cleaning and compliance checks before mobilised to site" • Civil works avoid clearance of mature vegetation • No unauthorised clearing. • Buffer distances from riparian vegetation, waterways and drainage lines to be applied in accordance to "Recommended Widths for Riparian Buffers of the LCG (2019) ○ 1st order streams and Drainage lines = 25m buffer from outer edge of drainage depression or riparian vegetation ○ 2nd order streams = 50m buffer ○ 3rd order creeks = 100m buffer ○ There are no 4th order or higher creeks or rivers in the project area. • Larger trees (including Corymbia and Eucalypt species) with a trunk diameter greater than 25cm at 1.3m above the ground are avoided whenever practical during clearing for seismic lines, to minimise disturbance to potential nesting trees for the Crested Shrike-tit and Gouldian Finch. • Refer to "traffic and transport management" for driving control measures • Refer to "Erosion Sediment Controls" for flooding and run-off control measure Track fauna strike/near miss in the fauna control register to enable knowledge sharing across personnel and contractors

Measurement Criteria (Monitoring and records)	• Records of disturbance will be maintained. • Records of inspections will be maintained. • All incidents will be reported in Imperial's incident reporting system and corrective action initiated

Table 42. Environmental Values and Objectives – Bushfire prevention

Environmental Values	• Maintain a natural fire regime of the region • Protection of public, private infrastructure and equipment	
Environmental Outcome	• Minimise the risk of causing bushfires from Imperial's activities • Minimise impacts on environmental habitat and fauna, soil erosion, impacts on stakeholders, impacts on culturally significant sites, public infrastructure and community lands • Prevent accidental fire risk and ensure safe storage of chemicals	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Civil works • Drilling activities • Flaring • Vehicle and equipment movement • Smoking	• Successful fire management will be indicated by having no uncontrolled fires occurring as a result of Imperial's drilling activities	• No open flames or fires outside of designated areas • Fire extinguishers fitted to all vehicles • Appropriate firefighting equipment available and serviced • Ensure vegetation stockpiles are stored away from ignition sources and in low profile mounds • No burning of waste • Availability of water to assist in fire control • Staff induction to include emergency response procedures and communications with neighbours maintained • Designated smoking areas with appropriate waste receptacles • Restricted flare access • Firebreaks clearly demarked (¬4m width) and available around all buildings and infrastructure • Monitor weather and fire danger to plan operations accordingly Flaring restricted where possible to low wind conditions and low fire danger periods
Measurement Criteria (Monitoring and records)	• All incidents of fire to be recorded in Imperial's incident reporting system and corrective action initiated.	

Table 43. Environmental Values and Objectives – Air Quality Protection Measures

Environmental Values	• Rural air environment with qualities conducive to suitability for the life, health and wellbeing of humans and ecosystems	
Environmental Outcome	• Minimise environmental nuisance due to dust for sensitive receptors resulting from Imperial's activities • Minimise greenhouse gas emissions	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Drilling activities • Wear and tear of gas/equipment fittings • Vehicle movements on unsealed roads • Civil works	• No complaints regarding dust/air quality • Amicable resolution of complaints.	• Implement Work Program staging and minimize total area of disturbance at any one time. Preference to use previously disturbed areas • Reduce speed on unsealed roads in the project area to 60km/hr • Crew mobilisation by dual cab vehicles, avoid extra vehicle movement when possible • Minimise haul / travel distances where practicable • Monitoring of all flaring events and record for greenhouse gas calculations and reported through the National Greenhouse Energy Reporting system. • Flaring only used during testing, in case of an emergency and into designated flare pit. • No burning on site • Vehicles and equipment will be switched off when not in use • Utilise meteorological information and weather forecast to confirm suitability of conditions for the proposed work program activities and assess fire danger. • Watering of roads when appropriate and as required • Dust control for civil works where appropriate • Monitor road conditions to ensure deterioration with possible increase in dust creation does not occur and undertake road rehabilitation as required • Vehicles and equipment maintained and regularly service • Refer to ""Asset Integrity Surface facilities"" control" • Refer to "Traffic and Transport Management"
Measurement Criteria (Monitoring and records)	• Annual NGERS and NPI reporting will be completed • Records of routine inspections for leaks will be maintained • All complaints and subsequent actions are to be recorded in Imperial's incident reporting system and corrective action initiated.	

Table 44. Environmental Values and Objectives – Traffic and Transport Management

Environmental Values	• Rural air environment with qualities conducive to suitability for the life, health and wellbeing of humans and ecosystems	
Environmental Outcome	• Minimise environmental nuisance due to dust for sensitive receptors resulting from Imperial's activities • Minimise greenhouse gas emissions	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Civil maintenance • Drilling activities • Increased traffic during activities • Movement of heavy machinery on public roads	• An absence of issues raised by the community as indicator for successful communication • No unresolved complaints • The community is highly consulted with and all comments provided are assessed and those viable implemented • High level of satisfaction by the community • No vehicular accidents.	• Consult with surrounding stakeholders when major activities will occur • An agreement will be reached with affected stakeholders to ensure that management strategies are agreed and adhered to on vehicle traffic • Active stakeholder engagement and complaints management which includes consultation with surrounding stakeholders when operations likely impact on lighting, noise, vibration and visual amenity values • All personnel and site visitors complete the appropriate inductions (including driving to weather and road conditions) • Engines/machinery maintained as per manufactures specifications. • Install buffer zones and distances into onsite tablets so machine operators have visual and audible alert when reaching buffer distances. Buffer distances will adhere to the LCG permit. • Drive only on designated access roads or tracks • Driving will be avoided where practical following significant rainfall • Adherence to speed limits 60km/hr in unsealed roads except in the event of an emergency • No unauthorised third-party access. • No driving under the influence of alcohol or drugs • All over-dimension loads will be moved in accordance with the traffic management plan (TMP) and Department of Transport applicable permits and escorts • Ensure vehicles are inspected regularly and have working lights and/or spotlights. • Drive fatigue management policy will be implemented as per Journey Management Plan rest stops • Limited driving at dawn and dusk • One designated spotter appointed per truck • Ensure Journey Management Plan is in place and all personnel adhered to it. • Do not disadvantage other uses of existing public roads and tracks • Only necessary vehicles will be utilized • Rig contractor to provide current and valid licence from drivers • All vehicles to drive with lights on at all times • All traffic and transport issues identified to be discussed at pre-spud meetings • Refer to "Chemical and Hazardous materials Management" for transport

Measurement Criteria (Monitoring and records)	• Register kept of all incidences relating to access issues, unauthorised access and requirements of pastoralists, recognising that these requirements may change seasonally • Track fauna strike/ near miss in the fauna control register to enable knowledge sharing across Imperial personnel • Complaints register • Record of stakeholder engagement • Record of environment compliance • All traffic and transport incidents related to any contamination to the environment, erosion or loss of fauna to be recorded in Imperial's incident reporting system • Corrective actions to be closed out and recorded.

Table 45. Environmental Values and Objectives – Community Impact Minimisation

Environmental Values	• Livelihood and well-being of local communities and towns	
Environmental Outcome	• Minimise impacts upon environmental values of the local community • Minimise impacts on cultural heritage • Minimise safety risks to the public and other third parties • Maintain and enhance partnerships with the local community, including using local contractors • No loss to the aesthetic or enjoyment factor for the community	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Civil works • Drilling activities • Workover projects • Office and camp operations • Release of waste • Noise generated during drilling activities, • Artificial lighting required for safety during 24-hour activities	• An absence of issues raised by the community as indicator for successful communication • No unresolved complaints • The community is highly consulted with and all comments provided are assessed and those viable implemented • High level of satisfaction by the community • No vehicular accidents • No off-site release of contamination from road corridors.	• Retain Services of Traditional Aboriginal Owners (TAO) to monitor activities and advise on culturally sensitive areas • Comply with Native Title Agreement provisions and all other legal obligations • All activities to stay within the approved exploration licence • Where possible, local and/or indigenous people employed • Stakeholders to be notified of all planned activities well in advance • No operations to occur within 200m of a known Culturally Sensitive or Sacred area without prior approval from the relevant Local Aboriginal Group and other relevant stakeholders • Retention of Traditional Aboriginal Owners to monitor and advise on Culturally sensitive locations • Site specific fire management plan will be implemented for the proposed activity. See Appendix 10 for details • A community contact number will be provided in communications correspondence • Implement Imperial Oil & Gas HSEMS and develop safe work procedures for all work program activities • Noise suppression devices to be fitted where applicable, • Minimal lighting used for safe operations of the facilities • Minimise the extent to which the operations would be visible by the community or public by utilizing natural topography and vegetation and distance screening or blocking potential views of the operations • Utilize natural barriers wherever possible. Locate sites preferably behind visual barrier such as tree line or hill.

		• Install and maintain adequate warning signs and fences to exclude people from sensitive areas. • All work crews will contain at least one qualified senior first aid provider • Communication programs will be implemented with McArthur River Mine Emergency response personnel and local emergency services in accordance with the Emergency Response Plan Attachment 1 and Safety Management Plan Attachment 6. • All boundary lighting will be positioned to face inwards to provide adequate lighting for safe operations, reduce light leakage from site • Appropriate personal protective equipment used for safe operations • A full stakeholder communication log will be maintained. • Refer to "Bushfire prevention" control • Refer to "Waste Management" control for spills, waste storage and transport. • Refer to "Rehabilitation management" control • Refer to "Erosion and Sediment Controls" control for disturbance • Refer to the "Biodiversity Management" control for weed impacts • Refer to "Air Quality Protection Measures" for vehicle servicing **Visual** • Refer to "Waste Management" for spills, waste storage and transport. • Refer to "Chemical and Hazardous Materials Management" for spills, handling and transport • Refer to "Decommissioning and Rehabilitation Management" • Refer to "Erosion and Sediment Controls" for disturbance • Refer to Biosecurity Management" for weed and pest fauna management **Noise** • Refer to "Air Quality" for vehicle servicing **Lighting** • Minimal lighting used for safe operation of the plant and facilities
Measurement Criteria (Monitoring and records)	• Register kept of all incidences relating to access issues, unauthorised access and requirements of pastoralists, recognising that these requirements may change seasonally • Complaints register • Record of stakeholder engagement • Record of environment compliance • All traffic and transport incidents related to any contamination to the environment, erosion or loss of fauna to be recorded in Imperial's incident reporting system. • Corrective actions to be closed out and recorded.	

Table 46. Environmental Values and Objectives – Cultural Heritage and Sacred Site Preservation

Environmental Values	• Maintain cultural heritage values of the region, both Indigenous and non-Indigenous	
Environmental Outcome	• Avoid disturbance of or damage to Aboriginal or cultural heritage artefacts or Sacred Sites • Minimise impacts upon or disruption to activities of Indigenous stakeholders in culturally significant areas • Ensure adequate background information and training is provided to employees and contractors working in culturally significant areas • Ensure that the health and safety of exploration workers and the community is not compromised through management of cultural and environmental awareness	
Activity	**Performance Standard (Performance measure)**	**Management Controls**
• Civil works • Drilling activities • Vehicle and equipment movement	• No incidences of disturbance of archaeological sites or sites of cultural significance.	• Cultural Heritage Clearance (and identification of artefacts of Aboriginal significance in conjunction with the NLC and TOs) will be conducted prior to commencement of disturbance activities, • Activities will be conducted in accordance with the NLC agreement and AAPA certificate. • 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. • Ensure 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. • Adhere to permit to work system, which ensures that all activities stay within the approved operating areas • No off road driving • First disturbance monitoring by TOs • Exclusion zones established and fenced off to not be damaged • 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 TOs and NLC. • All personnel to be inducted to highlight any areas of cultural significance and no-go zones. • Refer to ""Bushfire prevention"" • No unauthorised clearing • Upon identification of a potential culturally significant object, work will cease until the supervisor has investigated and called the relevant advisor
Measurement Criteria (Monitoring and records)	• A register is kept of all occurrences of archaeological sites identified for provision to the NLC, the AAPA and Heritage Branch within DLPE • Ensure that site personnel and contractors report all new discoveries of archaeological or cultural artefacts. Cease work and effect practical protection measures until the area can be assessed by appropriate personnel. • No incidences of disturbance of archaeological sites or sites of cultural significance, or if disturbance is required, an application to disturb is submitted and approved prior to disturbance.	

8.2 Imperial EHS Management System

Environmental aspects of the program will be managed using the Health, Safety and Environment Management Program (HSEMP) to strive to achieve industry best practice environmental management. This includes ensuring that all environmental obligations associated with the Project, and any general environmental management measures outlined in the EMP are met or exceeded in relation to the setting, and achievement, of performance targets for the Project.

The environmental management framework to be implemented during the program will mirror the corporate environment procedures and will incorporate the environmental management commitments outlined in this Environment Management Plan.

The program involves the participation of both Imperial and any contractor(s) associated with the Project. The framework is the driver for environmental management throughout the drilling phase of the Project. Each contractor is contractually obliged to undertake all activities in accordance with Imperial's HSEMP and will implement specific environment management plans for Project activities such as sediment and erosion control, oil spill contingency plans, ground and surface water management, waste management, and weed and pest control.

8.3 Roles and Responsibilities

All personnel are responsible for familiarising themselves with and understanding their Environmental obligations and responsibilities in accordance with the OHSMS. It is expected that all Imperial Oil & Gas personnel and contractors comply with relevant environmental and OHS legislation, standards, policies, procedures. In addition, it is expected that they will accept responsibility for protecting themselves and others from injury and/or illness.

The implementation of this EMP is the responsibility of the nominated Site Manager. All Imperial Oil & Gas employees have position descriptions describing the environmental and OHS requirements of the position they hold. Environmental performance objectives are established for all positions and are measured annually

During the work program, the overall management of the activities shall be under the supervision of the company CEO or nominated delegate, with day to day control of the project under the Project Manager (PM). The Site Coordinator (SC) will liaise with the CEO and PM to ensure that all environmental issues are being correctly managed.

The PM and SC will ensure that all staff have been trained in environmental awareness and the details of this Environmental Management Plan.

The Management Structure detailed below provides a chain of authority for the implementation of this Environmental Management (EM) Plan and a clear set of responsibilities for each person. The Table 47 below highlights the roles and responsibilities as nominated:

Table 47. Roles and Responsibilities

Role	Responsibilities
Manager Exploration (ME)	Responsible for overall supervision of the project staff Reports to the Chief Executive Officer Ensures audits are undertaken on the implementation of this EM Plan Ensures all project staff are trained in environmental awareness, site issues and the actions contained in this EM Plan Approves the training programme.
Project Manager (PM)	Reports to the ME Maintains a master copy of this EM Plan containing a record of the completed actions, monitoring, and reports supplied by the contractors and site supervisors Responsible for the day to day management of the overall Project Ensures that the Project needs are satisfied in accordance with the approved implementation plan
Site Coordinator (SC)	Coordinates staff when necessary to implement and monitor the actions contained in this EM Plan Reviews monthly Contractor(s) environmental report Ensures any non-conformances are followed up and corrected Undertakes liaison with relevant government bodies and other authorities or interested parties Ensures monitoring specified in this EM Plan is undertaken Ensures all reports and monitoring records are kept onsite and can be located easily Conducts regular site inspections and audits Provides environmental advice to the project team during construction Monitors complaints and reports the status of complaints to ME and PM Ensures corrective action has occurred within a reasonable timeframe Maintains a register of inducted personnel
Site Personnel	All exploration staff must attend induction training and have an understanding of the detail of this Environmental Management Plan Implementation of actions in accordance with this Environmental Management Plan or as directed by the ME or SC Each contractor and subcontractor will provide a person (environmental representative) who will be responsible for environmental management, environmental performance and compliance Each environmental representative report to the staff of the corresponding subcontractor Each environmental representative shall submit an environmental compliance report to the PM on activities monthly

8.4 Training and Competencies

Imperial will ensure that all staff and contractors are inducted and trained in their environmental responsibilities before they undertake any activity related to the Exploration programme.

Induction programs will include, but are not limited to, cultural and environmental obligations and responsibilities set out in:

- relevant legislation and government guidelines;
- any relevant recommendations made by National or Territorial Government representatives;
- the requirements of the EMP;
- relevant industry codes of practice;
- any agreements, licences, permits, consents or approvals associated with the Programme; and
- non-regulatory guidelines, where relevant.

Training programs will include, and are not limited to:

- appropriate environmental management skills and techniques training related to specific tasks undertaken during the Program, with a focus on minimising environmental effects associated with these tasks
- general environmental awareness training relating to specific environmental issues associated with the Program such as matters relating to environmental and cultural significance
- assessments of understanding of participants of trainings and inductions.

Additionally, Imperial mandate that all staff and contractors have a level of environmental competency to enable appropriate management of environmental issues associated with the Exploration programme. Project. Training competencies will be recorded in the site training register.

8.5 Emergency response Plan

Imperials Emergency Response Plan (ERP) is available in Attachment 1 and Safety Management Plan Attachment 6.

All site personnel will be inducted with the ERP to ensure they are familiar to all type of emergencies to which their work applies, and a rapid and effective response can be implemented.

8.6 Notice of Commencement

Imperial will notify the Minister and the landowner of the proposed date of commencement of construction and drilling activities through the submission of a letter. This information will be recorded in the communication log

8.7 Management of Change

Imperial has developed and implemented specific OHS Incident, Injury, Hazard reporting and investigation procedures that apply to all company and contractor personnel. These policies and procedures apply to all work-related incidents and hazard including:

- incidents, near misses or hazards injuries or illnesses
- environmental damage
- property loss or damage
- theft.

The HSEMP establishes the processes required to ensure that when changes are required to be made to a project, control system, procedure or an organisational structure or to personnel, the associated risks and other impacts of such change are identified and managed. Any change required to an environmental system, procedure, protocol or contractor must obtain approval prior to undertaking any change activity.

Environmentally relevant changes include:

a) new activities, assets, equipment, processes or procedures proposed to be undertaken or implemented that have potential to impact on the environment and have not been:
   - assessed for environmental impact previously, in accordance with the requirements of the standard; and
   - authorised in the existing management plans, procedures, work instructions, or maintenance plans.

b) proposed changes to activities, assets, equipment, processes or procedures that have potential to impact the environment or interface with an environmental receptor.

c) changes to requirements of an existing external approval (e.g. changes to conditions of environmental licence).

d) new information or changes of information from research, stakeholders, legal and other requirements, and any other sources used to inform the EMP.

Where an environmentally relevant change is identified, the method of change is assessed and if required appropriate technical and/or legal advice is sought. The change assessment is made against the in-force EMP and is undertaken to ensure that impacts and risks from the change can be managed to ALARP and acceptable levels, this may require a revised EMP or part in accordance with the Petroleum (Environment) Regulations 2016.

8.8 Incident Reporting

Incidents that impact on the environment or have the potential to impact on the environment (e.g. near misses) are to be reported to the OHS Manager and Environmental Manager (or delegate(s)) who shall be familiar with all country and state specific OHS and environmental regulatory reporting requirements for incidents at imperial locations. Department managers shall be made aware of the legislative requirements and ensure compliance in addition to the minimum requirements established in this EMP. Table 48 details the external incident notification, reporting requirements and timeframes for environmental incidents associated with the activity.

The Incident Control Process as shown below in Figure 26 outlines the steps to ensure timely and effective management of incidents to reduce the impact of environmental damage.

When an incident has occurred, initial response actions to make personnel and the area safe must only be carried out if an individual feel comfortable and safe doing so.

If an event occurs which **does not** involve harm or loss, it is defined as a Near Miss. This is defined as a work-related incident where there has been a release of energy which, in slightly different circumstances could have injured or caused ill health to a person, damaged plant, equipment, company reputation or the environment. In the case of a Near Miss, energy has been dissipated elsewhere into the environment resulting in no loss or harm.

Table 48 below details the external incident notification, reporting requirements and timeframes for environmental incidents associated with the activity.

Table 48. External Incident notification

Requirements	How and by when
Petroleum (Environment) Regulations 2016	
Recordable Incident Reporting: *A recordable incident is a breach of an Environmental Objective or Environmental Performance Standard in the Environment Management Plan that applies to the activity; and is not a reportable incident.*	
The recordable incident report must contain: (i) a record of all recordable incidents that occurred during the reporting period; and (ii) all material facts and circumstances concerning the recordable incidents that the operator knows or is able, by reasonable search or enquiry, to find out; and (iii) any action taken to avoid or mitigate any adverse environment impacts of the recordable incidents; and (iv) the corrective action that has been taken, or is proposed to be taken, to prevent similar recordable incidents	Submit written report to DPIR (the Environmental Performance Report) (petroleum.operations@nt.gov.au) within 15 days after the end of the reporting period.
The initial verbal report will include as much preliminary information as is available about the incident (e.g. interest holder, location, type of incident, affected stakeholders, initial assessment of environmental harm and initial response).	The initial verbal report will be made as soon as practicable but no later than 2 hours after the incident first occurred or when Imperial became aware of the reportable incident to the DPIR Operations Team Emergency Number (**1300 935 250**) or in writing.
Requirements	How and by when
Reportable Incident Reporting: *A reportable incident is an incident relating to the activity that has caused or has the potential to cause material or serious environmental harm as defined under the Petroleum Act.* *Based on the Risk Matrix this is an incident that has an actual or potential consequence* $\geqslant$ *III.*	
The initial written report will include: a) The results of any assessment or investigation of the conditions or circumstances that caused or contributed to the occurrence of the reportable incident, including an assessment of the effectiveness of the designs, equipment,	The initial written report will be provided as soon as practicable but not later than 3 days after the reportable incident first occurs.

procedures and management systems that were in place to prevent the occurrence of an incident of that nature; b) the nature and extent of the material environmental harm or serious environmental harm that the incident caused or had the potential to cause; c) any actions taken, or proposed to be taken, to clean up or rehabilitate an area affected by the incident; d) any actions taken, or proposed to be taken, to prevent a recurrence of an incident of a similar nature.	
Interim reports will include: 1. The results of any assessment or investigation of the conditions or circumstances that caused or contributed to the occurrence of the reportable incident, including an assessment of the effectiveness of the designs, equipment, procedures and management systems that were in place to prevent the occurrence of an incident of that nature; 2. the nature and extent of the material environmental harm or serious environmental harm that the incident caused or had the potential to cause; 3. any actions taken, or proposed to be taken, to clean up or rehabilitate an area affected by the incident; 4. any other matters relevant to the reportable incident	Interim reports to be provided as agreed with the Minister or at intervals of 90 days, starting on the day the initial report was given.
The final reportable incident report must include a root cause analysis of the reportable incident.	The final report to be provided to the Minister as soon as practicable but no later than 30 days after the clean up or rehabilitation of the area affected by the reportable incident is completed.
Waste Management and Pollution Control (WMPC) Act	
Duty to notify of incidents causing or threatening to cause pollution	
Where an incident occurs in the conduct of an activity and the incident causes, or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm. A notification is required to specify 1. the incident causing or threatening to cause pollution; 2. the place where the incident occurred; 3. the date and time of the incident; 4. how the pollution has occurred, is occurring or may occur; 5. the attempts made to prevent, reduce, control, rectify or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident; and the identity of the person notifying.	The proponent must notify the NT EPA on their Pollution Hotline 1800064567 as soon as practicable after (and in any case within 24 hours) first becoming aware of the incident or the time they ought reasonable be expected to become aware of the incident.
Heritage Act 2011	
When a proponent discovers a place or object that is known to be Aboriginal or Macassan archaeological place or object, they must provide • a description of the place or object; • its location;	The proponent must provide the OHE manager or authorised delegate a written report as soon as practicable but within seven days of discovery.

• the person's name and address; if known by the person the name and address of the owner or occupier of the place or place where the object is located.	
Work Health and Safety (National Uniform Legislation) Act 2011	
Where an incident occurs in the conduct of an activity and the incident causes: • The **dead of a person;** • **A serious injury or illness of a person; or** • **A dangerous** incident. (e.g. uncontrolled release)	A person who conducts a business or undertaking must ensure that the regulator is notified immediately after becoming aware that a notifiable incident arising out of the conduct of the business or undertaking has occurred. The notice must be given by the fastest possible means by telephone or in writing.

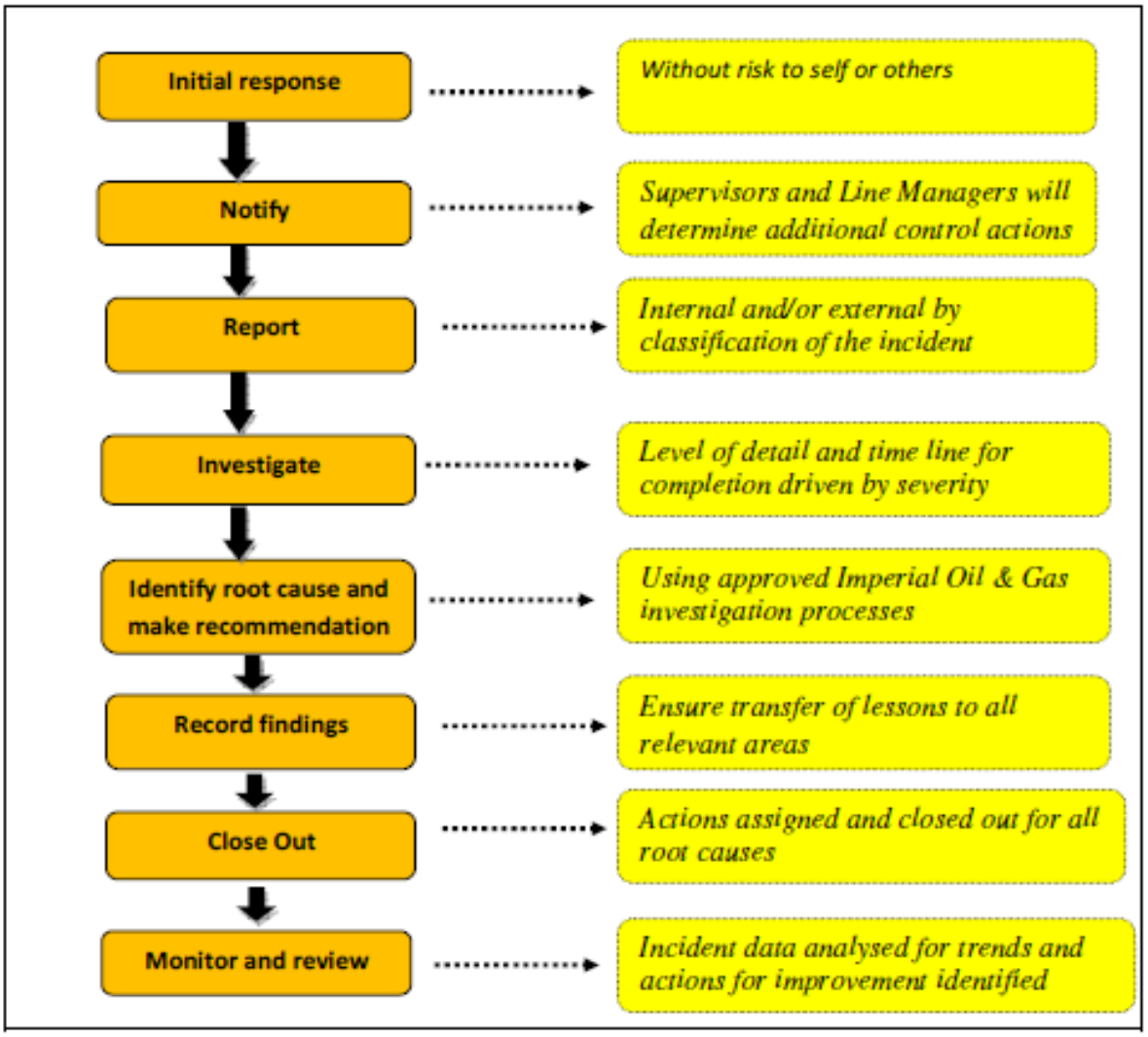


Figure 25. Incident Control Process

8.9 Environmental Performance Monitoring and Reporting

Imperial will undertake a suite of monitoring to implement this management plan and to deliver on the obligations described Tables 35 - 46. A summary of the key monitoring requirements is provided in Table 49 below.

Table 49. Reporting frequency

Monitoring program	Frequency	Requirement Source	Reporting
Weed Monitoring	Ongoing during civil and seismic program Annual to coincide with the end of the wet season	Weed Management Plan The Code	Annual Report
Groundwater Monitoring	Prior and at the end of drilling activities from nearby water bores (RN027848 & RN039574) Groundwater stored in tanks: • Daily: fluid level • Monthly: groundwater quality	Northern Territory Government guidelines for groundwater monitoring for petroleum operations The Code	Quarterly to DENR on the range of analytes specified in Table 7 of the Code
Rehabilitation Monitoring	Photo points established and revisited.	Rehabilitation Management Plan The Code	Environment Reports submitted to DENR and DPIR

8.9.1 Monitoring

Drilling activities will be monitored by site personnel. Monitoring will be supported by suitably qualified environmental personnel to ensure management controls described in Section 8 are implemented and that the performance measures are achieved. Table 50 provides an outline of the main monitoring activities to be undertaken during drilling activities.

Table 50. Environmental Monitoring

Control	Monitoring	
	Action	Frequency
All		
Site inductions and training	Keep records of inductions and training to ensure 100% participation by all relevant personnel, contractors and visitors.	For all new staff members and visitors before access to the site
Chemical and Hazardous Materials Management		
Hazardous chemical register	Records kept of quantities in and out from site	Updated as required
Emergency Response and Oil Spill Contingency Plans	Visual evidence of plans on site	Once at start of drilling activities

Control	Monitoring	
	Action	Frequency
Storage of chemicals, fuel and oils	Routine visual inspection of storage areas to ensure no leaks or spills.	Weekly
	Visual inspection to ensure adequate bunding and containment strategies implemented	Prior and during drilling activities
	Visual inspection of chemical storage areas to ensure no leaks or spills	At least once during drilling activities
Spills and leaks of chemicals, fuel and oils	Emergency response drills	At least once during drilling activities
	Groundwater monitoring	Prior drilling activities and after completion of activities. Groundwater stored in tanks: • Daily: fluid level • Monthly: groundwater quality
	Records kept of location, clean-up procedure and communication with DPIR if applicable	As required when applicable
Waste Management (Rehabilitation activities)		
Mud sumps and flare pit	Record distance from mud sump to existing trees canopy	Once after well pad construction
Disposal of drill cuttings	Soil testing of: • mud sump • drilling cuttings prior to disposal or burial to quantify salinity, heavy metals, hydrocarbons and radioactive content.	Testing of soil before sump is lined up. Testing of drilling cuttings once fluids have evaporated from the mud sump
Containment of drilling cuttings	Visual inspection of mud sump and flare pit to ensure adequate bunding and enough freeboard available	Daily during drilling operations
Wastewater treated	Records kept of quantity of water removed if applicable	Daily during drilling operations or as required if removal frequency is less
Grey water treatment and disposal	Records kept of disposal location, Visual inspection of sprinkler movement to avoid water pooling.	Daily during drilling operations.
Waste receptacles	Visual inspection of waste receptacles to ensure no fauna access to waste storage locations, lids are secure, waste are appropriately stored and there are no leaks	Daily
Waste handling	Update waste register when waste removal occurred (e.g. quantities in and out from site)	As required depending on waste removal frequency
Erosion and Sediment control		

Control	Monitoring	
	Action	Frequency
Erosion and sedimentation on site	Records of location and size	Site inspection at beginning of activities. Following any significant rainfall events (>10mm in 24 hours) During rehabilitation monitoring program: • Following the first wet season • One year after rehabilitation • Three years after • Five years after
Erosion control	Visual site inspection ensuring adequate control devices in place in accordance with DENR and IECA best practice guidelines. No erosion occurring	Site inspection at beginning of activities. Following any significant rainfall events (>10mm in 24 hours) During rehabilitation monitoring program: • Following the first wet season • One year after rehabilitation • Three years after • Five years after
Rehabilitation Management		
Decommission and rehabilitation activities	Photo points established before disturbance and revisited to compare progress.	As described in Table 29
P&A	Check for weeds, erosion and vegetation re-establishment	As described in Table 29
Suspended	Check for; • weeds, • erosion • vegetation re-establishment	As described in Table 29
Production	Check for: • weeds, • erosion, • vegetation re-establishment;	As described in Table 29
Biosecurity Management (Flora and Fauna)		
Weed-free certification	Spot check for weed free certificates when equipment, vehicles and materials are mobilised to site	As required
Change in health of existing vegetation and flora	Monitoring of existing flora and vegetation health to ensure no adverse impacts from operations	Pre-disturbance assessment and During rehabilitation monitoring program: • Following the first wet season • One year after rehabilitation
Weed management	Inspection to identify weed outbreaks	During drilling activities and

Control	Monitoring	
	Action	Frequency
		During rehabilitation monitoring program: • Following the first wet season • One year after rehabilitation
Presence of introduced fauna	Record number and location	Daily during drilling operations as required
Fauna strike	Records kept in a fauna register of any sightings, near misses or strikes	When applicable
Zone designated speed limits	Records of any failures to comply and corrective action taken	When applicable during drilling operations
Biodiversity Management		
Ecological assessment	Ecological survey for flora and fauna	Prior to any civil work
Land clearing	Evidence of approvals received prior any earthworks clearing is conducted.	Once, prior construction activities
Bushfire Prevention		
Fire drills and training	Records of fire drills and training carried out	Fire drills: At least once during drilling activities Training and Induction: Prior any new employee commence or site visitors going to site, as required
Fire control equipment	Inspect fire control equipment to ensure functionality	Prior activities commence
Gas flare combustion	Determine if any contamination occurring from unburnt fuel or external incidents in flare pit.	Daily check of flare pit
Fire break	Visual inspection of fire breaks maintained to 4m	Post pad construction then monthly
Smoking areas	Visual inspection of smoking areas clearly marked	Once at start. Then, after rig mobilisation and set-up
Unauthorised open fires	Visual inspection	Daily site inspection
Air Quality Protection Measures		
Emissions	Maintenance records of vehicles and equipment	Per inspection regime within maintenance management system
Flaring/Venting	Record of all flaring/venting events	During drilling activities, as required
Complaints	Record of complaints from surrounding land users regarding air quality or visual amenity	Records kept when applicable
Dust	Civil works	When applicable
	Road maintenance	When applicable
Traffic and transport management		

Control	Monitoring	
	Action	Frequency
No unauthorised off-road driving, all drivers inducted into the potential impacts of off road driving on soil	Records kept of any incidents and visual site inspections	Once any incident happens and during site inspections, as required
Personnel movements	All personnel movements are monitored by Site Supervisor and through the Journey Management Plan	Prior any personnel entry to site
Vehicles	Compliance with vehicle manufactures specification (e.g. vehicle services)	Before mobilisation of vehicles to site
Fauna strike	Records kept in a fauna register of any sightings, near misses or strikes	During activities as required
Community impact minimisation		
Complaints	Records of complaints from surrounding land users regarding noise and vibrations from drilling activities	Records kept of any incident when applicable
Cultural Heritage and Sacred Sites Preservation		
Cultural heritage clearance	An Authority Certificate application (doc. 20190486) has been submitted to the AAPA.	Once prior to well pad construction and road clearances
Interference with Aboriginal sacred sites, places or objects of archaeological significance.	Any incidents of damage or interference are reported directly to the Authority and records will be kept.	Records kept of any incident and reported when applicable.
Soil		
Topsoil	Ensure topsoil stockpiled around edge of well pad clearing in mounds between 1.5-2m	Once after site preparation is complete
	Top soil re-spread over all cleared areas no longer required for safe operation	Once during rehabilitation of different areas
Compaction	All actions of compaction deep ripped	Once during rehabilitation of different areas
Soil contamination	Soil sampling directly after clean-up at any location where spill/contamination has occurred	As required, following incident, until soil is classified as remediated in accordance with the NEPM 2013 guidelines for contaminated sites.
	Soil testing of: • any area of remediation following spill or leak if applicable, • conducted in mud sump before onsite burial	Soil testing before mud sump is lined up. After muds have dried and before is mixed with topsoil
Water		

Control	Monitoring	
	Action	Frequency
Surface water contamination	Water/soil sampling directly after incident to determine extent of contamination and following removal of contamination source if applicable	Directly after rehabilitation of contaminated water/soil One year later during rehabilitation program monitoring.
Water storage	Visual inspection to ensure sufficient freeboard available	Daily during drilling operations
	Record any access by fauna	Daily visual checks to ensure no fauna access. Records when applicable
Groundwater	Groundwater sampling from nearby water supply bores (RN027848 & RN039574). Reporting to DENR on the range of analytes specified in Table 7.	Quarterly reporting to DNER of existing nearby bores. Prior drilling activities and after completion of activities. Groundwater stored in tanks: • Daily: fluid level • Monthly: groundwater quality

8.9.2 Record Management

The list of environmental records that will be kept on site, includes:

- Induction records,
- Waste stream records including type and quantity,
- Incident register
- Hazardous materials manifests,
- Diesel fuel usage
- Weed species control efforts,
- Non-compliance and corrective action records,
- Internal audits and inspection records,
- External audits,
- Vehicles and equipment maintenance records,
- Road maintenance records (e.g. dust control efforts)
- Water usage

8.9.3 Audit

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

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

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

8.9.4 Management of Non-Conformances

Imperial's management procedures are designed to:

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

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

Incident management procedures are detailed in the Imperial HSE Management System.

Environmental incidents that may arise during drilling activities include:

- Well control event;
- Well integrity failure;
- Petroleum, saline produced water, grey water, chemical or sewerage spills (including uncontrolled escapes);
- Introduction and spread of weeds, invasive species or flora and fauna diseases;
- Fauna injury/fatality (vehicle collisions);
- Vegetation die back adjacent to the operational site;
- Uncontrolled fire;
- Clearing of threatened flora species;
- Clearing of threatened fauna species habitat; and
- Disturbance to heritage areas.

Work is to cease in the area of the incident. First mitigation measures will be conducted, in a safe manner, to avoid the extension of the Environmental impacts.

8.10 Routine Reporting

Imperial will supply daily drilling reports in accordance with the Schedule of Onshore Petroleum and Exploration Requirements 2017, Section 334. The reports and registers described in Tables 48 – 50 will be maintained and submitted to the DPIR as stipulated for compliance, unless otherwise advised by the minister.

Imperial will submit an Environmental Performance report once drilling program has finalized (unless otherwise advised by the minister) to DPIR (unless otherwise agreed by the Minister) which provides information where there has been a breach of an Environmental Objective or Environmental Performance Standards detailed in this Environmental Management Plan. The Environmental Performance Report will include actions taken to avoid or mitigate any adverse environment impacts of the recordable incidents and the corrective action proposed or undertaken to prevent similar recordable incidents.

9 Stakeholder Engagement

Imperial Oil & Gas communicate all relevant environmental management information to all staff and contractors associated with the Drilling program including the rehabilitation and monitoring of works. Information relating to the environmental performance associated with the rehabilitation of the legacy drilling activities will be made available to relevant government authorities, stakeholders and the local community where such information can be reasonably provided by Imperial Oil & Gas.

9.1 Stakeholder Identification

Relevant stakeholders were identified to include for engagement such that they could be informed of the proposed activities, and have their specific issues considered and addressed. The key relevant stakeholder groups include:

- Community,
- Landholders,
- Traditional Owners and Aboriginal People,
- Northern Territory Government departments including AAPA,
- Pipeline operators,
- Other land users.

9.2 Stakeholder Engagement Activities

Imperial has consulted with the NLC, the traditional owners of the land, the relevant pastoralists of the area, as well as the gas pipeline managers, the DIPL Div. Roads, other affected stakeholders and relevant regulatory authorities.

The key component of the engagement process has been face-to-face briefing sessions with key individuals and groups with timely feedback on issues and concerns regarding the project. The purpose of the consultation has been to:

- Identify the projected Work Program and possible future programs,
- Build and maintain stakeholder confidence through key relationships,
- Gain trust and acceptance in the local communities as a responsible member of society,
- Listen to and address concerns or queries,
- Work with stakeholders to build understanding as to why and how the company operates.

Some of the key items and stakeholder concerns identified and clarified during the various stages of consultation included:

- the protection of sacred sites within the region,
- protection of other sites of cultural significance to the local language groups
- the right of access to their traditional lands.
- Pastoralist retention of amenity and disruption to their economic use of the land keeping the land as close as possible to the natural state with no increase in introduced weed or feral animal pressure.
- potential for increased erosion of the fragile soils and associated ecosystems.
- risk of potential contamination of water and the environment in general, as well as the loss of and or contamination of aquifers; and

- employment opportunities to local indigenous groups

Imperial has evaluated all the stakeholder concerns and implemented constringent mitigation measures as disclosed in Section 6 to reduce all identified risks to ALARP. Some of the controls implemented are, but not limited to:

- weed management plan,
- fire management plan,
- land access negotiations,
- compensation agreements where relevant and necessary,
- implementation and monitoring of wash down of all vehicles prior to entry to site,
- implementation of erosion and sediment control devices as per the DLRM guidelines.

9.3 Ongoing Consultation

During both the planning and drilling activities, Imperial Oil & Gas will have a field liaison coordinator in the region. They will be the primary point of contact for all landholders and community members during the work phases. The Field Representative will also manage day to day activities and communications with respect to the landholders to ensure they are consistently updated on the status of the program.

Prior to any land access, the Field Supervisor and/or Field Representative will carry out an on-ground scouting and consultation to ensure that any impact or interruption to landholders is minimised. Imperial Oil & Gas will not access any person's land without prior consent in the form of a written agreement and in accordance with the DPIR policies and guidelines.

Where stakeholders have requested or Imperial Oil & Gas believes it would be beneficial to engage with stakeholders on an ongoing basis during the activity, communications will continue until the activity has concluded.

All internal and external complaints related to environmental matters associated with the rehabilitation program, will be recorded on a register, acknowledged in writing and investigated as incidents including formal responses to remedy the complaint where relevant and appropriate.

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11 Appendixes

Appendix 1. EPBC Protected Matters

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

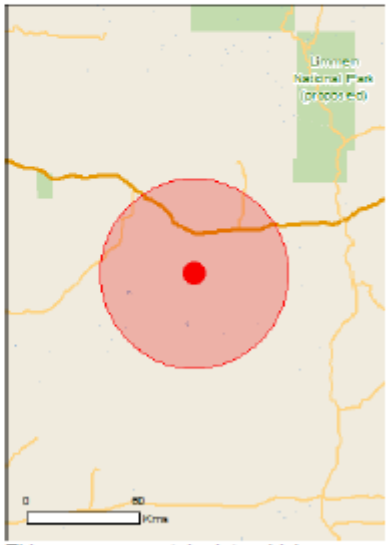
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 07/06/19 16:33:40

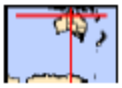
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 50.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	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:	14

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:	20
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:	None
Regional Forest Agreements:	None
Invasive Species:	14
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 known 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 may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to 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
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat may occur within area
Elseya lavarackorum Gulf Snapping Turtle [67197]	Endangered	Species or species habitat may occur within area
Sharks		
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
[60756]		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 Marine Species		
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known 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 may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely 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 may 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

Name	Threatened	Type of Presence
		area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may 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

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina		
Cane Toad [83218]		Species or species habitat likely to 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 asinus		
Donkey, Ass [4]		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

Name	Status	Type of Presence
Sus scrofa		
Pig [6]		Species or species habitat likely to occur within area
Plants		
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
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

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

-16.92933 135.00375

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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Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Appendix 2. Communication Log

Communication Details

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
8/09/2017	Charles Staple	PWC NT		No	Discussion re management of the McArthur gas pipeline and requirements for crossing the pipeline, weights and approvals	Positive engagement. Charles indicated PWC NT had no concerns with the proposal but we would need to clear it with OSD as they now had the pipeline management responsibility.
4/05/2018	Greg McDonald	NLC	Introduction of EP187 and EP184 proposal	No	provided introduction to new regional officers for EP187/184 Ian Harris and Malcolm Hauser respectively	No action required
10/05/2018	Ian Harris, Greg McDonald	NLC	Ecology Study	No	Work program submission for ecology study made to NLC for review	NLC confirmed receipt of application for work program
11/05/2018	Ian Harris	NLC		No	Request information on S19 land users for EP187	need to follow up
14/06/2018	Ian Harris	NLC	Seismic work program	No	Work program submission for seismic made to NLC for review	submit original work program for NLC review and approval. NLC acknowledge receipt. G McDonald advises process will be managed by Malcolm Hauser
24/06/2018	Ben & Sophie Sidle	Carpentaria Downs	Proposed land access	No	Discussion re land access to undertake planned seismic works	positive engagement. Ben has no concerns with work planned program but wanted to review the route map to check gates, fences etc. and potential impact.
24/06/2018	Raymond (Lou) Daniel	Relief creek	Proposed land access	No	Discussion re land access to undertake planned seismic works	Lou indicated he had no concerns with the proposal and was happy to sign the land access agreement but would discuss it with the NLC pastoral officer
25/06/2018	Ben & Sophie Sidle	Carpentaria Downs	Proposed seismic route	No	Follow up discussions. Review proposed seismic route.	Ben indicated he had no concerns and was willing to sign the land access agreement as drafted

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
25/06/2018	Joe Cronin	Carpentaria Downs	Map of proposed planned area	No	Joe is looking to sub lease a portion of Carpentaria Downs from Ben Sidle. Discussed with Joe land access and provided a map of the planned area. Joe indicated that as he was still negotiating access and sub lease that the decision had to be made by Ben but he had no issues with the proposal.	Joe is comfortable with the work program. He did indicate that if Imperial was looking to drill and needed to do water bores could he have some say in where the bore should go. I advised that to a large extent this would be determined by the DPIR but that we would continue to maintain contact.
29/06/2018	Ian Harris	NLC	Seismic work program	-	work program submission for seismic made to NLC for review	follow up on original submission of work program
3/07/2018	Ben & Sophie Sidle	Carpentaria Downs	-	-	followed up on the agreement.	Ben has confirmed he is willing to sign an agreement as required.
6/07/2018	Greg McDonald	NLC	-	-	provided update the Ian Harris is on leave and that Malcolm Hauser would take over the responsibility for the area.	Make contact with Malcolm Hauser
13/07/2018	Ben & Sophie Sidle	Carpentaria Downs		Minor concerns from Ben indicating he was subleasing part of the block.	followed up on land access. Accepted discussion as notification of intent to enter.	Ben indicated he now had some minor concerns as he was sub leasing part of the block but as the agreement was at this stage confined to seismic he was happy to sign a land access agreement. Advised of discussions with Joe Cronin.
18/07/2018	Malcolm Hauser	NLC regional Officer	-	-	Malcolm proposed Sept 5. for on country meeting	date conflicts with presentation at SEAOCC. Need to seek alternate date
20/07/2018	Raymond (Lou) Daniel	Relief creek		No objections. But Sam Tapp advised not to sign agreement.	Lou advised that he and Dave Daniel have no concerns over signing a land access agreement but they and Ben Sidle had been advised by Sam Tapp of the NLC not to sign as access was to be negotiated with the NLC and was a matter for the NLC lawyers to sort out. Accepted discussion as notification of intent to enter.	made contact with the company Lawyers Ward Keller to discuss. Kevin advised that S42 of the land use agreements between IOG and NLC allowed for S19 land access agreements to be negotiated and that Sam had overstepped his authority or misunderstood the relevant section of the NLC/IOG agreement.
20/07/2018	Alex Underwood	Imperial CEO	-	-	Advised Alex of the comments made by the Daniels of Relief Creek NT and the comments by Kevin Stephens. Alex advised that he would contact the NLC to make sure there was no confusion over the matter	Confirmation later received that land access agreement is not required in writing with S19 leaseholders.
26/07/2018	Malcolm Hauser	NLC	-	-	email to advise that NLC is unable to do an August on country meeting for EP187	need to find alternate date

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
30/07/2018	Malcolm Hauser	NLC regional Officer	-	-	follow up on date for on country meeting in Borroloola	Malcolm confirms the meeting for September 6
31/07/2018	Alex Underwood	Imperial CEO	-	-	followed up Alex on the land access with the NLC	Confirmation later received that land access agreement is not required in writing with S19 leaseholders.
3/08/2018	Neil Gardner	OSD ltd	Crossing of pipeline		phone call discussion re crossing the pipeline, weights and approvals	Neil will respond with criteria to allow crossover
3/08/2018	Neil Gardner	OSD ltd	Details of re-planned seismic program	-	Send letter with details of work program re planned seismic	letter sent
6/08/2018	Jarrod Woolnough	OSD ltd	Vehicle weights crossing pipeline		discussion re vehicle weights and approvals for pipeline crossing	Jarrod will complete the required calculations and provide a letter of authority to cross the pipeline
6/08/2018	Malcolm Hauser	NLC	-	-	follow up for on country meeting timing at Borroloola	Needs follow up
23/08/2018	Adam Thompson	NLC	-	-	cancelled timing for on country meeting Borroloola	AU/JW to follow up to reset meeting date and seek meeting with G. McDonald
24/08/2018	Jarrod Woolnough	OSD ltd	Approval letter to work in proximity to pipeline	-	provided copy of letter of approval for seismic to operate in proximity to McArthur gas Pipeline.	waiting on sign off of acceptance of conditions by AU
7/08/2018	OSD				letter of authority to cross pipeline approved and signed by all parties	approval to cross pipeline obtained
27/08/2018	Adam Thompson	NLC	Proposed meeting dates	-	proposed alternate meeting dates - 4th, 10th or 11th of October	AU/JW to follow up to reset meeting date and confirm availability for attendance
27/08/2018	Alex Underwood	Imperial CEO	-	-	follow up confirmation of meeting date with NLC	AU/JW to follow up to reset meeting date and confirm availability for attendance
27/08/2018	Kevin Stephens	Ward Keller	-	-	advised that NLC had cancelled proposed meeting date and provided alternative dates for confirmation	No action required
6/09/2018	Tahnee Hill/Chris Shaw/Louis Gomatos	DPIR/DENR	Environmental aspects of seismic program	Requirement for weed management plan revision	Meeting to discuss environmental aspects of planned 2D seismic survey	review of weed management plan required. AAPA cultural certificate required.
6/09/2018	Tahnee Hill	DENR	Weed management plan	-	provision of weed management plan draft guidelines	Tahnee provided draft of the new weed management plan guidelines and solicited feedback on same

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
14/09/2018	Adam Thompson	NLC	Notice of Intent to conduct weed survey	-	advice given of intent to conduct baseline weed survey	authority to conduct obtained
14/09/2018	Petroleum operations	DPIR	Notice of Intent to conduct weed survey	-	notification of intent to conduct weed survey	No action required
14/09/2018	Louis Gomatos	DPIR	-	-	acknowledgement of intent to conduct weed survey	No action required
3/10/2018	Dr Scambary	AAPA	Application for AAPA certificate		Application for AAPA certificate for EP187	Application submitted, waiting on transfer of data from NLC anthropology division to progress approvals.
3/10/2018	Laura Proos	AAPA	-	-	provision of AAPA application number	transfer number to NLC
10/10/2018	NLC/TO's	On country	Work program		Representatives of the Northern Land Council provided an update to traditional owners regarding the history of Imperial's involvement in EP187 including previous traditional owner approval to award exploration permit and the proposed exploration work program activities comprising 231 line km 2D seismic and the drilling of up to 4 exploration bore holes. Representatives of Imperial provided traditional owners with a more detailed overview of the proposed work program activities including reference to maps showing the likely location of land areas to be cleared for seismic acquisition and well pad preparation, locations of the seismic lines, and potential drilling locations. Imperial representatives noted that the drilling locations were indicative and could not be confirmed until after the seismic acquisition, processing and interpretation. Traditional owners raised questions regarding protection of water supplies and natural environment and potential for local job creation and skills. Imperial provided detailed explanation of its plans and procedures to protect the natural	NLC representatives asked representatives of Imperial to step away from discussions while NLC and traditional owner groups discussed the proposed work programs. Following extensive discussions amongst and between traditional owner groups and NLC representatives, all groups reconvened. Proposed work program of seismic line acquisition and drilling up to 4 exploration bore holes was approved

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
					environment and an overview of well bore design (steel casing / cement etc) and explained opportunities for jobs for local people including as cultural monitors / traffic control / associated services etc."	
15/10/2018	Greg McDonald	NLC	Approval for 2D seismic	-	formal notification received from NLC of permission to acquire 2D seismic	copy of correspondence supplied to DPIR petroleum ops team.
16/10/2018	Greg McDonald	NLC	Updated weed management plan	-	provided copy of updated weed management plan	No action required
18/10/2018	Charles Dack	DPIR	-	Comments on draft EMP	provision of comments on draft EMP	some areas of the EMP need to be updated in line with the DPIR recommendations
18/10/2018	Greg McDonald	NLC	Data for AAPA certificate	-	internal discussions with anthropology manager NLC for provision of data to AAPA for certificate	No action required
18/10/2018	Greg McDonald	NLC	-	-	follow up on data and contacts within the NLC for AAPA certificate	key contacts for AAPA within NLC identified
22/10/2018	Kushan Gunarathene	DoI - Main roads	Requirements for a Traffic Management Plan		discussion on review of traffic management plan approvals	Kushan to review and respond
23/10/2018	Charles Dack	DPIR	-	Update EMP with DPIR recommendations	provision of comments on draft EMP	some areas of the EMP need to be updated in line with the DPIR recommendations
25/10/2018	Laura Proos	AAPA	-	-	queries on corridor required for seismic lines	AAPA note the 50m width required for survey to go around obstacles and vegetation
25/10/2018	Maria Wauchope	DENR	-	-	confirm agenda and meeting time	various dept.'s to attend round table for review of EMP items.
26/10/2018	Laura Proos	AAPA	-	-	receipt of advice on cost of AAPA certificate	No action required
26/10/2018	Kushan Gunarathene	DoI - Main roads	Intended vehicle use for seismic project	-	confirmation of intended vehicle use and type for seismic acquisition to facilitate traffic management control plan	awaiting feedback from DoI

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
29/10/2018	various	DENR NT	Fire Management Plan, Weed Management Plan		discussions on EMP put forward, bush fire control, weed management, and other aspects of the EMP. DENR advise they only circulated the document for review last week and will provide feedback this week.	Appears to be general consensus of agreement, DENR will provide feedback this week.
29/10/2018	Various	DENR/DPIR	-	-	Alex Underwood advised relevant departments that G. Hokin would take over control of the work program approvals process.	G. Hokin to become key point of contact for support and delivering the required work program submission documents.
29/10/2018	Leeton McHugh	Terrex	Draft contract for seismic acquisition	-	draft contract agreed for seismic acquisition	final contract to be issued
29/10/2018	Greg McDonald	NLC	Anthropology data	-	correspondence between A underwood (IOG) and Greg re support on anthropology data to AAPA	NLC to follow up on data transfer to AAPA
30/10/2018	Tahnee Hill	DENR NT	-	-	discussion on review of weed management plan and time line to provide approvals.	Tahnee provided opportunity for accelerated approvals of the weed management plan.
30/10/2018	Tahnee Hill	DENR NT	-	Small areas of the program need to be updated	Tahnee identified small areas of the program had not been completed in the survey and requested these be attended to.	Paul Fox (Premise Ecology) discussion with Tahnee about science of survey and that the unsurveyed areas were not weed habitats based on information from the DENR regional weeds officers.
31/10/2018	Tahnee Hill	DENR NT	Criteria to undertake further weed survey	Extra areas needed to be addressed.	follow up on required criteria to complete weed survey and for criteria to undertake further surveys by air using helicopters	Tahnee identified areas needing to be addressed and provided a DENR weeds officer to assist in program. Final sections approved to be done by helicopter.
31/10/2018	Kushan Gunarathene	DoI - Main roads	Approval for seismic along road ways	-	received approval for seismic along road ways	develop traffic management plan
31/10/2018	Paul Fox	Premise Ecology	-	-	establish planning and coordination to complete weed survey under advise of DENR over tail ends of seismic lines	establish plan to finalise revisions to weed management plan to incorporate DENR recommendations
1/11/2018	Tahnee Hill/Chris Shaw	DENR	-	Update weed management plan	discussion on DENR comments on edits to the weed management plan	update weed management plan
2/11/2018	Michael J. Howard	Dep't Infrastructure Planning and	Approval letter from Dep't Infrastructure,	-	review of TMP approvals process after receipt of approvals letter from Dep't Infrastructure, Planning and Logistics	Provide copy of approval letter to Katherine traffic control to accompany developed TMP for approvals

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
		Logistics – Div. Roads	planning and logistics.			
6/11/2018	Chris Shaw	DENR			provide further comments to the EP187 EMP	update EMP in line with comments
6/11/2018	Anthony Waite	NT WorkSafe	-	Update HSEMP	discussion on review of HSEMP for planned works. Document approvals are valid for 3 years. However it is advisable to update regularly.	Send updated document for review
7/11/2018	Petroleum operations	DPIR	Revised EMP	-	provide revised version of EMP for review	revised document sent
7/11/2018	Nathan Groves	Katherine Traffic Control P/l	-	-	called to update on progress of TMP for approvals.	waiting on DIPL - Roads Div. TMP approval
7/11/2018	Adam Thompson	NLC	-	-	follow up anthropologists' report to be sent to AAPA for provision of AAPA certificate. Adam has indicated the report should be across to AAPA by end of the week.	follow up on 9/11/2018
7/11/2018	Anthony Waite	NT WorkSafe	Revised HSEMP	-	NT Worksafe provided edits and comments to improve the HSEMP. They advised that it is not necessary to provide them with a corrected document one the edits have been made.	HSEMP revised to note the edits, comments and recommendations of their review. Revised document sent to DPIR.
7/11/2018	Gibson Porkime	DPIR	-	-	several email correspondence queries from DPIR re status of AAPA NLC SSC and other matters	All raised issues have been responded to
8/11/2018	Raymond (Lou) Daniel	Relief creek	-	-	phone call to discuss land access notification and procedures.	Daniels are aware of intent to conduct work program and happy to support
8/11/2018	Gibson Porkime	DPIR	-	-	correspondence re outstanding documents and updates to HSEMP	Update HSEMP in line with comments and reissue Survey Technical work program with application letter and KMZ data file
8/11/2018	Gibson Porkime	DPIR	-	-	phone call to discuss land access notification and procedures. These may be evidenced by use of this log.	send updated copy of this log.
8/11/2018	Paul Fox	Premise Ecology	-	-	Paul advised completion of the weed survey with the weeds officer of the DENR. No weeds found in survey	Paul to update the WMP and survey report and submit to DENR for approvals

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
8/11/2018	Petroleum operations	DPIR	-	Update HSEMP	required update on HSEMP.	revised document sent
9/11/2018	Adam Thompson	NLC	-	-	follow up in transfer of anthropology report to AAPA. Adam advises this has not been done and the anthropologist is now overseas. I requested that he follow this up as it is becoming a critical and costly issue now.	referred the matter to Alex Underwood who will now follow it up with Greg McDonald and Joe Morrison if necessary.
13/11/2018	Adam Thompson	NLC	-	-	discussion with Adam re progress on report to AAPA. Adam advises report is in progress with NLC and expecting the report to be processed and delivered by Friday this week	follow up Friday on progress
13/11/2018	Gibson Porkime	DPIR	-	Update technical work program as per DPIR comments	email from Gibson to update page numbers of technical work program	update document and resubmit
15/11/2018	Gibson Porkime	DPIR	-	Update seismic work plan as per DPIR comments	update Seismic work plan as required	Document sent for review to DPIR
16/11/2018	Adam Thompson	NLC	-	Reformat the ethnographic report to comply with AAPA requirements	Adam advised progress on the paperwork required for the AAPA certificate and updated the status of the report. Wlodzimierz (Walter) Andrzej Zukowski (WZ) is the NLC anthropologist and familiar with the AAPA systems. WZ is currently reformatting the ethnographic report to comply with AAPA requirements and expects to submit wed next week (22/11/2018). Walter Zukowski prepared the anthropological report as a consultant anthropologist to the NLC.	Follow up progress on 22/11/2018. open dialogue with AAPA. Imperial does not have access to the report itself as it is a confidential document held by the NLC on behalf of the traditional owners.
16/11/2018	Nathan Groves	Katherine Traffic Control P/l	-	-	Nathan advises the PTW for the traffic management plan has been approved subject to Terrex sign off as prime contractor.	PTW issued for signature. On return of signed document send to Nathan for lodgement.
16/11/2018	Ben Shave	Terrex	Approved Traffic Management Plan	-	Provide copy of approved TMP for review.	follow up for signed document to send to DIPL

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
19/11/2018	Gibson Porkime	DPIR	-	References in EMP to be corrected	email re documents and references in EMP to be corrected	review document, edit and reissue and send copies of appendix
20/11/2018	Adam Thompson	NLC	Intent to conduct seismic	-	receipt of acknowledgement of on country meeting and advise to TO's of intent to conduct seismic.	forward copy of correspondence to DPIR.
20/11/2018	Gibson Porkime	DPIR	-	-	issue version 5 of EMP with corrections as requested.	issue document to DPIR
21/11/2018	Nathan Groves	Katherine Traffic Control P/l	Confirmation of TMP	-	Provide confirmation of acceptance of Traffic Management plan	Issue copy of documents evidence authority to conduct works to DPIR
21/11/2018	Gibson Porkime	DPIR	-	-	confirmation of status of work program approvals	follow up actions of revision to web document of EMP, follow up status of AAPA certification
22/11/2018	Walter Zukowski	NLC	-	-	NLC anthropologist discussion on progress of AAPA paperwork for certification. Walter advises the report will be completed Monday 26/11/2018 and will then be reviewed internally by NLC before sending to the AAPA	Follow up on progress of report to AAPA for issuing of certificate 26/11/2018
6/12/2018	PDG NT	Daniel Mulholland	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program
6/12/2018	Ben Sidel, Lou Daniel, Joe Cronin	S19 pastoralists	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program
6/12/2018	Rod Applegate	DPIR	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program
6/12/2018	Chris Shaw	DENR	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program
6/12/2018	Leeton McHugh	Terrex	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
6/12/2018	Jarrod Woolnough	OSD	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program
6/12/2018	Tahnee Hill	DENR	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program
6/12/2018	Michael Howard	DIPL Div. Roads Darwin	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program
6/12/2018	Michael Tait	DIPL corridor management	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program
6/12/2018	Phil Harris	DIPL Div. Roads Katherine	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program
6/12/2018	Anthony Waite	NT Worksafe	Deferment of planned seismic program	-	Advise of deferment of planned seismic until 2019	maintain contact with updated program
7/12/2018	Greg McDonald	NLC	Anthropology report sent. Authorisation letter of the permits.	-	Greg advised that the Anthropology report has been sent to AAPA and that IOG will need to supply a details of the agreement to AAPA for the authority certificate to be issued. Greg also provided a letter of authorisation of the redactions permitted. Drilling petroleum wells were included as part of the discussion.	redacted the agreement as advised and issue to AAPA with copy of authorisation letter The Agreement ("Exploration Deed") between the NLC on behalf of the Traditional Owners of the Mamabaliya Rrumburriya Wuyaliya Aboriginal Land Trust and Imperial Oil & Gas Pty Limited which allows Imperial to carry out petroleum exploration activities in EP187. Signatories were Imperial Oil & Gas Pty Limited and the Northern Land Council
10/12/2018	Laura Proos	AAPA	IOG agreement	-	issue redacted version of agreement as per advise to AAPA	document and cover letter sent. Follow up mid-week.

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
11/12/2018	Rick fletcher	NLC	Deferment of planned seismic program	-	sent letter notice of intent to defer 2D seismic due to AAPA authority certificate not yet available to complete DPIR approvals process	NLC acknowledged receipt of letter
4/01/2019	R & D Daniel, W Sidel	S19 pastoralists	Status of program	-	pastoralist consultation re status of program	maintain contact with updated program
9/01/2019	Angella Kennedy	NT DPIR	-	-	identification of 'no go zone' potential impacts on tenement	no zone excluded other than those on tenement grant
9/01/2019	Tammy Smart	DENR	-	-	onshore petroleum guidelines for work programs updates, discussion on use of existing water bores for assessment of work program impacts and potential impacts to planned work programs as result of CSIRO report on baseline SREBA of Beetaloo Basin	awaiting feedback from DENR for impact on future work programs
10/01/2019	Laura Proos	AAPA	-	-	follow upon Authority certificate for work program	waiting on NLC to provide language group information
14/01/2019	Laura Proos	AAPA	-	-	follow upon Authority certificate for work program	waiting on NLC to provide language group information
16/01/2019	Laura Proos	AAPA	-	-	follow upon Authority certificate for work program	waiting on NLC to provide language group information
18/01/2019	Ian Harris, Greg McDonald, Malcolm Hauser	NLC	Provision of language group representation	-	follow upon provision of language group representation to AAPA for completion of Authority certificate	need to maintain contact
19/01/2019	Laura Proos	AAPA	-	-	follow upon provision of language group representation to AAPA for completion of Authority certificate	need to maintain contact
22/01/2019		S19 pastoralists	Status of program	-	pastoralist information on status of program	maintain contact with updated program
6/02/2019	Tammy Smart, chris Shaw, Ursualla Zaar	DENR	-	Post wet weed survey is required	discussion on requirements for revision of seismic EMP as submitted in 2018. Need for post wet weed survey.	EMP maintains in place subject to AAPA authority certificate being issued and post wet weed survey

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
8/02/2019	tammy smart, chris Shaw	DENR	-	-	follow up on new EMP application process for change over from DPIR to DENR	new procedure to be issued post 27/2/2019
11/02/2019	James Pratt	DPIR	-	-	issues around issue of AAPA authority certificate and progress to approvals	AAPA certificate required
11/2/219	Technical AAPA	AAPA	-	-	follow up on status of NLC information to complete certificate	contact NLC to promote for outstanding information to be transferred
12/02/2019	Ian Harris, Greg McDonald, Malcolm Hauser	NLC	-	-	follow upon provision of language group representation to AAPA for completion of Authority certificate	need to maintain contact
13/02/2019	Greg McDonald	NLC	Proof of existing agreement with indigenous groups	NLC to reissue information for AAPA	proof of existence of agreement with indigenous language groups to explore tenement required from NLC to AAPA identifying the indigenous groups represented by the NLC	Greg identifies all required info is in the report provided by the NLC in October 2018, but not in format required by AAPA. NLC to reissue relevant documentation
14/02/2019	Technical AAPA	AAPA	-	-	follow up on status of NLC information to complete certificate	contact NLC to promote for outstanding information to be transferred
20/02/2019	Technical AAPA	AAPA	-	-	follow up on status of NLC information to complete certificate	contact NLC to promote for outstanding information to be transferred
21/02/2019	Jarrod Woolnough	OSD	Update on program status	-	re update on work program EP187 status	need to maintain contact
26/02/2019	Technical AAPA	AAPA	-	-	follow up on status of NLC information to complete certificate	maintain contact
28/02/2019	Ian Harris, Greg McDonald, Malcolm Hauser, Walter Zukowsi	NLC	-	-	progress on provision of required information to AAPA	anthropology manager to provide letter of needed information for authority certificate

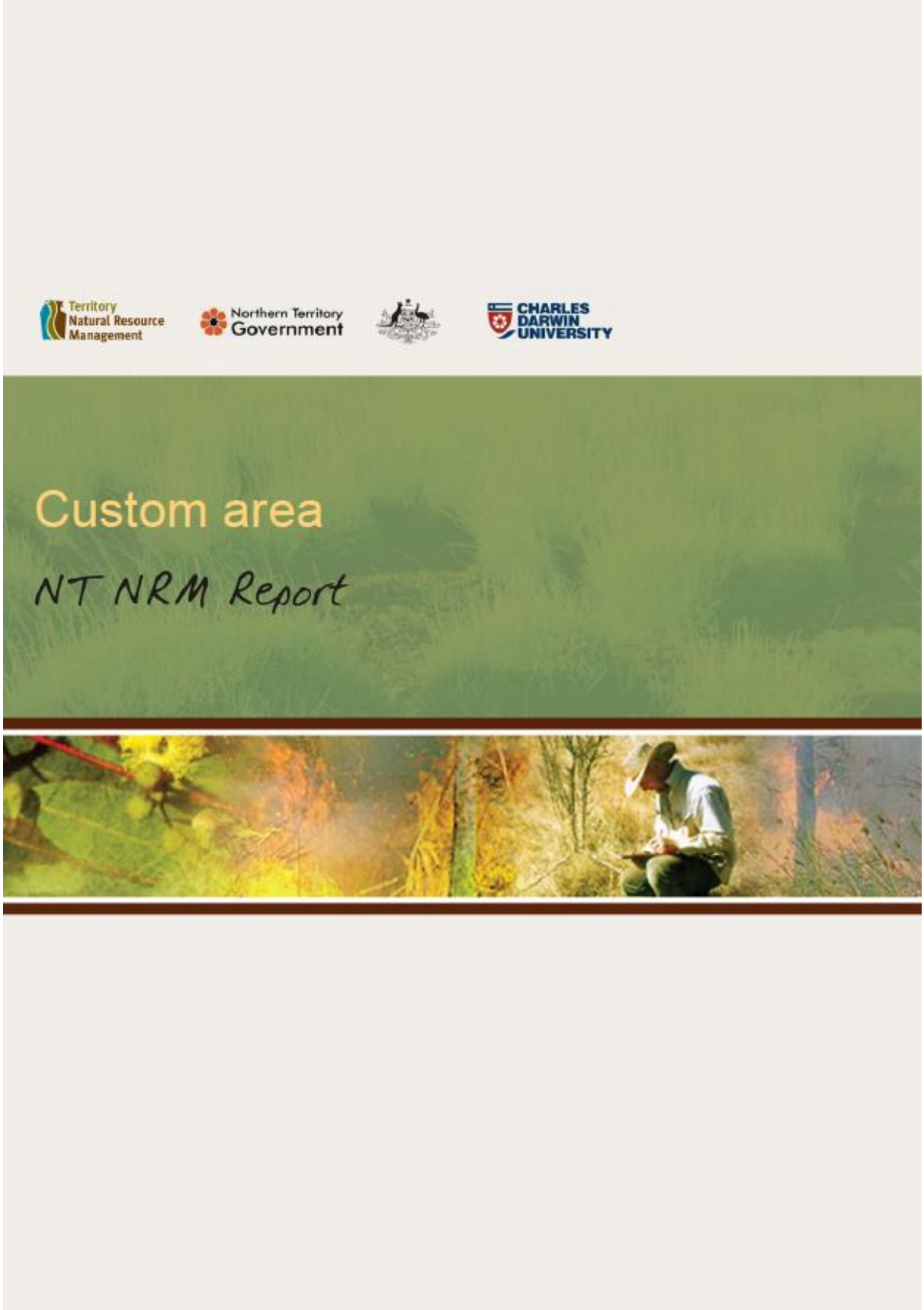
Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
28/02/2019	Wendy Joan Forscutt	AAPA	Approval to excise section	Excise 2km from top of one line	confirmation of receipt of required information and need to excise 2km from top of one line	approval to excise section. AAPA certificate to be issued
1/03/2019	Jarrod Woolnough	OSD	Status of seismic program	-	status of seismic program and confirmation of authority to operate in proximity to pipeline	waiting feedback
4/03/2019	EcoOz, Premise, Fox Ecology		-	-	solicit quotes for conduct of post wet weed survey	scope of work provided
11/03/2019	Technical AAPA	AAPA	Authority certificate		authority certificate for 187 seismic received	issue to DPIR/DENR copy of certificate
14/03/2019	Lou Daniel	S19 pastoralists - Relief creek	Progress of seismic program	Post wet weed survey required.	update on progress of seismic program, need for post wet weed survey. Ben Sidle has sold lease over Carpentaria downs. New owner Tossa Murphy.	Need to contact Tossa Murphy re work program
17/03/2019	Chris Parker	DENR Weeds office	-	-	Ecologist P. fox made contact with Chris as weeds officer to cooperatively undertake weed survey across the region.	Chris Parker will be involved in the survey
19/03/2019	Tossa Murphy	Carpentaria Downs	-	-	contact re planned weed and bore survey	notice of intent to enter given
19/03/2019	lou Daniel	S19 pastoralists - Relief creek	-	-	contact re planned weed and bore survey	notice of intent to enter given
19/03/2019	Ian Harris	NLC	Notice of Intent to conduct weed and bore survey	-	notice of intent to conduct weed and bore survey under section 5 of the exploration agreement	notice of intent to enter given
19/03/2019	NLC	NLC	Application to enter aboriginal land	-	issue application for permit to enter aboriginal land	14 days plus notice provided of intent to enter
19/03/2019	Daniel Mulholland	Senior TO Borroloola	-	-	contact re planned weed and bore survey	notice of intent to enter given
19/03/2019	DPIR	DPIR	Application to enter aboriginal land		notice of intent to conduct weed and bore survey	notice of intent to enter given
22/03/2019	DPIR	DPIR	letter of custodian of activity	-	letter of custodian of activity	notice of custodian of activity

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
29/02/2019	Paul Fox	Fox & Co.	-	-	coordination of post wet weed survey	timing confirmed
29/03/2019	NAH	NAH	-	-	PO for helicopter for aerial survey	chopper booked
4/04/2019	Lou Daniel	S19 pastoralists - Relief creek	-	-	update on timing of weed survey and coordination for land access to Relief creek.	confirmed notice of intent to enter and timing
4/04/2019	Joe Cronin	S19 pastoralists	-	-	update on timing of weed survey and coordination for land access	confirmed notice of intent to enter and timing
4/04/2019	Tossa Murphy	S19 pastoralists	-	-	update on timing of weed survey and coordination for land access	confirmed notice of intent to enter and timing
8/04/2019	Joe Cronin, David & Lou	S19 pastoralists -	Map of planned access	-	meet with Joe to discuss planned work program, provide map of planned access	consent for work program provided
8/04/2019	Tossa Murphy	S19 pastoralists	-	-	Tossa gone to hospital with infection	need to follow up
10/04/2019	Chris Parker	DENR	-	-	meet with DENR weeds officer, officer accompanied contract ecologist to undertake weed survey	officer satisfied with approach and outcome of survey
18/04/2019	Paul Fox	Fox & Co.	-	-	follow up on timeline to weed survey report completion for submission of revised weed management plan to accompany seismic EMP	waiting on final report
15/5/2019	Lou Daniels	S19 pastoralists - Relief creek	-	-	Discussed machines typically used to clear lancewood.	Confirmed minimum D6 dozer.
28/5/2019	Electronic lodgement	NLC	Notification of intent to visit	-	Sent site access request	Access granted
29/5/2019	Lou Daniels, , Joe Cronnin	S19 pastoralists	-	-	PF spoke to Lou re Jon Bennett coming up on the 10th-13th.	All good from Lou & Joe, Joe has cleared more tracks
5/6/2019	Lou Daniels & Joe Cronnin	S19 pastoralists – Relief Creek & west Balbarini	Site visit & scouting visit advice	-	Happy for site visit to proceed.	-

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
11/6/2019	Joe Cronnin	S19 pastoralists – West Balbarini	Update on Site visit status	-	Confirm he had no issue with seismic, and discussed concerns over grazing grass lost due to lease clearing for drilling. Happy for Seismic to proceed but wanted further discussion on impact of drilling clearing.	Confirmed project would limit clearing as much as practical for drilling. Confirmed that prior to drilling Imperial would clarify stakeholder arrangements around clearing grass. Upcoming works, disturbance areas and compensation sent via email; refer to communication below 30th July
11/06/2019	Kerry King	Heartbreak Hotel	Discussed future works & fuel	-	Hotel keen on providing fuel other services including accommodation.	Will seek pricing.
13/06/2019	Tim Burke	KD Machinery Hire	Seismic Line preparation & well construction scope	-	Discussed upcoming works. Tim very positive about woks.	Will follow with formal scope of work for pricing.
14/06/2019	Phillipa H& Sally S	DENR	Discussed EMPs.	-	Discussed seismic EMP and advised of upcoming drilling EMP.	Prepared to review documents on arrival.
1/07/2019	Gibson Porkime	DPIR	Updated ERP	-	Provided updated ERP in response to DPIR request.	ERP received and reviewed with one change requested. Document to be updated and resubmitted.
29/07/2019	Silvano Jung	Ellengowan Entreprises	Anthropological assessment	-	Engaged XXXX for cultural heritage survey over seismic lines and drill sites	Cultural Heritage report received and submitted to the regulator 15th Aug 2019
30/07/2019	Joe Cronin	S19 pastoralists – West Balbarini	Upcoming works, disturbance areas and compensation	-	Phone call: Discussed upcoming works, disturbance areas, and compensation	No Issues at the end of the conversation
30/07/2019	Lou & David Daniell	S19 pastoralists – Relief Creek & west Balbarini	Upcoming works, disturbance areas and compensation	-	Phone call: Discussed upcoming works, disturbance areas, and compensation	No Issues at the end of the conversation
31/07/2019	Joe Cronin	S19 pastoralists – West Balbarini	Sublease holder agreement	-	Land mail sent with sublease holder agreement letter	-
31/07/2019	Lou & David Daniell	S19 pastoralists –	Sublease holder agreement	-	Email sent with sublease holder agreement letter	-

Date	Contact	Company	Information Provided	Objections	Discussion / Assessment of Objections	Outcome / Response
		West Balbarini				
20/08/2019	Tossa Murphy	S19 pastoralists	Upcoming works, disturbance areas and compensation	-	Phone call: Discussed upcoming works, disturbance areas, and compensation	No Issues at the end of the conversation
20/08/2019	Tossa Murphy	S19 pastoralists	Sublease holder agreement	-	Email sent with sublease holder agreement letter	-
20/08/2019	Kerry King	Heartbreak hotel	Accommodation and meals requirements. Schedule		Phone call; Discussed upcoming works, accommodation and meals. Email; schedule and personnel levels for upcoming works, accommodation and meals.	All scheduled.

Appendix 3. Natural Resource Management Report

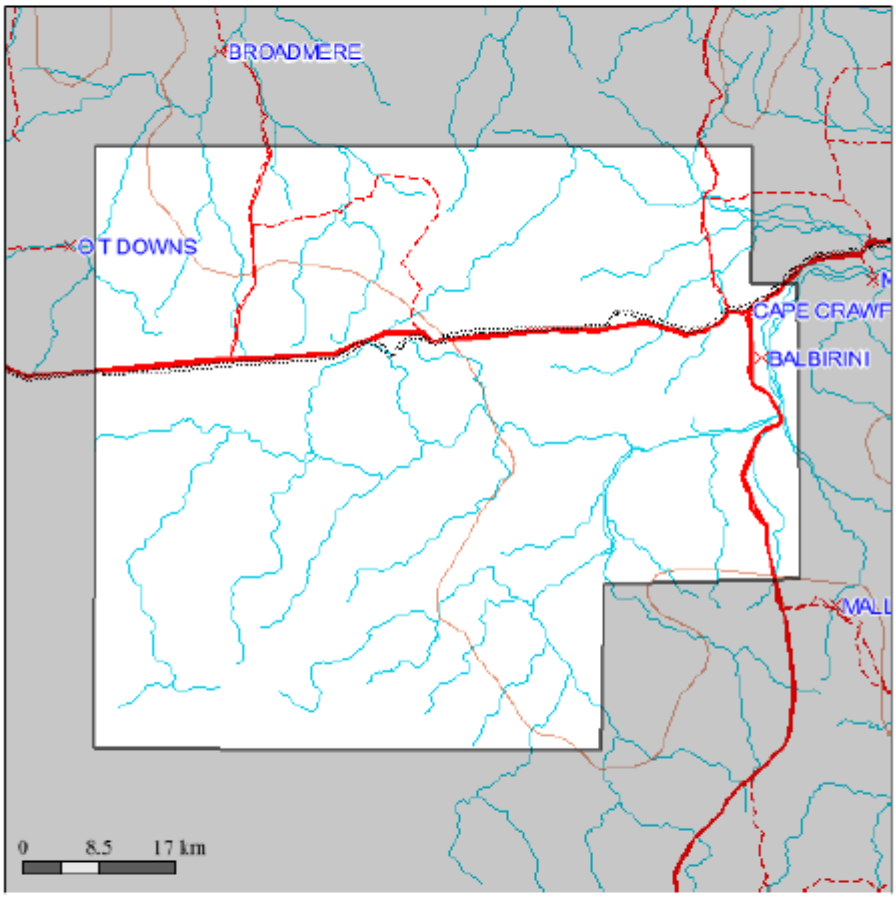


Custom area

Custom area encompasses an area of 4482.12 sq km extending from 16 deg 31.0 min to 17 deg 7.0 min S and 135 deg 4.0 min to 135 deg 46.0 min E.
Custom area is located in the Gulf Fall and Uplands, Sturt Plateau, bioregion(s)



Location of Custom area

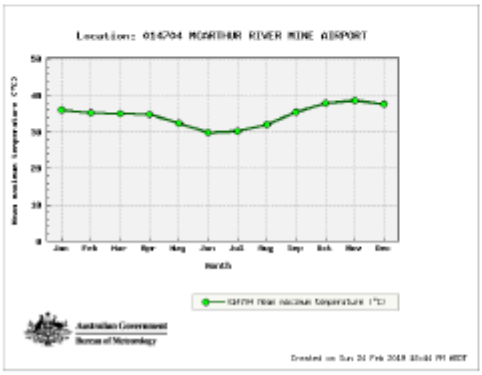


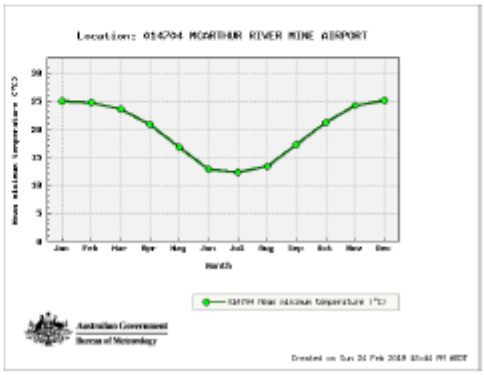
Custom area Climate

The closest long-term weather station is MCARTHUR RIVER MINE (16 deg 26.0 min S, 136.076E) 80 km NE of the center of selected area

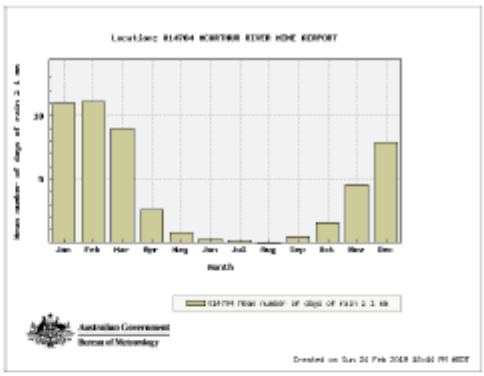
Statistics	Annual Values	Years of record
Mean max temp (deg C)	34.6	41
Mean min temp (deg C)	19.8	41
Average rainfall (mm)	766.9	41
Average days of rain	49.6	47

Climate summaries from Bureau of Meteorology (www.bom.gov.au)



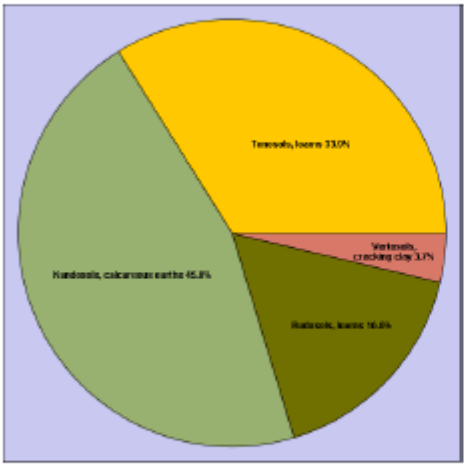






Custom area Soils

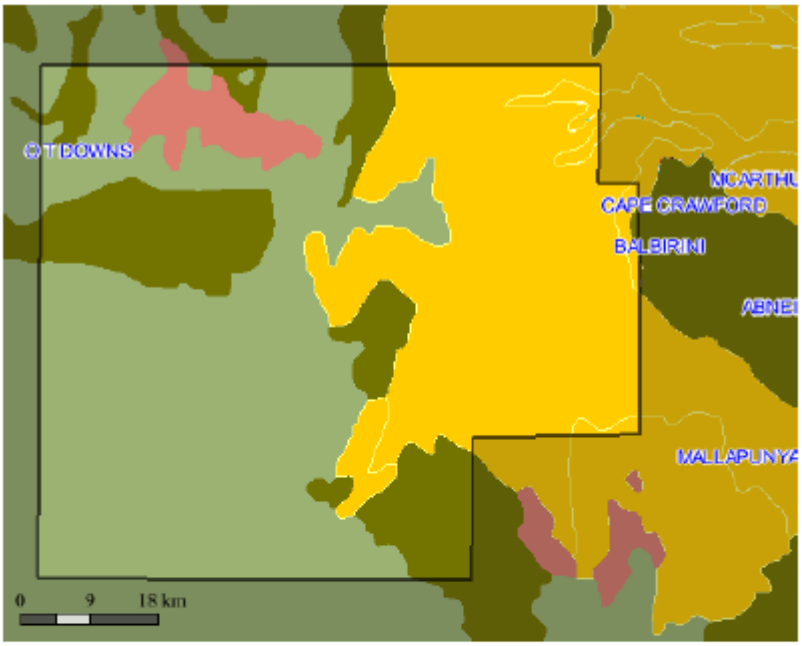
Soil Types



Area of soil types (Northcote Factual Key)

Category	Area sq km	Area%
Kandosols, calcareous earths	2053.05	45.81
Tenosols, loams	1518.69	33.88
Rudosols, loams	744.49	16.61
Vertosols, cracking clay	165.89	3.70

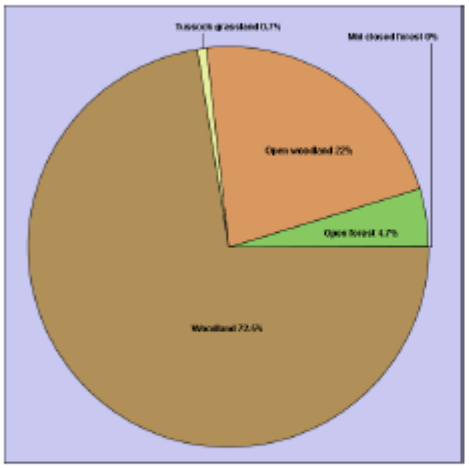
Soil Types



Soils 1:2M Layer is a copy of the NT portion (1:2,000,000 scale dataset) of the CSIRO Atlas of Australian Soils - K.H. Northcote et al. Data scale: 1:2,000,000 ANZLIC identifier: 2DBCB771205D06B6E040CD0B0F274EFE
More details: Go to www.lrm.nt.gov.au/nrmapert/ and enter the ANZLIC identifier in the Spatial Data Search

Custom area Vegetation

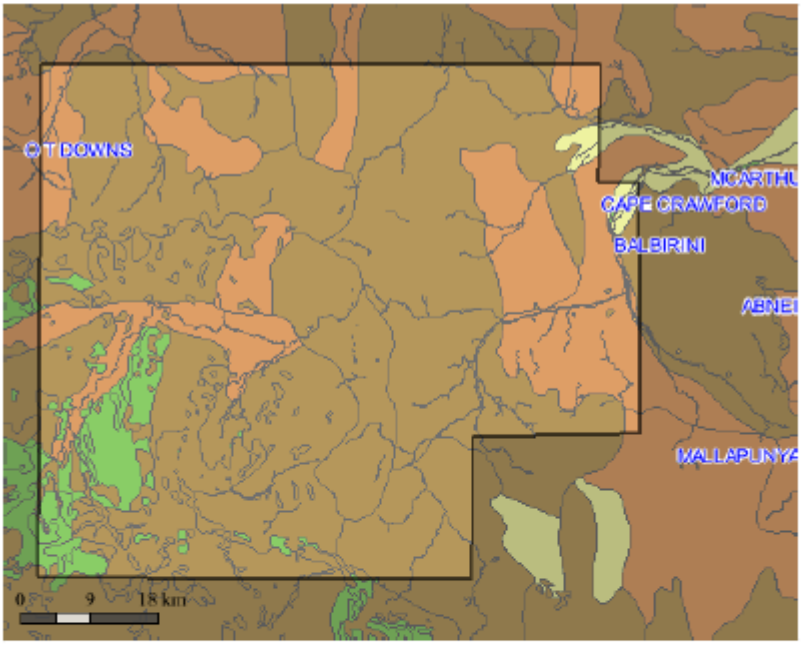
Vegetation Communities



Area of vegetation communities

Category	Area sq km	Area%
Woodland	3251.73	72.55
Open woodland	987.17	22.02
Open forest	210.61	4.70
Tussock grassland	31.91	.71
Mid closed forest	.70	.02

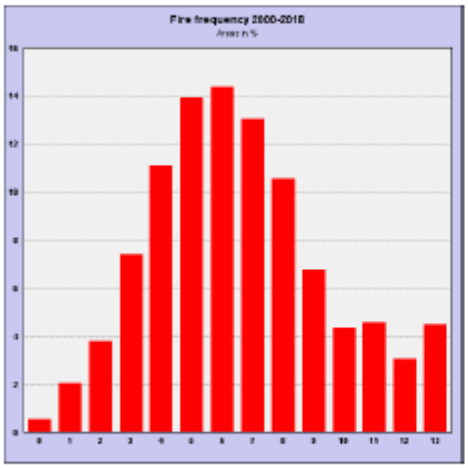
Vegetation Communities



The NVIS 2005 Layer is compiled from a number of vegetation and land unit survey maps that were recoded and re-attributed for the National Vegetation Information System (NVIS)
Data scale variable depending on location. ANZLIC Identifier:2DBCB771207006B6E040CD9B0F274EFE
More details:Go to www.lrm.nt.gov.au/mapent/ and enter the ANZLIC identifier in the Spatial Data Search

Custom area Fire History

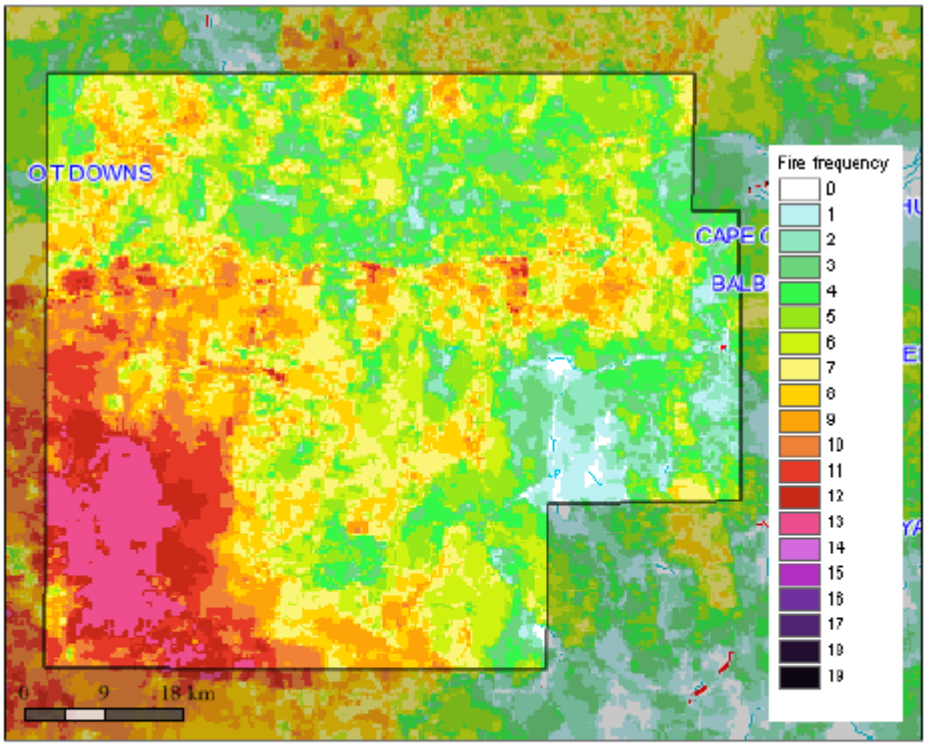
Fire frequency 2000-2018



area burnt for each fire frequency category 2000-2018

Category	Area sq km	Area%
0	23.78	.53
1	90.62	2.02
2	169.34	3.78
3	331.73	7.40
4	497.62	11.10
5	624.57	13.93
6	644.30	14.37
7	584.42	13.04
8	473.23	10.56
9	303.39	6.77
10	195.63	4.36
11	205.37	4.58
12	136.99	3.06
13	201.13	4.49

Fire frequency 2000-2018



The fire frequency(250m) Layer is derived from satellite imagery sourced from the Moderate Resolution Imaging Spectroradiometer (MODIS) on the NASA Terra satellite Spatial Resolution: 250m x 250m pixels (at Nadir).

Custom area Threatened Species

Threatened species recorded in Custom area (Records Updated: Sept 2013)

Group	Common Name	Scientific Name	NT Status	National Status	ID	#Observations (Latest)	#Specimens (Latest)	#Surveys (Latest)
Reptiles	Mitchell's Water Monitor	*Varanus mitchelli*	VU	.	.	0 (Unknown)	1 (1975)	0 (Unknown)
Birds	Painted Honeyeater	*Grantiella picta*	VU	VU	.	1 (1978)	0 (Unknown)	0 (Unknown)
Birds	Gouldian Finch	*Erythrura gouldiae*	VU	EN	176370	1 (1976)	0 (Unknown)	1 (2001)
Mammals	Golden-backed Tree-rat	*Mesembriomys macrurus*	CR (PE)	VU	176951	4 (Unknown)	1 (1901)	0 (Unknown)

EX = Extinct
EW = Extinct in the Wild
ER = Extinct in the NT
EN = Endangered
EN/VU = One Endangered subspecies/One Vulnerable subspecies
VU=Vulnerable
VU- = One or more subspecies vulnerable EN- = One or more subspecies endangered

Survey = this category refers to data collected using systematic survey methodology
Specimen = this category refers to museum or other records where a specimen has been collected and lodged
Observation = this category refers to all other incidental recordings where systematic methodology may not have been used consistently.

More species info: Go to www.landmanager.org.au/view/index.aspx?id=#### where #### is the ID number from the tables above for the species of interest.

Custom area Threatened Species Grid

Threatened species recorded in the grid cell(s) in which Custom area occurs (Records Updated: Sept 2013)

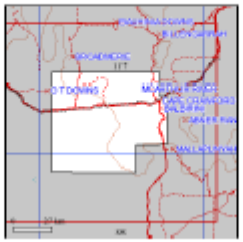
Group	Family Name	Scientific Name	Common Name	NT Status	National Status	#Observations	Latest Observation Date	#Specimens	Latest Specimen Date	#Surveys	Latest Survey Record
Reptiles	Varanidae	*Varanus mitchelli*	Mitchell's Water Monitor	VU		0	Unknown	2	1976	0	Unknown
Reptiles	Varanidae	*Varanus panoptes*	Yellow-spotted Monitor	VU		0	Unknown	0	Unknown	1	1990
Reptiles	Elapidae	*Acanthophis hawkei*	Plains Death Adder	VU	VU	0	Unknown	4	1980	0	Unknown
Birds	Columbidae	*Geophaps smithii*	Partridge Pigeon	VU	VU	3	1911	0	Unknown	0	Unknown
Birds	Tytonidae	*Tyto novaehollandiae kimberli*	Masked Owl (northern mainland)	VU	VU	0	Unknown	1	1913	0	Unknown
Birds	Maluridae	*Amytornis dorotheae*	Carpentarian Grasswren	EN	EN	2	1994	4	1917	0	Unknown
Birds	Meliphagidae	*Grantiella picta*	Painted Honeyeater	VU	VU	1	1978	3	1917	0	Unknown
Birds	Estrildidae	*Erythrura gouldiae*	Gouldian Finch	VU	EN	7	2009	0	Unknown	1	2001
Mammals	Phalangeridae	*Trichosurus vulpecula vulpecula*	Common Brushtail Possum (southern)	EN		1	1969	0	Unknown	0	Unknown
Mammals	Muridae	*Mesembriomys macrurus*	Golden-backed Tree-rat	CR (PE)	VU	4	Unknown	1	1901	0	Unknown

EX = Extinct
EW = Extinct in the Wild
ER = Extinct in the NT
EN = Endangered
EN/VU = One Endangered subspecies/One Vulnerable subspecies
VU=Vulnerable
VU- = One or more subspecies vulnerable EN- = One or more subspecies endangered

Survey = this category refers to data collected using systematic survey methodology
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More species info: Go to www.landmanager.org.au/view/index.aspx?id=#### where #### is the ID number from the tables above for the species of interest.

Species listed in the table above were recorded from all the grid cells shown below (red/blue line) that overlap Custom area



Custom area Weeds and Potential Weeds

Introduced plants recorded in the grid cell(s) in which Custom area occurs and that have been identified as problem weeds in one or more locations in northern Australia. Occurrence based on Northern Territory Government databases.

Family Name	Scientific Name	Common Name	NT Status	National Status	Other Status	#Surveys	Latest Record
Asteraceae	*Acanthospermum hispidum*	Starburr	B C			6	2001
Amaranthaceae	*Alternanthera pungens*	Khaki Weed	B C		*DEU NSW SA*	3	2001
Poaceae	*Cenchrus echinatus*	Mossman River Grass	B C		*NSW*	0	Unknown
Poaceae	*Cenchrus pedicellatus*	Mission Grass (annual)			*Weeds4us*	0	Unknown
Cucurbitaceae	*Citrullus lanatus*	Camel Melon			*G&M*	0	Unknown
Cucurbitaceae	*Cucumis melo*	Ulcardo Melon			*DEU*	18	1991
Poaceae	*Echinochloa colona*	Awnless Barnyard Grass			*DEU*	3	2001
Amaranthaceae	*Gomphrena celosioides*	Gomphrena Weed			*DEU*	0	Unknown
Boraginaceae	*Heliotropium indicum*	Indian Heliotrope			*DEU*	0	Unknown
Lamiaceae	*Hyptis suaveolens*	Hyptis	B C		*G&M*	1	1993
Malvaceae	*Malvastrum americanum*	Spiked Malvastrum			*DEU*	4	2008
Fabaceae	*Parkinsonia aculeata*	Parkinsonia	B C	*WONS*	*MP K2 WA1 WA4 Q2 G&M CYP DEU NSW SA*	5	2001
Fabaceae	*Prosopis pallida*	Mesquite	A C	*WONS*	*K2 WA1 WA2 WA4 Q2 G&M NSW SA*	1	1990
Plantaginaceae	*Scoparia dulcis*	Bitter Broom			*DEU*	0	Unknown
Malvaceae	*Sida acuta*	Spiny-head Sida	B C		*WA1 G&M*	0	Unknown
Malvaceae	*Sida cordifolia*	Flannel Weed	B C		*WA1 G&M DEU*	1	1993
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	B C		*MP G&M DEU*	4	1994
Malvaceae	*Sida spinosa*	Spiny Sida			*DEU*	9	1999
Poaceae	*Sporobolus fertilis*	Giant Parramatta Grass			*Q2 G&M NSW*	0	Unknown
Fabaceae	*Stylosanthes hamata*	Caribbean Stylo			*DEU*	3	2001
Fabaceae	*Stylosanthes humilis*	Townsville Lucerne			*DEU*	0	Unknown
Zygophyllaceae	*Tribulus terrestris*	Caltrop	B C		*CYP SA*	0	Unknown
Fabaceae	*Vachellia farnesiana*	Sweet Acacia			*DEU*	9	2010
Fabaceae	*Vachellia nilotica*	Prickly Acacia	A C	*WONS*	*MP K2 Q2 G&M DEU NSW*	0	Unknown
Asteraceae	*Xanthium strumarium*	Noogoora Burr	B C		*MP WA1 WA2 WA4 DEU NSW SA*	0	Unknown

Status Codes:
1. NATIONAL STATUS CODES
Alert, Alert List for Environmental Weeds (Please call Exotic Plant Pest Hotline 1800 084 881 if you think you have seen this weed)
Sleeper, National Sleeper Weed
Target,Targeted for eradication. (www.landmanager.com.au/view/index.aspx?id=449837)
WONS, Weeds of National Significance

2. NT STATUS CODES
A, NT Class A Weed (to be eradicated)
B, NT Class B Weed (growth & spread to be controlled)

C, NT Class C Weed (not to be introduced) (www.landmanager.com.au/view/index.aspx?id=449659)

3. OTHER STATUS CODES
C&E, Caufield, S. & Edwards, R. (1998) Potential Environmental Weeds in Australia. Candidate Species for Preventative Control. Environment Australia, Canberra (www.landmanager.com.au/view/index.aspx?id=394504)
CYP, Draft Cape York Peninsula Pest Management Plan 2006-2011 (www.landmanager.com.au/view/index.aspx?id=371200)
DEU, Plants listed as environmental weeds by the Desert Uplands Strategic Land Resource
Assessment (www.landmanager.com.au/view/index.aspx?id=332123)
G&M, Gifoe AC, Martin TG. 2005. The Management of Weeds and Their Impact on Biodiversity in the Rangelands. Cooperative Research Centre (CRC) for Australian Weed Management and CSIRO Sustainable Ecosystems, Commonwealth Australia (www.landmanager.com.au/view/index.aspx?id=163572)
Ge, Grieves et al. 2003. Weed categories for natural and agricultural ecosystem management. Bureau of
Rural Sciences (www.landmanager.com.au/view/index.aspx?id=388218)
K0, High Priority Weeds not yet established in the Katherine region
K1, High Priority Weeds posing environmental threats in the Katherine region
K2, High Priority Weeds posing existing threats in the Katherine region, as described in the Katherine Regional Weed Management Strategy 2005-2010 (www.landmanager.com.au/view/index.aspx?id=130286)
MP, Northern Territory Parks & Conservation Masterplan (www.landmanager.com.au/view/index.aspx?id=144141)
NAQS, North Australian Quarantine Strategy Target List (www.landmanager.com.au/view/index.aspx?id=449418)
NSW, Declared Noxious Weed in NSW (www.landmanager.com.au/view/index.aspx?id=449662)
Q1, QLD Class 1 Weed (not to be introduced, kept or supplied)
Q2, Class 2 Weed (eradicate where possible, not to be introduced, kept or supplied)
Q3, Qld Class 3 Weed (to be controlled near environmentally sensitive areas- not to be supplied/sold without a permit) (www.landmanager.com.au/view/index.aspx?id=190714)
SA, Declared Plant in South Australia (www.landmanager.com.au/view/index.aspx?id=449666)
Weeds/Aus, Listed as a significant weed by Weeds Australia (www.landmanager.com.au/view/index.aspx?id=14578)
WA1, WA Weed Class P1 (movement prohibited)
WA2, WA Weed Class P2 (aim to eradicate)
WA3, WA Weed Class P3 (control infestations)
WA4, WA Weed Class P4 (prevent spread)
WA5, WA Weed Class P3 (control infestations on public land) (www.landmanager.com.au/view/index.aspx?id=449664).

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Observation = this category refers to all other incidental recordings where systematic methodology may not have been used consistently.

More species info: Go to www.landmanager.org.au/view/index.aspx?id=#### where #### is the ID number from the tables above for the species of interest.

Plants listed in the table above were recorded from all the grid cells shown below (red/blue line) that overlap Custom area

Custom area Pest and Potential Pest Animals

Animals with pest potential recorded in the grid cell(s) in which Custom area occurs. Occurrence based on Northern Territory Government databases.

Common Name	Scientific Name	NT Status	National Status	ID	#Observations (Latest)	#Specimens (Latest)	#Surveys (Latest)
Cane Toad	*Rhinella marina*	P	.	183252	5 (2006)	5 (2006)	6 (1996)
Asian House Gecko	*Hemidactylus frenatus*	P	.	188064	0 (Unknown)	2 (2006)	0 (Unknown)
Rock Dove	*Columba livia*	P	.	183336	1 (1978)	0 (Unknown)	0 (Unknown)
Red-tailed Black-cockatoo	*Calyptorhynchus banksii macrorhynchus*	N	.	223765	31 (2000)	4 (1913)	0 (Unknown)
Sulphur-Crested Cockatoo	*Cacatua galerita*	N	.	223772	25 (2001)	2 (1913)	3 (1993)
House Sparrow	*Passer domesticus*	P	.	183322	1 (1978)	0 (Unknown)	0 (Unknown)
Agile Wallaby	*Macropus agilis*	N	.	223786	1 (1986)	0 (Unknown)	0 (Unknown)
Dingo / Wild dog	*Canis lupus*	N	.	183280	3 (1989)	16 (1989)	0 (Unknown)
Cat	*Felis catus*	P	.	183259	2 (1985)	1 (1978)	1 (1990)
Donkey	*Equus asinus*	P	.	183287	0 (Unknown)	0 (Unknown)	1 (1993)
Horse	*Equus caballus*	P	.	183315	9 (1988)	0 (Unknown)	0 (Unknown)
Cattle	*Bos taurus*	P	.	183266	4 (1988)	0 (Unknown)	3 (1993)

NT STATUS CODES:
Int, Introduced species (all non-prohibited vertebrates, and all other exotic species (www.landmanager.com.au/view/index.aspx?id=280771)
N, Native species with pest potential.
P, Prohibited species (all exotic vertebrates except those listed as non-prohibited (www.landmanager.com.au/view/index.aspx?id=450509)

Survey = this category refers to data collected using systematic survey methodology
Specimen = this category refers to museum or other records where a specimen has been collected and lodged
Observation = this category refers to all other incidental recordings where systematic methodology may not have been used consistently.

More species info: Go to www.landmanager.org.au/view/index.aspx?id=#### where #### is the ID number from the tables above for the species of interest.

Potential pest animals listed in the table above were recorded from all the grid cells shown below (red/blue line) that overlap Custom area



Generated from NT Infonet (http://www.infonet.org.au) Tue Jun 25 11:14:32 CST 2019

Soils and vegetation graphs and tables refer to area of soils and vegetation only. Fire graphs and tables refer to entire selected area including sea if present. Calculations are derived from map images or vector data, and should be taken as a guide only. Accuracy cannot be guaranteed. For small areas, figures should be rounded to the nearest whole number.

Fire map layers used in these reports have been updated in 2018 so their pixels are aligned to the same grid.

Appendix 4. Road Agency Approval

Imperial is applying for a Permit to work within NT Government Road Reserve.
Approvals will be attached here when received.

Appendix 5. Environmental Assessment Report (Likelihood of Occurrence)

EP187 Environmental Assessment Report
2019 Seismic and Drilling Program

Report IG-02

May 2019



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DOCUMENT AUTHORISATION					
Revision		**Rev. Date**		**Report Details**	
a		1 June 2019		Draft report	
Prepared By		**Reviewed By**		**Authorised By**	
P.F		K. A.		P. Fox	

Executive Summary

Imperial Oil & Gas Pty Ltd (Imperial) proposes to undertake an exploration program in the geographic area of the Northern Territory known as the Central Southern McArthur Basin. This region is covered by the tenement EP187 and is located in the southern and western gulf areas known as the Gulf Fall and Coastal Plain.

A number of previous environmental investigations have been undertaken on EP187 to gain an understanding of seasonal baseline surface water quality and also landscape values across the tenement. This was undertaken in accordance with Imperial's commitment to environmental stewardship and to inform potential exploration areas with consideration of environmental values and sensitive areas.

A revised desktop assessment and further targeted surveys were undertaken in October 2018, November 2018 and April 2019 with specific focus on Imperial's proposed seismic lines and well pads. The ecological assessment was carried out to identify weeds, key ecological characteristics and potential constraints to the proposed seismic and drilling activities on EP187 in the Northern Territory.

No threatened fauna or flora species were observed during on-ground surveys. Habitat exists for some conservation significant species in the area, however given the narrow linear nature of disturbance (and localised disturbance regarding well pads), species habitat requirements and likelihood of occurrence, impacts from proposed seismic and well pad construction are considered low.

This report was prepared by Mr P. Fox (BSc (App. Env Sci)(Hons)). Mr Fox is a Principal Ecologist with over 20 years experience in undertaken environmental assessments across Australia and Papua New Guinea. He has undertaken numerous surveys in the McArthur River catchment since 2011. He was involved in the field surveys on EP187 during previous employment.

1 INTRODUCTION

Imperial Oil & Gas Pty Ltd (Imperial) proposes to undertake an exploration program in the geographic area of the Northern Territory known as the Central Southern McArthur Basin. This region is covered by the tenement EP187 and is located in the southern and western gulf areas known as the Gulf Fall and Coastal Plain.

Several environmental investigations have previously been undertaken across EP187, including targeted flora (including weeds) and fauna surveys along the proposed seismic lines and well pads. Other investigations have involved developing baseline surface water quality data, targeted waterway assessments and landscape scale environmental assessments. During weed surveys undertaken in 2018 and 2019, concurrent biodiversity assessments were undertaken including the likelihood of occurrence of Northern Territory and Commonwealth listed threatened flora and fauna species. Previous environmental reporting focussed on the weed assessment for the seismic and wells pads, or at a broader landscape level. This report provides addition site specific assessment with particular focus on the proposed 2019 seismic and well pad exploration programs in relation to biodiversity and environmental values.

The following reports and material have been used to prepare this report:

- *Weed Management Plan, 2018 Seismic Program, EP187, Premise (15 November 2018), Report No. 1802587 (rev e)*
- *Environmental Assessment Report, EP184 and EP187, Premise (August 2018), Report No. 1802426 (rev a)*
- *Preliminary Ecological Assessment Report, EP184 and EP187, End of Dry Season 2015, O2Ecology (February 2016), Report No. R002499b*
- *Previous survey data collected during weed surveys.*

A desktop investigation and ecological assessment was carried out to identify key ecological characteristics and potential constraints to the proposed seismic and well development activities. The scope of the study was to provide:

- habitat and vegetation community descriptions;
- locations and photos of communities and species present;
- locations of fauna breeding places and other habitat features; and
- likelihood of targeted threatened species to occur within or adjacent to the proposed seismic and drilling activities.

This report presents the field survey methods, survey limitations, the results of desktop investigations and findings.

1.1 *Location*

EP187 is situated in the upper reaches of the McArthur River in proximity to the Barkly Tablelands. The tenement lies to the west of the Tablelands Highway and is crossed east to west by the Carpentaria Highway. The main access within the tenement is along the Carpentaria Highway and the Broadmere Road.

1.2 Proposed Seismic and Exploration Program Location

The work program is proposed to occur in the 2019 dry season. A number of historical pastoral access ways exist through the area as well as newer access ways developed by pastoralists holding S19 permits (under the *Aboriginal Land Rights (Northern Territory) Act*). Where available access to seismic lines will utilize the existing roadways and pastoral tracks.
Table 1 and **Table 2** provides the latitude and longitude coordinates of the start and end of the seismic lines and proposed well pads. **Figure 1** provides a map of the proposed route of the seismic lines and well pads.

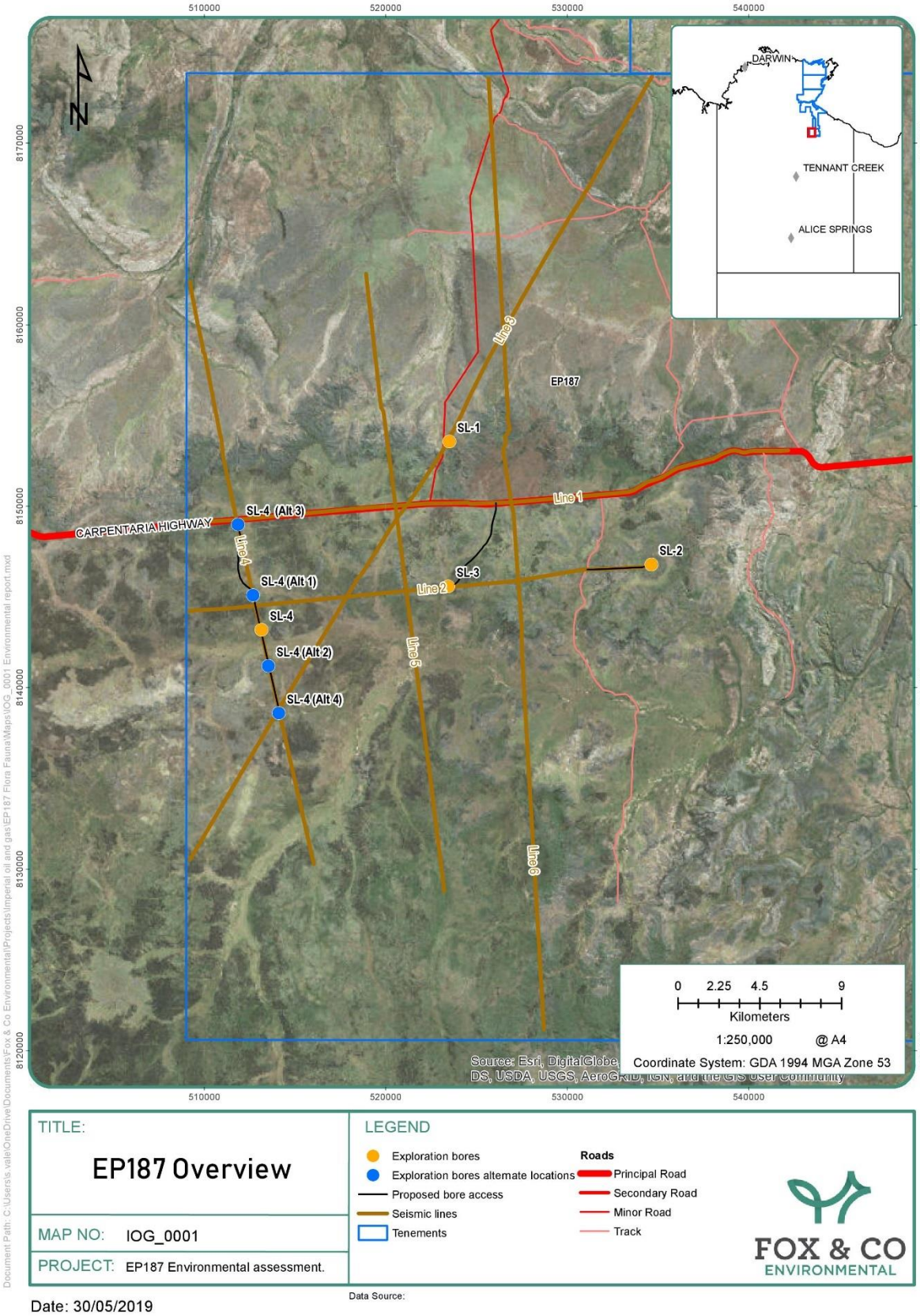
Table 1: Seismic line coordinates for start and end (decimal degrees)

Line	Start Longitude	Start Latitude	End Longitude	End Latitude	Length (km)
1	135.0863884	-16.7411125	135.3952893	-16.71437661	32.9
2	135.0853852	-16.78513537	135.3213451	-16.76289145	25.1
3	135.0864645	-16.90880039	135.3249762	-16.51846278	49.8
4	135.1159045	- 6.94503599	135.0861566	-16.6214288	35.9
5	135.2179975	-16.92453057	135.1772632	-16.61601824	34.2
6	135.2696648	-16.9932462	135.2404939	-16.51967737	52.2

NB: All coordinates are provided in decimal degrees.

Table 2 Coordinates for proposed well pads (options depending on seismic and avoiding sensitive areas)

SITE	Latitude (decimal degrees)	Longitude (decimal degrees)
Exploration bore(s)		
SL-1	-16.700640°	135.220163°
SL-2	-16.761726°	135.324698°
SL-3	-16.772641°	135.219816°
SL-4	-16.794398°	135.123266°
SL-4 (Alt 1)	-16.778475	135.1194361
SL-4 (Alt-2)	-16.8139167	135.1276611
SL-4 (Alt-3)	-16.74204167	135.11109167
SL-4 (Alt-4)	-16.83641	135.1328472
Grid: GDA94 Zone 53K		



TITLE:

EP187 Overview

MAP NO: IOG_0001

PROJECT: EP187 Environmental assessment.

LEGEND

- Exploration bores
- Exploration bores alternate locations
- Proposed bore access
- Seismic lines
- Tenements

Roads

- Principal Road
- Secondary Road
- Minor Road
- Track

FOX & CO ENVIRONMENTAL

Data Source:

Date: 30/05/2019

Document Path: C:\Users\s.vale\OneDrive\Documents\Fox & Co Environmental\Projects\Imperial oil and gas\EP187 Flora Fauna\Maps\IOG_0001 Environmental report.mxd

2 METHOD

This section outlines the methods undertaken to describe the existing environmental values of the Seismic Lines and Well Pad Areas. A combination of desktop assessment and field survey was conducted as part of this study. The desktop assessments included a review of previous investigations in EP187, relevant literature, mapping and database searches. The field survey obtained ecological information and opportunistic observations relevant to the seismic lines and well pads.

2.1 Desktop Assessment

Desktop assessments of available Northern Territory and Commonwealth databases were undertaken prior to the commencement of the field survey to identify records or potential occurrences of conservation significant species and vegetation communities within the study area. A review of previous desktop assessments was undertaken in addition to a revised search of the following databases:

- Commonwealth Department of Environment protected matters search tool (-16.73095, 135.2186)
- The Atlas of Living Australia (ALA) database
  - Australia's Virtual Herbarium (AVH)
  - Online Zoological Collections of Australian Museums (OZCAM)
- BirdLife Australia's Birdata
- Northern Territory Government Department of Environment and Natural Resources (DENR) NR Maps

2.2 Likelihood of Occurrence

An assessment was undertaken of the likelihood of occurrence for threatened fauna and flora species identified through the desktop review. The field survey further informed and verified this likelihood of occurrence assessment. The DOE and the Northern Territory DENR do not have prescriptive likelihood of occurrence guidelines within their policies but rather clarify the scale of assessment required to determine the level of impact (e.g. level of assessment, previous record searches, and distribution maps). The below criteria have been developed with the aim of considering this scale of assessment in order to identify the likelihood of occurrence for threatened species:

- **Low potential to occur** – the species has not been recorded in the region (no records from desktop searches) and/or current known distribution does not encompass study area and/or suitable habitat is generally lacking from the study area.
- **Moderate potential to occur** – the species has been recorded in the region (desktop searches) however suitable habitat is generally lacking from the study area or species has not been recorded in the region (no records from desktop searches) however potentially suitable habitat occurs at the study area.
- **High potential to occur** – the species has been recorded in the region (desktop searches) and suitable habitat is present at the study area.
- **Known to occur** – the species has been recorded on-site in the recent past (i.e. last 5-10 years) and the site provides suitable habitat for it.

2.3 Field Assessments

Surface water quality and landscape scale environmental surveys were undertaken over EP187 in December 2015 and June 2018. Targeted surveys were undertaken in relation to the proposed seismic and drilling activities on EP187 in October 2018, November 2018 and April 2019.

Due to previous restrictions on site access in EP187, ecological assessments undertaken in December 2015 and June 2018 consisted of opportunistic assessments at each water quality sampling location and from the vantage of the helicopter for a broader landscape scale perspective of the study areas. The location of the on-ground assessments during these surveys was therefore in areas adjacent to water. The December 2015 and June 2018 assessments included broad descriptions of vegetation communities, identification of dominant flora species (including weeds) present and habitat

assessments (including aquatic). Opportunistic fauna observations, identification of observed breeding places and targeted threatened species searches were also carried out to help inform subsequent surveys.

Targeted surveys were undertaken in October 2018 along seismic lines and well pads using All-Terrain Vehicles (ATV's) supplied by the DENR weeds branch. DENR weed officers also undertook the surveys with the Premise field teams. Seismic Line 1 was surveyed using a standard 4WD vehicle as it is located immediately adjacent to the Carpentaria Highway. Additional surveys were undertaken using a helicopter in December 2018 and April 2019.

3 EXISTING ENVIRONMENT

A detailed description of the existing environment is provided in the previous environmental assessment reports.

The following provides a more detailed assessment of the areas relevant to the proposed seismic and drilling program.

3.1 Conservation Significant Species

Conservation significant flora and fauna species are those species listed under the provisions of the *Commonwealth EPBC Act* and/or the *Territory Parks and Wildlife Conservation Act 2000* (TPWC Act) including threatened species as well as internationally protected wildlife and migratory species. Threatened species include those with conservation status listed as Endangered, Vulnerable or Near Threatened (EVNT) under the EPBC Act or Extinct in the Wild, Critically Endangered, Endangered or Vulnerable under the TPWC Act. Potentially occurring threatened flora and fauna species are listed in **Appendix B** with an account of their likelihood of presence within the study area based on known records, species biology and ecology and habitats available within the study area. Not all of the threatened species indicated through desktop information are expected to occur within the study area due to the absence of suitable habitat for some species.

No threatened flora species have been previously recorded within the search area. Two (2) threatened fauna species have previously been recorded within the study area. One (1) species (*Mesembriomys macrurus* (golden-backed tree rat)) was recorded over 100 years ago and is now considered locally extinct. The second threatened fauna species (*Erythrura gouldiae* (Gouldian Finch)) was not identified through NT or Commonwealth database searches, but rather is included due to anecdotal evidence.

Table 3 lists the threatened (or significant) fauna and flora species that have previously been recorded within the study area.

Table 4 lists the migratory fauna species that are at least moderately likely to occur within the study area based on the likelihood of occurrence assessment. Species which are specialists of tidal areas are not included.

The following sections summarise findings from each of the databases.

3.1.1 EPBC Protected Matters

A revised Protected Matters Search Tool (PMST) has been undertaken and included in the attached. The Commonwealth Department of the Environment (DoEE) Protected Matters search tool (PMST) was used to identify threatened species and vegetation communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that may occur within the search area. The PMST is a predictive database that identifies EPBC Act listed flora and fauna species with a Moderate Potential to Occur in a given search area based on bioclimatic modelling. The search area was defined by the latitude/longitude coordinates –16.73095, 135.2186 with a 50 km buffer.

The EPBC PMST identified the search area as having potential habitat for no nationally threatened flora species, 13 threatened terrestrial species and 15 migratory species listed under the EPBC Act (**Appendix A**). Nine (9) of the 15 migratory species are specialist marine species and have therefore been excluded from the assessment (including estuarine crocodiles as no suitable habitat exists within the project area).

No Threatened Ecological Communities (TEC), World Heritage Properties, National Heritage Places, Wetlands of International Importance, Great Barrier Reef Marine Park or Commonwealth Marine Area's occur within the study area.

3.1.2 Birdata

BirdLife Australia's Birdata (**Appendix A**) shows records of 92 bird species observed within the search area. Of those, 1 species *Ardeotis australis* (Australian bustard) is listed as Near Threatened (DD) under TPWC Act and 1 species *Merops ornatus* (Rainbow Bee-eater) is a migratory species under the EPBC Act.

3.1.3 Atlas of Living Australia

The ALA database returned records for 3 significant and/or threatened fauna species *Ardeotis australis* (Australian bustard), *Onychogalea unguifera* (Northern nailtail wallaby) and *Mesembriomys macrurus* (golden-backed tree rat) listed under the EPBC Act and/or TPWC Act within the search area.

3.1.4 DENR NR Maps

The Northern Territory Government (NR Maps) http://nrmaps.nt.gov.au/nrmaps.html was used to identify threatened flora and fauna species, sites of conservation significance and sites of botanical significance recorded in EP187.

A query of the DENR NR Maps database returned 5 Data Deficient (DD) plant species and 8 fauna species (9 fauna listed in the below table due to anecdotal observation of Gouldian Finch) that have been historically recorded within the study area. There are no historical records for threatened flora species within the search area. Data Deficient species while not considered threatened species under the EPBC Act or TPWC Act, they are considered Significant Species under the TPWC Act.

Table 3 Threatened species previously recorded in the study area

Class	Species Name	Common Name	EPBC Act Status	TPWC Act Status
Birds	*Erythrura gouldiae*	Gouldian finch[1]	E	V
Birds	*Ardeotis australis*	Australian bustard	-	NT
Birds	*Merops ornatus*	Rainbow bee-eater	migratory	LC
Birds	*Malurus coronatus macgillivrayi*	Purple-crowned fairy-wren	-	NT
Birds	*Burhinus grallarius*	Bush Stone-curlew	-	NT
Mammals	*Onychogalea unguifera*	Northern nailtail wallaby	-	NT
Mammals	*Mesembriomys macrurus*	Golden-backed Tree-rat[2]		CE
Reptiles	*Demansia quaesitor*	Sombre whipsnake	-	DD
Reptiles	*Tiliqua scincoides*	Common blue-tongued lizard	-	DD
Plant	*Eriachne squarrosa*	Eriachne, Wanderrie Grass		DD
Plant	*Ammannia crinipes*	Nesaea		DD
Plant	*Eriocaulon carpentariae*	Eriocaulon		DD
Plant	*Polygala petrophila*	Polygala		DD
Plant	*Dodonaea barklyana*	Distichostemon		DD

EPBC Act (species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Aust.): CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory, Ma = Marine
TPWC Act (species listed under the *Territory Parks and Wildlife Conservation Act 2000* (TPWC Act), NT): CE = Critically Endangered, E = Endangered, V = Vulnerable, NT=Near Threatened, DD = Data Deficient
[1] – anecdotal.
[2] – records from 1901 and presumed locally extinct

Table 4 Migratory species likely to occur within the study area

Class	Species Name	Common Name	EPBC Act Status	TPWC Act Status
Birds	*Apus pacificus*	Fork-tailed swift	Ma, M	-
Birds	*Cecropis daurica*	Red-rumped swallow	M, Ma	-
Birds	*Cuculus optatus*	Oriental cuckoo	Ma	-
Birds	*Hirundo rustica*	Barn swallow	M, Ma	-
Birds	*Motacilla cinerea*	Grey wagtail	M, Ma	-
Birds	*Motacilla flava*	Yellow wagtail	M, Ma	-
Birds	*Merops ornatus*	Rainbow bee-eater	Ma, M	-

EPBC Act (species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Aust.): M = Migratory, Ma = Marine
TPWC Act (species listed under the *Territory Parks and Wildlife Conservation Act 2000* (TPWC Act), NT): NT=Near Threatened

Appendix B provides a table of the species reported in search results with an assessment of their likelihood of occurrence within the seismic and drilling areas. Near Threatened (NT) and/or DD species are not included in the threatened species table.

3.1.5 Weeds and Pests

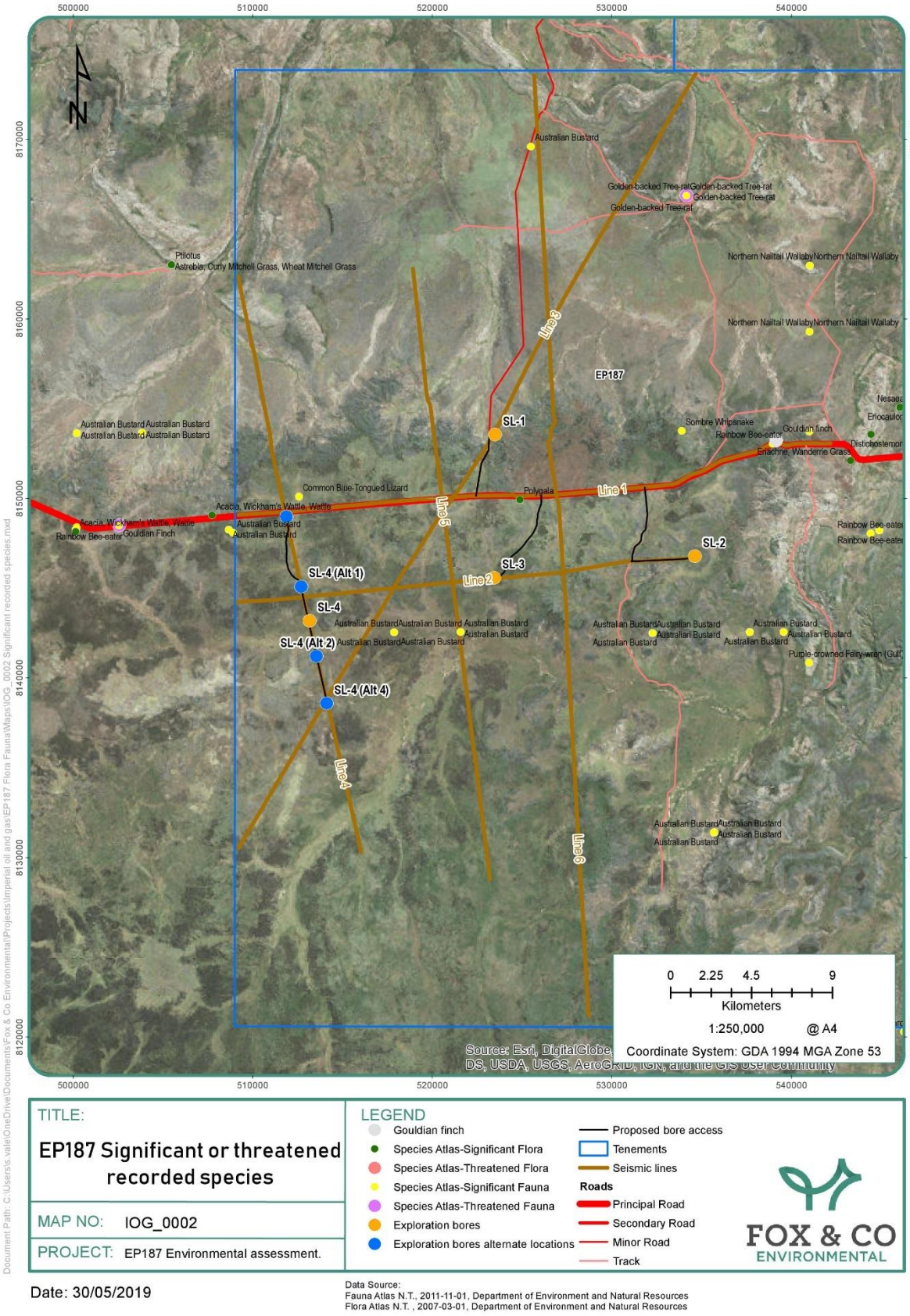
Details of the weeds occurring in relation to the proposed seismic are included in the Weed Management Plan (WMP) prepared by Premise (*Weed Management Plan, 2018 Seismic Program, EP187, Premise Environment, 15 November 2018, Report # 1802587e*). A revised WMP will be prepared to include the proposed well pads and access tracks.

Table 5 provides the weeds reported during 2018 and 2019 surveys

Table 5 Weeds recorded in the survey areas

Species	Common Name	WONS	NT Class
Hyptis suaveolens	Hyptis	-	B
Parkinsonia aculeata	Parkinsonia	-	B
Tribulus sp.	Caltrop	-	B

Refer **Appendix C** for weed survey reports and weed management plan (WMP).


500000
510000
520000
530000
540000
8170000
8160000
8150000
8140000
8130000
8120000
N
EP187
SL-1
SL-2
SL-3
SL-4
SL-4 (Alt 1)
SL-4 (Alt 2)
SL-4 (Alt 4)
Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
Australian Bustard
Golden-backed Tree-rat
Northern Nailtail Wallaby
Common Blue-Tongued Lizard
Polygala
Acacia, Wickham's Wattle, Wattle
Rainbow Bee-eater
Gouldian Finch
Sombre Whipsnake
Purple-crowned Fairy-wren (Gulf)
0 2.25 4.5 9
Kilometers
1:250,000 @ A4
Coordinate System: GDA 1994 MGA Zone 53
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
TITLE:
EP187 Significant or threatened recorded species
MAP NO: IOG_0002
PROJECT: EP187 Environmental assessment.
LEGEND
Gouldian finch
Species Atlas-Significant Flora
Species Atlas-Threatened Flora
Species Atlas-Significant Fauna
Species Atlas-Threatened Fauna
Exploration bores
Exploration bores alternate locations
Proposed bore access
Tenements
Seismic lines
Roads
Principal Road
Secondary Road
Minor Road
Track
FOX & CO ENVIRONMENTAL
Date: 30/05/2019
Data Source:
Fauna Atlas N.T., 2011-11-01, Department of Environment and Natural Resources
Flora Atlas N.T. , 2007-03-01, Department of Environment and Natural Resources
Document Path: C:\Users\s.vale\OneDrive\Documents\Fox & Co Environmental\Projects\Imperial oil and gas\EP187 Flora Fauna\Maps\IOG_0002 Significant recorded species.mxd

4 FIELD ASSESSMENT RESULTS

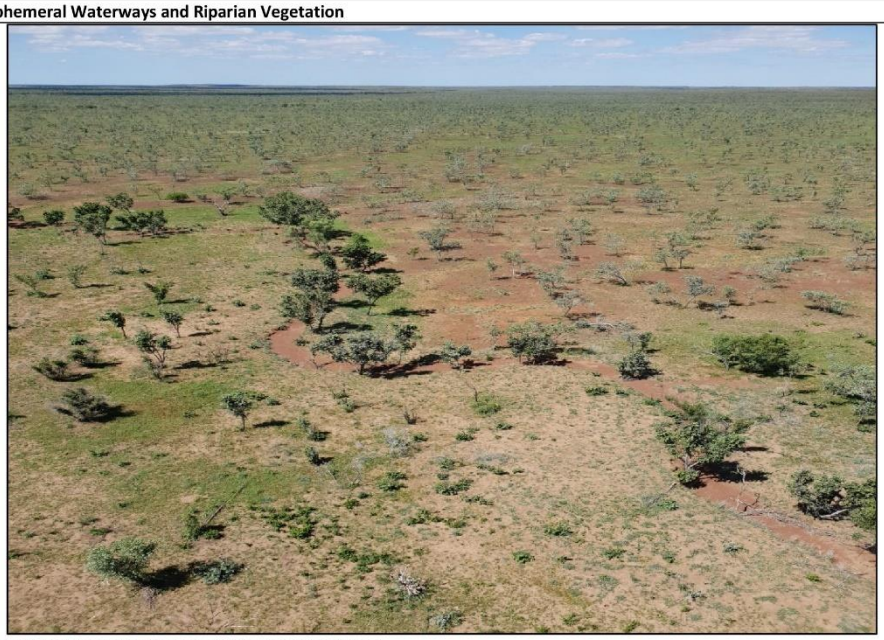
4.1 Threatened Species

No threatened flora or fauna species were observed.
Anecdotal evidence from local pastoralists reported a sighting [unknown date] of Gouldian Finch at the rest area located approximately 500m north of the eastern most extent of Seismic Line 1 (refer **Figure 2**).

4.2 Habitat Descriptions

The following table describes the habitats that occur within the seismic line impact area, including adjacent areas and proposed well pad options. The areas of intact vegetation provide a range of habitats that may support a diversity of fauna species.

Table 6 Habitat Descriptions

Ephemeral Waterways and Riparian Vegetation

Plate 1 Ephemeral waterway and riparian vegetation
Riparian areas often have significantly higher fauna diversity than surrounding areas. Whilst the riparian vegetation in the study area is predominantly sparse woodland (as per the above photo), habitat values include: • Provides water (in wet season) and supports flowering and seeding vegetation as well as prey (aquatic species, invertebrates and small vertebrates) for small mammals, birds and reptiles • Riparian vegetation provides refuge, sheltered movement corridors for fauna and shade for creeks and pools • No pools will be present during proposed works given the 'dry' 2018/19 wet season and the highly ephemeral nature of the drainage lines and waterways in relation to the project areas. • Riparian woodlands associated with Balbirini Creek and Relief Creek have some hollows which are important for hollow-dependent animals (e.g. parrots, bats) • Drainage lines and waterways were impacted by cattle, pigs and buffalo • Potential habitat for Gouldian finch (*Erythrura gouldiae*) where eucalypt and paperbark woodlands, usually with a grassy understorey, occur in the vicinity • Potential habitat for painted honeyeater (*Grantiella picta*) where riparian woodlands have an abundance of mistletoes.

Woodland or Shrubland



Plate 2 Low open woodland, *Eucalyptus pruinosa* woodland

Woodland or shrubland habitat values include:

- Woodland trees and shrubs provide food for sap and nectar eaters and supports prey (invertebrates and small vertebrates) for small mammals, birds and reptiles
- Provide shelter and protected areas for breeding for a variety of fauna, including live vegetation and fallen woody debris
- Woodlands with hollow bearing trees are of critical importance for hollow-dependent animals (e.g. parrots, bats)
- Potential habitat for painted honeyeater (*Grantiella picta*) where woodlands have an abundance of mistletoes, usually where *Acacia* spp. dominate.
- Potential habitat for spectacled hare-wallaby (*Lagorchestes conspicillatus leichardti*) dry *Eucalyptus* and *Acacia* in open forests, open woodland, tall shrublands, tussock grasslands and hummock grasslands

Sandstone Jump-ups and plains. Rocky outcrops.

Plate 3 Rocky habitats
Rocky slopes, stony hills and rock outcrops. Habitat values include: • Provide shelter and protected areas for breeding for a variety of fauna • The rocky habitats are largely unaffected by human impacts such as grazing • Potential habitat for small mammals and reptiles

Open Grassland Plains with Sparse Woodland



Plate 4 Open grassland

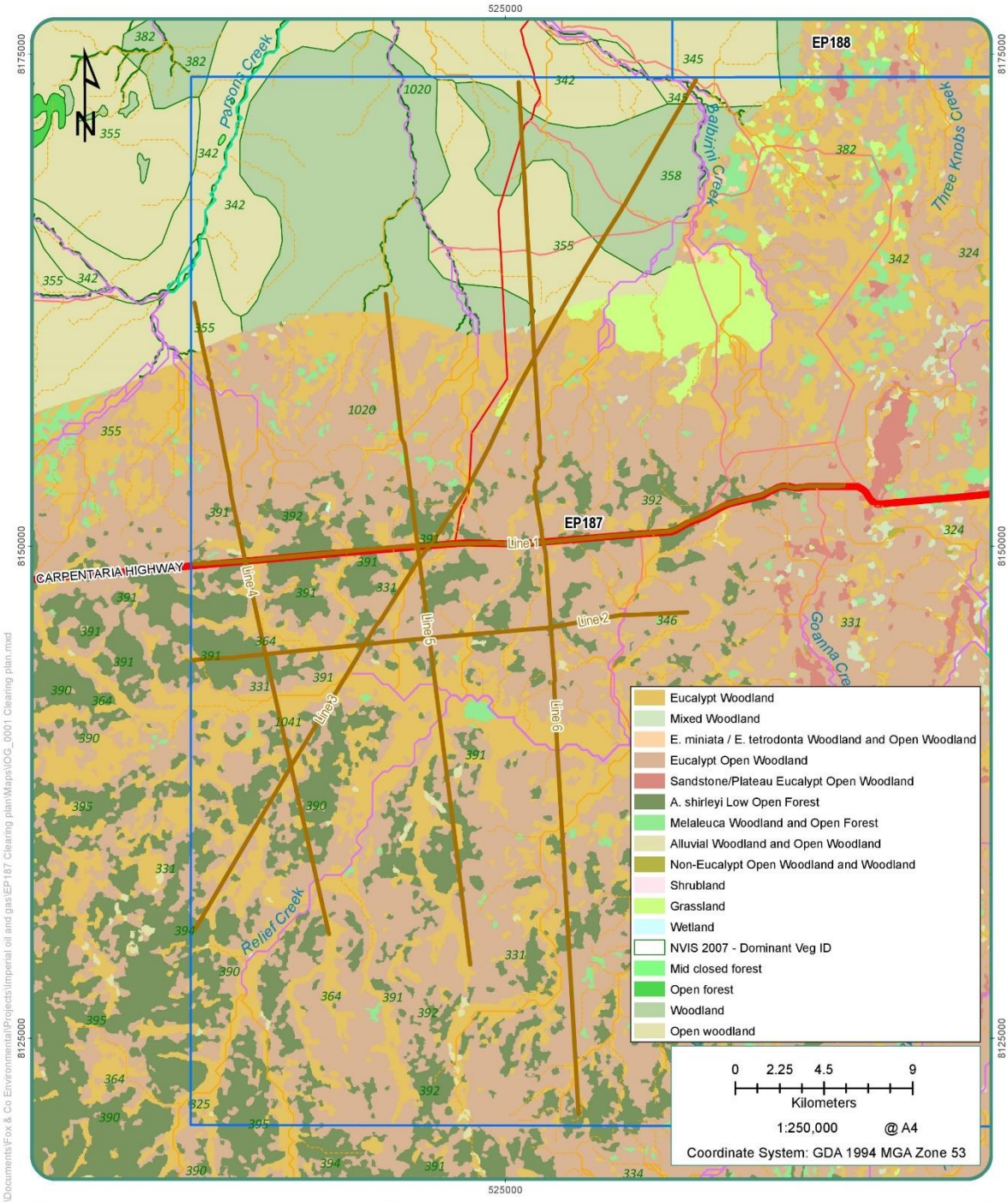
Open grassland on alluvial plains provide:

- deep cracks in dry alluvials which provides refuge for reptiles, amphibians and small mammals
- Large areas open for cattle grazing
- Open areas for raptor foraging

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Acacia shirleyi (lancewood)

Plate 5 Lancewood patches
Lancewood patches provide the thickest vegetation cover in the landscape and therefore provides: • Shade for a variety of fauna species • Fallen branches provide ground cover and refugia for small mammals and reptiles • Open areas for raptor foraging • Potential habitat for painted honeyeater (*Grantiella picta*) where woodlands have an abundance of mistletoes, usually where *Acacia* spp. dominate.


525000
8175000
8150000
8125000
EP188
EP187
Parsons Creek
Balbirini Creek
Three Knobs Creek
Relief Creek
Goanna Cre
CARPENTARIA HIGHWAY
Line1
Line2
Line3
Line4
Line5
Line6
Eucalypt Woodland
Mixed Woodland
E. miniata / E. tetrodonta Woodland and Open Woodland
Eucalypt Open Woodland
Sandstone/Plateau Eucalypt Open Woodland
A. shirleyi Low Open Forest
Melaleuca Woodland and Open Forest
Alluvial Woodland and Open Woodland
Non-Eucalypt Open Woodland and Woodland
Shrubland
Grassland
Wetland
NVIS 2007 - Dominant Veg ID
Mid closed forest
Open forest
Woodland
Open woodland
0 2.25 4.5 9
Kilometers
1:250,000 @ A4
Coordinate System: GDA 1994 MGA Zone 53
TITLE:
Habitats
MAP NO: IOG_0003
PROJECT: EP187 Investigation
LEGEND
Seismic lines (30m corridor)
Tenements
Roads
Principal Road
Secondary Road
Minor Road
Track
Stream Order
Intermittant Streams
1
2
Creeks
3
Rivers
4
5
6
7
FOX & CO ENVIRONMENTAL
Date: 29/05/2019
Data Source:
Vegetation Survey of McArthur River Catchment, Northern Territory, 2011-12-01, Department of Environment and Natural Resources
NVIS Version 3.1 National Vegetation Information System, NT Data Compilation, 2000-01-14, Department of Environment and Natural Resources
Document Path: C:\Users\s.vale\OneDrive\Documents\Fox & Co Environmental\Projects\Imperial oil and gas\EP187 Clearing plan\Maps\IOG_0001 Clearing plan.mxd

5 CONCLUSION

A number of previous environmental investigations have been undertaken on EP187 to gain an understanding of seasonal baseline surface water quality and also landscape values across the tenement. This was to inform potential exploration areas and no-go areas in relation to environmental values.

A revised desktop assessment and further targeted surveys were undertaken with specific focus on Imperial's proposed seismic lines and well pads. The ecological assessment was carried out to identify weeds, key ecological characteristics and potential constraints to the proposed seismic and drilling activities on EP187 in the Northern Territory.

No threatened fauna or flora species were observed during on-ground surveys. Habitat exists for some conservation significant species in the area, however given the narrow linear nature of disturbance (and localised regarding well pads), habitat requirements and likelihood of occurrence, impacts from proposed seismic and well pad construction are considered low.

6 RECOMMENDATIONS

Some additional access tracks have been proposed since field surveys were undertaken in 2018 and April 2019. Additional access tracks have been selected to avoid slopes greater than 2%, waterways/drainage lines and sensitive areas as per the DENR Land Clearing Guidelines, February 2019.

Nonetheless, the following is recommended to ensure compliance with regulatory provisions:

- Undertake additional weed survey on new areas prior to works proceeding.
- Undertake concurrent environmental assessments including threatened / significant species assessment, vegetation and soil descriptions and general assessment of biodiversity and sensitive areas.
- Undertake works in accordance with approved clearing permits and environmental management plans.

7 WORKS CITED AND RELEVANT REFERENCE DOCUMENTS

Cogger, H.G., 2014. Reptiles & Amphibians of Australia 7th ed., CSIRO Publishing.

Curtis, L.K. & Dennis, A.J. eds., 2012. Queensland's Threatened Animals, Collingwood, VIC, Australia: CSIRO Publishing.

Department of the Environment (2019). *Erythrotriorchis radiatus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Thu, 30 May 2019 12:45:32 +1000.

Department of the Environment, 2015h. *Erythrura gouldiae* in Species Profile and Threats Database. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=413 [Accessed May 27, 2015]

Department of the Environment, 2016d. *Falcunculus frontatus whitei* in Species Profile and Threats Database.

Department of the Environment, 2015m. *Macrotis lagotis*. Species Profile and Threats Database. Available at: http://www.environment.gov.au/sprat [Accessed January 20, 2015].

Department of the Environment, 2016g. Mesembriomys macrurus in Species Profile and Threats Database.

Department of the Environment, 2016k. *Saccolaimus saccolaimus nudicluniatus* in Species Profile and Threats Database.

Higgins, P.J., 1999. Handbook of Australian, New Zealand and Antarctic birds Volume 4., Melbourne, Victoria: Oxford University Press.

Morcombe, M., 2003. Field Guide to Australian Birds, Archerfield: Steve Parish Publishing Pty Ltd.

APPENDIX A

Search Results

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

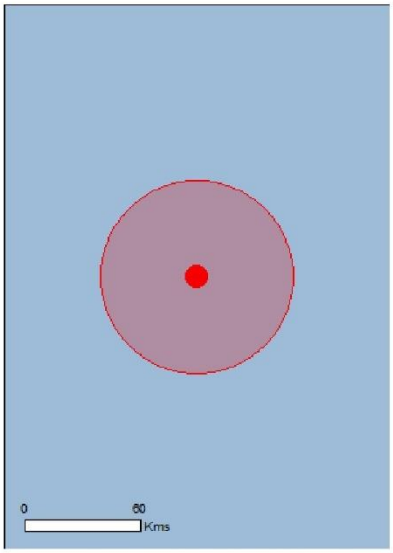
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 16/05/19 10:05:56

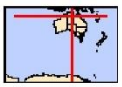
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 50.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	13
Listed Migratory Species:	15

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:	21
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:	16
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 known 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 may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to 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 may occur within area
Elseya lavarackorum Gulf Snapping Turtle [67197]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Sharks		
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Marine Species		
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known 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 may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to 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
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Reptiles		
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Limmen	NT

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Frogs		

Name	Status	Type of Presence
Rhinella marina Cane Toad [83218]		Species or species habitat likely to 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 asinus Donkey, Ass [4]		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
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		
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

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

-16.73095 135.2186

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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Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

NT Significant and Threatened Fauna in relation to IOG 2019 EP187 Proposed Seismic Program

Scientific Name	Common Name	Latitude	Longitude	Date	TWPCA	EPBCA
Demansia quaesitor	Sombre Whipsnake	-16.6986	135.3179	1994-11-01	DD	(not listed)
Malurus coronatus macgillivrayi	Purple-crowned Fairy-wren (Gul	-16.8152	135.3845	1985-06-28	NT	(not listed)
Onychogalea unguifera	Northern Nailtail Wallaby	-16.6152	135.3845	1986-08-24	NT	(not listed)
Onychogalea unguifera	Northern Nailtail Wallaby	-16.6986	135.3845	1986-08-24	NT	(not listed)
Onychogalea unguifera	Northern Nailtail Wallaby	-16.6486	135.3845	1986-08-24	NT	(not listed)
Tiliqua scincoides	Common Blue-Tongued Lizard	-16.7319	135.1179	1994-11-29	DD	(not listed)
Ardeotis australis	Australian Bustard	-17.0008	135.4347	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.9007	135.335	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8003	135.3028	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8002	135.1677	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8	135.2023	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7998	135.3535	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7997	135.3713	2000-11-01	NT	(not listed)
Onychogalea unguifera	Northern Nailtail Wallaby	-16.6486	135.3845	1986-07-21	NT	(not listed)
Onychogalea unguifera	Northern Nailtail Wallaby	-16.6152	135.3845	1986-07-21	NT	(not listed)
Onychogalea unguifera	Northern Nailtail Wallaby	-16.6986	135.3845	1986-07-21	NT	(not listed)
Merops ornatus	Rainbow Bee-eater	-16.7486	135.4212	1978-04-06	LC	(not listed)
Burhinus grallarius	Bush Stone-curlew	-16.7486	135.4212	1978-01-23	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7486	135.0812	1980-06-04	NT	(not listed)
Mesembriomys macrurus	Golden-backed Tree-rat	-16.58	135.32	1901-10-25	CR	(NL)
Mesembriomys macrurus	Golden-backed Tree-rat	-16.58	135.32	1901-10-25	CR	VU
Ardeotis australis	Australian Bustard	-16.8003	135.3028	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.9007	135.335	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7998	135.3535	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7997	135.3713	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-17.0008	135.4347	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7486	135.0812	1980-06-04	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8002	135.1677	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8	135.2023	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7486	135.0812	1980-06-04	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8002	135.1677	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8	135.2023	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8003	135.3028	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.9007	135.335	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7998	135.3535	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7997	135.3713	2000-11-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-17.0008	135.4347	2000-11-01	NT	(not listed)
Merops ornatus	Rainbow Bee-eater	-16.7047	135.3675	2015-05-17	LC	(not listed)
Ardeotis australis	Australian Bustard	-16.5556	135.2389	2006-07-01	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.705	135.3653	2002-04-26	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.75	135.0833	1980-06-04	NT	(not listed)
Merops ornatus	Rainbow Bee-eater	-16.75	135.4167	1978-04-06	LC	(not listed)
Ardeotis australis	Australian Bustard	-16.9007	135.335	2000-11-02 08:06	NT	(not listed)
Ardeotis australis	Australian Bustard	-17.0008	135.4347	2000-11-02 08:38	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7997	135.3713	2000-11-02 07:52	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.7998	135.3535	2000-11-02 07:52	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8003	135.3028	2000-11-02 07:50	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8	135.2023	2000-11-02 07:46	NT	(not listed)
Ardeotis australis	Australian Bustard	-16.8002	135.1677	2000-11-02 07:45	NT	(not listed)

Significant Flora in Relation to IOG 2019 EP187 Seismic Program

Family	Scientific Name	Common Name	Date	Latitude	Longitude	TPWCA	EPBCA	Threatened Species	Significant Species	Endemic to NT	Restricted Range	Growth Form
POACEAE	*Eriachne squarrosa*	Eriachne, Wanderrie Grass	1981-07-06	-16.71333235	135.40612	DD	-	No	Yes	No	N	Tussock grass
LYTHRACEAE	*Ammannia crinipes*	Nesaea	2004-08-04	-16.6864	135.4317	DD	-	No	Yes	No		Forb
ERIOCAULACEAE	*Eriocaulon carpentariae*	Eriocaulon	2004-08-04	-16.6864	135.4317	DD	-	No	Yes	No	N	Forb
POLYGALACEAE	*Polygala petrophila var. petrophila*	Polygala	1947-05-13	-16.73333333	135.23333	DD	-	No	Yes	No	N	Forb
SAPINDACEAE	*Dodonaea barklyana*	Distichostemon	1971-06-04	-16.7	135.41667	DD	-	No	Yes	No		Shrub

APPENDIX B

Likelihood of Occurrence

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Table 7 Likelihood of Occurrence

Species Name	EPBC Act Status	TPWC Act Status	IUCN Status	Habitat Preference	Likelihood of Occurrence
AVES					
Erythrura gouldiae Gouldian Finch	E	V	NT	Inhabits open woodlands that are dominated by Eucalyptus trees and support a ground cover of Sorghum and other grasses. Often found in vegetation along watercourses and mangrove edges. Critical components of suitable core habitat for the Gouldian Finch include the presence of favoured annual and perennial grasses (especially Sorghum), a nearby source of surface water and, in the breeding season, unburnt hollow-bearing Eucalyptus trees (especially *E. tintinnans, E. brevifolia* and *E. leucophloia*) Its breeding habitat is usually confined to ridges and rocky foothills, probably due to the presence of Sorghumgrasses(Department of the Environment 2015h; Morcombe 2003).	**High potential to occur** the species has been recorded in the region (desktop searches) and suitable habitat is present along Balbarini and Relief Creek. This species has been recorded at the rest area (anecdotal evidence), adjacent to the eastern end of Seismic Line 1. No clearing is proposed in this area as the seismic activity runs parallel to the Carpentaria Highway. Risk of impact is considered low.
Falco hyploleucos Grey Falcon	-	V	LC	Grey Falcons live in areas of lightly-timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm. They use nests built by other species and prefer nests in the tallest trees along watercourses. The majority of records from the Northern Territory (NT) are from the southern half, but there are records all the way up to Darwin and also a record from Groote Eylandt (NT Gov (2012) Threatened Species of the Northern Territory).	**Moderate potential to occur** Suitable habitat exists. Given the narrow linear nature of clearing, the likelihood of impact is considered low.
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit	V	-	-	Generally found in open Eucalypt woodlands dominated by Bloodwood, Darwin Box and Roughleaf Cabbage Gum. Species has been recorded in areas with grassy and shrubby understoreys. Seasonally waterlogged areas may attract the species. (Department of the Environment 2016d)	**Low – moderate potential to occur** species has not been recorded in the seismic project area (no records from desktop searches). Minimal clearing of suitable habitat and therefore considered low risk of impact
Grantiella picta Painted Honeyeater	V	V	VU	Sparsely distributed from southern Victoria and south-eastern South Australia to far northern Queensland and eastern Northern Territory where it inhabits forests, woodlands and dry shrublands, often with abundant mistletoe (Birdlife; Morcombe, 2003)	**Low to Moderate potential to occur** the species has been recorded in the region (desktop searches) however not within the study area. Suitable habitat is present anywhere mistletoe is present. Is likely a rare visitor from Qld. Dependent on mistletoe. Avoid clearing Acacia and Eucalypt with

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Species Name	EPBC Act Status	TPWC Act Status	IUCN Status	Habitat Preference	Likelihood of Occurrence
					mistletoe. Risk of impact is considered low.
Tyto novaehollandiae kimberli Masked Owl (northern)	V	V		Inhabits tall, open Eucalypt forests (particularly those dominated by Eucalyptus miniata and E. tetrodonta). Forages in open vegetation and grasslands and typically roosts and nests in tree hollows, though there are recordings of roostings in monsoon rainforests. Home range is estimated to be 5-10 km². Very similar in appearance to the Barn Owl (*Tyto alba*), though the Masked Owl is larger, darker and has more feathering on the feet (Higgins 1999)	**Low to Moderate potential to occur** species has not been recorded in the region (no records from desktop searches) and marginal potentially suitable habitat occurs No large hollows are in the proposed seismic area. No clearing of hollow-bearing trees (HBT) will occur. Risk of impact is considered low.
Erythrotriorchis radiatus Red goshawk	V	V	NT	Occurs in coastal and sub-coastal areas in riverine, wooded and forested lands of tropical and warm-temperate Australia. Known to prefer forest and woodland with a mosaic of vegetation types, large prey populations (birds), and permanent water. The vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins. The Red Goshawk nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are invariably within one km of permanent water (Department of the Environment, 2014b).	**Low potential to occur** No previous records and no suitable habitat
MAMMALIA					
Macroderma gigas Ghost Bat	V	NT		Ghost bats use several roosts or perches each night but often return to the same daytime roost, often in a deep crack or cave. Territory they have been recorded throughout the mainland Top End north of approximately 17⁰ latitude (north of the study area which is 16⁰ latitude) as well as Elcho Island, Groote Eylandt and other nearby islands.	**Low potential to occur** current known distribution does not encompass study area and no suitable habitat in study area.
Macrotis lagotis Greater Bilby	V	V	V	The greater bilby occupies primarily the flat to gently undulating clay areas, but also some stony plains, of the Channel Country amongst a diverse range of annual and perennial grasses and forbs (Curtis & Dennis 2012). The main Queensland population mostly occurs within the Astrebla Downs National Park. Extant population of the Greater Bilby occur in a variety of habitats, usually on landforms with level to low slope topography and light to medium soils. It occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial	**Low potential to occur** current known distribution does not encompass study area

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Species Name	EPBC Act Status	TPWC Act Status	IUCN Status	Habitat Preference	Likelihood of Occurrence
				areas. Laterite and rock feature substrates are an important part of Greater Bilby habitat. These habitat support shrub species, such as *Acacia kempeana, A. hilliana* and *A. rhodophylla*, which have root-dwelling larvae that provide a constant food source for the Greater Bilby. They also contain Spinifex hummocks which are quite uniform and discrete, providing runways between hummocks, enabling easier movement and foraging. Greater bilbies occurrence is strongly associated with higher rainfalls and temperatures, particularly as these conditions may not be favoured by foxes, which are one of their main threats. (Department of the Environment 2015m)	
Mesembriomys macrurus Golden-backed Tree-rat	V	CE	LC	Inhabits a variety of habitat types. Woodlands over tussock or hummock grasses on volcanic country, black soil plains and rugged sandstone country are common, though the Golden-backed Tree-rat has also been associated with mangroves and grasslands on some islands (Department of the Environment 2016g)	**Low potential to occur** current known distribution does not encompass study area Previous records over 100 years old, now considered likely extinct from local area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheathtail Bat	CE	-	-	Inhabits mostly lowland areas where woodland, forest and open areas are present. Foraging has been suggested to take place in habitat edges and clearings, though no information is available on changes in behaviour between wet and dry seasons. Roosting has been solely recorded to occur in tree hollows (Department of the Environment 2016k)	**Low potential to occur** current known distribution does not encompass study area
REPTILIA					
Acanthophis hawkei Plains Death Adder	V	V	-	Found in earth fissures during the dry season and shelters underground debris in the wet season. It is said to be confined to the Barklay Tablelands on the black soil Mitchell grass plains(Cogger 2014).	**Low potential to occur** No previous records. No potential habitat on seismic or well pad areas. Risk considered low due to lack of suitable habitat.
Varanus mertensi Mertens' Water Monitor	-	V	-	Aquatic lizard found on rocks and logs, or tree trunks and branches overhanging rivers, lagoons and swamps. Submerges itself when disturbed (Cogger 2014)	**Low potential to occur** Lack of suitable habitat in the seismic and well pad project areas. This species may potentially occur in the broader landscape of EP187 along permanent waterways and lagoons. This species was recorded in EP184 during previous surveys.
Varanus panoptes Yellow-spotted Monitor	-	V	-	Ground dwelling lizard, feeds mainly on insects and small vertebrates. Can grow to 1.2 metres. Occupies a range of habitats such as coastal beaches, grasslands, floodplains and woodlands (Cogger 2014).	**Moderate potential to occur** Has potential to occur due to wide range of occurrence and wide range of

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Species Name	EPBC Act Status	TPWC Act Status	IUCN Status	Habitat Preference	Likelihood of Occurrence
					habitats. Highly mobile species. Low risk of impact.

EPBC Act (species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Aust.): CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory, Ma = Marine
TPWC Act (species listed under the *Territory Parks and Wildlife Conservation Act 2000* (TPWC Act), NT): CE = Critically Endangered, E = Endangered, V = Vulnerable, NT=Near Threatened
IUCN (species listed under the International Union for Conservation of Nature (IUCN) Red List of Threatened Species): EX= Extinct, EW= Extinct in the Wild, CR= Critically Endangered, EN= Endangered, VU= Vulnerable, NT=Near Threatened, LC= Least Concern

Endangered, VU= Vulnerable, NT=Near Threatened, LC= Least Concern

APPENDIX C

Weed Management Plan

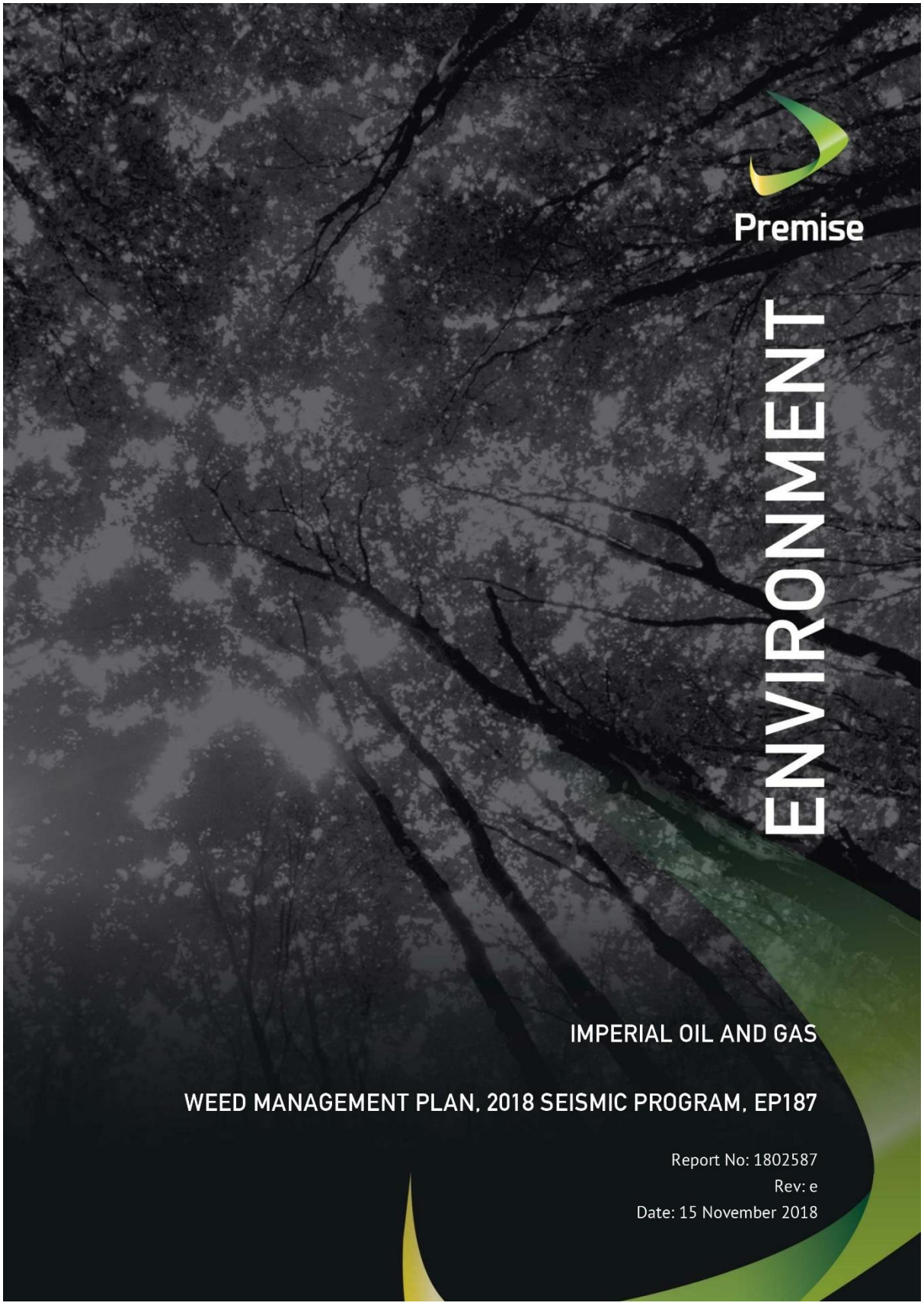

Premise
ENVIRONMENT
IMPERIAL OIL AND GAS
WEED MANAGEMENT PLAN, 2018 SEISMIC PROGRAM, EP187
Report No: 1802587
Rev: e
Date: 15 November 2018

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DOCUMENT AUTHORISATION					
Revision		**Rev. Date**		**Report Details**	
DRAFT		September 2018		Weed Management Plan	
a		September 2018		Minor amendments as per NT DENR review	
b		October 2018		Updated following field surveys	
c		November 2018		Updated following NT DENR final review	
d		12 November 2018		Update following additional field survey	
e		15 November 2018		Update following NT DENR wash/blow down comments	
Prepared By		**Reviewed By**		**Authorised By**	
P.F		A.F		P. Fox	

Executive Summary

Premise conducted a weed assessment on the Imperial Oil and Gas Limited (Imperial) exploration tenement EP187. The focus of the survey was seismic lines proposed for the 2018 seismic program. A desktop assessment was undertaken to identify all declared flora species that have previously been recorded in the area, or at risk of being introduced. A field survey at each proposed seismic line locations was undertaken on the 5-7 October 2018 and 8 November 2018.

Two weed species were recorded during the field survey. Both weeds are Class B declared weeds in the Northern Territory (*Hyptis suaveolens* (Hyptis) and *Parkinsonia aculeata* (Parkinsonia)). Hyptis was primarily recorded along the Carpentaria Highway (and also in some areas along Broadmere Road) in disturbed areas while Parkinsonia was recorded at a stock water bore (No. 3 bore) north of the Carpentaria Highway.

A range of mitigation measures and monitoring protocols have been recommended to reduce the risk and associated impacts of new weed introductions on the tenement.

1 INTRODUCTION

Premise conducted a weed survey on EP187 between 5-7 October 2018 and 8 November 2018. The focus of the survey was approximately 230 kilometres of proposed 2D seismic across the western portion of the tenement. A desktop assessment was undertaken of known weed records and the Northern Territory Department of Environment and Natural Resources (DENR) was consulted to determine which species were considered priority weeds (based on known occurrence and threat of introduction) and the following were named of prime concern:

Mesquite (*Prosopis spp),* Prickly acacia (*Vachellia nilotica),* Parkinsonia (*Parkinsonia aculeata),* Chinee apple (*Ziziphus mauritiana),* Mimosa (*Mimosa pigra),* Bellyache bush (*Jatropha gossypiifolia),* Gamba grass (*Andropogon gayanus),* Neem (*Azadirachta indica),* Grader grass (*Themeda quadrivalvis),* Snake weed (*Stachytarpheta spp),* Devils claw (*Martynia annua),* Hyptis (*Hyptis suaveolens),* Khaki weed (*Alternanthera pungens),* Sida (*Sida acuta, Sida cordifolia, Sida rhombifolia),* Lion's tail (*Leonotis nepetifolia),* Parthenium (*Parthenium hysterophorus)* and Rubber vine (*Cryptostegia spp.).*

A weed is defined as any plant that requires some form of action to reduce its harmful effects on the economy, the environment, human health and amenity. (Natural Resource Management Ministerial Council, 2006). There are two types of invasion: introduction of exotic plants and movement by native species into new areas well outside their native range. Weeds have an adverse effect on an area's environmental values and ecological functioning for the following reasons:

- Competition with native species;
- Change in the structure of a plant community through addition or removal of strata;
- Repress recruitment of native species;
- Change the natural fire fuel characteristics, which can change the natural fire regime to the detriment of native species, often resulting in the loss of native species;
- Change the food sources and habitat values available to native fauna, reducing some and increasing others;
- May change geomorphological processes such as erosion; and
- May lead to changes in the hydrological cycle.

Weed species considered to be of greatest threat to natural and economic values on a national basis have been ranked as Weeds of National Significance (WONS) (Thorp and Lynch 1999). Weed significance at a national level was assessed using four major criteria:

- Invasiveness;
- Impacts;
- Potential for spread; and
- Socio-economic and environmental impacts.

At the Northern Territory level, the *Weeds Management Act* (the Act) identifies those weed species that represent a threat to primary industries, natural resources and the environment. The Act enables 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

1.1 Location

EP187 is situated in the upper reaches of the McArthur River in proximity to the Barkly Tablelands. The tenement lies to the west of the Tablelands Highway and is crossed east to west by the Carpentaria Highway. **Figure 1** displays the location of the tenement area. Access within the tenement is along the Carpentaria Highway and the Broadmere Road.

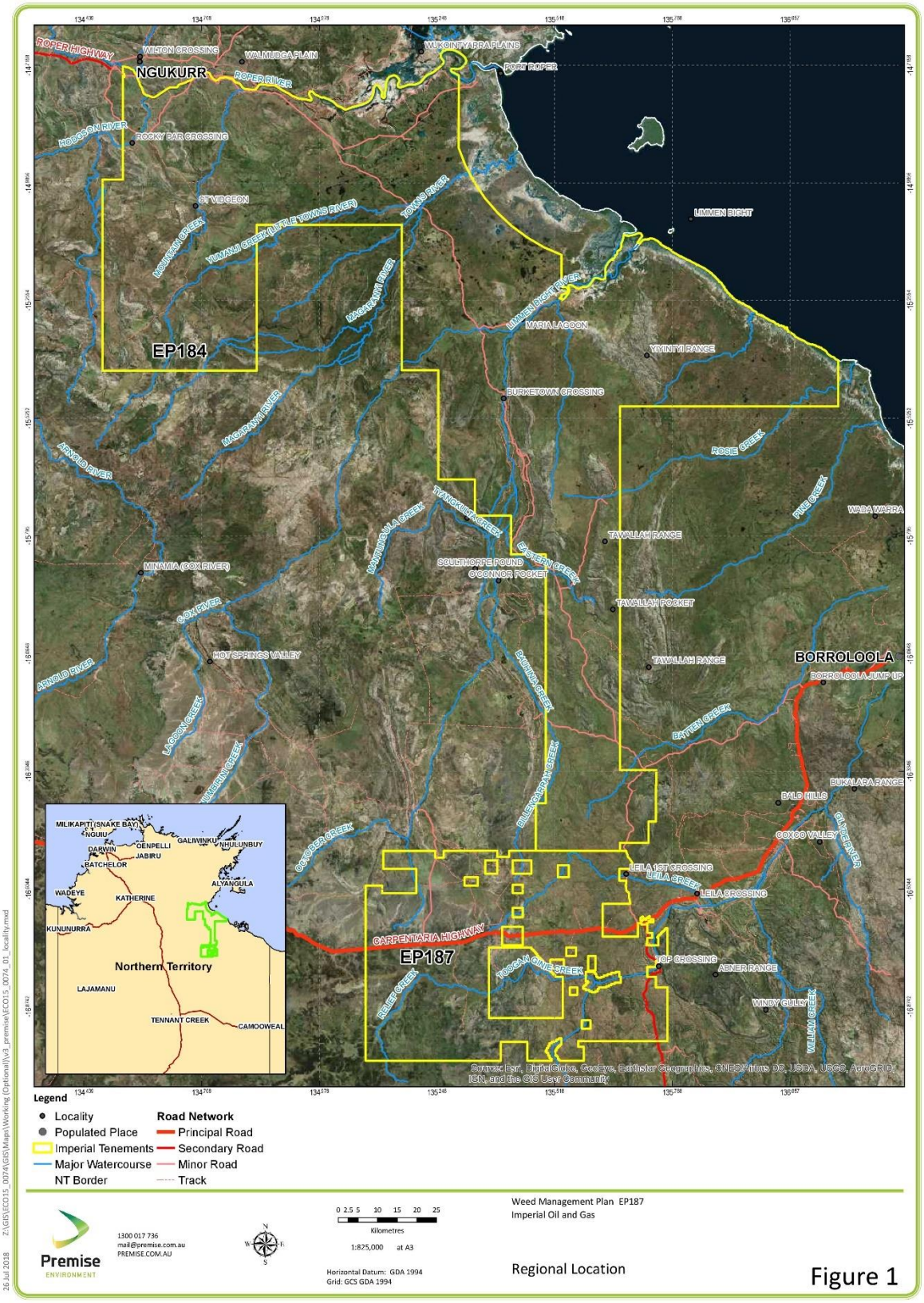
1.2 Proposed Seismic Program Location

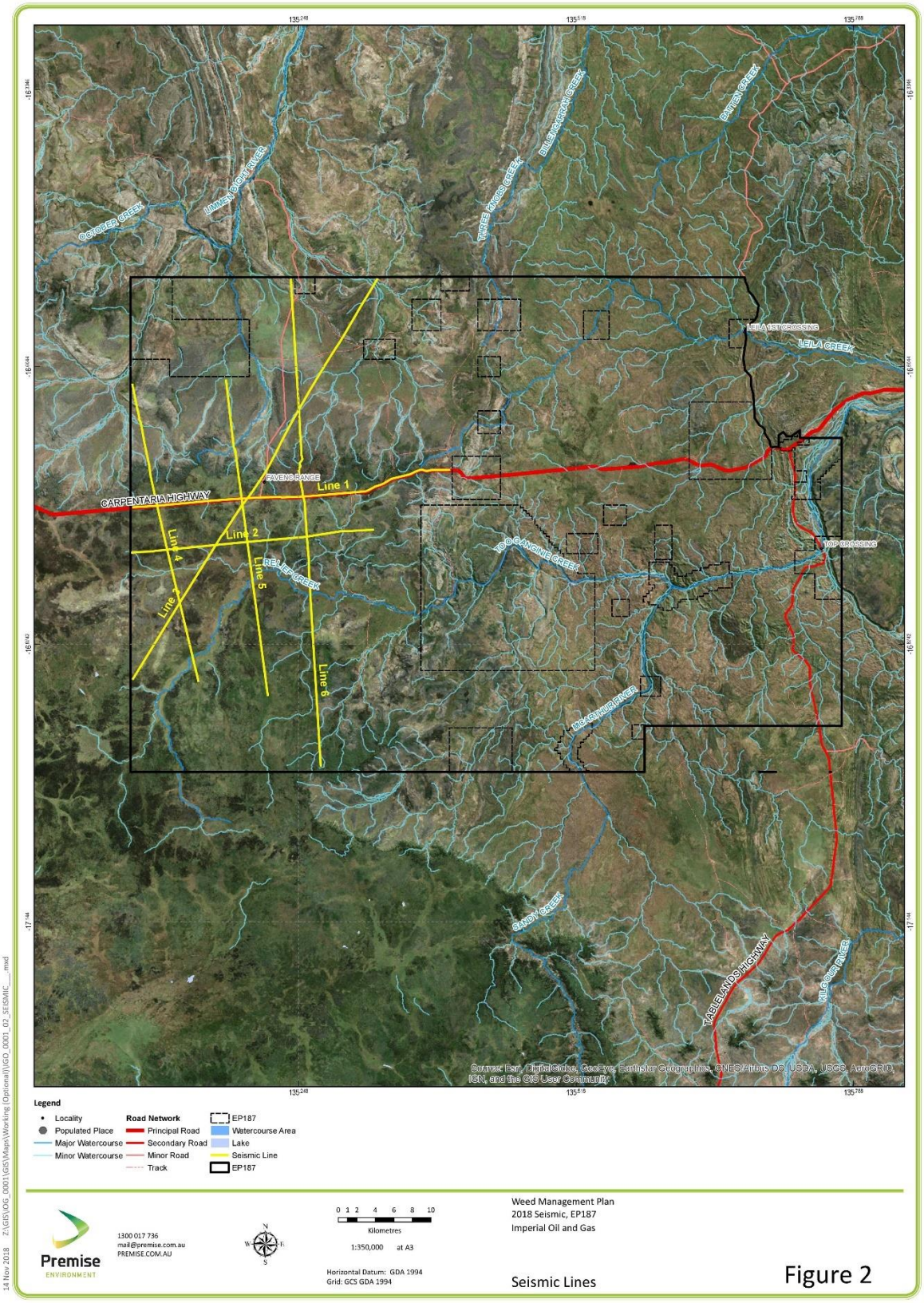
The proposed work program will occur late in the 2018 dry season as soon as practical for machinery and personnel to enter the region after approvals have been received. A number of historical pastoral access ways exist through the area as well as newer access ways developed by pastoralists holding S19 permits (under the *Aboriginal Land Rights (Northern Territory) Act*). Where available access to seismic lines will utilize the existing roadways and pastoral tracks.
Table 1 provides the latitude and longitude coordinates of the start and end of the seismic lines. **Figure 2** provides a map of the proposed route of the seismic lines.

Table 1: Seismic line coordinates for start and end (decimal degrees)

Line	Start Longitude	Start Latitude	End Longitude	End Latitude	Length (km)
1	135.0863884	-16.7411125	135.3952893	-16.71437661	32.9
2	135.0853852	-16.78513537	135.3213451	-16.76289145	25.1
3	135.0864645	-16.90880039	135.3249762	-16.51846278	49.8
4	135.1159045	16.94503599	135.0861566	-16.6214288	35.9
5	135.2179975	-16.92453057	135.1772632	-16.61601824	34.2
6	135.2696648	-16.9932462	135.2404939	-16.51967737	52.2

NB: All coordinates are provided in decimal degrees.


ROPER HIGHWAY
WILTON CROSSING
NGUKURR
WALIMUDGA PLAIN
ROPER RIVER
WUKONIYARRA PLAINS
PORT ROPER
HODGSON RIVER
ROCKY BAR CROSSING
ST VIDGEON
TOWNS RIVER
LIMMEN BIGHT
YOMANI CREEK (LITTLE TOWNS RIVER)
MOWIRAM CREEK
MACARANNI RIVER
LIMMEN BIGHT RIVER
MARIA LAGOON
EP184
YIYINTYI RANGE
BURKETOWN CROSSING
ROSIE CREEK
ARNOLD RIVER
MACARANNI RIVER
TAWALLAH RANGE
PINE CREEK
WADA WARRA
MINAMIA (COX RIVER)
SOUTHORPE POUND
O'CONNOR POCKET
EASTERN CREEK
TAWALLAH POCKET
COX RIVER
HOT SPRINGS VALLEY
BORROLOOLA
BORROLOOLA JUMP UP
BATTEN CREEK
BUKALARA RANGE
BALD HILLS
COXCO VALLEY
LEILA 1ST CROSSING
LEILA CREEK
LEILA CROSSING
CARPENTARIA HIGHWAY
EP187
TOP CROSSING
ABNER RANGE
WINDY GULLY
WILLIAM CREEK
RELIEF CREEK
MILIKAPITI (SNAKE BAY)
NGUIU
DARWIN
JABIRU
BATCHELOR
GALIWINKU
NHULUNBUY
WADEYE
KATHERINE
ALYANGULA
KUNUNURRA
Northern Territory
LAJAMANU
TENNANT CREEK
CAMOOWEAL
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
Locality
Populated Place
Imperial Tenements
Major Watercourse
NT Border
Road Network
Principal Road
Secondary Road
Minor Road
Track
Premise
ENVIRONMENT
1300 017 736
mail@premise.com.au
PREMISE.COM.AU
0 2.5 5 10 15 20 25
Kilometres
1:825,000 at A3
Horizontal Datum: GDA 1994
Grid: GCS GDA 1994
Weed Management Plan EP187
Imperial Oil and Gas
Regional Location
Figure 1
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26 Jul 2018


135.248
135.518
135.788
-16.946
-16.644
-16.342
-17.044
OCTOBER CREEK
LIMMEN BIGHT RIVER
THREE MOOSE CREEK
DILLENGARRAN CREEK
EARTHEN CREEK
LEILA 1ST CROSSING
LEILA CREEK
CARPENTARIA HIGHWAY
FAVENC RANGE
Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
RELIEF CREEK
YOO-GANGINIE CREEK
TOP CROSSING
MASSINGHAM RIVER
SANDY CREEK
BARKLY HIGHWAY
KILGOUR RIVER
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
Locality
Populated Place
Major Watercourse
Minor Watercourse
Road Network
Principal Road
Secondary Road
Minor Road
Track
EP187
Watercourse Area
Lake
Seismic Line
EP187
Premise
ENVIRONMENT
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mail@premise.com.au
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0 1 2 4 6 8 10
Kilometres
1:350,000 at A3
Horizontal Datum: GDA 1994
Grid: GCS GDA 1994
Weed Management Plan
2018 Seismic, EP187
Imperial Oil and Gas
Seismic Lines
Figure 2
14 Nov 2018
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1.3 Legal Requirements

A review of the overall legislative requirements is provided in **Section 9** of the EMP. Of particular relevance to this WMP is the Northern Territory *Weeds Management Act* (the Act)

1.3.1 Weeds Management Act

The purpose of the Act is:

I. 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
II. to ensure there is community consultation in the creation of weed management plans; and
III. to ensure that there is community responsibility in implementing weed management plans.

The Act enables 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

1.4 Recommendations from Scientific Inquiry

1.4.1 Imperial Weed Officer

As per recommendation 8.3 of the *Scientific Inquiry into Hydraulic Fracturing*, gas companies must have a dedicated weed officer for each gas field. To ensure the required weed management outcomes, 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 including but not limited to gamba and grader grass
- Knowledge of relevant weed management frameworks including NT legislation and plans, the EPBC Act; and
- Understanding of existing weed management arrangements being undertaken by landholders

As per **Section 7** of the EMP, the Site Coordinator (SC) will be responsible for weed related issues.

Contact: Raymond (Lou) Daniel
Title: IOG Site Coordinator
Location: Relief Creek
Contact Details: 0428 719 314, Raymond.andrew@outlook.com

1.4.2 DENR Weed Officer

Recommendation 8.3 of the *Scientific Inquiry into Hydraulic Fracturing* requires a dedicated Government weed officer who is responsible for:

- coordinating regional weed baseline assessments and subsequent weed surveillance; and

- overseeing strategic and effective management of any weed incursions by gas companies.

This WMP has been prepared in consultation with the Northern Territory (DENR).

Contact: Tahnee Hill
Title: DENR Katherine Regional Weeds Officer
Location: Katherine, NT
Contact Details: Tahnee.Hill@nt.gov.au

2 WEED INTRODUCTION AND RISKS

Section 1 of the EMP describes the seismic program and activities. In summary the seismic operation involves the following:

- Surveyors – pegging seismic lines
- Line preparation - caterpillar H140 Grader will be used to sweep the ground surface of large rocks and fallen timber.
- Seismic survey
- Stick raking and slashing (Carpentaria Highway)
- Rehabilitation

Table 2 Activities and Risk

Project stage	Risk		Mitigation measures
	Introduction of new weeds	Spread of existing weeds	
Seismic Operations	Machinery and equipment sourced from other locations infested with weed species not found in or around EP area	Traversing of weed infested areas with machinery	KD Machinery of Broadmere Station has been retained to provide the seismic line clearance. These operations with be supported by the indigenous contractor PDG-NT from Borroloola who will provide traffic control where required and additional labour and traditional owners as cultural monitors for the duration of the project. Machinery wash/blow down plans agreed with land owner / manager and implemented. Hygiene: vehicle wash down and inspection/certification of process adhered to and documented. All machinery will be inspected and certified as clean before entry into the project area. All contractors will be required to adhere to this process. Records of the certification will be retained by Imperial and made available immediately should it be requested.

Project stage	Risk		Mitigation measures
	Introduction of new weeds	Spread of existing weeds	
			Mark no-go areas if infestations of WONS and/or Class A/C weeds are found within the seismic lines. GPS marking of blown down sites. GPS records of all wash and blow down sites will be recorded by all operators in the field. These GPS records will be retained by Imperial and the sites inspected as soon as practicable following the wet season to check for weed incursions and to undertake management actions as required.
	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, survey effort conducted at wrong time of year, persons undertaking survey not familiar with / unable to identify declared weed species	Premise and DENR weed surveys undertaken in October/November 2018 prior to seismic to map known weed distribution. Site operators to undergo weed identification training and reporting (onsite training delivered by DENR weed officer). Training for KD Machinery operators.
	Pushing tracks off from the Carpentaria Highway and Broadmere Road into weed free areas	Pushing tracks from identified weed areas into clean weed free areas. Hyptis observed in disturbed areas along Carpentaria Highway and some areas along Broadmere Road.	Ensure to push tracks towards disturbed areas from clean weed free areas. If access is an issue, machinery inspections and washdowns if pushing tracks off Carpentaria Highway and Broadmere Road. Mark weed free areas to be used for access. Clearing, stick raking and slashing off Carpentaria Highway is undertaken last to avoid spreading weeds from the Highway to weed free areas. Wet season spray operations to occur along the Carpentaria highway and Broadmere road to mitigate potential of hyptis spread.

3 WEED SPECIES

The DENR Natural Resource (NR) maps database was used to identify all introduced flora species that have previously been recorded within the area of the tenement associated with the proposed seismic program. Weeds along the Carpentaria Highway between Cape Crawford (Heartbreak Hotel) were also identified as this is the road upon which contractors will be travelling each day. **Figure 3** shows the

historical weed locations and weeds identified during the October 2018 survey. **Figure 4** shows the recent (2018) fire scars over the project area with the recent weed survey results. Hyptis was generally not observed along the Carpentaria Highway (Seismic Line 1) in burnt areas. **Figure 5** shows the additional areas surveyed during the November 2018 seismic weed survey. It should be assumed Hyptis (and potentially other weeds) are present along the burnt disturbed area and mitigation measures should be adhered to.

3.1 Regional Priorities

The DENR *Katherine Regional Weed Management Plan 2015-2020* is guided by three (3) regional priorities to manage weeds. These are:

I. Priority weeds;
II. Priority landscape areas; and
III. Priority pathways of spread

The below table lists weeds that have previously been recorded in the area and also priority weed species as per the *Katherine Regional Weed Management Plan 2015-2020.*

Table 3 Known and/or Priority Weeds

Scientific name	Common name	Declaration	Where located (e.g. on EP, machinery source location, extractive proppant/s, corridors)
*Prosopis spp.**	Mesquite*	WONS, Class A, Class C	Not recorded. Priority weed
*Vachellia nilotica (previously Acacia nilotica)**	Prickly acacia	WONS, Class A, Class C	Previous records. Refer Figure 3.
Parkinsonia aculeata	Parkinsonia	WONS, Class B	Previous and recent (October 2018 survey) records. Refer Figure 3.
*Ziziphus mauritiana**	Chinee apple	Class A, Class C	Not recorded. Priority weed
*Mimosa pigra**	Mimosa	WONS, Class A, Class C	Not recorded. Priority weed
*Jatropha gossypiifolia**	Bellyache bush	WONS, Class A, Class C	Previous records along Carpentaria Highway. Refer Figure 3
*Andropogon gayanus**	Gamba grass	WONS, Class A, Class C	Not recorded. Priority weed
Azadirachta indica	Neem	Class B	Not recorded. Priority weed
Themeda quadrivalvis	Grader grass	WONS, Class B	Not recorded. Priority weed
Stachytarpheta spp	Snake weed	Class B	Not recorded. Priority weed
Martynia annua	Devils claw	Class A	Not recorded. Priority weed
Hyptis suaveolens	Hyptis	Class B	Previous and recent (October 2018 survey) records along Carpentaria Highway. Refer Figure 3
Alternanthera pungens	Khaki weed	Class B	Previous records. Refer Figure 3.
Sida acuta, Sida cordifolia, Sida rhombifolia	Sida	Class B	Previous records. Refer Figure 3.

Leonotis nepetifolia	Lion's tail	Class B, Class C	Previous records. Premise surveys 2015, 2018

*- subject to Statutory Weed Management Plan

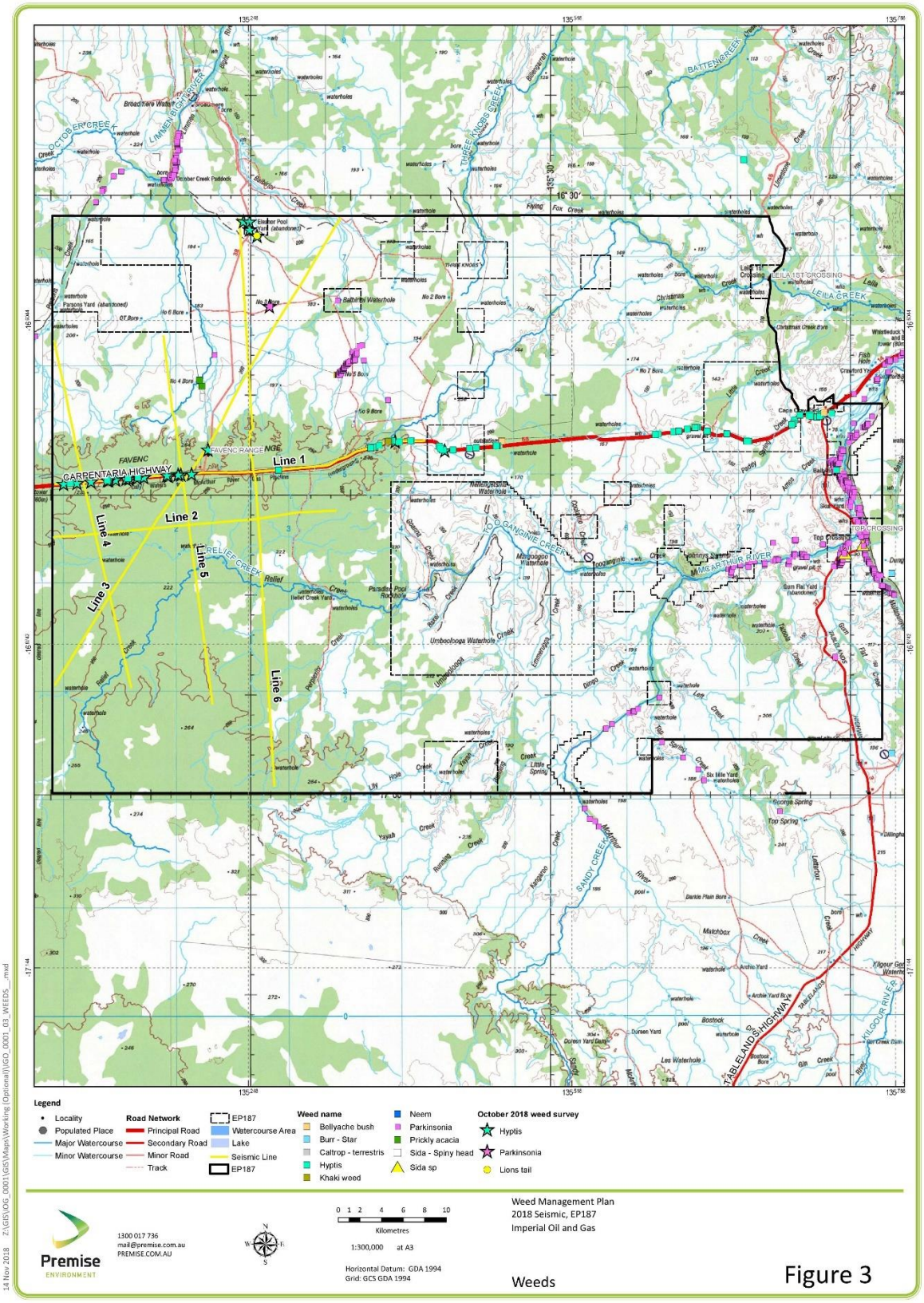
Table 4 lists weed alert species as per the *Katherine Regional Weed Management Plan 2015-2020*. These species are not yet naturalised in the region, however have the potential to have a high level of impact to the region.

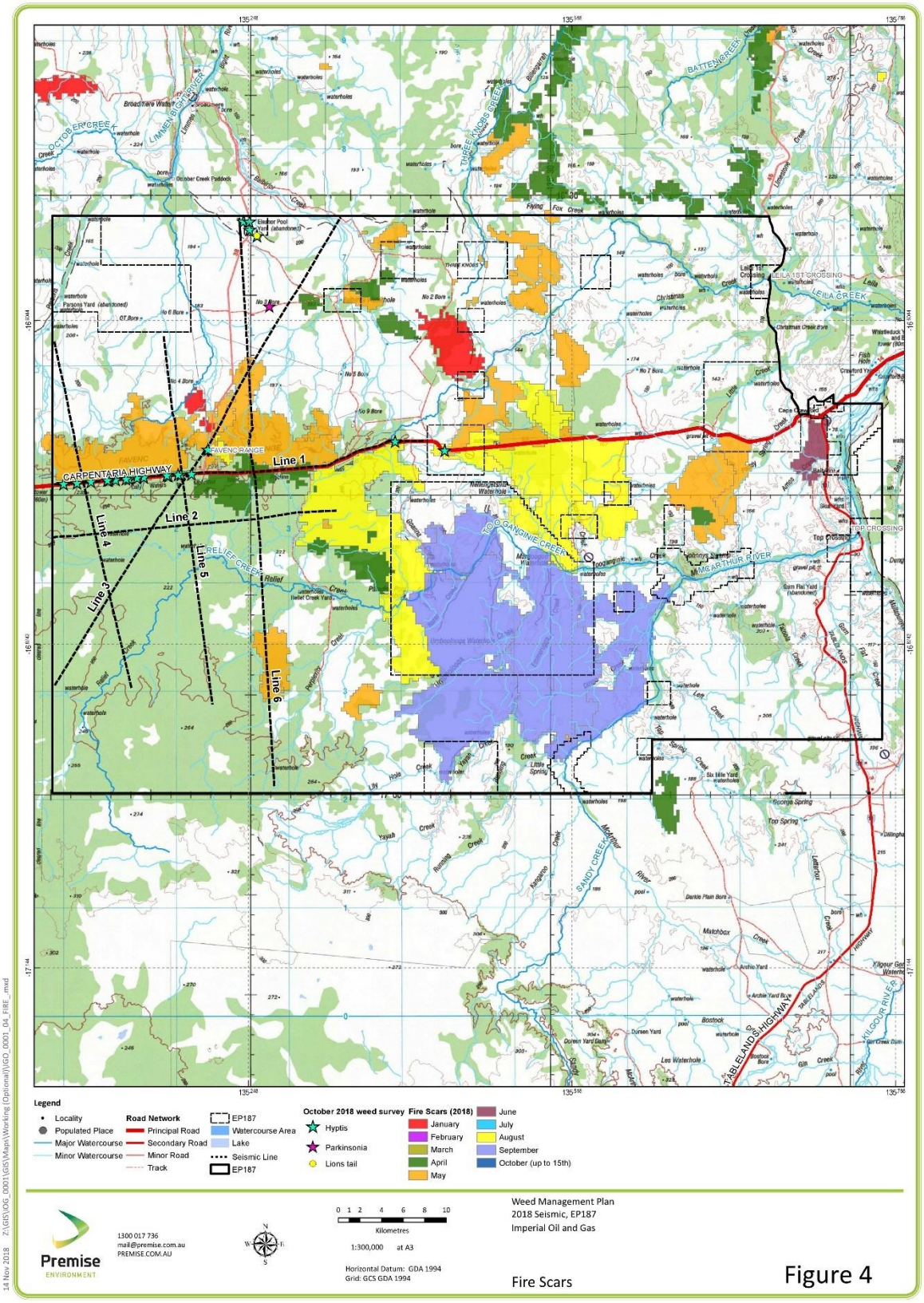
Table 4 Weed Alert Species

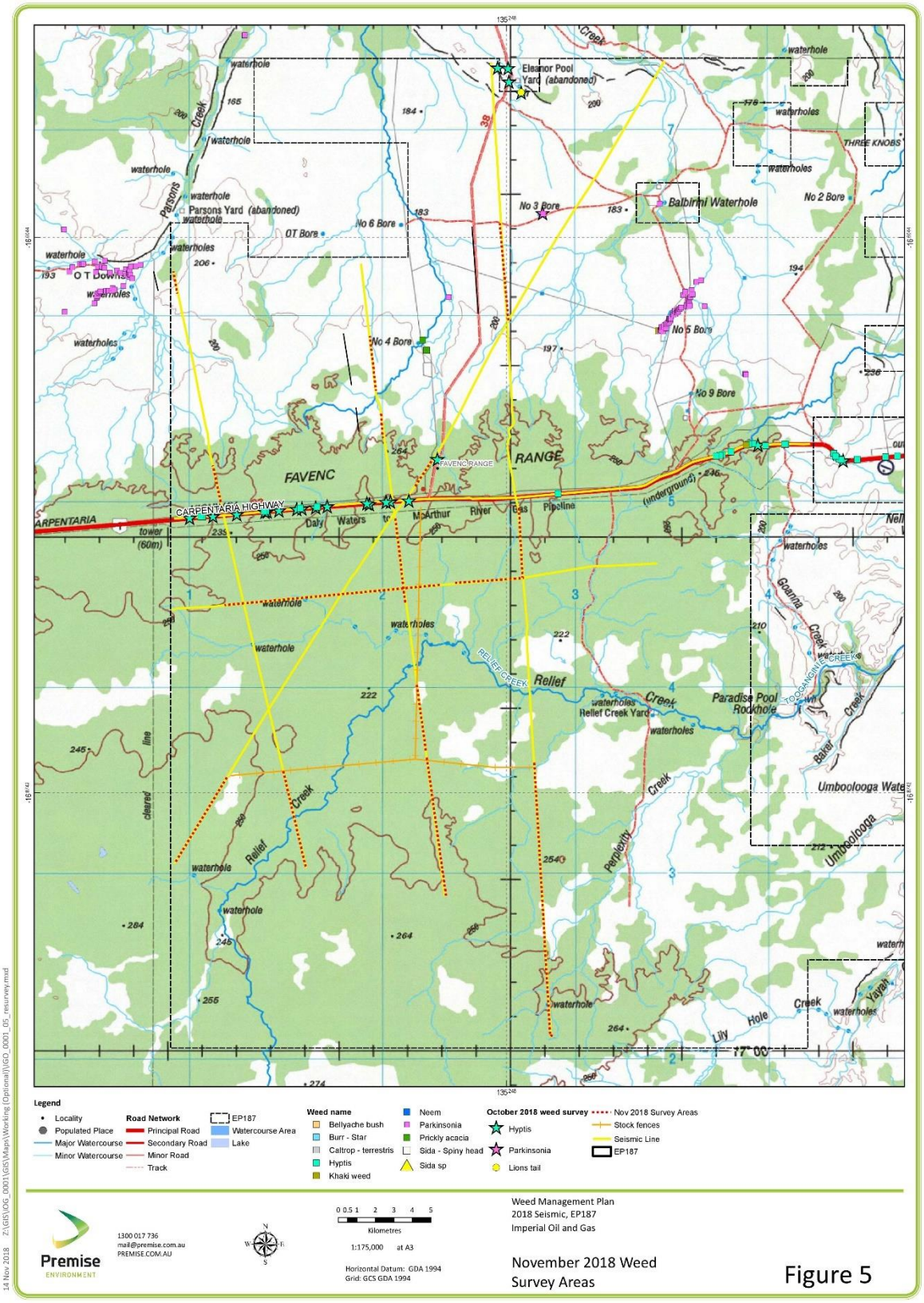
Scientific name	Common name
Annona glabra	Pond apple
Eichhornia crassipes	Water hyacinth
Cabomba caroliniana	Cabomba
Salvinia molesta	Salvinia
Schinus terebinthifolius	Brazilian pepper
Parthenium hysterophorus	Parthenium
Chromolaena odorata	Siam weed
Cryptostegia spp.	Rubber vine

Parthenium hysterophorus (parthenium) and *Cryptostegia spp* (rubber vine) are of particular concern as they are considered to be a very high risk of introduction to this area of the Northern Territory. This area of the Northern Territory is often accessed from Queensland where these two (2) weed species are well established and have had detrimental impacts to the Queensland beef industry.

On the 14th November 2018, the NT DENR issued a media release stating that Parthenium was recently detected in the Katherine region. Weed management officers are currently controlling and eradicating the occurrence with assistance from the landholder. This recent finding in the region highlights the high risk of introduction of this weed in the area.


Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
FAVENC RANGE NGE
GARRENTARIA HIGHWAY
RELIEF CREEK
TO GANGINIE CREEK
MCARTHUR RIVER
TOP CROSSING
LEILA 1ST CROSSING
LEILA CREEK
BATTEN CREEK
OCTOBER CREEK
LIMMEN BIGHT RIVER
THREE KNOBS CREEK
SANDY CREEK
TABLELANDS HIGHWAY
KILGOUR RIVER
Legend
Locality
Populated Place
Major Watercourse
Minor Watercourse
Road Network
Principal Road
Secondary Road
Minor Road
Track
EP187
Watercourse Area
Lake
Seismic Line
EP187
Weed name
Bellyache bush
Burr - Star
Caltrop - terrestris
Hyptis
Khaki weed
Neem
Parkinsonia
Prickly acacia
Sida - Spiny head
Sida sp
October 2018 weed survey
Hyptis
Parkinsonia
Lions tail
Premise
ENVIRONMENT
1300 017 736
mail@premise.com.au
PREMISE.COM.AU
0 1 2 4 6 8 10
Kilometres
1:300,000 at A3
Horizontal Datum: GDA 1994
Grid: GCS GDA 1994
Weed Management Plan
2018 Seismic, EP187
Imperial Oil and Gas
Weeds
Figure 3
14 Nov 2018
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Line 1
Line 2
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Line 4
Line 5
Line 6
CARPENTARIA HIGHWAY
Legend
Locality
Populated Place
Major Watercourse
Minor Watercourse
Road Network
Principal Road
Secondary Road
Minor Road
Track
EP187
Watercourse Area
Lake
Seismic Line
EP187
October 2018 weed survey
Hyptis
Parkinsonia
Lions tail
Fire Scars (2018)
January
February
March
April
May
June
July
August
September
October (up to 15th)
Premise
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1300 017 736
mail@premise.com.au
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Weed Management Plan
2018 Seismic, EP187
Imperial Oil and Gas
Fire Scars
Figure 4
14 Nov 2018
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Eleanor Pool Yard (abandoned)
Parsons Yard (abandoned)
No 3 Bore
No 6 Bore
OT Bore
No 4 Bore
No 5 Bore
No 9 Bore
No 2 Bore
Balbirini Waterhole
THREE KNOBS
FAVENC
RANGE
CARPENTARIA HIGHWAY
Daly Waters
MacArthur River Gas Pipeline
(underground)
tower (60m)
Relief Creek Yard
Paradise Pool Rockhole
Umbolooga Waterhole
Legend
Locality
Populated Place
Major Watercourse
Minor Watercourse
Road Network
Principal Road
Secondary Road
Minor Road
Track
EP187
Watercourse Area
Lake
Weed name
Bellyache bush
Burr - Star
Caltrop - terrestris
Hyptis
Khaki weed
Neem
Parkinsonia
Prickly acacia
Sida - Spiny head
Sida sp
October 2018 weed survey
Hyptis
Parkinsonia
Lions tail
Nov 2018 Survey Areas
Stock fences
Seismic Line
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Kilometres
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Horizontal Datum: GDA 1994
Grid: GCS GDA 1994
Weed Management Plan
2018 Seismic, EP187
Imperial Oil and Gas
November 2018 Weed Survey Areas
Figure 5
14 Nov 2018
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4 ANNUAL ACTION PLAN

Control options will be undertaken in accordance with the species-specific Statutory Weed Management Plans and also the Northern Territory Weed Management Handbook (2018).

Table 5 Annual Action Plan

Weed Management Area	Weed species	Management objective	Survey time/s	Treatment time/s	Control method/s	Herbicide
Seismic Line 1	Khaki Weed *Alternanthera pungens* (not observed in October 2018 survey)	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Glyphosate (various trade names)
	Hyptis *Hyptis suaveolens*	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Metsulfuron methyl
Seismic Line 2	None observed in October 2018	No introduction of new weed species.	End of wet season	tba	tba	tba
Seismic Line 3	Parkinsonia east of line 3 at No. 3 Bore. Hyptis *(H. suaveolens)* is present in proximity to where Line 3 crosses Line 1 (Carpentaria Highway) and also where it crosses Broadmere Road	No spread No introduction of new weed species.	End of wet season	immediately upon identification	Ground applied	Tebuthiuron (Graslan^{R}) for Parkinsonia. Metsulfuron methyl for Hyptis
Seismic Line 4	Hyptis *(H. suaveolens)* is present in proximity to where Line 4 crosses Line 1 (Carpentaria Highway)	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Metsulfuron methyl

Weed Management Area	Weed species	Management objective	Survey time/s	Treatment time/s	Control method/s	Herbicide
Seismic Line 5	Hyptis *(H. suaveolens)* is present in proximity to where Line 5 crosses Line 1 (Carpentaria Highway)	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Metsulfuron methyl
Seismic Line 6	Hyptis *(H. suaveolens)* is present along Broadmere Road (northern end). Lion's tail has also been previously observed around the large Elenor Pool.	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Metsulfuron methyl 2,4-D amine (various trade names) for Lion's tail

*Treatment times and herbicide mixing rates are provided in the *Northern Territory Weed Management Handbook 2018*

5 MITIGATION MONITORING

Field surveys were undertaken along each proposed seismic line to determine weed species presence. Other information such as presence of feral animals and vegetation community / species were described along the proposed seismic lines.

Follow-up monitoring (e.g. timeframes following treatment) is species specific and will be undertaken in accordance with the species-specific Statutory Weed Management Plans for the priority weeds (if identified on site) listed in
Table 3.

A post-wet season (2019) survey will be undertaken to actively determine treatment success and weed presence (if any) along the seismic lines. All data will be supplied to DENR.

5.1 Mitigation

Weed mitigation measures should include hygiene protocols to minimise the likelihood of introduction and spread of environmental, agricultural and declared weeds. These should include:

- Vehicle wash-down procedures and facilities to avoid the potential for weed spread including inspection by a certified weed inspector and certification.

- Requirement that all equipment/machinery arrives on site clean of plant and soil matter. This will include inspection by a certified weed inspector and records of weed hygiene certificates for all vehicles and plant arriving on site.
- Require that all equipment/machinery is clean of plant and soil matter before demobilising from one site and working on another.
- Restrict movement of topsoil from sites where significant or declared weeds are known to exist to prevent the spread of weeds on the lot.
- Immediately control and/or remove all weeds that have been introduced or exacerbated by the works.
- Develop weed identification material to be made available to staff and contractors while working on the lot. Problem weeds can be defined during pre-work toolboxes.
- Compulsory site inductions will present information to staff and contractors working on site on problem weed species and protocols to minimise risk of introduction including wash down locations and procedures, certification of plant and machinery before entering site, weed hygiene measures, non-compliance and reporting procedures
- Use existing and designated tracks where possible. Restrict access to areas outside of the cleared footprint to limit the disturbance area to within the approved footprint
- Conduct post-wet season weed surveys to determine whether any weed introductions have occurred and to monitor existing weed populations. Take the appropriate and government authority preferred corrective actions where necessary.
- Rehabilitate seismic lines and tracks.
- Monitoring data of weed populations based on pre-seismic presence and abundance around the seismic lines and tracks.

If weed monitoring indicates new introductions and/or detrimental changes in existing weed species density and abundance, the following should be undertaken:

- Immediate notification to DENR
- Determine the cause of the incident and review the process to ensure that the incident does not re-occur.
- Assess and implement the appropriate course of action in consultation with relevant authorities and landholder

6 NOTIFICATION PROCEDURE

Should a new weed species in the project area be identified, the DENR (Katherine) Regional Weeds Officer (refer **Section 1.4.2**) will be contacted within 48hrs of discovery. Initial notification will be via telephone and subsequently followed up with an email (written notification) within seven (7) working days with details of species, location (latitude and longitude), abundance and any other relevant details such as life stage.

7 RECORDING

During weed surveys over the EP187 seismic lines, weed data was collected in accordance with the DENR *Weed Data Collection Field Guide*.
Information was collected using Arc Collector. Arc Collector is utilised with Arc GIS Online web map viewer. The advantage to using this application includes:

- Real time field data collection updates to Arc GIS online map.

- Efficient and quality data capture capability. A project specific form was established for the EP187 seismic weed survey.
- Allows multiple field crew to capture at the same time and ensures data consistency and reduces processing time back in office.
- Ability to geo tag photos and videos to data capture location.
- Data export compatible with council's ESRI applications so data supply to Imperial and DENR is easy. Also, ability to export as Excel, KML etc.
- Ability to record track log.
- Compatible with iOS, Android, Windows smartphone or tablet

As a backup, data was also collected using a combination of manual field sheets and Garmin handheld GPS units.

All weed data was supplied to the DENR Katherine Weed Management Branch.

8 REPORTING

Following the post-wet season survey, an annual report will be submitted to DENR. The report will include the following:

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) Submission of all weed data collected

c) Details of survey and monitoring events, including dates, personnel, maps and track data; and

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))

9 WORKS CITED AND RELEVANT REFERENCE DOCUMENTS

Department of Environment and Natural Resources, (2015) Katherine Regional Weed Management Plan

Department of Environment and Natural Resources, (2018) Draft Weed Management Planning Guide, Onshore Shale Gas Development Projects

Department of Environment and Natural Resources, (2018) Weed Management Plan for Gamba Grass (*Andropogon gayanus*)

Department of Land Resource Management. (2015) Weed Management Plan for Mesquite (*Prosopis* spp.)

Department of Land Resource Management, (2013) Weed Management Plan for Mimosa (*Mimosa pigra*)

Department of Land Resource Management, (2015) Weed Management Plan for Prickly Acacia (*Acacia nilotica*)

Department of Land Resource Management, (2016) Weed Management Plan for Grader Grass (*Themeda quadrivalvis*)

Department of Land Resource Management, (2015) Weed Management Plan for Chinee Apple (*Ziziphus mauritiana*)

Department of Land Resource Management (2013), Weed Management Plan for Bellyache Bush (*Jatropha gossypiifolia)*

Weed Management Branch, Northern Territory Government, (2015) Northern Territory Weed Data Collection Manual - Northern Territory Government of Australia, Darwin

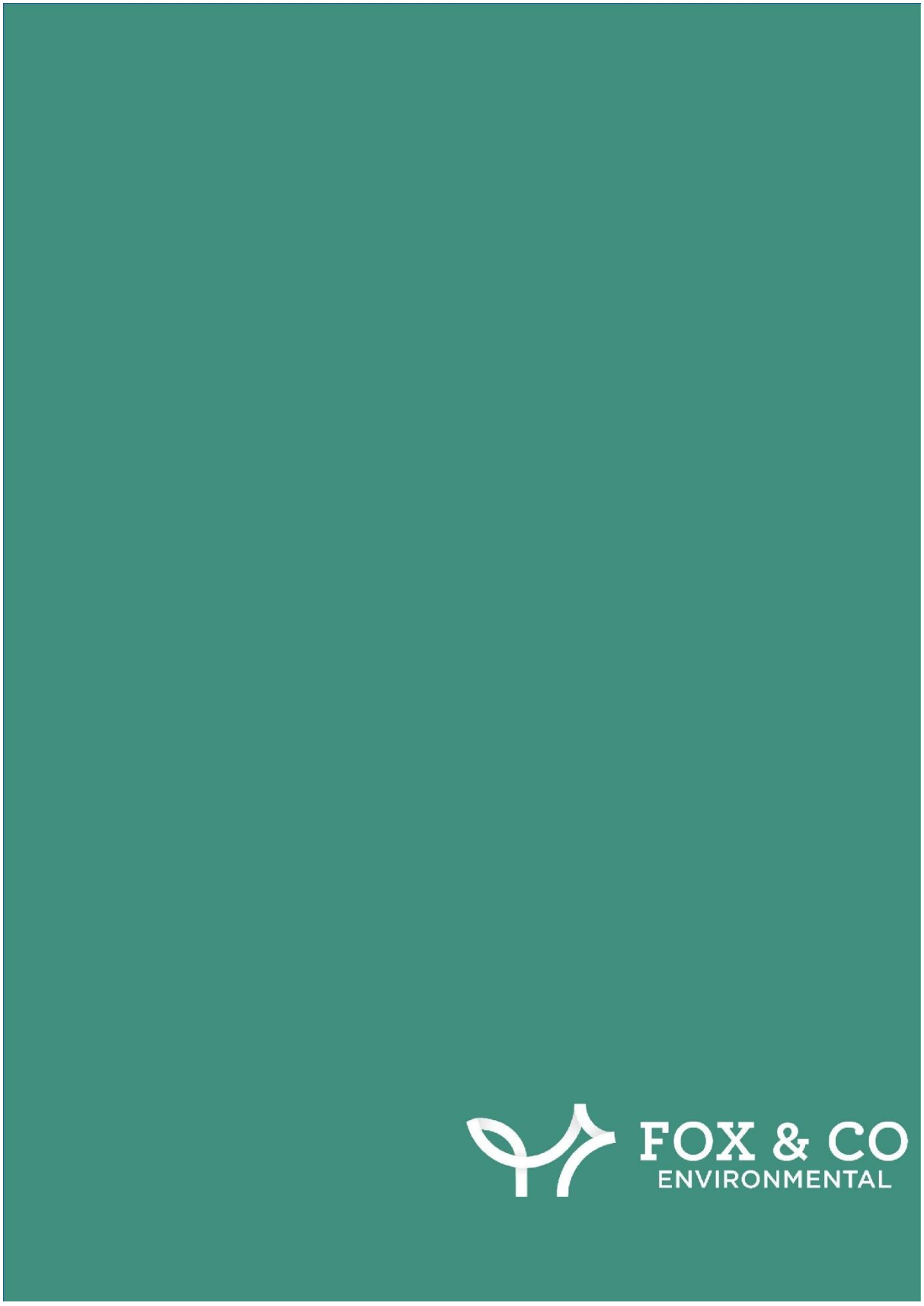
Northern Territory Government, (2018) Northern Territory Weed Management Handbook

Scientific Inquiry into Hydraulic Fracturing in the Northern Territory (2018) Final Report

Natural Resource Management Ministerial Council, 2007. The Australian Weeds Strategy, Canberra: The Department of the Environment and Water Resources

Thorp, J. R. & Lynch, R., 2000. The Determination of Weeds of National Significance, Launceston: National Weeds Strategy Executive Committee


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mail@premise.com.au
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ENVIRONMENT
AGRIBUSINESS
WATER


FOX & CO
ENVIRONMENTAL

Appendix 6. Weed Survey

EP187 POST-WET SEASON WEED SURVEY

Report IG-01

June 2019



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1.2 Proposed Seismic and Drilling Program Locations 5
2 2019 POST-WET SEASON WEED SURVEY RESULTS 9
3 UPDATED ANNUAL ACTION PLAN 13
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Executive Summary

Previous weed assessments have been undertaken on the Imperial Oil and Gas Limited (IOG) exploration tenement EP187 in relation to a proposed seismic and drilling program. Previous surveys were undertaken in dry season conditions (October and November 2018). The timing of these surveys was sub-optimal due to weed die-off and fires during that time of the year in the Northern Territory. Nonetheless, surveys were undertaken under approval by the Northern Territory Department of Environment and Natural Resources (DENR) to assist with obtaining approval for a 2018 seismic program, under condition that an additional weed survey was undertaken post-wet season 2019 in conditions more conducive to observing weed presence and abundance. The 2018 seismic program did not proceed however a post-wet weed survey was undertaken to assist IOG with their 2019 approvals and to fully understand the current weed status associated with the proposed seismic and drilling operations. This report details the findings of the 2019 post-wet season weed survey.

A review of the previous Weed Management Plan (WMP) prepared by Premise (*Weed Management Plan, 2018 Seismic Program, EP187, Premise Environment, 15 November 2018, Report # 1802587e*) was undertaken. A summary of different survey results between seasons is provided. Any changes in mitigation measures and monitoring protocols as a result of the revised 2019 weed survey are summarised in this report and the annual action plan.

This addendum report should be read in conjunction with the Premise WMP which provides information on the work program, activities and risks, known and/or priority weeds (including weed alert species), DENR and IOG contacts, mitigation measures and recording/reporting procedures.

1 INTRODUCTION

Fox & Co Environmental Pty Ltd conducted a post-wet season weed survey on EP187 on 10 April 2019. The focus of the survey was approximately 230 kilometres of proposed 2D seismic across the western portion of the tenement. Eight (8) well options are also situated on the seismic lines.

A desktop assessment and review of the following documents and reference material was undertaken prior to the survey to familiarise with existing information and any changes (if any) of weed listing status:

- DENR known weed records;
- DENR information alerts;
- *Weed Management Plan, 2018 Seismic Program, EP187, Premise Environment, 15 November 2018, Report # 1802587e*

Weeds considered prime concern in relation to IOG's proposed seismic and drilling operations, based on known occurrence and threat of introduction include:

Mesquite (*Prosopis spp),* Prickly acacia (*Vachellia nilotica),* Parkinsonia (*Parkinsonia aculeata),* Chinee apple (*Ziziphus mauritiana),* Mimosa (*Mimosa pigra),* Bellyache bush (*Jatropha gossypiifolia),* Gamba grass (*Andropogon gayanus),* Neem (*Azadirachta indica),* Grader grass (*Themeda quadrivalvis),* Snake weed (*Stachytarpheta spp),* Devils claw (*Martynia annua),* Hyptis (*Hyptis suaveolens),* Khaki weed (*Alternanthera pungens),* Sida (*Sida acuta, Sida cordifolia, Sida rhombifolia),* Lion's tail (*Leonotis nepetifolia),* Parthenium (*Parthenium hysterophorus)* and Rubber vine (*Cryptostegia spp.).*

On the 14th November 2018, the NT DENR issued a media release stating that Parthenium was recently detected in the Katherine region. Weed management officers are currently controlling and eradicating the occurrence with assistance from the landholder.
DENR announced the occurrence of another alert species in the Katherine region, rubber vine (*Cryptostegia grandiflora*), on 21st March 2019.
These recent finding in the region highlights the high risk of introduction of these weeds in the area.

1.1 *Location*

EP187 is situated in the upper reaches of the McArthur River in proximity to the Barkly Tablelands. The tenement lies to the west of the Tablelands Highway and is crossed east to west by the Carpentaria Highway. The Limmen Bight National Park is situated to the northeast of EP187. **Figure 1** displays the location of the tenement area in relation to the broader region. The main access within the tenement is along the Carpentaria Highway and the Broadmere Road.

1.2 *Proposed Seismic and Drilling Program Locations*

The proposed seismic work program will occur in the 2019 dry season (June/July), whilst the drilling program is expected to occur following the seismic program in 2019 subject to statutory approval processes. A number of historical pastoral access ways exist through the area as well as newer access ways developed by pastoralists holding S19 permits (under the *Aboriginal Land Rights (Northern Territory) Act*). Where available access to seismic lines will utilize the existing roadways and pastoral tracks and will be in accordance with the NT Land Clearing Guidelines (LCG) (2019) and the pending Land Clearing Permits (LCP). Access to the well pads will be via existing pastoral tracks or new tracks selected to avoid sensitive areas as per the LCG (2019). The new proposed bore access track have not been surveyed at the time of reporting and will require inspection prior to drilling. Assessment of these tracks is proposed at the seismic inception when DENR weed officers will be present to undertaken onsite weed training for the seismic contractors.

Table 1, **Table 2** and **Table 3** provides the latitude and longitude coordinates of the start and end of the seismic lines, bore options and proposed bore access tracks, respectively. **Figure 2** provides a map of the proposed route of the seismic lines, proposed bore locations and access tracks.

Table 1: Seismic line coordinates for start and end (decimal degrees)

Line	Start Longitude	Start Latitude	End Longitude	End Latitude	Length (km)
1	135.0863884	-16.7411125	135.3952893	-16.71437661	32.9
2	135.0853852	-16.78513537	135.3213451	-16.76289145	25.1
3	135.0864645	-16.90880039	135.3249762	-16.51846278	49.8
4	135.1159045	- 6.94503599	135.0861566	-16.6214288	35.9
5	135.2179975	-16.92453057	135.1772632	-16.61601824	34.2
6	135.2696648	-16.9932462	135.2404939	-16.51967737	52.2

NB: All coordinates are provided in decimal degrees.

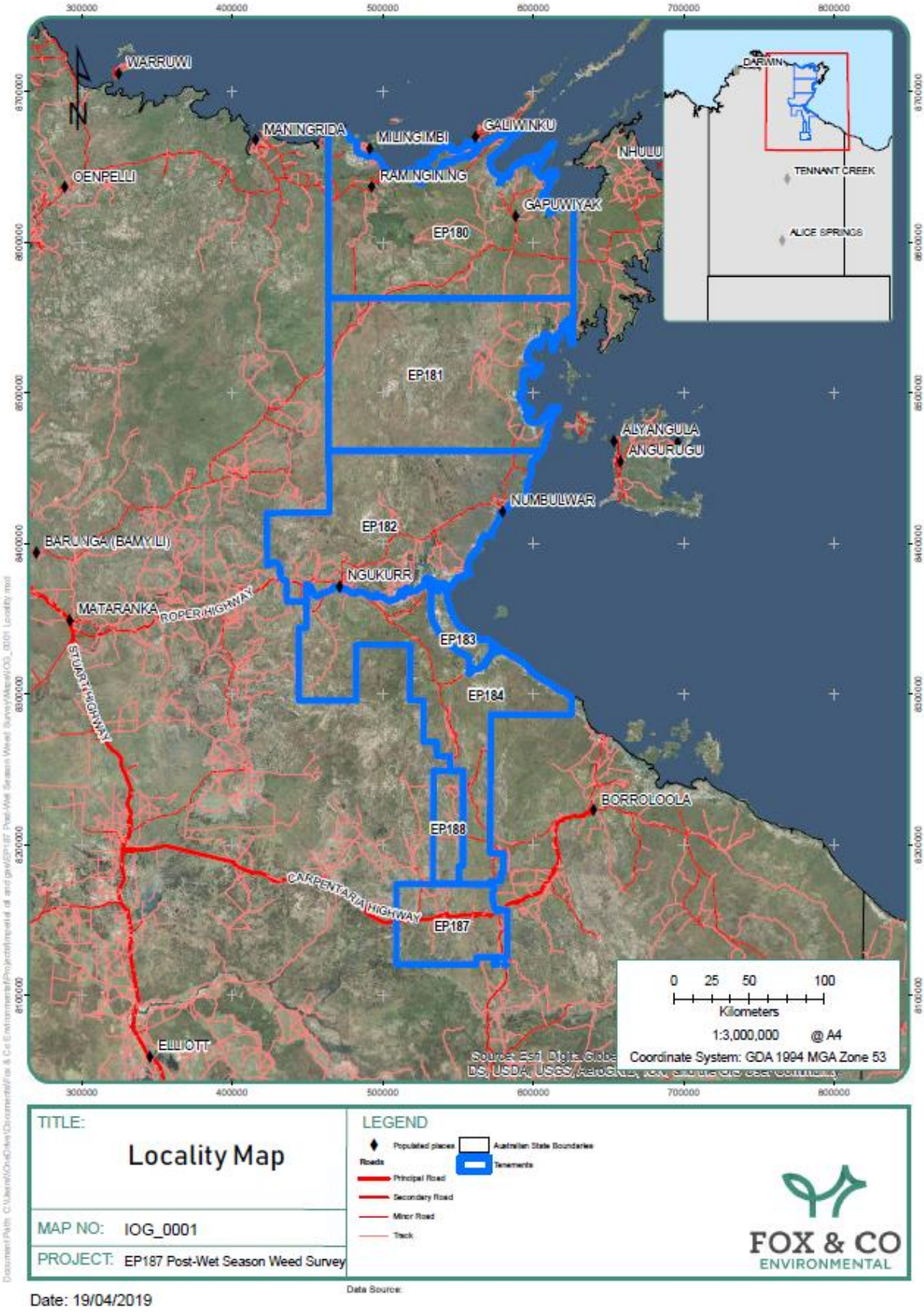
Table 2 Coordinates for proposed well pads

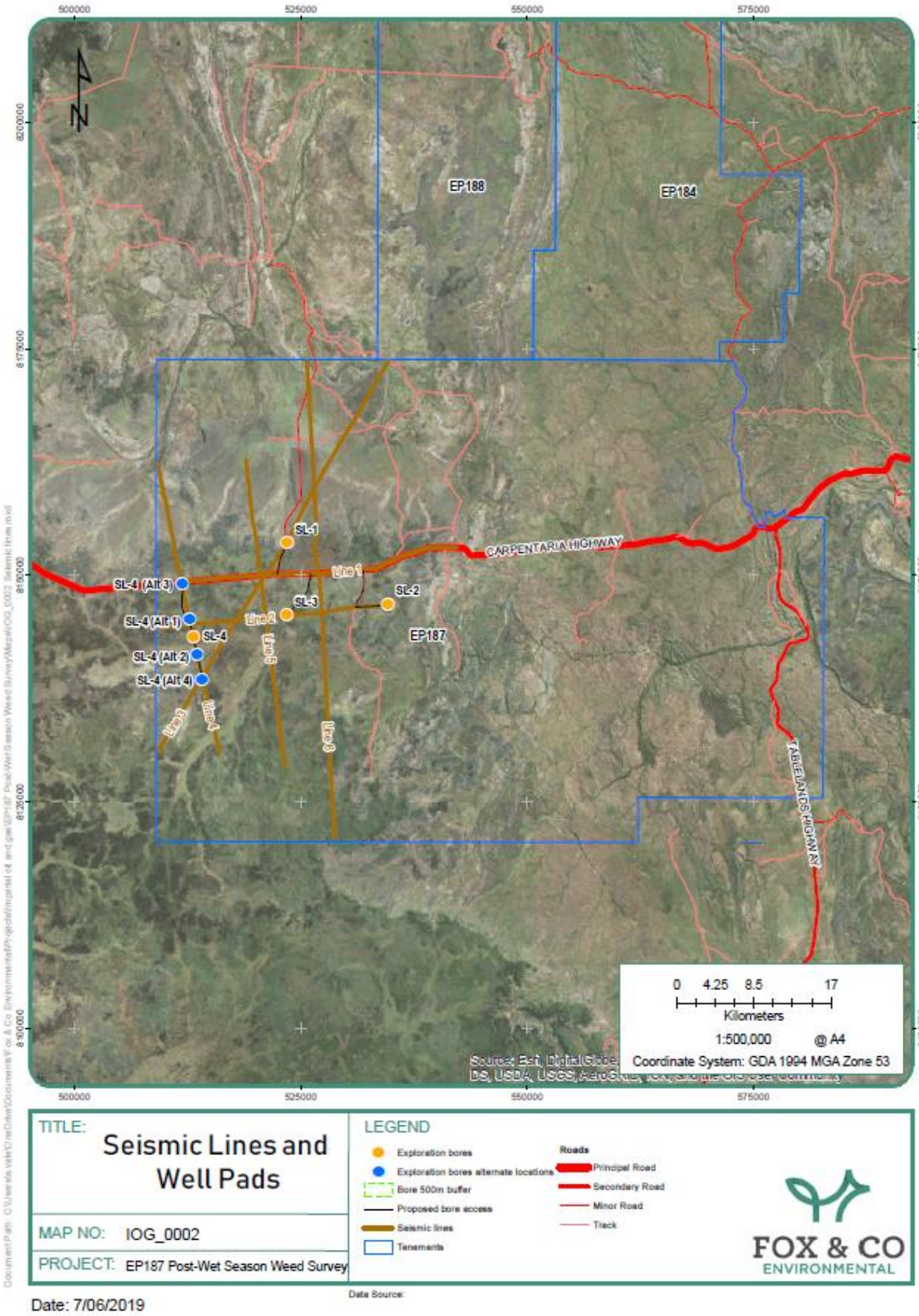
SITE	Latitude (decimal degrees)	Longitude (decimal degrees)
Exploration bore(s)		
SL-1	-16.700640°	135.220163°
SL-2	-16.761726°	135.324698°
SL-3	-16.772641°	135.219816°
SL-4	-16.794398°	135.123266°
SL-4 (Alt 1)	-16.778475	135.1194361
SL-4 (Alt-2)	-16.8139167	135.1276611
SL-4 (Alt-3)	-16.74204167	135.11109167
SL-4 (Alt-4)	-16.83641	135.1328472
Grid: GDA94 Zone 53K		

Table 3 Access track for start and end (decimal degrees

Tracks	Start Longitude	Start Latitude	End Longitude	End Latitude	Length (km)
Western Access track joining SL-4 (Alt-3) and SL-4 (Alt-4)	135.111092	-16.742042	135.132847	-16.83641	10.7
Carpentaria Hwy to SL-3	135.244503	-16.731386	135.219816°	-16.772641°	5.3
Track from Relief Creek Pastoralist track to SL-2	135.291714	-16.764219	135.324698°	-16.761726°	3.5

NB: All coordinates are provided in decimal degrees.


WARRUWI
MANINGRIDA
MILINGIMBI
GALIWINKU
NHULU
OENPELLI
RAMINGINING
GAPUWIYAK
EP180
EP181
ALYANGULA
ANGURUGU
NUMBULWAR
EP182
BARUNGA (BAMYILI)
NGUKURR
MATARANKA
ROPER HIGHWAY
STUART HIGHWAY
EP183
EP184
BORROLOOLA
EP188
CARPENTARIA HIGHWAY
EP187
ELLIOTT
DARWIN
TENNANT CREEK
ALICE SPRINGS
0 25 50 100
Kilometers
1:3,000,000 @ A4
Coordinate System: GDA 1994 MGA Zone 53
TITLE:
Locality Map
MAP NO: IOG_0001
PROJECT: EP187 Post-Wet Season Weed Survey
LEGEND
Populated places
Australian State Boundaries
Roads
Tenements
Principal Road
Secondary Road
Minor Road
Track
FOX & CO
ENVIRONMENTAL
Data Source:
Date: 19/04/2019


500000
525000
550000
575000
8200000
8175000
8150000
8125000
8100000
N
EP188
EP184
EP187
SL-1
SL-2
SL-3
SL-4
SL-4 (Alt 1)
SL-4 (Alt 2)
SL-4 (Alt 3)
SL-4 (Alt 4)
Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
CARPENTARIA HIGHWAY
TABLELANDS HIGHWAY
0 4.25 8.5 17
Kilometers
1:500,000 @ A4
Coordinate System: GDA 1994 MGA Zone 53
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AeroGRID, IGN, and the GIS User Community
TITLE:
Seismic Lines and Well Pads
MAP NO: IOG_0002
PROJECT: EP187 Post-Wet Season Weed Survey
LEGEND
Exploration bores
Exploration bores alternate locations
Bore 500m buffer
Proposed bore access
Seismic lines
Tenements
Roads
Principal Road
Secondary Road
Minor Road
Track
FOX & CO
ENVIRONMENTAL
Data Source:
Date: 7/06/2019

2 2019 POST-WET SEASON WEED SURVEY RESULTS

Two weed species were recorded during the 2019 post-wet season field survey (*Hyptis suaveolens* (Hyptis) and *Tribulus sp.* (Caltrop). Both weeds are herbaceous Class B declared weeds in the Northern Territory.

Figure 3 shows the 2018 dry season weed survey results and the 2019 post-wet season survey results. **Figure 4** shows the survey tracks. As expected, more Hyptis was identified in the 2019 survey as conditions were more conducive to weed growth and therefore observation. As per the 2018 dry season survey, Hyptis was primarily recorded along the Carpentaria Highway in disturbed areas and drainage culverts while Caltrop was recorded at the jump-up picnic area adjacent to the Carpentaria Highway at the eastern end of Seismic Line 1.

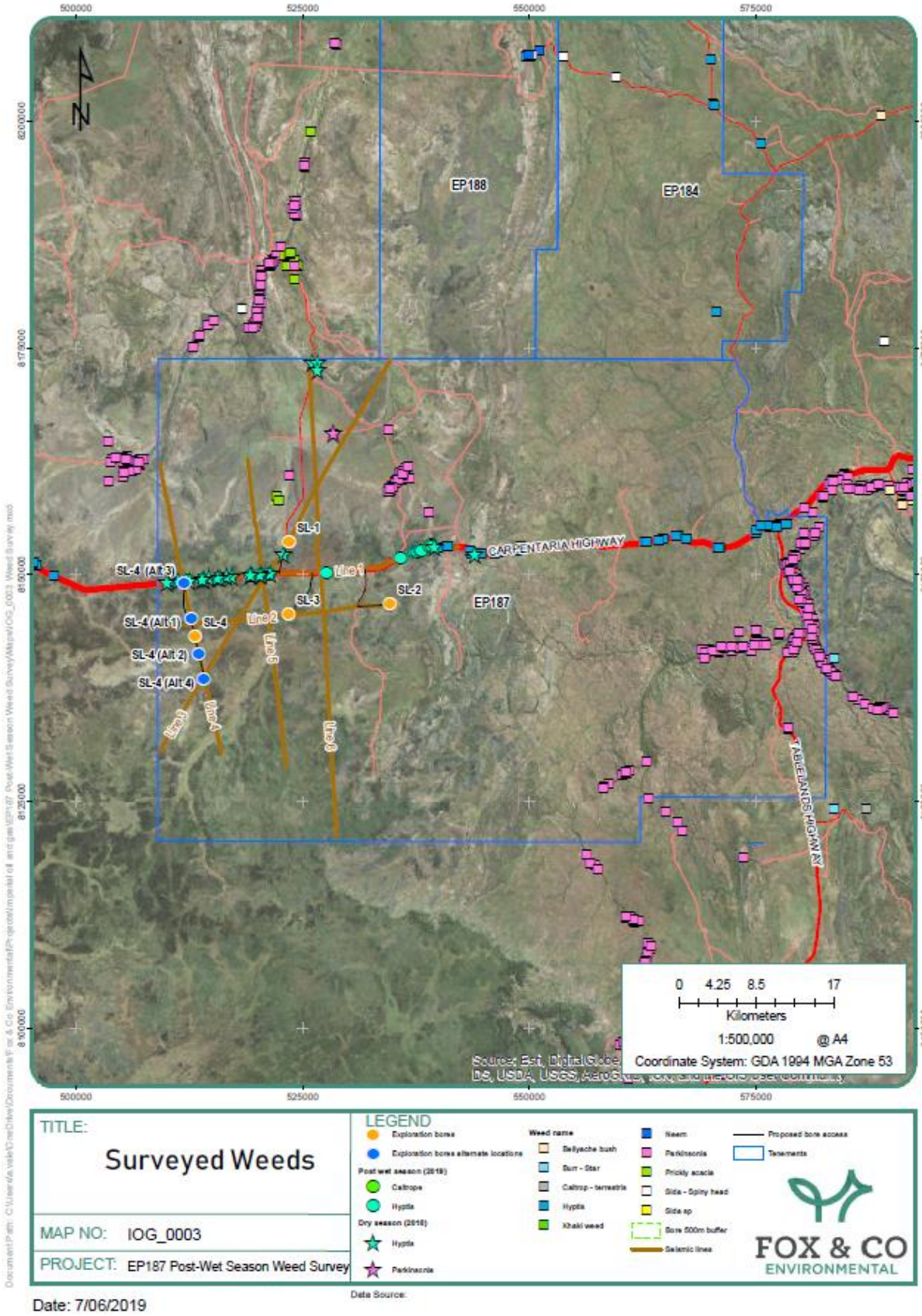
Hyptis records along the Carpentaria Highway west of Line 3/Line 1 intersection (ie. West of Broadmere Road) were comparable between seasons. Only two (2) Hyptis locations were recorded east of the Line 3/Line 1 intersection along Seismic Line 1 (Carpentaria Highway) during the 2018 weed surveys, in contrast to 11 locations recorded during the recent 2019 post-wet season survey. The locations where Hyptis was identified during the recent survey were comparable to historical records of Hyptis along the Carpentaria Highway.

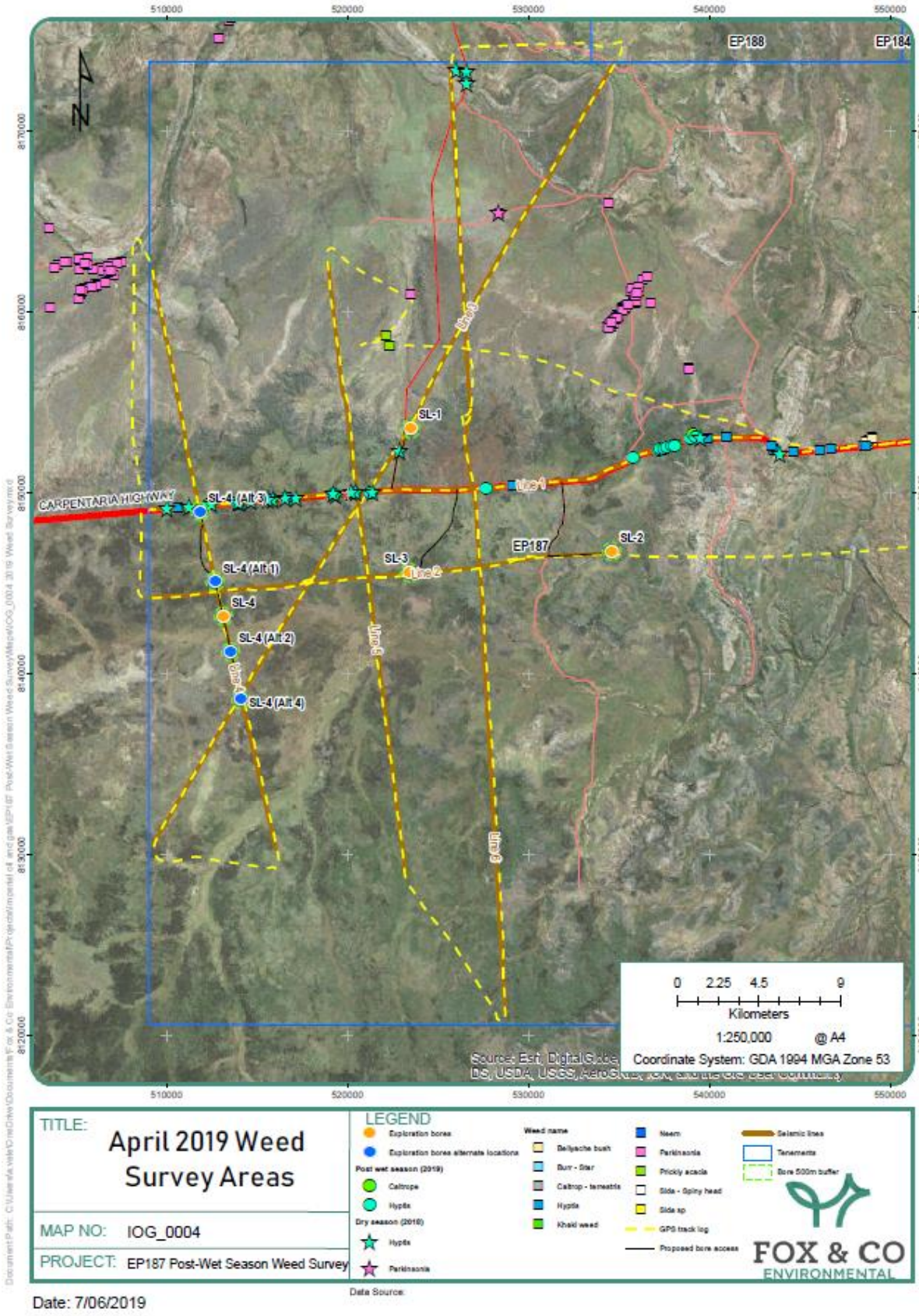
Appendix A provides a table of the post-wet season survey results. These results were supplied to DENR in the required format within 7 days of undertaking the weed survey.

Table 4 Weeds Observed During 2019 Post-wet Season Weed Survey

Weed	Plate
Hyptis suaveolens (Hyptis). Class B herbaceous weed. Hyptis was observed along the Carpentaria Highway in disturbed areas (ie. Truck rest stops) or drainage lines. Location: -16.710633, 135.349883	

Weed	Plate
Tribulus sp. (Caltrop). Class B herbaceous weed. Caltrop was observed at the picnic area at the jump-up proximate to the eastern end of Seismic Line 1, just off the Carpentaria Highway. Location: -16.703183, 135.366863	


500000
525000
550000
575000
8200000
8175000
8150000
8125000
8100000
N
EP188
EP184
EP187
SL-1
SL-2
SL-3
SL-4
SL-4 (Alt 1)
SL-4 (Alt 2)
SL-4 (Alt 3)
SL-4 (Alt 4)
Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
CARPENTARIA HIGHWAY
TABLELANDS HIGHWAY
0 4.25 8.5 17
Kilometers
1:500,000 @ A4
Coordinate System: GDA 1994 MGA Zone 53
TITLE:
Surveyed Weeds
MAP NO: IOG_0003
PROJECT: EP187 Post-Wet Season Weed Survey
LEGEND
Exploration bores
Exploration bores alternate locations
Post wet season (2019)
Caltrops
Hyptis
Dry season (2018)
Hyptis
Parkinsonia
Weed name
Bellyache bush
Burr - Star
Caltrop - terrestris
Hyptis
Khaki weed
Neem
Parkinsonia
Prickly acacia
Sida - Spiny head
Sida sp
Bore 500m buffer
Seismic lines
Proposed bore access
Tenements
FOX & CO
ENVIRONMENTAL
Data Source:
Date: 7/06/2019


EP188
EP184
EP187
SL-1
SL-2
SL-3
SL-4
SL-4 (Alt 1)
SL-4 (Alt 2)
SL-4 (Alt 3)
SL-4 (Alt 4)
CARPENTARIA HIGHWAY
Line 1
Line 2
Line 3
Line 4
Line 5
0 2.25 4.5 9
Kilometers
1:250,000 @ A4
Coordinate System: GDA 1994 MGA Zone 53
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
TITLE:
April 2019 Weed Survey Areas
MAP NO: IOG_0004
PROJECT: EP187 Post-Wet Season Weed Survey
LEGEND
Exploration bores
Exploration bores alternate locations
Post wet season (2019)
Caltrope
Hyptis
Dry season (2018)
Hyptis
Parkinsonia
Weed name
Bellyache bush
Burr - Star
Caltrop - terrestris
Hyptis
Khaki weed
Neem
Parkinsonia
Prickly acacia
Sida - Spiny head
Sida sp
GPS track log
Proposed bore access
Seismic lines
Tenements
Bore 500m buffer
FOX & CO ENVIRONMENTAL
Data Source:
Date: 7/06/2019

3 UPDATED ANNUAL ACTION PLAN

The annual action plan has been updated to reflect the additional survey results obtained during the post-wet survey (April 2019).

Control options will be undertaken in accordance with the species-specific Statutory Weed Management Plans and also the Northern Territory Weed Management Handbook (2018).

Table 5 Annual Action Plan

Weed Management Area	Weed species	Management objective	Survey time/s	Treatment time/s	Control method/s	Herbicide
Seismic Line 1	Khaki Weed *Alternanthera pungens* (not observed in October 2018 survey or 2019 post-wet survey)	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Glyphosate (various trade names)
	Hyptis *Hyptis suaveolens*	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Glyphosate (various trade names)
	Caltrop (*Tribulus sp.*)	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Glyphosate (various trade names)
Seismic Line 2	None observed in October 2018 or 2019 post-wet survey	No introduction of new weed species.	End of wet season	tba	tba	tba
Seismic Line 3	Parkinsonia east of line 3 at No. 3 Bore. Hyptis *(H. suaveolens)* is present in proximity to where Line 3 crosses Line 1 (Carpentaria Highway) and also where it crosses Broadmere Road	No spread No introduction of new weed species.	End of wet season	immediately upon identification	Ground applied	Tebuthiuron (Graslan®) for Parkinsonia. Metsulfuron methyl for Hyptis

Weed Management Area	Weed species	Management objective	Survey time/s	Treatment time/s	Control method/s	Herbicide
Seismic Line 4	Hyptis *(H. suaveolens)* is present in proximity to where Line 4 crosses Line 1 (Carpentaria Highway)	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Glyphosate (various trade names)
Seismic Line 5	Hyptis *(H. suaveolens)* is present in proximity to where Line 5 crosses Line 1 (Carpentaria Highway)	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Glyphosate (various trade names)
Seismic Line 6	Hyptis *(H. suaveolens)* is present along Broadmere Road (northern end). Lion's tail has also been previously observed around the large Elenor Pool.	No spread. No introduction of new weed species.	End of wet season	Immediately upon identification	Foliar spray	Glyphosate (various trade names) 2,4-D amine (various trade names) for Lion's tail
Exploration Bores SL-1 to SL-4, alternative SL-4 locations and both access track options	Hyptis *(H. suaveolens)* is present along Broadmere Road and Carpentaria Hwy proximate to the proposed side access tracks for all wells	No spread. No introduction of new weed species.	Prior to construction of access tracks and well pads. At start of seismic before well pad locations are finalised.	Immediately upon identification	Foliar spray	Glyphosate (various trade names)

*Treatment times and herbicide mixing rates are provided in the *Northern Territory Weed Management Handbook 2018*

EP187 Post-wet season weed survey report
IG-01

14

4 MITIGATION MONITORING

No further changes or amendments are required to the Activities and Risk table in the WMP (2018). No further mitigation or management measures proposed other than what is recommended in the WMP (2018).

Access tracks for the well pads were selected following the previous weed surveys and site assessments. Tracks were selected to avoid sensitive areas as per the LCG (2019). Weed surveys are required at both access tracks as these were not surveyed during previous weed surveys and environmental investigations. The proposed timing for additional surveys is at the commencement of the seismic program as the NT DENR weed officers will also be on site undertaking onsite weed training for the contractors.

5 WORKS CITED AND RELEVANT REFERENCE DOCUMENTS

Department of Environment and Natural Resources, (2015) Katherine Regional Weed Management Plan

Northern Territory Government, (2018) Northern Territory Weed Management Handbook

Northern Territory Government (2019) Land Clearing Guidelines

Weed Management Plan 2018 Seismic Program EP187 (15 November 2018) Premise Environment, Report # 1802587e

APPENDIX A

Weed Survey Data, April 2019

RECORDER:		Paul Fox			PROJECT:		Imperial Oil & Gas Baseline Weed Survey for Proposed Seismic					LOCALITY:	EP187 proposed seismic lines	
ORG_NAME:		Fox and Co Environmental. Imperial Oil and Gas			GPS NAME/MODEL:		Garmin etex touch 25					RECORDING METHOD :	Handheld GPS	
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
920	10/04/2019	16.73900	135.11538	Hyptis suaveolens	20	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
921	10/04/2019	16.73742	135.13055	Hyptis suaveolens	20	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
922	10/04/2019	16.733450	135.180000	Hyptis suaveolens	20	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
923	10/04/2019	16.733533	135.180700	Hyptis suaveolens	20	2	Yes	Yes	Yes	Yes	No	No treatment		baseline
924	10/04/2019	16.732683	135.190933	Hyptis suaveolens	20	4	Yes	Yes	Yes	Yes	No	No treatment		baseline
925	10/04/2019	16.732500	135.199283	Hyptis suaveolens	50	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
926	10/04/2019	-16.730200	135.259183	Hyptis suaveolens	50	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
927	10/04/2019	-16.715150	135.335533	Hyptis suaveolens	20	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
928	10/04/2019	-16.710883	135.349150	Hyptis suaveolens	50	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
929	10/04/2019	-16.710533	135.350267	Hyptis suaveolens	50	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
930	10/04/2019	-16.710633	135.349883	Hyptis suaveolens	20	4	Yes	Yes	Yes	Yes	No	No treatment		baseline
931	10/04/2019	-16.710133	135.351983	Hyptis suaveolens	20	4	Yes	Yes	Yes	Yes	No	No treatment		baseline
932	10/04/2019	-16.709800	135.353433	Hyptis suaveolens	20	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
933	10/04/2019	-16.709150	135.355767	Hyptis suaveolens	20	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
934	10/04/2019	-16.708633	135.357300	Hyptis suaveolens	20	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
935	10/04/2019	-16.705017	135.365317	Hyptis suaveolens	20	3	Yes	Yes	Yes	Yes	No	No treatment		baseline
936	10/04/2019	-16.703183	135.366883	Caltrop sp	20	3	Yes	Yes	Yes	Yes	No	No treatment		old records. Likely previous treatment in this
938	10/04/2019	-16.704700	135.368100	Hyptis suaveolens	20	3	Yes	Yes	Yes	Yes	No	No treatment		baseline

Appendix 7. Erosion and Sediment Control Plan

TOPO.

EROSION AND SEDIMENT CONTROL PLAN

IMPERIAL DRILLING AND SEISMIC 2019



CLIENT: IMPERIAL OIL AND GAS PTY LTD

DOCUMENT NUMBER: 19-0109/R0940

VERSION: A

DATE: 15/08/19

1 SCOPE

Topo were engaged by Imperial Oil and Gas Pty Ltd (Imperial) to develop a CPESC certified Erosion and Sediment Control Plan (ESCP) for works associated with the Imperial Drilling and Seismic Exploration 2019 project located near Borroloola, Northern Territory. It is understood that the project will commence in August 2019.

1.1. GUIDELINES

This ESCP has been prepared in accordance with the following documents:

- Environmental Assessment Act 1982
- The Petroleum Act 2016
- Waste Management and Pollution Control Act 1998
- Soil Conservation and Land Utilisation Act 1969
- Imperial Environment Management Plan 2019 for Drilling Program Rev C
- Imperial Environment Management Plan for EP187 2D Seismic Work Program (EP187-EMP-XPN-REP-007 Rev 3)
- Best Practice Erosion and Sediment Control (IECA, 2008)
- Soil, land and vegetation guidelines and fact sheets (NT.GOV.AU)
- Land Clearing Guidelines (Department of Environment and Natural Resources)

1.2. OBJECITVES

This ESCP is part of a hierarchy of documentation prepared to minimise the potential environmental impacts associated with Imperial's 2019 seismic exploration program.

With respect to ESC, this plan has been prepared specifically to assist the project in achieving the following objectives:

1. Ensure that the clearing of native vegetation does not unreasonably contribute to environmental degradation of the locality
2. Avoid impacts on environmental significant or sensitive vegetation
3. Avoid impacts on drainage areas, wetland and waterways
4. Avoid impacts on highly erodible soils
5. Take all reasonable and practicable measures to minimise actual or potential environmental harm resulting from soil or water movement as a consequence of either the construction or operational phases (with regard to soil erosion and land rehabilitation) of seismic exploration
6. Maintain, and where practical, enhance the land use capabilities of disturbed areas with respect to land's soil, water and vegetation attributes
7. Ensure temporary ESC measures do not unreasonably impact upon the economic and safety-related attributes of the project

Preliminary slope data derived from SRTM Digital Elevation Modelling (DEM) identified a number of locations across the project where slopes exceeded 2%, and in places 5%. The Land Clearing Guidelines class slope of 2-3% and >3% as having an associated high and very high risk of erosion, respectively (refer Table 1).

Table 1 - Acceptability of erosion risk associated with clearing works based on slope gradient (DENR Land Clearing Guidelines)

Slope (%)	Erosion risk	Recommendation
0 to 1%	Low	Risk is acceptable; management required.
1 to 2%	Moderate	
2 to 3%	High	Required management is prohibitive; clearing not recommended.
>3%	Very High	

The project has previous demonstrated that exclusion of land with slopes greater than 2% is unfeasible. This ESCP has been prepared to demonstrate how the risk will be mitigated and thus satisfy DENR requirements.

1.3. CERTIFICATION

I Tom Bailey certify that this Erosion and Sediment Control Plan (ref: R0940) has been prepared to satisfy the following requirements:

- The intent and outcomes conditioned within the approved Land Clearing Plan (LCP);
- The intent and minimum standards nominated within the IECA (2008) Best Practice Erosion and Sediment Control Guideline and relevant supporting Appendices (IECA, 2015).

If implemented correctly, it will assist Imperial in meeting environmental obligations defined in the Environmental Protection Act (1994) – s440zg, the Environmental Protection (Water) Policy (2009) and the aforementioned LCP conditions.

Bailey CPESC 6374

1.4. REVISION

VERSION	DATE	AUTHOR	REVIEWER	APPROVED
DRAFT	13/08/19	R. Kleijn	T. Bailey	T. Bailey
A	15/08/19	T. Bailey	R. Kleijn	T. Bailey

2 PROJECT DESCRIPTION

2.1. LOCATION

The project works are located across the eastern margin of the Beetaloo Sub-Basin within Exploration Permit (EP) 187, approximately 85km south-west of Borroloola within the Carpentaria and Macarthur Basin in the Northern Territory. EP187 is situated in the upper reaches of the McArthur River, lies to the west of the Tablelands Highway, and is crossed east to west by the Carpentaria Highway.

This ESCP has been developed for the vegetation clearing works associated with the seismic lines, as well as the drilling of up to two wells on two separate locations within EP187.

The site location and outline of the proposed seismic lines is presented in Figure 1. Proposed drilling locations are presented in Figure 2, with alternatives in Appendix A.

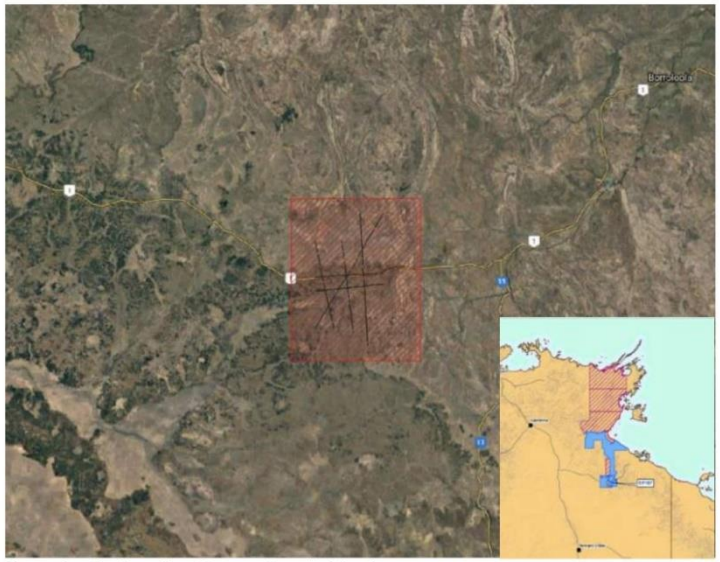


Figure 1 – Site Location (Source: Google Maps)

2.2. PROJECT WORKS

Projects works will involve the following major activities:

- Line clearing and preparation using a H140 Grader with 4m blade, within 30m corridor;
- Clearing of patches of Lancewood with D6 Dozer within 4m blade, within 30m corridor;
- Conducting seismic testing with Vibroseis buggies;
- Spreading of cleared mulch/timber over disturbed areas upon completion of works;
- Upgrading existing tracks and/or creation of new access tracks;
- Clearing of vegetation and drilling of well, pending acquisition of seismic survey data. Instalment of a drill pad and associated structures and infrastructure (location to be confirmed).

The seismic lines length and areas have been shown in Table 2 below. It is noted that no clearing is envisaged for Line 1 which runs alongside the Carpentaria Highway, adjacent to the bitumen.

The areas presented in Table 1 include approximately 20ha of land not subject to clearing during this scope of works, comprising previously cleared areas and non-clearing zones such as drainage lines, waterways and creeks and their associated buffer widths.

Table 2 – Seismic Lines and area (source: Land Clearing Permit Supporting Information June 2019)

Line	Length (km)	Area (ha)
1	33.6	13.0
2	25.3	10
3	50.2	20
4	32.8	13
5	34.3	14
6	54.8	21

2.3. CLIMATE

The historic monthly rainfall for the region is presented below in Figure 2. Works are expected to commence in August 2019. Based on historic rainfall data August and September have a low monthly mean rainfall. The seasonal outlook, included as Figure 3, predicts a 25% chance of rainfall over 10mm from August to October, which implies it is unlikely for rainfall to be above the historic median of 15mm. The climate is described as a tropical savannah climate which can experience rainfall of between 600-800mm per year during the summer wet. The wet season is also characterised by high intensity rainfall and cyclonic winds.

With the weather in this region dominated by a stark contrast in wet and dry seasons, erosion, sediment and drainage controls considered in this plan are heavily based on seasonal variability.

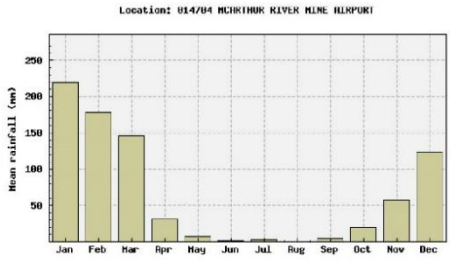


Figure 2 – Historic rainfall (Source: BoM)

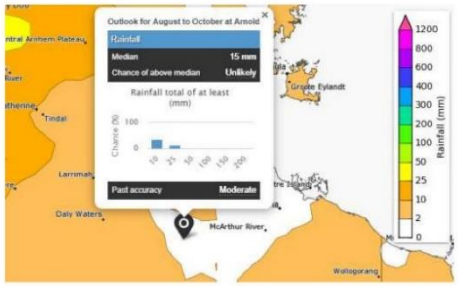


Figure 3 – Seasonal outlook – August to October (Source: BoM)

2.4. TOPOGRAPHY AND DRAINAGE

The project area is predominantly situated on grassy woodland and the land is generally flat with slopes below 2%. There are some mapped streams within the area of works, with stream order 3 being the maximum. Unmapped flow paths are present within the area and have been identified in the control plans in Appendix A. Regional topography and major flow paths are presented in Figure 4, with additional detail presented in Appendix A.

Generally, seismic lines in the east-west orientation move between 258m ASL to 213m ASL with average slope of 1% over 30km. Line 1 follows the Carpentaria Highway. Lines in the north-south orientation vary from south 260m ASL to north 162m ASL over a 50km length with an average of 1% (max 3.7%).

A key consideration in plan development was the orientation of lines with respect to local fall, whether it be perpendicular or parallel to slope, or passing diagonally up the slope. The impact that these orientations have on drainage, erosion and sediment control is presented in Appendix A.

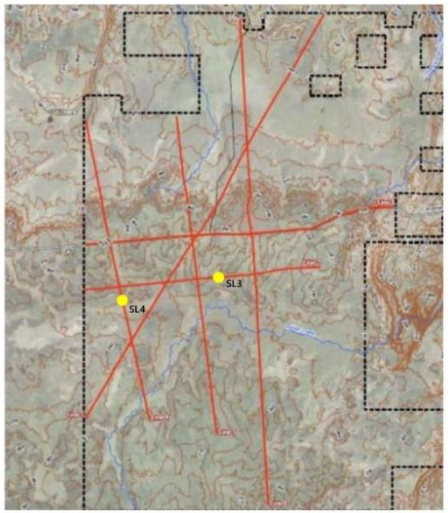


Figure 4 – Regional topography and major drainage paths

Land types have been described in Table 3.

Table 3 – Area of Land Types (source: Land Clearing Permit Supporting Information June 2019)

Land Type	Description	Total Area (ha)
A	Lancewood	13.0
B	Grassy Woodland	48.1
C	Open Grassland	4.2
D	Sandstone jump-ups and plans	4.7

2.5. SOILS

The Northern Territory Natural Resource Management report (2015) indicates that soils of the Upper McArthur River catchment are dominated by Kandosols and calcareous earths (40%), Tenosol loams (38%), Rudosol loams (19%) and Vertosols (2%).

The parent rocks of most of the soils are on at least their second cycle of erosion or are deeply weathered or both and are generally arenaceous (composed of sand sized particles). This has produced mainly very infertile soils with a near neutral reaction. Large areas are underlain by a laterite sheet, and the laterite is exposed or at shallow depth over some of the area. These 'soils' are akin to alluvial soils in that they show no profile development.

Tenosols have only weak soil profile development and are often shallow. In the Australian Soil Classification, they are defined as having limited subsoil (B horizon) development (less than 15% clay content). These soils may merge with Kandosols as the clay content can be slightly higher than specified as the upper limit for Tenosols (i.e. 15%). Kandosols soils lack strong texture contrast and have massive or only weakly structured B horizons. The B2 horizon is well developed and has maximum clay content in some part of the Horizon which exceeds 15%. They are also not calcareous throughout.

Shallow stony soils with a low moisture holding capacity are widespread. Most of the soil chemical limitations are due to low soil fertility, and soil physical problems are mostly due to sandy or massive and brittle topsoils.

For the purpose of this report, soil maps were extracted from the CSIRO 'Maps of Australian soil loss by water erosion derived using the RUSLE'.

These data sets are described in the following publication; Teng H, Viscarra Rossel RA, Shi Z, Behrens T, Chappell A and Bui E 2016 Assimilating satellite imagery and visible-near infrared spectroscopy to model and map soil loss by water erosion in Australia - Environmental Modelling & Software 77: 156-167.

3 EROSION RISK ASSESSMENT

An erosion risk assessment has been conducted using the Revised Universal Soil Loss Equation (RUSLE). The calculated soil loss is then used to determine the level of sediment control required, as well as stabilisation and staging requirements.

$$A = K \times R \times LS \times P \times C$$ Equation 1 (IECA 2008)

Where:

A is the predicted soil loss per hectare per year
K is the soil erodibility factor
R is the rainfall erosivity factor
LS is the slope length/gradient factor
P is the erosion control practice factor
C is the ground cover and management factor

3.1. K-FACTOR – SOILS

The soil erodibility factor (K factor) is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. Soil texture is the principle component affecting the K factor, but soil structure, organic matter and profile permeability also contribute.

Based on the description and maps discussed in section 2.5 and based on Table E5 Best Practice Erosion and Sediment Control (IECA, 2008) K-factors ranging between 0.028 and 0.030 were adopted for this risk assessment.

We note that the factors presented in the CSIRO mapping is consistent with the DLRM K-factors derived for a range of soil families in the Northern Territory.

3.2. R- FACTOR – RAINFALL

The rainfall erosivity factor (R factor), is a measure of the ability of rainfall to cause erosion. The R factor is defined as the mean annual sum of individual storm rainfall intensity (EI30) values - EI30 being the total storm energy (E) multiplied by the maximum 30 minute rainfall intensity (I30). Under otherwise identical conditions, soil loss is directly proportional to EI30 (Renard et al 1997).

Rainfall data for the site was obtained using the Bureau of Meteorology (BoM) Design Rainfall Data System (2016). Intensity Frequency Duration (IFD) data was extracted over the study area between 500310.2871 (E), 8118456.8329 (N) and 547935.2872(E), 8178252.6663(N). Using the ascii data provided, a rainfall map was created representing the spatial variation of rainfall intensity over the study area. Rainfall mapping is presented in Appendix A.

3.3. LS - SLOPE-LENGTH

Slope length and slope gradient have substantial effects on soil erosion by water. The two effects are represented by the slope length factor (L) and the slope steepness factor (S). In application of RUSLE the two are evaluated together as a numerical representation of the length-slope combination (LS factor).

The CSIRO Data Portal provides a set of maps that represent the RUSLE factors. Reference was made to the Maps of Australian soil loss by water erosion derived using the RUSLE, and data for the combined length and slope (LS) factor was obtained. Using the data provided, a map representing the combined length-slope factor over the study area was created. The resulting LS map is illustrated in Appendix A. It is noted that contour mulch bunds must be placed at a maximum spacing of 200m on site during clearing works.

3.4. COVER (C) AND PRACTICE (P) FACTORS

Within RUSLE, the C and P factors are used to describe management of the site with respect to reducing soil loss. The C factor measures the combined effect of all the interrelated cover and management variables adopted over the site. It also represents non-structural methods for controlling erosion (i.e. covering exposed areas with various erosion control products to minimise raindrop impact or stabilisation by temporary or permanent vegetation).

The P factor measures the combined effect of all support practices and management variables. P factor is reduced by practices that reduce both the velocity of runoff and the tendency of runoff to flow directly downhill. It also represents structural methods for controlling erosion.

In accordance with the Imperial EMP (EP187-EMP-XPN-REP-007 Rev 3) and Land Clearing Permit (LCP) Supporting Information, ground disturbance is to be limited to the removal of rocks and fallen branches and the slashing of grasses and shrubs to allow effective ground contact of the seismic vibro-source and the geophones, minimise the risk of fire, and provide for safe vehicle access. Topsoil will not be stripped or windrowed.

Based on the description above and Table E10 of IECA 2008 it would be reasonable to assume a C factor of 0.45 for the dozer cleared areas, and 0.1 for grader cleared areas, representing 0% to 40% cover in areas of long-established grass cover.

However, to conservatively allow for additional areas of disturbance, closer to that resembling a half-stripped seismic line a C-factor for both areas of clearing has been set at 0.5.

Given that topsoil will not be stripped, with grass and roots retained a P factor of 0.9 has been adopted, similar to that used for track-walked or straw punched surfaces.

Table 4 – Cover and Practice Factor Consideration

Type	Description	C Factor	P Factor
Typical line	H140 grader with blade set at 1" above the ground used to sweep the ground surface of large rocks and fallen timber	0.5	0.9
Lancewood areas	D6 bulldozer used for clearing (blade 1in above ground level). Grass and brush root stocks to be retained	0.5	0.9

3.5. ESTIMATED SOIL LOSS

Using Global Mapper GIS software, the aforementioned factors were multiplied to calculate the resulting soil loss for the site, indicating a very low erosion risk (<30t/ha/yr) for the entire site according to Table 4.4.7 of IECA, 2008. Figure 5 and Table 5 below indicate the determined erosion risk for the site and surrounding areas.

Table 5 – Erosion Risk

Colour	Erosion Risk (t/ha/yr)
Green	0-10
Yellow	10-20
Orange	20-30
Red	30-40
Dark Red	40-50

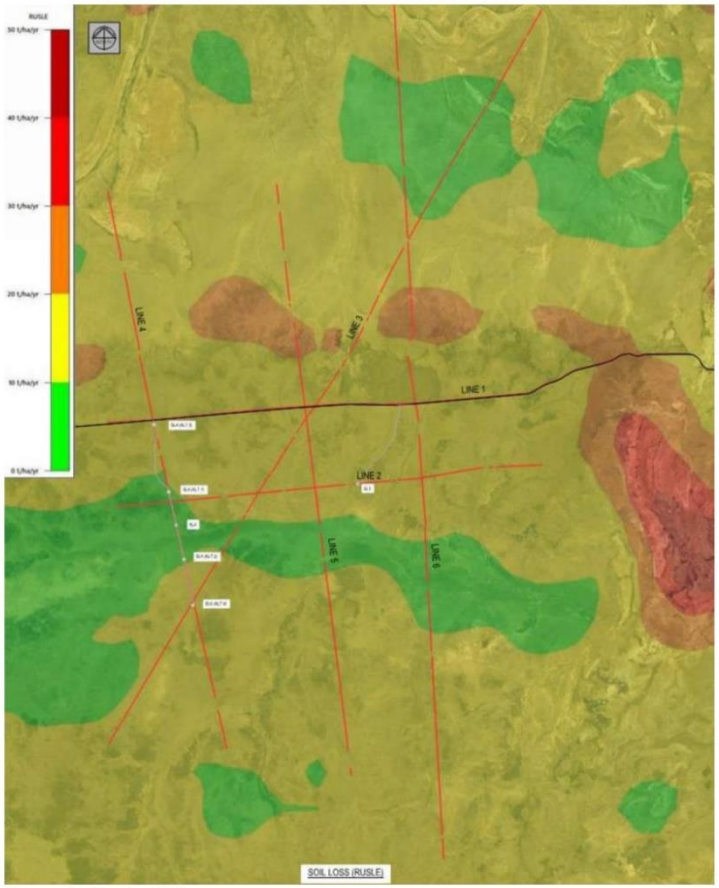


Figure 5 – Erosion Risk

4 SEDIMENT CONTROL

The sediment control standard is typically determined using Table 4.5.1 (IECA, 2008) which defines the sediment control standard based on catchment area and soil loss rate. The revised Table 4.5.1 (IECA, 2008) provided in Appendix B (IECA, 2018) as Table B1 is provide below as Table 6. The revised table includes an additional area limit trigger of 1 hectare to increase the sediment control standard for large sites with an estimated soil loss exceeding 75 t/ha/yr.

Table 6 – Sediment Control Standard (Table B1 Appendix B IECA 2018)

AREA LIMIT (m^2)	SOIL LOSS RATE LIMIT (T/HA/YR)		
	TYPE 1	TYPE 2	TYPE 3
1000	N/A	N/A	All cases
2500	N/A	> 75	75
> 2500	> 150	150	75
> 10000	>75	N/A	75

Based on Table 6 (IECA, 2018), the calculated soil losses (which are very low) permit the use of Type 3 sediment control measures throughout site. Specific Type 3 controls have been selected as suitable depending on the scope of works.

4.1. SEISMIC LINES AND ACCESS TRACKS

It has been proposed that grass, rocks, branches and shrubs be raked to the downslope extent of works, establishing a control similar to a mulch bund. Where installed as a mulch bund, this control is likely to be considerably effective in trapping the coarse sediment (sandy particles) comprising the site area.

However, it is also acknowledged that the bund may be inconsistent in some areas (based on material found on site) and the grading of material (grass, leaves, branches and rocks) is unlikely to achieve effective ponding or filtering.

Alternatives typically associated with linear projects such as sediment fence, topsoil bunding with rock filter dams or mulched vegetation bunds are either impractical for the length of the project or unsuited to the proposed scope of works.

Rather, the windrow of cleared material is considered the most suitable form of sediment control, with the varying level of effectiveness addressed by greatly increasing the level of erosion control above the minimum standard required for calculated soil loss.

4.2. DRILL PADS

Sediment controls installed on the downslope extent of disturbance may include:

Option 1 – Mulch Berm

- Placed along a line of constant elevation
- Be a minimum of 0.5m high
- Ensure 100% contact with soil surface

Option 2 - Coir log sediment trap

- Installed in accordance with the standard drawing
- Extended upslope enough to ensure the ground level is at least 100mm higher than the spill-through weir

5 EROSION CONTROL

The minimum erosion control requirements for various risk ratings in accordance with IECA (2008) guidelines are presented in Table 7.

Table 7 – Minimum erosion control requirements according to IECA (2008) - adapted from Table 4.4.7

EROSION RISK RATING	SOIL LOSS RATE (T/HA/YEAR)	ADVANCE LAND CLEARING ALLOWED (WKS WORK)	MAX DAYS TO STABILISATION (DAYS - % COVER)	STAGED CONSTRUCTION AND STABILISATION OF EARTH BATTERS >6H:1V	STOCKPILES STABILISED
Very Low	0 to 150	8	30 (60%)		
Low	150 to 225	8	30 (70%)		
Moderate	225 to 500	6	20 (70%)	✓	
High	500 to 1500	4	10 (75%)	✓	✓
Extreme	> 1500	2	5 (80%)	✓	✓

With consideration given to the sediment control described in Section 4, and seasonal variability in rainfall discussed in Section 2.3 it is proposed that seismic operations adopt an erosion control management standard that far exceeds the minimum given in Table 7. Proposed measures are presented in Table 8.

Table 8 – Proposed minimum erosion control standards to be adopted above that in Table 4.4.7 of IECA (2008)

EROSION CONTROL ELEMENT	DRY SEASON	WET SEASON
Advance land clearing (max)	30 days	5 days
Rainfall forecast trigger for stabilisation of exposed surfaces	> 60% chance of > 50mm	> 50% chance of > 20mm
Minimum ground cover required for stabilisation	70%	90%
Reinstatement/revegetation timeframes	30 days	5 days
Stabilisation of material stockpiles (drill pad)	7 days	1 day

In addition to these requirements, erosion controls shall include:

- Geolocation and warning signals utilised to prevent any disturbance outside the seismic easement or within nominated buffer areas
- Stabilisation of any high traffic areas within drill pads using gravel
- Establishing stabilised entry/exit points where access tracks intersect public roadways
- Utilising existing tracks wherever possible
- Adapting the alignment of the seismic line within the 30m easement to a path of least disturbance
- Restricting access tracks to 5m width where located within 25m of a watercourse

It is noted that the proposed exploration methodology has been adopted to minimise disturbance of existing ground cover wherever possible, including restricting the maximum possible 30m width of clearing to 4m and using machinery to limit ground disturbance to the removal of rocks and fallen branches and the slashing of grasses and shrubs. Topsoil will not be stripped or windrowed and the cleared and windrowed ground cover/vegetation is to be re-spread over the site upon completion of the seismic survey.

5.1. SEISMIC LINE CLEARING METHODOLOGY

Given that a high level of ground cover is expected to be retained on site, the following methodology and approach to erosion control is proposed.

Step 1: Assess site and select path of least disturbance for 4m width of clearing within 30m corridor.

Step 2: Programme alignment into clearing machinery to prevent over-disturbance or intrusion of buffer zones

Step 3: Commence clearing, ensuring timeframes between clearing and scheduled seismic work do not exceed those indicated in Table 8.

Step 4: Complete clearing and assess residual groundcover (%) using the tools presented in Appendix A.

Step 5: Carry out seismic works, ensuring that if rainfall is forecast that exceeds the probability AND depth presented in Table 8 immediately re-establish the level of groundcover required in Table 8 (if current % assessed in Step 4 does not comply).

Step 6: Complete survey and re-establish minimum ground cover % within minimum timeframes indicated in Table 8.

Options for re-establishing ground cover include:

- Respreading windrowed grass, branches, rocks and other vegetation over exposed areas
- Application of soil binder at manufacturers specification
  - eg. Vital Stonewall applied at minimum 1L/m^2

It is suggested that a supply of soil binder be readily available to seismic teams to achieve the timeframes and groundcover requirements proposed (note, binder can be applied via the same water trucks used on standby for fire suppression).

6 DRAINAGE CONTROL

Drainage control considers three main principles; diverting external flow before it enters site, directing site runoff to an appropriate sediment control, and ensuring runoff is conveyed in a non-erosive manner.

6.1. SEISMIC LINES AND ACCESS TRACKS

Flow diversion for linear sites is typically achieved using topsoil bunding or excavated catch drains. Given that a) no topsoil will be stripped on site, and b) drain excavation would result in more exposure than required for seismic work there are limited options for diversion. Additionally, retention of ground cover wherever possible, including topsoil and roots reduces the potential impact associated with lack of diversion of external catchments. Adoption of windrowed vegetation and rock, similar to a mulch bund, as a primary sediment control will maintain sheet flow conditions, except where used for contour bunds. In these locations it is proposed that the windrow be returned upslope and flattened to restore sheet flow conditions (similar to level spreader).

Seismic line and access track drainage has been considered to specifically address runoff over a variety of topography (discussed in Section 2.4) whether the line is orientated perpendicular or parallel to slope, or passing diagonally up/down the slope, with the resulting control arrangements presented in Appendix A.

Another key consideration was the presence of mapped, and unmapped watercourses. Control measures and management practices are presented below:

Mapped waterway	Inspect site, noting that actual waterway may not align with mapped waterway. Adjust buffer to suit. Retain buffer width in accordance with Land Clearing Permit (width varies) Maintain all existing ground cover within buffer zone. If access results in disturbance of more than a single set of wheel tracks, restrict access and re-establish ground cover using soil binder (min. Stonewall 2L/m2 or equiv.) or ground cover mattress Install cleared vegetation windrows or woah boys on either side of flow path.

Unmapped flow path	Retain a 3m wide buffer (or adapt to suit flow path (if defined). Establish stable flow path crossing either through minimal disturbance traffic practices, ground cover mattress or applying heavy application of soil binder (min. Stonewall 2L/m2 or equiv.) Install cleared vegetation windrows or woah boys on either side of flow path.

Where buffer zones require the establishment of a detour route all efforts should be made to cross the mapped waterway at an existing ford, bridge or culvert, or at an alternative stable, dry and trafficable area. Maintain all existing ground cover along the detour route. If disturbance results in more than a single set of wheel tracks restrict access and re-establish ground cover using soil binder.

Further detail of proposed drainage, including the layout of temporary measures and flow path crossings has been provided in Appendix A.

6.2. DRILL PADS

Specific measures have been described to address drainage control within and around the proposed drill pads identified as SL3 and SL4 with the arrangements presented in Appendix A. If alternative locations are selected this plan shall be updated to suit.

Clean Water Diversion

Coir logs or a mulch berm are to be used on the upslope side of the pad to divert runoff around the pad or to dissipate runoff prior to it entering the pad.

Dirty Water Diversion

Pad runoff is to be dissipated through the use of coir logs or a mulch berm. The control is to be installed along the contour to promote sheet flow leaving the site.

Intra-Site Drainage

Given the level of disturbance and size of site runoff will be allowed to sheet flow to sediment controls without the installation of intra-site drainage.

7 ROLES AND RESPONSIBILITIES

Table 9 outlines the responsibilities of project personnel in respect to ESC.

Table 9 - Roles and responsibilities

ROLE	RESPONSIBILITY
Project Manager	+ Overall responsibility for environmental compliance (including ESC implementation)
Construction Superintendent/Manager	+ Notify the Environmental Manager immediately of any non-compliance with ESCP; + Provide resources to ensure installation, maintenance and operation of ESC devices on ground.
Site Supervisor/Foremen	+ Ensure ESC measures are installed prior to commencing any disturbance activities; + Conduct site inspections as required to ensure ESC measures are operational and in good order; + Monitor daily rainfall; + Notify Environmental Advisor when runoff generating rainfall occurs in the previous 24 hours; + Treat, test and dispose of captured runoff as per operation procedures;
Environmental Manager/ Advisor	+ Conduct site inspections and audits as required; + Prepare audit reports based in inspections; + Provide advice, as required regarding ESC site improvement. + Conduct in-situ monitoring as required; + Collect and submit samples to laboratory as required; + Collate results and prepare reports as required; + Maintain current records of rainfall, water quality, treatment practices, discharge activities.
All Personnel	+ Report any damage to ESC devices and any potential or actual environmental harm in line with Duty to Notify under the requirements of the Environmental Protection Act 1994

8 SITE INSPECTION AND MONITORING

Site inspections and monitoring is to be undertaken in accordance with Sections 6.17 and 7.4 of the Best Practice Erosion and Sediment Control Document (IECA, 2008) as detailed below. When a site inspection detects a notable failure in the adopted ESC measures, the source of this failure must be reported, investigated and appropriate amendments made to the site and the ESCP.

ESCPs should be considered live documents that in some instances will require review and updating as site conditions change, or if the adopted measures fail to achieve the required treatment standard.

Best practice site management requires all ESC measures to be inspected at the following frequencies and include the following checks as a minimum:

Daily site inspections (during rainfall)

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- All site discharge points (including dewatering activities as appropriate)

Weekly site inspections (even if work is not occurring on-site)

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements
- Litter and waste receptors
- Oil, fuel and chemical storage facilities

Prior to anticipated runoff producing rainfall (within 24 hours of expected rainfall)

- All drainage, erosion and sediment control measures
- All temporary flow diversion and drainage works

Following runoff producing rainfall (within 18 hours of rainfall event)

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements

Prior to Wet Season

- It is recommended that the plan preparer undertake a site wide inspection of active works to assess the suitability of existing controls and identify any corrective actions or required plan updates prior to the onset of the tropical wet season

19-0109/R0940a – IMPERIAL SEISMIC 2019 ESCP

TOPO.

APPENDIX A

EROSION AND SEDIMENT CONTROL DRAWINGS

Environment. Engineering. Education

TOPO.

EROSION AND SEDIMENT CONTROL DRAWINGS
IMPERIAL SEISMIC 2019



DRAWING LIST:
D00 - COVER SHEET
D01 - OVERVIEW OR WORKS
D02 - R FACTOR
D03 - K FACTOR
D04 - LS FACTOR
D05 - SOIL LOSS (RUSLE)
D06 - CONTROLS - LINE 1 SHEET 1/2
D07 - CONTROLS - LINE 1 SHEET 2/2
D08 - CONTROLS - LINE 2 SHEET 1/2
D09 - CONTROLS - LINE 2 SHEET 2/2
D10 - CONTROLS - LINE 3 SHEET 1/3
D11 - CONTROLS - LINE 3 SHEET 2/3
D12 - CONTROLS - LINE 3 SHEET 3/3
D13 - CONTROLS - LINE 4 SHEET 1/2
D14 - CONTROLS - LINE 4 SHEET 2/2
D15 - CONTROLS - LINE 5 SHEET 1/2
D16 - CONTROLS - LINE 5 SHEET 2/2
D17 - CONTROLS - LINE 6 SHEET 1/3
D18 - CONTROLS - LINE 6 SHEET 2/3
D19 - CONTROLS - LINE 6 SHEET 3/3
D20 - SEISMIC LINE CONTROLS
D21 - UNMAPPED FLOW PATH CONTROLS
D22 - MAPPED FLOW PATH CONTROLS
D23 - GROUND COVER ASSESSMENT
D24 - LOW RISK DRILL PAD SL4 CONTROLS
D25 - LOW RISK DRILL PAD SL3 CONTROLS
D26 - TRACK CONTROLS
D27 - TRACK CONTROLS - FLOW PATH
D28 - DRAINAGE NOTES SHEET 1/2
D29 - DRAINAGE NOTES SHEET 2/2
D30 - COIR ROLLS NOTES

REFER TO REPORT **R0940** FOR ADDITIONAL DETAILS RELATING TO GUIDELINES USED, PROJECT AND SITE DESCRIPTION, CLIMATE, TOPOGRAPHY, SOILS, EROSION RISK ASSESSMENT, EROSION, SEDIMENT AND DRAINAGE CONTROL SPECIFICATIONS, ROLES AND RESPONSIBILITIES AND SITE INSPECTION AND MONITORING.

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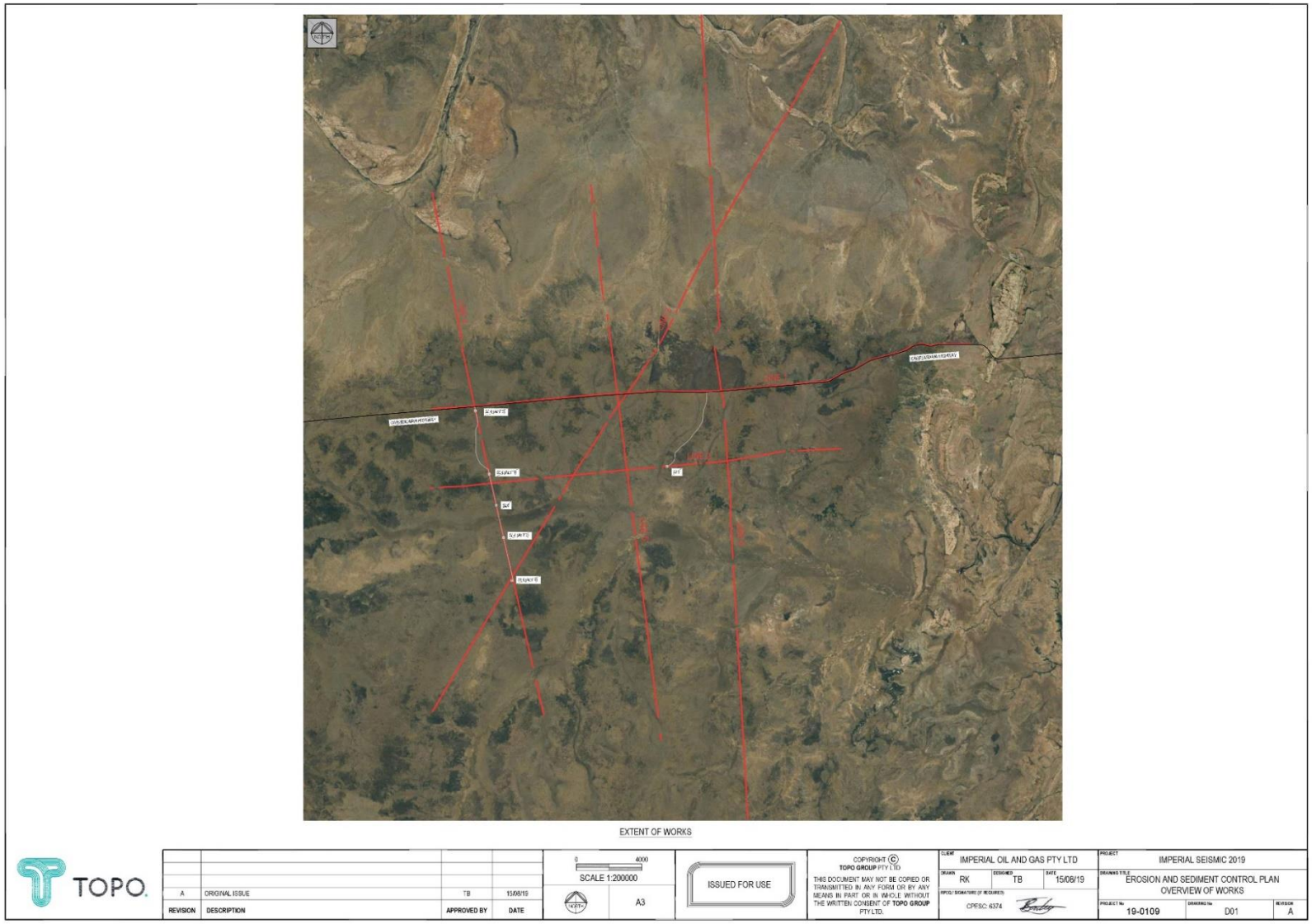
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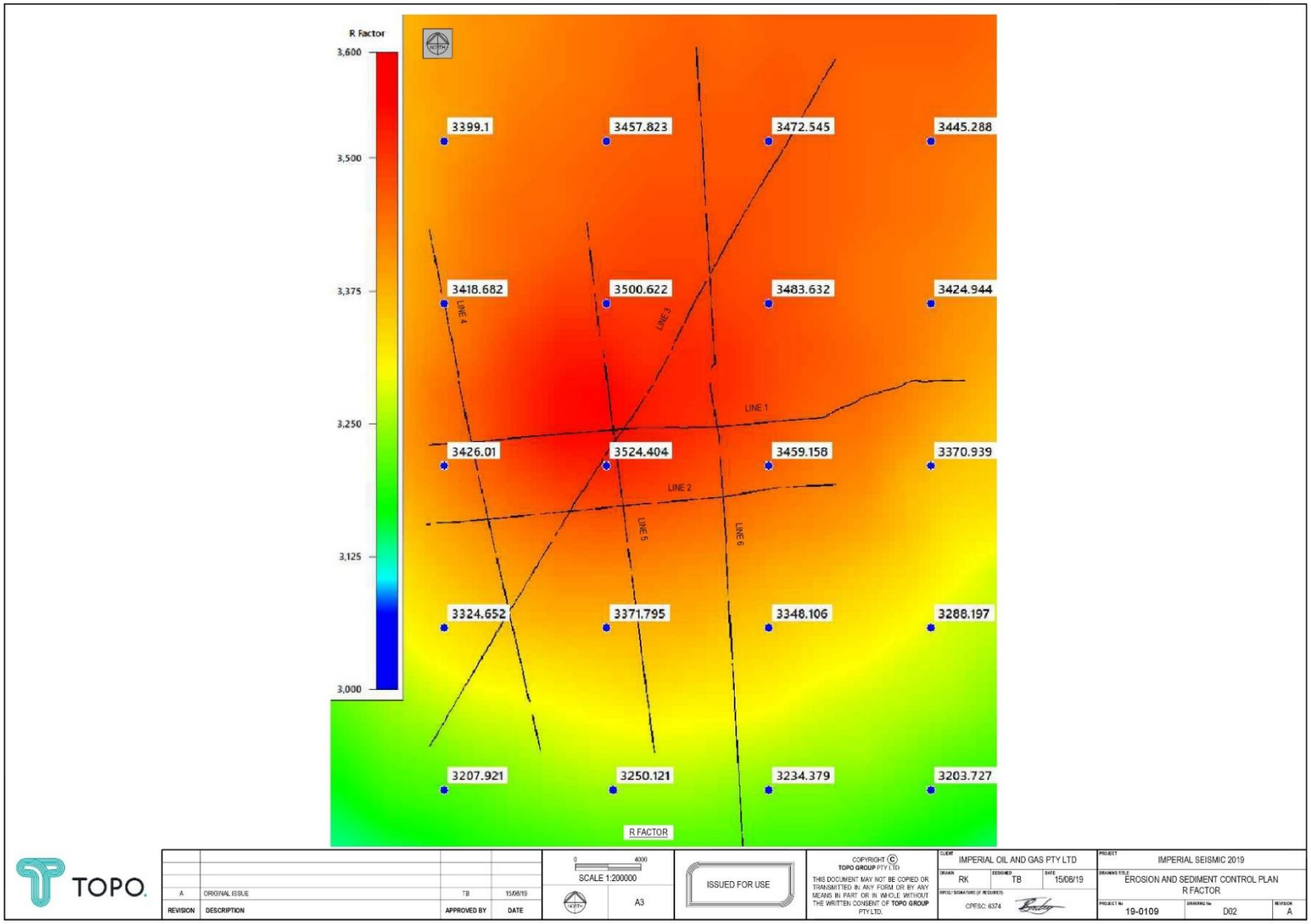
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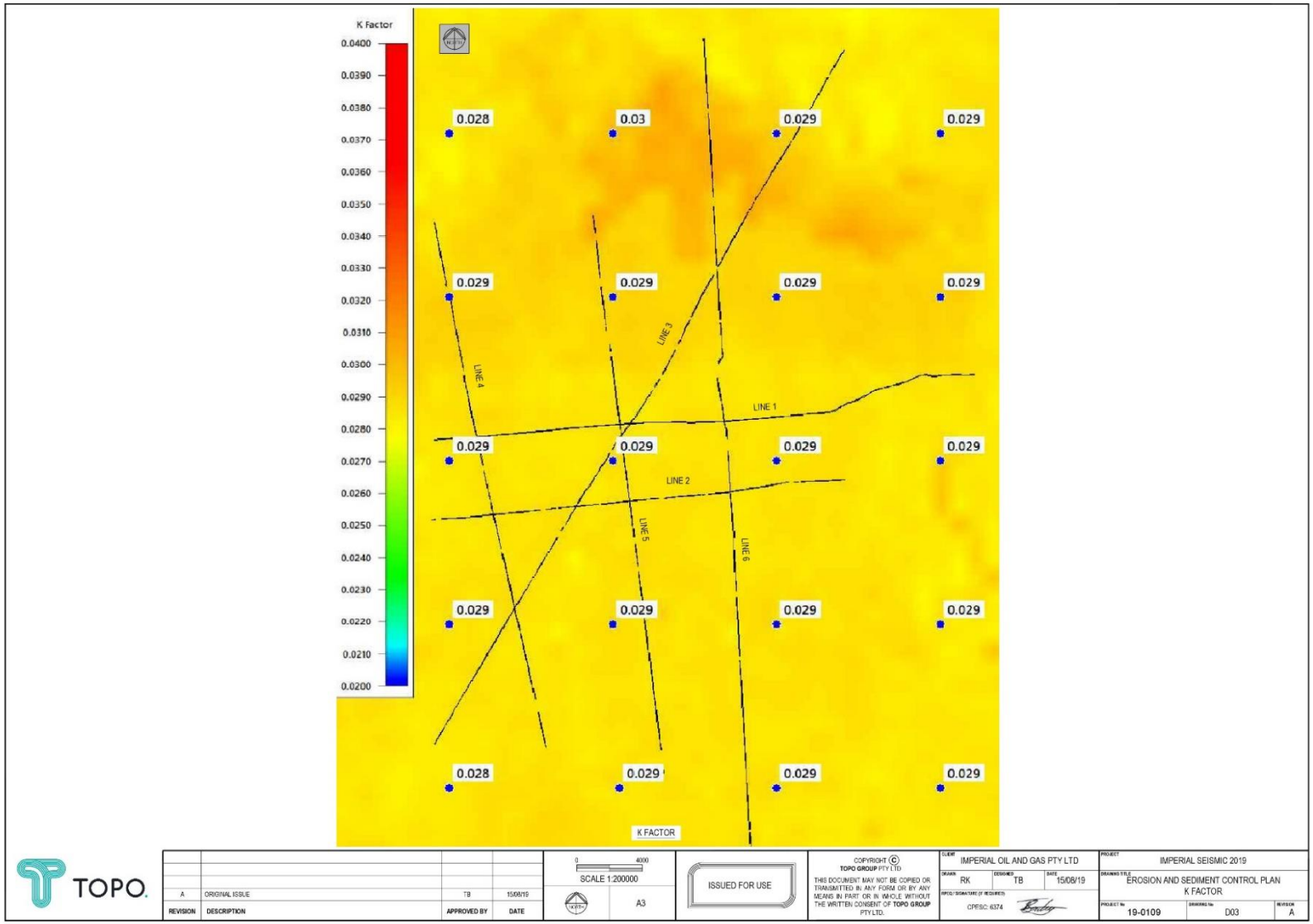
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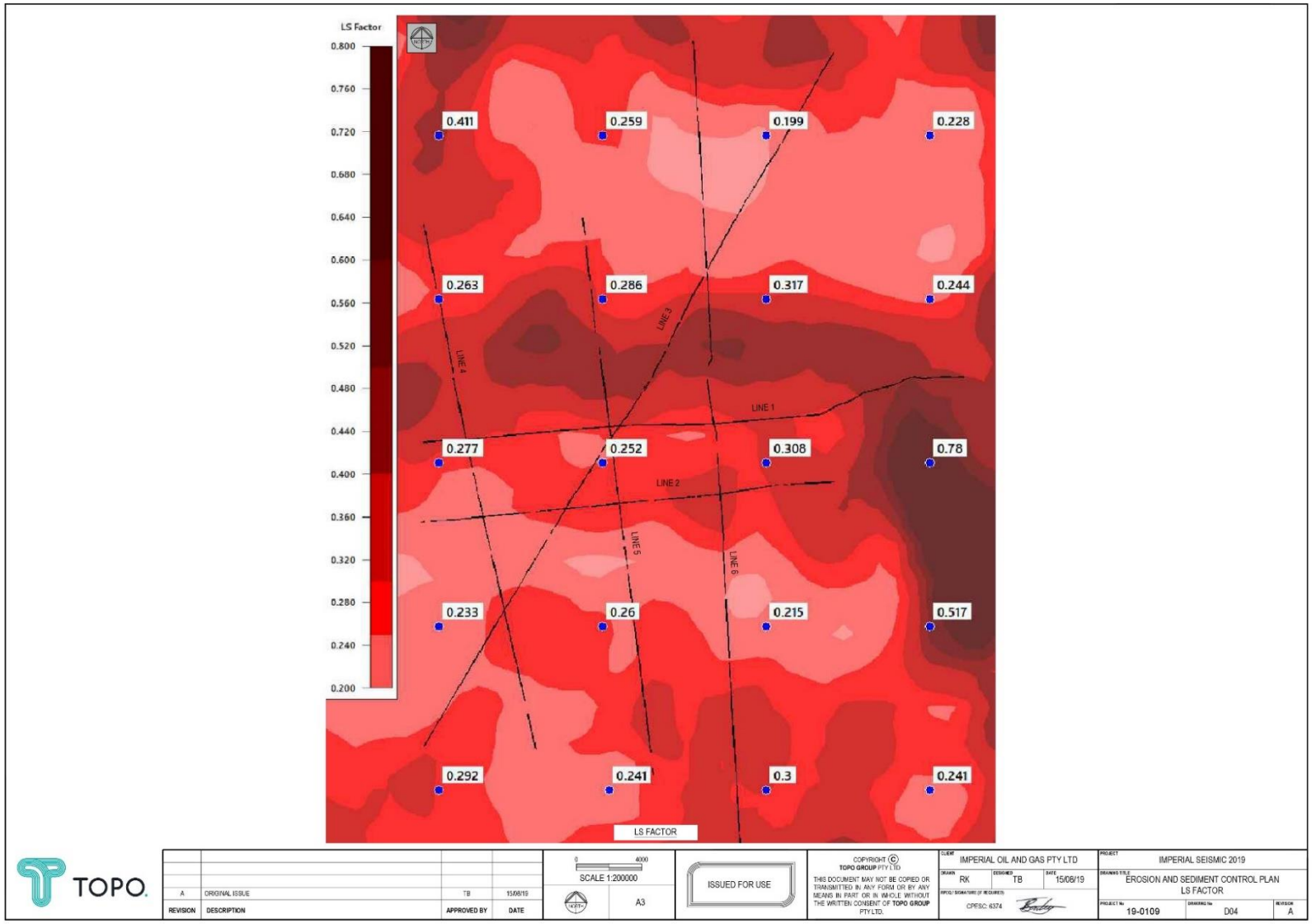
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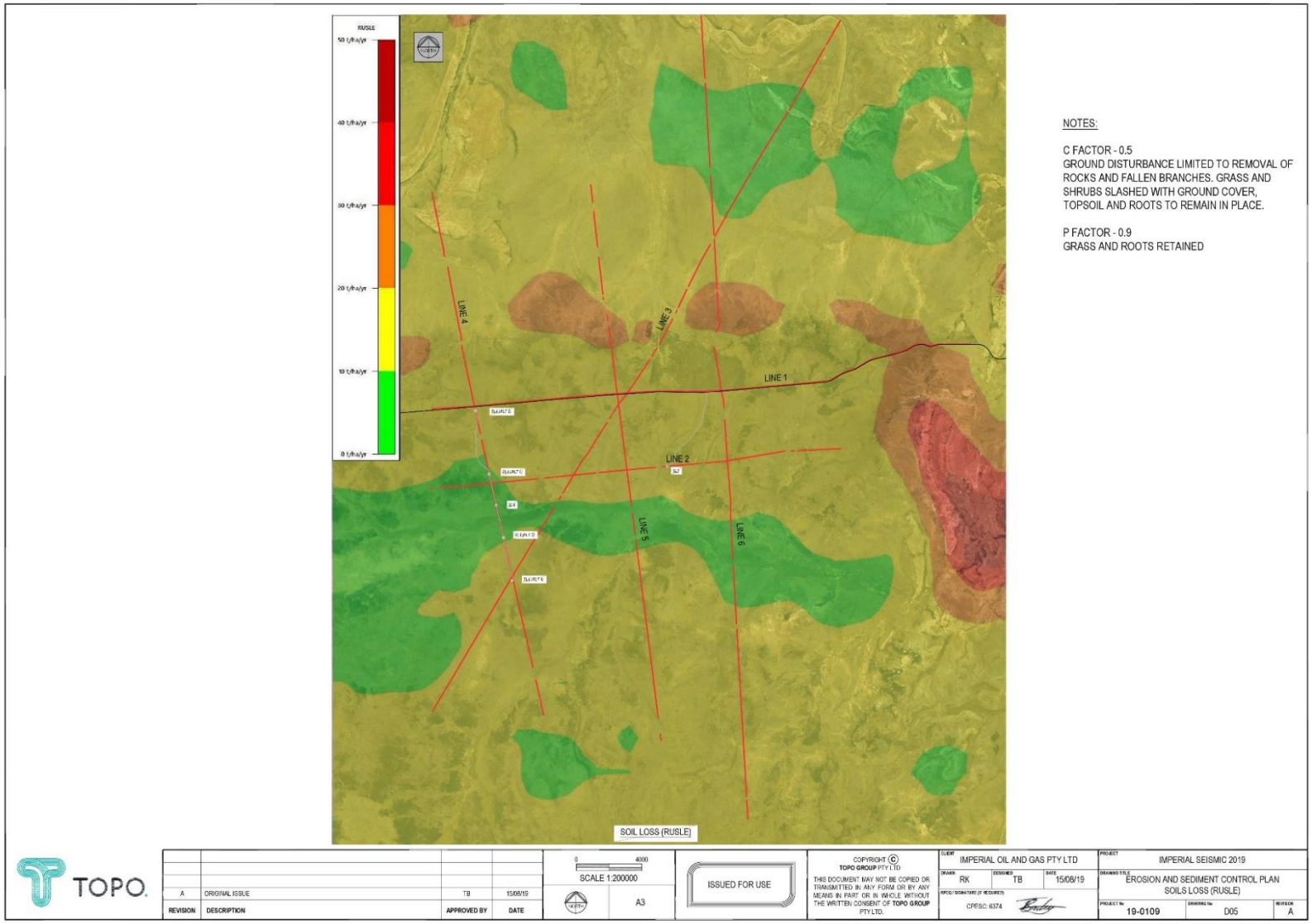
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DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN COVER SHEET
PROJECT No: 19-0109 | DRAWING No: D00 | REVISION: A

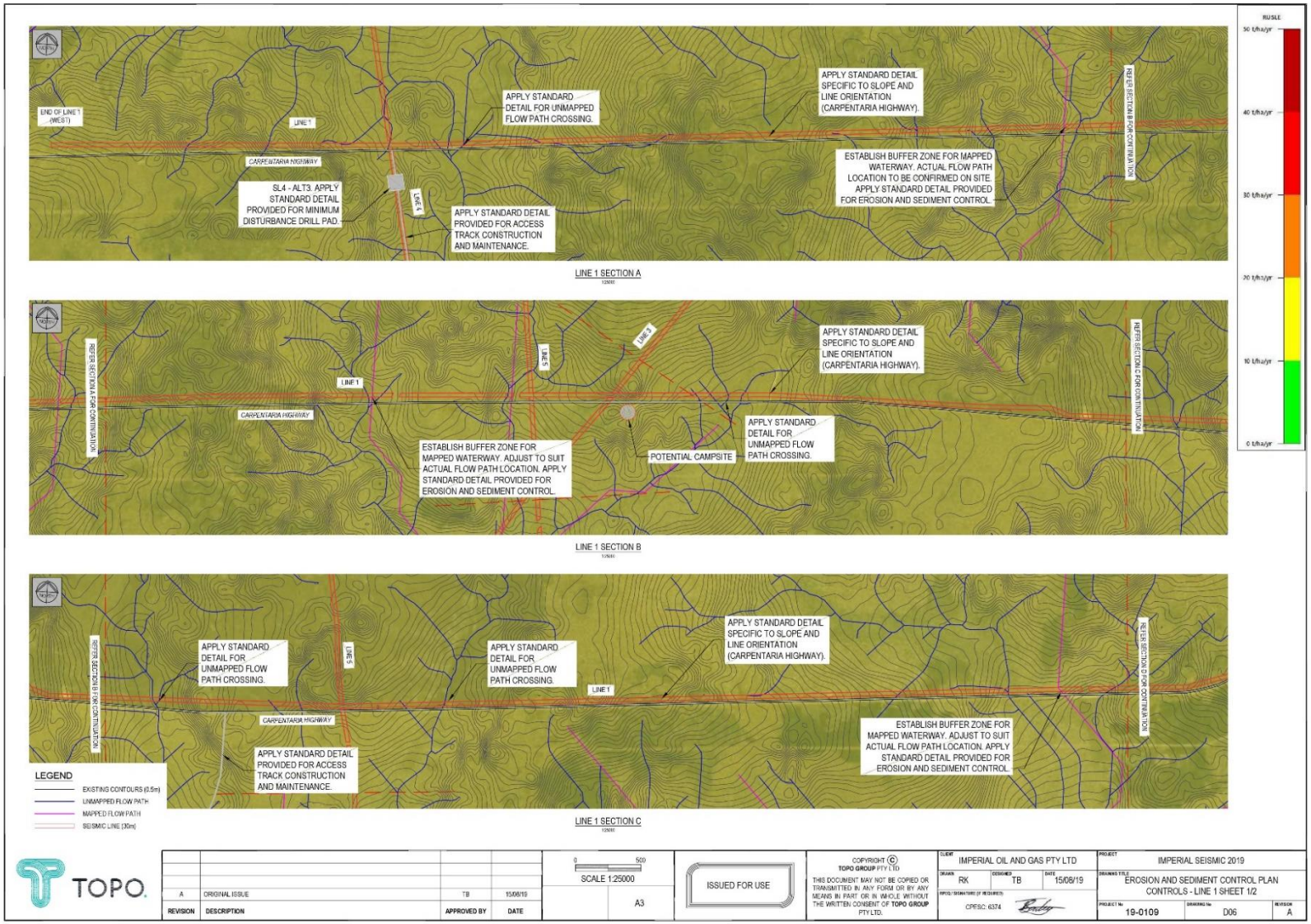

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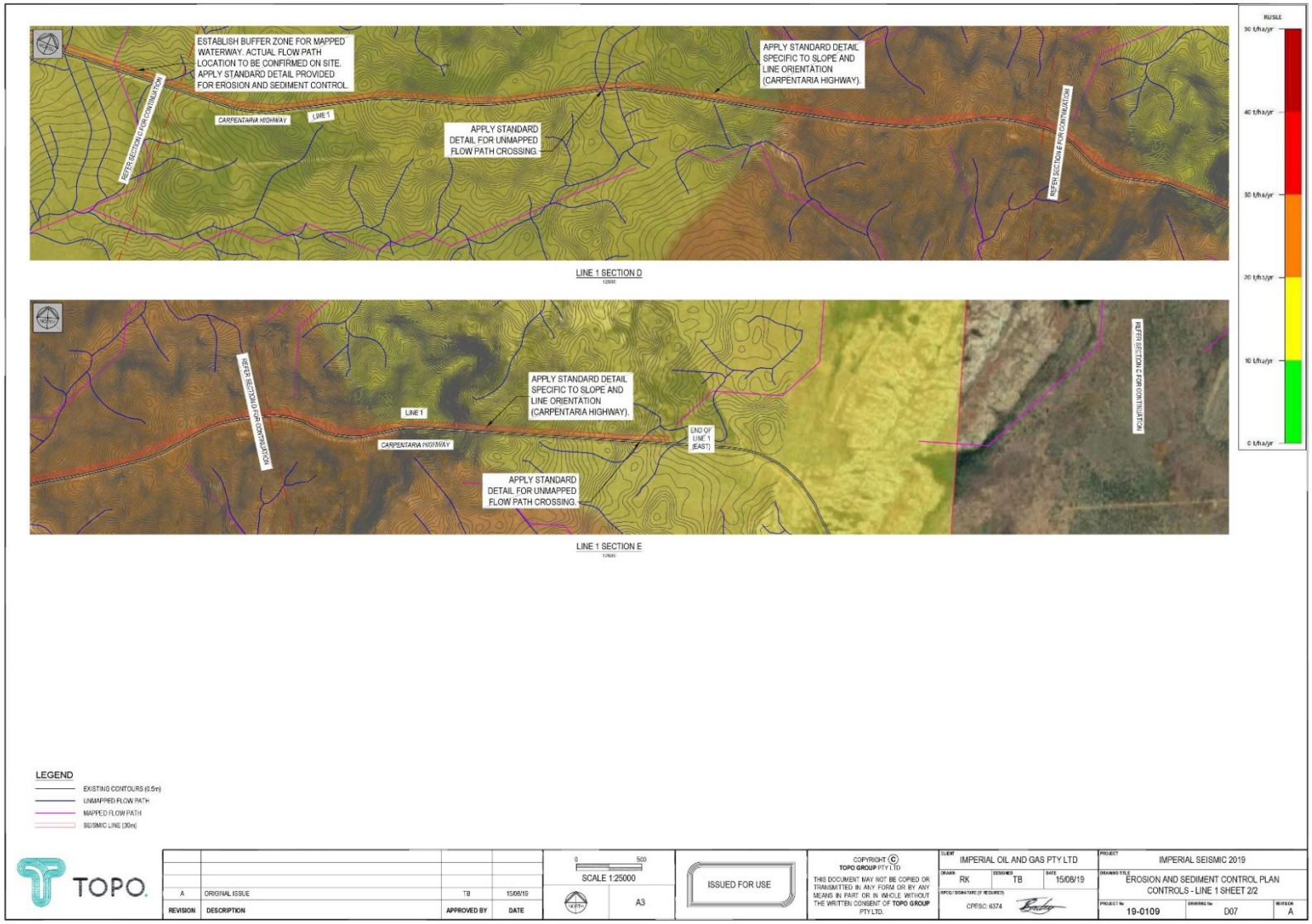

R Factor
3,600
3,500
3,375
3,250
3,125
3,000
3399.1
3457.823
3472.545
3445.288
3418.682
3500.622
3483.632
3424.944
3426.01
3524.404
3459.158
3370.939
3324.652
3371.795
3348.106
3288.197
3207.921
3250.121
3234.379
3203.727
LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
LINE 6
R FACTOR
TOPO.
SCALE 1:200000
A3
ISSUED FOR USE
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IMPERIAL SEISMIC 2019
EROSION AND SEDIMENT CONTROL PLAN
R FACTOR
19-0109
D02
A

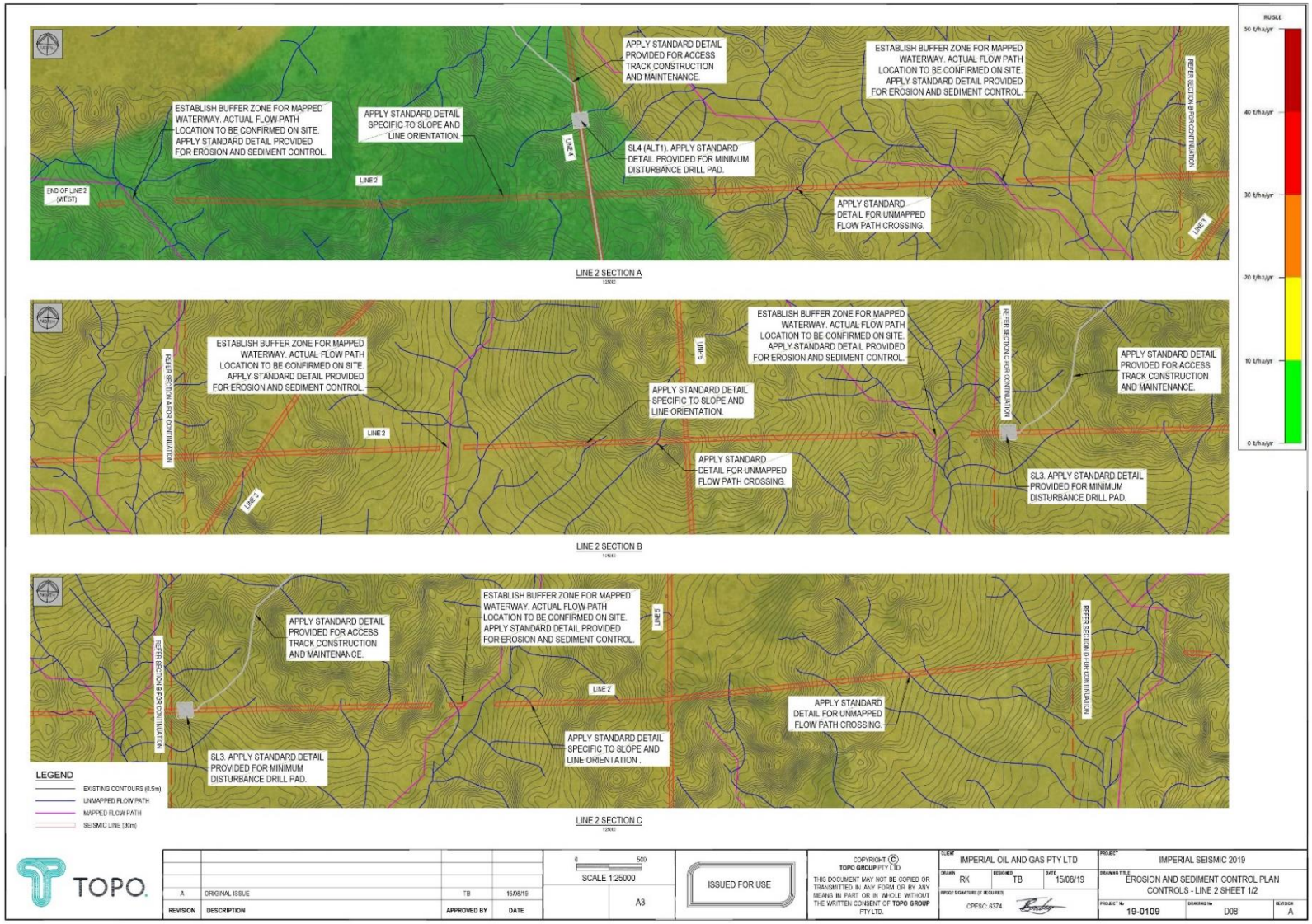

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0.0390
0.0380
0.0370
0.0360
0.0350
0.0340
0.0330
0.0320
0.0310
0.0300
0.0290
0.0280
0.0270
0.0260
0.0250
0.0240
0.0230
0.0220
0.0210
0.0200
0.028
0.03
0.029
LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
LINE 6
K FACTOR
TOPO
SCALE 1:200000
A3
ISSUED FOR USE
IMPERIAL OIL AND GAS PTY LTD
IMPERIAL SEISMIC 2019
EROSION AND SEDIMENT CONTROL PLAN
K FACTOR
19-0109
D03
A
ORIGINAL ISSUE
15/08/19

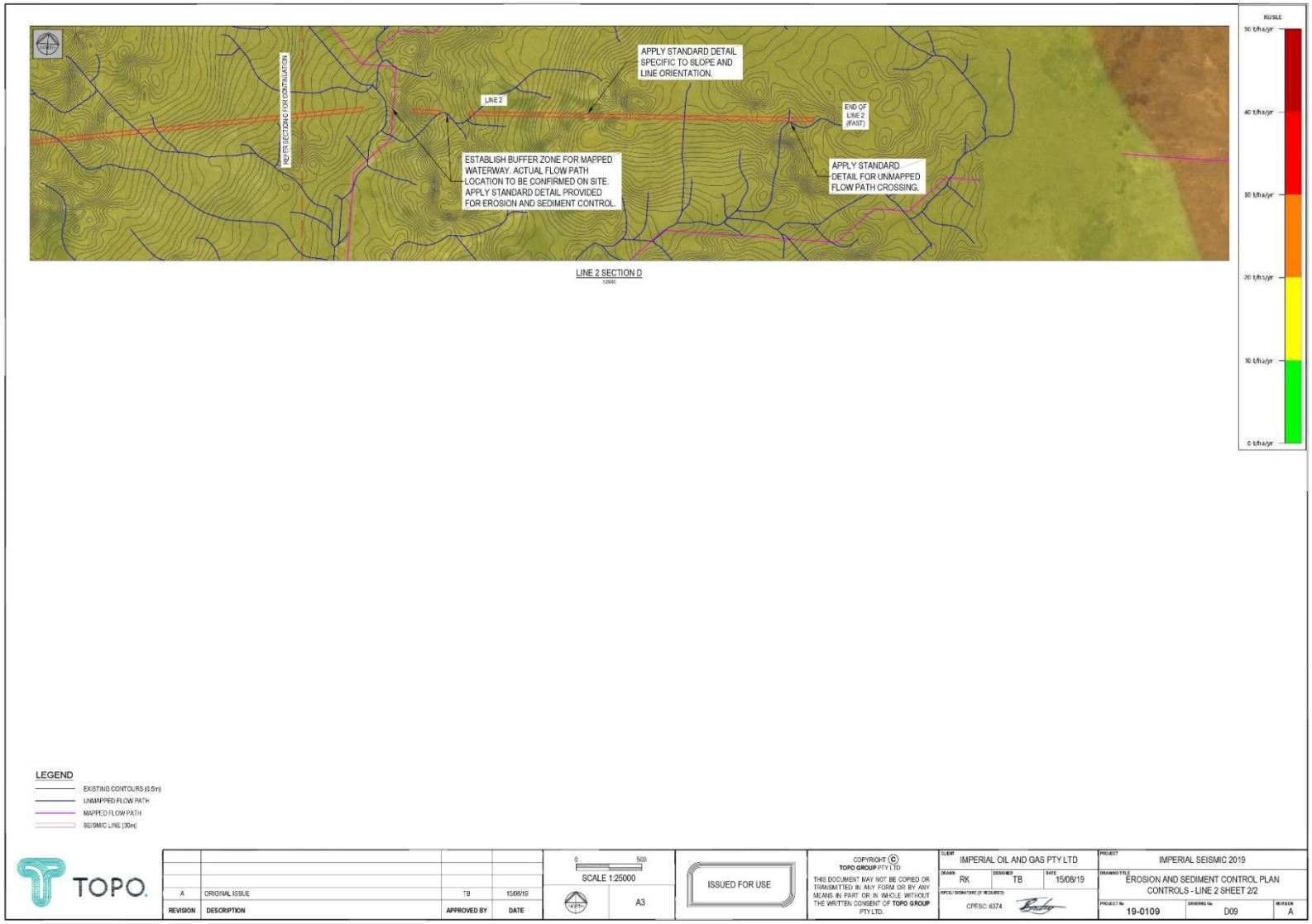

LS Factor
0.800
0.760
0.720
0.680
0.640
0.600
0.560
0.520
0.480
0.440
0.400
0.360
0.320
0.280
0.240
0.200
0.411
0.259
0.199
0.228
0.263
0.286
0.317
0.244
0.277
0.252
0.308
0.78
0.233
0.26
0.215
0.517
0.292
0.241
0.3
0.241
LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
LINE 6
LS FACTOR
TOPO.
SCALE 1:200000
A3
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IMPERIAL SEISMIC 2019
EROSION AND SEDIMENT CONTROL PLAN
LS FACTOR
19-0109
D04
A

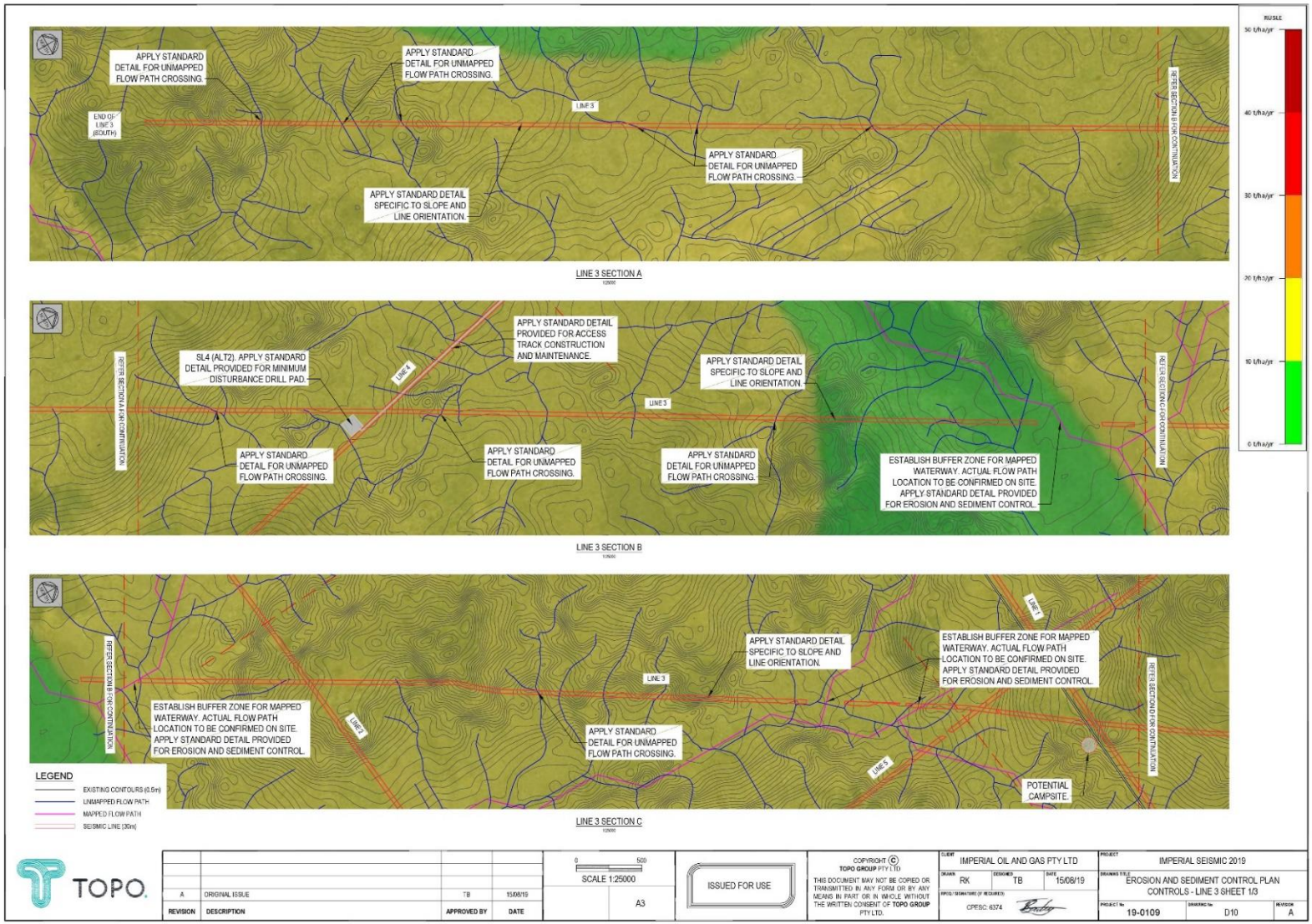

RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
LINE 6
SOIL LOSS (RUSLE)
NOTES:
C FACTOR - 0.5
GROUND DISTURBANCE LIMITED TO REMOVAL OF ROCKS AND FALLEN BRANCHES. GRASS AND SHRUBS SLASHED WITH GROUND COVER, TOPSOIL AND ROOTS TO REMAIN IN PLACE.
P FACTOR - 0.9
GRASS AND ROOTS RETAINED
TOPO.
A ORIGINAL ISSUE TB 15/08/19
REVISION DESCRIPTION APPROVED BY DATE
SCALE 1:200000
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RPEQ/SIGNATURE OF REQUESTS
CPESC: 6374
PROJECT IMPERIAL SEISMIC 2019
DRAWING TITLE EROSION AND SEDIMENT CONTROL PLAN SOILS LOSS (RUSLE)
PROJECT No 19-0109
DRAWING No D05
REVISION A

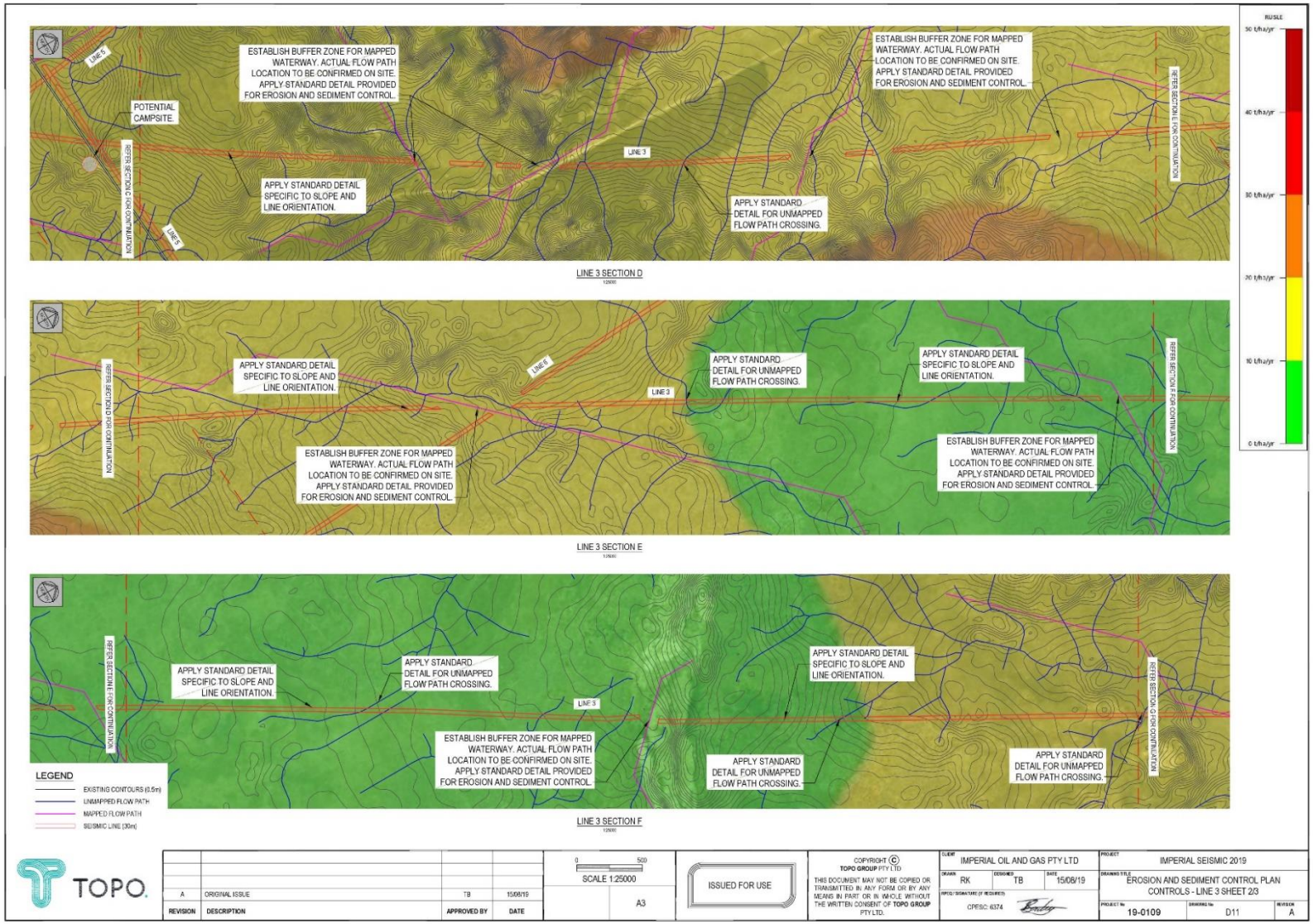

END OF LINE 1 (WEST)
LINE 1
CARPENTARIA HIGHWAY
SL4 - ALT3. APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD.
LINE 5
APPLY STANDARD DETAIL PROVIDED FOR ACCESS TRACK CONSTRUCTION AND MAINTENANCE.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION (CARPENTARIA HIGHWAY).
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION B FOR CONTINUATION
LINE 1 SECTION A
REFER SECTION A FOR CONTINUATION
LINE 1
LINE 5
LINE 3
CARPENTARIA HIGHWAY
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ADJUST TO SUIT ACTUAL FLOW PATH LOCATION. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
POTENTIAL CAMPSITE
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION (CARPENTARIA HIGHWAY).
REFER SECTION C FOR CONTINUATION
LINE 1 SECTION B
REFER SECTION B FOR CONTINUATION
LINE 5
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
LINE 1
CARPENTARIA HIGHWAY
APPLY STANDARD DETAIL PROVIDED FOR ACCESS TRACK CONSTRUCTION AND MAINTENANCE.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION (CARPENTARIA HIGHWAY).
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ADJUST TO SUIT ACTUAL FLOW PATH LOCATION. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION C FOR CONTINUATION
LINE 1 SECTION C
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
TOPO.
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0 500
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RPEQ / SIGNATURE (IF REQUIRED) CPESC: 6374
PROJECT IMPERIAL SEISMIC 2019
DRAWING TITLE EROSION AND SEDIMENT CONTROL PLAN CONTROLS - LINE 1 SHEET 1/2
PROJECT No 19-0109
DRAWING No D06
REVISION A

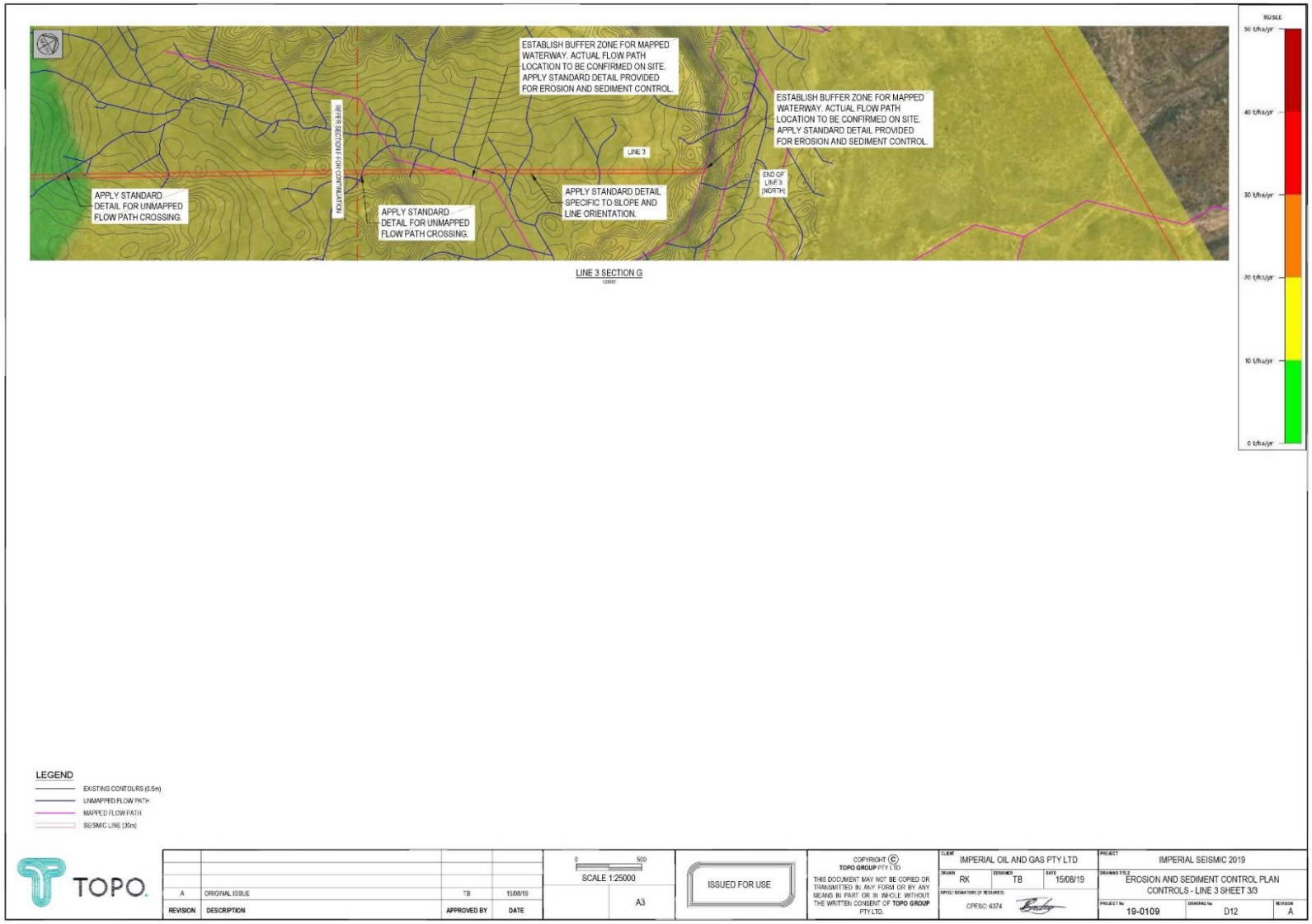

ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION (CARPENTARIA HIGHWAY).
CARPENTARIA HIGHWAY
LINE 1
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
REFER SECTION C FOR CONTINUATION
REFER SECTION E FOR CONTINUATION
LINE 1 SECTION D
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION (CARPENTARIA HIGHWAY).
LINE 1
CARPENTARIA HIGHWAY
END OF LINE 1 (EAST)
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
REFER SECTION D FOR CONTINUATION
REFER SECTION C FOR CONTINUATION
LINE 1 SECTION E
RUSLE
30 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
TOPO.
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0 500
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PROJECT IMPERIAL SEISMIC 2019
DRAWING TITLE EROSION AND SEDIMENT CONTROL PLAN CONTROLS - LINE 1 SHEET 2/2
PROJECT No 19-0109
DRAWING No D07
REVISION A

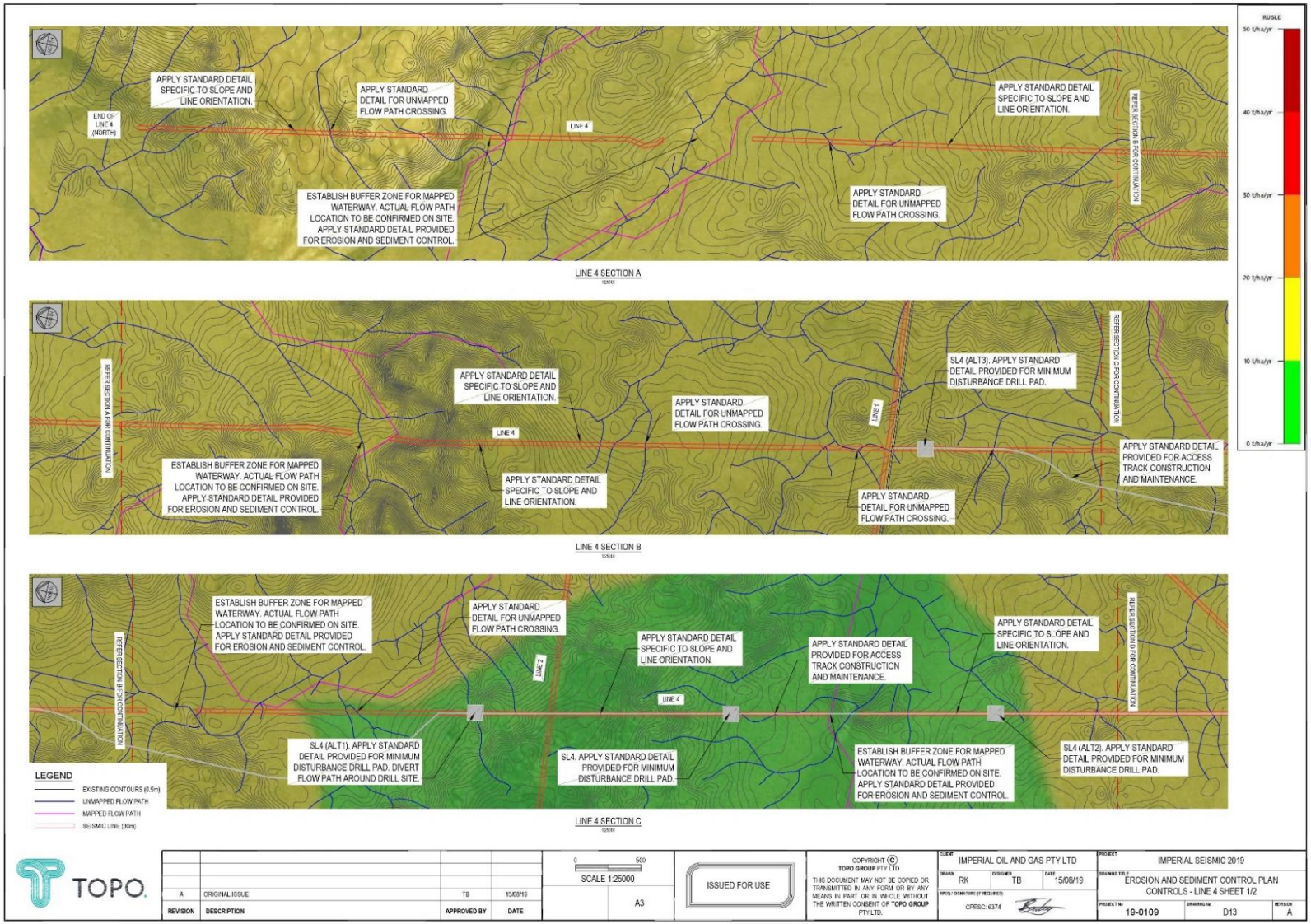

ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL PROVIDED FOR ACCESS TRACK CONSTRUCTION AND MAINTENANCE.
SL4 (ALT1). APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION B FOR CONTINUATION
END OF LINE 2 (WEST)
LINE 1
LINE 2
LINE 3
LINE 2 SECTION A
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION A FOR CONTINUATION
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
SL3. APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD.
APPLY STANDARD DETAIL PROVIDED FOR ACCESS TRACK CONSTRUCTION AND MAINTENANCE.
REFER SECTION C FOR CONTINUATION
LINE 5
LINE 2
LINE 3
LINE 2 SECTION B
APPLY STANDARD DETAIL PROVIDED FOR ACCESS TRACK CONSTRUCTION AND MAINTENANCE.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
SL3. APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
REFER SECTION B FOR CONTINUATION
REFER SECTION D FOR CONTINUATION
LINE 5
LINE 2
LINE 3
LINE 2 SECTION C
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
TOPO.
REVISION
DESCRIPTION
APPROVED BY
DATE
A
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TB
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CPESC: 6374
PROJECT
IMPERIAL SEISMIC 2019
DRAWING TITLE
EROSION AND SEDIMENT CONTROL PLAN CONTROLS - LINE 2 SHEET 1/2
PROJECT No
19-0109
DRAWING No
D08
REVISION
A

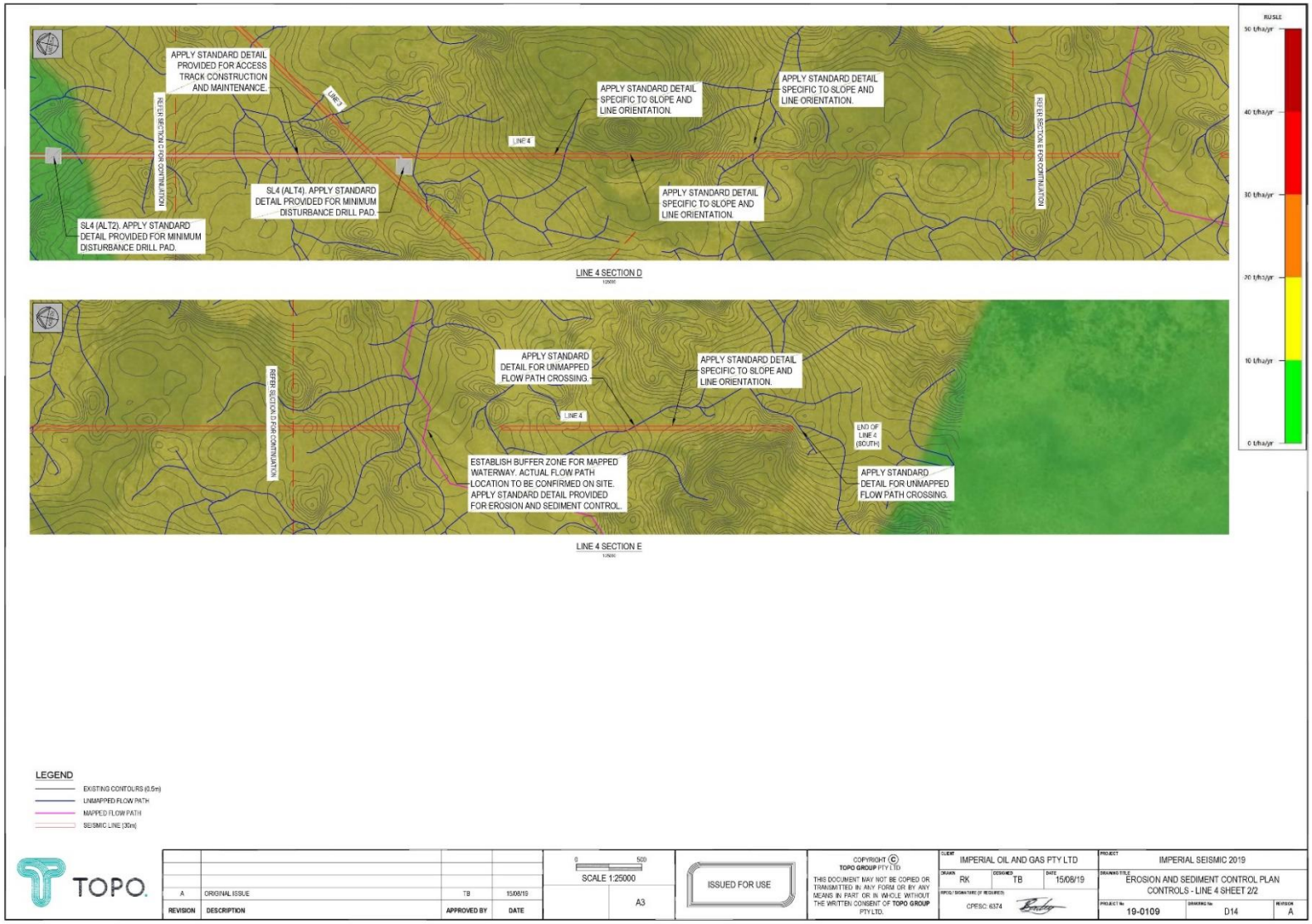

APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
LINE 2
END OF LINE 2 (FAST)
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
REFER SECTION D FOR CONTINUATION
LINE 2 SECTION D
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
TOPO.
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PROJECT No 19-0109 DRAWING No D09 REVISION A

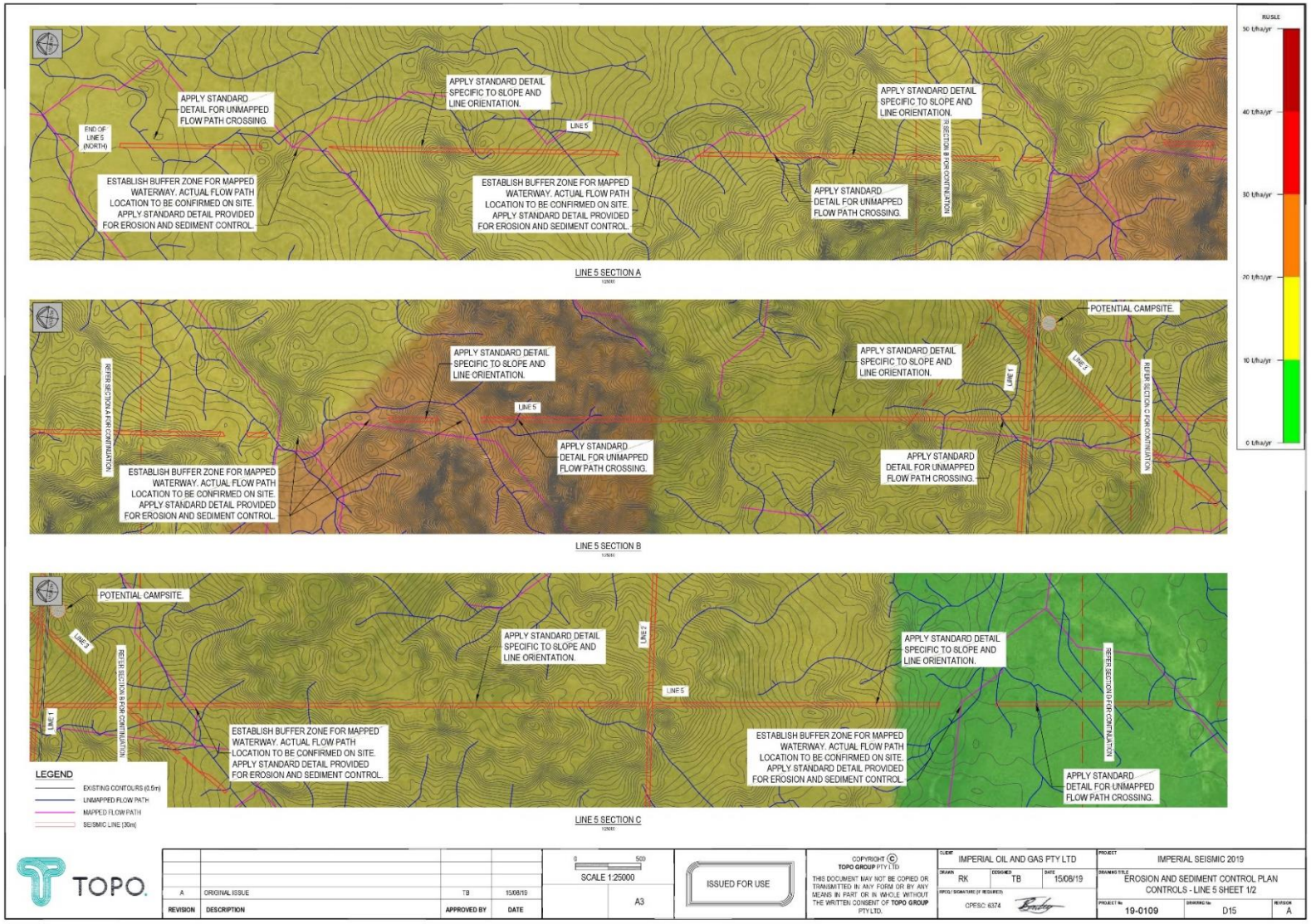

APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
END OF LINE 3 (SOUTH)
LINE 3
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
REFER SECTION A FOR CONTINUATION
LINE 3 SECTION A
SL4 (ALT2). APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD.
LINE 4
APPLY STANDARD DETAIL PROVIDED FOR ACCESS TRACK CONSTRUCTION AND MAINTENANCE.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
LINE 3
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION B FOR CONTINUATION
REFER SECTION C FOR CONTINUATION
LINE 3 SECTION B
REFER SECTION B FOR CONTINUATION
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
LINE 2
LINE 3
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
LINE 1
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
LINE 5
POTENTIAL CAMPSITE.
REFER SECTION C FOR CONTINUATION
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
LINE 3 SECTION C
RUSLE
90 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
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PROJECT No 19-0109
DRAWING No D10
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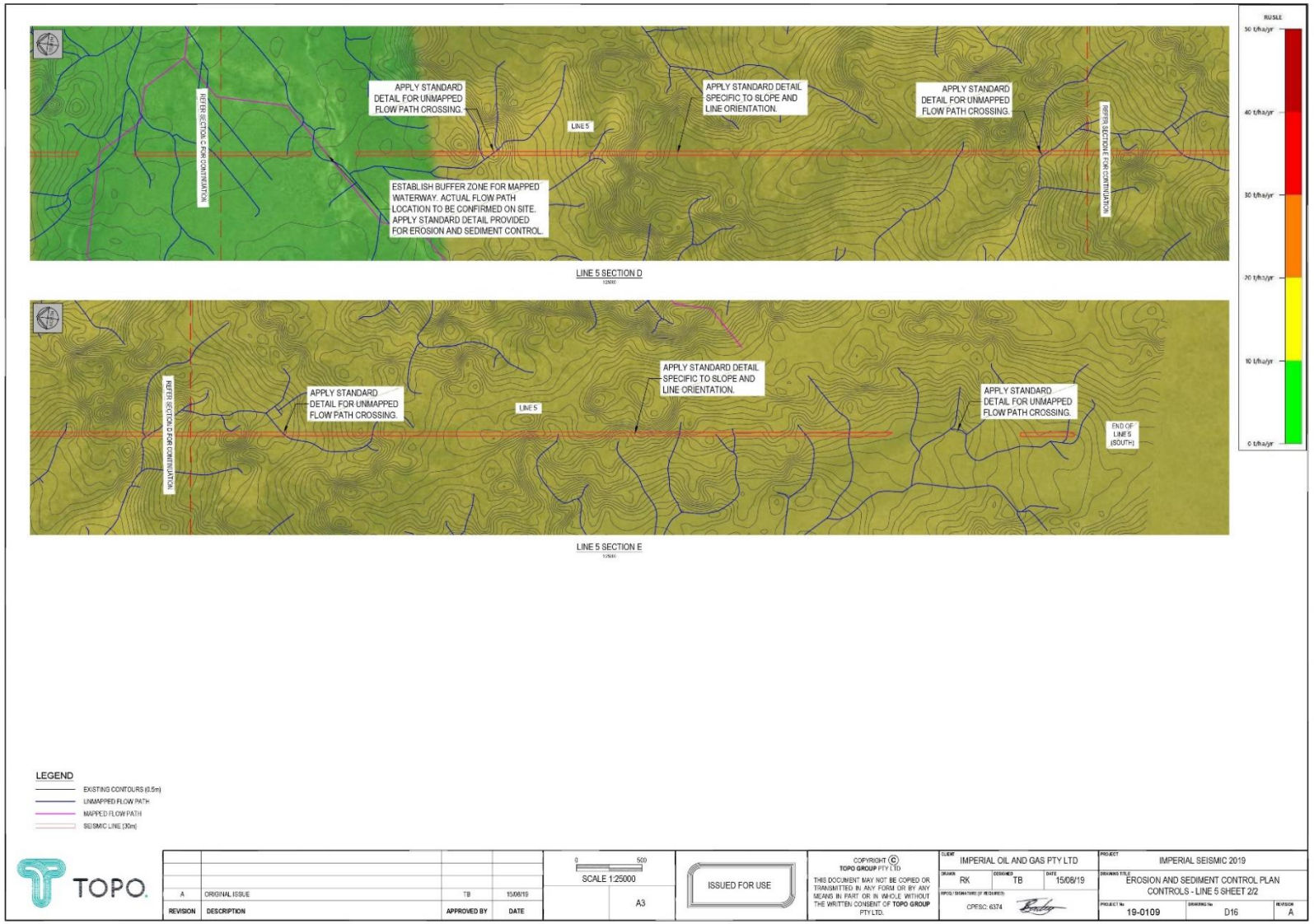

ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
POTENTIAL CAMPSITE.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
LINE 3
LINE 5
LINE 6
REFER SECTION E FOR CONTINUATION
REFER SECTION D FOR CONTINUATION
LINE 3 SECTION D
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION F FOR CONTINUATION
REFER SECTION D FOR CONTINUATION
LINE 3 SECTION E
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION E FOR CONTINUATION
LINE 3 SECTION F
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
TOPO.
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DRAWING TITLE EROSION AND SEDIMENT CONTROL PLAN CONTROLS - LINE 3 SHEET 2/3
PROJECT No 19-0109
DRAWING No D11
REVISION A

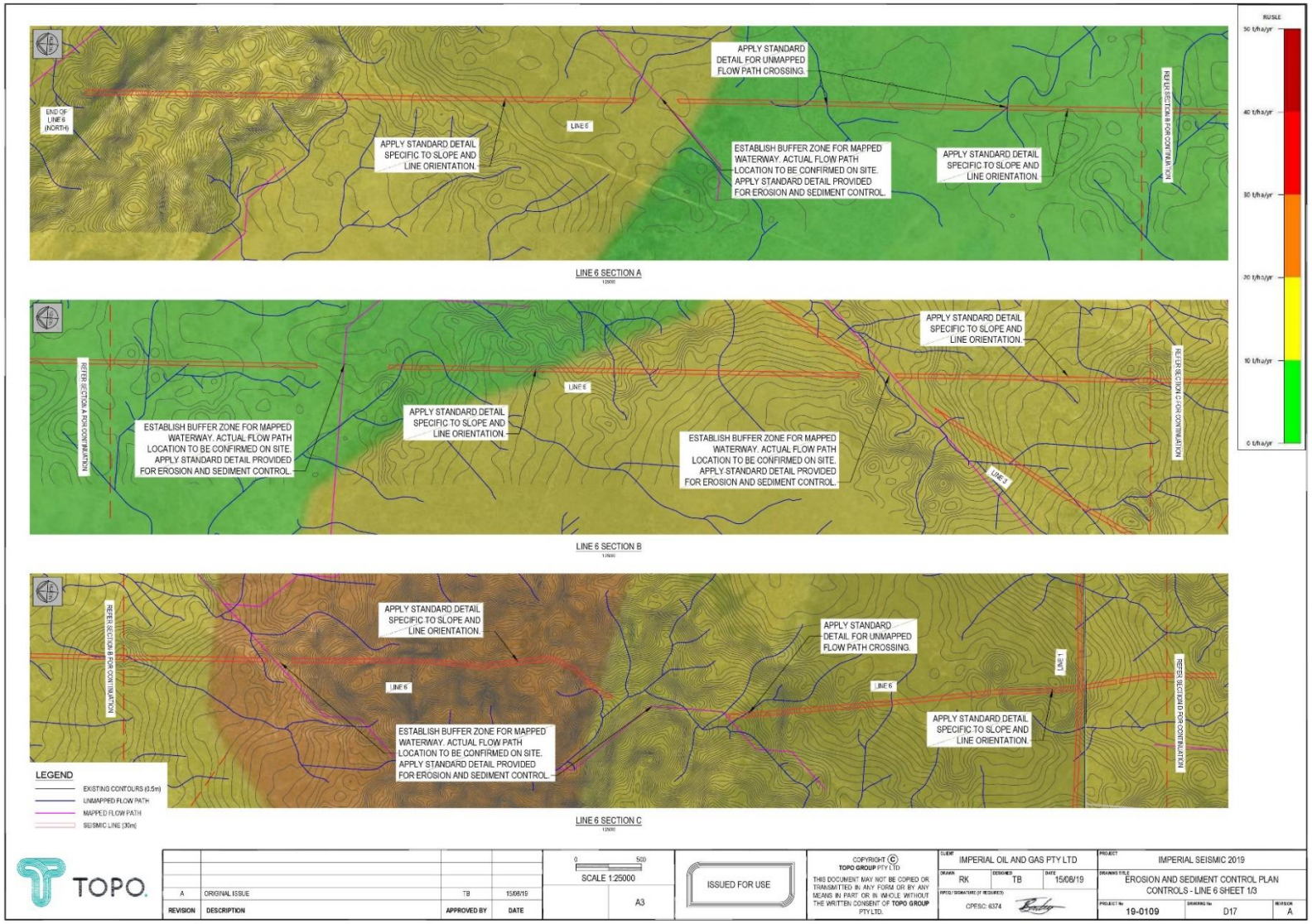

ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION FOR CONTINUATION
LINE 3
END OF LINE 3 (NORTH)
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
LINE 3 SECTION G
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
TOPO.
A ORIGINAL ISSUE TB 15/08/19
REVISION DESCRIPTION APPROVED BY DATE
0 500
SCALE 1:25000
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DRAWN RK DESIGNED TB DATE 15/08/19
RPEQ / SIGNATURE (IF REQUIRED) CPESC: 6374
PROJECT IMPERIAL SEISMIC 2019
DRAWING TITLE EROSION AND SEDIMENT CONTROL PLAN CONTROLS - LINE 3 SHEET 3/3
PROJECT No 19-0109
DRAWING No D12
REVISION A

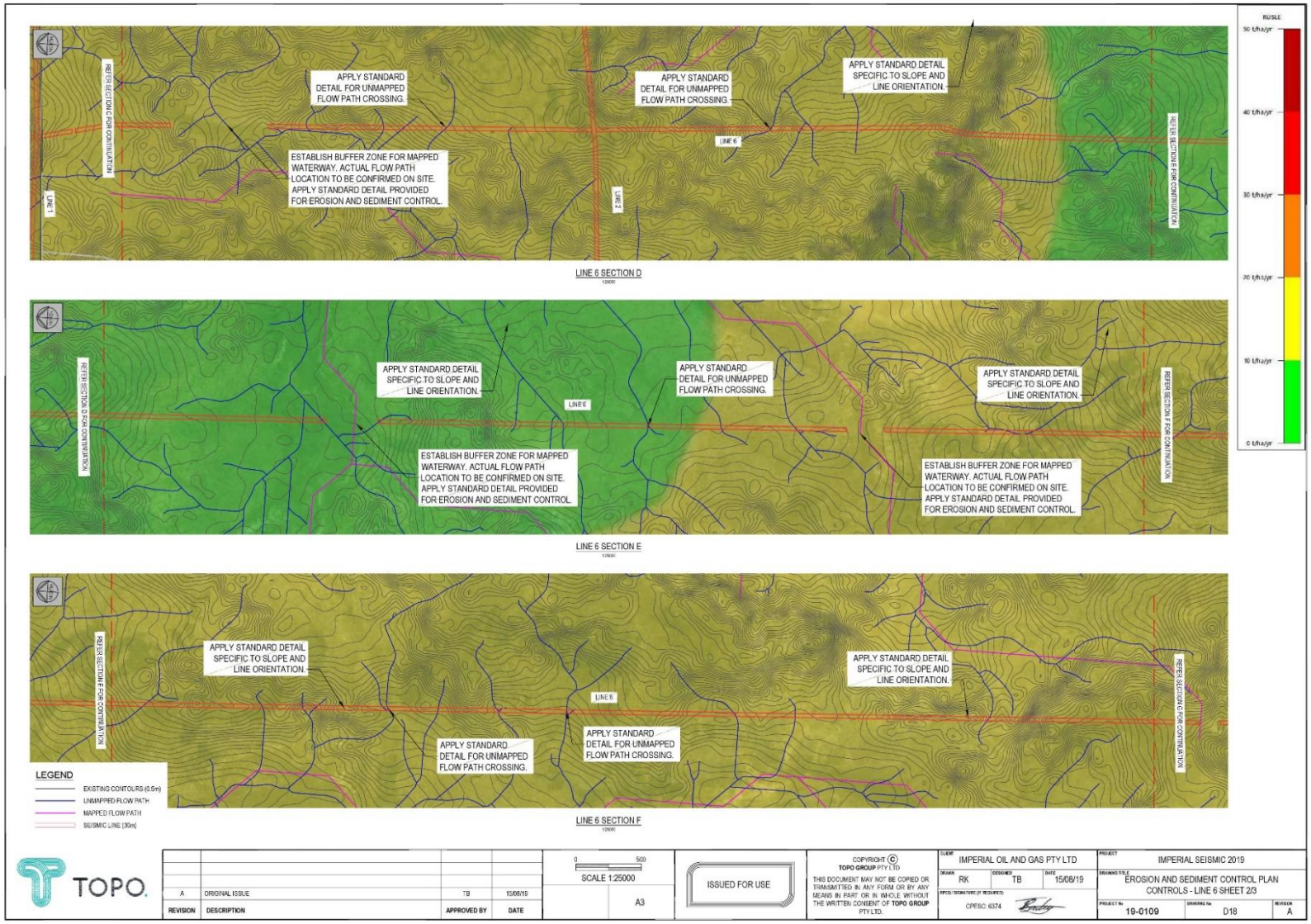

APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
END OF LINE 4 (NORTH)
LINE 4
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
REFER SECTION B FOR CONTINUATION
LINE 4 SECTION A
REFER SECTION A FOR CONTINUATION
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
LINE 4
LINE 1
SL4 (ALT3). APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD.
REFER SECTION C FOR CONTINUATION
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL PROVIDED FOR ACCESS TRACK CONSTRUCTION AND MAINTENANCE.
LINE 4 SECTION B
REFER SECTION B FOR CONTINUATION
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL PROVIDED FOR ACCESS TRACK CONSTRUCTION AND MAINTENANCE.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
REFER SECTION D FOR CONTINUATION
LINE 2
LINE 4
SL4 (ALT1). APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD. DIVERT FLOW PATH AROUND DRILL SITE.
SL4. APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
SL4 (ALT2). APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD.
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
LINE 4 SECTION C
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
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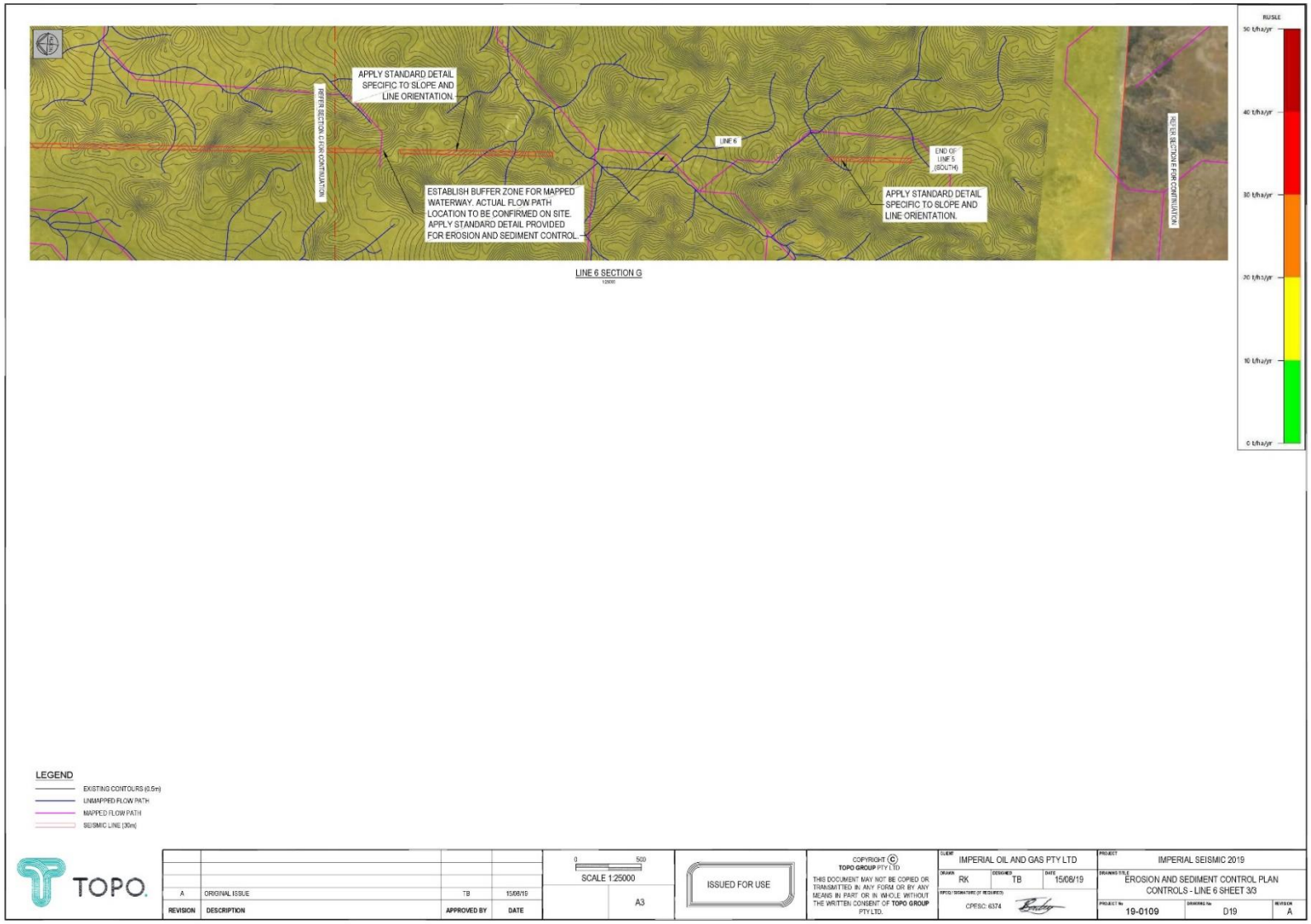

APPLY STANDARD DETAIL PROVIDED FOR ACCESS TRACK CONSTRUCTION AND MAINTENANCE.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
SL4 (ALT4). APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
SL4 (ALT2). APPLY STANDARD DETAIL PROVIDED FOR MINIMUM DISTURBANCE DRILL PAD.
LINE 4
LINE 3
REFER SECTION D FOR CONTINUATION
REFER SECTION E FOR CONTINUATION
LINE 4 SECTION D
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
END OF LINE 4 (SOUTH)
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
LINE 4 SECTION E
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
TOPO.
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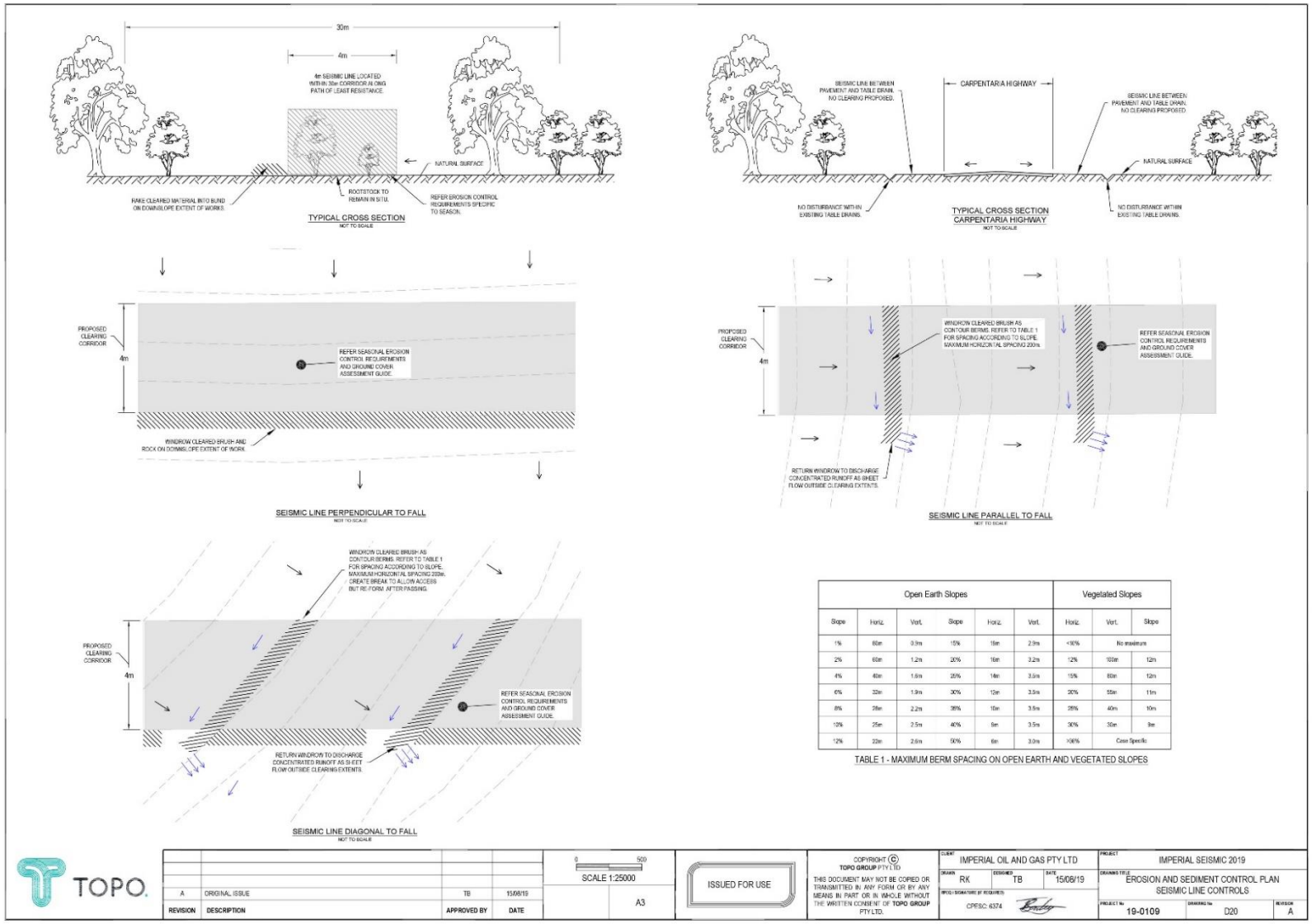

RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
END OF LINE 5 (NORTH)
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
LINE 5
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION B FOR CONTINUATION
LINE 5 SECTION A
REFER SECTION A FOR CONTINUATION
POTENTIAL CAMPSITE.
LINE 1
LINE 2
REFER SECTION C FOR CONTINUATION
LINE 5 SECTION B
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
LINE 5 SECTION C
TOPO.
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APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
LINE 5
REFER SECTION C FOR CONTINUATION
REFER SECTION E FOR CONTINUATION
LINE 5 SECTION D
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
END OF LINE 5 (SOUTH)
REFER SECTION D FOR CONTINUATION
LINE 5 SECTION E
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
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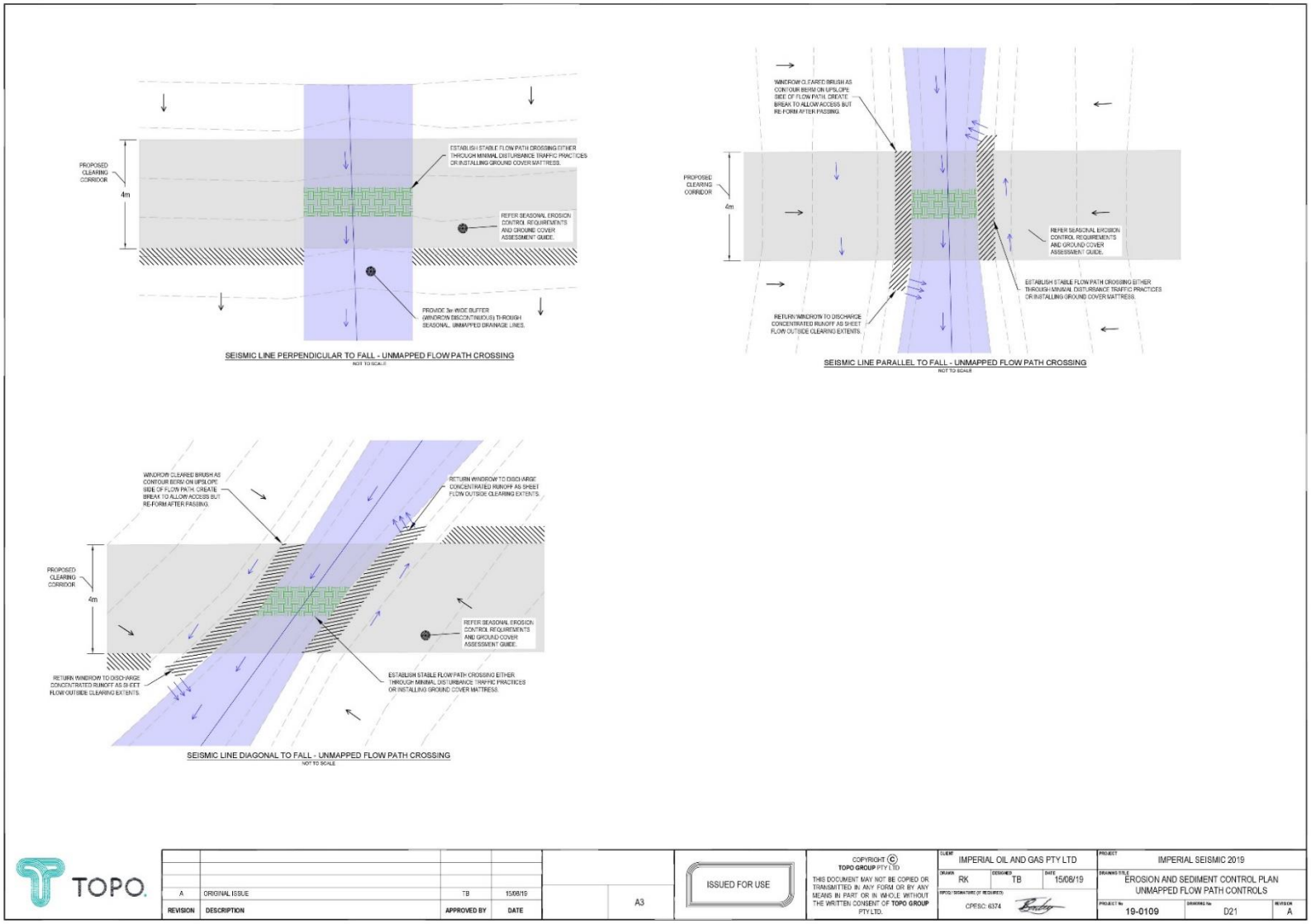

APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
END OF LINE 6 (NORTH)
LINE 6
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
REFER SECTION B FOR CONTINUATION
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
LINE 6 SECTION A
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
REFER SECTION A FOR CONTINUATION
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
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ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION C FOR CONTINUATION
LINE 6 SECTION B
REFER SECTION B FOR CONTINUATION
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
LINE 6
LINE 6
LINE 1
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION B FOR CONTINUATION
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
LINE 6 SECTION C
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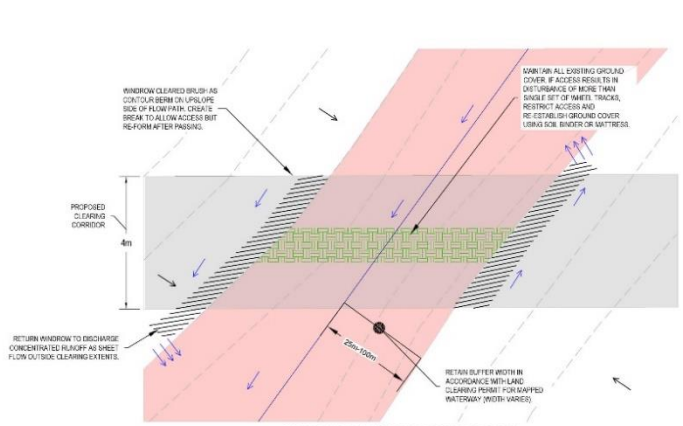

APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION C FOR CONTINUATION
REFER SECTION E FOR CONTINUATION
LINE 1
LINE 2
LINE 6
LINE 6 SECTION D
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
REFER SECTION D FOR CONTINUATION
REFER SECTION F FOR CONTINUATION
LINE 6
LINE 6 SECTION E
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
APPLY STANDARD DETAIL FOR UNMAPPED FLOW PATH CROSSING.
REFER SECTION E FOR CONTINUATION
REFER SECTION G FOR CONTINUATION
LINE 6
LINE 6 SECTION F
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
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APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
REFER SECTION FOR CONFIRMATION
ESTABLISH BUFFER ZONE FOR MAPPED WATERWAY. ACTUAL FLOW PATH LOCATION TO BE CONFIRMED ON SITE. APPLY STANDARD DETAIL PROVIDED FOR EROSION AND SEDIMENT CONTROL.
LINE 6
END OF LINE 5 (SOUTH)
APPLY STANDARD DETAIL SPECIFIC TO SLOPE AND LINE ORIENTATION.
REFER SECTION FOR CONFIRMATION
LINE 6 SECTION G
RUSLE
50 t/ha/yr
40 t/ha/yr
30 t/ha/yr
20 t/ha/yr
10 t/ha/yr
0 t/ha/yr
LEGEND
EXISTING CONTOURS (0.5m)
UNMAPPED FLOW PATH
MAPPED FLOW PATH
SEISMIC LINE (30m)
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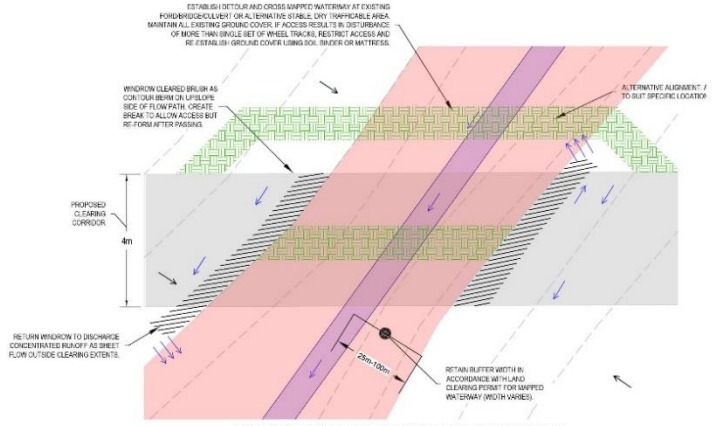
Open Earth Slopes						Vegetated Slopes		
Slope	Horiz.	Vert.	Slope	Horiz.	Vert.	Horiz.	Vert.	Slope
1%	80m	0.9m	15%	15m	2.3m	<16%	No maximum	
2%	60m	1.2m	20%	16m	3.2m	12%	100m	12m
4%	40m	1.6m	25%	14m	3.5m	15%	80m	12m
6%	32m	1.9m	30%	12m	3.5m	20%	55m	11m
8%	28m	2.2m	35%	10m	3.5m	25%	40m	10m
10%	25m	2.5m	40%	9m	3.5m	30%	30m	9m
12%	22m	2.6m	50%	6m	3.0m	>36%	Case Specific	


PROPOSED CLEARING CORRIDOR
4m
ESTABLISH STABLE FLOW PATH CROSSING EITHER THROUGH MINIMAL DISTURBANCE TRAFFIC PRACTICES OR INSTALLING GROUND COVER MATTRESS.
REFER SEASONAL EROSION CONTROL REQUIREMENTS AND GROUND COVER ASSESSMENT GUIDE.
PROVIDE 3m WIDE BUFFER (WINDROW DISCONTINUOUS) THROUGH SEASONAL, UNMAPPED DRAINAGE LINES.
SEISMIC LINE PERPENDICULAR TO FALL - UNMAPPED FLOW PATH CROSSING
NOT TO SCALE
WINDROW CLEARED BRUSH AS CONTOUR BERM ON UPSLOPE SIDE OF FLOW PATH. CREATE BREAK TO ALLOW ACCESS BUT RE-FORM AFTER PASSING.
PROPOSED CLEARING CORRIDOR
4m
REFER SEASONAL EROSION CONTROL REQUIREMENTS AND GROUND COVER ASSESSMENT GUIDE.
ESTABLISH STABLE FLOW PATH CROSSING EITHER THROUGH MINIMAL DISTURBANCE TRAFFIC PRACTICES OR INSTALLING GROUND COVER MATTRESS.
RETURN WINDROW TO DISCHARGE CONCENTRATED RUNOFF AS SHEET FLOW OUTSIDE CLEARING EXTENTS.
SEISMIC LINE PARALLEL TO FALL - UNMAPPED FLOW PATH CROSSING
NOT TO SCALE
WINDROW CLEARED BRUSH AS CONTOUR BERM ON UPSLOPE SIDE OF FLOW PATH. CREATE BREAK TO ALLOW ACCESS BUT RE-FORM AFTER PASSING.
RETURN WINDROW TO DISCHARGE CONCENTRATED RUNOFF AS SHEET FLOW OUTSIDE CLEARING EXTENTS.
PROPOSED CLEARING CORRIDOR
4m
REFER SEASONAL EROSION CONTROL REQUIREMENTS AND GROUND COVER ASSESSMENT GUIDE.
RETURN WINDROW TO DISCHARGE CONCENTRATED RUNOFF AS SHEET FLOW OUTSIDE CLEARING EXTENTS.
ESTABLISH STABLE FLOW PATH CROSSING EITHER THROUGH MINIMAL DISTURBANCE TRAFFIC PRACTICES OR INSTALLING GROUND COVER MATTRESS.
SEISMIC LINE DIAGONAL TO FALL - UNMAPPED FLOW PATH CROSSING
NOT TO SCALE
TOPO.
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UNMAPPED FLOW PATH CONTROLS
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MAPPED WATERWAY BUFFER - TRAFFICABLE WITH NO FORMED BANKS AND NO SURFACE WATER EVIDENT

NOT TO SCALE



MAPPED WATERWAY BUFFER - NOT TRAFFICABLE: FORMED BANKS AND SURFACE WATER EVIDENT

NOT TO SCALE

EROSION CONTROL ELEMENT	DRY SEASON	WET SEASON
Advance Land Clearing (max)	30 days	5 days
Rainfall forecast trigger for stabilisation of exposed surfaces	>60% chance of >5mm	>50% chance of >20mm
Minimum ground cover required for stabilisation	70%	85%
Reinstatement/revegetation timeframes	30 days	5 days

TABLE 2 - EROSION CONTROL REQUIREMENTS

SEISMIC LINE CLEARING METHODOLOGY

GIVEN THAT A HIGH LEVEL OF GROUND COVER IS EXPECTED TO BE RETAINED ON SITE, THE FOLLOWING METHODOLOGY AND APPROACH TO EROSION CONTROL IS PROPOSED.

STEP 1: ASSESS SITE AND SELECT PATH OF LEAST DISTURBANCE FOR 4M WIDTH OF CLEARING WITHIN 30M CORRIDOR.

STEP 2: PROGRAMME ALIGNMENT INTO CLEARING MACHINERY TO PREVENT OVER-DISTURBANCE OR INTRUSION OF BUFFER ZONES

STEP 3: COMMENCE CLEARING, ENSURING TIMEFRAMES BETWEEN CLEARING AND SCHEDULED SEISMIC WORK DO NOT EXCEED THOSE INDICATED IN TABLE 8.

STEP 4: COMPLETE CLEARING AND ASSESS RESIDUAL GROUNDCOVER (%) USING THE TOOLS PRESENTED IN APPENDIX A.

STEP 5: CARRY OUT SEISMIC WORKS, ENSURING THAT IF RAINFALL IS FORECAST THAT EXCEEDS THE PROBABILITY AND DEPTH PRESENTED IN TABLE 8 IMMEDIATELY RE-ESTABLISH THE LEVEL OF GROUNDCOVER REQUIRED IN TABLE 8 (IF CURRENT % ASSESSED IN STEP 4 DOES NOT COMPLY).

STEP 6: COMPLETE SURVEY AND RE-ESTABLISH MINIMUM GROUND COVER % WITHIN MINIMUM TIMEFRAMES INDICATED IN TABLE 8.

OPTIONS FOR RE-ESTABLISHING GROUND COVER INCLUDE:

- RESPREADING WINDROWED GRASS, BRANCHES, ROCKS AND OTHER VEGETATION OVER EXPOSED AREAS
- APPLICATION OF SOIL BINDER AT MANUFACTURERS SPECIFICATION
  - EG. VITAL STONEWALL APPLIED AT MINIMUM 1L/M^2

IT IS SUGGESTED THAT A SUPPLY OF SOIL BINDER BE READILY AVAILABLE TO SEISMIC TEAMS TO ACHIEVE THE TIMEFRAMES AND GROUNDCOVER REQUIREMENTS PROPOSED (NOTE, BINDER CAN BE APPLIED VIA THE SAME WATER TRUCKS USED ON STANDBY FOR FIRE SUPPRESSION).

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DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN MAPPED FLOW PATH CONTROLS

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GROUND COVER ASSESSMENT

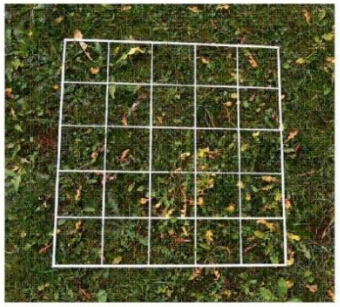
STEP POINT METHOD

1. PREPARE A FIELD SHEET ON WHICH TO RECORD OBSERVATIONS.
2. IDENTIFY AN AREA WITHIN THE SITE WHICH IS TYPICAL IN TERMS OF THE AMOUNT OF COVER AND PROPORTION OF NATIVE GROUNDCOVER.
3. WALK 100 STEPS IN A STRAIGHT LINE ACROSS THE SELECTED AREA.
4. AT EACH STEP, RECORD THE GROUNDCOVER AT THE TIP OF YOUR BOOT.
5. REPEAT THIS IN AT LEAST FOUR OTHER AREAS ACROSS THE CLEARED SITE, COVERING VARIATIONS IN GROUNDCOVER WHERE POSSIBLE.
6. TO CALCULATE THE PERCENTAGE OF THE GROUNDCOVER DIVIDE THE AVERAGE BY THE OVERALL GROUNDCOVER PERCENTAGE FROM THE PREVIOUS STEP AND THEN MULTIPLY BY 100.
7. LOG PHOTOGRAPHS OF THE ASSESSMENT FOR PERFORMANCE TRACKING.

QUADRAT METHOD

THIS METHOD USES A SQUARE FRAME (QUADRAT) OF AT LEAST 70cm x 70cm. SUCH A QUADRAT IS EASILY ASSEMBLED USING FOUR THIN PIECES OF PVC PIPE OR WIRE CUT TO EQUAL LENGTHS AND JOINED WITH TIGHT-FITTING ELBOW JOINTS.

1. PREPARE A FIELD SHEET ON WHICH TO RECORD OBSERVATIONS.
2. WITHIN THE SPECIFIC AREA SELECT AT LEAST FIVE AREAS OF GROUNDCOVER THAT ARE TYPICAL OF THE GROUNDCOVER ACROSS THAT AREA.
3. FOR EACH REPRESENTATIVE AREA (SAMPLE AREA), PLACE THE QUADRAT RANDOMLY 10 TIMES.
4. FOR EACH QUADRAT PLACEMENT ESTIMATE THE PERCENTAGE OF THE QUADRAT THAT HAS VEGETATIVE GROUNDCOVER (NON NATIVE AND NATIVE GROUNDCOVER), AND RECORD THIS IN THE FIELD SHEET.
5. FOR THE WHOLE SITE ADD THE AVERAGES FROM ALL SAMPLE AREAS AND DIVIDE THESE TOTALS BY THE NUMBER OF SAMPLE AREAS TO YIELD THE AVERAGE PERCENTAGE OF GROUNDCOVER (NATIVE AND NON-NATIVE) ACROSS THE ENTIRE SITE.
6. LOG PHOTOGRAPHS OF THE ASSESSMENT FOR PERFORMANCE TRACKING.



QUADRAT METHOD



GROUND COVER - 20%



GROUND COVER - 40%

'GROUND COVER' APP

A USEFUL APPLICATION TO ASSESS GROUND COVER IS AVAILABLE FOR IOS DEVICES ON THE APP STORE. 'GROUND COVER' USES GEO-LOCATION TECHNOLOGY ALONG WITH A STANDARD STEP POINT MONITORING PROCESS AND IS SUPPORTED WITH PHOTOGRAPHIC BENCHMARK CAPABILITY. 'GROUND COVER' TAKES THE USER THROUGH THE STEP POINT METHOD IN A STRAIGHT FORWARD WAY TO GET YOU STARTED.

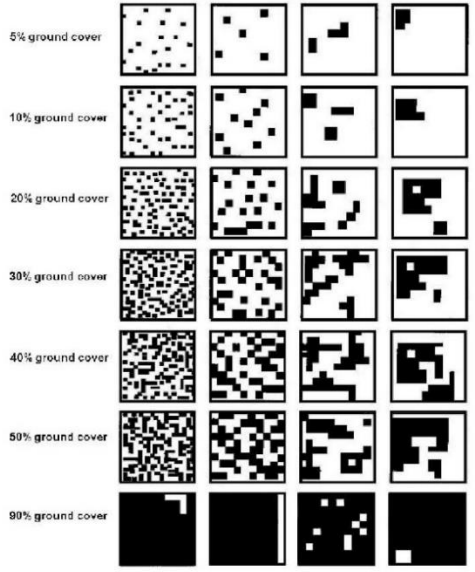


GROUND COVER - 70%



GROUND COVER - 90%

GROUND COVER ASSESSMENT OF VEGETATION



GROUND COVER ASSESSMENT FOR VEGETATION, ROCK, GRAVEL, SOIL BINDER, LEAF MATTER, MULCH OR SIMILAR

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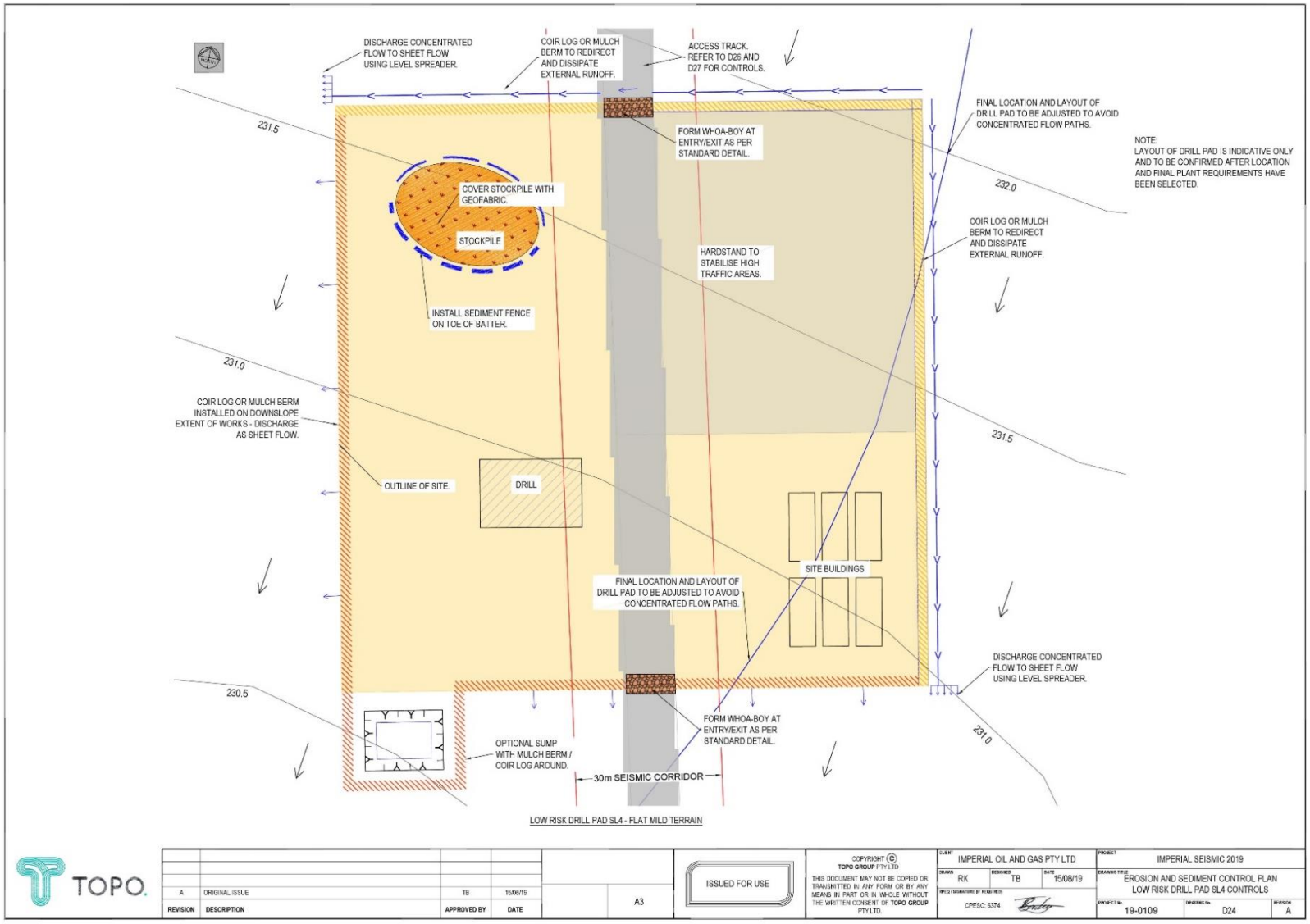
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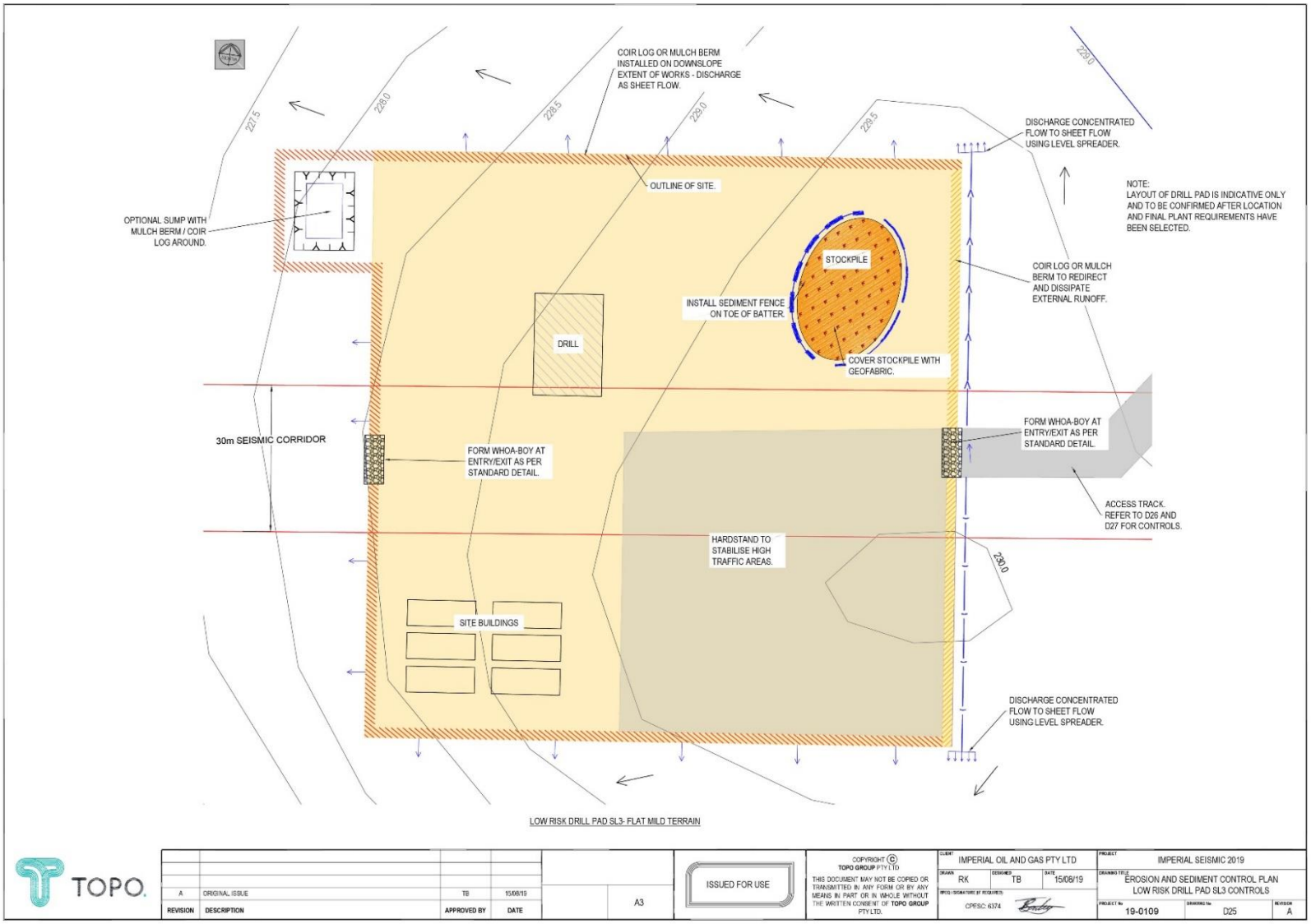
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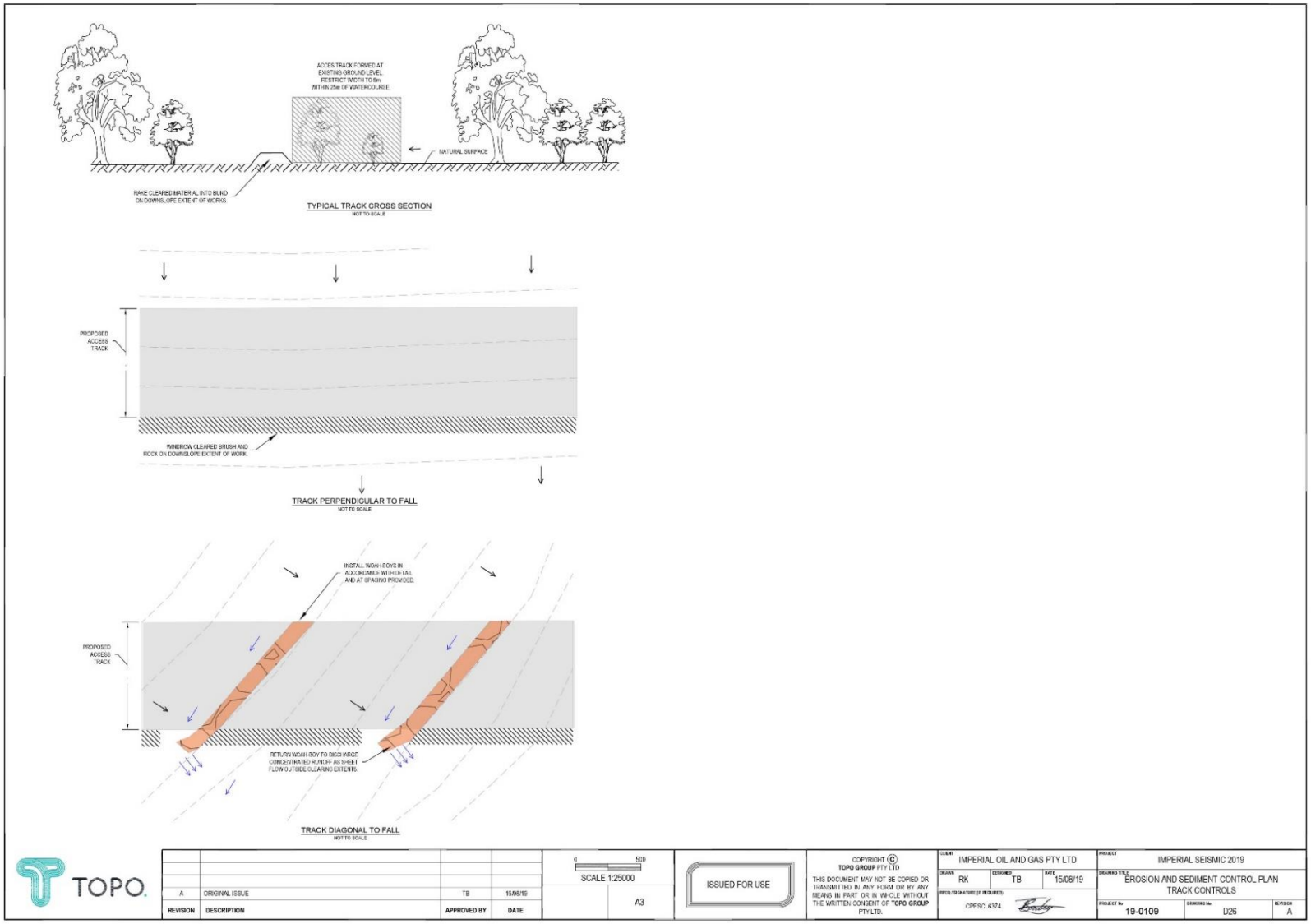
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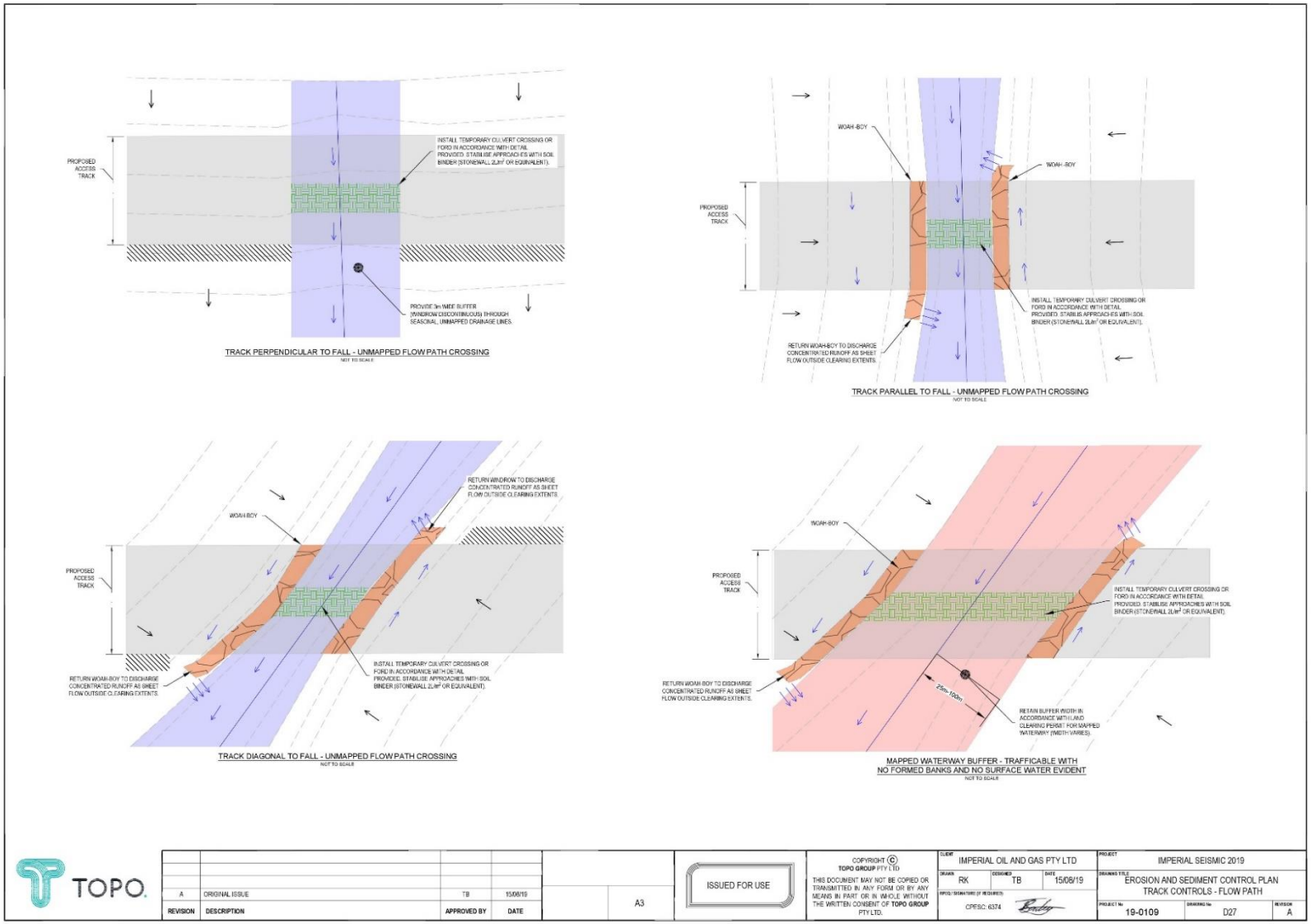
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DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
GROUND COVER ASSESSMENT
PROJECT No: 19-0109 | DRAWING No: D23 | REVISION: A


DISCHARGE CONCENTRATED FLOW TO SHEET FLOW USING LEVEL SPREADER.
COIR LOG OR MULCH BERM TO REDIRECT AND DISSIPATE EXTERNAL RUNOFF.
ACCESS TRACK. REFER TO D26 AND D27 FOR CONTROLS.
FINAL LOCATION AND LAYOUT OF DRILL PAD TO BE ADJUSTED TO AVOID CONCENTRATED FLOW PATHS.
NOTE: LAYOUT OF DRILL PAD IS INDICATIVE ONLY AND TO BE CONFIRMED AFTER LOCATION AND FINAL PLANT REQUIREMENTS HAVE BEEN SELECTED.
FORM WHOA-BOY AT ENTRY/EXIT AS PER STANDARD DETAIL.
COVER STOCKPILE WITH GEOFABRIC.
STOCKPILE
HARDSTAND TO STABILISE HIGH TRAFFIC AREAS.
COIR LOG OR MULCH BERM TO REDIRECT AND DISSIPATE EXTERNAL RUNOFF.
INSTALL SEDIMENT FENCE ON TOE OF BATTER.
231.5
232.0
231.0
COIR LOG OR MULCH BERM INSTALLED ON DOWNSLOPE EXTENT OF WORKS - DISCHARGE AS SHEET FLOW.
OUTLINE OF SITE.
DRILL
SITE BUILDINGS
FINAL LOCATION AND LAYOUT OF DRILL PAD TO BE ADJUSTED TO AVOID CONCENTRATED FLOW PATHS.
DISCHARGE CONCENTRATED FLOW TO SHEET FLOW USING LEVEL SPREADER.
230.5
FORM WHOA-BOY AT ENTRY/EXIT AS PER STANDARD DETAIL.
OPTIONAL SUMP WITH MULCH BERM / COIR LOG AROUND.
30m SEISMIC CORRIDOR
LOW RISK DRILL PAD SL4 - FLAT MILD TERRAIN
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PROJECT No 19-0109 DRAWING No D24 REVISION A


COIR LOG OR MULCH BERM INSTALLED ON DOWNSLOPE EXTENT OF WORKS - DISCHARGE AS SHEET FLOW.
227.5
228.0
228.5
229.0
229.5
229.0
DISCHARGE CONCENTRATED FLOW TO SHEET FLOW USING LEVEL SPREADER.
NOTE:
LAYOUT OF DRILL PAD IS INDICATIVE ONLY AND TO BE CONFIRMED AFTER LOCATION AND FINAL PLANT REQUIREMENTS HAVE BEEN SELECTED.
OUTLINE OF SITE.
OPTIONAL SUMP WITH MULCH BERM / COIR LOG AROUND.
STOCKPILE
COIR LOG OR MULCH BERM TO REDIRECT AND DISSIPATE EXTERNAL RUNOFF.
INSTALL SEDIMENT FENCE ON TOE OF BATTER.
DRILL
COVER STOCKPILE WITH GEOFABRIC.
30m SEISMIC CORRIDOR
FORM WHOA-BOY AT ENTRY/EXIT AS PER STANDARD DETAIL.
FORM WHOA-BOY AT ENTRY/EXIT AS PER STANDARD DETAIL.
ACCESS TRACK. REFER TO D26 AND D27 FOR CONTROLS.
HARDSTAND TO STABILISE HIGH TRAFFIC AREAS.
230.0
SITE BUILDINGS
DISCHARGE CONCENTRATED FLOW TO SHEET FLOW USING LEVEL SPREADER.
LOW RISK DRILL PAD SL3- FLAT MILD TERRAIN
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PROJECT No 19-0109 DRAWING No D25 REVISION A


ACCES TRACK FORMED AT EXISTING GROUND LEVEL. RESTRICT WIDTH TO 6m WITHIN 25m OF WATERCOURSE
NATURAL SURFACE
RAKE CLEARED MATERIAL INTO BUND ON DOWNSLOPE EXTENT OF WORKS
TYPICAL TRACK CROSS SECTION
NOT TO SCALE
PROPOSED ACCESS TRACK
WINDROW CLEARED BRUSH AND ROCK ON DOWNSLOPE EXTENT OF WORK
TRACK PERPENDICULAR TO FALL
NOT TO SCALE
INSTALL WOAH BOYS IN ACCORDANCE WITH DETAIL AND AT SPACING PROVIDED
PROPOSED ACCESS TRACK
RETURN WOAH BOY TO DISCHARGE CONCENTRATED RUNOFF AS SHEET FLOW OUTSIDE CLEARING EXTENTS
TRACK DIAGONAL TO FALL
NOT TO SCALE
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DRAWING No D26
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PROPOSED ACCESS TRACK
INSTALL TEMPORARY CULVERT CROSSING OR FORD IN ACCORDANCE WITH DETAIL PROVIDED. STABILISE APPROACHES WITH SOIL BINDER (STONEWALL 2L/m² OR EQUIVALENT).
PROVIDE 3m WIDE BUFFER (WINDROW DISCONTINUOUS) THROUGH SEASONAL, UNMAPPED DRAINAGE LINES.
TRACK PERPENDICULAR TO FALL - UNMAPPED FLOW PATH CROSSING
NOT TO SCALE
WOAH-BOY
WOAH-BOY
PROPOSED ACCESS TRACK
INSTALL TEMPORARY CULVERT CROSSING OR FORD IN ACCORDANCE WITH DETAIL PROVIDED. STABILISE APPROACHES WITH SOIL BINDER (STONEWALL 2L/m² OR EQUIVALENT).
RETURN WOAH-BOY TO DISCHARGE CONCENTRATED RUNOFF AS SHEET FLOW OUTSIDE CLEARING EXTENTS.
TRACK PARALLEL TO FALL - UNMAPPED FLOW PATH CROSSING
NOT TO SCALE
RETURN WINDROW TO DISCHARGE CONCENTRATED RUNOFF AS SHEET FLOW OUTSIDE CLEARING EXTENTS
WOAH-BOY
PROPOSED ACCESS TRACK
RETURN WOAH-BOY TO DISCHARGE CONCENTRATED RUNOFF AS SHEET FLOW OUTSIDE CLEARING EXTENTS.
INSTALL TEMPORARY CULVERT CROSSING OR FORD IN ACCORDANCE WITH DETAIL PROVIDED. STABILISE APPROACHES WITH SOIL BINDER (STONEWALL 2L/m² OR EQUIVALENT).
TRACK DIAGONAL TO FALL - UNMAPPED FLOW PATH CROSSING
NOT TO SCALE
WOAH-BOY
PROPOSED ACCESS TRACK
INSTALL TEMPORARY CULVERT CROSSING OR FORD IN ACCORDANCE WITH DETAIL PROVIDED. STABILISE APPROACHES WITH SOIL BINDER (STONEWALL 2L/m² OR EQUIVALENT).
RETURN WOAH-BOY TO DISCHARGE CONCENTRATED RUNOFF AS SHEET FLOW OUTSIDE CLEARING EXTENTS.
25m-100m
RETAIN BUFFER (WIDTH IN ACCORDANCE WITH LAND CLEARING PERMIT FOR MAPPED WATERWAY (WIDTH VARIES).
MAPPED WATERWAY BUFFER - TRAFFICABLE WITH NO FORMED BANKS AND NO SURFACE WATER EVIDENT
NOT TO SCALE
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TRACK CONTROLS - FLOW PATH
PROJECT No
19-0109
DRAWING No
D27
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ROAD CROWNING

CROWNING PROVIDES A LOW-GRADE FALL ENABLING DRAINAGE FROM BOTH SIDES OF THE CENTRE OF THE ROAD (SEE FIGURE 1). THIS METHOD IS ONLY EFFECTIVE IF THE CROWN IS SLIGHTLY HIGHER THAN THE NATURAL SURFACE.

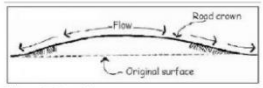


Figure 1: Crowning

ROAD CROWNING SHOULD BE AVOIDED IN AREAS WHERE WATER NATURALLY CROSSES THE ROAD SUCH AS BROAD DRAINAGE FLOORS. FLOODWAYS ARE REQUIRED IN THESE CASED.

INFALL AND OUTFALL DRAINAGE

WHEN ROADS ARE BUILT ACROSS THE SLOPE CONSIDERATION MUST BE GIVEN TO TAKING WATER FROM THE UP SLOPE SIDE OF THE ROAD TO THE DOWN SLOPE SIDE OF THE ROAD. WHEN YOU INSTALL CROSS DRAINAGE YOU MUST MAKE SURE THAT IT DOES NOT CAUSE EROSION OF THE ROAD SURFACE.

CROSSFALL/OUTFALL DRAINAGE

THE SIMPLEST METHOD IS BY PROVIDING THE ROAD SURFACE WITH A CROSSFALL IN THE SAME DIRECTION AS THE SLOPE (OUTFALL DRAINAGE), THEREBY DIRECTING WATER OVER THE ROAD SURFACE TO DISPOSAL AREAS ON THE LOWER SIDE OF THE ROAD (SEE FIGURE 2).

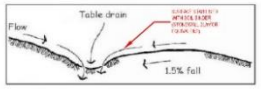


Figure 2: Crossfall/outfall drainage

THE OTHER METHOD IS BY PROVIDING THE ROAD SURFACE WITH INFALL DRAINAGE BACK INTO THE SLOPE, DIRECTING WATER BACK TO THE UP SLOPE SIDE OF THE ROAD (SEE FIGURE 3). IF INFALL DRAINAGE IS NECESSARY THEN TABLE DRAINS, CULVERTS OR INVERTS NEED TO BE CONSTRUCTED. THESE WILL SAFELY DIRECT WATER TO THE DOWN SLOPE SIDE OF THE ROAD.

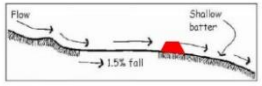


Figure 3: Infall drainage

OUTFALL DRAINAGE IS PREFERRED TO INFALL DRAINAGE AS THERE IS GENERALLY NO NEED FOR OTHER DRAINAGE WORKS SUCH AS CULVERTS, INVERTS, TABLE AND MITRE DRAINS.

WHEN INSTALLING OUTFALL DRAINAGE ON STEEPER SLOPES, BATTERS ON THE DOWNSLOPE SIDE OF THE ROAD MUST NOT BE TOO STEEP. STEEP BATTERS MAY ERODE, IMPACTING ON THE ROAD ITSELF.

THE CROSSFALL OF THE ROAD SURFACE SHOULD BE KEPT AS FLAT AS POSSIBLE TO ENSURE GOOD DRAINAGE. FOR OUTFALL DRAINAGE IT IS RECOMMENDED THAT THE MAXIMUM CROSSFALL SLOPE BE IN THE ORDER OF 1.5 – 2%, WHEREAS INFALL DRAINAGE SLOPES CAN BE AS GREAT AS 4%.

SIDE DRAINAGE

TABLE DRAINS

TABLE DRAINS ARE EXCAVATED OPEN CHANNELS THAT ARE BUILT PARALLEL TO ROADS AND TRACKS. THESE DRAINS DIRECT RUNOFF TO DISPOSAL AREAS FURTHER DOWNSLOPE. TABLE DRAINS SHOULD ONLY BE USED WHEN NATURAL RUN-OFF IS NOT POSSIBLE.

FILL OBTAINED FROM CONSTRUCTING TABLE DRAINS CAN BE USED TO BUILD UP ROAD SURFACES. THE DESIGN OF TABLE DRAINS DEPENDS ON A NUMBER OF FACTORS, INCLUDING THE SIZE AND NATURE OF THE CATCHMENT, THE SLOPE AND WATER VOLUMES AND FLOW. LARGER TABLE DRAINS MAY NEED TO BE DESIGNED BY ENGINEERS OR OTHER SUITABLY QUALIFIED PROFESSIONALS.

TABLE DRAINS SHOULD BE CONSTRUCTED WITH A FLAT BOTTOM (TRAPEZOID SHAPE) (SEE FIGURE 4). IN GENERAL THEY SHOULD BE 0.5 TO 1.0M WIDE AT THE BASE. AVOID USING V SHAPED DRAINS AS THEY MAY CAUSE EROSION IN THE CHANNEL.

WHERE POSSIBLE TABLE DRAINS SHOULD BE REVEGETATED AS SOON AS POSSIBLE AFTER CONSTRUCTION, AND REGULARLY SLASHED. TABLE DRAINS SHOULD NOT BE GRADED.

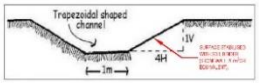


Figure 4: Table & Mitre drain cross section

MITRE DRAINS

WATER SHOULD BE TAKEN OUT OF TABLE DRAINS AT REGULAR INTERVALS USING MITRE (OFFSHOOT) DRAINS. MITRE DRAINS TAKE RUNOFF OUT OF TABLE DRAINS OR DIRECTLY OFF ROAD SHOULDERS WHERE TABLE DRAINS ARE ABSENT. THESE DRAINS DISPOSE OF WATER IN AREAS AWAY FROM THE ROAD (SEE FIGURE 5).

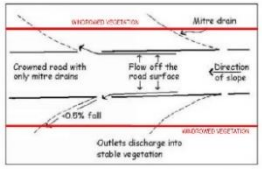


Figure 5: Crowned road with only mitre drains

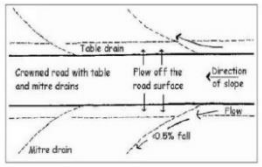


Figure 6: Crowned road with table and mitre drains

MITRE DRAINS STOP WATER ACCUMULATING IN TABLE DRAINS OR ON THE ROAD SHOULDER. IDEALLY MITRE DRAINS
SHOULD BE CONSTRUCTED SO THAT THEY HAVE A BROAD FLAT BASE AT LEAST 1M WIDE. MITRE DRAINS ALSO SHOULD NOT BE GRADED TO PRODUCE A V.
MITRE DRAINS SHOULD SLOPE TO DIRECT THE FLOW OF WATER AWAY FROM THE ROAD. TO MINIMISE EROSION THE SLOPE SHOULD BE NO GREATER THAN 0.5% ON ERODIBLE SOILS OR 1% ON STABLE SOILS. MITRE DRAIN OUTLETS EFFECTIVELY CONCENTRATE RUNOFF, FOR THIS REASON THEY SHOULD BE LOCATED IN STABLE UNDISTURBED AREAS.

MITRE DRAIN SPACING IS DEPENDENT ON:

- THE GRADE OF THE TABLE DRAIN OR ROAD
- SOIL TYPE AND ERODIBILITY
- RAINFALL

Table 1: Recommended mitre drain spacing

Slope		Mitre Drain Spacing (m)
%	Gradient	
0.5	1 : 200	170 - 180
1	1 : 100	120 - 130
2	1 : 50	90 - 100
3	1 : 33	70 - 80
4	1 : 25	60 - 70
5	1 : 20	55 - 60
6	1 : 17	50 - 55
10	1 : 10	40 - 45

CROSS DRAINAGE

ENGINEERED, STABLE CROSS DRAINAGE SUCH AS INVERTS, FLOODWAYS OR CULVERTS CAN BE USED TO COLLECT WATER FROM UPSLOPE TABLE DRAINS, OR DRAINAGE LINES. IT IS GENERALLY MORE CONOMICAL AND PRACTICAL TO FORD DRAINAGE LINES USING FLOODWAYS OR INVERTS THAN TO USE MAJOR CULVERTS OR
BRIDGES. ON STEEPER COUNTRY, WHERE CREEKS AND DRAINAGE LINES ARE DEEPER, CULVERTS MAY BE MORE PRACTICAL.

INVERTS AND FLOODWAYS

CARE MUST BE TAKEN IN THE DESIGN AND CONSTRUCTION OF FLOODWAYS AND INVERTS IN ORDER TO CAUSE MINIMAL INTERFERENCE TO NATURAL FLOWS. INVERTS AND FLOODWAYS ARE DESIGNED TO BE TEMPORARILY OVER TOPPED BY WATER FLOW AND MINIMISE BANK AND BED EROSION. THEY SHOULD BE SITED AT LOW POINTS IN THE BANK AND AT RIGHT ANGLES TO THE DIRECTION OF FLOW.

INVERTS

INVERTS SHOULD BE CONSTRUCTED WITH THE FINISHED SURFACE AT, OR JUST BELOW THE LEVEL OF THE EXISTING STREAM BED. CONSTRUCTION OF AN INVERT IS GENERALLY BASED ON EXCAVATING SOFT, ERODIBLE MATERIAL. AT LEAST 300MM SHOULD BE REMOVED, GEOTEXTILE MAY BE NECESSARY AS A BASE. EXCAVATED MATERIAL IS THEN REPLACED WITH COMPACTED GRANULAR MATERIAL TO
PROVIDE A TRAFFICABLE SURFACE (SEE FIGURE 7).

TEXT AND IMAGES SOURCED FROM NORTHERN TERRITORY 'ROAD DRAINAGE FACT SHEET', DEPARTMENT OF LAND RESOURCE MANAGEMENT (www.lrm.nt.gov.au)

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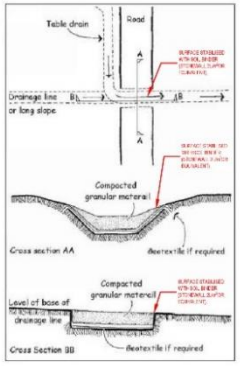


Figure 7: Inverts

FLOODWAYS

FLOODWAYS ARE USUALLY ELEVATED ABOVE THE BED LEVEL OF THE CHANNEL AND OFTEN INCORPORATE CULVERTS TO TAKE "NORMAL" FLOWS WITH THE ROAD ONLY BEING OVERTOPPED DURING FLOOD EVENTS, AS ILLUSTRATED IN FIGURE 8.

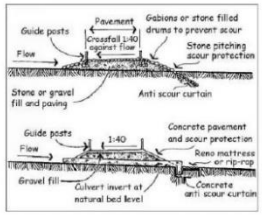


Figure 8: Floodways (Australian Road Research Board, 1993)

THE DESIGN SHOULD HAVE ENDS OF THE STRUCTURE THAT ARE WELL ANCHORED INTO THE BANKS AND OBSTRUCTION TO FLOW KEPT TO A MINIMUM BY USING GENTLE BATTER SLOPES ON THE UP- AND DOWNSTREAM FACES. WHEN IT IS NECESSARY TO CONSTRUCT AN ELEVATED FLOODWAY IT IS RECOMMENDED THAT SPECIALIST ADVICE BE SOUGHT.

AS FLOODWAYS ARE GENERALLY ELEVATED ABOVE BED LEVEL PROTECTION WORKS ARE REQUIRED ON THE DOWNSTREAM SIDE OF THE FLOODWAY TO PREVENT EROSION.

CULVERTS

WHEN CULVERTS ARE USED THEY SHOULD BE ANGLED DOWNWARD AT BETWEEN 1 AND 3%. THIS WILL MINIMISE SILTING OF THE PIPE AND PREVENT EXCESSIVE SCOURING AT THE OUTFLOW. ON DRAINAGE LINES THE CULVERT SHOULD BE KEYED INTO THE STREAMBED BY DIGGING A TRENCH AND SEATING THE CULVERT INTO IT.

THE AREA BELOW THE OUTLET WILL NEED PROTECTION TO PREVENT EROSION. THIS PROTECTION CAN BE ACHIEVED BY ARMOURING (EG: ROCK MATTRESS) THE DRAIN DOWNSTREAM OF THE OUTLET, OR BY CONSTRUCTING A DISSIPATING DEVICE (SEE FIGURE 9).

PROTECTION MAY ALSO BE REQUIRED AT THE INLET. THE LOCATION, SPACING, SIZE AND TYPE OF CULVERT MAY VARY. ADVICE SHOULD BE SOUGHT PRIOR TO CONSTRUCTION.

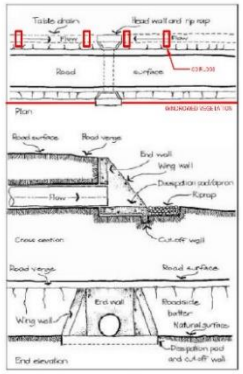


Figure 9: Culverts

WHOA BOYS ON VEHICLE TRACKS

WHOA BOYS CAN VARY IN SIZE. THEY CAN BE A COUPLE OF METRES LONG AND ONLY 10–30CM HIGH ON WALKING TRACKS, OR THEY MAY BE LARGE, GENTLY SLOPING BANKS
UP TO 30-40M AND UP TO 3M HIGH ON DEEPLY ERODED AREAS.

WHOA BOYS CAN BE CONSTRUCTED IN TWO WAYS:

1. BY CUT AND FILL – LINES ARE RIPPED ACROSS THE AREA AT A GRADE OF 0.3 %. A SHALLOW CHANNEL SHOULD BE CUT ALONG THIS LINE. EXCAVATED MATERIAL IS DUMPED ON THE DOWN SLOPE SIDE OF THE CHANNEL, THEN COMPACTED AND SMOOTHED OUT TO FORM A BANK WITH EVEN BATTERS AND A LEVEL TOP (SEE FIGURE 10).

2. USING IMPORTED SOIL MATERIAL TO CONSTRUCT A BANK WITH A GRADE OF BETWEEN 0.3 AND 0.5% ALONG THE UP SLOPE EDGE OF THE BANK.

TO AID TRAFFICABILITY, AN APPROACH AND DEPARTURE RAMP CAN BE CUT INTO THE BANK (SEE FIGURE 11). THE BANK SHOULD BE RUN OFF INTO UNDISTURBED VEGETATION OR INTO AN EXISTING DRAIN (CARE NEEDS TO TAKEN TO ENSURE THAT EROSION DOES NOT OCCUR WHERE THE WATER RUNS DOWN INTO THE DRAIN).

ALTERNATIVELY A LEVEL SILL CAN BE CONSTRUCTED AT THE END OF THE BANK TO ENHANCE THE SPREAD OF WATER.

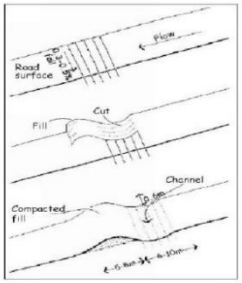


Figure 10: Whoa boy construction

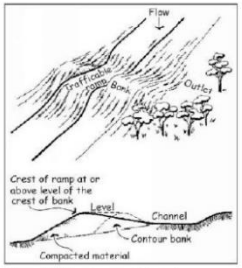


Figure 11: Whoa boy - vehicle track

TEXT AND IMAGES SOURCED FROM NORTHERN TERRITORY 'ROAD DRAINAGE FACT SHEET', DEPARTMENT OF LAND RESOURCE MANAGEMENT (www.lrm.nt.gov.au)

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
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CLIENT: IMPERIAL OIL AND GAS PTY LTD
DRAWN: RK | DESIGNED: TB | DATE: 15/08/19
CPESC: 6374

PROJECT: IMPERIAL SEISMIC 2019
DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN DRAINAGE NOTES SHEET 2/2
PROJECT No: 19-0109 | DRAWING No: D29 | REVISION: A

MATERIALS

FIBRE ROLLS: TYPICALLY 200 TO 250mm JUTE, COIR OR STRAW ROLL TIED WITH SYNTHETIC OR BIODEGRADABLE MESH.

STAKES: MINIMUM 25 x 25mm TIMBER STAKES

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.
2. WHEN PLACED ACROSS NON-VEGETATED OR NEWLY SEEDED SLOPES, THE ROLLS MUST BE PLACED ALONG THE CONTOUR.
3. IF PLACED ON OPEN OR LOOSE SOIL, ENSURE THE FIBRE ROLLS ARE TRENCHED 75 TO 125mm IN SANDY SOILS AND 50 TO 75mm IN CLAYEY SOILS.
4. ENSURE THE OUTER MOST ENDS OF THE FIBRE ROLLS ARE TURNED UP THE SLOPE TO ALLOW WATER TO ADEQUATELY POND UP-SLOPE OF THE ROLL, AND TO MINIMISE FLOW BYPASSING.
5. WHEN PLACED ACROSS THE INVERT OF MINOR DRAINS, ENSURE THE SOCKS ARE PLACES SUCH THAT:

(I) THE CREST OF THE DONWSTREAM ROLL IS LEVEL WITH THE CHANNEL INVERT AT THE IMMEDIATE UPSTREAM SOCK (IF ANY);
(II) EACH ROLL EXTENDS UP THE CHANNEL BANKS SUCH THAT THE CREST OF THE FIBRE ROLL AT ITS LOWEST POINT IS LOWER THAN THE GROUND LEVEL AT EITHER END OF THE ROLL.

6. ENSURE THAT THE ANCHORING STAKES ARE DRIVEN INTO THE END OF EACH ROLL AND ALONG THE LENGTH OF EACH ROLL AT A SPACING NOT EXCEEDING 1.2m OR SIX TIMES THE ROLL DIAMETER, WHICHEVER IS THE LESSER. A MAXIMUM STAKE SPACING OF 0.3m APPLIES WHE USED TO FORM CHECK DAMS.
7. ADJOINING ROLL MUST BE OVERLAPPED AT LEAST 450mm, NOT ABUTTED.

MAINTENANCE

1. INSPECT ALL FIBRE ROLLS PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORMS OR OTHERWISE AT WEEKLY INTERVALS.
2. REPAIR OR REPLACE DAMAGED FIBRE ROLLS.
3. REMOVE COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. ALL EXCESSIVE SEDIMENT TRAPPED BY THE ROLLS MUST BE REMOVED FROM THE DRAIN OR SLOPE IF SUCH SEDIMENT IS LIKELY TO BE WASHED AWAY BY THE EXPECTED FLOWS.
2. DISPOSE OF COLLECTED SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.
3. THE BIODEGRADABLE CONTENT OF THE STRAW ROLLS MAY NOT NECESSARILY NEED TO BE REMOVED FROM THE SITE.
4. ALL SYNTHETIC (PLASTIC) MESH OR OTHER NON READILY BIO-DEGRADABLE MATERIAL MUST BE REMOVED FROM THE SITE ONCE THE SLOPE IF DRAIN IS ESTABLISHED, OR THE ROLLS HAVE DETERIORATED TO A POINT WHERE THEY ARE NO LONGER PROVIDING THEIR INTENDED DRAINAGE OR SEDIMENT CONTROL FUNCTION.

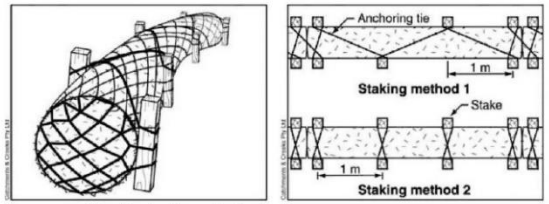
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Source: www.westernexcelsior.com/products.html



Source: www.catchmentsandcreeks.com/docs/Log-1.pdf

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PROJECT: IMPERIAL SEISMIC 2019
DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN COIR ROLLS NOTES
PROJECT No: 19-0109 | DRAWING No: D30 | REVISION: A

Appendix 8. Traffic Approval

A Traffic Management Plan is being compiled for submission.
This Traffic Management Plan requires approval before any works can be carried out.

Appendix 9. Additional photolog of proposed wellpads and access tracks

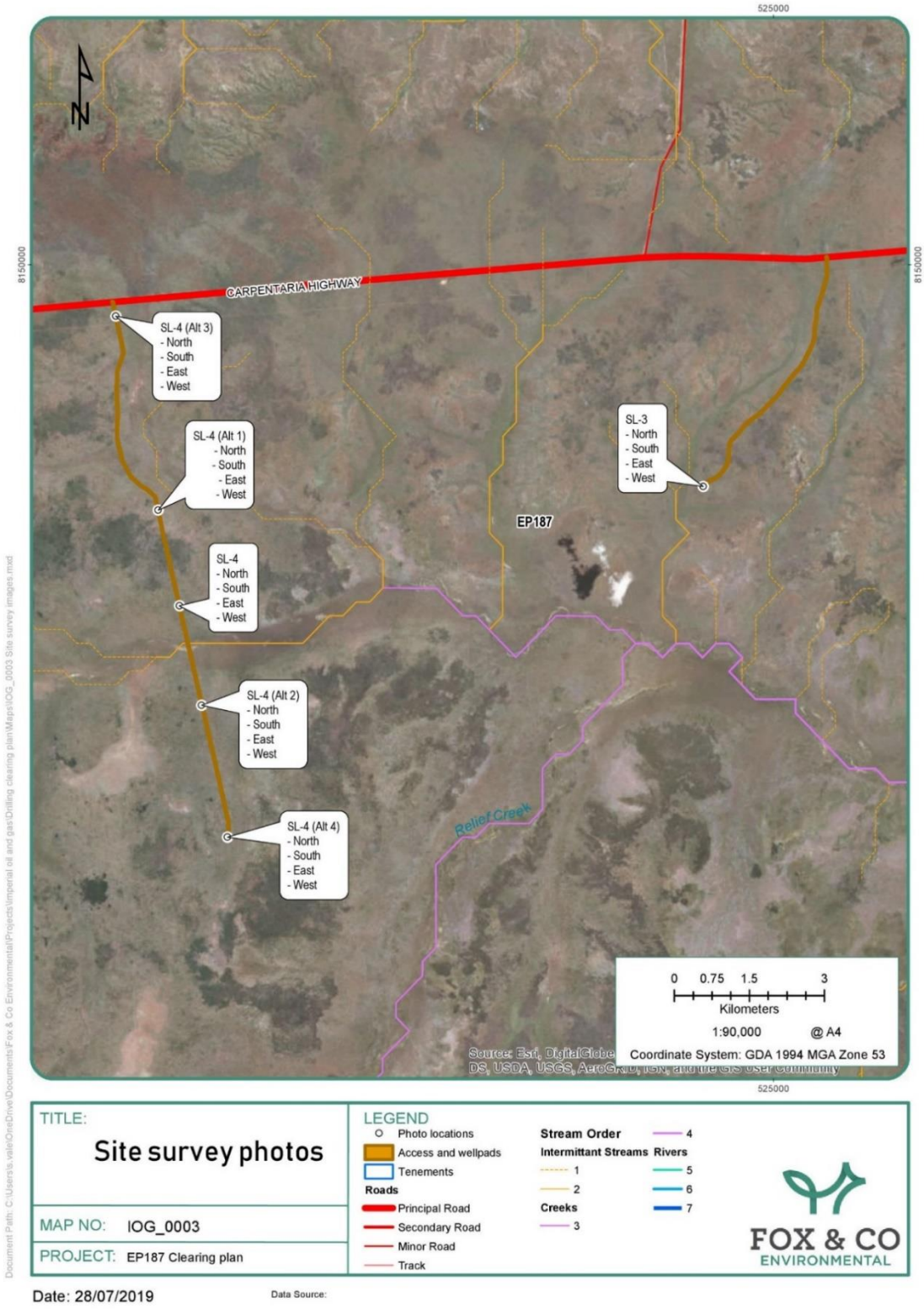


Photo ID	Description	Photo
133043	Acacia on Line 2	
SL-3 North	SL-3 Wellcentre looking North	
SL-3 North	SL-3 Wellcentre looking South	

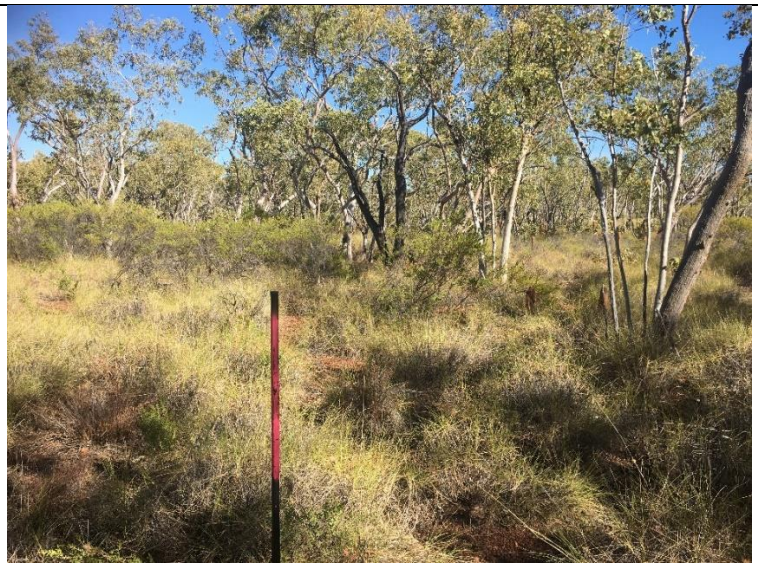
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SL-3 East	SL-3 Wellcentre looking East	
SL-3 West	SL-3 Wellcentre looking West	
SL-4 North	SL-4 Wellcentre looking North	

Photo ID	Description	Photo
SL-4 North	SL-4 Wellcentre looking South	
SL-4 East	SL-4 Wellcentre looking East	
SL-4 West	SL-4 Wellcentre looking West	

Photo ID	Description	Photo
SL-4 Alt 1 North	SL-4 Alt 1 Wellcentre looking North	
SL-4 Alt 1 South	SL-4 Alt 1 Wellcentre looking South	
SL-4 Alt 1 East	SL-4 Alt 1 Wellcentre looking East	

Photo ID	Description	Photo
SL-4 Alt 1 West	SL-4 Alt 1 Wellcentre looking West	
SL-4 Alt 2 North	SL-4 Alt 2 Wellcentre looking North	
SL-4 Alt 2 South	SL-4 Alt 2 Wellcentre looking South	

Photo ID	Description	Photo
SL-4 Alt 2 East	SL-4 Alt 2 Wellcentre looking East	
SL-4 Alt 2 West	SL-4 Alt 2 Wellcentre looking West	
SL-4 Alt 3 North	SL-4 Alt 3 Wellcentre looking North	

Photo ID	Description	Photo
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SL-4 Alt 3 East	SL-4 Alt 3 Wellcentre looking East	
SL-4 Alt 3 West	SL-4 Alt 3 Wellcentre looking West	

Photo ID	Description	Photo
SL-4 Alt 4 North	SL-4 Alt 4 Wellcentre looking North	
SL-4 Alt 4 South	SL-4 Alt 4 Wellcentre looking South	
SL-4 Alt 4 East	SL-4 Alt 4 Wellcentre looking East	

Photo ID	Description	Photo
SL-4 Alt 4 West	SL-4 Alt 4 Wellcentre looking West	

Appendix 10. Bushfire Management Plan

Bushfire Management Plan

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1. Objectives.

The objectives of this bushfire management plan are to protect:

- Personnel - Maintain safety of employees and visitors by managing fire risk and spread where possible, in the event where fire cannot be managed personnel are to be evacuated.
- Neighbours – Prevent the instances of unplanned Fires caused by Imperial Oil and Gas during exploration activities, which have the ability to quickly impact on neighbouring properties where grass is a major asset to their livelihoods.
- Assets - Protecting Imperial Oil and Gas assets (resources, materials and equipment) by removing fuel in their vicinity prior to mobilisation and maintaining fire breaks during operation.
- Responsibility- Comply with Bushfires Management Act and other relevant land management organisation to reduce/ remove bad publicity.

2. Fire Mitigation Measures.

Overall mitigation Measures

Project specific requirement to mitigate risks of ignition include:

- All project infrastructure will be designed and constructed to mitigate risks of ignition. All vehicles will be equipped with portable fire extinguishers.
- Machinery and vehicles should be parked in areas of low fire risk and be free of any combustible material. All vehicles/plant to enter the site must undergo daily inspection for accumulated vegetation; any accumulations will be removed prior to the vehicle/plant entering site
- Any repairs to machinery or plant that involves welding, cutting or grinding activities will require a Hot Work Permit to be issued prior to commencing. Any such work will be at a site well removed from any combustible material. All such activities will include the use of spark and flash barriers

- Any petrol motor vehicles or petrol-powered pumps will be fitted with spark arresters.
- All vehicles will be equipped with operational VHF and / or UHF radio transceivers.
- Smoking will only be permitted in areas clear of vegetation, and there will be no disposal of butts.
- Fire-fighting equipment and competent fire-fighting personnel will be available.

Communication

All personnel will receive information prior to the commencement of the activity relating to:

- Provisions of the Emergency Response Plan including procedures during a fire emergency
- The operation of firefighting equipment and communications
- Restricted smoking requirements
- Communication methods of fire alerts

Toolbox meetings will be conducted to:

- Alert the workforce of the fire risk level for the day ‘
- Discuss any fire risk management breaches and remedial actions.

Fire Mitigation Measures for Seismic activities.

The central piece of the Bushfire management for the Seismic program is evacuation.

As the Seismic program will involve a small work group that is constantly moving no fire control zones will be set up. Equipment and vehicles utilised in the Seismic program will be fitted with portable fire extinguishers as a first response attempt at extinguishing and preventing the spread of fires cause caused by that vehicle or equipment.

Fire Mitigation Measures for Drilling activities.

The central piece of the bushfire management for the project is the implementation of Fire control zones surrounding the SL-3 and SL-4 locations. These fire control zone has been allowed for in the wellpad layouts.

The objectives of the fire control zones are:

- Safety - Manage fire to maintain safety of employees and visitors to site in regards to removing vegetation and managing bushfire hazards involved in machinery used.
- Neighbours - Prevent the instances of unplanned Fires caused by Imperial Oil and Gas during exploration activities, which have the ability to quickly impact on neighbouring properties where grass is a major asset to their livelihoods.
- Assets - Protecting assets (resources, materials and equipment) by removing fuel in their vicinity may be done using other means
- Firebreaks - Installation of firebreaks to allow for management to ensure fire does not enter lease or possible exit lease impacting on neighbours.

The fire control zones will be cleared of vegetation and maintained to ensure no fire encroachment during drilling activities.
The access to the SL-3 and the Sl-4 locations are also the fire access trails. These will be constructed and maintained to ensure ongoing access to land to allow for exploration work to be undertaken and to allow landholder to access to the areas.

Fire Mitigation Measures for Flaring activities.

Production flaring is not proposed under this EMP, testing by flaring may be carried out during drilling operations. To mitigate the risk of fire from flaring operations the following will be carried out:

- The flare pit will have a minimum of 15m cleared of vegetation on all sides.
- A light 4x4 fitted with firefighting equipment will be on site during flaring operations.
- A water truck with the ability to transfer water to the light 4x4 fitted with fire fighting equipment will be on site during flaring operations.

3. Operational Area.

The area of planned drilling program within EP187 is generally an open grassland savannah area lightly timbered. The area is regularly burnt using aerial fire bombing and traditional owner cultural fire management practices. The project lies within the Savanna Fire Management Zone in the Northern Territory. The Savanna
Regional Bushfires Management Plan 2018 has been developed to support community wide fire management within the Savanna Fire Management Zone in line with the Bushfires Management Act 2016.

More recently the area has been increasingly utilized for cattle grazing and therefore many new fence lines and fire breaks have been constructed through the exploration area. As a part of grazing management practices towards the end of the dry season the area is regularly burnt to reduce fuel load and to promote new pasture growth through the following wet season. The practice of regular burns reduces the risk of significant hot fires and allows for a cooler less intense burn; however, the risk of bush fires and wildfires remains in some areas.

4. Impacts of the proposed activities on the existing fire management.

The proposed activities will be located on a small size cleared area which ensures there will be no impacts on existing fire management. Imperial O&G will not impose a new fire management regime identify so will therefore not increase local operational, economic, social, cultural and environmental risks. The building new access tracks will not significantly introduce more fire into the landscape around exploration wells so will not fire risk.
The proposed exploration activities do not include the use of fire other than a brief test flaring operation during drilling, and fire exclusion from the lease pads is proposed. Outside of the lease pads there will be no impact on fire management. This is consistent with the Savanna Regional Bushfires Management Plan 2018 and the Fire management objectives for petroleum exploration.

5. Fire History.

Fig 1. Fire Frequency between 2009 and 2018 at the project area

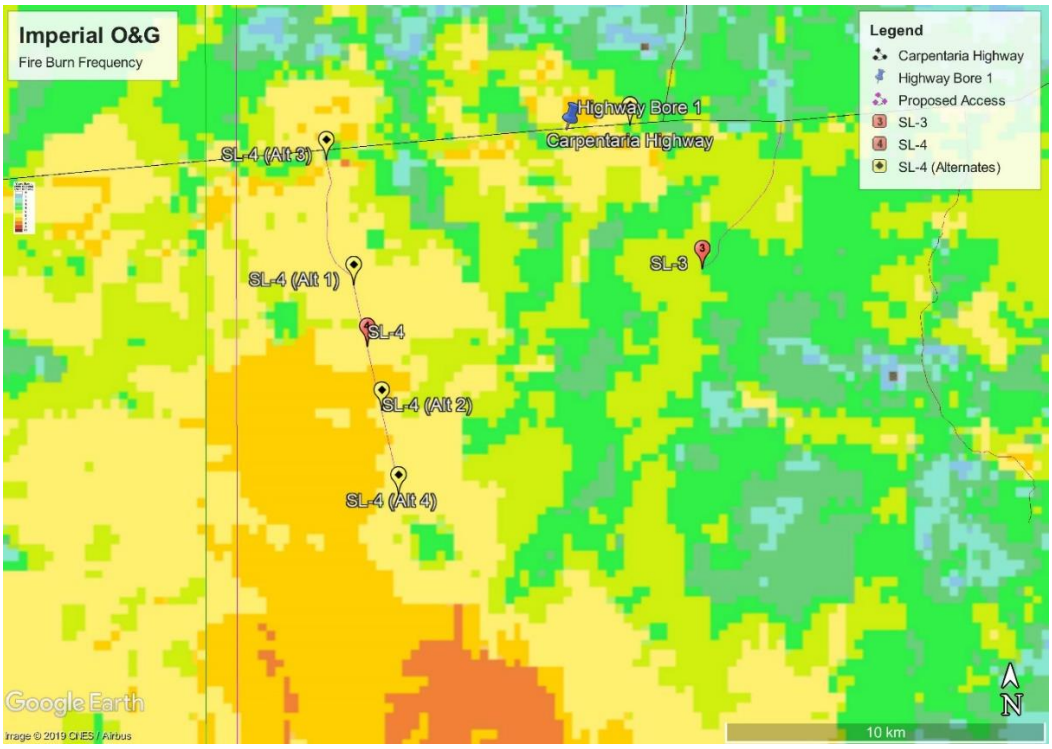
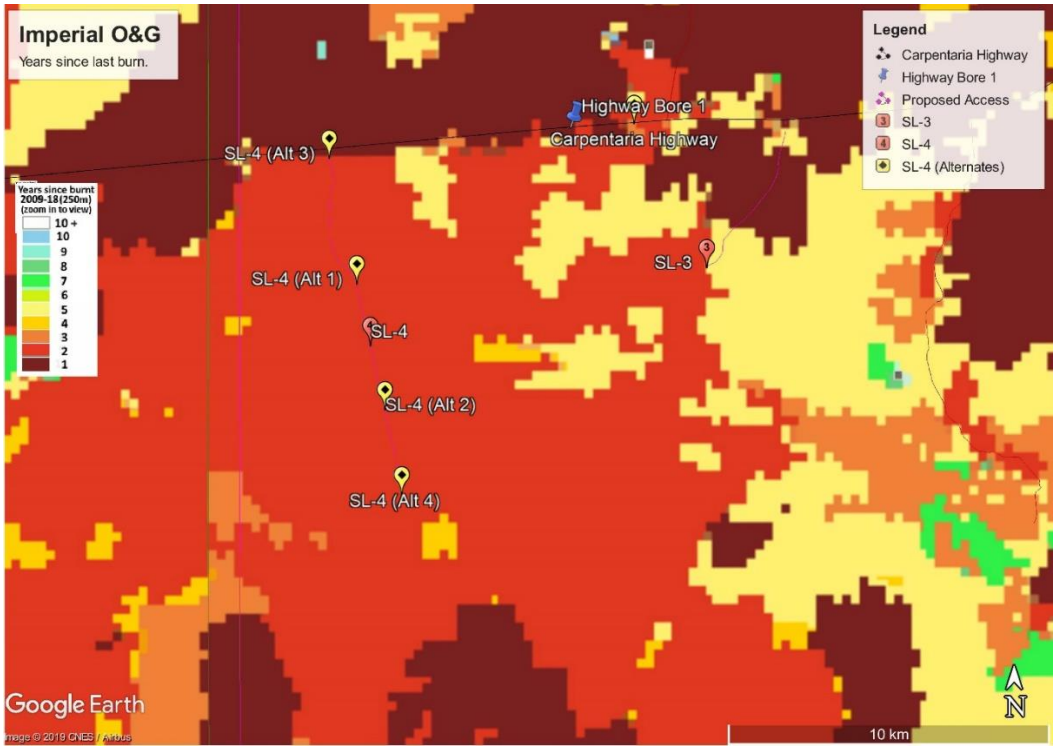
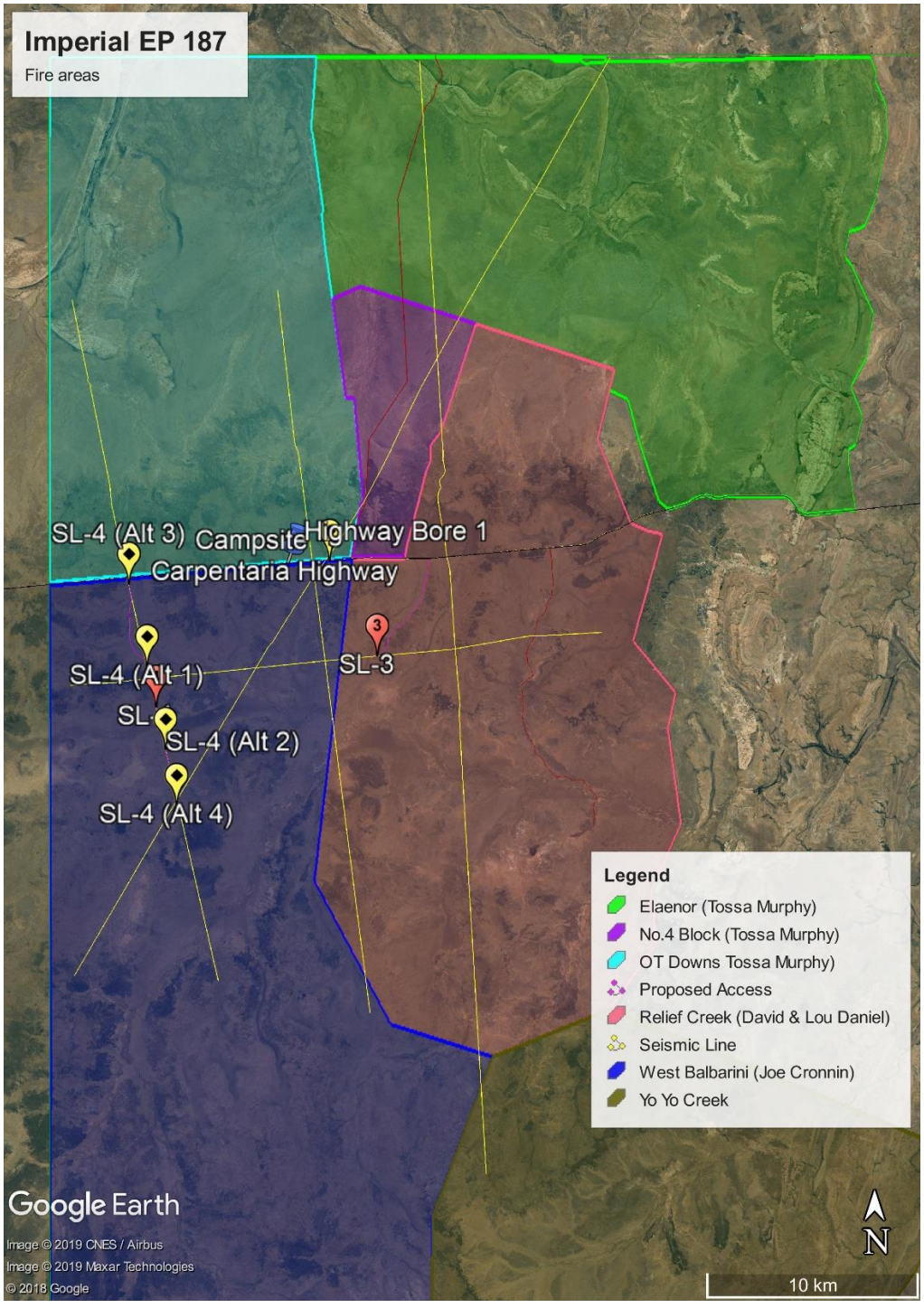


Figure 2. Last burn



6. Coordination with the landholder and other land uses

The proposed development will require a Land Access Agreement with the landholder/s. Through the process, Imperial will ensure that the project does not affect the landholder's fire management obligations and strategies. During the event of a fire whilst Imperial Oil & Gas are operating in the area Imperial will liaise directly with the leaseholders to co-ordinate efforts to minimise the unwanted impacts of the fire.



7. Neighbour contacts

Leaseholder	Contact Number
Tossa Murphy	08 8975 9784
David and Lou Daniel	08 8975 9996
Joe Cronin	08 8975 9868

8. What to do in event of a Fire

If a fire starts:

1. Do not panic, remain calm, and think
2. Ensure someone has raised the alarm. Notify PIC.
3. Should a bush fire become active in or near work locations evacuation is necessary.

In an emergency use the Imperial UHF Channel or satellite telephone to notify the **Person In Charge (PIC).** Inform the PIC of your location, number of personnel at the location and the type and extent of fire.

DO NOT CALL

- a Rural Fire Service district office
- a Fire Control Centre
- a rural fire brigade
- volunteer member

The PIC will make the necessary contact

4. Do not attempt to fight the fire if you do not feel safe to do so. Raise the alarm and leave the area in accordance with the evacuation procedure
5. Select the right type of extinguisher to fight the fire and be sure you know how to use it or any other equipment provided. Be trained and assessed competent in correct use
6. If in doubt, **READ THE INSTRUCTIONS** provided with equipment
7. Have another person back you up with another extinguisher or fire control appliance
8. If possible do not let the fire get between you and your pre planned escape route
9. Do not get too close to the fire. Radiated heat will burn you
10. Quick test the extinguisher or other fire control appliance with a test squirt to ensure they work before approaching the fire
11. Direct the extinguisher nozzle stream at the flame source and not the flames or the smoke
12. If a bush fire occurs then work crews should attempt to drive out of the fire area if safe to do so, if it's not safe to drive away from the area then work crews should make their way to the nearest road, open area or established cleared hard stand area. This will provide best protection while the fire passes over

a. All Personnel

1. If time permits clear away any long grass or scrub that may act as a fire source.
2. Determine type, location and extent of fire. Do not close off any pipes or vessels that are subject to heat as they may become over pressured and fail.
3. Direct visitors, contractors and service personnel to an appropriate safe area.

b. Person-in-Charge

1. If safe to do so, de-pressure any gas containing equipment located close to the fire by venting/flaring to minimise collateral damage.
2. While natural gas will normally disperse quickly and in an upward direction, gas vented from high pressures can be very cold and hence heavier than air, until it warms up, and can contain heavier hydrocarbon that will not disperse so easily.
3. If safe to do so, relocate a fire trailer to the area in preparation for firefighting activities.
4. Advise and liaise with Site Coordinator or most Senior person present at the site of the fire
5. Use fire trailer and/or knapsack if safe to do so. Note it may be appropriate to allow fire to diminish prior to using the correct type of extinguisher.
6. Determine need for additional services or evacuation.
7. Advise other appropriate Government contacts including as appropriate Police / Fire / Emergency Service or other bodies, e.g. relevant Councils.

c. Head of Field Operations

1. Advise Imperial Chief Executive Officer.
2. Ensure emergency contacts have been notified and necessary steps taken.
3. Liaise with Government Departments as appropriate.
4. Notify other Imperial personnel as appropriate.

d. Imperial Chief Executive Officer

Notify Imperial legal counsel and Insurers, as appropriate.

9. Implementation

The person in charge (PIC) of field operations is responsible for the implementation of this BMP on site. Resources shall be obtained and maintained to provide the level of protection required by this plan.

As a minimum:

- All field personnel shall understand the requirements of this BMP;
- All field personnel shall be trained in first aid and firefighting techniques;
- All Supervisory personnel shall understand the detail of all emergency response procedures; and
- The PIC of any works shall be competent in all of the above requirements as they apply to the works.
- The PIC shall ensure that drills of the emergency response procedures are performed.

10. District Contact Details

Hospitals		
Royal Darwin Hospital	Darwin	**08 8922 8888**
Katherine Hospital	Katherine	**08 8973 9211**
Tennant Creek Hospital	Tennant Creek	**08 8962 4399**
Care flight NT	Darwin	**Tel: 08 89442007**
		Fax: 08 89270645
Police Emergency 000		
Police	Borroloola	**08 8975 8770**
	Katherine	**08 8973 8000**
Emergency Service	Borroloola	**000**
	Katherine	**08 8972 3602**
Bushfire	Borroloola	
	Katherine	**08 8973 8871** **0401 115 744**
Fire Station	Borroloola	**000**
Community Health	Borroloola	**08 8975 8711**
	Katherine	**08 8973 8871**
Aerial Medical services	Borroloola	**08 8973 8570**
	Katherine	**08 8999 4988**
Remote Rural Health	Borroloola	**08 8975 8711**
	Katherine	**08 8973 8570**
Northern Land Council	Borroloola	**08 8975 8848**
	Darwin	**08 8920 5100**
	Katherine	**08 8971 9899**
Borroloola Doctor	Work Hours	**08 8975 8711**
	After Hours	**08 8975 9859**
Land holders	On file in field office	
Dep't Primary Industry & Resources	Darwin	**Tel: 08 8999 6567** **Tel: 08 8999 6350** **Fax: 08 8999 5191**
	After Hours	**Tel: 0439 744 119** **Tel: 0430 739 507**
Next of Kin	On file at field Office	
Imperial Oil & Gas Alex Underwood	Managing Director and Chief Executive Officer Level 7, 151 Macquarie Street Sydney NSW 2000	**02 92511846**

Appendix 11. Well Pad Elevations

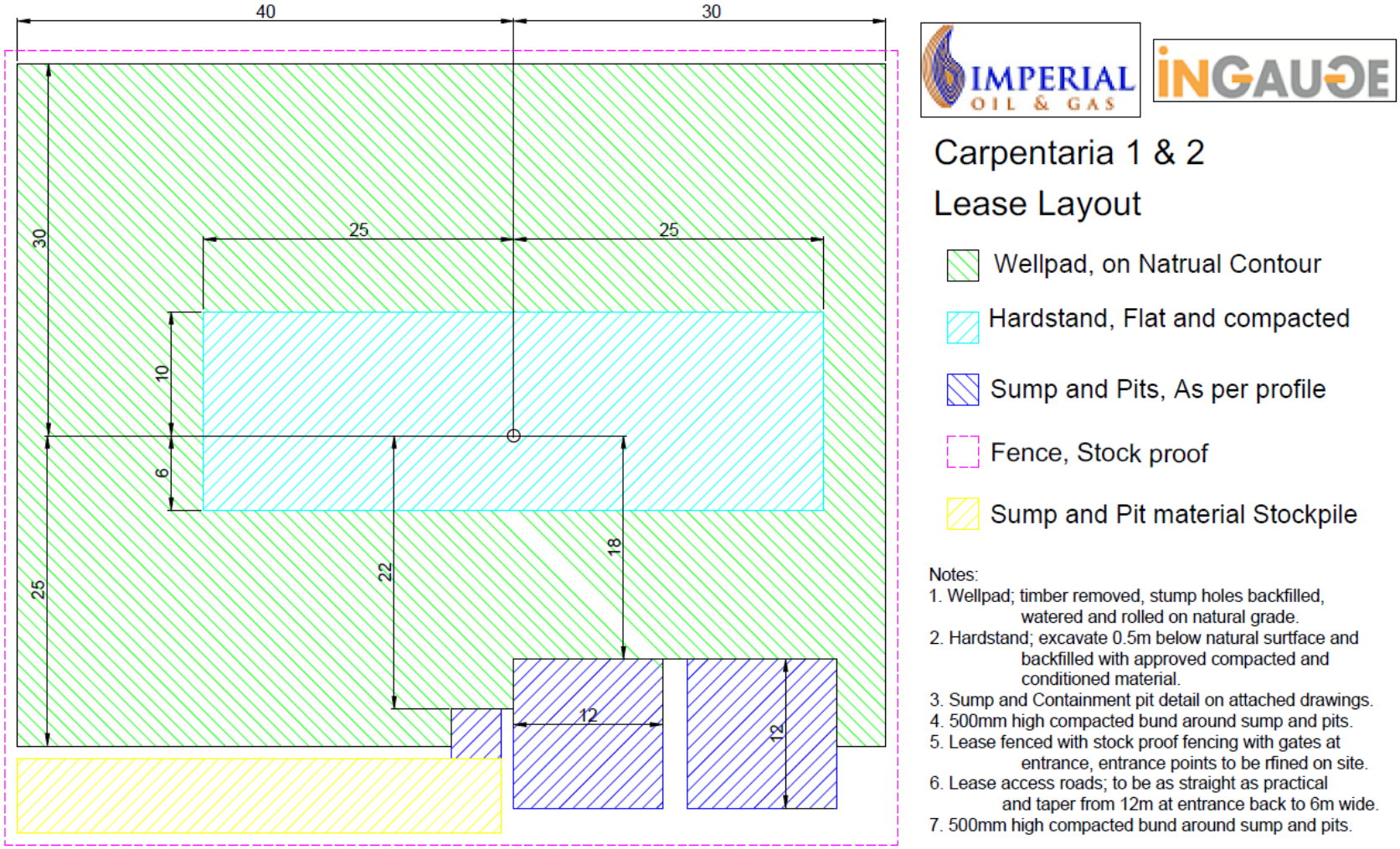


Figure A: Plan view for SL-3 & SL-4 Wellpads

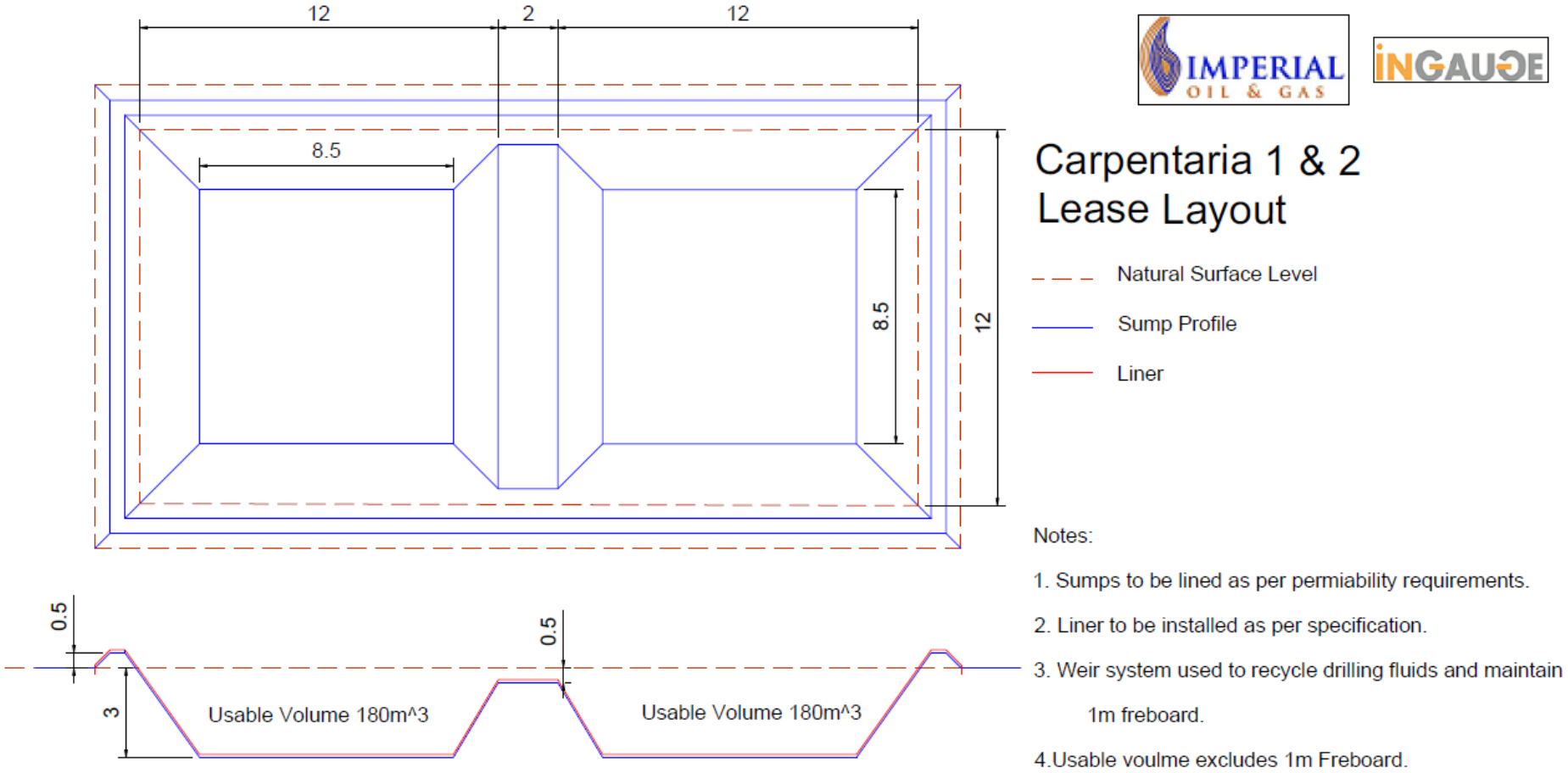


Figure B: Sump profile for all well pads

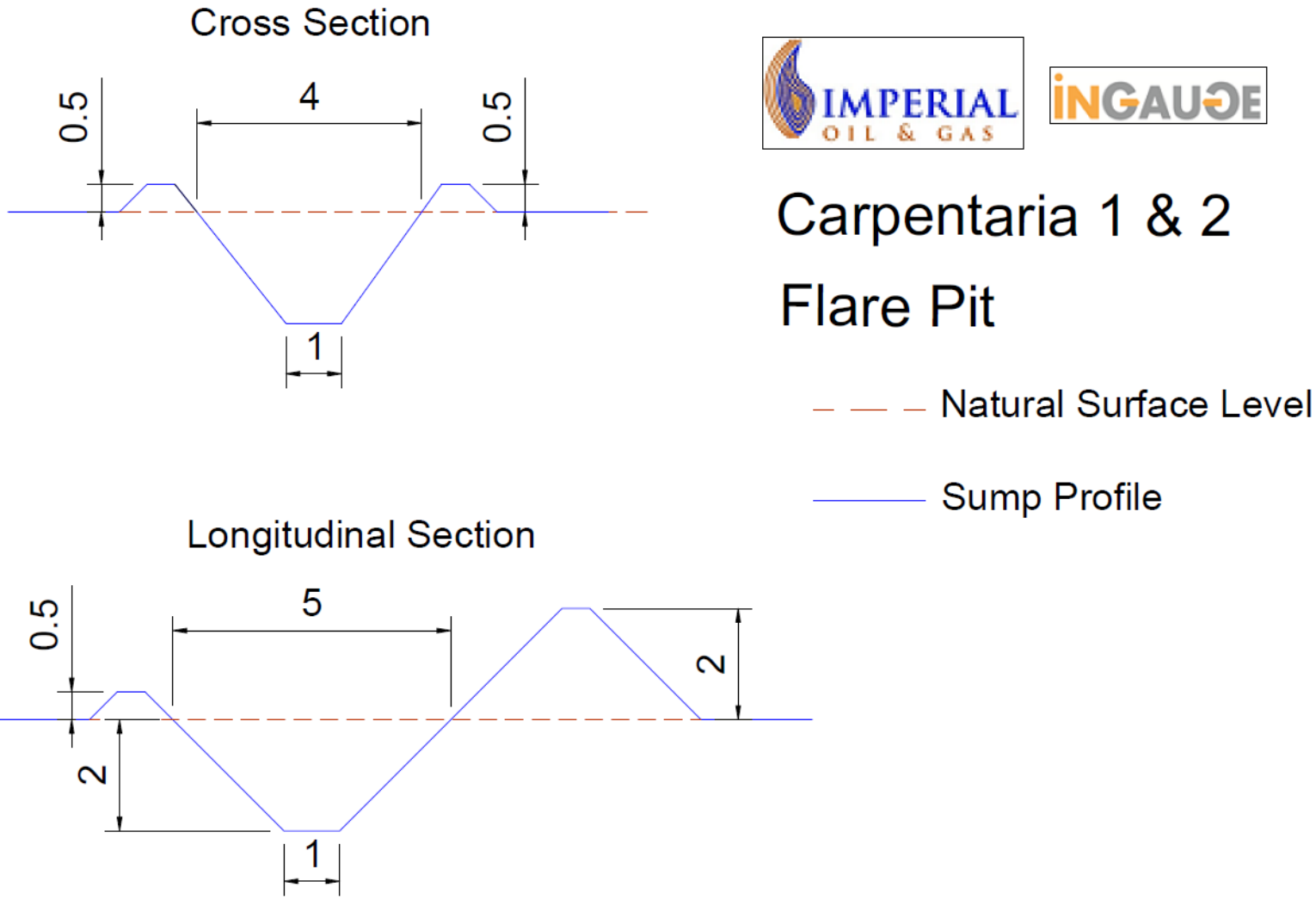


Figure C: Flare pit

Appendix 12. Description of drilling fluids proposed for drilling program.

Item	Product Name	Storage Location	Hazardous goods (Yes/No)	Dangerous Goods (Yes/No)	Class Packaging group
1	Citric Acid	Store in cold, dry, well ventilated area, removed from moisture	Yes	No	None allocated
2	Drilling foam	Store in cold, dry, well ventilated area, removed from moisture	Yes	No	None allocated
3	Idcide G20	Store in cool, dry, well ventilated area, out of direct sunlight, removed from oxidising agents, acids, alkalis and foodstuffs.	Yes	Yes	II
4	NDFT 376	Store in a cool, dry, well ventilated area, removed from incompatible substances, heat or ignition sources and foodstuffs.	No	No	None allocated
5	Newzan D	Store in a cool, dry, well ventilated area, removed from incompatible substances and foodstuffs.	No	No	None allocated
6	Potassium Chloride (KCL)	Store in a cool, dry, well ventilated area, removed from incompatible substances and foodstuffs.	No	No	None allocated

Appendix 13. Waste Management Plan

1. Introduction

1.1. Background

Imperial Oil & Gas proposes to undertake exploration activities in EP187. The purpose of exploration is to gain understanding of the potential of the permit area. The objective whenever undertaking such activity is to minimise impact to the environment, including any activities of Traditional Owners and pastoral lessees. To meet this purpose, Imperial Oil & Gas (Imperial) endures to manage waste in accordance with the internationally accepted guide for prioritising waste management practices with the objective of achieving optimal environmental outcomes. To achieve this, waste will be managed in accordance with the following hierarchy principals:

- **Avoid**: eliminate the generation of wastes through design modification
- **Reduce**: reduce unnecessary resource use or substitute a less resource intensive product or service,
- **Re-use:** reuse a waste without further processing
- **Recycle**: recover resources from a waste
- **Treatment**: treat the waste to deduce the hazard of the waste prior to disposal
- **Disposal**: disposal of waste if there is no viable alternative.

Under the Petroleum (Environment) Regulations (the Regulations), interest holders in Petroleum titles must prepare and submit and Environmental Management Plan (EMP). Approval of an EMP is necessary for all activities that have an environmental impact or risk. This is a statutory document that is enforceable. The Code of Practice for Petroleum Activities in the Northern Territory sets out the mandatory requirements for management plans for wastewater and spills. The Code states that an EMP for a petroleum activity must include a Waste and Wastewater Management Plan.

1.2. Scope

This Waste Management Plan (WMP) assesses all waste, water and wastewater management activities which are proposed including:

- Waste material and material containing contaminants as defined in s
- Residual drilling waste, e.g. muds and cuttings (solids and fluids)
- Wastewater meeting the definition of waste under the Waste Management and Pollution Control Act 1998 (NT)
- Water that has been used in, or produced from petroleum wells, whether it be re-used, recycled, treated or disposed of, and includes drilling fluids, completion fluids (excluding hydraulic stimulation fluids) and well suspension fluids.
- Water that has been acquired or used in petroleum activities that is being disposed of

No produced water or flow back fluid are to be produced as part of the proposed activities.

No non-aqueous drilling fluids are to be used as part of the proposed activities.

This WMP is for the Drilling Program at EP187 and does not include hydraulic fracture stimulation activities. Imperial Oil & Gas does not intend to conduct hydraulic fracture stimulation in this project, but this could be subject of a separate EMP.

1.3. Activity Description

The Section below, describes the three main streams of waste production activities and the appropriate disposal according to the Waste Management and Pollution Control Act.

Table 1 below describes the activities that will generate waste.

Table 1. Waste Stream Generated at the Project Area.

Waste	Examples of Main Source	Management and disposal method
Domestic activity (camp and offices) and activity ancillary	• Putrescible and municipal waste • Recyclables (glass and cans) • Plastic; • Paper and cardboard; and • Organic wastes	Stored on site in predator proof bins and routinely removed for offsite disposal by a licensed waste removal contractor.
Ancillary activities to drilling	• Scrap metal (including clean, empty used drums) • Chemical bags and cardboard packaging materials • Chemical waste • Timber pallets • Tyres • Oily rags, filters	Collection and storage onsite, and transport off-site by licensed contractor for disposal to licenced landfill or recycling facility, depending on waste's nature.
Listed Wastes	• Waste mineral oils unfit for their original intended use; • Soils contaminated with a listed waste; • Containers contaminated with a listed waste; • Waste mixtures or waste emulsions of oil and water or hydrocarbon and water; and • Sewerage sludge and residues including nightsoil and septic tank sludge;	Classified and stored in suitable containers according to listing based on the NT EPA listed waste register. Removed from site by licensed contractor for disposal in the nearest licensed waste disposal facility.
Sewerage, grey and storm water	Effluent from camp and offices • Grey water (laundry, shower, sink wastes, etc) • Treated sewage effluent	Sewage to be collected and transported offsite at a licenced disposal facility Grey water captured and piped to a treatment system that meet the NT Code of Practice for Small On-Site Sewage, then piped to an irrigation area in accordance with Department of Health requirements. All stormwater will be released to grade in compliance with the following: • Is uncontaminated with hydrocarbons or other chemicals • Is not released to watercourses or waterways • The release will not cause environmental harm (soil erosion or vegetation damage)

Waste	Examples of Main Source	Management and disposal method
		• All contaminated stormwater will be captured and disposed of offsite at a licenced facility.
Well drilling	• Drilling fluids • Drilling cuttings	***Fluids*** Initially recycled. Volume reduced further via evaporation. May be transferred to the cuttings pit for temporary storage and to encourage evaporation of water. Any residual drilling fluids will be removed from the drill pit and transported for disposal off site prior to the onset of the wet season. Residual solid waste (from evaporated drill fluids) will be mixed in with drill cuttings. ***Cuttings*** Cuttings and solid drilling residue initially stored in a lined pit. Subject to sampling and testing results, drill cuttings will be buried and disposed in-situ. Certification will be sought from a suitably qualified third party that the material is of acceptable quality for disposal to land by the proposed method, and that environmental harm will not result from the proposed disposal. Approval of the certified method must be provided by DPIR/DENR. If approval cannot be granted, then waste may be disposed of to a licenced facility.

1.4. Description of Waste Streams

Domestic Waste and activities ancillary

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

General waste, particularly putrescible waste, is stored in predator proof receptacles with secure, fit-for-purpose lids. General waste is regularly removed off-site and disposed of at the nearest licenced waste management facility. Similarly, any separate receptacles for recyclable materials such as those listed below are transported to the nearest licenced off-site waste management facility:

- Scrap metal (including clean, empty used drums)
- Plastic
- Glass
- Aluminium cans
- Paper and cardboard
- Treated sewage effluent
- Putrescible and municipal waste
- Grey water (laundry, showers, sink wastes, etc).

Ancillary activities to drilling

All waste streams from ancillary activities will be collected and stored on site. Waste will be transported for disposal or recycling depending on waste nature.

Listed Waste

Listed Waste is specified in Schedule 2 of the Waste Management and Pollution Control (Administration) Regulations.
Current activities will potentially generate only several types of waste described in the regulations. These are:

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

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

Sewage System

Sewage management consist of the use of port-a-loos and a fully self-contained sewage treatment plant (STP). Sewage from port-a-loss will be transported offsite by a waste management contractor.

The STP will be furnished with an irrigation sprinkler system to manage sewage and grey water wastes. All wastes water will be disposed of in accordance with the Public and Environmental Health Regulation. Discharge from the camp will be treated to achieve the specifications provided in the Code of Practice for On-site Wastewater Management. Treated effluent will be sprayed 50-100m away from the camp location to the surrounding environment, at a location well away from any place from which it is reasonably likely to enter any water, and to minimise spray drift and ponding. Fencing will be installed around the irrigation area.

Well Drilling

Drilling fluids

Understand the term 'fluid' as is frequently used interchangeably term 'mud'. The term 'mud' is used because of the thick consistency of the fluid system. In general, drilling muds are used during the drilling of oil or gas wells to:

- Carry cuttings from the hole
- Cool and clean the drill bit
- Reduce friction
- Maintain the stability of the bore
- Maintain down-hole hydrostatic pressure to prevent formation flow while drilling
- Prevent damage to the formation.

The drilling fluid system will be a contained system and consist of engineered fluid storage tanks. Drilling fluids are recirculated through the mud system on the drill rig during drilling operation. Drilling muds will be formulated in-situ by mixing the different additives with water in a dedicated aboveground storage tank.

Drilling cuttings

Drill cuttings are lifted out of the hole by the drilling fluid which is pumped down the inside of the drill pipe and circulated back to surface via the annulus of the drilling pipe. During an overbalanced operation, drilling fluid is utilised to mitigate subsurface drilling hazards. Drilling fluids will be separated from drill cuttings. The returned drilling fluid flows over shale shakers to separate the drill cuttings from the drilling mud, with cuttings ejected into a skip for transferal into the cuttings pit and the drill fluid flows through the sieves and is cycled back to the mud tanks. The cuttings are sampled as they drop off the shale shakers at specified intervals for processing and analysis by the mudlogging team and wellsite geologist.

2. Waste management requirements

Imperial Oil & Gas is committed to the following environmental requirements in order to maintain the integrity of ecosystems and soil productivity as well to minimise the amount of waste generated.

- Prior to commencement of any activity Imperial will identify waste streams to be produced during works and identify opportunities to reduced, reuse and recycle waste. Furthermore, Imperial will provide suitable waste receptacles and arrange waste removal by an approved government waste contractor for disposal to a licenced facility.
- All waste must always remain within designated work area and be secured with appropriate storage and segregation.
- Waste must not be burnt or buried on site unless agreed otherwise with the respective government departments.
- All waste (including any surplus materials) must be removed from site at completion of works by licenced waste transport or for disposal at a licenced facility as per government requirements and standards.
- All listed wastes specified in Schedule 2 of the *Waste Management and Pollution Control (Administration) Regulations* must be transported by a licenced contractor and disposed of at a licenced facility.
- All waste will be disposed of appropriately ensuring all transport and disposal is in accordance with the *Waste Management and Pollution Control Act*.
- Sewage generated on-site must be contained and removed offsite for disposal by a licenced transporter at an appropriately licenced facility. Sewage water treated could be released on site in a benign area avoiding pooling and fenced off; if agreed in advance with the respective government departments.
- All waste to be segregated and stored away from watercourses.
- Grey water from kitchen and showering facilities will be managed in accordance with Part 6 of the Department of Health Code of Practice for Small Onsite Sewage and Sullage Treatment Systems and the Disposal or Reuse of Sewage Effluent, 2014. Alternatively, all grey water will be removed from site.
- Imperial will maintain an up to date details of all waste sub-contractors undertaking waste management and transportation services with the details of all waste generated, and their disposal location.
- The movement of wastewater will be tracked and include:

  - volumes of produced water and flowback fluid from each well;
  - volumes of water transferred into each tank;
  - estimates for evaporation rates from each tank;
  - volumes of water planned to be, and ultimately, reused in petroleum operations including drilling
  - volumes of water and wastewater used for other purposes including dust suppression and construction water;
  - volumes of water and wastewater removed from site and its destination including details of the licence number of the any licensed waste transporters; and
  - volumes of any spills of water or wastewater.
- Wastewater tracking to be documented in an auditable chain of custody system.
- Wastewater tracking will be in accordance with other legislative requirements such as those imposed under the Waste Management and Pollution Control Act 1998 (NT) and the Radiation Protection Act 2004 (NT).
- Wastewater tracking documentation to be reported to the Minister at least annually

3. Waste characteristics

Section and Table 2 below provides a summary of the anticipated waste characteristics.

Table 3. Waste volumes and characterisation

Wastewater	Estimated Volume	Chemical characteristic	Management Method
Domestic waste – putrescible, municipal and recyclable	Less than 200m^3	Potentially hazardous to non-hazardous	Designated collection bins with transport off-site by licenced contractor
Domestic wastewater – grey water and treated sewage effluent	~150m^3	Non-hazardous	Reticulated collection, on-site treatment and disposal via irrigation
Domestic wastewater – grey water	~150m^3	Non-hazardous	Reticulated collection, on-site treatment and disposal via irrigation
Domestic wastewater – port-a-loo toilets	~1m^3	Potentially hazardous	Collection and storage on-site, disposal off-site by licenced contractor
Ancillary activities to civils	~1m^3	Hazardous to non-hazardous	Collection and storage on-site, and transport off-site by licenced contractor
Drilling fluids	~150m^3	Potentially hazardous to non-hazardous	Collection and storage on-site in lined sumps to let dry out. Tested for suitability to backfilled or transported off-site by a licenced contractor
Drilling cuttings	~90m^3	Potentially hazardous to non-hazardous	Initially recycled. Volume reduced further via evaporation. May be transferred to the cuttings pit for temporary storage and to encourage evaporation of water. Any residual drilling fluids will be removed from the drill pit and transported for disposal off site prior to the onset of the wet season. Residual solid waste (from evaporated drill fluids) will be mixed in with drill cuttings

Drilling fluids.

Chemical Characteristics.
Drilling fluids used are a water based, homogenous blend of water, clays and other minor chemical additives. Additives used have various purposes such as:

- Treating bacteria
- Adjusting pH
- Controlling viscosity
- Reducing fluid loss to the formation
- Inhibiting equipment corrosion.

Specific chemicals are selected during drilling, depending upon the particular requirements or any difficulties encountered. Of the total volume used, only small volumes have the potential to move beyond the well bore to the formations due to the filter cake properties of the mud and their design. All chemicals used in Australia must be approved for use by the Commonwealth Government, Department of Health and listed on the Australian Inventory of Chemical Substances which is maintained under the National Industrial Chemicals Notification and Assessment Scheme.

No drilling fluid additives that are used in the process contain benzene, toluene, ethylbenzene or xylene. The Material Safety Data Sheets for all the chemicals will be provided as required to the DPIR and DENR.

Drilling cuttings

The amount of drill cuttings produced can vary depending on the depth and diameter of the well to be drilled. Nonetheless it is anticipated that 90m^3 will be produced in the current campaign.

Chemical characteristics
Drill cuttings are expected to primarily comprise siliciclastic rocks (mudstones and sandstones) containing predominantly quartz grains, feldspars, and clays that are benign in terms of environmental hazard. The drill cuttings will be inert and appear as gravelly sandy or silty material.

It is expected that naturally occurring radiogenic materials (NORMs) will increase above background levels in the cuttings from the organic rich intervals in the Kyalla Formation and Velkerri Formation. This is because uranium has a natural affinity for concentration in similar geological settings to the preservation of organic material; however, the NORMs activity levels are not expected to approach reportable levels. This assumption is based on data from other wells drilled across the Beetaloo Sub-basin.

Monitoring of drill cuttings is proposed in Section 6.4. The results of the sampling and analysis of the cuttings will inform disposal and rehabilitation measures.

4. Waste Minimisation Strategies

This section contains strategies to minimise or reduce the volume of wastewater that will be disposed of off-site, and the expected quality and quantity of water and wastewater that will be treated and re-used within the petroleum activity.

The table 4 below summarises the methods that will be used to minimise waste in accordance with the waste management hierarchy.

Table 4. Waste management hierarchy considerations

Waste stream	Avoid	Reduce	Reuse	Recycle	Treat	Dispose
-	Eliminate the generation of wastes through design modification	Reduce unnecessary resource use or substitute a less resource intensive product or service	Reuse a waste without further processing	Recover resources from a waste	Treat the waste to deduce the hazard of the waste prior to disposal	Disposal of waste if there is no viable alternative
Drilling fluids	Only water-based drilling mud planned. Non-aqueous drilling mud will not be used.	Recycle fluids as much as possible – reduces consumption of additives and production of waste	Transfer recycled fluids between wells where applicable. Treat fluid to avoid bacteria and prolong operational lifespan.	Recycle fluids as much as feasible with available solids control equipment	Treat with drilling chemicals to facilitate recycling where feasible	At the end of the campaign, drilling fluids with be evaporated as much as possible, pending the weather window and freeboard requirements (minimum 1m during wet season). Remaining fluid will be transferred to a 3rd party process facility for disposal/reuse.
Drilling cuttings	Cannot avoid.	Mud weights designed for gauge wellbore. This will minimise excess cuttings, Mud chemicals used for shale inhabitation to minimise wellbore instability resulting in excess cuttings.	No proposed.	Not proposed.	Separate fluids from cuttings as much as possible to maximise recycling of fluid.	Cuttings burial or removal subject to sampling results. The decision on disposal of the pit contents will be made in consultation with, and on the advice of, a suitably qualified independent environmental consultant and approval by DPIR/DENR

5. Risk Assessment

A comprehensive risk assessment posed by waste management is presented in Section 6 and Section 8 of the EMP. All risks associated with wastewater have been assessed to a level that is ALARP and acceptable.

6. Monitoring Plan

This section contains a monitoring plan that:

- *Outlines the sampling locations, frequency, proposed analytical methods and analytical detection limits, and any quality assurance and quality control measures that will be implemented,*
- *Reflects all monitoring requirements mandated by the COP and the EMP, as well as any monitoring that is determined to be necessary as part of the risk assessment,*
- *Requires all field measurements and sampling to be undertaken by suitably qualified personnel and to utilise equipment that is suitably maintained, laboratory checked and calibrated,*
- *Requires all laboratory analyses to be conducted at a National Association of Testing Authorities (NATA) accredited lab, where possible*.

6.1. Baseline monitoring of soils

An assessment of physical properties of representative baseline soils at each well site will be conducted.

Three samples will be taken at equidistant depth intervals in a 0.5-metre-deep soil core from three locations across the well site, adjacent to:

- the proposed well,
- the proposed location for drill fluid storage tanks (i.e. on the well pad),
- cuttings pit location.

Soil tests for each sample will include:

- A permeability test, such as falling head permeability testing on a sample or triaxial constant head permeability testing.
- A sample tested for:
  o Particle size distribution
  o Total chlorides (mg/kg)
  o Exchangeable sodium (%)
  o Emmerson aggregate test

6.2. Monitoring of stored water

The quality and quantity of all water stored will be monitored as per the below.

Quantity

If water is abstracted from an approved water bore, this will be measured using flowmeter and recorded on a weekly basis. Otherwise, records of water carted to site will be kept in a water register.

Fluid levels in water storages containers will be monitored daily during well site operations.

Quality

Water quality of abstracted groundwater stored in tanks will be sampled monthly. The suite will be tested as per Table 5 below. Testing will comprise grab samples from the tank, or sample of water pumped from the storage tank.

6.3. Monitoring of drill fluid

The quality and quantity of drill fluid will be recorded while within the area of the approved petroleum activity.

Quantity

The fluid levels in tanks containing drilling fluids will be monitored daily throughout drilling operations. Fluid level will be used to calculate the stored volume of drilling fluid in tanks.

The volume of each load of residual drill fluid, after evaporation, that is removed for treatment and/or disposal by third-party waste management contractors will be recorded and tracked in the waste register.

Quality

A representative sample of stored drill fluids will be taken each month. The sample will be tested for the suite shown in Table 6. Sampling and testing will occur at least once each month throughout drilling operations.

The composition of residual drill fluids will be analysed to determine whether it is consistent with the assumptions used for the assessment of environmental hazards and the design of proposed disposal methods.

6.4. Monitoring of drill cuttings

The quality and quantity of drill cuttings will be recorded while within the area of the approved petroleum activity.

Quantity

The volume of drill cuttings that will be stored in the pits will be estimated based on drilling data. An estimate of the total volume of drill cuttings stored in the is available in Table 3.

At the end of the drilling operations, representative samples will be taken of stored drill cuttings. Samples will be tested for the suite shown in Table 7 and Table 8.

Leachability testing of drill cuttings will be undertaken in accordance with the Australian Standard Leachate Procedure (Australian Standard AS4439.2 and 44396.3) by a NATA accredited laboratory.

Further samples may be taken to verify that the quality of the material has been adequately characterised for the purpose of determining that the proposed disposal option is suitable, in accordance with any requirements to classify the waste as is required under the EMPC Act 1989 (NT).

The composition of residual drill cuttings will be analysed to determine whether it is consistent with the assumptions used for the assessment of environmental hazards and the design of proposed disposal methods.

6.5. Quality assurance and quality control measures

All field measurements and environmental sampling will be undertaken by suitably qualified personnel.

All samples shall be collected using suitable sample containers, preservation methods and chains of custody prior to receipt by analytical laboratories. Holding times will be met, where practical.

All laboratory analyses will be conducted at a National Association of Testing Authorities (NATA) accredited lab, where possible.

Table 5. Suite of analysis for testing of stored groundwater

Analyte	ALS Method Code	Limit of reporting	Units
Electrical Conductivity (EC)	EA010-P	1	µS/cm
Total Dissolved Solids (TDS)	EA015H	10	mg/L
Total Suspended Solids (TSS)	EA025H	5	mg/L
pH	EA05-P	0.01	pH units
Sulfate (SO_4^{-2})	NT-2A	1	mg/L
Chloride (CL^-)		1	mg/L
Carbonate (CO_3^{-2})		1	mg/L
Bicarbonate (HCO_3^-) (as CaCO3 equivalent)		1	mg/L
Bicarbonate Alkalinity (as CaCO3 equivalent)		1	mg/L
Hydroxide Alkalinity (as CaCO3 equivalent)		1	mg/L
Total Alkalinity (as CaCO3 equivalent)		1	mg/L
Nitrite (NO_2^-)	NT-8A	0.01	mg/L
Nitrate (NO_3^-)		0.01	mg/L
Fluoride (F^-)	NT-2A	0.1	mg/L
Sodium (Na^+)	NT-1B	1	mg/L

Analyte	ALS Method Code	Limit of reporting	Units
Magnesium (Mg^{2+})		1	mg/L
Potassium (K^{+})		1	mg/L
Calcium (Ca^{2+})		1	mg/L
Arsenic	W-3, W-3T, EG020F, EG020T	0.001	mg/L
Barium		0.001	mg/L
Boron		0.001	mg/L
Cadmium		0.0001	mg/L
Chromium		0.001	mg/L
Lithium	W-3, W-3T, EG020F, EG020T	0.001	mg/L
Copper		0.001	mg/L
Iron		0.05	mg/L
Lead		0.001	mg/L
Manganese		0.001	mg/L
Mercury		0.0001	mg/L
Selenium		0.001	mg/L
Silica		0.1	mg/L
Silver		0.001	mg/L
Strontium		0.001	mg/L
Zinc		0.001	mg/L

Table 6. Suite of analyses for testing of residual drill fluid

Analyte	ALS Method Code	Limit of reporting	Units
Dissolved oxygen (DO) measured in situ	EP025	0.1	mg/L
Electrical Conductivity (EC) measured in situ and lab	EA010-P	1	µS/cm
Total Dissolved Solids (TDS)	EA015H	10	mg/L
Total Suspended Solids (TSS)	EA025H	5	mg/L
pH measured in situ and in lab	EA05-P	0.01	
Temperature measured in situ	-	0.1	°C
Nitrate	NT-6	0.01	% saturation and mg/L
Nitrite		0.01	
Total Nitrogen	NT-8A	0.1	
Total Kjeldahl Nitrogen		0.1	
Ammonia		0.01	
Reactive Phosphorus		0.01	
Total Phosphorus		0.01	
Sulfate (SO_4^{-2})	NT-2A	1	mg/L
Chloride (Cl^{-})		1	mg/L
Carbonate ($CO3^{-2}$)		1	mg/L
Bicarbonate (HCO_3^{-}) (as CaCO3 equivalent)		1	mg/L
Bicarbonate Alkalinity (as CaCO3 equivalent)		1	mg/L
Hydroxide Alkalinity (as CaCO3 equivalent)		1	mg/L
Total Alkalinity (as CaCO3 equivalent)		1	mg/L
Nitrite (NO_2^{-})	NT-8A	0.01	mg/L
Nitrate (NO_3^{-})		0.01	mg/L

Analyte	ALS Method Code	Limit of reporting	Units
Fluoride (F^-)	NT-2A	0.1	mg/L
Bromide (Br)	ED009X	0.01	mg/L
Total Cyanide	EK026SF	0.004	Mg/L
Sodium (Na^+)	NT-1B	1	mg/L
Magnesium (Mg^{2+})		1	mg/L
Potassium (K^+)		1	mg/L
Calcium (Ca^{2+})		1	mg/L
Aluminium	W-3, W-3T, EG020F, EG020T	0.01	mg/L
Antimony		0.001	mg/L
Arsenic		0.001	mg/L
Barium	W-3, W-3T, EG020F, EG020T	0.001	mg/L
Beryllium		0.001	mg/L
Boron		0.001	mg/L
Cadmium		0.0001	mg/L
Chromium		0.001	mg/L
Cobalt		0.001	mg/L
Copper		0.001	mg/L
Iron		0.05	mg/L
Lead		0.001	mg/L
Manganese		0.001	mg/L
Mercury		0.0001	mg/L
Molybdenum		0.001	mg/L
Nickel		0.001	mg/L
Selenium		0.001	mg/L
Silica		0.1	mg/L
Silver		0.001	mg/L
Strontium		0.001	mg/L
Thorium		0.001	mg/L
Tin		0.001	mg/L
Uranium		0.001	mg/L
Vanadium		0.5	mg/L
Zinc		0.001	mg/L
Other radionuclides and gross alpha, beta and gamma radiation	EA250-LSC	0.05 – 0.1	Bq/L
Benzene	W-24	0.001	mg/L
Toluene		0.001	mg/L
Ethylbenzene		0.001	mg/L
M and p Xylene		0.001	mg/L
o Xylene		0.001	mg/L
Total Xylenes		0.002	mg/L
TRH C6 - C10		0.02	mg/L
TRH C6 - C10 less BTEX		0.02	mg/L
TRH >C10 - C16		0.02	mg/L
TRH >C10 - C16 less Naphthalene		0.02	mg/L
TRH >C16 - C34		0.01	mg/L
TRH >C34 - C40		0.01	mg/L
Total TRH C6 - C40		0.01	mg/L

Analyte	ALS Method Code	Limit of reporting	Units
3-Methylcholanthrene	W-24, EP074 A to H and EP033	0.001	mg/L
7, 12- Dimethyl Benz (a) anthracene		0.001	mg/L
Acenaphthene		0.001	mg/L
Acenaphthylene		0.001	mg/L
Anthracene		0.001	mg/L
Benzo (a) pyrene		0.001	mg/L
Benzo (b) fluoranthene		0.001	mg/L
Benzo (ghi) perylene		0.001	mg/L
Benzo (k) fluoranthene		0.001	mg/L
Benzo (a) anthracene		0.001	mg/L
Chrysene	W-24, EP074 A to H and EP033	0.001	mg/L
Dibenz (ah) anthracene		0.001	mg/L
Fluoranthene		0.001	mg/L
Fluorene		0.001	mg/L
Indeno (1,2,3-cd) pyrene		0.001	mg/L
Naphthalene		0.001	mg/L
Phenanthrene		0.001	mg/L
Pyrene		0.001	mg/L
Carcinogenic PAHs (benzo[a}pyrene equivalents			
Total PAH		0.001	mg/L
2,3,4,6-Tetrachlorophenol	W-24, EP074 A to H and EP033	0.005	mg/L
2,4,5-Trichlorophenol		0.005	mg/L
2,4,6-Trichlorophenol		0.005	mg/L
2,4-Dichlorophenol		0.005	mg/L
2,4-Dimethylphenol		0.005	mg/L
2,4-Dinitrophenol		0.005	mg/L
2,6-Dichlorophenol		0.005	mg/L
2-Chlorophenol		0.005	mg/L
2-Methyl-4,6-dinitrophenol		0.005	mg/L
2-Nitrophenol		0.005	mg/L
4-Chloro-3-methylphenol		0.005	mg/L
4-Nitrophenol		0.005	mg/L
Dinoseb		0.005	mg/L
Hexachlorophene		0.005	mg/L
m- and p-Cresol		0.005	mg/L
Pentachlorophenol		0.005	mg/L
Phenol		0.005	mg/L
Dissolved Organic Carbon (DOC)	EP002	1	mg/L
Total Organic Carbon (TOC)	EP005	1	mg/L
Bromide	ED009X	001	mg/L
Chlorine/Chloride	NT-2A	1	mg/L
Formaldehyde	EP010		

Table 7. Suite of analyses for testing of drill cuttings (solid samples)

Analyte	Method Code	Limit of reporting	Units
Ag	iMET2SAICP	0.5	mg/kg
Al		10	mg/kg
As		1	mg/kg
B		5	mg/kg
Ba		0.1	mg/kg
Be		0.05	mg/kg
C	(combs)	0.05	%
CO_3	(combs)	0.25	%
Cd	iMET2SAICP	0.05	mg/kg
Cl	iCO1SEDA	5	mg/kg
Co	iMET2SAICP	0.1	mg/kg
Cr	iMET2SAICP	0.05	mg/kg
Cu		0.1	mg/kg
Electrical conductivity at 25 °C	iEC1SASE	0.2	ms/m
F	eF1ST	50	mg/kg
H_2O_105C	iMOIS1SAGR	0.1	%
Hg	iMET2SAMS	0.02	mg/kg
Mn	iMET2SAICP	0.2	mg/kg
Mo		0.5	mg/kg
N	(total)	0.005	%
Ni	iMET2SAICP	1	mg/kg
P	(totals)	10	mg/kg
Pb	iMET2SAICP	0.5	mg/kg
Se		2	mg/kg
Sr		0.2	mg/kg
TIC	(combs)	0.05	%
TOC	(combs)	0.05	%
V	iMET2SAICP	0.2	mg/kg
Zn		5	mg/kg
pH	iPH1SASE	0.1	-
Benzene	eBTEXSoil	0.5	mg/kg
Toluene		0.5	mg/kg
Ethylbenzene		0.5	mg/kg
Xylene		1	mg/kg
Total BTEX		2.5	mg/kg
TPH C6-C9	eTPHSoils	25	mg/kg
TPH C10-C14		50	mg/kg
TPH C15-C28		100	mg/kg
TPH C29-C36		100	mg/kg
Total TPHs		275	mg/kg
Acenaphthene	ePAH1SOIL	1	mg/kg
Acenaphthylene		1	mg/kg
Anthracene		1	mg/kg
Benz(a)anthracene		1	mg/kg
Benzo(a)pyrene		1	mg/kg
Benzo(b+k)fluoranthene		1	mg/kg
Benzo(g,h,i)perylene		1	mg/kg
Chrysene		1	mg/kg
Dibenzo(a,h)anthracene		1	mg/kg
Fluoranthene		1	mg/kg
Fluorene		1	mg/kg
Indeno(1,2,3-cd)pyrene		1	mg/kg
Naphthalene		1	mg/kg

Analyte	Method Code	Limit of reporting	Units
Phenanthrene		1	mg/kg
Pyrene		1	mg/kg
Total PAHs		16	mg/kg

Table 8. Suite of analyses for testing of drill cuttings (Australian Standard Leaching Procedure Extract from Solid)

Analyte	Method Code	Limit of reporting	Units
Ag	iMET1WCMS	0.0001	mg/kg
Al	iMET1WCICP	0.005	mg/kg
As	iMET1WCMS	0.001	mg/kg
B	iMET1WCICP	0.02	mg/kg
Ba		0.002	mg/kg
Be		0.001	mg/kg
Cd	iMET1WCMS	0.0001	mg/kg
Cl	iCO1WCDA	1	mg/kg
Co	iMET1WCICP	0.005	mg/kg
Cr		0.001	mg/kg
Cu	iMET1WCMS	0.0001	mg/kg
Hg	iHG1WCVG & iMET1WCMS	0.0001	mg/kg
Mn	iMET1WCICP	0.001	mg/kg
Mo	iMET1WCMS	0.001	mg/kg
Ni		0.001	mg/kg
Pb		0.0001	mg/kg
Se		0.001	mg/kg
Sr	iMET1WCICP	0.002	mg/kg
V		0.005	mg/kg
Zn		0.005	mg/kg
pH_ASLP	iASLP	0.1	-

Appendix 14. Groundwater survey

EP187 GROUNDWATER INVESTIGATION

Report IG-02

May 2019



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Executive Summary

A baseline groundwater monitoring program was undertaken within the western portion of Exploration Permit (EP) area EP187 in the Northern Territory. The objectives of the baseline assessment are to provide:

- Comply with recommendations from the *Scientific Inquiry into Hydraulic Fracturing in the Northern Territory, April 2018*
- Establish a baseline groundwater quality profile prior to proposed exploration works on EP187

Groundwater samples were collected from five (5) existing pastoralist bores. Bores were selected based on their location within the extent of proposed seismic and exploration activities. Samples were analysed for a range of contaminants which are relevant for exploration purposes. No stygofauna (GDE) monitoring was undertaken.

Naturally occurring elevated heavy metal concentrations (zinc) above trigger levels were reported in House Bore (HB-1), No. 5 Bore (5B-1) and No. 4 Bore (4B-1). This is consistent with the natural ore bodies in the area and is expected. Total petroleum hydrocarbons (TPH), total recoverable hydrocarbons (TRH) fractions and benzene, toluene, ethyl-benzene and xylenes (BTEX) were less than the laboratory level of reporting (LOR) from all samples collected. Physical parameters (pH, conductivity and TDS), major cations and total hardness were consistent with historical results.

The groundwater monitoring program undertaken provides a baseline understanding of the groundwater aquifer in the western portion of EP187. It provides a sound basis on which to conduct further groundwater monitoring and assessment. The groundwater bores were selected to provide a representative spread across the western portion of EP187 where exploration activities are proposed.

1 INTRODUCTION

The hydraulic fracturing Panel (*Scientific Inquiry into Hydraulic Fracturing in the Northern Territory, April 2018*) assessed the risk of groundwater contamination from leaky wells and on-site surface spills as 'low'. This was assessed by using historical data from previous exploration activities and operations in other regions. Nonetheless, the Panel is prevented from making a definitive assessment of the fate of some contaminants and their risk to groundwater and aquatic ecosystems (groundwater dependent ecosystems (GDE)) due to a lack of baseline information and knowledge of groundwater (and surface water and GDE) systems in the Northern Territory.

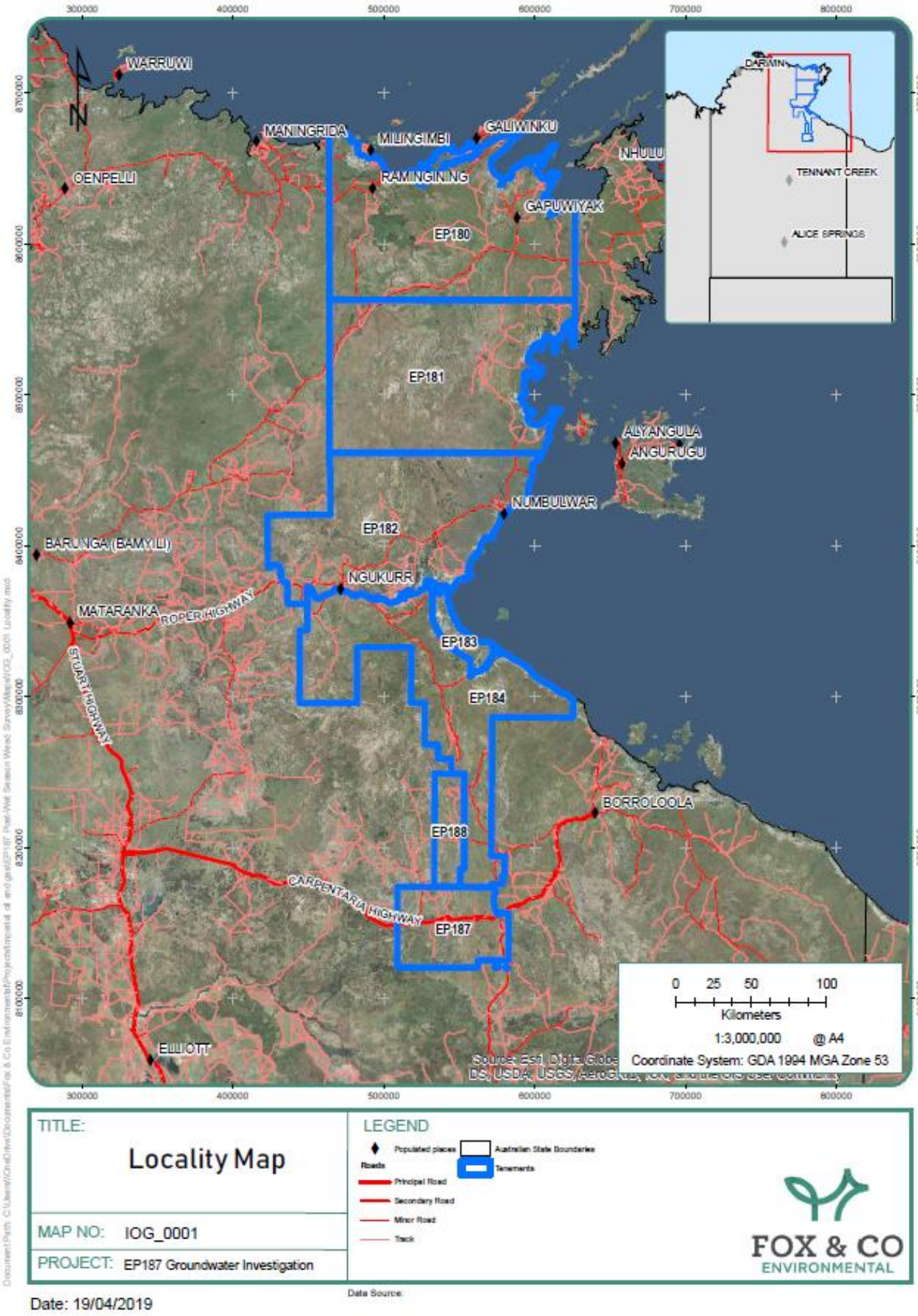
In this regard, to be proactive and demonstrate good environmental stewardship, IOG commissioned Fox & Co Environmental Pty Ltd to commence a baseline groundwater monitoring program on EP187. The focus of the survey was to gain an understanding of the groundwater quality in the area on EP187 associated with proposed exploration activities.

The investigation was undertaken on 10-11 April 2019 across the western portion of the tenement.

1.1 Location

EP187 is situated in the upper reaches of the McArthur River in proximity to the Barkly Tablelands. The tenement lies to the west of the Tablelands Highway and is crossed east to west by the Carpentaria Highway. **Figure 1** displays the location of the tenement area in relation to the broader region. The main access within the tenement is along the Carpentaria Highway and the Broadmere Road.

The groundwater monitoring program targeted existing bores proximate to the proposed 2019 IOG exploration program, in the western portion of the tenement. **Table 1** provides the latitude and longitude coordinates of the five (5) bores sampled during April 2019. **Figure 2** provides a map of the sampled bores. **Figure 3** shows the registered groundwater bores on EP187.


300000
400000
500000
600000
700000
800000
WARRUWI
MANINGRIDA
MILINGIMBI
GALIWINKU
NHULU
OENPELLI
RAMINGINING
GAPUWIYAK
EP180
EP181
ALYANGULA
ANGURUGU
NUMBULWAR
EP182
BARUNGA (BAMYILI)
NGUKURR
MATARANKA
ROPER HIGHWAY
STUART HIGHWAY
EP183
EP184
BORROLOOLA
EP188
CARPENTARIA HIGHWAY
EP187
ELLIOTT
DARWIN
TENNANT CREEK
ALICE SPRINGS
0 25 50 100
Kilometers
1:3,000,000 @ A4
Coordinate System: GDA 1994 MGA Zone 53
TITLE:
Locality Map
MAP NO: IOG_0001
PROJECT: EP187 Groundwater Investigation
LEGEND
Populated places
Australian State Boundaries
Roads
Tenements
Principal Road
Secondary Road
Minor Road
Track
FOX & CO
ENVIRONMENTAL
Data Source:
Date: 19/04/2019

2 METHODS

The following methods were utilised to collect representative groundwater samples of the aquifer. The baseline groundwater sampling program was undertaken in accordance with the Northern Territory Methodology for Sampling of Ground Waters (Methodology for the Sampling of Ground Waters. Advisory Note AA7-024. Northern Territory Government (Resources, 2009)).

2.1 Existing Groundwater Bores Monitored in April 2019

The groundwater monitoring program targeted existing bores proximate to the proposed 2019 IOG exploration program. Bores with existing infrastructure were also targeted to assist with the collection of the samples. **Table 1** provides the latitude and longitude coordinates of the five (5) bores sampled during April 2019. **Figure 2** provides a map of the sampled bores. **Figure 3** shows all the registered groundwater bores on EP187.

Table 1: Groundwater bores (decimal degrees), April 2019

Well ID	Common / Pastoralist Well Name	NT DENR Well ID	Latitude	Longitude
HWY-1	Highway Bore	RN027848	-16.7338	135.1815
HB-1	House Bore	RN039575	-16.7491	135.2964
RCB-1	Relief Creek Bore	RN027945	-16.8348	135.3193
5B-1	No. 5 Bore	RN007699	-16.6484	135.3243
4B-1	No. 4 Bore	RN007696	-16.6567	135.2070

NB: All coordinates are provided in decimal degrees. Positional data was collected with a handheld Garmin eTrex Global Positioning System (GPS) unit, with accuracy between 4 and 8 m.

2.2 Desktop Assessment

Prior to commencing the field program, local pastoralists responsible for installing and equipping groundwater bores were contacted to obtain relevant, area specific and bore specific information such as:

- Groundwater bores proximate and accessible to the western portion of EP187
- Which bores were equipped with existing and functional bore infrastructure (ie. Generators and pumps)
- Type of pump (eg. Solar powered submersible)
- Historical and recent information on groundwater levels
- Pump rates

The Northern Territory Department of Natural Resources (DENR), Natural Resource Maps (NR Maps) were accessed to review existing groundwater bore information in the area. The original bore logs for the five (5) bores sampled are provided in **Appendix A**.

2.3 Sampling

Groundwater bores were purged using submersible pumps to remove standing water within the well in order to gain a representative sample of the aquifer. A flow-through cell was used with real-time in-situ physical parameter readings (temperature, pH and conductivity). Once the physical parameters stabilised, a groundwater sample was collected.

Field parameters collected included pH, temperature, conductivity and total dissolved solids (TDS).

Samples were collected in analyte specific containers (ie. with analyte specific preservatives). Once collected, the samples were immediately labelled and stored within a portable refrigerator.

Samples were sent to Australian Laboratory Services (ALS) a National Association of Testing Authorities (NATA) approved laboratory for the analysis performed.

The following analysis was undertaken for each groundwater bore:

- Suspended Solids (SS)
- Total Hardness as $CaCO_3$
- Dissolved Major Cations
  - Calcium
  - Magnesium
  - Sodium
  - Potassium
- Dissolved Metals
  - Arsenic
  - Cadmium
  - Chromium
  - Copper
  - Lead
  - Nickel
  - Zinc
- Dissolved Mercury
- Nitrogen
  - Nitrite + Nitrate as N
  - Total Kjeldahl Nitrogen as N
  - Total Nitrogen as N
- Total Phosphorus as P
- Laboratory Quality Assurance / Quality Control
- Total Petroleum Hydrocarbons
  - C6 - C9 Fraction
  - C10 - C14 Fraction
  - C15 - C28 Fraction
  - C29 - C36 Fraction
  - C10 - C36 Fraction (sum)
- Total Recoverable Hydrocarbons
  - C6 - C10 Fraction
  - C6 - C10 Fraction minus BTEX (F1)
  - >C10 - C16 Fraction
  - >C16 - C34 Fraction
  - >C34 - C40 Fraction
  - >C10 - C40 Fraction (sum)
  - >C10 - C16 Fraction minus Naphthalene (F2)
- BTEXN
  - Benzene
  - Toluene
  - Ethylbenzene
  - meta- & para-Xylene
  - ortho-Xylene
  - Total Xylenes
  - Sum of BTEX
  - Naphthalene
- TPH(V)/BTEX Surrogates
  - 1.2-Dichloroethane-D4
  - Toluene-D8
  - 4-Bromofluorobenzene

Appendix B provides the laboratory results, chain of custody and sample receipt.

2.3.1 *Adopted Assessment Criteria*

The following assessment criteria was adopted for the purpose of assessing baseline surface water quality:

- National Environment Protection Council *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), May 2013
- Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000) 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality

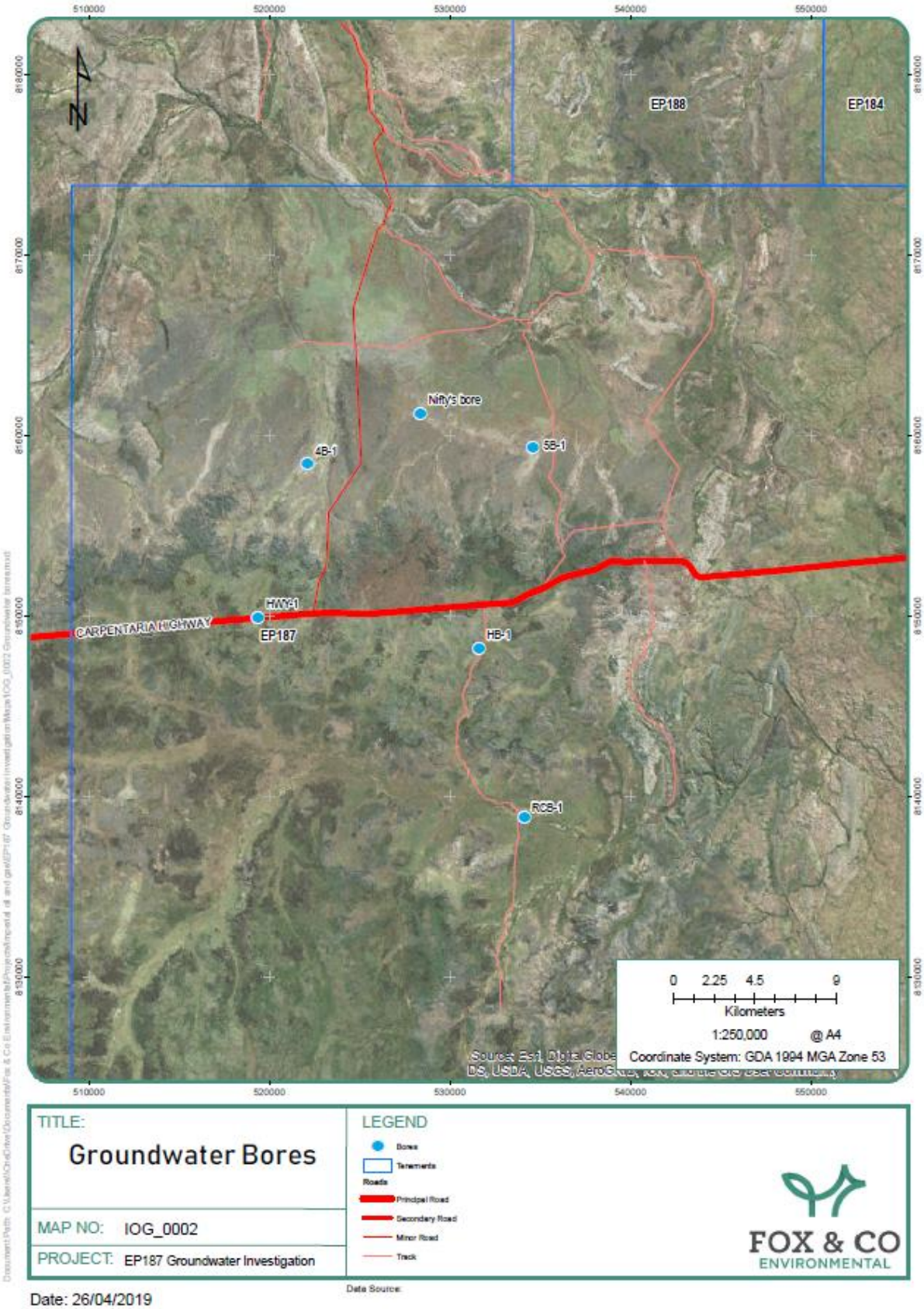
2.3.2 *Quality Control*

The field and laboratory QA/QC program is to validate the data to ensure it is reasonable and of sufficient quality to meet the data quality objectives for this baseline ground water investigation. Certified laboratory documentation including chain of custodies, sample receipt notifications, certificates of analysis and laboratory QA/QC reports are provided in **Appendix B.**

2.3.3 Study Limitations

The baseline groundwater assessment was undertaken using existing, equipped pastoralist groundwater bores. As the bores are working pastoralist bores with equipped pipes, pumps and generators, groundwater probes are unable to fit down the well to measure the exact standing water level (as the top of the bores are steel cased). As such, discussions were held with each pastoralist and persons responsible for equipping the bores to ascertain the approximate standing water level. Historical logs were also reviewed which correlated with the anecdotal evidence.

It is also noted, while no hydrocarbons were recorded above the laboratory level of reporting (LOR) (refer **Table 2**), anecdotal evidence reported practices of pouring diesel down bores during construction to lubricate augers, while diesel and engine oils have also been historically poured on the ground surface around the bores, to keep the stand-pipe clear of grass. Other anecdotal evidence also reported observations of diesel overspilling generators during filling and also entering the localised bore area (refer **Table 4**).


510000
520000
530000
540000
550000
8180000
8170000
8160000
8150000
8140000
8130000
N
EP188
EP184
Nifty's bore
4B-1
5B-1
HWY-1
CARPENTARIA HIGHWAY
EP187
HB-1
RCB-1
0 2.25 4.5 9
Kilometers
1:250,000 @ A4
Coordinate System: GDA 1994 MGA Zone 53
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
TITLE:
Groundwater Bores
MAP NO: IOG_0002
PROJECT: EP187 Groundwater Investigation
LEGEND
Bores
Tenements
Roads
Principal Road
Secondary Road
Minor Road
Track
FOX & CO
ENVIRONMENTAL
Data Source:
Date: 26/04/2019


525000
550000
575000
8179000
8150000
8129000
N
EP188
EP184
EP187
RN035534
RN007698
RN007695
RN025471
RN008064
(Nifty's bore)
RN024503
RN037057
RN007697
RN008062
RN008270
RN007696 (4B-1)
RN007699 (5B-1)
RN007700
RN007694
RN023350
RN024788
RN035525
RN028064
RN008061
RN024789
RN024516
RN023351
RN027848 (HW1-1)
RN022865
RN039578 (HB-1)
RN008060
RN039574
RN007661
RN027945 (RCB-1)
RN025714
RN000641
RN025715
TABLELANDS HWY
0 3.5 7 14
Kilometers
1:400,000 @ A4
Coordinate System: GDA 1994 MGA Zone 53
Source: Esri, DigitalGlobe, USDA, USGS, AeroGRID, IGN, and the GIS User Community
TITLE:
Regional Bores
MAP NO: IOG_0003
PROJECT: EP187 Groundwater Investigation
LEGEND
Regional bores
Tenements
Roads
Principal Road
Secondary Road
Minor Road
Track
FOX & CO
ENVIRONMENTAL
Data Source:
Date: 26/04/2019

3 RESULTS

Table 2 provides the laboratory results from the five (5) groundwater bores sampled. Results were consistent across all groundwater bores sampled, and where comparison was possible, also consistent with historical groundwater bore data.

Table 2 Annual Action Plan

		Sample date	9/4/19	9/4/19	9/4/19	9/4/19	10/4/19
Analyte grouping Analyte	**Units**	**Investigation Level**	**HWY-1**	**HB-1**	**RCB-1**	**5B-1**	**4B-1**
EA025: Total Suspended Solids dried at 104 ± 2°C							
Suspended Solids (SS)	mg/L		<5	<5	<5	17	23
EA065: Total Hardness as CaCO							
Total Hardness as $CaCO_3$	mg/L		528	495	439	537	576
ED093F: Dissolved Major Catio							
Calcium	mg/L	700[3]	124	114	100	126	120
Magnesium	mg/L	2000[4]	53	51	46	54	67
Sodium	mg/L	180[3]	45	36	4	44	45
Potassium	mg/L		8	8	3	8	8
EG020F: Dissolved Metals by IC MS							
Arsenic	mg/L	0.007[1]	0.001	<0.001	0.001	<0.001	<0.001
Cadmium	mg/L	0.002[1]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.05[1]	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	2[1]	<0.001	<0.001	0.002	<0.001	<0.001
Lead	mg/L	0.01[1]	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	mg/L	0.02[1]	<0.001	<0.001	0.001	<0.001	<0.001
Zinc	mg/L	0.008[2]	<0.005	**1.53**	<0.005	**0.581**	**0.126**
EG035F: Dissolved Mercury by FIMS							
Mercury (total)	mg/L	0.001[1]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK050G: Nitrite plus Nitrate as (NOx) by Discrete Analyser							
Nitrite + Nitrate as N	mg/L	0.005[5]	**0.11**	**0.05**	**0.13**	**0.03**	**0.05**
EK061G: Total Kjeldahl Nitroge Discrete Analyser							
Total Kjeldahl Nitrogen as N	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1
EK062G: Total Nitrogen as N (T + NOx) by Discrete Analyser							
Total Nitrogen as N	mg/L	0.2-0.3[5]	0.1	<0.1	0.1	<0.1	<0.1
EK067G: Total Phosphorus as P Discrete Analyser							
Total Phosphorus as P	mg/L	0.01[5]	<0.01	<0.01	<0.01	<0.01	**0.03**
EP080/071: Total Petroleum Hydrocarbons							
C6 - C9 Fraction	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	µg/L		<50	<50	<50	<50	<50

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		Sample date	9/4/19	9/4/19	9/4/19	9/4/19	10/4/19
Analyte grouping Analyte	**Units**	**Investigation Level**	**HWY-1**	**HB-1**	**RCB-1**	**5B-1**	**4B-1**
C10 - C36 Fraction (sum)	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
C6 - C10 Fraction	µg/L		<20	<20	<20	<20	<20
C6 - C10 Fraction minus BTEX (F1)	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	µg/L		<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	µg/L		<100	<100	<100	<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN							
Benzene	µg/L	950[2]	<1	<1	<1	<1	<1
Toluene	µg/L	800[1]	<2	<2	<2	<2	<2
Ethylbenzene	µg/L	300[1]	<2	<2	<2	<2	<2
meta- & para-Xylene	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	µg/L	350[2]	<2	<2	<2	<2	<2
Total Xylenes	µg/L	600[1]	<2	<2	<2	<2	<2
Sum of BTEX	µg/L		<1	<1	<1	<1	<1
Naphthalene	µg/L	16[2]	<5	<5	<5	<5	<5
EN055: Ionic Balance							
Total Anions	meq/L		13.2	10.8	8.11	12.4	12.4
Total Cations	meq/L		12.7	11.6	9.03	12.8	13.7
Ionic Balance	%		2.07	3.98	5.36	1.76	4.86
Field Measurements							
Temperature	oC		35.2	34.1	32.5	31.1	32.0
Electrical Conductivity	µS/cm	20-250	1236	1134	864	1250	1285
pH		6-8.0	6.60	6.65	6.78	6.50	6.50
TDS	ppm		-	737	562	810	839

[1] – Investigation Level for Drinking Water. Schedule B(1) – Guideline on Investigation Levels for Soil and Groundwater (NEPM, 2013).
[2] - Investigation Level for Fresh Water (95% species protection). Schedule B(1) – Guideline on Investigation Levels for Soil and Groundwater (NEPM, 2013). Used in absence of IL for Drinking Water (1)
[3] –Groundwater, Explanatory notes to the Groundwater Map of the Northern Territory (DNREAS, 2008)
[4] - In high doses magnesium can cause scouring and diarrhoea in cattle. Levels up to 2000 mg/L have been observed to have no adverse effects. There is insufficient information available at present to set a guideline value (DNREAS, 2008)
[5] - ANZECC Water Quality Guidelines (2000) for belowland streams of Tropical North Australia.

3.1 QA/QC

The below table provides a summary of data quality compliance for the project. The data quality objectives (DQOs) and methods were developed using those recommended in *NEPM Schedule B (2) Guideline on Data Collection, Sample Design and Reporting*. The guideline nominates the implementation of the DQO process in Section 5 of AS4482.1-2005.

Table 3 Summary of QA/QC Compliance

Task	Objective	Reference	Outcome	Achieved Compliance
Compare field data and analytical data	Visual and olfactory evidence relates to laboratory results		Field observations relate to laboratory results	Yes
Calibration of water quality meter	Adhere to machine specifications	AS4482.1-2005	Yes. Field pH compares to historical bore data in addition to calibration	Yes
Chain of Custody documentation	Completed		Completed and provided in Appendix B.	Yes
Sample analysis and extraction holding times	Comply with holding times	AS4482.1-2005/NEPM(2013)	Yes. Refer Appendix B.	Yes
Sample preservation	Samples collected in appropriate preserved sample bottles		Yes. Refer Appendix B.	Yes

3.2 Photo Log

Table 4 Groundwater Bores Sampled in April 2019

Groundwater Bore	Plate
Highway Bore (HWY-1), RN027848 Location: -16.7338, 135.1815	

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Groundwater Bore	Plate
House Bore (HB-1), RN039575 Location: -16.7491, 135.2964	
Relief Creek Bore (RCB-1), RN007696 Location: -16.6567, 135.2070	

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Groundwater Bore	Plate
No. 5 Bore (5B-1), RN007699 Location: -16.6484, 135.3243 Note historical oil and diesel staining on the surface.	
No. 4 Bore (4B-1), RN007699 Location: -16.6484, 135.3243 Note historical oil and diesel staining /spills on the unsealed ground surface.	

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4 DISCUSSION AND INTERPRETATION OF RESULTS

Zinc was reported above the adopted trigger level in 3 of the 5 bores. Groundwater bores HB-1, 5B-1 and 4B-1 reported concentrations of 1.53mg/L, 0.581mg/L and 0.126 mg/L, respectively. All other samples reported heavy metal (arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), zinc (Zn) and mercury (Hg)) concentrations below the laboratory LOR or only marginally above the laboratory LOR.

Major cations (calcium (Ca), magnesium (Mg), sodium (Na) and potassium (K)) were less than the adopted trigger levels for human and livestock consumption.

All samples reported concentrations of total petroleum hydrocarbons (TPH), total recoverable hydrocarbons (TRH) and benzene, toluene, ethyl-benzene and xylenes (BTEX) below the laboratory LOR.

Comparison of historical physical parameters (pH, conductivity and TDS) of groundwater samples collected with the recent round of samples reported consistent results. Similarly, historical groundwater results (only a reduced suite of analytes have historically been analysed including major cations and total hardness) are consistent with the recent round of results.

5 CONCLUSION

Concentrations of zinc above the trigger levels in regional groundwater is not unexpected. The McArthur River Mine located in the region, is one of the world's largest zinc, lead and silver mines and the zinc in the groundwater is likely associated with these natural ore bodies.

Despite historical oil and fuel spills around the groundwater bores, all samples reported concentrations of hydrocarbons less than the laboratory LOR. The samples collected from the April 2019 investigation are consistent with previous historical results (physical parameters, major cations and total hardness). Only a reduced suite of analytes has historically been analysed, therefore comparison is limited, however this investigation provides a more comprehensive baseline for interpretation of future trends.

This investigation is limited to assessing the existing contamination status and groundwater quality within the western portion of EP187. Little is known about stygofauna (animals that live exclusively in aquifers) and groundwater dependent ecosystems (GDE) in the region. It is recommended future groundwater investigations include stygofauna monitoring as they are an indicator of groundwater health.

6 WORKS CITED AND RELEVANT REFERENCE DOCUMENTS

Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000) 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality

Department of Natural Resources, Environment, the Arts and Sport (June 2008), Groundwater Explanatory notes to the Groundwater Map of the Northern Territory.

National Environment Protection Council *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), May 2013

Scientific Inquiry into Hydraulic Fracturing in the Northern Territory, Summary of the Final Report, April 2018.

Refer to Attachment 4 for the full report on groundwater survey including appendixes

Appendix 15. AAPA Certificate

Imperial has applied for an AAPA Certificate and will attach it here when received.

Appendix 16. Anthropological map

In May 2015, during the EP 187 application phase, the NLC did engage a consultant anthropologist to undertake an aerial survey for the purpose of identifying and delineating consent land and non-consent land. During this survey Aboriginal sacred sites were identified and excluded from land subsequently subject to the grant of title EP 187. Refer to Attachment 7 for the full Anthropological report.

