EP187 Seismic and Drilling Program

Emergency response Plan

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Well Engineering & Project Management
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Contents

1. Introduction

This Emergency Response Plan (ERP) describes processes to be followed by Imperial Oil and Gas in the event of an emergency during civil works, seismic operations or well construction as part of the EP 187 2019 project activities.

Imperial Oil & Gas will coordinate a site emergency response team for the project with support from its engineering and project management subcontractor, primary contractors and relevant third parties.

All external communications in relation to any emergency incident at the site will be conducted by Imperial Oil & Gas. This includes communications to government agencies as part of license requirements and any statements to the media or the community or discussions with any government agencies.

2. Relevant Parties

2.1. Imperial Oil & Gas

Imperial Oil & Gas is the proponent of the EP187 2019 work program.

- Imperial Oil & Gas will hold the contracts with the relevant service companies to be used on the project including the civils contractor, the seismic contractor and the drilling rig contractor.
- An Imperial Oil & Gas designated supervisor will be located on site during the civil construction activities.
- Imperial Oil & Gas will maintain supervision during the seismic operation and the seismic contractors own ERP will be bridged to this document.
- Imperial Oil & Gas will maintain site supervision via the rig OCR during the well construction activities, however the primary contractor for drilling activities will be the drilling rig contractor. The drilling rig contractor ERP will become the primary ERP during this period, and Imperial Oil & Gas HSE systems will be bridged to the contractor's ERP.
- Once the drilling rig has demobilised, an Imperial Oil & Gas supervisor will be on site for all activities that impact on the well.
- Emergency response equipment will, at a minimum, be provided by the site supervisor and will be located in the site office, or in the site supervisors vehicle where no site office exists, at all times during the course of the project including first aid, fire and spills management.
- A muster point at the site office will be maintained for civil construction and seismic activities and once the leases are constructed and drilling operations commence, muster points will be located at the entrance to each lease for activities on that lease

2.2. InGauge Energy

inGauge Energy has been contracted by Imperial Oil & Gas to provide engineering and project management services for the project. InGauge personnel will act on behalf of Imperial Oil and Gas as site supervision and will implement the ERP during the project.

2.3. Seismic Contractor

Velseis Pty Ltd are the likely contractor for the seismic operations. Velseis will provide an ERP which will be bridged to this ERP for their operations.

2.4. Drilling Contractor

The drilling contractor has not been selected at this time, however the drilling contractor will provide an ERP and the well construction activities will be done under the drilling contractors ERP.

During well construction activities, for subsurface events such as well blowouts the Imperial Oil & Gas OCR will be the Incident Controller and Imperial Oil & Gas EHS systems will take priority.

For all surface events during well construction, the drilling contractor's site supervisor will be the Incident Controller, and the drilling contractor's EHS system will take priority.

This will be clarified in a bridging document to be prepared prior to rig mobilisation.

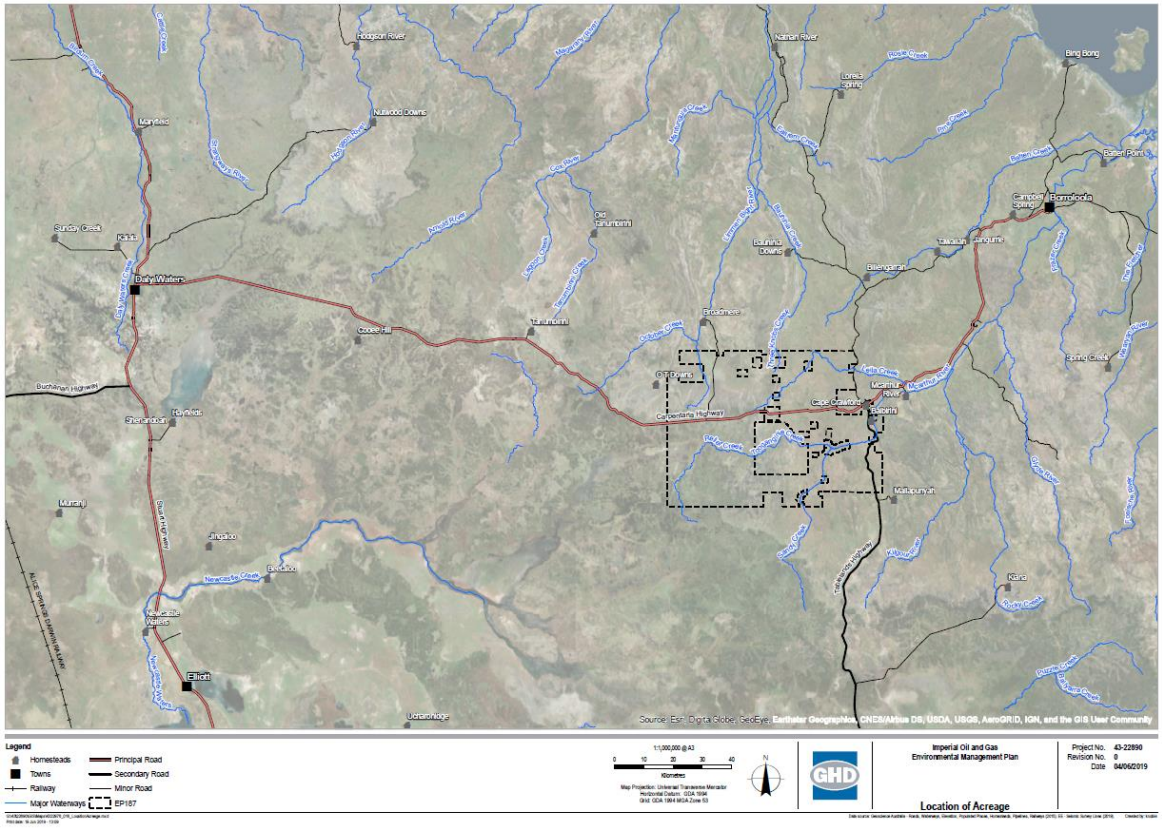
3. Background

The EP 187 2019 Seismic and Drilling Project is being carried out across the eastern margin of the Beetaloo Sub-Basin within EP87. The project area is approximately 200km to the East of Daily Waters, on either side of the Carpentaria Highway in the Northern Territory.

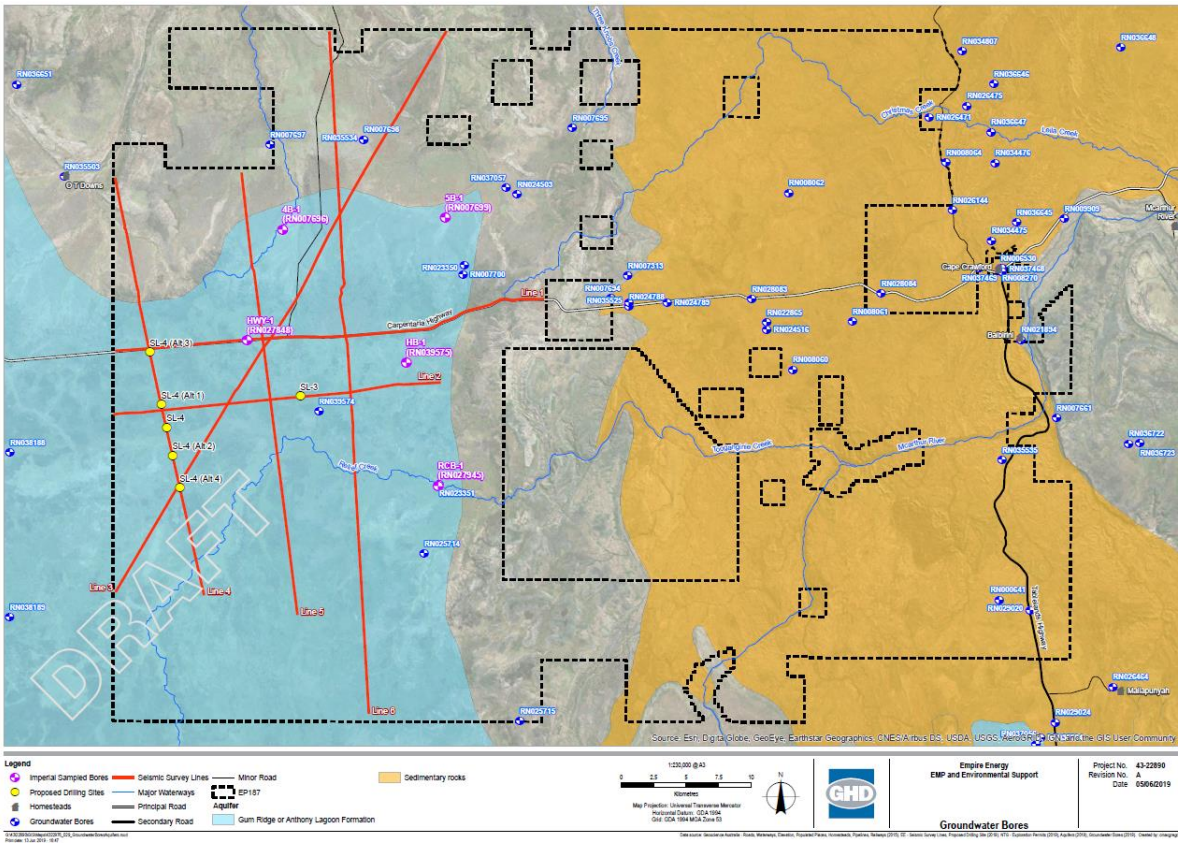
The project includes the acquisition of 231km of seismic line and the drilling of up to two wells. The works include required civil works, camp installation, well logging and data gathering, rehabilitation and other associated activities.

The seismic lines and well pads are shown in the image below. The first well has a preferred location and 4 alternative locations on which that well may be drilled, but only one well will be drilled.

EP187 Location Overview



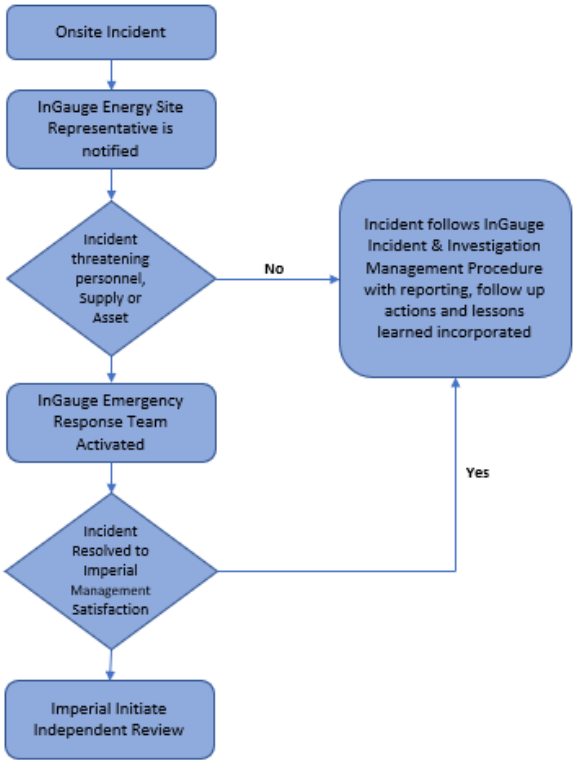
EP187 Seismic lines and Potential well locations



Potential well and campsite locations

4. Emergency Response Process

4.1. Emergency Response Procedure



4.2. Emergency Evacuation

Emergency evacuation can include medical evacuation for an injured person following treatment of the person on site by first aiders and/or emergency services.

As part of the emergency evacuation, an airstrip is available at Heartbreak Hotel, located approximately 60m by sealed road from site. The airstrip is in very good condition and is regularly used by the landowner. The closest hospital is in Katherine, but the medical team will decide where to transport the injured person for further treatment.

4.3. EP187 Emergency Response Plan

This Emergency Response Plan (ERP) will take effect where an incident occurs involving the seismic contractor working under the Imperial Oil & Gas Health and Safety Management.

While the drilling rig is on site the drilling contractors Environment Health and Safety Management System (EHSMS) including the drilling contractor's ERP will take effect for surface incidents.

In the case of a subsurface incident this ERP in conjunction with the inGauge Energy Well Control Standard (Document No. ING_STD_WELL CONTROL) will be utilised with inGauge's site supervisor acting as Incident Controller.

4.4. Emergency Response Drills

Emergency response drills will be carried out to train and refresh personnel with regard to emergency equipment and procedures. The EMT will request emergency response drills be held as appropriate and will ensure that sufficient resources are available to carry out these drills.

It is expected that emergency drills will be held at the start of each significant operation, which means early in the seismic program and early in the drilling program.

Drills will be noted on the morning reports and monthly Environment, Health and Safety meetings minutes. Learnings from the drills will be used to improve and update this ERP.

While drilling regular BOP drills will be held as part of the operational emergency readiness.

5. Emergency Response Team (ERT)

5.1. General Overview

The site ERT is responsible for:

- Providing tactical response to site incidents;
- Providing direction and back-up ER support to Stakeholders;
- Providing expertise and technical advice in support of the ER effort;
- Liaison with Imperial Oil & Gas Representatives
- Inform the police in the event of serious injury or death of any site personnel

The ERT is responsible for the overall tactical response and local management of emergencies at that site including the initial response to oil spills, which requires external or offsite support.

The site ERT is activated and controlled by the ERT Leader (Imperial Oil & Gas Site Supervisor) who will coordinate the site ER commensurate to the level of action and support required by each incident.

The site ERT Leader is responsible to ensure adequate personnel and resources are available to support, manage and close out any site emergency.

5.2. Emergency Response Team (ERT)

The ERT consists of:

- ERT Leader
- Incident Controller/s
- ERT Information Coordinator

The site ERT will assemble in the designated site Emergency Response Room (ERR) as available at the time and will be led and directed by the ERT Leader.

5.3. Emergency Management Team (EMT)

- Imperial Oil & Gas Emergency Management Team (EMT) is located at the inGauge Operations Base in Brisbane and is led and directed by the EMT Leader (EMTL);
- The ERT has a reporting responsibility to the EMT for all low-level incidents or greater as per the Imperial Oil & Gas Incident Report and Investigation Procedure.
- The EMT will assume an operational support overview of incidents and will provide operational management support to site ERT's during incidents which present an actual or potential threat to Imperial Oil & Gas operations.
- The EMT will request emergency response drill as appropriate and ensure appropriate authority and equipment is in place to hold the emergency response drills.

5.4. Emergency Roles

This section of the ERP provides guidance for key Imperial Oil & Gas personnel, in particular the site ERT's members who may assume an ER role identified in this ERP during an emergency or crisis event associated with Imperial Oil & Gas's operations or activities.

The responsibilities of key Imperial Oil & Gas site Emergency Response Team (ERT) personnel are defined in the subsections below.

In practice some of these responsibilities may be delegated to other individuals. However, the responsibility for ensuring execution of assigned tasks remains with personnel holding the roles listed below.

Importantly, the ERT roles are not a rigid list of prescribed duties. They are a flexible series of prompts and key considerations designated to cater for an escalating range of site events and/or a change in the severity of emergency events.

During the initial activation of the ERT, during any emergency or crisis event, responding personnel may be required to initially assume one or more ERT roles – this requirement will be at the complete discretion of the ERT Leader (Imperial Oil & Gas Site Supervisor) and will be based on the severity and circumstances of the event in question.

It is essential that all site ERT personnel are kept informed of the current status of ERT role position holders at all time.

5.4.1. Emergency Response Team (ERT) Leader

	Action
Role	**Emergency Role Profile** • Responsible for overall management of emergencies on Imperial Oil & Gas controlled worksites • Establishes control of and oversees the tactical response to an Imperial Oil & Gas emergency and ensures all appropriate support is provided to the Imperial Oil & Gas Incident Controller (if deployed) • Lead the ERT in the tactical development/implementation of strategies that provide a safe, efficient and cost-effective response to an onsite emergency situation
Initial Actions	**Pre-Emergency** • Maintain familiarisation with Imperial Oil & Gas and Contractor ERP's, key emergency respondents and respective notification and callout requirements. • Ensure IC holds emergency response drills as requested by Imperial and at least once per operation.

	Action
First Hour Actions	**Emergency Actions** • ***Alert*** emergency contact(s), ***Confirm*** details, ***Activate*** resources (as required) **Initial Activation**: • Confirm callout and ETA at ERR if after-hours • Initiate ERT callout, ensure all roles are appointed • Ensure ERT is activated as appropriate and open Emergency Pack (in ERR) • Hold situation briefing with all ERT personnel and Imperial representative at earliest opportunity; maintain regular briefings throughout response • Assess extent of emergency/classification; initiate appropriate response **Incident Site:** • Request incident site communication channels and phone lines kept clear • Complete Site report from Imperial Oil & Gas Incident Controller with as much detail as possible • Create initial response strategy with Incident Controller and relevant Contractor • Ensure weather is assessed regularly if incident response can be impacted by weather • Oversee activities between incident site and support requested by Incident Controller • Allocate resources for support as requested by Incident Controller **EMT:** • Ensure early notification and Site reports are sent to EMT as appropriate • With EMT, assist with the development of an initial media release for Imperial Oil & Gas consideration. • Via EMT Technical Operations, consult EMT/CMT Legal Adviser if situation requires advice on duty of care, due diligence or any contractual provisions which may be contingent to the emergency or the response • Communicate updates to Imperial Oil & Gas.

5.4.2. Incident Controller (IC)

	Action
Role	**Emergency Role Profile** • Reports to the Imperial Oil & Gas ERT Leader • Has overall responsibility for ensuring Imperial Oil & Gas onsite procedures and policies are carried out by any Third-Party Contractor • Ensures a chronological summary of key events is maintained and coordinates the display of information on the Emergency Response Room (ERR) incident board(s)
Initial Actions	**Pre-Emergency** • Maintain familiarisation with Imperial Oil & Gas site ERP and Contractor ERP's, key emergency respondents and respective notification and callout requirements • Ensure all ERR resources are available and in working order. • Conduct emergency response drills as requested by the EMT / ERT.

	Action
First Hour Actions	**Emergency Actions** • Liaise with Contractor Field Manger (CFM) and coordinate safe measures to be adopted during emergency situations • Assume the role of CFM in the event the incumbent is unavailable or incapacitated • Advise CFM and other Third-Party Contractor Personnel on emergency activities • Monitor the safe suspension of operations and associated activities • Ensure ERT Leader is notified ASAP in the event of an alert or emergency event • Submit Site reports or other relevant reports to the ERT Leader as required • Recommend restricted airspace around incident scene if appropriate, via ERT • On behalf of ERT Leader, direct Imperial Oil & Gas personnel and 3rd Party Contractors at incident scene in the performance of their specific emergency response activities • Maintain log of incident events, actions, messages and decisions; provide to ERT Leader at the conclusion of any incident • Set up ERR and ensure all likely operational, communication, administration requirements are available • Ensure Emergency Pack is activated and all relevant material distributed • Arrange additional support staff for ERT communications/administrative activities as required • Maintain chronological summary of key events • Filter incident events information to ERT Leader • Utilise Emergency Response Incident Log Sheets • Track regulatory authority notifications and ensure information is logged • Do not talk to the Media at any time unless authorised by the Imperial Oil & Gas IC.

	Action
Ongoing Actions	**Post Emergency Actions** • Contribute to debrief of key personnel involved in any emergency response • Consider a debrief of key external response agency personnel involved, via tele-conference if necessary • Assist in the development of a post emergency action and responsibility plan • Ensure key respondents provide incident reports/logs at the conclusion of any incident/emergency and provide to the ERT Leader

5.4.3. Third Party Contractor Field Manager (CFM)

	Action
Role	**Emergency Role Profile** • Liaises with the Imperial Oil & Gas Site Supervisor or appointed Incident Controller • Maintains the ultimate authority and responsibility for the safety of personnel and the integrity of the third party contractor's crew. • Is supported by and interfaces with the Imperial Oil & Gas Incident Controller
Initial Actions	**Pre-Emergency** • Maintain familiarisation with the Contractor and Imperial Oil & Gas ERP's, key emergency respondents and respective notification and callout requirements.
First Hour Actions	**Emergency Actions** • Assume the role of Imperial Oil & Gas site Incident Controller in the event the incumbent is unavailable or incapacitated • Liaises with Imperial Oil & Gas Site Supervisor or Incident Controller and coordinates appropriate safety actions (to be adopted during an emergency situation • Ensure communication flow with the Imperial Oil & Gas Site Supervisor or Incident Controller and/or Imperial Oil & Gas site ERT and Third-Party Contractor Management is maintained as appropriate • Direct and coordinate actions of Contractor personnel in their required emergency duties • Initiate immediate action to mitigate the effect of an emergency • Maintain a log of incident events and actions taken.

5.4.4. First Person at Incident Location

	Action
First Hour Actions	**Emergency Actions** • On identification of an emergency immediately report to the Imperial Oil & Gas Site Supervisor, the location, type of emergency and need for assistance, and intentions to assist. Give an indication of your next contact, which should be within 5 minutes • Check the area and assess any personnel for injuries, provide first aid to injured persons in accordance with training and ability • Move injured, only if they are in immediate and/or further danger, in-order to avoid any additional injuries/risk to persons • Note the impacts of the emergency and any potential requirements for evacuations • Notify the Imperial Oil & Gas Site Supervisor of support required (i.e. ambulance, firefighting etc.); provide an overview of what has happened and do so in as calm a manner as possible – this initial report/information will assist in requested support being coordinated and provided • If safe and appropriate to do so, shut down any plant affected by the emergency in keeping with site Standing Operating Procedures • Dispatch names of all personnel, including those injured or unaccounted for, to the ERT Leader or Incident Controller • Brief the ERT Leader or Incident Controller on arrival and assist as directed
Ongoing Actions	**Post Emergency Actions** • Attend debrief session • Assist in incident investigation.

5.4.5. First ERT Person at Emergency Response Room (ERR)

	Action
First Hour Actions	**Emergency Actions** • Open, clear and prepare the ERT ERR for immediate use • Activate the Emergency Packs, check there is an adequate supply of whiteboard pens, cleaners, and stationary (including proforma ER forms/logs etc.) • Clean and prepare whiteboards for use as information boards if required • Locate copies of any related site Emergency Response Plans and/or Procedures • Place in/out trays for ERT members with role checklists, etc. • Check all equipment is operational • Photocopy logs/incident log sheets and distribute • Establish contact with the Imperial Oil & Gas Incident Controller to advise the ERR is functional • Update ERT Members of the incident status as they arrive in the ERR • Assume your designated role in the ERT

5.4.6. All Personnel

	Action
Initial Actions	**Pre - Emergency** • Maintain familiarisation with Imperial Oil & Gas site ERP and/or relevant Contractor ERP's and respective emergency notification requirements • Be familiar with the site Muster Points and evacuation procedures • Always be alert for and report hazardous situations that could escalate into an emergency situation – immediately report any actual or potential emergencies
First Hour Actions	**Emergency Actions** • Be alert for hazardous situations which may escalate beyond an emergency situation • Report any emergency situation immediately to the nominated Imperial Oil & Gas Site Supervisor / ERT Leader or designated Incident Controller and keep informed of all operations and of any hazards which may affect the safety of onsite responding personnel • Avoid placing themselves or others in danger • MUST NOT communicate with the Media under any circumstances

6. Requirements

6.1. Response Actions

Imperial Oil & Gas emergency preparedness and response capability is supported by underpinning risk management processes. Each site must risk assess potential emergency events to support the site emergency management requirements; incorporating client specific requirements as appropriate.

The following depicts some emergency response scenarios and recommended actions:

Category	Response
Basic Emergency Response	• Remove yourself and others from danger • Activate emergency shutdown devices/isolate equipment as necessary if safe to do so • Provide First Aid to any injured persons (DRSABCD) • Raise the alarm (report location, type and extent of incident) by any means available • Follow the directions of emergency services or response personnel and assist as required if you feel safe and capable to do so • Notify appropriate Imperial Oil & Gas contacts • Never put yourself at risk

Category	Response
Building Evacuation – e.g. Fire in camp accommodation	• Initiate Emergency Response Plan • If you see SMOKE, FLAMES or hear a FIRE ALARM alert others in your vicinity immediately • Remove anyone in danger if safe to do so • Activate the Fire Alarm • If you can see a fire, attempt to extinguish if safe to do so. If the fire is small enough, use a nearby fire extinguisher to control and extinguish the fire. Do not fight the fire if the following conditions exist: • You have not been trained or instructed in using a fire extinguisher • You don't know what's burning • The fire is spreading rapidly and might block your means of escape • You don't have the proper equipment • You might inhale toxic smoke • Your instincts tell you not to do so • If the first attempts to put out the fire do not succeed, evacuate the building immediately • Close any doors if safe to do so • Call ooo and contact the Fire Brigade • Ensure all personnel leave the building • All persons leaving the building should follow the Green Exit Signs to leave through the nearest emergency exit • All persons should leave the property via the identified entrance to ensure clear access for emergency service and proceed to Emergency Evacuation Point • Do not return to the building until advised by emergency personnel • Do not leave the Emergency Evacuation Point at any time without advising and gaining the approval of the Building Warden or Managing Director • Follow Imperial Oil & Gas Incident Notification and Investigation Procedure
Medical Emergency	• Initiate Emergency Response Plan • If injuries require more than first aid but not critical or life threatening and the person can be transferred by vehicle, take the injured person/s to the closest medical facility or site paramedic if available • If injuries are critical or life threatening call ooo and then the site paramedic if available • Continue first aid until assistance arrives • Follow Imperial Oil & Gas Incident Notification and Investigation Procedure
Civil Disturbance / Criminal Activity	• Initiate Emergency Response Plan • Always avoid physical confrontation • Contact your supervisor, and police if necessary • Move to the muster location or safe location
Bomb Threat	• Initiate Emergency Response Plan

Category	Response

Snake bite	• Initiate Emergency Response Plan
	• Life threatening effects from a snake bite aren't usually seen for a few hours but can appear in minutes - what to look for:
	  ○ Fang marks
	  ○ Headache, difficulty breathing
	  ○ Nausea and vomiting
	  ○ Stomach pain
	  ○ Swollen glands in the armpits & groin
	  ○ Weakness, collapse
	• Check the immediate area for Danger to yourself or the injured person
	• Calm the person and keep them still
	• Call for assistance
	• If person is unconscious, check breathing & pulse and apply CPR
	• Do not wash or suck the bite or use a tourniquet
	• If bitten on a limb, apply a pressure bandage or cloth approx 10-15cm wide upwards form the fingers or toes, firm but not too tight
	• Keep the limb still by using a splint
	• If able to do so mark the area of the bandage where you think the bite occurred – this will assist medical staff
	• Leave the splint or bandage on until reaching the hospital
	• Follow Imperial Oil & Gas Incident Reporting an investigation Procedure

Vehicle Accident	• Raise Alarm (report location, type and extent of incident) • Request assistance of Emergency Services as required • Switch off vehicle ignition • Assess vehicle and site damage; take relevant actions to secure accident scene • If vehicle in contact with power lines, stay clear and advise occupants to stay in vehicle • Do not try to remove casualties from vehicle until sure other dangers are not present • When possible, remove trapped/injured personnel, provide medical aid (as qualified)
Bushfire	• Initiate Emergency Response Plan • Initiate Medical Emergency Response if required • Account for all personnel • Contact Supervisor • Obtain information about the fire such as location and size of fire • Initiate contact with emergency services • Consider escape route and alternate routes • Consider task timings and pack up timings • Consider checking of fire breaks if safe to do so • Follow Imperial Oil & Gas Incident Notification and Investigation Procedure

Category	Response

Environmental Incident – Hazardous Spill	• Initiate Emergency Response Plan
	• All necessary action should be taken to minimise the size and any adverse effects of the release
	• If adequate resources are not available to contain the release and if it threatens public health, property or the environment, the NT Fire Brigades should be contacted for emergency assistance - phone 000
	• Always pay attention to fire and health hazards
	• Activate containment operations immediately to prevent spill from reaching a surface water course or ground water
	• Points to Remember
	  ○ Activate containment operations immediately
	  ○ Do not allow vehicles to run over spill saturated areas
	  ○ Do not flush the spill down clean drains on areas or other inlets
	  ○ Do not use mechanical excavators on areas with free oil on the surface
	  ○ Containment and recovery is easier on land than on water
	  ○ Contain & recover at the source
	• Clean up
	  ○ Retrieve as much as possible with sorbents
	  ○ Permeable ground - break up remaining patch/s with a rake to aerate the soil
	  ○ Remove contaminated subsoil to reduce transfer to ground water

Missing / Overdue Personnel	• Initiate Emergency Response Plan • Obtain information on time and location of last sighting • Attempt to establish communication with missing person via mobile phone and SMS contact and if possible, UHF, VHF, Satellite phone • Advise Supervisor and EHS Representative • If possible, contact the destination point eg hotel/motel/camp to determine if person has arrived • If possible and safe to do so (ie weather conditions) despatch other nearby employees to look for the missing person • After a period of time without contact (as determined collaboratively by the Supervisor, Manager, EHS Representative and Senior Management) notify the police of the missing person
Subsurface Incident (ie loss of well control)	• Initiate Emergency Response Plan • Initiate Medical Emergency Response if required • Initiate inGauge Well Control Procedure if required • Account for all personnel • Contact Supervisor • Contact emergency services if required • Consider escape route and alternate routes • Consider task timings and pack up timings • Follow Imperial Oil & Gas Incident Notification and Investigation Procedure

Category	Response
Weather Related (e.g. flood, cyclone)	• Initiate Emergency Response Plan • Initiate Medical Emergency Response if required • Account for all personnel • Contact Supervisor • Contact emergency services if required • Take shelter if possible • Monitor weather alerts and radio stations • Consider escape route and alternate routes • Consider task timings and pack up timings • Never cross a flooded creek, road or causeway – always assess the risk before crossing • Follow Imperial Oil & Gas Incident Notification and Investigation Procedure

6.2. Emergency Response Equipment

6.2.1. First Aid

First Aid kits will be located with at the site office with additional First Aid Kits available in the inGauge Site Supervisor vehicle.

6.2.2. Fire Equipment

Fire extinguishers will be located within all operating plant. Further fire equipment will be available in the inGauge Site Supervisors vehicle including extinguishers and blankets and at the site office once established.

6.2.3. Defibrillator

A defibrillator unit is located at the rig once rig operations commence.

6.2.4. Oil Spill Kits

Oil Spill Kits will be located at the contractor's site office. Additional kits are available upon request from the inGauge Site Supervisors.

6.3. Reporting

6.3.1. Internal Reporting

In the event of an incident the inGauge Site Supervisor is required to notify the inGauge Project Manager. The inGauge Project Manager will inform the inGauge Principle Engineer's, Imperial Oil & Gas IC Project Manager and Imperial Oil & Gas Site Administrator in accordance with the the inGauge

Incident Report and Investigation Procedure (Document No. ING_PRO_INCIDENT_01). In conjunction with the inGauge representative the Imperial Oil & Gas Project Manager will arrange contact with the appropriate regulator(s) (EPA, DEDJTR or SRW) for an environmental or well integrity incident or WorkCover for a safety related issue.

6.3.2. Reporting Format

In an emergency situation it is imperative that all emergency messages and reports clearly and concisely relay the nature of the problem and request for assistance.

The following emergency reporting format is included for reference as the requirements for each emergency situation may vary. In addition to its use in assisting the formatting of reports, the following format can be used as a quick check list.

All verbal reports should be confirmed by e-mail.

All emergency reports sent or instructions received should be logged and the names of the caller and receiver noted.

Incident

1. Name of location
2. Name of contractor/s involved.
3. Description of incident.
4. Time incident occurred.
5. Cause of incident if known
6. Status report of well security, equipment, personnel and environment as appropriate.
7. Details of any injured, deceased and missing personnel including:
    - number of personnel involved
    - name, company, position of personnel
    - cause of injury or death
    - details of injuries
    - details of any treatment given
    - location and time person last seen (if missing person)
8. Weather conditions (including wind strength and direction, etc).
9. Actions taken on site and emergency services activated.
10. Details of assistance requested from outside emergency.
11. Assistance required from Emergency Response Team (ERT).
12. Any other points that may be relevant to the emergency.

7. Emergency Contact Details

7.1. Imperial Oil & Gas Contacts

Position
Chief Executive Officer
Office Manager

7.2. InGauge Energy Contacts

Position
Principal Engineer
Company Civils Coordinator
Site Supervisor

7.3. Government and other Stakeholders

Name	Location	Contact Number
Department of Primary Industry and Resources (DPIR)	Darwin	Ph: 0889996567 - 08 8999 6350 A.H: 0439 744 119 - 0430 739 507 Emergency: 1300 935 250
Ngukurr Essential Services Officer	Ngukurr	08 89754656
Roper Gulf Shire Office		08 8975 4656 - 0488 954 221

7.4. Emergency Services

Service	Location	Contact Number
Police	Emergency	000
	Borroloola	08 8975 8770
	Gapuwiyak	08 8987 9318
	Tennant Creek	08 8962 0944
	Ngukurr	08 8975 4644
	Nhulunbuy	08 8987 1333
	Numbulwar	08 8975 4183
Emergency Service	Borroloola	000
	NTES Duty Officer Southern	0418 843 627
	Nhulunbuy	08 8987 2727
Bushfire	Arnhem land	08 8922 0829
	Katherine	08 8973 8871 - 0401 115 744
	Gulf	08 8987 0365
Fire Station	Borroloola	000
	Nhulunbuy	08 8987 1906

Service	Location	Contact Number
Community Health	Borroloola	08 8975 8711
	Katherine	08 8973 8871
	Nhulunbuy	08 8987 0435 - 08 8987 0365
Aerial Medical services	Borroloola	08 8973 8570
	Katherine	08 8999 4988
	Nhulunbuy	08 8987 0211
Remote Rural Health	Borroloola	08 8975 8711
	Gapuwiyak	08 8987 9150
	Katherine	08 8973 8570
	Maningrida	08 8979 5930
	Ngukurr	08 8975 4688
	Nhulunbuy	08 8987 0211
	Numbulwar	08 8975 4670
	Urapunga	08 8975 4345
Borroloola Doctor	Borroloola	WH: 08 8975 8711 AH: 08 8975 9859
Northern Land Council	Borroloola	08 8975 8848
	Darwin	08 8920 5100
	Katherine	08 8971 9899
	Ngukurr	08 8975 4755
	Nhulunbuy	08 8986 8500

8. Appendixes

Appendix 1. Incident Reporting Matrix

Required action	Major Incident	High Risk Incident	Medium Risk Incident	Low Risk Incident
Notification to Imperial Oil & Gas Managing Director and QHSE Representative	Immediately by phone, followed by an Incident Notification Form within two hours	Immediately by phone, followed by an Incident Notification Form within two hours	Immediately by phone, followed by an Incident Notification Form within six hours	Immediately by phone, followed by an Incident Notification Form within twenty four hours
Notification to the relevant regulatory authority (depending on location of incident)	Immediately	If required by the definition (further defined in section 5.2) – immediately or within 24 hours	Not required	Not required
Timeframe for Completion of Investigation	Five Working Days	Five Working Days	10 working days	Not required
Imperial Oil & Gas signoff by	Managing Director	Managing Director	Managing Director	Managing Director

Appendix 2. Site ERP Display Sheet

Emergency Response Numbers

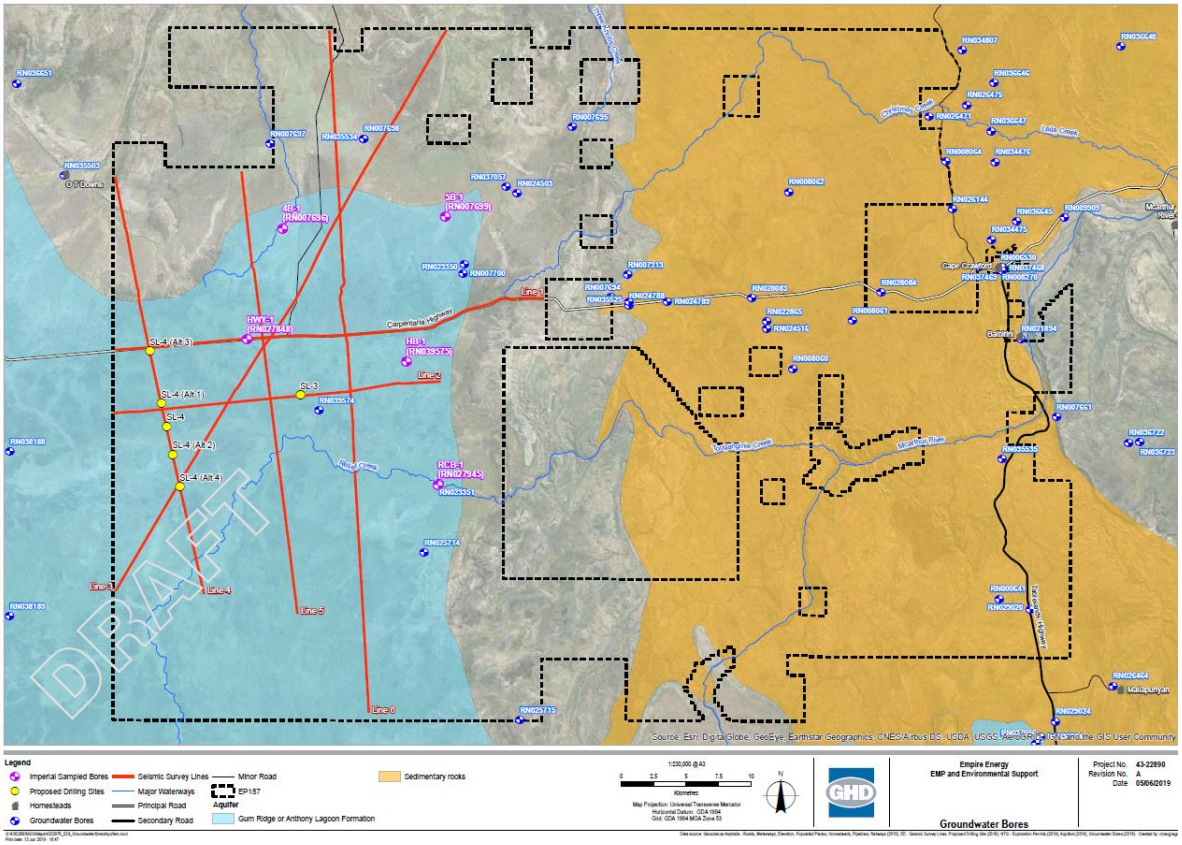
Project Name: EP187 ERP Seismic and Drilling Program Co-ordinates (Emergency Response Meeting Point): Latitude: 16°43'56.13"S Longitude: 135°12'0.30"E		
Emergency Contacts		
Entity		**Number**
State Emergency Service		000
Ambulance		Emergency - 000
Police		Emergency - 000
Country Fire Authority		000
inGauge Energy		
Position		
Principal Engineer		
Company Civils Coordinator		
Site Supervisor		
Imperial Oil & Gas		
Position		
Chief Executive Officer		
Office Manager		
Medical Services		
Entity	**Location**	**Number**
Aerial	Borroloola	08 8973 8570
	Katherine	08 8999 4988
Community Health	Borroloola	08 8975 8711
	Katherine	08 8973 8871
	Nhulunbuy	08 8987 0435 - 08 8987 0365
Borroloola Doctor	Borroloola	WH: 08 8975 8711 AH: 08 8975 9859

Making an emergency call provide the following information:

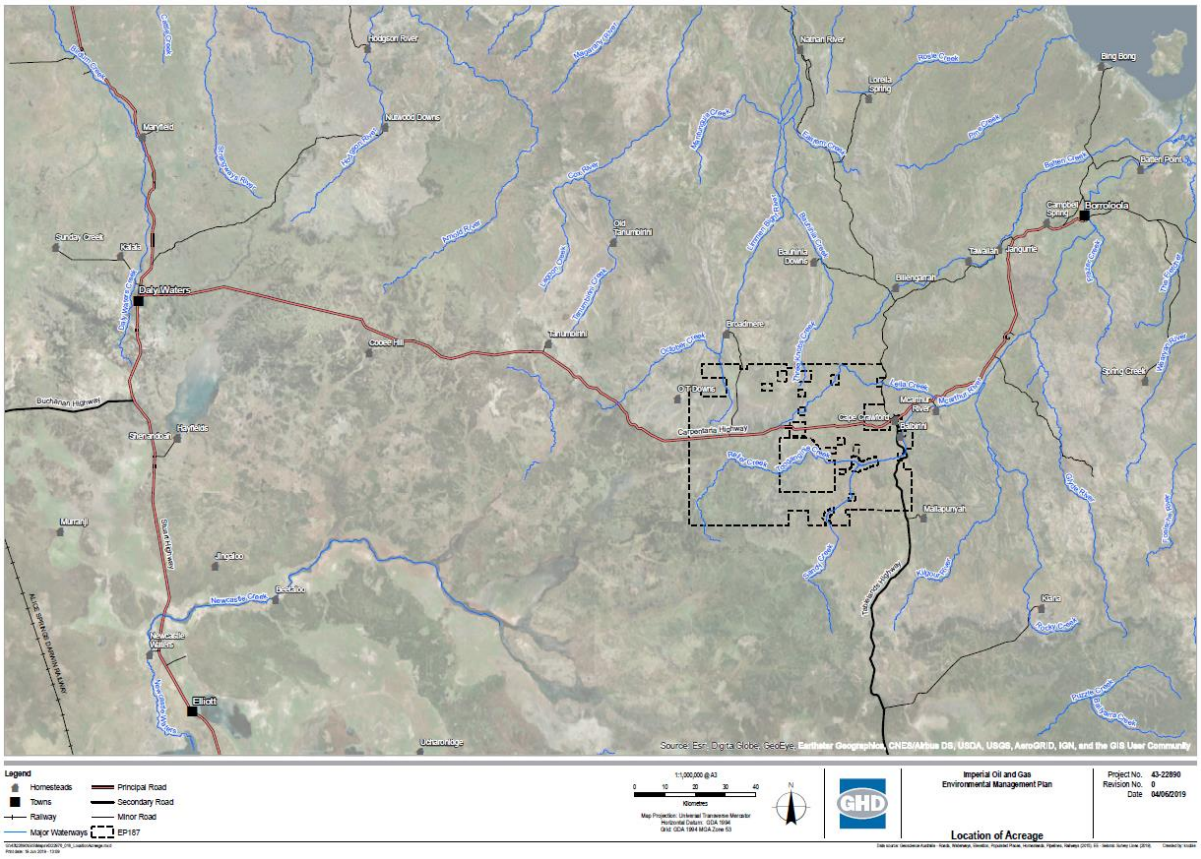
- Dial 000
- Injury/illness details
- Location of meeting point
- Your Name
- Patient name, DOB etc. if know

Worksite	• From the Stuart Highway, at the intersection of the Carpentaria Highway (5km South of Daily Waters) drive East on the Carpentaria Highway for 211km. • The primary meeting point is alongside the highway and will be signposted. • Follow Site personnel to worksite
Rig Camp	• From the Stuart Highway, at the intersection of the Carpentaria Highway (5km South of Daily Waters) drive East on the Carpentaria Highway for 211km. • The rig camp is alongside the highway and will be signposted

Operating Area



Directions to EP187 Project Area



Imperial Oil and Gas

TO CONDUCT

SEISMIC AQUISITION CARPENTARIA HIGHWAY

I Nathan Groves (WZTM #.20017), declare that I have designed this Traffic Management Plan. Site visit has not been conducted. The Traffic Management Plan prepared, subject to the variations approved, is in accordance with the DIPL Provision for Traffic and AS 1742.3

Signature…… ……. Date 08/11/18

Traffic Management Plan No. IOG-015

Rev. No.	Date	Description	Prepared	Checked	Appraised
0	09/11/18	For submission	NG		Client/DIPL

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T
C

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Appendix A	Safety Work Method Statement
Appendix B	Traffic Control Diagram/s
Appendix C	Sign & Equipment Manifest
Appendix D	Record of Tool Box Talk
Appendix E	Daily Traffic Management Checklist & Docket
Appendix F	Incident Report Form
Appendix G	Injury / Illness Report Form
Appendix H	NT Worksafe Accident/Incident Notification Form (FM137)
Appendix I	Risk Assessment
Appendix J	Conditions of Approval
Appendix K	Certificate of Currency Public Liability

REFERENCED DOCUMENTS

- Work Health and Safety (National Uniform Legislation) Act
- Work Health and Safety (National Uniform Legislation) Regulations
- NT Control of Roads Act
- NT Traffic Act
- DIPL Technical Requirements for Works Within the NT Government Road Reserve
- Department of Infrastructure Planning and Logistics 2015/2016 Standard Specification for Roadworks
- Australian Standard AS1742.3-2009; Manual of uniform traffic control devices – Part 3: Traffic control for works on roads
- Australian Standard AS/NZS ISO 31000:2009; Risk management – principles and guidelines
- Australian Standard AS/NZS 4602; High visibility safety garments
- Australian Standard AS/NZS 4192; Illuminated flashing arrow signs
- Australian Standard AS/NZS 1906.1; Retro-reflective materials
- Australian Standard AS/NZS 3845; Road safety barrier systems
- Australian Standard AS 4191; Portable traffic signals
- NT WorkSafe; All relevant bulletins

** except where expressly overridden by the DIPL Requirements for Works Within the NT Government Road Reserve*

SECTION 1 INTRODUCTION

1.1 PURPOSE AND SCOPE

Imperial Oil and Gas is to conduct SEISMIC AQUISITION CARPENTARIA HIGHWAY. This TMP will outline factors such as risk and hazards, and how to best mitigate them.

Traffic management measures may include lane closures, traffic diversions, signage, other temporary measures and public communication. The Contractor and Subcontractors shall execute all services with the least possible disruption to the flow of traffic and where disruption does occur, all reasonable attempts shall be made to reduce the impact on road users. The convenience of the public and of residents adjacent to any work site and the protection of persons and property shall be provided at all times. This document is designed to establish efficiencies, consistencies and good understanding of the commitment to safety

This Traffic Management Plan (TMP) provides the traffic management procedures to be implemented by the contractors and subcontractors during the project. It has been prepared for routine construction and maintenance activities. This document addresses the minimum traffic management requirements for normal daily work activities through a number of site specific diagrams as attached at Appendix A. The document has been prepared in accordance with current versions of the Department of Infrastructure, Planning and Logistics (DIPL) Requirements for Works Within the NT Government Road Reserve and Australian Standards 1742.3.

1.2 OBJECTIVES AND STRATEGIES

The objectives of this Traffic Management Plan are to:

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

To assist in meeting these objectives the Traffic Management Plan provides information on:

- The Scope of the Works
- Site Conditions
- Permissible working times
- Procedures and Responsibilities
- The Traffic Management Scheme
- The Traffic Control Diagram

SECTION 2 PROJECT OVERVIEW

2.1 PROJECT DESCRIPTION

ITEM	DESCRIPTION
Project	SEISMIC AQUISITION CARPENTARIA HIGHWAY
Classification	Long Term Rural Works
Road Authority	Northern Territory Government Department of Infrastructure Planning and Logistics (DIPL)
Client	Northern Territory Government Department of Infrastructure Planning and Logistics (DIPL)
Prime Contractor	Imperial Oil and Gas
Traffic Management Sub-Contractor	Katherine Traffic Control Pty Ltd
Scope of Works	The TMP shall be used for Long Term Rural Works, Along Various DIPL roads and highways in the Katherine Region. The works will be SEISMIC AQUISITION CARPENTARIA HIGHWAY off the of the road.These will be accounted for in the risk assessment and TCD./ Implementation of generic Traffic Control Diagrams as found in Appendix A shall be communicated to DIPL along with other Project Details (Date / Time / Location) at least 3 working days prior to any works being conducted. Traffic management design is by KATHERINE TRAFFIC CONTROL Pty Ltd. Suitability and or Compliance Audits of this Traffic Management Plan will not be conducted using an independent Consultant unless so directed by applicable Road Authority.
Project Date/s	21/11/18 – 31/12/18
Hours / Days of Work	7am – 7pm
Other Constraints	As per DIPL Standard Specifications, Provision for Traffic.

2.2 PROJECT REPRESENTATIVES

Road Authority	NT Government Department of Construction and Infrastructure Level 1 Government Centre 5-7 First St Katherine N.T Email: roadskatherine.dpi@nt.gov.au
Contact	Phil Harris NT Government Department of Infrastructure Planning and Logistics Level 1, NTG Centre, First Street, Katherine Email: phil.harris@nt.gov.au Other Contact: Michael Howard NT Government Department of Infrastructure Planning and Logistics Floor 2, Highway House, GPO Box 61, Palmerston, NT 0831 Email: michaelj.howard@nt.gov.au
Client	Terrex Seismic 22 Crockford St Banyo, QLD 4014 Ph: 07 3621 0304
Client's Representative	Leeton McHugh 07 3621 0301 leeton@terrexseismic.com 22 Crockford St Banyo, QLD 4014 Ph: 07 3621 0304
Prime Contractor	Imperial Oil and Gas 71 Zimin Drive Katherine NT Ph: 8971 1391
Project Manager / Site Contact	Geoff Hokin M: +61 437 440 417
Traffic Management Sub Contractor	PDG-NT Pty Ltd Daniel Mulholland 0438846844 Borroloola NT 0854

2.3 TRAFFIC MANAGEMENT ADMINISTRATION

TMP Design	Katherine Traffic Control Pty Ltd PO Box 2400 Ph: 0418 681 351 Fax: 89711312 Email: info@katherinetrafficcontrol.com.au
Contact Details	Nathan Groves WZTM 1 Reg. # 20017, exp. 12/12/2019 Ph: 0413 182 279 Email: info@katherinetrafficcontrol.com.au
Traffic Management by	PDG-NT Pty Ltd Daniel Mulholland 0438846844 Borroloola NT 0854
Manager	Daniel Mulholland M: 0418 681 351 Email; info@katherinetrafficcontrol.com.au
Supervisor / Site Contact / Traffic Controllers	TBA

SECTION 3 PROVISION FOR TRAFFIC

3.1 TRAFFIC ENVIRONMENT

3.1.1 Road Classification

Works will be conducted on the Carpentaria Highway.

3.1.2 Traffic Volume and Composition

The two most relevant traffic volumes measured are RKVDP008 (2km East of Stuart Highway) with a total volume of 71 and RTVDC031 (2km West of Tablelands Highway) with a total volume of 91.

3.1.3 Existing speed restriction/s

The existing speed limit is 110kp/h

3.1.4 Proposed speed restriction/s

N/A

3.1.5 Lane Widths and Capacity

Minimum lane widths of 3.5m will be maintained at all times.
Traffic volume does not exceed the maximum desirable 500vph capacity allowed for in one lane of traffic travelling in one direction on a main road at road works within 200m of an intersection.

Minimum lane widths of 3.0m will be maintained at all times at 60km/h or less.

3.1.6 Parking Facilities

No existent parking facilities in vicinity of works.

3.1.7 High / Wide Loads

High / wide loads are not anticipated during these works. Should a high / wide load approach the worksite all work will cease, workers will leave the travelled path and traffic controller will remove any traffic control devices impeding access past site.

3.1.8 Public Transport

Works are not being conducted along a bus route The Public Transport Network Supervisor will not require notification.

3.2 NON-MOTORISED ROAD USERS

Consideration of other road users such as cyclists, pedestrians and the disabled shall be made at all times during the implementation of this TMP. Onsite personnel shall make concessions on site and allow safe passage of all road users around / through the site.

3.2.1 Cyclists and Pedestrians

Cyclist and Pedestrians are not expected to be affected by these works.

3.2.2 People with Ambulatory Difficulties

People with ambulatory difficulties will not be affected by these works.

3.2.3 School Crossings

School Crossings will not be affected by these works.

3.3 ACCESS

3.3.1 Works Vehicles, Plant and Personnel

Works vehicles, plant and personnel entering and leaving the worksite shall do so at designated locations to be determined on site. A Traffic Controller may be used to control traffic whilst works vehicles, plant and personnel are entering or leaving the worksite.

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

3.3.2 Access to Adjoining Properties / Developments

Property / development accesses within or adjacent to the worksite are not affected by the works, however if work proposed zone is likely to impact property or development areas a site specific TCD shall be submitted along with a Risk Assessment to accommodate the pedestrians and cyclists.

3.4 IMPACT ON ADJOINING NETWORK

Congestion is a possibility, works are long term on high volume roads and the side roads in the immediate vicinity of the worksite are low volume roads, however while stoppage of traffic will not be common the speed on Carpentaria Highway will be reduced to 60kph .

3.5 NIGHT WORK PROVISIONS

No night works are being undertaken on this project.
In the unlikely event that works are not completed prior to 19:00 arrangement shall be made for the delivery of suitable and adequate portable lighting in areas where existing street lighting is deemed insufficient to provide safety for workers and road users alike. I.e. the work area, road and surroundings within a 50m radius of the work area shall be illuminated to a ground level luminance of 10 lux minimum.

In accordance with AS1742.3-2009 lighting at a work site shall, as a minimum requirement, illuminate the following areas:
a) The work area.
b) Any locations where workers or plant might encroach on traffic lanes.

c) Intersections in which works are taking place.
d) Any traffic controller positions.

3.6 WORK ON RAILWAY SITES

There are no railway sites in vicinity of the works.

3.7 UNATTENDED WORKSITE

Unattended worksite will be clear of equipment and devices.

3.8 SPECIAL EVENTS AND OTHER WORKS

No special events are taking place concurrently with this project.

There are no other worksites anticipated within close proximity of this project; however should other works commence traffic controllers shall consult with the other works site traffic controllers and contractor on site to ensure sites do not conflict. A
WZ1 shall be consulted regarding any changes to the TCD that may be required.

3.9 CONSULTATION AND COMMUNICATION

3.9.1 Approvals

DIPL – Permit To Work Within The Road Reserve

3.9.2 Public Notifications

No public notification will be required for these works.

3.9.3 Variable Message Signs

No variable message signs will be required for these works.

SECTION 4 TRAFFIC CONTROL DEVICES

4.1 TRAFFIC CONTROL DEVICES

MUST BE WZ3 TO SET UP DEVICES ON WORKSITE

A detailed listing depicting the type and quantity of devices required to implement this Traffic Management Plan is included on the Traffic Control Diagram/s (TCD/s) and sign manifest (See appendix B and C).

Should the use of additional (not shown on the Traffic Control Diagram or listing of devices) or reduced number of devices be required due to unforeseen needs, they shall be recorded within the Daily Traffic Management Checklist as a variation to the Traffic Management Plan, following prior approval.

The number, type and location of signs and devices shall be to a standard not less than Appendix B of this plan and AS1742.3 (except where specifically detailed in this Traffic Management Plan with reasons for the variations). Should a situation arise that is not covered by this TMP or AS1742.3, the Road Authority's Representative shall be notified as soon as practicable.

The Road Authority's Representative may direct erection, relocation or removal of signs or devices, which, in the opinion of the Road Authority's Representative, are not in accordance with the Traffic Management Plan and do not provide sufficient safety for road users. If such directions are not complied with, the Road Authority's Representative may arrange for erection, relocation or removal by others at the cost of the Contractor.

4.2 EQUIPMENT STANDARDS

All signs shall be in accordance with AS1742 (and manufactured in accordance with AS1743), shall be at least size 'B' and shall be Class 1 retro reflective. The Symbolic Worker sign shall also be fluorescent. Prior to the installation all signs shall be checked for damage and cleanliness and repaired, replaced or cleaned as necessary.

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

All works vehicles shall be fitted with rotating flashing yellow lamps in accordance with AS1742.3 clause 3.12.1.

4.3 SIGN SPACING

There is no impediment to laying out the traffic management signs and devices in accordance with AS1742.3-2009.

4.4 TAPER LENGTH/S

Tapers will be in accordance with the unique environment of the site and the Taper Length appropriate for the site according to AS 1742.3 (2009)

4.5 SETTING UP AND DISMANTLING

Setting up of the traffic management shall be carried out starting at the Symbolic Worker sign and proceeding to the Symbolic Worker sign. Dismantling shall be carried out in the reverse order. A 'shadow vehicle' with twin rotating flashing yellow lamps in accordance with AS1742.3 clause 3.12.1 shall be used at all times to protect workers setting up and dismantling the traffic management.

Devices no longer required shall be promptly and completely removed from road users lines of sight.

4.6 EXISTING TRAFFIC AND ADVERTISING SIGNAGE

There are no other traffic or advertising signs in the vicinity which could cause distractions or confusion, or which restrict sight lines. However, if such signage is found to be a distraction, the controller must rectify the issue.

4.7 PROTECTION OF EXCAVATIONS

There will be no significant excavations in these works.

4.8 FLASHING ARROW BOARD/S

Flashing Arrow Boards will be required for these works and will be set in accordance with the TCD's relevant to these works.

4.9 PORTABLE TRAFFIC SIGNALS

Portable Traffic Signals will not be required for these works.

SECTION 5 EMERGENCY ARRANGEMENTS

5.1 EMERGENCY SERVICES

Emergency services will have continual access to all properties and the worksite; hence no specific facilities are required.

5.2 EMERGENCY / HAZARDOUS CONDITION/S

In the event of any emergency or hazardous conditions, personnel are to ensure the area is safe, if it is safe for them to do so. If conditions are placing personnel at risk they are to proceed to the muster point identified in the site toolbox meeting. In such an event the appropriate authorities will be contacted and traffic controllers will accommodate authorities as much as possible.

No unnecessary changes to the work site will occur, all other signage to stay in place

5.3 DANGEROUS GOODS

For any work site that is located directly adjacent to a fuel service station, the regulations require full and un-interrupted access to the site by emergency services for emergency situations.

5.4 DAMAGE TO SERVICES

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

All site personnel shall be briefed on evacuation, muster area and control procedures.

5.5 FAILURE OF SERVICES

5.5.1 Failure of Traffic Signals

Traffic Signals will not be affected by the works

5.5.2 Failure of Street Lighting

Failure of Street Lighting will not affect the works.

SECTION 6 ENVIRONMENTAL CONDITIONS

6.1 WEATHER

6.1.1 Rain

In the Northern Territory rainfall is predominantly experienced during the “Wet Season” between the months of October and April with the majority of rainfall between the months of December and March.

Road drainage is installed hence no significant flooding or water sheeting is expected.

In the event of rain, an on-site assessment shall be made and sign spacing and tapers may be extended, within allowable tolerances, by 25% to account for increased stopping distances. All changes shall be recorded in the Daily Traffic Management Checklist.

In the event of extremely heavy rain causing sight distance to be reduced below 1.5D a temporary work zone speed restriction to 40km/hr may be installed, if not already.

Such installation shall be regarded as an emergency hence approval of a temporary speed limit authorisation form by the relevant authority will not be required prior to installation. The relevant authority shall be informed at the earliest possible convenience. All changes shall be recorded in the Daily Traffic Management Checklist.

6.1.2 Wind

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

6.1.3 Lightning

The Northern Territory experiences one of the highest occurrences of lightning strikes anywhere in the world.

As far as practicable, contractors and subcontractors shall be aware of approaching storms with the potential for lightning and shall take appropriate action in preparation to return the roadway to normal in order that delineation may be removed and traffic controllers stood down temporarily from their duties to seek appropriate protection.

6.1.4 Flooding

Road drainage is installed hence no significant flooding or water sheeting is expected.

In the unlikely event of the road flooding due to heavy rain or damage to water pipes, a temporary work zone speed restriction to 40km/hr may be installed, if not already, and traffic controllers positioned to assist in maintaining low traffic speeds.

Such installation shall be regarded as an emergency hence approval of a temporary speed limit authorisation form by the relevant authority will not be required prior to installation. The relevant authority shall be informed at the earliest possible convenience. “Traffic Hazard Ahead” (T1-10), “Water Over Road” (T2-13) or “Slippery When Wet (symbolic)” (T3-3) signs shall be installed as soon as practicable. All changes shall be recorded in the Daily Traffic Management Checklist.

6.1.5 Heat and Humidity

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

6.1.6 Sun Glare

The visibility of a sign, vehicle mounted warning device, delineation, traffic controller position, etc. can be affected by the direction of the sunlight, including background conditions. Although the work is being undertaken outside the hours of sunrise and sunset, some roads run east-west and traffic control personnel shall consider such when

positioning signs, vehicle mounted warning devices, delineation, traffic controller positions, etc.

In the event of sun glare dramatically reducing visibility, an on-site assessment shall be made and sign spacing and tapers may be extended, within allowable tolerances, by 25% to account for reduced visibility. All changes shall be recorded in the Daily Traffic Management Checklist.

In the event of prolonged sun glare drastically reducing visibility for extended periods of time a temporary work zone speed restriction to 40km/hr may be installed, if not already. Such installation shall be regarded as an emergency hence approval of a temporary speed limit authorisation form by the relevant authority will not be required prior to installation. The relevant authority shall be informed at the earliest possible convenience. All changes shall be recorded in the Daily Traffic Management Checklist.

6.1.7 Dust / Smoke / Fog

Where sight distances are significantly reduced below 1.5D by dust, smoke, fog, or similar, a temporary work zone speed restriction to 40km/hr may be installed, if not already. Such installation shall be regarded as an emergency hence approval of a temporary speed limit authorisation form by the relevant authority will not be required prior to installation. The relevant authority shall be informed at the earliest possible convenience. All changes shall be recorded in the Daily Traffic Management Checklist.

6.2 TERRAIN

The road may be winding in sections and sight lines may be affected. As works are low impact and away from the travelled path Worker Symbolic Signage shall be placed prior to the bend in roadway to allow a clear line of site to the work zone.

6.3 VEGETATION

The works may be near, National Parks or catchment areas, however there is no vegetation which will be significantly damaged by the works, or which constitutes an increased fire risk.

6.4 STRUCTURES

There are no structures affecting sight lines or access, or which will be affected by the excavation or works processes.

6.5 DUST

If dust presents as a problem works will cease until such times as can be resumed with clear visibility.

6.6 NOISE

The work is being carried out during normal daytime hours. There are no nearby facilities which require specific noise limiting measures. There are no specific noise restrictions by the Environmental Protection Agency.

6.7 FUMES

Fumes are not expected to affect the workers. Conditions shall be monitored and appropriate recovery breaks, away from the effects of the fumes, provided if necessary.

SECTION 7 MISCELLANEOUS PROVISIONS

7.1 VARIATIONS TO STANDARDS AND PLANS

There are no variations in this TMP to the DIPL Provision for Traffic and AS1742.3 (*except where expressly overridden by the Provision for Traffic)*

On-site variations, if required, shall generally only be made following approval by the Superintendent's Representative and recorded in the Daily Traffic Management Checklist.

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

In emergency situations, on-site variations shall be made and recorded in the Daily Traffic Management Checklist, and the Superintendent's Representative notified as soon as practicable.

7.2 AUDIT PROVISIONS

Due to the nature of the works one compliance audit (including the use of the 'Compliance Audit Checklist for Traffic Management for Works on Roads) may be conducted following setting-up of the traffic management and prior to commencement of the works in accordance with DIPL and Local Government Authority Specifications.

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

7.3 RECORDS

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

Daily Traffic Management Checklist and Inspection Sheets shall be completed by the Supervisor. All variations to the TMP / TCD, non-conformances, incidents and accidents shall be recorded. Copies of the completed report shall be forwarded to the Project Manager and or the Superintendent's Representative.

Inspections shall be carried out periodically.

All activities onsite in relation to the implementation and maintenance of this TMP shall be recorded in a daily dairy.

Daily Traffic Management Checklist and Inspection Report Forms are at Appendix E. One sheet per report-inspection should be used, with the relevant sections filled in.

SECTION 8 SAFETY PLAN

8.1 RESPONSIBILITIES

The Imperial Oil and Gas Project Manager has the ultimate responsibility to ensure the TMP is implemented for the prevention of injury and property damage to employees, contractors, sub-contractors, road users and all members of the public.

The Imperial Oil and Gas Project manager will ensure all site personnel are fully aware of their responsibilities and that traffic controllers have been appropriately trained and are in

the final stages of being assessed for accreditation and that sufficient controllers are available to ensure appropriate breaks are taken.

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

Work will not commence or continue until all signs, devices and barricades are in place and operational in accordance with the requirements of the TMP.

The number, type and location of signs, devices and barricades shall be to a standard not less than Appendix A of this plan and AS1742.3 (except where specifically detailed in this TMP with reasons for the variations). Should a situation arise that is not covered by this TMP or AS1742.3, the Superintendent's Representative shall be notified.

The Superintendent's Representative may direct erection, relocation or removal of signs or devices, which, in the opinion of the Superintendent's Representative, are not in accordance with the TMP and do not provide sufficient safety for road users. If such directions are not complied with, the Superintendent's Representative may arrange for erection, relocation or removal by others at the cost of the Contractor.

The minimum qualifications of personnel required for the implementation of this TMP shall be as follows:
Review and modification of diagrams (WZTM Level One)
Implementation and maintenance of site traffic management plan (WZTM Level Three)
Traffic control (WZTM Level Two)
These shall be current at all times during implementation of this TMP.

8.1.1 Project Manager

The project manager shall:

- Ensure all traffic control measures of this TMP are placed and maintained in accordance with this plan and the relevant Acts, Codes, Standards and Guidelines
- Ensure suitable communication and consultation with the affected stakeholders is maintained at all times
- Ensure inspections of the Traffic Controls are undertaken in accordance with the TMP, and results recorded. Any variations shall be detailed together with reasons
- Review feedback from field inspections, worksite personnel and members of the public, and take action to amend the traffic control measures as appropriate following approval from the Superintendent's Representative
- Arrange and/or undertake any necessary audits and incident investigations

8.1.2 Supervisor

The Imperial Oil and Gas supervisor is responsible for overseeing the day-to-day activities, and is therefore responsible for the practical application of the TMP, and shall:

- Instruct workers on the relevant safety standards, including the correct wearing of high visibility safety vests
- Ensure traffic control measures are implemented and maintained in accordance with the TMP
- Undertake and submit the required inspection and evaluation reports to management
- Render assistance to road users and stakeholders when incidences arising out of the works affect the network performance or the safety of road users and workers

- Take appropriate action to correct unsafe conditions, including any necessary modifications to the TMP.

8.1.3 Traffic Management Personnel

- At least one person on site shall be accredited in WZTM Level 3, and shall have the responsibility of ensuring the traffic management devices are set out in accordance with this TMP.
- At least one person accredited in WZTM Level 1 shall be available to attend the site at short notice at all times to manage variations, contingencies and emergencies, and to assume overall responsibility for traffic management.
- Possess an OH&S approved White Card or interstate equivalent

8.1.4 Traffic Controllers

Where required traffic controllers must be briefed on the work activity including details of work sequences to ensure clear and effective traffic control instructions is given to road users. Communication equipment is recommended where site does not allow visual contact between all traffic controllers.

Traffic Controllers shall be used to control road users to avoid conflict with plant, workers, traffic and pedestrians, and to stop and direct traffic in emergency situations.
.
Traffic Controllers shall:

- Operate in accordance with Section 4.10 and Appendix C of AS1742.3-2009
- Be accredited in WZTM Level 2
- Take appropriate breaks as required by AS1742.3-2009 and/or OH&S Regulations
- Possess an OH&S approved White Card or interstate equivalent

8.1.5 Workers and Subcontractors

Workers and Subcontractors shall

- Correctly wear high visibility clothing, in addition to other protective equipment required (e.g. footwear, eye protection, helmet sun protection etc.), at all times whilst on the worksite
- Comply with the requirements of the TMP and ensure no activity is undertaken that will endanger the safety of other workers or the general public
- Enter and leave the site by approved routes and in accordance with safe work practices

8.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

All personnel entering the work site shall correctly wear high visibility PPE to AS/NZS 4602, in addition to other protective equipment required on a site-by-site basis (e.g. protective footwear, eye protection, helmet, sun protection, respiratory devices etc.) at all times whilst on the worksite.

8.3 RADIO COMMUNICATIONS

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

These works will include a sign which notifies traffic that the controllers on site are available on UHF CH 40

8.4 MOBILE PHONES

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

8.5 FACILITIES REQUIRED TO PREVENT FALLS

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

Where works extend beyond daylight hours and adjacent lighting is insufficient to illuminate hazards to non-motorised road users, appropriate temporary lighting shall be installed.

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

8.6 INCIDENT / ACCIDENT PROCEDURES

In the event of an incident or accident, whether or not involving traffic or road users, all work shall cease and traffic shall be stopped as necessary to avoid further deterioration of the situation. First Aid shall be administered as necessary, and medical assistance shall be called for if required. For life threatening injuries an ambulance shall be called.

Any traffic crash resulting in injury shall immediately be reported to the NT Police Service.

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

Details of all incidents and accidents shall be reported to the Traffic Management Supervisor & Remote Civil Project Manager using the incident report form at Appendix G and also fill out the worksafe incident report form at appendix H.

8.7 FATAL OR SERIOUS INJURY AT WORKSITE

In the case of serious injury or fatality occurring within the traffic control zone all work shall cease immediately, machinery and vehicles turned off and the area cleared of personnel as soon as possible.

Traffic Controllers (and other personnel if necessary) shall be deployed immediately to ensure no traffic or other road users approach the area.

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

NT Worksafe will be notified 1800 019 115 and an NT Worksafe Accident/Incident Notification Form (FM137) at Appendix F.

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

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

8.8 EMERGENCY CONTACTS

In the event of an emergency the following relevant authorities must be contacted and advised of nature of works, location, type of emergency and contact details for the site supervisor.

Emergency Service	**Phone (Emergency)**
NT Police Service	000
St. John Ambulance	000
NTFRS	000
Power Water	1800245 090
DIPL Operation Centre	8999 4402

SECTION 9 RISK MANAGEMENT

Risk analysis of the proposed works has identified a number of risk events/items that will be managed by effective traffic management planning and the implementation of this TMP.

All identified risk items have been treated by the development of this TMP. Unforeseen risk items shall be treated in accordance with standard work practices and procedures where appropriate. Any such unforeseen risk items and their associated treatments shall be communicated to all personnel present at the work site either by way of a tool box talk or by communication with their respective supervisor/s.

Any modifications to the TMP during the works to suit site conditions, if required, shall be communicated to and approved by the TMP Designer.

This TMP meets the 'minimum' requirements of the DIPL Standard Specifications, Provision for Traffic; hence there is no requirement for an external Risk Assessment to be undertaken by an independent consultant unless so directed by the Superintendent's Representative. Any associated additional costs incurred by this shall be borne by the Client.

9.1 HIERARCHY OF CONTROL

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

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

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

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

- **Elimination of the hazard**

E.g. divert traffic away from the work area or for hazards associated with high volumes, undertake work at times of low volumes.

- **Substitution of the hazard**

E.g. undertaking drainage / service works using trench-less technology.

- **Management of the risk by Engineering Controls**

E.g. placement of safety barriers, the use of physical devices that reduce speed, temporary traffic signals, reverse alarms, flashing lights, delineators.

- **Management of the risk by Administrative Controls**

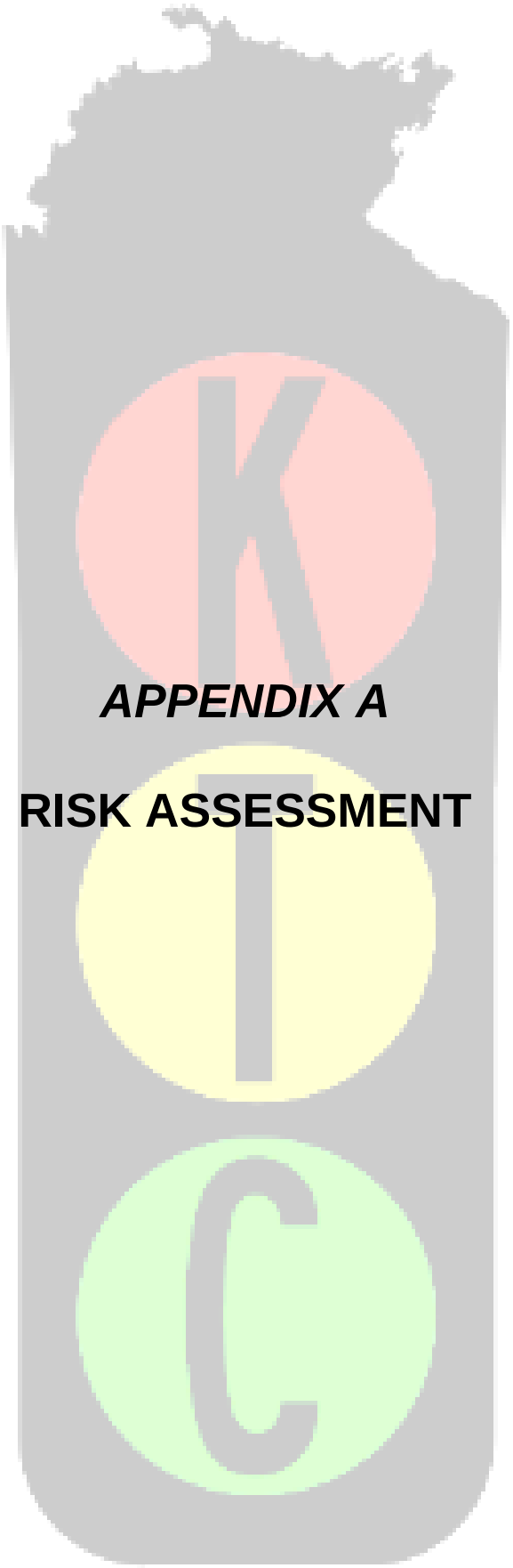
E.g. signage, variable message boards, safe work procedures for workers around mobile plant, procedures for placement of signage under traffic, induction and communication procedures.

- **Personal Protective Equipment**

E.g. use of high visibility vests

9.2 SAFE WORK METHOD STATEMENT – TRAFFIC GUIDANCE

Risk analysis of the proposed works has determined a number of possible risk items that will be managed by effective traffic management planning and implementation as per the TMP.



APPENDIX A

RISK ASSESSMENT

RISK ASSESSMENT

Carpentaria Highway

Introduction

- This Traffic Management Plan details proposed traffic management treatments for the following work activities:
- SEISMIC AQUISITION CARPENTARIA HIGHWAY ;
- This Traffic Management Plan outlines the procedures and processes that will be engaged by the Contractor to manage potential hazards associated with the traffic environment
    - **Location**
- The work will undertake on Carpentaria Highway.

Risk Assessment

Objectives and Strategies

The objectives of the Traffic Management Plan are;

- To provide protection to workers and the general public from traffic hazards that may arise as a result of the construction activity.
- To manage potential adverse impacts on traffic flows to ensure network performance is maintained at an acceptable level.
- To minimise adverse impacts on users of the road reserve and adjacent properties and facilities.
- To minimise adverse impacts on pedestrian movements.

In an effort to meet these objectives the Traffic Management Plan will incorporate the following strategies;

- Provide a sufficient number of traffic lanes to accommodate vehicle volumes.
- Ensure delays are minimised.
- Ensure all road users are managed including motorists, pedestrians, cyclists, people with disabilities and people using public transport.
- Ensuring work activities are carried out sequentially to minimise adverse impacts.
- Provision will be made for works personnel to enter the work area in a safe manner in accordance with safety procedures.
- All entry and exit movements to and from traffic streams shall be in accordance with the requirements of safe working practices and the contract.

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

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

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

Wherever possible, risk control is based on the desirable hierarchy of control i.e. the elimination of the hazard, substitution with a less hazardous activity, provision of engineering controls and provision of management controls.

RISK EVENT	Root Cause	Pure Risk Rating			RISK RESPONSE	Residual Risk Rating		
		L	C	RATING		L	C	RTNG
Placing and Removal of Vibrophones potential projectile from traffic could impact on roadside workers	≈ Inadequate separation distance ≈ Lack of spotter	B	IV	High	Maintain 7.5 or greater separation distance, Conduct works under watchful eye of a dedicated spotter	D	I	Mod
Moderate speed traffic flows along Carpentaria Highway adjacent to work site. Have potential to cause severe injury	≈ Inadequate worksite protection. ≈ Traffic Speed ≈ Inadequate separation from traffic ≈ Working at high traffic flow periods	B	V	Extreme	Control mechanism will be implemented to provide adequate separation of traffic from worksites and safe protection of workers. All works personnel to have suitable high visibility vests.	D	II	Mod
Traffic flows along Carpentaria Highway creating unsafe access to worksites leading to crashes	≈ Unclear delineation of access point. ≈ Traffic Speed ≈ Poor direction from traffic Control ≈ Entering worksites during peak traffic periods ≈ Vehicles follow traffic in to work zone	B	IV	High	1. Determine safe access points to the work site and outline safe entry and exit procedures for all personnel. Undertake work activities when traffic flows have been reduced. All truck drivers and persons requiring vehicular access/egress to/from the construction site to abide by access entry procedure. Suitable clearance zones provided for protection of workers.	D	1	Mod
Workers accessing roadway worksites leading to injury or crashes	≈ Workers enter Roadway areas, ≈ Work areas not clearly delineated. ≈ Inadequate	A	IV	Extreme	Access to work sites adjacent to verge areas must be accessed utilising traffic signal facilities or along the shared path with the approval of the Local Authority. No workers permitted to cross Roadway to enter a work space.	D	II	Mod

RISK EVENT	Root Cause	Pure Risk Rating			RISK RESPONSE	Residual Risk Rating		
		L	C	RATING		L	C	RTNG
	access provided to workers							
Construction activities necessitating lane closures resulting in congestion	≈ Insufficient lane capacities at peak periods ≈ Vehicle breakdown adjacent to worksite	B	IV	Extreme	Minimum lane requirements as per contract. No work during peak periods. Contact with breakdown contractors	C	II	Mod
Construction activity causing an obstruction to or requiring Emergency Services	≈ Traffic congestion preventing access to the site. ≈ Traffic congestion delays Emergency vehicles	D	II	Low	Assistance to be provided for emergency services where practical Minimum lane requirements to be adhered to at all times. Contact emergency services re timing of work	D	II	Low
Vehicle breakdown/crash causing obstruction to traffic		C	II	Low	Contractor to assist where practical for access by emergency assistance vehicles or removal and storage of affected vehicle. Contact with breakdown contractors	C	II	Low
Inappropriate placement and use of temporary signs and line markings leads to confusion and crashes.	≈ Incompetent persons. ≈ Not applying approved Plans ≈ Changes to road lane markings effected by works	C	III	Mod	Implementation and removal of temporary signs and line markings will be managed by competent personnel as required by DIPL provisions for traffic. Appropriate use of Traffic control and delineation warning signs. Site monitoring procedures to identify changes to signage requirements	D	II	Low
Parking of construction plant leading to traffic hazards	≈ No clear procedure for parking of	C	III	Mod	All construction traffic not in use to be parked clear of highway work zones. Parking only in designated	D	II	Low

RISK EVENT	Root Cause	Pure Risk Rating			RISK RESPONSE	Residual Risk Rating		
		L	C	RATING		L	C	RTNG
	vehicles. ≈ No designated parking areas				areas.			
Workers proximity to road causing collision or crash.	≈ Speed of Traffic ≈ Less than 1.2m clearance from road	A	IV or V	Extreme	Maintain 60kph speed limit. Maintain 1.2m worker clearance from cones on lane delineation. Provide lane status symbols and other adequate advance warning signs.	D	III	Mod

ATTACHMENT A - RISK CRITERIA

Table 1 - QUALITATIVE MEASURES OF LIKELIHOOD

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

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

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

Table 2 - QUALITATIVE RISK ANALYSIS MATRIX – RISK RATING

	Consequences				
Likelihood	Insignificant I	Minor II	Moderate III	Major IV	Catastrophic V
A (almost certain.)	L	M	H	E	E
B (Likely)	L	M	H	H	E
C (Possible)	A	L	M	H	E
D (Unlikely)	A	L	M	H	H
E (Rare)	A	A	L	M	M

Table 3 – MANAGEMENT APPROACH FOR RESIDUAL RISK RATING

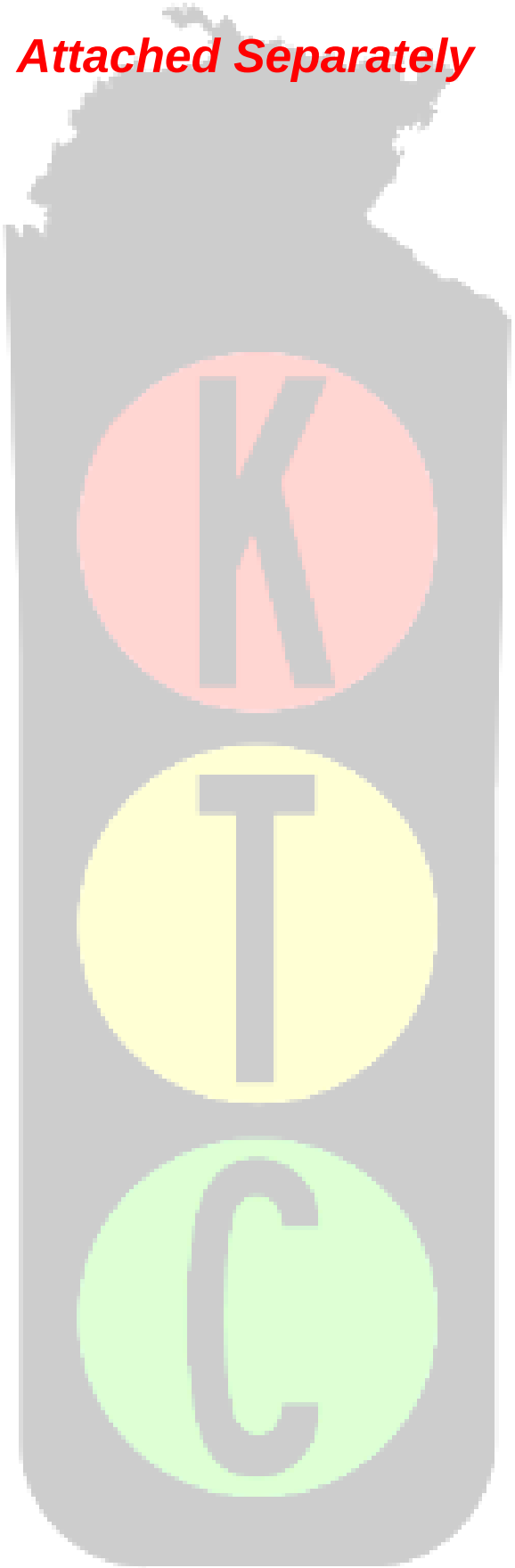
Retained Risk Rating		Required Treatment
E	Extreme risk	Unacceptable risk. HOLD POINT. Work cannot proceed. Avoidance or elimination of risk preferred. Superintendent must review and sign-off treatment
H	High risk	High priority, Treatment may look to reduce consequence or likelihood if both is impracticable. Project Manager / Superintendent approves treatment and signs off when effectively implemented.
M	Moderate risk	Medium Risk, Documented management procedure and prescribed risk treatment subject to review by experienced management and signed off at implementation.
L	Low risk	Managed in accordance with the approved standard management procedures and documented standard work practices
A	Accept	Standard informal and formal work practices manage such.

QUALITATIVE MEASURES OF CONSEQUENCE OR IMPACT (Contract Management AS2142)

Level	Descriptor Type	1 Injury	2 Damage	3 Traffic/ Network Performance	4 Reputation
I	Insignificant	First Aid required / immediate return to work;	Less than $5K	Short term delays, Some minor reduction in Level of Service (LoS) at non peak periods	Unsubstantiated claims in correspondence to Main Roads. Low impact, low profile. No news item.
II	Minor	Minor medical treatment, attendance by doctor. No lost time injury occurs	$5K to $10K	Delays occur during peak periods. Minor reduction in level of service. Localised impact <1 day	Minor substantiated issue, low impact, internal inquiry only
III	Moderate	Medical treatment required, Hospitalisation No WorkSafe Report required. Lost time injury occurs	$10K to $20K	Moderate reduction in Level of Service. Impacts up to a week. Impacts in immediate adjacent streets also. Some short term impact on property access (< 1hr)	Substantiated issue, short-term impact, public embarrassment, moderate news profile. Action by Executive Manager
IV	Major	Significant injuries, Hospitalisation, temporary disability. WorkSafe Report	$20K to $40K	Significant reduction in Level of Service. Impacts up to a month. Some “rat running” during peak periods. Impact on local property access.	Substantiated issues, non-compliance with Departmental policy, high news profile, long term impact. Third party inquiry
V	Catastrophic	Death, Permanent Disability, WorkSafe Investigation .	More than $40K	Major reduction of Loss of Service over several weeks Adverse impacts on surrounding residential/ commercial areas due to traffic overflow. May result in loss of access for extended periods.	Substantiated multiple impacts, widespread multiple news profile, long-term impact. Substantial non-compliance with Department objectives or values. Third party actions.

APPENDIX A

Attached Separately



APPENDIX B

TRAFFIC CONTROL DIAGRAMS

Attached Separately

APPENDIX C

SIGN AND EQUIPMENT MANIFEST

SIGN / EQUIPMENT MANIFEST

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

Regulatory Traffic Control Signage	Sign Number	Size (mm)		Quantity
Stop / Slow Bat	R6-8 / T7-1 A	450		
Reduce Speed	G9-9A	1500	750	
Prepare To Stop	T1-18B	1200	900	
Give Way	R1-2B	900	900	
No Overtaking Or Passing	R6-1A	750	900	
Signals Ahead (symbolic)	T1-30A	900	600	
Stop Here On Red Signal	R6-6A	450	750	

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

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

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

Lane Status Magnetic Overlay (T-shaped)				
Lane Status Magnetic Overlay (left arrow)				
Lane Status Magnetic Overlay (right arrow)				

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

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

Other Roadworks Signage	**Sign Number**	**Size (mm)**		**Quantity**
Traffic Hazard Ahead	T1-10A	1200	900	
Traffic Accident Ahead	T1-11A	1200	900	
Water Over Road	T2-13B	1200	900	
Trucks Entering (symbolic)	T2-25A	900	600	

Speed Restriction Signs	**Sign Number**	**Size (mm)**		**Quantity**
25 km/hr	R4-80B	600	800	
40 km/hr	R4-80B	600	800	
50 km/hr	R4-80B	600	800	
60 km/hr	R4-80B	600	800	
70 km/hr	R4-80B	600	800	
80 km/hr	R4-80B	600	800	
90 km/hr	R4-80B	600	800	
100 km/hr	R4-80B	600	800	
110 km/hr	R4-80B	600	800	
130 km/hr	R4-80B	600	800	

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

APPENDIX D

RECORD OF TOOL BOX TALK

TOOLBOX MEETING

Project:	Date:	Presenter

Items Discussed :

- ☐ Daily Checklist Procedure and check
- ☐ Project Specific Details and site safety
- ☐ Mobile Phones and safety
- ☐ Vehicle Safety / Driver Awareness / Duty of Care / Drug and Alcohol Testing
- ☐ Correct Radio Use
- ☐ PPE / Water / Fatigue
- ☐ Professional Behaviors / Public Relations
- ☐ Signs / Speed Restrictions / After Care / Stop Slow /Escape route / Calls Traffic Signals
- ☐ Breaks / Conveniences / Medical Facility / First Aid Personnel/Amenities
- ☐ Fitness for Work / Alcohol / Drugs / Fatigue / Illness / Dehydration / Heat Exhaustion
- ☐ Incident / Accident Reporting
- ☐ Cigarette Smoking / In Vehicles / Public Area's
- ☐ Best Safe Practice Working Near Plant and Equipment
- ☐ Away Work / Driving / Conduct
- ☐ Risk Assessments

Radio's

Record all comments and discussion

Tool Box Sign Off

Present at Tool Box Talk		Present at Worksite / Visitors	
Print Name	Signature		

APPENDIX E

DAILY TRAFFIC MANAGEMENT CHECKLIST & DOCKET

TRAFFIC MANAGEMENT CHECKLIST

Date		**Time**	
Employer			
Location of work site			
Activity being undertaken			
Health & Safety Representative		**Worksite Manager**	

Road type (Street directory road colour or road sign prefix)		**Clearance between workers and traffic**	**metres**
'Normal' traffic speed through area	**km/h**	**Worksite traffic speed**	**km/h**
Risk rating			

	Issue	Yes	No	N/A
	PLANNING			
1.	Has a traffic management plan been selected or provided? (eg. Field Guide reference, or specific traffic management plan?)			
2.	Is the plan available for inspection?			
3.	Is the plan relevant for the work?			
4.	Are any required written authorisations, or consents for speed limits, in order?			
5.	Are documented changes (if any) to the plan available for inspection?			
6.	Have roadworks speed limits been determined correctly?			
	ADVANCE WARNING / SIGNAGE			
7.	Are all roadworks signs and devices installed according to the plan?			
8.	Have any contradictory, distracting or superfluous signs or markings been covered up or removed?			
9.	Are signs appropriate for current conditions? (eg. symbolic workmen signs not displayed / not visible when no workers on site; road condition signs after worksite vacated.)			
10.	Is signage suitably placed, especially for vehicles approaching at high speed? (eg. check sight distance; advance warning sign distance; height of signs above ground; vehicle queue length not beyond signage.)			
11.	Are multi-message signs being used correctly?			
12.	Are the signs free from damage and defect? (eg. easy to read; check shadow & glare issues.)			
13.	Are sign mountings secure, stable and not a hazard to road users if struck?			
14.	Are signs in pairs where needed? (Note: recommended on high speed high volume roads and multi-lane roads.)			
15.	Are flashing arrow signs available and in use where required?			
16.	Are sign sizes correct?			
	WORKSITE			
17.	High visibility clothing appropriate for conditions and used correctly? (eg. day/night; meet AS 4602-1999 and AS 1906; clean; fastened; personnel visible.)			
	WORK ZONE SEPARATION			
18.	Are clearances between workers and adjacent traffic being maintained?			
19.	Have safety barriers (where used) been installed correctly? (eg. units connected; recommended length; proper end treatment installed; water filled where required; correct rating for speed zone; no go zones observed.)			
20.	Has containment fence been installed where required? (eg. workers / pedestrians / cyclists separation.)			
	OTHER ROAD USERS			
21.	Has possible traffic congestion been considered and steps taken to avoid it?			
22.	Have needs of other road users been provided for? (eg. pedestrians, cyclists, wheelchairs)			
23.	Has proper access to side roads and properties been provided?			
	NOTES			

	REFERENCES
A.	AS 1742.3 – 2002 Manual of uniform traffic control devices, Part 3: Traffic control devices for works on roads.
B.	DIPL Permit to Work Within the Northern Territory Road Reserve
C.	Provision for Traffic
D.	

APPENDIX F

INCIDENT REPORT FORM

Traffic Controller Incident Report Form

Use this form to record the details of motorists who have disobeyed legally set up traffic controls.

Noting as many details as possible assists NT Police to investigate the incident.

Incident Details

Date: Time: am/pm

Vehicle:

Vehicle registration: Colour :

Make and/or model: Body :

Driver:

Male / female: Other passengers in vehicle? yes/no

Description of event:

Weather conditions:

Site Details

Location:

Melway reference:

Activities underway:

If acting as subcontractor, contractor / principal name:

Sketch

If possible, provide a quick sketch showing the situation:

* Road layout
* Road names, including closest side street
* Sign layout
* Location of traffic controller
* Location and direction of travel of motorist
* Confirm that appropriate high visibility clothing was being worn

Page 1of _____

Your Details

Your personal details will remain strictly confidential unless you are required to attend court as a witness.
Under the Privacy Act, your personal details will not be used for any other purposes without your consent.

In signing below I declare the information in this document to be true and correct and I am willing and prepared to attend court if required.

Traffic controller name:		Contact phone:	
Company name:			

Signature:
Date:

Witness name, if applicable:		Contact phone:	
Company:			

Signature:
Date:

Management contact name:		Contact phone:	
Company:		Title:	

Signature:
Date:

What to do now?

Provide copy of Permit to Work and/or road authority permit as applicable.

Fax this form (and documents noted above) to the Northern Territory Police nearest to the incident location.

Fax numbers for all TMU's are located on the 'Roadside Worksite - Speeding Vehicles - Checklist.

What happens next?

Northern Territory will investigate the incident. A warning may be given to the motorist.

If the case proceeds further to prosecution, then the traffic controller will be asked to provide a statutory declaration / statement and must be willing to attend court.

APPENDIX G

INJURY / ILLNESS REPORT FORM

Name		Date of completion of this form	Day	Month	Year	
Depot		Contact Number (mobile)				
Incident Locality Details-						
1. The time & date of the incident	Day / Month / Year / Time	2. Client				
3. Location of the event-						
Injury Details -						
4. Nature of injury e.g. back / arm / leg / foot / head						
5. Describe in your own words what actually happened i.e what you were doing at the time of the injury, what worksite event caused the injury						
6. Provide the name and contact details of any other person that witnessed the event -						
7. Who did you notify of the injury and when						
8. Site Risk Assessment						
Did you conduct a site specific risk assessment prior to the commencement of works	☐ Yes ☐ No	What site specific risks did you identify -				
Did you record the risks on the Daily Traffic Management Checklist and Docket-	☐ Yes ☐ No	What control measures did you implement to eliminate the identified risks -				
9. Do you take medication for any pre existing medical condition / illness						
10. Were you suffering from any pre existing injury or illness at the time of the event -						
11. Is the injury that you are reporting a worksite injury (did the injury happen at work) -						

12. Did you receive first aid treatment at the worksite (if so provide details) -
13. Where have you *been* treated (hospital/clinic/medical center) -
14. Have you been treated by a medical practitioner If so provide details -
15, What PPE were you wearing at the time of the event -
16. Have you been provided with a suitable duties plan (provide details) -
17. How could this event have been prevented -
18. If you have suffered a manual handling injury describe what you were handling (e.g. loading or unloading signage into rear of ute / installing signage / installing or removing taper / operating power tools/ civil construction equipment) -
19. if you have suffered a slip trip and fall injury describe what object caused the incident (e.g. pothole, broken concrete or asphalt, road surface, fluid on the ground surface) -
.
Worker Declaration (
I, (Insert full name) declare that the above information provided by me
is true and correct to the best of my knowledge and belief (Signature)
Witnessed by - (Name of depot manager/supervisor) (Signature)
Location - Date :
Depot/Section Manager/Supervisor Report) if this report is being completed by a depot/section manager do not complete Section 20.
20. I provide the following additional information in relation to this event/incident -
Name- Signature - Date -
National Safety Manager's Comment -

APPENDIX H

NT WORKSAFE INCIDENT/ACCIDENT NOTIFICATION FORM (FM 137)

NTWorkSafe

FORM

Incident Notification Form

NT WorkSafe must be notified of the occurrence as soon as practicable by the PCBU on 1800 019 115. You will be given an incident notification Reference Number that must be included on this form. This number is proof of your notification phone call as soon as was practicable.

Sections 35 to 39 of the *Work Health and Safety (National Uniform Legislation) Act 2011* (WHS Act).

In addition to immediate (as soon as is practicable) phone notification, this 2-page notification form must be faxed or emailed to NT WorkSafe within **48 hours** after the incident occurrence. Fax: **08 8999 5141**. Email: ntworksafe@nt.gov.au

For more information please see NT WorkSafe bulletin Incident Notifications.

Reference Number:		**Date:**	

Person Submitting Details (if completing form by hand, please print in BLOCK letters)					
Name:				Gender:	☐ Male ☐ Female
Position Title:					
Name of Employer/Self Employed Person notifying:				ABN:	
Business Address: (Not Postal Address)	Lot/Unit No.	Street No.	Street Name.	Suburb	City
Mobile:			Phone:		
Email:			Fax:		

Incident Details					
Date of Incident:	/ /		Time of Incident:	: ☐ am ☐ pm	
☐ Death of a person	☐ Serious injury or illness		☐ Dangerous incident		
Name of Employer of any Injured or Deceased Person(s) if different from above:					
Address or location where the incident occurred:	Lot/Unit No.	Street No.	Street Name.	Suburb	City
Describe the specific location of the incident:					

Details of Injured/Deceased Person(s):					
Name:				Gender:	☐ Male ☐ Female
Date of Birth:	/ /	Occupation/Job Title:			
☐ Direct Worker	☐ Contractor	☐ Member of Public	☐ Other		
Residential Address:	Lot/Unit No.	Street No.	Street Name.	Suburb	City
Phone:			Mobile:		
Fax:			Email:		

Please complete all information overleaf ↳

NTWorkSafe

Incident Description		
Work activity being undertaken at the time of the incident (identify any plant, substance equipment involved) and a brief description of the incident:		
Brief description of any injury/illness:		
Did the person receive treatment following the injury/illness?	☐ No ☐ Yes	If yes, describe treatment received below:
Name of person(s) who saw the incident or was first on the scene:		
Action taken/intended, if any, to prevent recurrence of the incident:		
Describe any longer term action proposed to prevent a recurrence:		

Notification Date:	/ /	Signed:	☐ I have submitted this form electronically (signature is not required)

APPENDIX I

PERMIT TO WORK WITHIN THE NT GOVERNMENT ROAD RESERVE
(Submitted Separately)

APPENDIX J

CONDITIONS OF APPROVAL IN SUMMARY (Submitted Separately)

APPENDIX L

CERTIFICATE OF CURRENCY OF PUBLIC LIABILITY INSURANCE
(Submitted Separately)

Spill Management Plan

2020 Drilling Program

NT EP-187

Table of Contents

Abbreviations and Units

Acronym / Abbreviation	Description
ALARP	As Low as Reasonably Practicable
EMP	Environmental Management Plan
DENR	Department of Environment and National Resources
DPIR	Department of Primary Industry and Resources
EP	Exploration Permit
ERP	Emergency Response Plan
m^3	Cubic meter
SDS	Safety Data Sheet
SPM	Spill Management Plan
WMP	Waste Management Plan
WMPC Act	Waste Management Pollution Control Act
WOMP	Well Operations Management Plan

Document Control

Document number	**SMP-187-XPN-GEN-REP-006**
Document Name	EP-187 Spill Management Plan
Author(s):	Diana Gomez
Client:	Imperial Oil & Gas Pty Ltd
Name of Project:	EP-187 Drilling Program

Revision History

Revision No.	Date	Revision Details	Author(s)	Date
1	07/06/2019	Address comments from DPIR	Paul Fox	12/07/18
2	06/09/2019	Legislation Updated	Diana Gomez	12/07/18
3	02/10/2019	Address comments from DENR	Diana Gomez	02/10/19

Approvals

Role	Name	Signature	Date
Author(s)	Diana Gomez	DG	10/10/2019
Reviewed by	Jon Bennett	Jon Bennett	11/10/2019
Approved by	Alexander Underwood		11/10/2019

1. Introduction

1.1. Background

Imperial Oil & Gas (Imperial) 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. 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 with planning commencing in 2020 and drilling early 2020 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. This Spill Management Plan is in support of the EMP.

1.2. Scope

Imperial proposes to undertake a Drilling Program in 2020 at SL-4 (preferred location). The EMP have considered 4 additional alternatives if the preferred location is not acceptable. This Spill Management Plan (SMP) is to be included in the EMP for the drilling program.

The Spill Management Plan assess and manages the risks posed by potential spills of waste, wastewater, fluids and any chemicals used or stored as part of the Drilling Program. The drilling program considered as part of the EMP and this SMP will not involve any hydraulic fracture stimulation activities. Any future consideration of hydraulic fracturing would form part of a completely separate EMP and SMP process.

1.3. Company vision

Imperials vision is based on "*Safety 1st*". To achieve this vision, Imperial believes that everybody is a leader for safety and is committed to:

- Safe development of shale HC resources while preserving cultural heritage, customs & natural environment,
- Provide business opportunities, training & career opportunities for traditional owners with the proposed Imperial business model,
- An incident and injury free environment where people are safe from injury and work together to protect themselves and each other,
- A workplace where people can freely express their concerns and listen willingly to better ways of working safely,
- An environment where people actively avoid mistakes through training, use of safe practices, the identification and correction of hazards and learning from others' experiences,
- A willingness to share safety with others outside of the project,
- Safety, good health, environmental protection and a secure worksite are the ImperialOil & Gas Northern Territory Project way of life.

Complying with this vision, Imperial expectation is to "Achieve world class safety performance".

2. Legislation Overview

Key legislation for the development of this plan are as followed.

- **Code of practice: Onshore Petroleum Activities in the Northern Territory**:
  Mandatory code of practice legislating the management of chemicals and wastewater onsite, including the use of secondary containment, lined tanks and spill management plan,
- **Transport of Dangerous Goods by road and Rail (National Uniform Legislation) Act 2010:**
  Covers the transportation of goods by road in the NT, this also covers licences for vehicles and drivers carrying dangerous goods,
- **Workplace Health and Safety (National Uniform Legislation) Act 2011:**
  Covers the storage and handling of chemicals on site,
- **Waste Management and Pollution Control Act 1998:**
  Covers the requirements for the transportation and disposal of waste within the NT. This includes the requirements for contractors, vehicles and facilities managing listed wastes to be licenced.

3. Potential Spill Materials

A list of chemicals, water/wastewater and the way they will be stored, transported and transferred as part of Imperial's activities is provided below.

3.1. Chemicals used in the Activity

3.1.1. Grey water and Sewage

Camp wastewater from laundry, showers and kitchen is proposed to be piped to a benign irrigation area. For treated sewage that has already passed through the treatment system, the liquid component will be either disposed of using an irrigation system or transported with the solid waste to an approved disposal facility. Macerated sewage is not treated sewage. For further waste management facility refer to Appendix 13 of the main EMP.

3.1.2. Hydraulic Fluids and Fuel

Hydraulic fluid and fuel drums are stored within portable bunding and bulk fuel is stored within tankers equipped with safety features such as double skins (or temporary bunding), safety cut-off valves, top accessing etc. Spill leak and drip trays will be used to address the risk of minor drips and spills associated with re-fuelling operations.

The estimated volumes and storage of fuels and oils used in the Drilling program is provided in Table 1 below.

Table 1. Estimated volumes and storage of fluids

Description	Stored on Site (m^3)	Storage Location	Containment
Diesel Fuel	50	Rig Fuel Storage Tanks (Double skinned)	Secondary Containment
Hydraulic Oil	2.5	Storage Tanks and Drums	Secondary Containment (Double Skinned Tank or Bunded Containment Area or Bunded Pallet Storage)
Other Chemicals (Excluding drilling additives)	2.5	Oil Storage Skids or Mechanics Shack	Secondary Containment (Double Skinned Tank or Bunded Containment Area or Bunded Pallet Storage)

3.1.3. Drilling Fluid

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 muds or additives that are used in the process contain benzene, toluene, ethylbenzene and xylene.

The proposed drilling fluid is comprised of predominantly water with the remaining made up of salts and fluid additives. A list of fluid additives potentially to be used for the drilling activities are provided in Table 2 below.

Testing of the residual drilling fluid will be undertaken in accordance with the Waste Management Plan submitted in support of the Drilling EMP.

Table 2. Proposed Drilling Chemicals

Trade Name	Purpose of use	Component Name	Maximum ingredient concentration
Anti-Balling surfactant	Anti-Balling surfactant	CON-DET	N/A contingent only
Barabuf	pH Stabilizer	pH buffer	N/A contingent only
Barite	Weighting Agent	Barium sulphate	500 lb/bbl
Bentonite	Viscosifier	Sodium montmorillonite clay	15 lb/bbl
Biocide	Biocide	Biocide	0.3 lb/bbl
Calcium Carbonate	Weighting / Bridging Agent	Calcium carbonate	N/A contingent only
Caustic Soda	pH Control	Caustic Soda (Sodium Hydroxide)	0.6 lb/bbl
Citric Acid	pH Controller	Citric Acid	N/A contingent only
Corrosion Inhibitor	Corrosion Inhibitor	Filming Amine	N/A contingent only
Cross-linked Starch	HTHP Filtration Control Additive	N-Drill HT Plus	8 lb/bbl
Defoamer	Defoamer	Defoamer	N/A contingent only
Foaming Agent	Foaming Agent	Foaming Agent	N/A contingent only
H2S Scavenger	H2S Scavenger	H2S Scavenger	N/A contingent only
LCM	Lost Circulation Material	LCM	N/A – contingent only
Low toxicity spotting fluid/lubricant	Stuck Pipe Spotting Fluid	Low Toxicity spotting fluid/lubricant	N/A contingent only
Lubricant	Lubricant	Lubricant	N/A contingent only
Modified Starch	Filtration Control Agent	Modified Starch	8 lb/bbl
Non-amine inhibitor	Shale Stabilizer	Non-amine inhibitor	N/A contingent only
Oxygen Scavenger	Oxygen Scavenger	Oxygen Scavenger	N/A contingent only
PHPA	Shale Stabilizer	PHPA	N/A contingent only
Polyanionic cellulose, low viscosity	Fluid Loss Additive	Pac-L	5 lb/bbl
Polyglycol	Shale Stabilizer	Glycol	N/A contingent only
Potassium Chloride	Inhibitor / Weighting Agent	Potassium Chloride	22lb/bbl
SAPP	Thinner/Dispersant	SAPP	N/A contingent only
Soda Ash	pH Controller	Soda Ash	0.3 lb/bbl
Sodium Bicarbonate	pH Controller	Sodium Bicarbonate	N/A contingent only
Sodium Chloride	Inhibitor / Weighting Agent	Sodium Chloride	50 lb/bbl
Xanthan Gum	Rheology Modifier	Barazan D Plus	2 lb/bbl

4. Spill Risk Assessment

4.1. Potential Spill Scenarios

A number of chemicals and hydrocarbons will be handled, stored and transported for the project. The potential impact of a spill or leak is dependent on the type and volume of material released. Due to the remote location of the project, chemicals will be transported by road and stored on site prior to use.

Potential sources of spills during drilling activities are shown in Table 3 below. These scenarios include:

- Spills from chemical and wastewater handling and storage activities,
- Spills from chemical and wastewater during transportation (offsite),
- Tank, drilling sump and containment vessel overflows and structural failures.

The loss of containment due to the failure of well barriers is covered under the Well Operations Management Plan (WOMP).

Refer to Table 4 for a summary of Spill Scenarios.

4.2. Potential Receptors

A description of the environment, including environmental cultural sensitivities with the potential to be impacted by a spill is detailed in the EMP. The location of activities is remote as shown in the various figures from the main EMP, they illustrate the separation distances from sensitive receptors such as:

- Communities,
- Heritage Places,
- Homesteads,
- Protected areas,
- Vegetation communities, and
- Watercourses.

Maps regarding no-go zones and restricted work areas will be provided to site personnel to ensure awareness of these features.

4.3. Potential Impact to the Environment

Potential impacts to the environment as a result of a spill event include reduction in quality of groundwater, surface water or soils. These are discussed in mire details below.

4.3.1. Groundwater

Chemicals and fuels used during the drilling program have the potential to leak to surface and infiltrate the ground, migrating to shallow or perched aquifers. However, well sites are designed to prevent spills of hazardous chemicals to infiltrate like compacting the lease pad and provision of chemical segregated and bunded areas. Imperial believes that impacts to groundwater are very unlikely.

4.3.2. Surface Water

Spills to surface have the potential to migrate to surface waters such as ephemeral watercourses. This has the potential to effect surface water quality and ecological values of that habitat. Control measures have been assessed and disclosed in the EMP, a summary of controls can be also found in Section 6 of this Plan.

4.3.3. Soil

For smaller spills and leaks (<1m^3), migration is likely to be contained within the surface soils and would be readily removed or remediated. If a larger spill were to occur, such as that from a bulk tanker, there is the potential that product could infiltrate.

5. Risk Assessment

An assessment of environmental impacts and environmental risks posed by a spill event has been address ed in Section 6 of the main EMP.

6. Control Measures

Control measures to manage spills associated with exploration activities are provided in the EMP. The key management controls include:

- A Waste Management Plan (WMP) developed and will be implemented for wastewater managed on site.
- All flowback, completion fluids, chemicals, oil and fuel storage will be equipped with secondary containment (or dual liners), as per the codes of practice.
- Contractors are required to develop spill management plans to comply with the requirements for hits plan.
- Drilling sump will be lined, with enough freeboard to manage a 1:100 ARI.
- Effective spill clean-up material readily available at each work site and on all mobile service trucks or vehicles, where hydrocarbons and chemicals are stored and/or used.
- Inspection reports and maintenance records of secondary containment shall be kept and available for review.
- Monitoring to detect spills will be undertaken in accordance with section 8 of this plan.
- Procedures will be developed by contractors designed to detect, remediate and report any spills. This includes:
  - Chemical handling procedures,
  - Chemicals storage and handling inspection procedures,
  - Spill prevention, detection and response procedures.
- Well sites are be designed and constructed to prevent spills of hazardous chemicals; this includes:
  - Compacting the lease pad surface to prevent infiltration
  - Provision of chemical segregation areas.
- Where flowback is being stored on a lease pad, the lease pad shall be earthen bunded to prevent release to surrounding areas in the case of a catastrophic failure.

7. Spill Response and management

The following section provides an overview of the response to spills during drilling. Where the spill is the result of an emergency that is still active, the Emergency Response Plan will take precedence over this plan.

7.1. Procedures

Imperial manages environmental impacts and risk of its activities through the implementation of the Imperial Management System. The system provides a formal and consistent framework for all activities of Imperial employees and contractors.

As part of this management system a site-specific Emergency Response Plan and Well Operations Management Plan has been developed.

7.1.1. Emergency Response Plan

The Emergency Response Plan has been prepared by the drilling contractors and will be submitted to DENR and DPIR as part of the EMP approval. Updates made to any of the plans will be proved to DENR and DPIR.

The emergency response arrangements within the Emergency Response Plan will be exercised early in the campaign to ensure that personnel are familiar with the plan and the type of emergencies to which it applies and that there will be a rapid and effective response in the event of a real emergency occurring.

7.1.2. Well Operations Management Plan

Well Operations Management Plan (WOMP) will be submitted to the regulator for approval prior to spud of the first well activity to which the plan would apply.

Fundamentally the risk of spills associated with the activity are managed effectively through the implementation of the mitigation measures described in the EMP. Imperial believes that with the implementation of the mitigation measures described in this plan and the EMP the potential for chemicals spills and leaks is reduced to an acceptable level and its risks and impacts of physical disturbance have been reduced to ALARP.

7.2. Site material and fluids

The well site layout has been designed to minimise the potential for harm to others and the environment with considerations of the Land Clearing Guidelines and the Code.

Through the implementation of the mitigation measures provided in Table 27 of the EMP, the relevant mandatory site material and fluids management requirements will be met. In particular the well will be:

- Designed and operated to minimise the risk of causing a fire on the well site or in the surrounding environment,
- Adequately secured to prevent access by wildlife,
- Designed and operated to minimise the potential for releases of contaminants to the environment and the impacts of such a release,
- Designed to ensure the use, storage and handling of materials is adequate comply with the code.

7.3. Spill detection

Spills monitoring measures used to detect spills throughout the Drilling Program include:

- Drill fluids that are contained in engineer fluid storage tanks. These tanks and system as a whole will be monitored throughout the Drilling Program.
- Cuttings and fluids storages will be inspected daily to check integrity throughout drilling operations.
- Daily monitoring of weather and for predicted significant rainfall events will be undertaken
- Completion of the daily monitoring checklist.

7.4. Rapid Spill Assessment

When a spill occurs, the on-site Supervisor will carry out a rapid assessment to determine the potential hazards and the type and location of emergency assistance required. The assessment includes the following but not limited to:

- Determine the physical (volume and estate) and location of the spill,
- Determine the appropriate spill category and type of response
- Assess the hazard of the material spilled, including any potential hazards associated with chemical mixing (such as oxidising and reducing agents);
- Determine the safety hazard to immediate response personnel and whether additional resources (such as emergency services or specialised equipment or advice) are required to manage the spill safely;
- Determine spill movement, factors affecting the movement (i.e. impending weather, topography, drainage lines etc.)

7.5. Spill Response Strategy

Small spills will be managed locally at the site using dedicated spill kits; which are readily available and appropriately stocked.

For spills that are large and cannot be managed locally, the operating company will notify Imperial to provide incidents and initiate an appropriately response support.

All spills will be managed in accordance with:

- Imperial and Contractors Emergency Response Plan
- Incident reporting, Investigation and learning procedure
- The EMP

7.6. Spill containment and clean up procedures

Generic spill containment clean-up procedures must be developed and implemented by the drilling contractor aligning with the requirements of this plan. These procedures shall be adapted (where appropriate) to consider the site and chemical specific hazards associated with each spill event.

The procedure shall consider the following generic spill containment and response procedure:

- Move all people out of harm's way
- Alert others near-by
- Assess the situation – determine what substances are involved, the potential receptors (people and the environment) and if additional support is required. The substance must be known prior to taking any action (refer to SDS).
- If applicable, remove any possible risk escalating factors (e.g. ignition hazards in case of flammable/combustible spills); approach from up-wind to reduce fume risks, isolate the spill source (close containment valve, similar). Ensure appropriate controls requirements are met – e.g. PPE, first aid support, etc. – prior to conducting spill clean-up.
- If it is safe to do so, stop the source of the leak (if possible) and contain the spill using onsite equipment to prevent from leaving site or entering a waterway or sensitive feature.
- Recover free liquid and contaminated material as soon as practicable to mitigate infiltration. Material recovery should consider the benefit of recovery versus the additional impact that recovery of all contaminated material could cause as per the National Environment Protection (Assessment of Site Contamination) Measure.
- Prevent people, livestock and wildlife access to hazardous material through fencing or other barriers.
- Store contaminated material in a manner to minimise the risk of additional contamination.
- Follow communication paths for notification to the respective management team.
- Project manager to ensure appropriate external (DENR/DPIR) incident reporting requirements are actioned in accordance with the impact of the spill.
- Project manager to seek expertise as to whether additional testing and remediation is required upon completion of the initial containment and clean up. This consideration will be undertaken in accordance with the National Environment Protection (Assessment of Site Contamination) Measure.
- Upon rectification of a reportable spill, an incident investigation shall be completed as per the Petroleum (Environment) Regulations. This shall include the root cause of the incident, actions taken to mitigate the impact and ongoing monitoring and maintenance required to ensure the site is stable and non-polluting.

7.7. Contaminated Material Disposal

- During a spill clean-up, the storage of contaminated material must be undertaken in a manner that minimises additional contamination.
- Offsite disposal must be undertaken in accordance with the NT Waste Management and Pollution Control Act 1998.
- All listed waste transportation shall be undertaken by licenced contractors, be tracked and disposed of at approved waste management facilities.

8. Monitoring and inspections

The Table 3 below summarises the monitoring and inspection program.

Table 3. Spill monitoring and inspection

Monitoring Program	Frequency	Methodology	Purpose	Minimum volume of leak
Tank and sump level monitoring (when wastewater is stored onsite)	During operations: Daily All other times: Weekly during dry season	Level dip / Visual assessment	Prevent the overtopping of tanks	10's of litres
Tank leak detection (when wastewater is stored onsite)	Continuous	Instrument	Detect the mitigation of fluid through primary containment	10's of Litres
Chemical storage areas (when chemical stored onsite)	Daily during operations. Weekly all other times	Visual	Detection of leaks	Litres
Tank structural integrity (when wastewater is stored onsite)	Weekly	Visual inspection	Detect potential structural weakness	N/A

9. Communication Plan

9.1. Communication to personnel

Spill prevention and monitoring strategies will be communicated to personnel working on the drilling program via:

- This Plan
- The EMP
- Site inductions
- Safety meetings
- Tool box talks
- Daily meetings

9.1.1. Wellsite Emergency Response Number

The well site will be clearly identified in a permanent manner with the well name, well number, major hazards and details of the interest holder. The name of the person in charge will be displayed in writing where the lease pad meets the well site.

9.2. Incident reporting

In the case of any inconsistencies the reporting requirement of the Petroleum (Environment) Regulations and the Waste Management and Pollution Control Act (WMPC Act) trump any requirements listed in the plan. Incident reporting will be as follow:

- Spills located within the EP187 will be reported to the minister in accordance with Part 3 of the Petroleum (Environment) Regulations.
- Spills that are located entirely outside of the EP187 permit area will be reported to the NT Pollution Hotline (1800 064 567) in accordance with Section 14 of the WMPC Act.
- Where spill occurs initially within the EP187 permit area, but discharges outside of the permit area, it will be reported to the minister in accordance with Part 3 of the Petroleum (Environment) Regulations and to the NT pollution Hotline (1800 064 567) in accordance with Section 14 of the WMPC Act.

9.2.1. Notice of a reportable incident under the Petroleum (Environment) Regulations

Imperial must give the Minister notice of a reportable incident in accordance with this regulation for reportable incidents within the EP187 area. A reportable incident means an incident, arising from a regulated activity that has caused or has the potential to cause material environmental harm or serious environmental harm. A notice of the reportable incident must be given to the Minister as soon as practicable but not later than 2 hours after the incident first occurred or if the incident was not detected at the time it first occurred, the time the interest holder became aware of the reportable incident.

9.2.2. Report about reportable incident

An initial report about a reportable incident will be given to the Minister as soon as practicable but not later than 3 days after the reportable incident first occurs; and must include comprehensive details about the following:

- 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 system that were in place to prevent the occurrence of an incident of that nature.
- The nature an extent of the material environmental harm or serious environmental harm that the incident caused or had the potential to cause.
- Any actions taken, or proposed to be taken, to clean up or rehabilitate an area affected by the incident.
- Any actions taken, or proposed to be taken, to prevent a recurrence of an incident of a similar nature.

9.2.3. A report about recordable incidents

Must relate to each reporting period for the regulated activity and must be given as soon as practicable but not later than 15 days after the end of the reporting period The report must contain:

- A record of all recordable incidents that occurred during the reporting period
- All material facts and circumstances concerning the recordable incidents that the interest holder knows or is able, by reasonable search or enquiry, to identify,
- Any action taken to avoid or mitigate any environmental impacts and environmental risks of the recordable incidents,
- The corrective action that has been taken or is proposed to be taken to prevent similar recordable incidents.

Reporting will occur at a period agreed in writing between the interest holder and the Minister or each 90 day period after the day on which the environment management plan is approved.

Recordable incident means an incident arising from a regulated activity that has resulted in an environmental impact or environmental performance standard specified in the current plan for the activity; or is inconsistent with an environmental outcome specified in the current plan for the activity. A recordable incident is not a reportable incident.

9.2.4. Duty to notify of incidents causing or threatening to cause pollution under the WMPC Act.

Imperial must notify the NT EPA on their Pollution Hotline (1800 064 567) as soon as practicable after (and in any case within 24 hours) first becoming aware of a reportable incident or the time they ought reasonable be expected to become aware of a reportable incident. A reportable incident under the WMPC Act includes an incident that causes, or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm.

The notification must include the following details:

- The incident causing or threatening to cause pollution,
- The place where the incident occurred;
- The date and time of the incident,
- How the pollution has occurred, is occurring or may occur,
- 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.

Table 4. Spill Scenario Summary Table

Spill Scenario	Mechanisms	Location	Key Management Control	Monitoring	Receptors
Loss of containment during transfer onsite (leakage from pipes, hoses, fittings etc).	• Coupling, valve, hosing and equipment failure	Chemical mixing and transfer areas on the drill rig, mixing hoppers and wastewater storages.	• Secondary containment to be deployed under high risk/leak storage and handling areas, • Spill Kits available, • Routine inspection of chemical stores, • Sites and manned during operations, • Waste Management Plan	Routine inspection of all chemicals handling areas, including wastewater transfer points and chemical mixing areas.	Retained onsite.
Spills from chemical and wastewater handling and storage activities onsite. Poor refuelling or fuel transfer practices Drill fluid leaching from below pit.	• Container rupture, • Spill during chemical handling and mixing	• Chemicals storage area, • Drilling rig • Drilling sumps, • Flowback storage tanks, • Well testing equipment	• Designated storage areas with appropriate segregation of incompatible chemicals, • Secondary containment to be deployed under high risk spill/leak storage and handling areas, • Spill kits available, • Routine inspection of chemical stores, • Sites are manned during operations, • Waste Management Plan.	• Routine inspection of chemical stores, sumps and tanks during operations, • Tank leak detection.	Retained onsite
Spills from chemical and wastewater during transportation (offsite)	• Transport spill, • Traffic accident (total or partial release)	• Offsite along highway.	• All transport companies to be appropriately licenced to transport chemicals and waste (Dangerous goods and Waste Management and Pollution Control Act) including the requirement to detect and respond to spills, • Waste Management Plan	• Performance of contractors to be monitored as part of transportation contractors.	Chemical and wastewater transport between Darwin/Katherine or Mt. Isa
Tank, drilling sump and containment vessel overflows and structural failures	• Overflowing of a sump and flowback tank, • Structural failure of embankments or tank wall	• Sumps and tanks on lease	• Lease pads bunded during the storage of flowback, • Open tanks with 1:100 ARI freeboard, • Tanks constructed to Australian Standards Routine tank and sump inspections	• Routine tank and sump level and structural integrity (visual) inspections.	Retained on lease pad within bund.

EP187 GROUNDWATER INVESTIGATION

Report IG-02

May 2019

FOX & CO ENVIRONMENTAL

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DOCUMENT AUTHORISATION					
Revision	**Rev. Date**	**Report Details**			
a	2 May 2019	Draft report			
Prepared By		**Reviewed By**		**Authorised By**	
P.F		A.F		P. Fox	

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.

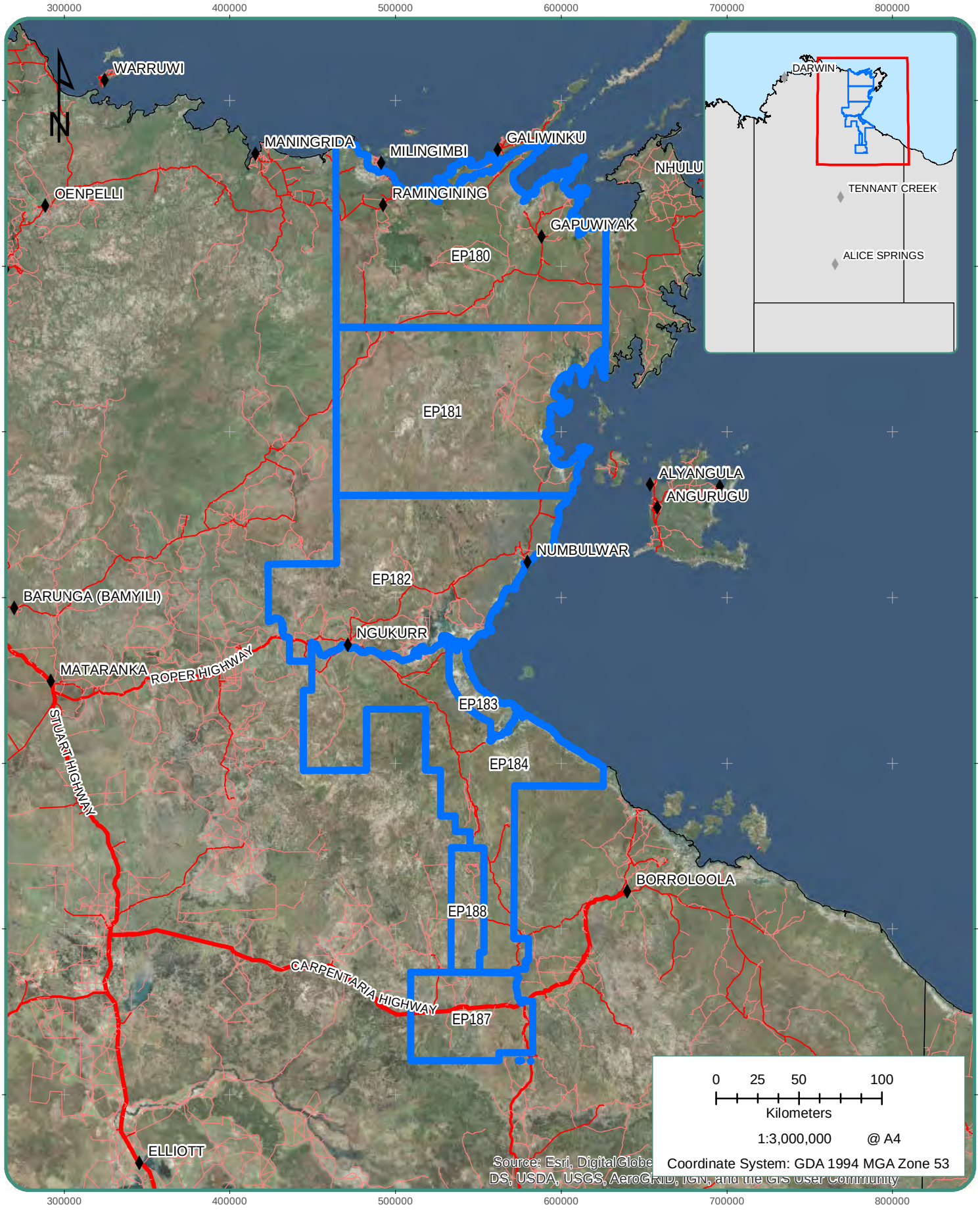
In this regard, to be proactive and demonstrate good environmental stewardship, IOG commissioned Fox & Co Environmental Pty Ltd to commence a baseline groundwater monitoring program on EP187. The focus of the survey was to gain an understanding of the groundwater quality in the area on EP187 associated 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.



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

Document Path: C:\Users\OneDrive\Documents\Fox & Co Environmental\Projects\Imperial oil and gas\EP187 Post-Wet Season Weed Survey\Maps\IOG_0001 Locality.mxd

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

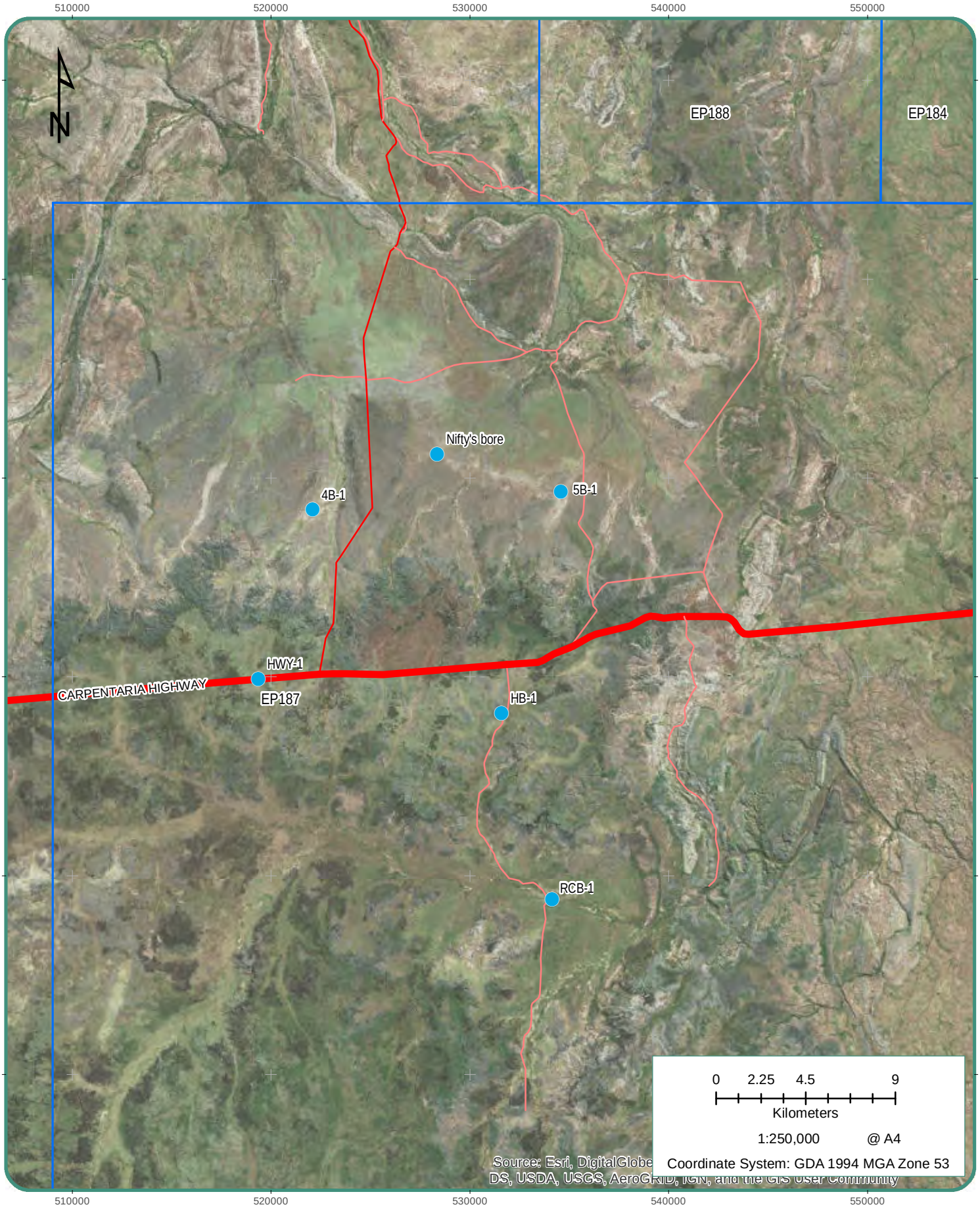
2.3.2 Quality Control

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**).



TITLE:

Groundwater Bores

MAP NO: IOG_0002

PROJECT: EP187 Groundwater Investigation

LEGEND

- Bores
- Tenements

Roads

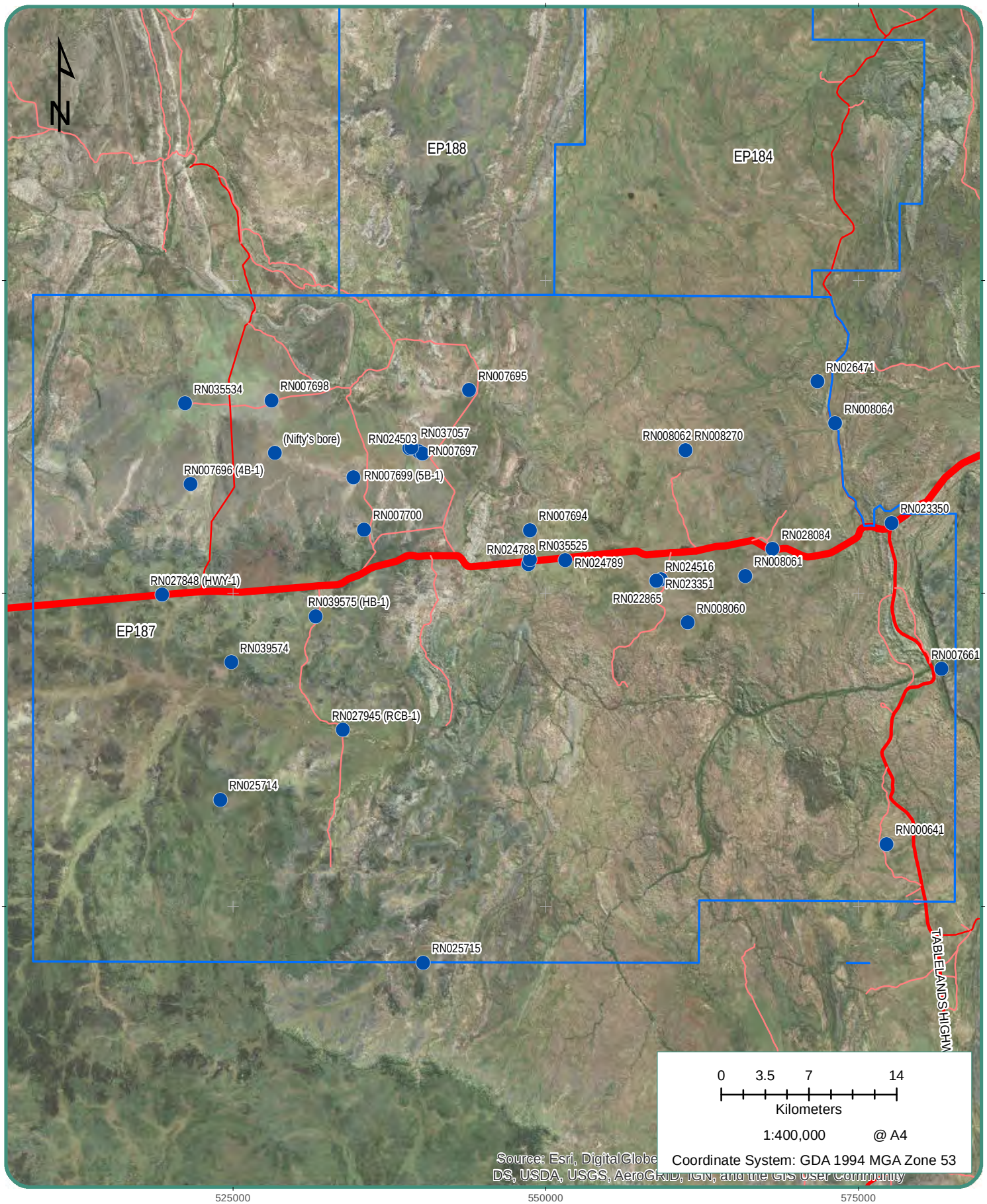
- Principal Road
- Secondary Road
- Minor Road
- Track

FOX & CO ENVIRONMENTAL

Data Source:

Date: 26/04/2019

Document Path: C:\Users\OneDrive\Documents\Fox & Co Environmental\Projects\Imperial oil and gas\EP187 Groundwater Investigation\Maps\IOG_0002 Groundwater bores.mxd



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

Document Path: C:\Users\OneDrive\Documents\Fox & Co Environmental\Projects\Imperial oil and gas\EP187 Groundwater Investigation\Maps\IOG_0003 Regional bores.mxd

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 CaCO3	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
EK059G: 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

		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	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.

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	

Groundwater Bore	Plate
House Bore (HB-1), RN039575 Location: -16.7491, 135.2964	
Relief Creek Bore (RCB-1), RN007696 Location: -16.6567, 135.2070	

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.	

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.

APPENDIX A

Bore logs

THE NORTHERN TERRITORY OF AUSTRALIA
APPROVED FORM 21 (25/01/2011)

STATEMENT OF BORE

As per Water Regulations (2009)

Name of Owner: N.L.C. DAVE DANIELS
Location/Address: CARPENTARIA DOWNS
Intended Use: Stock

Registration No.: 039575
BC Permit No:

GPS Location: Zone: 53 K | GDA94 ☐ | Other: ☑ Specify: WGS 84 | Easting: 0531586 | Northing: 8148173

From	To	Particulars of Strata
0	70m	CLAY BROWN
70m	93m	LIMESTONE HARD

Name of Drilling Company: TREVOR HUGHES
Name of Driller: TREVOR HUGHES
Name of supervising driller: TREVOR HUGHES
Date Commenced: 1-7-2016
Date Completed: 3-7-2016
Depth Drilled: (m)
Completion Depth: (m)

METHOD OF DRILLING

Other	Auger	Rev. Circ.	Rotary Air	Rotary Mud
☐	☐	☐	☑	☐

Specify:

HOLE DIAMETER			DRILLING FLUID
From (m)	To (m)	Dia. (mm)	Type

PARTICULARS OF CASING

From	To	Dia (ID)	Type
0	5.8m	208mm	STEEL
0.35	72m	156mm	STEEL
72m	93m	OPEN	HOLE

PARTICULARS OF PERFORATIONS OR SCREEN STRINGS

From	To	Dia (ID)	Aperture	Type
BLANK				

Casing Suspended: Yes ☐ No ☑
Method:
Height of Casing above GL: 350 mm (m)
(m)

Top of Packer Set at: (m)
Length of Packer: (m)
Method of Packer Connection:

CEMENTING/GRAVEL PACKING

From	To	Type
5.8m	BACK TO SURFACE	CEMENTED

WATER BEARING BEDS

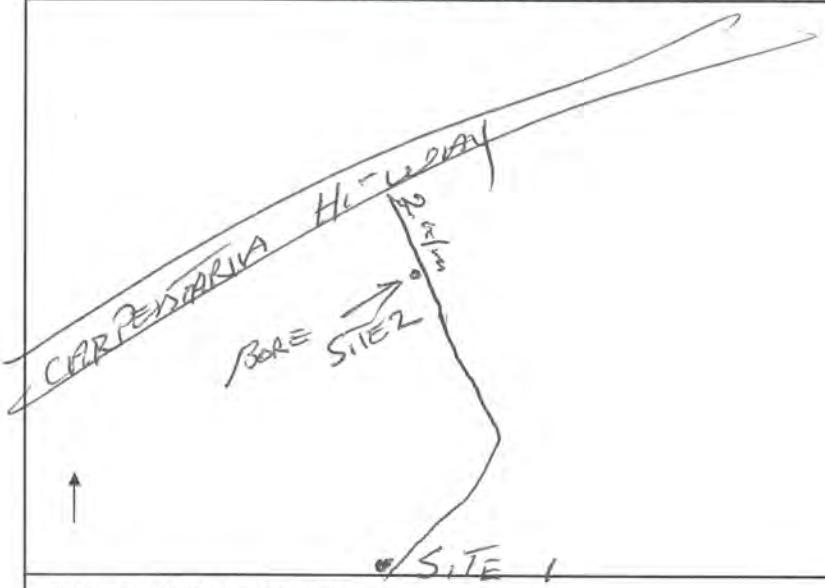
Depth (m) From	Depth (m) To	Yield (L/s)	SWL (m)	Duration (hr)	Quality	EC	pH	Bottle No.
79m	81m	3	60.2	2HRS	GOOD		6.2	

STRATA / WATER SAMPLES
Have been ☐ Will be ☐
Left at:

Completion Yield: 3 (L/s) Method: AIR Duration: 2 (hr)
Completion SWL from GL: 60.2 (m) Depth of Lift: 72 (m)

NOTE: No company advertising is to be imprinted on this certificate apart from where requested.

LOCATION SKETCH OF BORE RN: 0 39575



LOCATION DESCRIPTION OF BORE

2 K/m		m/km
NW ☐	North ☐	NE ☐
West ☐		East ☐
SW ☐	South ☑	SE ☐

OF: Hi-way

FINAL CONSTRUCTION STATUS

Capped	Casing Pulled	Left for Obs.	Abandoned	Equipped	Backfilled	Other
☑	☐	☐	☐	☐	☐	☐

ADDITIONAL INFORMATION ABOUT THE BORE: *(Include any information which may assist for future reference)*

Pump from 72 metres for 2.5 L.P.S

or 2000 G.P.H.

Note: The holder of the NT licence shall submit the form to the Department within 28 days of completion of any works.

I certify that the information contained above is true and correct, and that I have complied with the bore licensing requirements and conditions of the Bore Construction Permit as issued if a Bore Construction Permit was required.

Name and licence number of driller: TREVOR HOFFEE 25 Signature and licence number of licensed driller: Date: 3-7-2016

FOR OFFICIAL USE ONLY

How Located:	GPS	TST	Survey	Hand Plotted	Other
	☑	☐	☐	☐	☐

DESCRIPTION OF PROPERTY:

Rural	Mineral	Pastoral	Reserve	VCL	Other
☐	☐	☐	☑	☐	☐

RECEIVED DATE 8/8/16 BY m CHIN ENTERED 29/11/16

Lease No: Lot No: Hundred of:

Portion No: 5706 Section No: Town of:

Class of Bore:	Town	Domestic	Investigation	Agriculture	Mineral	Pastoral	Other
	☐	☐	☐	☐	☐	☑	☐

Use of Bore:	Production	Investigation	Irrigation	Observation	Monitoring	Roads	None
	☑	☐	☐	☐	☐	☐	☐

Grid Reference: AMG ☑ Clark ☐ Zone: 53 Scale:

Easting: 531586 Lattitude: Map Name:

Northing: 8148173 Longitude: Index Map Number: 57/16 O

Date Registered: Bore Plotted on the map? Yes ☐ No ☐

Dept Officer: Signature:

Remarks:

S/C 0903

RN027848

Regulation 6

THE NORTHERN TERRITORY OF AUSTRALIA

Control of Waters Act

FINAL STATEMENT OF BORE

1-N. 57/67 WRA/3

R.N. 27848

RMD 8089

From	To	Description of Strata (including colour and hardness)
0	3	BLACKSOIL
3	53	CLAYS
53	60	SANDSTONE
60	70	DOLAMITIC SANDSTONE
70	101.5	NO CIRCUNATION

Location of Bore (or supply sketch on the back hereof) —

..... Km

[ ] S SE of (b) 209 Km CHAINAGE
[ ] E NW
[ ] W SW CARPENTARIA H'WAY

(a) Circle appropriate direction.
(b) Use known point such as existing bore, homestead, outstation, etc

Additional information of interest about bore. ZONE 53
S/B 903

and Reference S/10250 - 8149700 ~~485450 - 8160350~~

Map Number ~~1:100,000 SHEET 5864 'OTTOBER'~~
1:100,000 Sheet 5964 'OT DOWNS'

Samples of Strata and Water Supplies

have been* ~~not~~

at the following place —

Craig Mayfield
Signature

*delete non applicable

Office use only — Plotted 22/1/92

C. L. DURRIELD, Government Printer of the Northern Territory

Name of Bore —
R.N. 27848

Name of Property —
CARPENTARIA H'WAY

Description of Property — PL 1021
CROWN LAND. ~~VCL~~

Name of Owner —
N.T. GOVT

Name of Contractor —
GORDY & CONE DRILLERS

Name of Driller —
S. RICHARDS

Date of Commencement —
23-10-91

Date of Completion —
24-10-91

Total Depth —
101.5m

Particulars of Casing — 6.5m OF 219mm STEEL
91.6m OF 168.3mm STEEL

Particulars of Perforations or Screens —
SLOTS BETWEEN 78.8 - 84.9m

Water	1st Supply Units	2nd Supply Units	3rd Supply Units
Struck at	✓		
Standing Water Level	✓		
Pumping Supply Litres/sec	✓		
Duration of Pump Test	✓		
Water Level During Test	✓		
Quality: Good, Fair or Bad	✓		

POWER AND WATER AUTHORITY
WATER RESOURCES
WATER CHEMISTRY LABORATORY
G.P.O. Box 1096, Darwin N.T. 0801
Telephone: (089) 82 6413
Telex: AA85644
Facsimile: (089) 82 6410

Bottle No.	Lab. Register No.
A559	91/92/0649

27,848.

Date Received in Lab.	Time Sampled	Date Sampled
11/11/91	1610	07/11/91

Location and Details 209 KM CHAINAGE CARPENTARIA H/WAY BORE R/N 27848 DEPTH 90.5 M

DISCHARGE 13.17 L/S SAMPLER P. REES TEMP. 35 pH 6.64 COND 1158

P/N RMD 8089 RSP N° 199

ANALYSIS — PHYSICAL

☐ pH	[423]	6.9	☐ Colour (Hazen units)	[204A]	
☐ Electrical conductivity (microsiemens/cm at 25° C)	[205]	1170	☐ Turbidity (NTU's)	[214A]	
☐ Total dissolved solids (mg L^{-1} - dried at 180° C)	[209B]	730	☐ Suspended solids (mg L^{-1})	[209C]	

ANALYSIS — CHEMICAL (mg L^{-1})

☐ Sodium, Na	[303A]	47	☐ Chloride, Cl	[407A]	62
☐ Potassium, K	[303A]	11	☐ Sulphate, SO_4	[G]	113
☐ Calcium, Ca	[311C]	131	☐ Nitrate, NO_3	[418A]	<1
☐ Magnesium, Mg	[303C]	59	☐ Bicarbonate, HCO_3	[403]	567
☐ Total Hardness (as $CaCO_3$)	[314B]	534	☐ Carbonate, CO_3	[403]	
☐ Total Alkalinity (as $CaCO_3$)	[403]	465	☐ Fluoride, F	[413B]	0.6
☒ Iron, (total) Fe	[303A]	0.4	☐ NaCl (calc. from chloride)		102
☐ Silica, SiO_2	[425D]	29			

ANALYSIS — ADDITIONAL (mg L^{-1})

☐ Copper, Cu	[304] [303A]		☐ Lead, Pb	[303A] [304]		☐ Arsenic, As	[303E]	
☐ Manganese, Mn	[303A] [304]		☐ Zinc, Zn	[304] [303A]		☐ Cadmium, Cd	[303A] [304]	
☐ Selenium	[303E]		☐			☐		

This report relates specifically to the "sample tested as received".

The test methods used (denoted within brackets) refer to the 16th edition of "Standard Methods for the examination of Water and Wastewater", A.P.H.A. Except [G] which refers to the method of R. Goguel, Anal.Chem. 1969, 41. 1034.

DATE: 19 NOV 1991

CHECKED: J. McMahony

SIGNATORY: E. Gomes

Boxes marked thus indicate:

☐ Levels are within the limits as quoted in the "Guidelines for Drinking Water Quality in Australia", 1987 N.H. & M.R.C. and the A.W.R.C.

☒ Levels exceed non-health related limits.

⊠ Levels exceed health related limits.

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POWER AND WATER AUTHORITY

WATER RESOURCES DIVISION

TEST REPORT — BORE RN. 27848

Bore Location: BROADMERE.
Map: OT DOWNS. 1:100,000. Sheet 5964.
Grid Reference: 193 - 497.

Client : ROADS DEPT.
Purpose : CONSTRUCTION.

****

RECOMMENDATION.

Pumping Rate: 13 L/s. Pump Setting: 90 m. below Ground Level. General recommendations are given on the reverse side. The aquifer and bore can sustain higher pumping rates with deeper pump settings or for short periods in favourable seasons. Further advice can be obtained from: Water Resources.
(In all correspondence please refer to bores RN number) Sasco House,
DARWIN NT.

****

BORE DATA.

Finished depth: 101.5 m. Completion Date: 21/10/91. Test Date: 7/11/91.
Standing Water Level: 77.8 m. on 3.10.91. Test Rate: 13 L/s.
Construction details: Test Duration: 6 hrs.

Interval.	Description.
0 - 6.50 m.	203 mm. ID. steel casing.
0 - 78.80 m.	152 mm. ID. steel casing.
78.80 - 84.90 m.	152 mm. ID. steel slotted casing.
84.90 - 91.00 m.	152 mm. ID. steel casing.
91.00 -101.50 m.	OPEN HOLE.

Notes: 1. Top of casing as constructed was 0.65 m. above ground.
2. All depths are measured from natural ground level.
3. Test rates are not indicative of safe long term pumping rates.

WARNING: MINIMUM INTERNAL BORE DIAMETER IS 152 mm.

****

COMMENTS.

1. The above recommendations are based on a multi-rate test to 13 L/s., a constant rate test at 13 L/s. for 6 hrs. and assume hydrological conditions remain constant.

2. Provision to monitor water levels and obtain water samples should be incorporated when equipping this bore.

3. This bore is located in a drain 20 m. off the road and may be subject to flooding.

****

WATER ANALYSIS. See water laboratory report Analysis No. 91/92/0649.

Prepared by: P. REES TO.1
18/11/91.

Checked by: R. SANDERS.
30/7/92.

boredata

BROADMERE RN 27848.
JOB No. RMD 8089.

LOCATION.

O.T. DOWNS. 1:100,000. SHEET 5964. GRID REF. 193 - 497.
RN 27848 is a Roads bore on the Carpentaria Highway, 209 km. from the Stuart Highway.
The bore is on the southern side of the highway, 3 km. west of the Broadmere Station turnoff.

SUMMARY.

CAG. = 0.65 m.
SWL. = 77.80 m. GL.
T.D. = 99.95 m. GL.
P.S. = 90.50 m. GL.
A.D. = 12.70 m.

STEP TEST. - 7/11/91.

1st Step @ 6.50 L/s., d/d. @ 100 mins. = 0.25 m.
2nd Step @ 9.00 L/s., d/d. @ 100 mins. = 0.43 m.
3rd Step @ 13.17 L/s., d/d. @ 100 mins. = 0.75 m.

CONSTANT RATE. -7/11/91.

The 3rd step was extended to 320 mins. d/d. = 0.77 m.
TEMP. = 35°C.
Ph. = 6.64.
COND. = 1158.

RECOVERY. - 0.09 m. in 70mins.

COMMENTS.

1. All measurements are taken from G.L.
2. The bore pumped clean & clear for most of the test. The discharge was slightly hazy with a small amount of fine sand at the start of each step.
3. Tech. note book no. 2193.

P.REES TO.1
18/11/91.

...PAPERS ... CHRISTCHURCH N.Z. ... E33TY Log-log 3 cycles x 3 cycles

$dd = \frac{15 \times 4 \times Q}{T_{av}}$

$= \frac{15.8 \times 4 \times 8}{2856}$ $= \frac{15.8 \times 4 \times 13.17}{2856}$ $= \frac{15.8 \times 4 \times 20}{2856}$ $= \frac{15.8 \times 4 \times 30}{2856}$

$= 0.18$ $= 0.29$ 0.44 0.66

Av. T = 2856 m²/DAY

Q	10^2	10^4	10^6
8	0.34	0.18	0.52
13.17	0.75	0.29	1.04
20	1.42	0.44	1.86
30	2.7	0.66	3.36

100

AVAILABLE 12.7 M

10 10

DRAWDOWN IN METRES

30

20

13.17 L/S

9 L/S

8 L/S

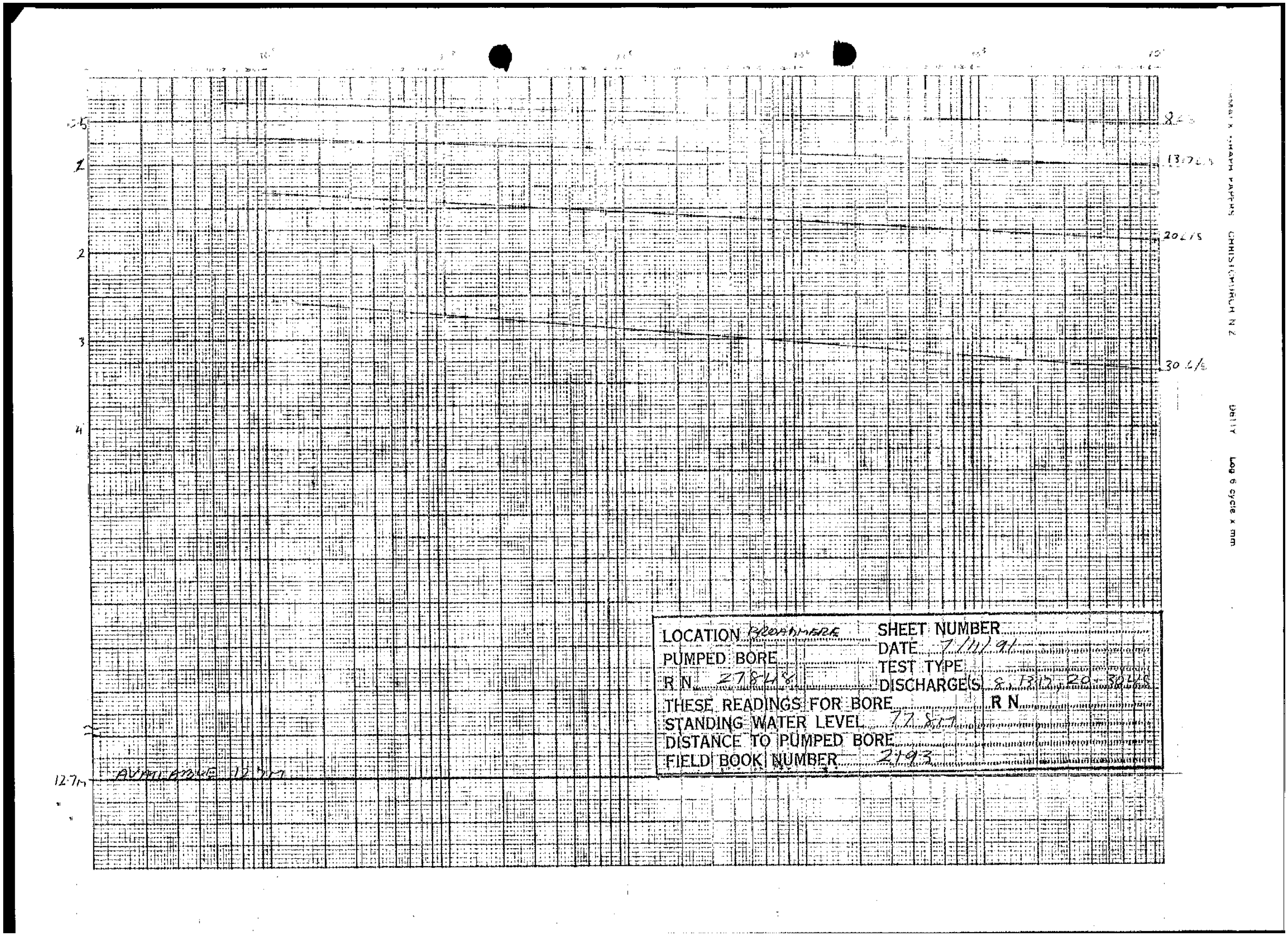
6.5 L/S

LOCATION BROADMEADOW
PUMPED BORE
R N 27848
THESE READINGS FOR BORE R N
STANDING WATER LEVEL 7.78 m
DISTANCE TO PUMPED BORE
FIELD BOOK NUMBER 2193

SHEET NUMBER
DATE 7/11/91
TEST TYPE STEP
DISCHARGE(S) 6.5, 8 & 13.17 L/s

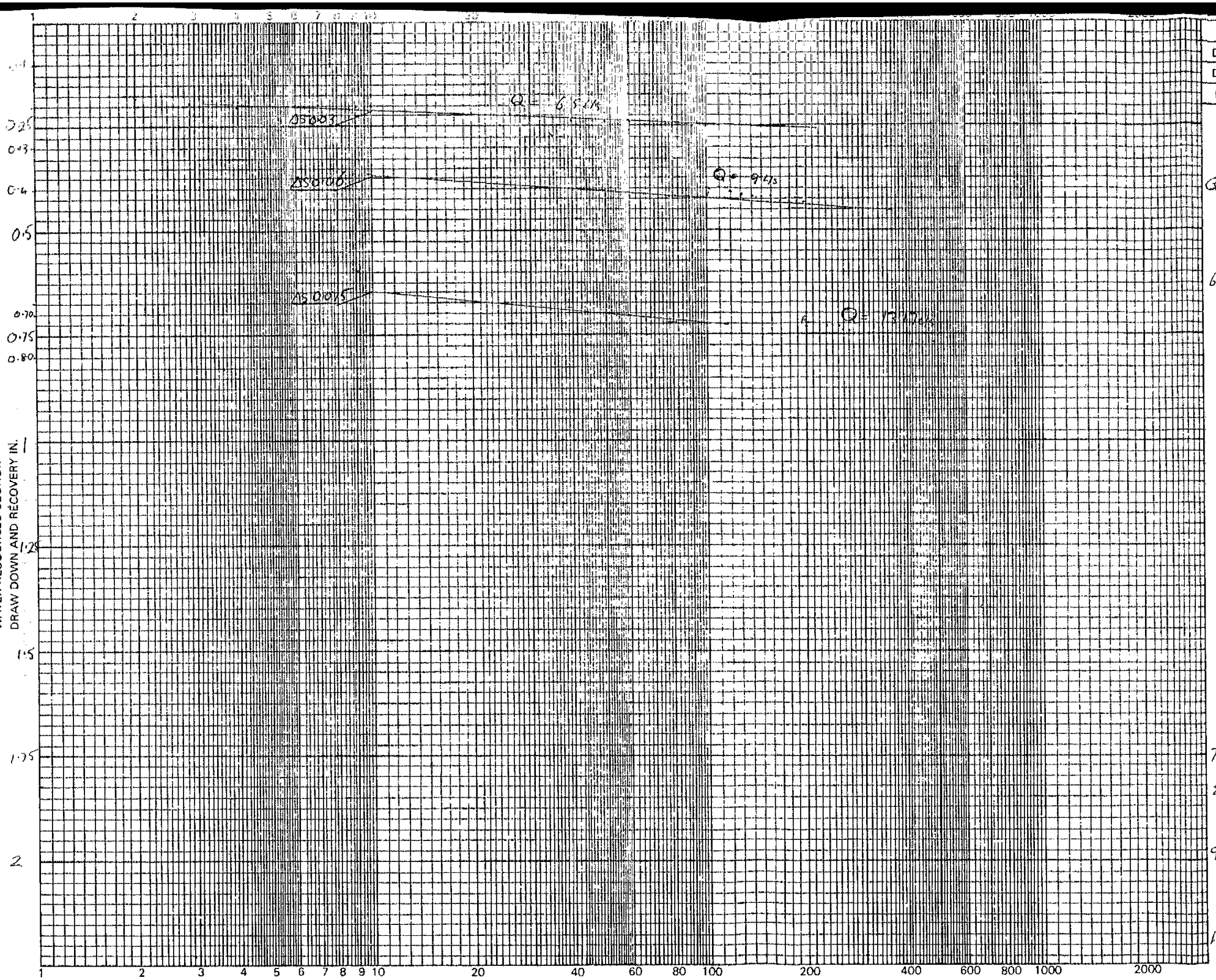
1 L/S 10 L/S

DISCHARGE IN L/S



WR 15-1

NORTHERN TERRITORY GOVERNMENT
WATER RESOURCES SECTION
DRAW DOWN AND RECOVERY IN.



BORE DATA

DRILLED BY GORMLY COLE DRILLERS.

DATE DRILLED 24/10/91

DEPTH	CASING	STRATA
GL	203mm ID STEEL	
6·5m		
		152MM ID STEEL
78·8	152MM ID SLOTTED STEEL	
84·9		
91·0	OPEN HOLE	
101·5		

DEPTH STRUCK: 78·8-84·9

AQUIFER THICKNESS: 6M

WATER TEMP: 35°

SWL 77·8M

$T = \frac{1.58 \times Q}{\Delta S}$

$T_1 = \frac{1.58 \times 6.5}{0.03}$
$= 342.33 \text{ m}^3/\text{DAY}$

$T_2 = \frac{1.58 \times 9}{0.06}$
$= 237.0 \text{ m}^3/\text{DAY}$

$T_3 = \frac{1.58 \times 13.17}{0.075}$
$= 277.45 \text{ m}^3/\text{DAY}$

$T_{AV} = 285.6 \text{ m}^3/\text{DAY}$

NAME OF BORE: BROADMERE	PUMPING TEST No.
LOCATION: 209 CHAINAGE CAMPBELL TRACK H/WAY OTTDOWNS 519150 - 8150300	ACTUAL TIME OF TEST 0731 — 1610 Hrs.
REG No: 27848	DATE OF TEST 7/11/91
INDEX No.	DURATION OF TEST: 520 MINUTES.
STANDING WATER LEVEL: 77·8M	FINAL PUMPING RATE: 13·17 L/S
TOTAL DEPTH OF BORE: 99·95M	FINAL DRAW DOWN 0·77M
MEASURING POINT: 0·74M	RECOVERY TIME (DURATION): BACK TO 0·09M IN 70 MINS.
DIAMETER OF BORE: 156mm ID.	REMARK: FIELD BOOK N° 2193
TOTAL CASING IN BORE: 91M.	

O.I.C. P. REES 21-10-91

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WR 9/1 **DRILLERS LOG** **Power and Water Authority**

DATE 23·10·91 BORE No. RW 27848

Supervisor: Despic

Driller: S Richards

Time	Depth	Metres drilled	Mins lapsed	Drillers remark, casing details	BIT DATA No.	Size	Type	Worn cond'n	STRING DATA Item	O.D.	Length	Prog. tally	MUD DATA	WATER SAMPLES No.	Depth
11·00				ESTABLISH Rig on Site 115 KM			SEALED		ROAD						
1130				Drill 6m 250mm											
1200				RUN 6.5m 219mm Casing CEMENT ANNULUS 4 BAGS CEMENT 30 min WAITING											
				0-3 Blackseal											
1245				3.53 Clays				⊕	HAM						
									IX			4.9			
				53 - 58.8 SANDSTONE				①	DP	4½	6.1	11.0			
								②	DP	4½	6.1	17.1			
				58.8 - 70.0 DOLOMITIC SANDSTONE				③	DP	4½	6.1	23.2			
								④	DP	4½	6.1	29.3			
				70.0 - 101.5 NO RETURNS				⑤	DP	4½	6.1	35.4			
								⑥	DP	4½	6.1	41.5			
								⑦	DP	4½	6.1	47.6			
								⑧	DP	4½	6.1	53.7			
15·00	58·8							⑨	DP	4½	6.1	59.8			
				NO CIRCULATION				⑩	DP	4½	6.1	65.9			
								⑪	DP	4½	6.1	72.0			
				CONSTRUCT - SUSPENDED 168.3mm at 91 MTRS				⑫	DP	4½	6.1	78.1			
								⑬	DP	4½	6.1	84.2			
				SLOTTED - 78.8 to 84.9 mtrs				⑭	DP	4½	6.1	90.3			
				A/L (DRY) AT VARIOUS DEPTHS 1.5 HR WORKTIME				⑮	DP	4½	6.1	96.4			
								⑯	DP	4½	6.1	102.5			

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CARPENTARIA HIGHWAY – 208 Kms east of Stuart Highway – south of road

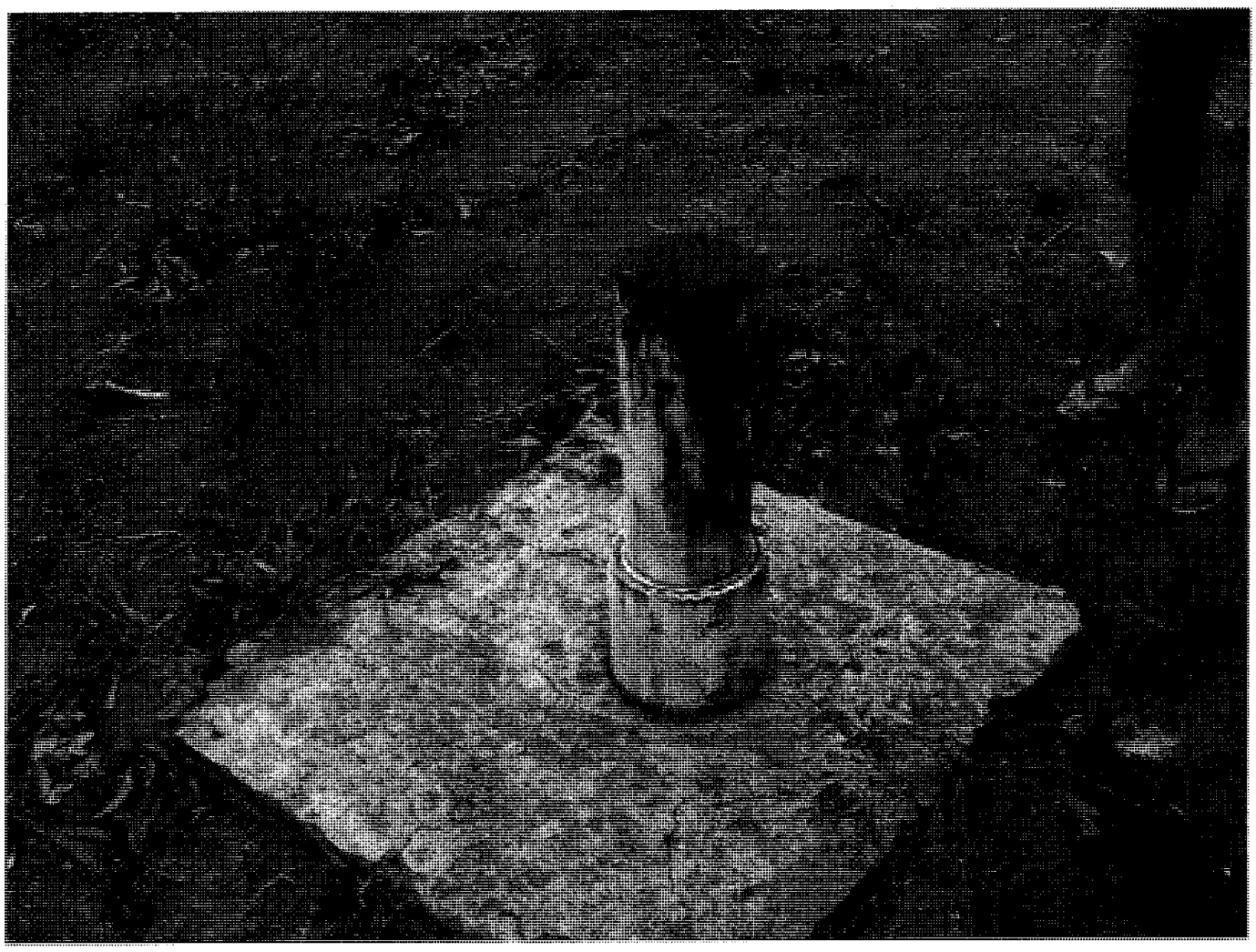
RN 27848 – Drilled 24.10.91 – 101.5 m – no circulation

CAG = 0.65 m
SWL = 77.30 m
TD = 99.63 m – un capped

Tested 18.11.91 – 13 L/s – pump setting 90 metres

Bore may be capable of higher yields

53K 0519331
8149900 – WGS 84



Bore Location: BROADMERE. Client : ROADS DEPT.
Map: OT DOWNS. 1:100,000. Sheet 5964. Purpose : CONSTRUCTION.
Grid Reference: 193 - 497.

**********RECOMMENDATION.

Pumping Rate: **13 L/s.** Pump Setting: **90 m.** below Ground Level. General recommendations are given on the reverse side. The aquifer and bore **can** sustain higher pumping rates with deeper pump settings or for short periods in favourable seasons. Further advice can be obtained from: Water Resources.
(In all correspondence please refer to bores RN number) Sasco House,
DARWIN NT.

****

BORE DATA.

Finished depth: **101.5 m.** Completion Date: 21/10/91. Test Date: 7/11/91.
Standing Water Level: **77.8 m.** on 3.10.91. Test Rate: **13 L/s.**
Construction details: Test Duration: **6 hrs.**

Interval.	Description.
0 - 6.50 m.	203 mm. ID. steel casing.
0 - 78.80 m.	152 mm. ID. steel casing.
78.80 - 84.90 m.	152 mm. ID. steel slotted casing.
84.90 - 91.00 m.	152 mm. ID. steel casing.
91.00 -101.50 m.	OPEN HOLE.

Notes: 1. Top of casing as constructed was 0.65 m. above ground.
2. All depths are measured from natural ground level.
3. Test rates are not indicative of safe long term pumping rates.

WARNING: MINIMUM INTERNAL BORE DIAMETER IS 152 mm.

****

COMMENTS.

1. The above recommendations are based on a multi-rate test to 13 L/s., a constant rate test at 13 L/s. for 6 hrs. and assume hydrological conditions remain constant.

2. Provision to monitor water levels and obtain water samples should be incorporated when equipping this bore.

3. This bore is located in a drain 20 m. off the road and may be subject to flooding.

****

WATER ANALYSIS. See water laboratory report Analysis No. 91/92/0649.

Prepared by: P. REES TO.1 Checked by: R. SANDERS.
18/11/91. 30/7/92.

BROADMERE RN 27848.
JOB No. RMD 8089.

LOCATION.

O.T. DOWNS. 1:100,000. SHEET 5964. GRID REF. 193 - 497.
RN 27848 is a Roads bore on the Carpentaria Highway, 209 km. from the Stuart Highway.
The bore is on the southern side of the highway, 3 km. west of the Broadmere Station turnoff.

SUMMARY.

CAG. = 0.65 m.
SWL. = 77.80 m. GL.
T.D. = 99.95 m. GL.
P.S. = 90.50 m. GL.
A.D. = 12.70 m.

STEP TEST. - 7/11/91.

1st Step @ 6.50 L/s., d/d. @ 100 mins. = 0.25 m.
2nd Step @ 9.00 L/s., d/d. @ 100 mins. = 0.43 m.
3rd Step @ 13.17 L/s., d/d. @ 100 mins. = 0.75 m.

CONSTANT RATE. -7/11/91.

The 3rd step was extended to 320 mins. d/d. = 0.77 m.
TEMP. = 35^C.
Ph. = 6.64.
COND. = 1158.

RECOVERY. - 0.09 m. in 70mins.

COMMENTS.

1. All measurements are taken from G.L.

2. The bore pumped clean & clear for most of the test. The discharge was slightly hazy with a small amount of fine sand at the start of each step.

3. Tech. note book no. 2193.

P.REES TO.1
18/11/91.

2193

BORE NAME BROADMERE

Registered Number 27848

Index Number

Location 209hc CARPENTARIA H/WAY

Total Depth 99.95M

Depth Water Struck

Estimated Supply — NONE OBTAINED BY AIRLIFT.

Aquifer Material

MAP O.T. DOWNS 1:100,000 SHEET 5964
GRID REF. 519150 - 8150300

Construction details casing screens, etc.

Interval	Size and description
0 - 6.5 M	203MM STEEL. 1b
0 - 78.8 M	156MM STEEL 1b
78.8 - 84.9M	156MM ID STEEL SLOTTED
84.9 - 91 M	156MM ID STEEL

Distance to production bore

Bore name	Distance

Pump test crew

P REES
M MOLINA
W ARCHARD

Pump type MONO 1 640 MONO 2 20

Powered by 3 CYL LISTER UNIT 33

Pump setting 90.35M 90.25M

Method measuring pump discharge DISCHARGE PIPE ORIFICE PLATES

List any other equipment used

14 x 6.15M x 80MM MONO COLUMN
1 x 2.15M x " " "
1 x 0.6M
15MM CLASS 15 PVC x 15' LENGTHS
3MM S/S WIRE. x 100M

Comments

6/11 TD 99.95M
8/11 TD 99.75M
6/11 SWL 77.8M
8/11 SWL 77.78M
CAG 0.65M
MP 0.74M
RUN 640 NO APPRECIABLE DD.
TRIP OUT RUN 820

INDEX

Pumped Bore: 27848 OBS Bore:

Standing Water Level: 7.78m

Available Drawdown: 12.7m

Time Started: 1351 Date: 6/11/91

Time Stopped: 1415 Date: 6/11/91 01

Test Type: PRELIM STEP Step No.: 1

Time C.S.T.	Time (min)	D/Down (m)	PZh (cm)	Orifice Plate Size	Q (l/S)	Water Sample Bot. No.	Water Sample Temp. (°C)		Comments			
	1	0.08	10	50	2.2				640MONO			
	2	0.09										
	3	0.07										
	4	0.07	DISCHARGE	STARTED					DIRTY RUST COLOUR			
	5	0.06										
	6	0.06							HAZY SMALL AMT FINES			
	7	0.06										
	8	0.06										
	9	0.06							CLEARING FEW FINES			
	10	0.06										
	12	0.06										
	15	0.06										
	20	0.06							CLEAN + CLEAR			
	25	0.06							C + C			

Pumped Bore: 27848 OBS Bore:

Standing Water Level: 77.8m

Available Drawdown: 12.7m

Time Started: 1641 Date: 6/11/91

Time Stopped: 1700 Date: 6/11/91 02

Test Type: PRELIM STEP Step No.:

Time C.S.T.	Time (min)	D/Down (m)	PZh (cm)	Orifice Plate Size	Q (l/S)	Water Sample Bot. No.	Water Sample Temp. (°C)		Comments			
1641	1	0.21	13	80	7.08				$20 MONO			
2	2	0.22							HAZY SOME FINES			
	3	0.21										
	4	0.22										
	5	0.21							SLIGHT HAZY VSB FINES			
	6	0.21										
	7	0.22							CLEARING			
	8	0.22										
	9	0.21							CLEAR VSB FINES			
1650	10	0.22										
	12	0.23										
	15	0.22										
							34.9°		PH 6.56 COND	1150		
1700	20	0.23							CLEAN + CLEAR			

Pumped Bore: 27848 OBS Bore:

Standing Water Level: 77.8M

Available Drawdown: 12.7M

Time Started: 1700 Date: 6/11/91

Time Stopped: 1720 Date: 6/11/91 03

Test Type: PRELIM STEP Step No.: 2

Time C.S.T.	Time (min)	D/Down (m)	PZh (cm)	Orifice Plate Size	Q (l/S)	Water Sample Bot. No.	Water Sample Temp. (°C)	Comments
1701	1	0.36	21	80	9			
	2	0.37						SLIGHT HAZY USED FINES
	3	0.37						
	4	0.37						CLEARING
	5	0.37						
	6	0.37						CLEAR + CLEAR
	7	0.37						
	8	0.37						CLEAR + CLEAR
	9	0.37						
1710	10	0.37					35°	PH 6.60 COND 1096
	12	0.37						
	15	0.38						
1720	20	0.38						CHC

Pumped Bore: 27848 OBS Bore:

Standing Water Level: 77.8m

Available Drawdown: 12.7m

Time C.S.T.	Time (min)	D/Down (m)	PZh (cm)	Oriface Plate Size	Q (l/S)	Water Sample Bot. No.
1721	1	0.65	26	80	10	
	2	"				
	3	"				
	4	"				
	5	"				
	6	"				
	7	"				
	8	"				
	9	"				
1730	10	"				
	12	"				
	15	"				
1740	20	"				
		RECOVERY				
		< 1 MINUTE				

Time Started: 1720 Date: 6/11/91

Time Stopped: 1740 Date: 6/11/91 04

Test Type: PRELIM STEP Step No.: 4

Water Sample Temp. (°C)		Comments			
		CHC			
		CHC			
34.9°	PH	6.66 COND	1104		
		CHC			
		CHC			
34.9°	PH	6.60 COND	1190		

Pumped Bore: 27848 OBS Bore:

Standing Water Level: 77.8M

Available Drawdown: 12.7M

Time Started: 0730 Date: 7/11/91

Time Stopped: 0910 Date: 7/11/91 05

Test Type: STEP Step No.: 1

Time C.S.T.	Time (min)	D/Down (m)	PZh (cm)	Orifice Plate Size	Q (l/S)	Water Sample Bot. No.	Water Sample Temp. (°C)		Comments			
0731	1	0.14	11	80	6.5							
	2	0.18						SLIGHTLY HAZY				
	3	0.19										
	4	0.20						CLEARING				
	5	0.20										
	6	0.20						C+C				
	7	0.20										
	8	0.20										
	9	0.20						C+C				
0740	10	0.20										
	12	0.20										
	15	0.20					35°	PH	6.62	COND	1160	
	20	0.21										
	25	0.22						C+C				
0800	30	0.23										
	35	0.23										
	40	0.24										
	50	0.24										
0830	60	0.24					34.9°	PH	6.66	COND	1093	
	70	0.25										
	80	0.25										
0900	90	0.25						C+C				
0910	100	0.25					34.9°	PH	6.64	COND	1133	

Pumped Bore: 27848 OBS Bore:

Standing Water Level: 77.8m

Available Drawdown: 12.7m

Time C.S.T.	Time (min)	D/Down (m)	PZh (cm)	Orifice Plate Size	Q (l/S)	Water Sample Bot. No.
0911	1	0.42	21	80	9	
	2	0.40				
	3	0.40				
	4	0.40				
	5	0.40				
	6	0.40				
	7	0.40				
	8	0.40				
	9	0.40				
	10	0.40				
	12	0.40				
	15	0.40				
0930	20	0.41				
	25	0.42				
	30	0.42				
	35	0.42				
	40	0.42				
1000	50	0.42				
	60	0.42				
	70	0.43				
1010	80	0.43				
	90	0.43				
1050	100	0.43				

Time Started: 0910 Date: 7/11/91

Time Stopped: 1050 Date: 7/11/91 06

Test Type: STEP Step No.: 2

Water Sample Temp. (°C)		Comments			
		CLEARING + CLEARER			
34.9°	PH	6.61	COND	1163	
	C+C				
	C+C				
34.9°	PH	6.60	COND	1159	
	C+C				
	C+C				
34.9	PH	6.59	COND	1160	
	C+C				
34.9°	PH	6.59	COND	1162	

Pumped Bore: 27848 OBS Bore:

Standing Water Level: 77.8m

Available Drawdown: 12.7m

Time Started: 1050 Date: 7/11/91

Time Stopped: 1620 Date: 7/11/91

Test Type: STEP EXTENDED Step No.: 3

Time C.S.T.	Time (min)	D/Down (m)	PZh (cm)	Orifice Plate Size	Q (l/S)	Water Sample Bot. No.	Water Sample Temp. (°C)		Comments			
1051	1	0.73	45	80	13.17							
	2	0.72							SLIGHT HAZY			
	3	0.72										
	4	0.72							CLEARING			
	5	0.72										
	6	0.72							C+C			
	7	0.72										
	8	0.72					35°	PH	6.62	COND	1103	
	9	0.72										
1100	10	0.72							C+C			
	12	0.72										
	15	0.73					35°	PH	660	COND	1101	
	20	0.72							C+C			
	25	0.73										
	30	0.73							C+C			
	35	0.73					35°	PH	664	COND	1132	
1130	40	0.73										
	50	0.73										
	60	0.74					35°	PH	662	COND	1167	
1200	70	0.74										
	80	0.74										
	90	0.75					35°	PH	667	COND	1162	
1230	100	0.75										
	120	0.75										
1310	140	0.76										
1330	160	0.77										
	180	0.76										
1410	200	0.77										

Pumped Bore: 27848 OBS Bore:

Standing Water Level: 77.8m

Available Drawdown: 12.7m

Time C.S.T.	Time (min)	D/Down (m)	PZh (cm)	Oriface Plate Size	Q (l/S)	Water Sample Bot. No
1440	230	0.77	45	80	13.17	
1510	260	0.77				
1540	290	0.77				
1610	320	0.77				A559

Time Started: 1150 Date: 7/11/91

Time Stopped: 1620 Date: 7/11/91 08

Test Type: EXTENDED STEP Step No.: 3

Water Sample Temp. (°C)		Comments			
	C+C				
35°	PH	665	COND	1078	
35°	PH	664	COND	1158	

Pumped Bore: 27848 OBS Bore:

Standing Water Level: 57.8m

Available Drawdown: 12.7m

Time Started: 1610 Date: 7/11/91

Time Stopped: 1720 Date: 7/11/91 09

Test Type: RECOVERY Step No.:

Time C.S.T.	Time (min)	D/Down (m)	PZh (cm)	Orifice Plate Size	Q (l/S)	Water Sample Bot. No.	Water Sample Temp. (°C)		Comments			
1611	1	0.14										
	2	0.13										
	3	0.11										
	4	0.11										
	5	0.11										
	6	0.11										
	7	0.10										
	8	0.10										
	9	0.10										
	10	0.10										
	12	0.10										
	15	0.10										
1630	20	0.10										
	30	0.16										
	40	0.10										
1700	50	0.10										
	60	0.09										
1720	70	0.09										
	240	0.06										

Regulation 8

THE NORTHERN TERRITORY OF AUSTRALIA

Control of Waters Act

1·N. 56/103 WR413

FINAL STATEMENT OF BORE R.N. 27,945

From	To	Description of Strata (including colour and hardness)
0	3	BLACKSOIL
	15	CLAYS
	58·8	LIMESTONE

Location of Bore (or supply sketch on the back hereof) —

..... km

[ ] S SE of (b) DUPNCATE No 6
[ ] E NW
[ ] W SW .....

(a) Circle appropriate direction.
(b) Use known point such as existing bore, homestead, outstation, etc

Additional information of interest about bore. PUMP 4 HS

and Reference 520940 – 8164700 FROM 40m.

Map Number 1·100,000 SHEET 5964 'OT DOWNS'

ZONE 53
S/B 905

Samples of Strata and Water Supplies

have been / ~~will be~~

left at the following place —

..... Craig Aldfield
Signature

delete non applicable

Office use only — Plotted 10/12/91

G. L. DURRELL, Government Printer of the Northern Territory

Name of Bore —
R.N. 27945

Name of Property —
BALBIRINI PL 1021

Description of Property —
PASTORAL LEASE

Name of Owner —
M. HOLT

Name of Contractor —
GOREY & CONE DRILLERS

Name of Driller —
S. RICHARDS

Date of Commencement —
6.10.91

Date of Completion —
6.10.91

Total Depth —
58.8M

Particulars of Casing — 6.5M OF 219MM STEEL
59.3M OF 168MM STEEL

Particulars of Perforations or Screens —
PERFS BETWEEN 46.3 AND 57.8

Water	1st Supply units	2nd Supply units	3rd Supply units
Struck at	47m	52m	
Standing Water Level	28		
Pumping Supply Litres/sec	0.5HS	1.4 HS	
Duration of Pump Test	1 HOUR	AIR LIFT	
Water Level During Test			
Quality: Good, Fair or Bad	GOOD.		

RN027945

N.T.A. 181

THE NORTHERN TERRITORY OF AUSTRALIA

Regulation 8.

Control of Waters Ordinance

RN007699

1N 2nd 56/21

FINAL STATEMENT OF BORE

From	To	Description of Strata
0	10	CLAY
10	30	SANDY CLAY
30	40	CHERT, LIMESTONE
40	60	CHERT, CLAY, LIMESTONE
60	235	NO RETURNS OF CUTTINGS - CAVES ALL THE WAY .

Location of Bore (or supply sketch on back hereof)—

.....Miles

(*a*) N NE / S SE / E NW / W SW of (*b*) .....

.....

(*a*) Circle appropriate direction.
(*b*) Use known point such as existing bore, homestead, outstation, etc.

Additional information of interest about the bore—

BORE DRILLED BY T3 DRILLMASTER

Samples of strata and water supplies ~~have been~~ will be* left at the following trading place—

WRB ALICE SPRINGS

Signature

*Strike out which does not apply.

For office use only—

Name of Bore—
GC2-71

Name of Property—
BALBARINI STATION

Description of Property—
PASTORAL

Name of Owner—
L.R.M. PASTORAL TRADING CO.

Name of Contractor—
GOREY & COLE DRILLERS

Name of Driller—
OTTO LOZERIS

Date of Commencement—
9.6.71

Date of Completion—
9.6.71

Total Depth—
235 FEET

Particulars of Casing—
236 FEET OF 6" DIAMETER

Particulars of Perforations or Screens—
20' OF OXY PERFS ON BOTTOM

Water	1st Supply	2nd Supply	3rd Supply
Struck at	NO RETURNS	60'	235'
Standing Water Level	120'		
Pumping Supply : G.P.H.	2,400 G.P.H. AIRLIFT		
Duration of Pump Test	4 HOURS		
Water Level During Test	-		
Quality : Good, Fair or Bad	GOOD		

Rofa

N.T.A. 181

THE NORTHERN TERRITORY OF AUSTRALIA

Control of Waters Ordinance

RNC07696

Regulation 8.

FINAL STATEMENT OF BORE

12 56/18

From	To	Description of Strata
0	10	SANDY CLAY, LATERITE
10	60	CLAY
60	65	CLAY, LIMESTONE, SANDSTONE
65	110	SILTY CLAY, LIMESTONE
110	135	CLAY, LIMESTONE
135	160	SANDSTONE, LIMESTONE, QUARTZ
160	235	SANDSTONE, LIMESTONE, QUARTZ
235	240	LIMESTONE, SILTSTONE, SOAPSTONE
240	285	LIMESTONE, SOAPSTONE, SANDSTONE, SLATE
285	300	SOAPSTONE, SANDSTONE

Location of Bore (or supply sketch on back hereof)—

.....Miles

(*a*) N NE S SE E NW W SW of (*b*) .....

.....

(*a*) Circle appropriate direction.
(*b*) Use known point such as existing bore, homestead, outstation, etc.

Additional information of interest about the bore—

BORE DRILLED BY T3 DRILLMASTER

Samples of strata and water supplies ~~have been~~ will be* left at the following trading place—

WRB ALICE SPRINGS

.....
Signature

*Strike out which does not apply.

For office use only—

Name of Bore—
GOS-71

Name of Property—
BALBARINI STATION

Description of Property—
PASTORAL

Name of Owner—
L.R.M. PASTORAL TRADING CO.

Name of Contractor—
GOREY & COLE DRILLERS

Name of Driller—
OTTO LOZERIS

Date of Commencement—
13.6.71

Date of Completion—
14.6.71

Total Depth—
300 FEET

Particulars of Casing—
50 FEET OF 5" DIAMETER
240 FEET OF 6" DIAMETER

Particulars of Perforations or Screens—
20' OF OXY PERFS ON BOTTOM

Water	1st Supply	2nd Supply	3rd Supply
Struck at	160'	200'	285'
Standing Water Level			30'48 100'
Pumping Supply : G.P.H.			6,000 GALS.
Duration of Pump Test			4 HOURS
Water Level During Test			–
Quality : Good, Fair or Bad			GOOD

Rota

N.T.A. 152

NORTHERN TERRITORY ADMINISTRATION—WATER RESOURCES BRANCH

WATER ANALYSIS

Sample No. 71/0609 Date received in Laboratory 30.7.71

Time and date of sampling –

Location and details Balbarini G.C.5/71 R.N.7696

300ft (no advice) 1N 56/18

Analysis in parts per million— p.p.m. (unless otherwise stated)—

Appearance		Taste and odour	
Conductivity (Micromhos/cm²) at 25°C	1210	pH	7.9
Total dissolved solids	750	Hardness, total	484
Suspended solids		Hardness, temporary	406
Total solids		Hardness, permanent	78

Anions—		Cations—	
Chloride	93	Sodium	76
Sulphate	150	Potassium	8
Nitrate	1	Calcium	74
Nitrite		Magnesium	73
Carbonate		Ammoniacal nitrogen	
Bicarbonate	495	Iron	2.4
Fluoride	1.0	Aluminium	
Silica	18	Selenium	
Boron		Arsenic	
Alkalinity	406	Copper	
Turbidity		Lead	
Phosphate	<1	Manganese	

Analysed by Miep Dobbe

Date 1.9.71

REMARKS: Excessive iron, otherwise the sample as tested is chemically suitable for human consumption according to World Health Organisation Drinking Water Standards.

BORE DATA SHEET

RESIDENT GEOLOGIST'S OFFICE

DARWIN N.T.

LOCATION

Photo.....

Run.....

.....ins. N. .....ins. E. from S.W. Corner

4 MILE BAUHINIA DOWNS

LEASE.....

BORE No. RN-7696

NAME OF BORE..... CLASS OF BORE.....

SITED BY..... DATE.....

ELEVATION.....

SITUATION.....miles.....

DESCRIPTION OF SITE.....

DRILLING RESULTS

Drilled by.....

Date Drilled.....to.....

Total Depth.....

Standing W. Level.....

Pump Level.....

.....

WATER

	Struck at	Supply (g.p.h.)	Quality
1			
2			
3			

Present Supply.....g.p.h. Date.....

Casing Diameter .....ins from.....to.....Slotted } from.....

.....to.....Perforated

Screened } to.....

LOG OF BORE

from	to	~~Drilling~~	Geological Comment
0	10	Red Ferruginous Laterite	
10	30	Clay - gray, fine grained, plastic.	
30	60	Sandy Clay - gray, fine, clay having medium grained well rounded qtz sand grains.	
60	80	Silt, gray & khaki, fine grained, micaceous, with pieces of chett.	
80	150	Calcareous Siltstone - gray & yellowish gray, coarse grained soft, micaceous, dolomitic with occasional pieces of chert.	
150	180	Calcareous Sandstone - yellow, buff & gray, fine grained, soft, with qtz, calcite and dolomite, some interbeds of limestone.	
180	250	Limestone, gray, fine, hard, massive, with fine plastic clay and chert.	
250	300	Clay - gray, fine, plastic clay with some limestone as above.	

GEOLOGY 0 - 30 Cainozoic

30 - 300 Cambrian ?

Remarks Good water supply.

Location of bore hole not known, stratigraphic position of rock units difficult to determine. MASOOD AHMAD 18-5-72.

APPENDIX B

Laboratory Results and QA/QC Documentation

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1911589**	Page	: 1 of 7
Client	: **FOX & CO ENVIRONMENTAL**	Laboratory	: Environmental Division Sydney
Contact	: MR PAUL FOX	Contact	: Customer Services ES
Address	: 5 GOULDIAN COURT PEREGIAN BEACH 4573	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 16-Apr-2019 09:00
Order number	:	Date Analysis Commenced	: 16-Apr-2019
C-O-C number	: ----	Issue Date	: 30-Apr-2019 14:33
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 6		
No. of samples analysed	: 6		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Sarah Griffiths	Microbiologist	Sydney Microbiology, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

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

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

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

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

- MF = membrane filtration
- CFU = colony forming unit
- EG020: It is recognised that total concentration is less than dissolved for some analytes. However, the difference is within experimental variation of the methods.
- Microbiological Comment: The sample was received and tested out of holding time. It may be informative to record this fact.
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- MW006 is ALS's internal code and is equivalent to AS4276.7.
- MW007 is ALS's internal code and is equivalent to AS4276.5.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HWY-1	HB-1	RCB-1	5B-1	4B-1
				Client sampling date / time	09-Apr-2019 00:00	09-Apr-2019 00:00	09-Apr-2019 00:00	09-Apr-2019 00:00	10-Apr-2019 00:00
Compound	CAS Number	LOR	Unit		ES1911589-001	ES1911589-002	ES1911589-003	ES1911589-004	ES1911589-005
					Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		<5	<5	<5	17	23
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		528	495	439	537	576
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		403	391	390	408	447
Total Alkalinity as CaCO3	----	1	mg/L		403	391	390	408	447
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		171	74	3	123	92
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		58	50	9	60	55
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		124	114	100	126	120
Magnesium	7439-95-4	1	mg/L		53	51	46	54	67
Sodium	7440-23-5	1	mg/L		45	36	4	44	45
Potassium	7440-09-7	1	mg/L		8	8	3	8	8
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	0.002	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	1.53	<0.005	0.581	0.126
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	0.001
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	0.004	<0.001	0.004	0.020
Zinc	7440-66-6	0.005	mg/L		<0.005	1.58	<0.005	0.742	0.734
EG035F: Dissolved Mercury by FIMS									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HWY-1	HB-1	RCB-1	5B-1	4B-1
				Client sampling date / time	09-Apr-2019 00:00	09-Apr-2019 00:00	09-Apr-2019 00:00	09-Apr-2019 00:00	10-Apr-2019 00:00
Compound	CAS Number	LOR	Unit		ES1911589-001	ES1911589-002	ES1911589-003	ES1911589-004	ES1911589-005
					Result	Result	Result	Result	Result
EG035F: Dissolved Mercury by FIMS - Continued									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.11**	**0.05**	**0.13**	**0.03**	**0.05**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	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**	----	0.1	mg/L		**0.1**	<0.1	**0.1**	<0.1	<0.1
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**0.03**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**13.2**	**10.8**	**8.11**	**12.4**	**12.4**
Total Cations	----	0.01	meq/L		**12.7**	**11.6**	**9.03**	**12.8**	**13.7**
Ionic Balance	----	0.01	%		**2.07**	**3.98**	**5.36**	**1.76**	**4.86**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HWY-1	HB-1	RCB-1	5B-1	4B-1
				Client sampling date / time	09-Apr-2019 00:00	09-Apr-2019 00:00	09-Apr-2019 00:00	09-Apr-2019 00:00	10-Apr-2019 00:00
Compound	CAS Number	LOR	Unit		ES1911589-001	ES1911589-002	ES1911589-003	ES1911589-004	ES1911589-005
					Result	Result	Result	Result	Result
EP080: BTEXN - Continued									
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ **Total Xylenes**	----	2	µg/L		<2	<2	<2	<2	<2
^ **Sum of BTEX**	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**94.6**	**94.4**	**84.6**	**94.6**	**92.5**
Toluene-D8	2037-26-5	2	%		**103**	**101**	**86.1**	**101**	**99.3**
4-Bromofluorobenzene	460-00-4	2	%		**109**	**109**	**84.7**	**109**	**107**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**HH-1**	----	----	----	----
				Client sampling date / time	11-Apr-2019 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES1911589-006**	--------	--------	--------	--------
					Result	----	----	----	----
MW006: Faecal Coliforms & E.coli by MF									
Escherichia coli	----	1	CFU/100mL		**570**	----	----	----	----
MW007: Coliforms by MF									
Coliforms	----	1	CFU/100mL		**1700**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1911589**	Page	: 1 of 9
Client	: **FOX & CO ENVIRONMENTAL**	Laboratory	: Environmental Division Sydney
Contact	: MR PAUL FOX	Contact	: Customer Services ES
Address	: 5 GOULDIAN COURT PEREGIAN BEACH 4573	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 16-Apr-2019
Order number	:	Date Analysis Commenced	: 16-Apr-2019
C-O-C number	: ----	Issue Date	: 30-Apr-2019
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 6		
No. of samples analysed	: 6		

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

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Sarah Griffiths	Microbiologist	Sydney Microbiology, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 2300524)									
ES1911533-007	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	15	21	34.5	No Limit
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 2301280)									
ES1911593-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.00	No Limit
ES1911597-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	108	118	8.66	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2300033)									
ES1911549-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	49	50	2.43	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	49	50	2.43	0% - 20%
ES1911549-011	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	51	52	2.07	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	51	52	2.07	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 2300034)									
ES1911590-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	323	324	0.393	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	323	324	0.393	0% - 20%
ES1911637-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	401	399	0.485	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	401	399	0.485	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2300233)									
ES1911589-001	HWY-1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	171	144	17.3	0% - 20%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED045G: Chloride by Discrete Analyser (QC Lot: 2300232)									
ES1911589-001	HWY-1	ED045G: Chloride	16887-00-6	1	mg/L	58	62	7.51	0% - 20%
ES1911820-005	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	29	29	0.00	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2301128)									
ME1900500-004	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	19	19	0.00	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	12	11	0.00	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	16	16	0.00	0% - 50%
		ED093F: Potassium	7440-09-7	1	mg/L	10	10	0.00	No Limit
ES1911817-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	42	42	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	30	31	0.00	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	104	106	2.62	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	4	4	0.00	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2301127)									
ME1900500-004	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.004	0.005	27.4	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.004	0.001	115	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.009	0.009	0.00	No Limit
ES1911817-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.004	0.007	38.4	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.002	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.005	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 2305819)									
ES1912043-001	Anonymous	EG020A-T: Lead	7439-92-1	0.001	mg/L	<1 µg/L	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<5 µg/L	<0.005	0.00	No Limit
ES1912043-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.1 µg/L	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<1 µg/L	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	46 µg/L	0.047	0.00	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<1 µg/L	<0.001	0.00	No Limit
ES1912043-011	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.1 µg/L	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<1 µg/L	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<1 µg/L	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<1 µg/L	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<1 µg/L	<0.001	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 2305819) - continued									
ES1912043-011	Anonymous	EG020A-T: Zinc	7440-66-6	0.005	mg/L	<5 µg/L	<0.005	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 2308495)									
ES1911584-013	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
ES1911602-006	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0010	<0.0010	0.00	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.010	<0.010	0.00	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.010	<0.010	0.00	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.010	<0.010	0.00	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.010	<0.010	0.00	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.010	<0.010	0.00	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.050	<0.050	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2301129)									
ES1911589-002	HB-1	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
ME1900500-003	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2299697)									
ES1911475-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
ES1911590-002	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2301115)									
ES1911589-002	HB-1	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.05	0.05	0.00	No Limit
ES1911549-021	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2301119)									
ES1911549-021	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	<0.1	0.00	No Limit
ES1911589-003	RCB-1	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	<0.1	0.00	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2301118)									
ES1911549-021	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
ES1911589-003	RCB-1	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2309929)									
ES1911589-001	HWY-1	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit
ES1911648-020	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 2309929)									
ES1911589-001	HWY-1	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit
ES1911648-020	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit
EP080: BTEXN (QC Lot: 2309929)									

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP080: BTEXN (QC Lot: 2309929) - continued									
ES1911589-001	HWY-1	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit
ES1911648-020	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 2300524)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	110	83	129
				<5	1000 mg/L	97.8	82	110
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 2301280)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	97.0	83	129
				<5	1000 mg/L	88.6	82	110
ED037P: Alkalinity by PC Titrator (QCLot: 2300033)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	86.0	81	111
				----	50 mg/L	90.8	70	130
ED037P: Alkalinity by PC Titrator (QCLot: 2300034)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	87.5	81	111
				----	50 mg/L	90.4	70	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2300233)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	104	82	122
ED045G: Chloride by Discrete Analyser (QCLot: 2300232)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	105	81	127
				<1	1000 mg/L	102	81	127
ED093F: Dissolved Major Cations (QCLot: 2301128)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	95.8	80	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	99.8	90	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	99.9	82	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	95.4	85	113
EG020F: Dissolved Metals by ICP-MS (QCLot: 2301127)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.1	85	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	96.9	84	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	95.8	85	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	95.5	81	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	92.4	83	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	91.8	82	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	95.1	81	117
EG020T: Total Metals by ICP-MS (QCLot: 2305819)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	98.1	82	114
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	99.4	84	112
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	91.8	86	116

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 2305819) - continued								
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	95.2	83	118
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	93.0	85	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	96.6	84	116
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	89.5	79	117
EG020T: Total Metals by ICP-MS (QCLot: 2308495)								
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	93.3	82	114
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	94.2	84	112
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	95.4	86	116
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	92.7	83	118
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	91.7	85	115
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	97.9	84	116
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	93.2	79	117
EG035F: Dissolved Mercury by FIMS (QCLot: 2301129)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.2	83	105
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2299697)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	92.7	77	111
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2301115)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	91	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2301119)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	88.0	69	101
				<0.1	1 mg/L	91.8	70	118
				<0.1	5 mg/L	90.2	74	118
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2301118)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	93.1	71	101
				<0.01	0.442 mg/L	93.7	72	108
				<0.01	1 mg/L	93.2	78	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2300026)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	2000 µg/L	89.7	70	113
EP071: C15 - C28 Fraction	----	100	µg/L	<100	3000 µg/L	107	81	111
EP071: C29 - C36 Fraction	----	50	µg/L	<50	2000 µg/L	108	67	117
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2309929)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	81.8	75	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2300026)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	2500 µg/L	94.6	76	112
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	3500 µg/L	109	65	118
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	1500 µg/L	90.6	77	119
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2309929)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2309929) - continued								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	86.1	75	127
EP080: BTEXN (QCLot: 2309929)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	86.2	70	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	95.6	69	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	96.1	70	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	93.7	69	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	97.7	72	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	97.1	70	120

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2300233)							
ES1911589-001	HWY-1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 2300232)							
ES1911589-001	HWY-1	ED045G: Chloride	16887-00-6	250 mg/L	102	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 2301127)							
ES1911589-002	HB-1	EG020A-F: Arsenic	7440-38-2	1 mg/L	100	70	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	98.6	70	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	98.5	70	130
		EG020A-F: Copper	7440-50-8	1 mg/L	95.7	70	130
		EG020A-F: Lead	7439-92-1	1 mg/L	113	70	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	99.5	70	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	98.6	70	130
EG020T: Total Metals by ICP-MS (QCLot: 2305819)							
ES1911880-001	Anonymous	EG020A-T: Arsenic	7440-38-2	1 mg/L	106	70	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	99.5	70	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	95.5	70	130
		EG020A-T: Copper	7440-50-8	1 mg/L	100	70	130
		EG020A-T: Lead	7439-92-1	1 mg/L	106	70	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	98.6	70	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020T: Total Metals by ICP-MS (QCLot: 2305819) - continued							
ES1911880-001	Anonymous	EG020A-T: Zinc	7440-66-6	1 mg/L	# Not Determined	70	130
EG020T: Total Metals by ICP-MS (QCLot: 2308495)							
ES1911589-002	HB-1	EG020A-T: Arsenic	7440-38-2	1 mg/L	100	70	130
		EG020A-T: Cadmium	7440-43-9	0.25 mg/L	102	70	130
		EG020A-T: Chromium	7440-47-3	1 mg/L	105	70	130
		EG020A-T: Copper	7440-50-8	1 mg/L	102	70	130
		EG020A-T: Lead	7439-92-1	1 mg/L	97.7	70	130
		EG020A-T: Nickel	7440-02-0	1 mg/L	103	70	130
		EG020A-T: Zinc	7440-66-6	1 mg/L	102	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 2301129)							
ES1911589-001	HWY-1	EG035F: Mercury	7439-97-6	0.01 mg/L	94.8	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2299697)							
ES1911417-001	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	92.0	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2301115)							
ES1911549-021	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	95.1	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2301119)							
ES1911549-022	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	94.5	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2301118)							
ES1911549-022	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	98.9	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2309929)							
ES1911589-001	HWY-1	EP080: C6 - C9 Fraction	----	325 µg/L	98.0	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2309929)							
ES1911589-001	HWY-1	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	95.8	70	130
EP080: BTEXN (QCLot: 2309929)							
ES1911589-001	HWY-1	EP080: Benzene	71-43-2	25 µg/L	90.5	70	130
		EP080: Toluene	108-88-3	25 µg/L	95.7	70	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	98.7	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	95.9	70	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	101	70	130
		EP080: Naphthalene	91-20-3	25 µg/L	93.2	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1911589**	Page	: 1 of 10
Client	: **FOX & CO ENVIRONMENTAL**	Laboratory	: Environmental Division Sydney
Contact	: MR PAUL FOX	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 16-Apr-2019
Site	: ----	Issue Date	: 30-Apr-2019
Sampler	: ----	No. of samples received	: 6
Order number	:	No. of samples analysed	: 6

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	ES1911589--001	HWY-1	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG020T: Total Metals by ICP-MS	ES1911880--001	Anonymous	**Zinc**	7440-66-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA065: Total Hardness as CaCO3						
Clear Plastic Bottle - Unspecified; Lab-acidified						
HWY-1, HB-1, RCB-1, 5B-1	----	----	----	17-Apr-2019	16-Apr-2019	**1**
ED093F: Dissolved Major Cations						
Clear Plastic Bottle - Unspecified; Lab-acidified						
HWY-1, HB-1, RCB-1, 5B-1	----	----	----	17-Apr-2019	16-Apr-2019	**1**
MW006: Faecal Coliforms & E.coli by MF						
Sterile Plastic Bottle - Sodium Thiosulfate						
HH-1	----	----	----	16-Apr-2019	12-Apr-2019	**4**
MW007: Coliforms by MF						
Sterile Plastic Bottle - Sodium Thiosulfate						
HH-1	----	----	----	16-Apr-2019	12-Apr-2019	**4**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
TRH - Semivolatile Fraction	0	5	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
TRH - Semivolatile Fraction	0	5	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025H)							
HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**----**	----	----	**16-Apr-2019**	16-Apr-2019	✓
Clear Plastic Bottle - Natural (EA025H)							
4B-1	**10-Apr-2019**	**----**	----	----	**17-Apr-2019**	17-Apr-2019	✓
EA065: Total Hardness as CaCO3							
Clear Plastic Bottle - Unspecified; Lab-acidified (ED093F)							
HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**----**	----	----	**17-Apr-2019**	16-Apr-2019	×
Clear Plastic Bottle - Unspecified; Lab-acidified (ED093F)							
4B-1	**10-Apr-2019**	**----**	----	----	**17-Apr-2019**	17-Apr-2019	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**----**	----	----	**16-Apr-2019**	23-Apr-2019	✓
Clear Plastic Bottle - Natural (ED037-P)							
4B-1	**10-Apr-2019**	**----**	----	----	**16-Apr-2019**	24-Apr-2019	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**----**	----	----	**16-Apr-2019**	07-May-2019	✓
Clear Plastic Bottle - Natural (ED041G)							
4B-1	**10-Apr-2019**	**----**	----	----	**16-Apr-2019**	08-May-2019	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**----**	----	----	**16-Apr-2019**	07-May-2019	✓
Clear Plastic Bottle - Natural (ED045G)							
4B-1	**10-Apr-2019**	**----**	----	----	**16-Apr-2019**	08-May-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Unspecified; Lab-acidified (ED093F) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**----**	----	----	**17-Apr-2019**	16-Apr-2019	×
Clear Plastic Bottle - Unspecified; Lab-acidified (ED093F) 4B-1	**10-Apr-2019**	**----**	----	----	**17-Apr-2019**	17-Apr-2019	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Unspecified; Lab-acidified (EG020A-F) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**----**	----	----	**17-Apr-2019**	06-Oct-2019	✓
Clear Plastic Bottle - Unspecified; Lab-acidified (EG020A-F) 4B-1	**10-Apr-2019**	**----**	----	----	**17-Apr-2019**	07-Oct-2019	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Unspecified; Lab-acidified (EG020A-T) HWY-1	**09-Apr-2019**	**18-Apr-2019**	06-Oct-2019	✓	**18-Apr-2019**	06-Oct-2019	✓
Clear Plastic Bottle - Unspecified; Lab-acidified (EG020A-T) HB-1, RCB-1, 5B-1	**09-Apr-2019**	**23-Apr-2019**	06-Oct-2019	✓	**23-Apr-2019**	06-Oct-2019	✓
Clear Plastic Bottle - Unspecified; Lab-acidified (EG020A-T) 4B-1	**10-Apr-2019**	**23-Apr-2019**	07-Oct-2019	✓	**23-Apr-2019**	07-Oct-2019	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Unspecified; Lab-acidified (EG035F) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**----**	----	----	**18-Apr-2019**	23-Apr-2019	✓
Clear Plastic Bottle - Unspecified; Lab-acidified (EG035F) 4B-1	**10-Apr-2019**	**----**	----	----	**18-Apr-2019**	24-Apr-2019	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Unspecified; Lab-acidified (EG035T) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**----**	----	----	**17-Apr-2019**	07-May-2019	✓
Clear Plastic Bottle - Unspecified; Lab-acidified (EG035T) 4B-1	**10-Apr-2019**	**----**	----	----	**17-Apr-2019**	08-May-2019	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**----**	----	----	**17-Apr-2019**	07-May-2019	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) 4B-1	**10-Apr-2019**	**----**	----	----	**17-Apr-2019**	08-May-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**17-Apr-2019**	07-May-2019	✓	**17-Apr-2019**	07-May-2019	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) 4B-1	**10-Apr-2019**	**17-Apr-2019**	08-May-2019	✓	**17-Apr-2019**	08-May-2019	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**17-Apr-2019**	07-May-2019	✓	**17-Apr-2019**	07-May-2019	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) 4B-1	**10-Apr-2019**	**17-Apr-2019**	08-May-2019	✓	**17-Apr-2019**	08-May-2019	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**16-Apr-2019**	16-Apr-2019	✓	**18-Apr-2019**	26-May-2019	✓
Amber Glass Bottle - Unpreserved (EP071) 4B-1	**10-Apr-2019**	**16-Apr-2019**	17-Apr-2019	✓	**18-Apr-2019**	26-May-2019	✓
Amber VOC Vial - Sulfuric Acid (EP080) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**23-Apr-2019**	23-Apr-2019	✓	**23-Apr-2019**	23-Apr-2019	✓
Amber VOC Vial - Sulfuric Acid (EP080) 4B-1	**10-Apr-2019**	**23-Apr-2019**	24-Apr-2019	✓	**23-Apr-2019**	24-Apr-2019	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**16-Apr-2019**	16-Apr-2019	✓	**18-Apr-2019**	26-May-2019	✓
Amber Glass Bottle - Unpreserved (EP071) 4B-1	**10-Apr-2019**	**16-Apr-2019**	17-Apr-2019	✓	**18-Apr-2019**	26-May-2019	✓
Amber VOC Vial - Sulfuric Acid (EP080) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**23-Apr-2019**	23-Apr-2019	✓	**23-Apr-2019**	23-Apr-2019	✓
Amber VOC Vial - Sulfuric Acid (EP080) 4B-1	**10-Apr-2019**	**23-Apr-2019**	24-Apr-2019	✓	**23-Apr-2019**	24-Apr-2019	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) HWY-1, HB-1, RCB-1, 5B-1	**09-Apr-2019**	**23-Apr-2019**	23-Apr-2019	✓	**23-Apr-2019**	23-Apr-2019	✓
Amber VOC Vial - Sulfuric Acid (EP080) 4B-1	**10-Apr-2019**	**23-Apr-2019**	24-Apr-2019	✓	**23-Apr-2019**	24-Apr-2019	✓
MW006: Faecal Coliforms & E.coli by MF							
Sterile Plastic Bottle - Sodium Thiosulfate (MW006) HH-1	**11-Apr-2019**	**----**	----	----	**16-Apr-2019**	12-Apr-2019	×

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
MW007: Coliforms by MF							
Sterile Plastic Bottle - Sodium Thiosulfate (MW007)							
HH-1	**11-Apr-2019**	**----**	----	----	**16-Apr-2019**	12-Apr-2019	✗

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	26	**11.54**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	5	34	**14.71**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	5	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	26	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	34	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	17	**17.65**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Suspended Solids (High Level)	EA025H	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	34	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite A	EG020A-T	2	34	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	5	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
Thermotolerant Coliforms & E.coli by Membrane Filtration	MW006	WATER	AS 4276.7 2007
Coliforms by Membrane Filtration	MW007	WATER	AS 4276.5 - 2007

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Digestion for Total Recoverable Metals	EN25	WATER	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for sparging.

26.4.19

LIMS No: _____

Request for Laboratory Services and Chain of Custody Form

ALS Group 26 Shand Street, Stafford, Brisbane, Qld, 4053

Laboratory Section

Received Date: _____ Received By: A Reagan Cooling Method: ☐Ice ☐Gepack ☒None Samples Intact: ☒Yes ☐No

Logged-in Date: _____ Time of Receipt: 12/04/19 8:45am Cooler Sealed: ☐Ice ☐Ice ☒Ambient Temperature: ☒Ambient ☐Chilled

0.5° 5.1°C

COD must pay via cheque or credit card before analysis is commenced. AMEX & DINERS cards incur a 5% surcharge

INVOICE TO:

Name:	Paul Fox
Company:	Fox & Co Environmental
Address:	5 Gouldian Court, Peregian Beach, QLD, 4573
Email:	info@ecofoxco.com.au
Phone:	0413 636 072 Fax:

Quote #: BNBQ/192/16

Attached Parameter List: ☐Yes ☐No

Replacement Sample Containers Required: ☐Yes ☐No

Results Required By: _____ Urgent TA requires lab approval

Notes:

Client information | PO No.: | Project No.: IMP-1

Company Name:	**Fox & Co Environmental**
Contact Name:	**Paul Fox**
Address:	**5 Gouldian Court, Peregian Beach, QLD, 4573**
Phone Number:	**0413 636 072**
After Hours Phone Number:	**0413 636 072**
Fax Number:	
Email:	info@ecofoxco.com.au

Note: Results will be sent via email to an unlimited number of addresses for no additional fee. In the absence of email, fax is available upon request.

Indicate results format (please check one): Email ☑ Fax ☐

SAMPLE INFORMATION

Lab Sample ID	Sample Identifier	Date Sampled	Time	Matrix: Soil Water Other	# of Bottles	Analysis Requested: Heavy Metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg (total and dissolved))	Suspended solids	sulfate	major cations	hardness	total phosphorus, total Nitrogen	TRH, BTEX	Total coliforms, E. coli				
1	HWY-1	09/04/2019	AM	Water	7	✓	✓	✓	✓	✓	✓	✓					
2	HB-1	09/04/2019	AM	Water	7	✓	✓	✓	✓	✓	✓	✓					
3	RCB-1	09/04/2019	AM	Water	7	✓	✓	✓	✓	✓	✓	✓					
4	5B-1	09/04/2019	PM	Water	7	✓	✓	✓	✓	✓	✓	✓					
5	4B-1	10/04/2019	PM	Water	7	✓	✓	✓	✓	✓	✓	✓					
6	HH-1	11/04/2019	PM	Water	1								✓				

Environmental Division
Sydney
Work Order Reference
ES1911589

Telephone : +61-2-8784 8555

ES1911589

URGENT

LAB OF ORIGIN: DARWIN

Sampled By: Fox **Date: 12/04/2019**

Relinquished By: _____ **Date:** 12/4/19 **Time:** 8:45 am

Kim_ALS
16.04.19
8.30am

Revision #: 1

CONFIDENTIAL

FOX & CO
ENVIRONMENTAL

CULTURAL HERITAGE TRAINING

CULTURAL HERITAGE TRAINING

This program was designed and developed by Marlene Karkadoo of Borroloola in conjunction with a number of senior traditional owners (men and women) of the region.

The Traditional Owners of the region have authorised Geoff Hokin to deliver this cultural induction on their behalf. Geoff has post graduate qualifications from the University of Southern Queensland in Cross Cultural Anthropology and Psychology with a major in Australian Indigenous culture.

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Housekeeping

- Hours
- Evacuation procedures
- Mobile phones
- Tea & coffee
- Amenities
  - Women
  - men

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Where are you going?

- EP187
  - Exploration permit 187 is located in the McArthur Basin and straddles the Carpentaria Hwy in the Southern Gulf of the NT.
- EP184
  - Exploration permit 184 sits south of the Roper River in the Eastern part of the NT 256 Km east of Katherine and north of EP187.

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Map


ISLAND
COBOURG MARINE PARK
Nguiu
DARWIN
FOGG DAM CONSERVATION RESERVE
MARY RIVER NATIONAL PARK
Oenpelli (Gunbalunya)
Nhulunbuy
GOVE PENINSULA
ARNHEM LAND
East Alligator River
Mann River
Jabiru
Arnhem
Cooinda
Batchelor
Adelaide River
Mary River
LITCHFIELD NATIONAL PARK
Hayes Creek
KAKADU NATIONAL PARK
Bulman
Central Arnhem Rd
Daly River
Daly River
Pine Creek
NITMILUK (KATHERINE GORGE) NATIONAL PARK
GROOTE EYLANDT
Peppimenarti
KATHERINE
Manyallaluk
Barunga
Roper Bar
Roper River
CUTTA CUTTA CAVES NATURE PARK
ELSEY NATIONAL PARK
GULF OF CARPENTARIA
Mataranka
Roper Hwy
GREGORY NATIONAL PARK
Elsey
STUART
Nathan River Rd
Timber Creek
KEEP RIVER NATIONAL PARK
Victoria River
Buntine Hwy
Larrimah
SIR EDWARD PELLEW GROUP
Victoria Hwy
Borroloola
Daly Waters
Hi-Way Inn
Heartbreak Hotel
GREGORY NATIONAL PARK
Victoria Riv
Top Springs
Carpentaria Hwy
Cape Crawford
McArthur Riv
Dunmarra
Buchanan Hwy
With thanks to the Katherine Region Tourist Association

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Australian Indigenous cultural heritage

- Aboriginal and Torres Strait Islander cultures are complex and diverse. The Indigenous cultures of Australia are the oldest living cultural history in the world - they go back at least 50,000 years and some argue closer to 65,000 years. One of the reasons Aboriginal cultures have survived for so long is their ability to adapt and change over time. It was this affinity with their surroundings that goes a long way to explaining how Aboriginal people survived for so many millennia.
- Cultural heritage is seen as 'the total way of living built up by a group of human beings, which is passed from one generation to the next', given to them by reason of their birth.
- In Australia, Indigenous communities keep their cultural heritage alive by passing their knowledge, arts, rituals and performances from one generation to another, speaking and teaching languages, protecting cultural materials, sacred and significant sites, and objects.

Source: http://australia.gov.au/about-australia/australian-story/austn-indigenous-cultural-heritage

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Dreaming

- The Dreaming tells of the journey and the actions of Ancestral Beings who created the natural world
- Recorded in the countryside around us, Aborigines can see all the evidence of the creative events of The Dreaming
  - ❖Rock sites
  - ❖Song lines
  - ❖The river

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Tradition

- Funerals
- Ceremony
- Initiation
- Tribal Structure

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Mother's country / Fathers' country

- Traditional land and sea ownership is based on customary law, passed from generation to generation.
- This sacred trust involves defined groups or people, their ancestors and decedents.
- In many areas, a system of '**managers'** and '**owners**' operates.
  *** Land Managers** generally have maternal links to the land, while **landowners** generally have paternal links to the land.
- Aboriginal **landowners** and **managers** have specific and complementary rights and obligations to ensure the spiritual and physical health of defined areas of land.
- In other areas, different land tenure systems operates, each region can be different

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Jungai and their role

- Jungai is the person responsible to uphold the correct application and true knowledge of the Kudjigka.
- Can only by Jungai for his mothers' country
- Has full knowledge of the songs depicting the Dream Path (road map) of his area of responsibility.
- Theirs is the police to individual sacred sites mentioned in the song and has to ensure no damage occurs or no unauthorized person enters a site.
- He reports to the "Boss-man" (true traditional owner of each individual site)

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Customs

- Social organizations
- Clan groups or skin (land, people, animals, plants)
- Role and responsibilities
- Women's business
- Men's business

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Workplace relations

- Mannerisms
  - Understand cultural obligations and commitments may impact on performance and attendance
  - Understand background
- Avoid the risk of *shaming*
  - Show the same personal respect as you would for any colleague
  - No discrimination policy

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Sacred sites / sites of significance

- Significant sites:
  - **Sacred:** direct link to dreamtime stories
  - **Significant:** importance to history or lifestyle
- Visiting sites – Protocols
  - Visiting sacred sites involved in ceremonial practices is not acceptable, even if the site is not being currently used by Aboriginal people
  - When visiting Aboriginal Land or sacred sites, it is expected that visitors follow a series of protocol
- Comparison with modern religion and beliefs

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What to do in case of unrecorded cultural heritage find

- Stop work in immediate location (suggested distance 30 – 50 meters radius)
- Contact Traditional Owner who will deal with the find immediately or will contact a Senior person who will provide further advice
- Do not remove the find yourself
- Leave it where you found it
- Go around it and work around buffer zone

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Language groups

Traditional owners

- Yanyuwa – Sir Edward Pellew Islands, Borroloola
  - Graham Friday, Samuel Evans, Syd Rusca, Mavis Timothy,
- Mara – Limmin Bite Region
  - Jacob Riley, Phillip Riley, Ralph Hammer
  - Walter Rogers, James Garadji, Peter Ellis,
- Garawa – Robinson River / Wollograng
  - Tony Jack, Noel Dixon
- Gurdanji – South of Borroloola
  - Bruce Joy, Ronnie Raggett, Billy [Coolibah] Rapsin, Timothy Lansen, Alan Baker

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Indigenous organizations

- Mabunji Aboriginal Resource Services
  - CEO – Alison Doyle, Chairperson - Frazer Baker
- Mawurli and Wirriwangkuma Aboriginal Corporation (MAWA)
  - Representative organization for the four language groups
  - Chairman – Tony Jack
- Robinson River (Mungoorbada Aboriginal Corporation)
  - CEO – Bill South, Chairperson – John Clark
- Northern Land Council (NLC)
  - Manager – Daniel Mulholland
- Sea Rangers (auspiced by Mabunji)
  - Coordinator – Chris Francis

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Examples of cultural heritage

- There are numerous sites of significance and sacred sites in and around the Gulf Region. They are not always obvious, however some include:

Rock shelters	Bush medicine
Artifact scatters	Sacred Men's business
Rock carvings	Sacred Women's business
Burial sites	Fire places

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Legislation

- Native Title Act
- NT Aboriginal Sacred Sites Act
- Aboriginal Land Rights (Northern Territory) Act 1976
- Environmental Acts – Federal and Territory
- Petroleum Act
- Nt Heritage Act 2011 - Protects Aboriginal archaeological sites

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Duty of care

- What do we need to do to meet our Duty of Care?
  - Risk analysis/Due Caution
  - Consultation with Aboriginal Party (Aboriginal Cultural Heritage survey) when appropriate
  - Agreement between Imperial and Aboriginal Areas Protection Authority (e.g. AAPA)
  - Management System
  - Effective communication during project

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Fines

Offence	Corporate Penalty	Individual (natural person) Penalty
Entry onto sacred Sites	*1000 penalty units ($133,000)	200 penalty Units ($26,600) or 12 months imprisonment
Work on Sacred Sites	2000 penalty units ($266,000)	400 penalty Units ($53,200) or 2 years imprisonment
Desecration	2000 penalty units ($266,000)	400 penalty Units ($53,200) or 2 years imprisonment

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Assessment

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Document Title	Safety Management Plan
Document Number	SMP-XPN-GEN-REP-004 - Draft

Safety Management Plan

Document Title	Safety Management Plan
Document Number	SMP-XPN-GEN-REP-004 - Draft

REVISION HISTORY

Revision No.	Description of Changes	Authorised By	Issue Date

INTRODUCTION

THIS DOCUMENT MUST BE USED IN CONJUNCTION WITH THE SMP INSTRUCTION GUIDELINE

The information within this Safety Management Plan (SMP) is intended to demonstrate how Imperial Oil & Gas Pty Ltd ('Imperial') manages and implements the Occupational Health and Safety Management System (herein referred to as OHSMS) at a site level.

Whilst this plan provides guiding descriptions of safety management practices to be followed it is not intended to be a manual of safe or recommended practice in a particular set of circumstances. *This plan is intended to guide the Company in managing safety. In the absence of better experience or guidance being available Section 6.0 should be seen as providing guidance in managing well control.*

All Imperial operated assets and project locations develop SMPs which demonstrate compliance with the requirements of the legislation for that location.

This document is formulated in accordance with the **Schedule of Onshore Petroleum Exploration and Production Safety Requirements,** referred to in Clause 27 of the **Petroleum (Onshore) Regulation** under the ***Petroleum (Onshore) Act,*** **Schedule of Onshore Petroleum Exploration And Production Requirements;** ***The Mining Act*** and the **Occupational Health & Safety Regulation** under the ***Occupational Health & Safety Act.*** Reference is also made to the **Petroleum (Occupational Health & Safety) Regulations NT** and the **Onshore Petroleum Directions (NT)*; Work Health and Safety (National Uniform Legislation) Act***; **Work Health and Safety (National Uniform Legislation) Regulations**; ***The Dangerous Goods Act (NT)*** and the **Dangerous Goods Regulations (NT)**.

1.1 Purpose of SMP

The purpose of this SMP is to:

- Communicate Imperial policy arrangements for the provision of a healthy and safe working environment;
- Ensure that the design and operation of any installation or site and its equipment are safe;
- Identify and document hazards associated with operations and document the systems used to mitigate and control the hazards;
- Facilitate communication of hazards and controls with personnel working at site;
- Describe processes which ensure personnel are appropriately trained and competent in their roles;
- Describe the mechanisms for site OHS performance measurement, monitoring and reporting
- Facilitate the active involvement of personnel in the OHS matters; and
- Establish emergency response procedures.

1.2 OHSMS Interface

Activities at all Imperial sites fall under the umbrella of the OHSMS.

The OHSMS provides a consistent and planned approach to ensuring the health and safety of all personnel. It establishes expectations which implement through the minimum worksite standards, work practices and processes detailed within this SMP. The OHSMS expectations are provided in the 11 Pillars of the Imperial OHSMS.

The supporting OHSMS documents such as procedures, guidelines, Standard Operating Procedures (SOPs), forms and the like, are readily available to all personnel at Imperial work sites via the intranet or alternatively through the OHS representative for that site.

The OHSMS also establishes minimum requirements for communicating and integrating OHS policies, improvement plans and strategies at site level. It includes methods for documenting systems, incorporating OHS standards, assessing their effectiveness, analysing and improving performance.

Imperial implements the requirements of the OHSMS and continually works towards improving OHS performance by:

- Ensuring adequate supervision and training consistent with job requirements;
- Ensuring hazards and risks are identified and controlled to acceptable levels;
- Providing safe materials, plant and equipment;
- Communicating openly with the workforce;
- Implementing processes for continuous improvement; and
- Meeting all obligations and compliance requirements of relevant state and country legislation.

1.3 Site Details

Imperial work sites are outlined in the Exploration Program Scope of Works document and comprise the seismic lines and exploration drill holes as outlined in that document (i.e. exploratory/stratigraphic/chip hole/lateral drilling).

The key activities related to the sites are the acquisition of seismic data and the determination of geological structure through drilling of core and open holes.

1.4 Site Access

Access to the Imperial work sites site is restricted. All personnel entering the site are expected to comply with Imperial policies, OHSMS requirements, procedures, site specific systems and rules. Imperial reserves the right to remove anyone from the work sites who does not comply with the above mentioned requirements.

All efforts are made to ensure the work sites are secure and adequately delineated through the use of fencing and barricading to ensure there is a minimum possibility of someone ‘accidentally’ entering the site.

In addition, some areas within the workplace may have restrictions on who may enter them because of potential OHS and/or security risks. Any warnings, conditions of entry, emergency directions or other information intended for persons entering a restricted area shall be displayed on signs and notices at each point of access.

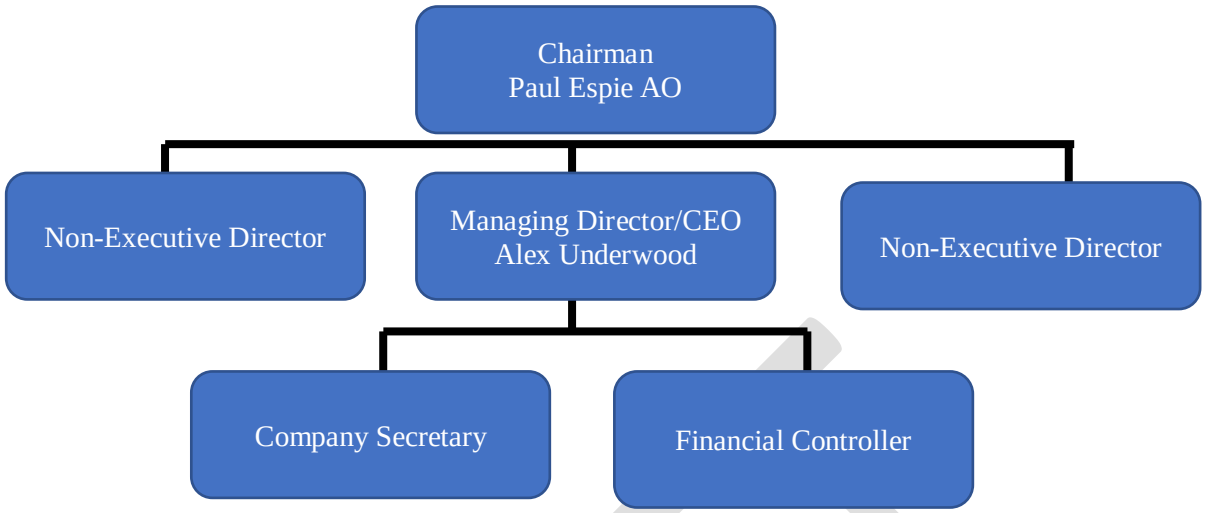
Personnel sign in and out, or use swipe cards (as applicable) when accessing and leaving the work sites to ensure their whereabouts are known. All visitors report to the site office on arrival and sign the visitors register. Visitors are accompanied by designated Imperial personnel at all times.

An induction will be required and will be conducted by staff at the work site or at the company head office prior to entering the site.

1.5 Organisational Structure

An organisational chart is maintained by Imperial to show the lines of communication and reporting structure. The organisational chart is a controlled document and is updated when change occurs. Current organisational charts can be found on file in the Sydney office. The managers have joint responsibility and delegated authority to ensure that they provide the resources within their areas of operation to comply with the SMP.

EMPIRE ENERGY GROUP LIMITED



IMPERIAL OIL & GAS PTY LTD
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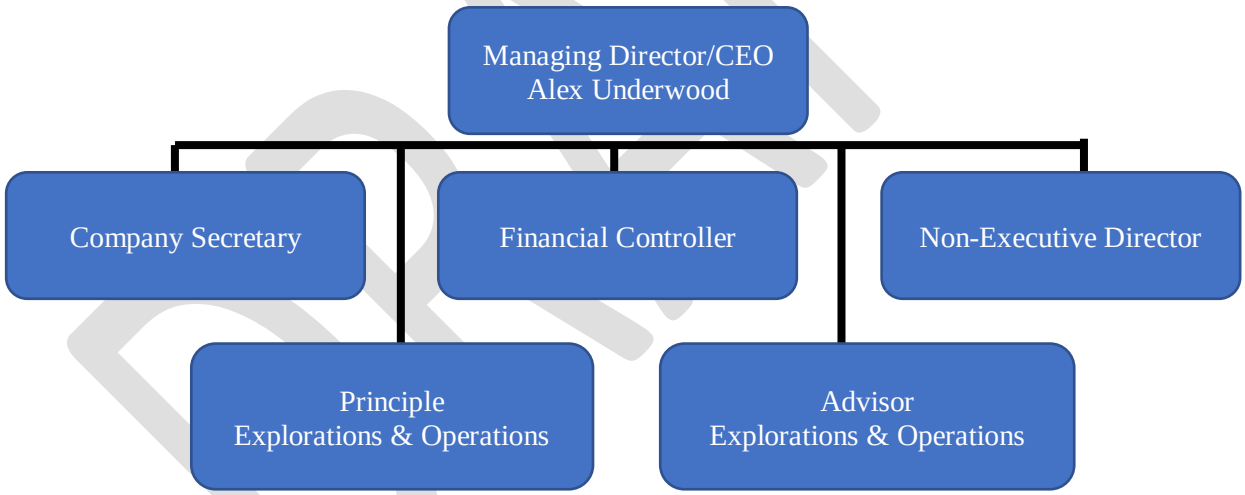

1.6 Policies

Imperial has the following 6 policies for the management of health and safety:

- Occupational Health and Safety Policy;
- Drug, Alcohol and Contraband Policy;
- Workplace Rehabilitation Policy;
- Fit For Duty Policy;
- Right to Stop Work; and
- Harassment and Discrimination Policy.

All 6 polices are displayed in prominent locations throughout the work sites.

1.7 Key Performance Indicators

Key Performance Indicators (KPIs) are used to measure company and contractor progress towards the Imperial s target of zero incidents and zero injuries. Site specific KPIs are also established to monitor and measure operations and activities that may cause injury and/or illness. Imperial has the following leading and lagging site specific KPIs:

- Leading:
  - Audits completed as per schedule:
    - Drilling/Work over Audits
    - Safety Improvement Plan
    - Environment Improvement Plan
    - Pre-drilling and site inspection checklist
    - Contractor OHS pre-qualification Questionnaire
  - Risk Management Strategies
    - Preliminary risk assessments
    - Formal risk assessments
    - Hazard and Operability studies (HazOp)
    - Job safety and environmental Analysis (JSEA)
    - Standard operating procedures (SOP)
    - Hazard Observations (HazOb)
    - Stop, Look, Assess, Manage (SLAM) system to identify hazards and plan a safe way to manage tasks
    - Communication and consultation with all personnel on findings, actions and close out
- Lagging:
  - Zero incidents
  - Produce an annual safety report to review compliance against the SMP
  - Monitor and close corrective actions as identified by audits and investigations into incidents

2.0 RESPONSIBILITIES

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

The implementation of this SMP is the responsibility of the Site Safety Manager.

All Imperial employees have position descriptions describing the OHS requirements of the position they hold. OHS performance objectives are established for all positions and are measured annually.

2.1 General Duties & Responsibilities of Tenement Holders & Operators

- In carrying out operations, the tenement holder must provide and cause to be maintained so far as is practicable, a site that is safe and without risk to employees, visitors and the public.
- Where an operator has been engaged to perform work on the tenement area, the operator must provide, install and maintain such plant as is necessary to ensure compliance with legislative requirements and so far as is practicable maintain a site that is safe and without risks to health.
- The titleholder must employ/ or engage suitably qualified persons in relation to the work being performed.
- The operator must take reasonable steps to ensure that every supervisor of a worksite, or a portion of a worksite, on changing shift, informs the next supervisor, orally or in writing, of the state of

the operation, plant and equipment in the part of the worksite for which that person is immediately responsible.

2.2 Executive Safety Manager

The Chief Executive Officer (CEO) is the designated Executive Safety Manager.

As the **Executive Safety Manager**, the CEO must ensure the health and safety of all personnel engaged in Imperial activities. To meet this obligation for all Imperial work sites, the Executive Safety Manager provides:

- The OHSMS as a safe system of work for the management of health and safety;
- Processes, procedures and appropriate equipment for the safe operation of plant and equipment;
- Resources for the provision of training, implementation of systems and supervision; and
- Consultative arrangements so that cooperation and commitment to OHS outcomes are achieved.

The Executive Safety Manager may delegate responsibilities for the management of OHS, but retains ultimate responsibility.

2.3 Site Safety Manager

The Company Chief Executive Officer will formally appoint the Site Safety Manager for all Imperial work sites. The **Site Safety Manager** holds the primary responsibility for OHS at the site and maintains an awareness of all hazards and mitigating procedures for the jobs at hand through various consultative processes.

When the Site Safety Manager is not at the site, their nominated replacement ensures all Site Safety Manager's obligations and responsibilities are met. The nominated replacement has all the necessary competencies and resources available to fulfil this role.

To meet their Site Safety Manager responsibilities for the work sites the Site Safety Manager is responsible for ensuring:

- Implementation of this SMP;
- Appropriate site inductions are given to all personnel entering the site;
- Communication including toolbox meetings & safety meetings etc;
- Hazard identification & risk assessment (JSEAs where relevant), including implementation of controls to ensure the management, design, construction, operation, and maintenance of the site and its associated services are safe;
- Personnel comply with applicable SOPs, emergency procedures and the like;
- Blow Out Preventer (BOP) requirements (emergency procedure requirements, testing, records and reporting;
- Ensuring site movements & activities are restricted to cleared areas & access roads only;
- Monitoring of site safety systems (implementation, effectiveness) through regular documented site inspections/audits;
- Appropriate first aid and safety equipment is available and adequately maintained; and
- Relevant personnel are trained in first aid, emergency and other procedures;
- Capturing, filing and storage of relevant safety documentation.

2.4 Employees

All employees have an obligation to comply with Imperial OHS policies, procedures and instructions to ensure a safe workplace. This means that employees are required to:

- Adhere to conditions outlined in the site SMP;
- Correctly use all appropriate tools, materials, Personal Protective Equipment (PPE) and the like;
- Follow standard operating procedures;
- Attend and participate in toolbox and safety meetings;
- Participate in emergency response drills, including evacuation and administration of first aid;
- Complete permits as required;
- Immediately report unsafe acts or conditions, equipment or practices and make suggestions for

improvements;
- Use their initiative to rectify minor hazards found in the workplace;
- Follow any instructions given regarding their health and safety and the health and safety of others;
- Be aware of workplace risks and preventative actions;
- Be responsible and held accountable for non-compliance with OHSMS and site specific requirements provided for their health and safety: and
- Comply with the testing requirements of the Drug, Alcohol and Contraband Policy.

2.5 Managers and Supervisors

In addition to the above requirements covering all employees, the Managers and Supervisors have the following additional responsibilities:

- Support, implement, promote and enforce legislation, best practice, Imperial policies, standards, procedures and the like;
- Actively encourage participation and involvement in the implementation of the OHSMS and this SMP;
- Provide and maintain safe plant, equipment and working environments;
- Facilitate hazard identification, risk assessments and risk control programmes;
- Ensure there is an up-to-date Hazard (Risk) Register and that once identified, all hazards are effectively and appropriately controlled;
- Consult with personnel on changes to materials, equipment and procedures where OHS considerations are a factor;
- Ensure accidents and incidents are reported, properly recorded and investigated and that appropriate corrective actions are assigned and undertaken;
- Ensure all personnel under their control are suitably trained and competent to perform all tasks expected of them;
- Monitor and discuss OHS performance and OHS related issues at meetings and provide necessary feedback;
- Provide first aid, medical treatment and emergency facilities;
- Facilitate rehabilitation and return to work programs;
- Ensure site emergency management strategies comply with Emergency Response Manual requirements; and
- Manage employees, contractors and other persons under their control.

2.6 Contractors, Service Providers and Visitors

All contractors, service providers and visitors are responsible for meeting and implementing the requirements of the OHSMS and this SMP.

When working at an Imperial work site contactors, service providers and visitors must:

- Provide, install, and maintain such plant and equipment as is necessary to ensure compliance with statutory regulations and the provisions of this safety management plan.
- Comply with relevant legislation, standards and codes of practice;
- Comply with the OHS requirements as established in their contract(s) with Imperial;
- Maintain a healthy and safe workplace, safe equipment and systems of work as provided for them by Imperial and their employer;
- Ensure their personnel are adequately trained and appropriately supervised for the work being performed;
- Immediately report any incident or hazard, and complete any necessary documentation;
- Follow any instructions given regarding their, or others, health and safety;
- Complete appropriate inductions prior to commencement of work; and
- Be responsible for their employees and subcontractors working or visiting the work site.

3.0 RISK MANAGEMENT

Imperial is committed to the identification and management of risk as an integrated approach for every aspect of operations including, but not limited to planning and decision making and the procurement of plant, products and services or changes to work practices, SOPs, procedures, equipment or operations.

The following **Risk Management Strategies**, as detailed in the Risk Management Procedure are used for hazard identification, risk assessment and management at all company work sites:

- Preliminary Risk Assessments;
- Formal Risk Assessments;
- Hazard and Operability Studies;
- Job Safety and Environmental Analysis;
- Hazard Observation using the SLAM card; and
- Regular communication and consultation with personnel on findings, actions and close out.

Risk management strategies are used to control risks to an acceptable level. Controls are identified and implemented as necessary, to ensure risks are reduced and maintained at levels **A**s **L**ow **A**s **R**easonably **P**racticable (ALARP).

3.1 Preliminary Risk Assessments

Preliminary Risk Assessments are carried out in the early stages of exploration operations and continue to be a useful tool for the management of proposed changes. They are used to formally and systematically identify potential major hazards and accident scenarios and are considered to be the first stage in managing risks.

Preliminary Risk Assessments provide valuable information on which hazards should be subjected to further, more detailed risk assessment. A more detailed risk assessment is then conducted to provide greater clarity on how a hazard consequence may materialise, and the controls necessary.

3.2 Formal Risk Assessments

A Formal Risk Assessment is conducted on activities to identify and ensure appropriate control of high level hazards. Results from the Formal Risk Assessment are recorded on a Hazard Register which provides a list of identified hazards and controls prioritised according to the level of risk involved.

Formal Risk Assessments are also completed on an ongoing basis for activities that are conducted in or adjacent to exploration and operational leases; where drilling related plant is used and may affect present or future exploration and or production operations for engineering activities and when a complex or medium to high risk change is proposed. The Hazard Register is a living document and is reviewed and updated with the results of these ongoing assessments or when other new information becomes available.

In general, hazards associated with planned exploration operations include, but are not limited to:

- Confined space;
- Cutting, grinding and welding;
- Electrical;
- Excavations;
- Hazardous substances including flammable and explosive atmospheres;
- Journey management;
- Manual Handling;
- Noise;
- Plant and equipment;
- Radiation while logging;
- Remote locations;

- Safety critical plant;
- Stored Energy;
- Suspended loads and falling objects;
- Well control;
- Working at Heights including falls; and
- Unforeseen hazards such as proximity to dangerous fauna such as crocodiles, buffalo, spiders and venomous snakes.

3.3 Hazard and Operability Studies

Hazard and Operability Studies (HAZOPs) are used at Imperial to identify hazards and problems which prevent efficient operation.

3.4 Job Safety and Environmental Analysis

Job Safety and Environmental Analysis (JSEA) is a process used to examine a specific task to identify hazards, evaluate risks and specify appropriate controls. JSEAs are undertaken by a team of people analysing the sequential steps that comprise a task.

At Imperial work site Supervisors ensure JSEAs are developed for any task that:

- Has no SOP which comprehensively identifies and controls the hazards of the task;
- Deviates from an authorised policy, procedure or practice;
- Involves confined space entry;
- Requires the removal or inhibition of a protective device;
- Involves a substance which is hazardous to health;
- Requires a critical lift as defined by the Lifting Operations Procedure;
- Requires the use of explosive/radioactive materials;
- Presents a change to the normal operating environment which may introduce a new hazard;
- Is in close proximity to, and may affect the work activities of others or may impact on an environmentally sensitive location; and
- Requires a Permit to Work.

All personnel are required to review the task they are about to perform to determine the need for a JSEA. JSEAs are completed following the requirements of the JSEA Development Procedure.

3.5 SLAM

“Stop Look Assess Manage” (SLAM) is a personal risk assessment tool which can be used by any person who feels a potential hazard needs to be addressed prior to or during any task. It is an ad hoc assessment used to discuss and record potential hazards and work practices at the workplace.

A SLAM is also undertaken when a person has stopped a job because of a change which they feel could have, or has had, an adverse effect on the safety of the task. All actions are agreed by the workgroup and recorded on a SLAM Form and are to be resolved before work recommences. This record is then given to a relevant Supervisor for review, close out and filing.

3.6 Hazard Observation

Hazard identification is a crucial step in risk assessment, at work sites, personnel are not expected to stop looking for hazards once a Formal Risk Assessment or a JSEA has been completed. Hazard Observation (HAZOB) is a process used at all work sites for the continual identification and management of hazards. They are recorded on the Safety and Environment Hazard Report Form which is designed to be easy to use and completed by all members of the workforce including Supervisors and Line Managers.

Using continual hazard spotting techniques at all levels, aims to improve awareness of work surroundings, personal actions taken and the actions of others.

If a hazard raises a concern that there is immediate danger to a person or group, Supervisors and Line Managers at the work site emphasise to individuals that they are empowered and responsible for stopping the job.

3.7 Hazard Consultation

Personnel involved in risk assessments are trained in the processes being used and have a familiarity with the activities/operations under review. Their involvement serves to increase understanding of the hazards and gain ownership of the controls and procedures used to manage the risks.

3.8 Action Close Out

On some occasions risk assessment controls are complex and require a comprehensive level of effort to ensure adequate implementation. In these instances a Risk Management Action Plan is developed. Action Plans are managed by respective levels of management depending on the nature and magnitude of the risk. The Risk Management Action Plan provides clear documentation of controls being implemented. If Action Plans are not developed, alternative and equally effective processes shall be utilised to ensure controls are implemented prior to any activity or task being authorised to commence.

4.0 CONTROL MEASURES

4.1 Hierarchy of Control

Controls are implemented to manage, reduce or remove the level of risk caused by a hazard. Figure 2 – Hierarchy of Control illustrates the Imperial Hierarchy of Control which is used, in descending order, when assessing control options and their effectiveness.

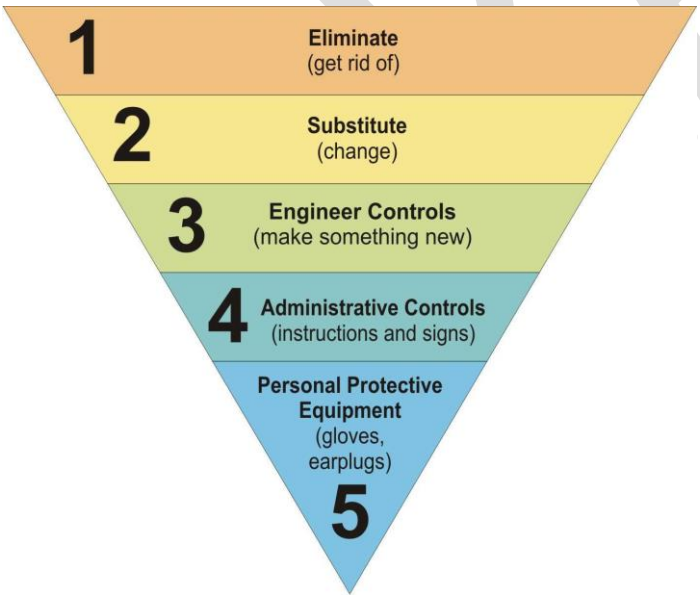

Figure 2 - Hierarchy of Control

PPE, although necessary, should be considered as the least acceptable proactive control measure. It is however required as an additional mitigation measure to accompany other already identified controls higher in the Control Hierarchy. Implementing 'Hard Control' solutions such as elimination, substitution and engineering controls, are always considered first as they rely less on the actions of personnel.

4.2 Communication and Consultation

Imperial is committed to consultative work practices where all personnel are involved and actively participate in all OHS site aspects. Effective consultation on OHS issues is undertaken to ensure concerns are addressed. Consultation with personnel on health and safety matters is undertaken through Team OHS Meetings and Toolbox Meetings as per the OHS Communications Procedure. In addition, employees are involved in risk management processes, workplace inspections, incident investigations, proposed workplace changes and other health and safety matters.

4.2.1 Site OHSMS Committee

The primary function of the Site OHSMS Committee is to coordinate and assess implementation of the Imperial OHSMS at a site level. This includes the coordination and completion of self-assessments against each of the OHSMS elements and close out of non-conformances. The OHS Representative attends the Site OHSMS Committee along with personnel who are either appointed by a Department Manager or elected by peers. Sometimes OHS professionals may attend a meeting to provide subject specific support and guidance.

4.2.2 Site OHS Meetings

Site OHS meetings are held weekly. They are coordinated by the HSEC staff and attended by all Supervisors and the site OHS Representative. The meetings focus on OHS issues relevant to achieving the work site performance indicators, improvement plans and activities. It provides Line Management with advice and assistance on action items raised in Team OHS Meetings, whilst meeting the expectations of the Imperial OHSMS and site OHS procedures and practices.

Meeting minutes and attendance records are maintained. Minutes are displayed on site OHS notice boards.

4.2.3 Team OHS Meetings

Team OHS meetings are held weekly and are chaired by the Supervisor. Employee attendance is mandatory for at least one meeting per week whilst on hitch. The meeting is focused on OHS issues relevant to the team activities. Discussion points include:

- New or changed hazards;
- Progress towards close out of inspection and incident findings; and
- Team OHS performance/improvement planning.

Team OHS Meeting minutes are maintained and displayed in team work areas.

4.2.4 Toolbox Meetings

Toolbox meetings are conducted pre-shift and are chaired by the Supervisor. Toolbox meetings include discussion of planned activities, priorities and constraints of the shift's activities. In addition, the meeting may be used to communicate new or changed hazards, procedures or operations on site. Attendees include all personnel on shift or may be restricted to a specific task or activity. A record of the attendees and items discussed are maintained using the Toolbox Meeting Record Form.

4.3 Safe Systems of Work

Processes that affect or could affect the health or safety of personnel are controlled through the application of appropriate procedures and work practices. Deviation from a safe system of work must be undertaken in accordance with the requirements of the OHS Documentation Deviation Procedure.

4.3.1 Standard Operating Procedures

SOPs provide a step-by-step guide on how to perform and/or record a specific task conducted at each work site. They describe materials, equipment and documentation required for the task as well as when and how these are to be used. SOPs include a level of checking, inspection or direct supervision equal to the potential consequences of deviation. They include checks and balances to ensure that a mistake by an individual operator does not result in a situation that could cause a serious injury or major plant malfunction. SOPs provide information on critical operating parameters and safe operating limits.

SOPs are developed in consultation with personnel who are also required to review the SOP prior to use. Where areas for improvement are identified, amendments are made to the SOP under the supervision and approval of relevant site Manager and OHS Representative.

4.3.2 Permit to Work

The Permit to Work System is detailed in the Imperial Permit to Work System. All non-routine work and/or hazardous work, such as those listed below, require a Permit to Work:

- Confined space entry;
- Excavation work;
- Hot work;
- Cold work;
- Work at Height;
- Electrical work; and
- Work involving explosives or radioactive sources.

Only personnel trained as Permit Authorities are permitted to authorise and issue a Permit to Work.

4.3.3 Lockout, Isolation and Tagging

An isolation, lockout and tag out process is in place to protect personnel, plant/equipment and the environment from hazards associated with an unexpected release of stored energy. The Lockout, Isolation and Tagging Procedure manages the preparation, notification of personnel, isolation methods, lockout and tag out methods, verification of isolation and recommissioning of plant/equipment.

Energy Isolation Plans (EIPs) are completed by Supervisors and Authorised Persons for all work site activities which involve stored energy. A JSEA and/or Permit to Work are also required for any isolation, lockout and tag out.

Supervisors identify all parts of any system/equipment that will be isolated and serviced and record details on the Isolation List Form. The Isolation List Form is used to identify each isolation point location and the level of isolation required at each isolation point.

4.3.4 Handover Procedures

Information on the status of plant/equipment, personnel and OHS issues are communicated at the end of shift/swing changes or when the responsibility for an activity or operation is handed over from one work group to another.

Key aspects covered in the handover by Imperial personnel include:

- The site conditions/operations occurring at the time of the handover;
- Any outstanding matters including potential hazards, Permits to Work, isolations and the like, in place at the time of the handover;
- Any associated documentation related to ongoing tasks/operations; and
- A sign-off indicating the information was adequately covered, explained and understood by both parties.

Designated personnel accountable for the completion of appropriate handover reports are detailed in the Shift Handover Controls Procedure.

4.3.5 *Interaction with Operating Plant*

There are a number of situations where multiple operating plants are undertaking activities in the same operational area. It is also common for there to be a number of different contractors operating various pieces of plant at the site.

Interactions with operating plant or simultaneous operations with contractors occur on a regular basis. An incident may occur when the operators of the plant do not comply with road rules or site specific instructions.

The risks and control mechanisms as a result of these interactions include:

- Collision of mobile plant with other mobile plant
- Collision of mobile plant with stationary objects
- Collision of mobile plant with pedestrians or workers;
- Control measures include complying with;
- Mobile Plant procedure; and
- Where possible utilise a spotter.

4.4 Plant and Equipment

The equipment on all Imperial work sites is managed through the use of various procedures including but not limited to:

- Power Tools Procedure;
- Mobile Plant Procedure;
- Machine Guarding Procedure;
- Ladders Procedure;
- Scaffolding Procedure; and
- Lifting Gear Procedure.

4.4.1 *Purchase*

To ensure that the most suitable plant and equipment is purchased, Line Managers ensure all purchasing requisitions and requests are assessed using the following criteria:

- Identify if the plant or equipment requires special certification, testing or approval;
- Ensure the plant or equipment to be purchased and/or provided meets all statutory and industry standards/requirements such as Australian Standards and relevant state, federal, country legislative requirements;
- Ensure items to be purchased and/or provided meet all contractual and company requirements; and
- Ensure safety related components such as guarding, noise controls, emergency stops and safety devices are present (or not compromised).

4.4.2 *Maintenance and Inspection*

Appropriate inspections and maintenance of the site and equipment is undertaken to ensure that it is safe and operating correctly. Inspections are performed periodically depending on equipment and preventative maintenance undertaken to control operational hazards.

Logbooks & records maintained for every piece of equipment, with preventative maintenance performed at regular intervals in accordance with manufacturer's specifications and appropriate or relevant standards. Certificate(s) showing the plant has been inspected & complies with safety standards also retained.

Maintenance of the same type of plant and equipment is staggered so that at no time a work site is left without the use of a particular type/piece of plant or equipment.

4.4.3 Safety Critical Plant

Some types of plant and equipment at the site are defined as safety critical and have legal requirements to be calibrated, inspected tested and certified by a competent person, independent of Imperial. Records of safety critical plant and equipment are recorded on a register and are regularly inspected to ensure their safe and correct operation.

Personnel who are required to operate safety critical equipment as a part of their normal or emergency response duties are provided with necessary training. Safety critical plant/equipment at work sites includes:

- Pressure relief valves;
- Blowout preventer (BOP);
- Emergency Shutdown devices; and
- Isolation Points.

4.4.3.1 Requirements for Safety Critical Plant

BOP

- The title holder must ensure that the BOP and related well control equipment are installed operated, maintained and tested in accordance with good oilfield practice.
- The results of all tests conducted must be recorded in the driller' log.
- There must be a control panel located on the drill floor for operating the BOP, and if appropriate another located at such a distance from the well to ensure safe and ready access in an emergency.
- Drills must be conducted weekly for each drilling crew to ensure that equipment is operating and that crews are trained to carry out emergency duties. A record of these drills and the response time should be recorded in the driller's log.
- A notice should be displayed on the drill floor providing details of the well control procedure to be followed in the event of a well kick; all crews should be trained in this procedure.
- Those holding the position of driller, rig manager and rig company man must have proven proficiency in well control.

4.4.4 Control Systems

Safety shut down systems are located so they can be activated in the instance of any foreseeable unplanned event without putting the safety of the person activating it at risk.

Personnel are made aware of the work site safety shut down systems through training and induction programs.

The following systems are in place at the site that react to deviations from normal operating levels:

- Pressure relief devices; and
- Emergency Shutdown devices.

4.4.5 Registrable Plant

Any plant that would normally fall under the classification of 'registrable plant', for example pressure vessels or cranes, are managed to at least meet the standard for registration. Records and certification of registration are maintained. Evidence of registration is displayed on or near the plant. Registration of plant is required to be renewed when:

- Registration renewal is received;
- It is altered in any way;
- Fixed plant is relocated; and/or
- There is a change of ownership.

4.4.6 *Electrical*

Only competent experienced electrical tradespersons are to carry out work on electrical apparatus. This person shall hold the following qualification:

- An electrician license issued by the energy Authority of NSW; Qld or the NT as appropriate
- An electrical trades certificate issued by the NSW department of technology and further education or other recognised institution as appropriate.
- Any qualification recognised by the Minister as being equivalent to the abovementioned.

All structures should be adequately protected from the effects of atmospheric electricity in accordance with AS1768.

Adequate measures must be taken to prevent the ignition of flammable materials by static electricity, for example through the identification of possible sources and the implementation of control measures.

No person shall carry out work on or near exposed electrical apparatus energised at a voltage exceeding 110v ac.

Instructions on the procedure and treatment to be followed in case of electric shock are to be kept prominently displayed on the rig floor or in the doghouse, in any generator or other worksite where electricity is used. Anyone who receives an electric shock shall be given immediate medical treatment and an investigation conducted into the cause.

4.5 Working Environment

4.5.1 *Noise*

Noise is defined as any unwanted sound that may damage hearing. Employees who may be regularly exposed to excessive noise levels have the opportunity to participate in an audiometric testing program.

The Noise Procedure is used to determine the need for implementing a workplace noise control strategy and/or a hearing conservation program.

A hearing conservation program will be used to detail how to reduce and/or maintain acceptable noise exposure levels. Topics covered by the hearing conservation program will be dependent on the existing noise exposure levels, current and proposed workplace operations and layout, as well as how long and how often workers are exposed to excessive noise.

Employees will be trained in noise related health effects including the cumulative effects of workplace noise. Noise specific training is provided to employees who are (or may be) exposed to excessive noise levels.

Personnel working in proximity to machinery and/or operations where noise levels exceed the exposure standard for noise where the exposure standard for noise, in relation to a person, means:

a) (a)$L_{Aeq,8h}$ of 85 dB(A); or
b) (b)$L_{C,peak}$ of 140 dB(C).

Where:

$L_{Aeq,8h}$ means the eight-hour equivalent continuous A-weighted sound pressure level in decibels (dB(A)) referenced to 20 µPa, determined in accordance with AS/NZS 1269.1:2005 (Occupational noise management – Measurement and assessment of noise immission and exposure).

$L_{C,peak}$ means the C-weighted peak sound pressure level in decibels (dB(C)) referenced to 20 µPa, determined in accordance with AS/NZS 1269.1:2005 (Occupational noise management – Measurement and assessment of noise immission and exposure).

Personnel working in proximity to machinery and/or operations where noise levels exceed the exposure standard for noise shall wear the appropriate PPE of noise reducing or cancelling ear plugs compliant with the relevant and current Australian Standard as detailed in the Noise Procedure.

4.5.2 Hazardous Substances/Dangerous Goods

Risk assessments are conducted prior to the purchase and introduction of a potentially hazardous chemical at any Imperial work site as per the requirements of the Chemical Management Procedure and Cylinder Safety Procedure. Work activities involving Hazardous Substances and/or Dangerous Goods are assessed to determine the level of risk to the health of personnel handling and/or exposed to them.

Monitoring will occur at determined intervals to check the effectiveness of risk control measures, particularly where serious health effects may result from failure of the controls for instance because of high substance toxicity.

Current Material Safety Data Sheets (MSDSs) are available from the ChemAlert database for all Hazardous Substances and Dangerous Goods. MSDSs are kept in a register that is readily available and easily accessible to all personnel.

Personnel are made aware of Hazardous Substances and Dangerous Goods through the site induction. Specific training on the hazards, risks, appropriate use, PPE and other controls is provided to personnel who may be exposed to or are required to use and handle Hazardous Substances and/or Dangerous Goods.

4.5.3 Hazardous Manual Tasks

In determining the control measures that need to be to implemented the personnel conducting the task must have regard to all relevant matters that may contribute to a musculoskeletal disorder, including:

- postures, movements, forces and vibration relating to the hazardous manual task;
- the duration and frequency of the hazardous manual task;
- workplace environmental conditions that may affect the hazardous manual task or the worker performing it;
- the design of the work area;
- the layout of the workplace;
- the systems of work used; and
- the nature, size, weight or number of persons, animals or things involved in carrying out the hazardous manual task.

Risk assessments are carried out before work associated with a Hazardous Manual task is undertaken. PPE appropriate to the task must be identified as part of the risk assessment. Any specialised PPE requirements (such as respiratory protective equipment) and protective clothing is selected based on the hazards associated with the planned activity.

4.5.4 Confined Spaces

Only personnel who have been trained and assessed as competent by an accredited training provider are permitted to enter confined spaces, act as a stand-by person or take part in a confined space entry rescue. All confined space entry work requires the completion of a **Confined Space Entry Permit** and is controlled by the **Confined Space Entry Procedure**.

All confined spaces at work sites are to be been identified and entered into the confined space register. All permanently designated confined spaces are to be appropriately sign posted. All confined space work will be covered by a Permit to Work and JSEA.

Risk assessments are carried out before work associated within a confined space is undertaken. PPE for confined space entry is identified as part of the risk assessment. Any specialised PPE requirements (such as respiratory protective equipment) and protective clothing is selected based on the hazards associated with the confined space and the planned activity. No person shall enter a confined space without the presence of a confined space entry rescue person present as a spotter and this person must have the appropriate training, authorisation and PPE on hand.

So far as is reasonably practicable procedures will be utilized that while work is being carried out in a confined space, the concentration of any flammable gas, vapour or mist in the atmosphere of the confined space must be less than 5% of its lower explosive limit (LEL).

If it is not reasonably practicable to limit the atmospheric concentration of a flammable gas, vapour or mist in a confined space to less than 5% of its LEL and the atmospheric concentration of the flammable gas, vapour or mist in the space is:

- equal to or greater than 5% but less than 10% of its LEL – the supervising person must ensure that any worker is immediately removed from the space unless a suitably calibrated, continuous-monitoring flammable gas detector is used in the space; or
- equal to or greater than 10% of its LEL – the person must ensure that any worker is immediately removed from the space.

4.5.5 Excavations

All excavation work will be covered by a Permit to Work and JSEA as per the requirements of the Excavation Procedure. All efforts are made to identify any buried services or hazards in the area where excavation work is to be carried out.

Personnel who participate in excavation work are made aware of the task and are made familiar with the excavation work. Personnel not familiar with excavation work are adequately supervised by an experienced person at all times. Personnel carrying out excavation work are required to be appropriately qualified and trained, that is, they will be certified in the operation of front-end loaders, excavating machines and the like.

4.5.6 Working at Height

Risk assessments are carried out prior to the commencement of any work at height activity. Work at heights must be covered by a Permit to Work and conducted as per the requirements of the Working at Height Procedure.

At all times the necessity to perform the task at height is considered. Where there are no alternative methods than to perform the work at height, appropriate control measures are implemented.

Working at height equipment is maintained and only used by authorised, trained personnel. Rescue plans are in place for the safe rescue of a person. These include the provision of trained rescuers, rescue equipment and medical support available.

4.5.7 Risk of a Fall

Risk assessments are carried out prior to the commencement of any work that may involve a risk of a fall. This could include excavation, working at heights or other activity. This includes any activity that risks health and safety associated with a fall by a person from one level to another that is reasonably likely to cause injury to the person or any other person and includes the risk of a fall:

- in or on an elevated workplace from which a person could fall;
- in the vicinity of an opening through which a person could fall; or
- in the vicinity of an edge over which a person could fall;
- on a surface through which a person could fall; and/or
- in any other place from which a person could fall.

A method of control will be implemented that may include any or all of:

- barriers around the danger zone perimeter and any openings to prevent a fall;
- an even and readily negotiable surface and gradient;
- a safe means of entry and exit;
- providing a fall prevention device if it is reasonably practicable to do so;
- if it is not reasonably practicable to provide a fall prevention device, providing a work positioning system;
- providing a fall arrest system, so far as is reasonably practicable;
- Providing temporary work platforms;

- Providing training in relation to the risks involved in working at the workplace;
- Providing safe work procedures, safe sequencing of work, safe use of ladders, permit systems and appropriate signs; and/or
- The provision of emergency rescue procedures and systems.

4.5.8 Cutting, Grinding and Welding

Cutting, grinding and welding are prime sources of fire ignition and require special consideration as set out below. Cutting, grinding and welding are not permitted on drilling sites unless, on each occasion, authorisation has been granted by the person in charge, the Permit to Work system is adhered to and the work is undertaken by a qualified operator.

All cutting and welding operations must be properly supervised by the Drilling Contractor who must inspect the area in which the work is to be done to determine if the work:

- is necessary and safe;
- that the Welder has a thorough understanding of the job;
- that the Welder is qualified for the job;
- that the equipment to be used is in first class condition; and
- that an alert assistant is standing by with a fire extinguisher at hand.

4.5.9 Falling Objects

While working in proximity to drilling operations and other operations with equipment raised at height all personnel must wear head protection such as an approved hard hat issued as PPE and that complies with the current Australian standard and closed in footwear with an incorporated steel or Kevlar toe cap to protect the foot.

No personnel will be engaged in such tasks without proper training and authorisation. Risk assessments are to be carried out before work associated with equipment and or tools at height is required. This risk assessment will identify specific actions to:

- prevent an object from falling freely, so far as is reasonably practicable; or
- if it is not reasonably practicable to prevent an object from falling freely – providing, so far as is reasonably practicable, a system to arrest the fall of a falling object such as a tie and or barricade.
- The drop zone area as far as is practical will be identified as a 'No Go' exclusion zone and the area cordoned off using a temporary barricade to clearly identify the zone of risk.

At all times the necessity to have the equipment and or tools to perform the task at height is considered. Where there are no alternative methods than to position the equipment and or tools at height, appropriate control measures are to be implemented including the provision of first aid equipment and communications equipment in the event of an emergency response call.

4.5.10 Journey Management

The whereabouts of all Imperial and its contractor personnel is to be known at all times. A record of personnel movements will be maintained for safety purposes. As such all personnel are to sign-on/sign-off at the beginning and end of each shift. They also must confirm their intended travel route and work location for the day. Any person(s) working alone and/or remotely shall identify their working area in the register. Regular checks of their well-being will be made by call in or other methods.

Personnel working alone or in remote locations that do not sign-off will be presumed to be missing and a search will be instigated.

Drivers are to obtain approval to travel to locations remote from their Supervisor. Once approval is granted, the driver is required to confirm the intended route to be taken and the estimated time of arrival at the designated location. Where practical all drivers should carry a mobile phone or other adequately functioning form of communication.

Prior to departure, drivers are briefed on:

- Area specific driving hazards;
- Local/facility driving policies and procedures; and
- Emergency contact/phone numbers.

4.6 Personnel Health Monitoring Program

All personnel entering the site are considered as potentially 'at risk' and where required all operational personnel involved in carrying out hazardous work will be provided with health monitoring where the nature of the work is:

- using, handling, generating or storing hazardous chemicals and there is a significant risk to the worker's health because of exposure to a hazardous chemical;
- where exposure to noise may exceed the level permitted under the Act and the Regulations; and/or
- where a worker may be at risk due to other environmental and or situational exposures as a consequence of specific work tasks undertaken.

Each personnel will be required to undertake a pre-employment medical assessment to define their current health status at the time of employment within 90 days of commencing employment to be used as a benchmark for future health monitoring where it is deemed that the nature of their employment may place the person in an at risk role.

Where the personnel are the employee of a contractor or subcontractor this same condition will apply to the contractor to ensure their employees comply with such requirement.

On employment of the personnel for the task the person will be informed of the requirement to undertake such health monitoring and that the monitoring will be provided by the company at the company cost.

Each person must provide to the company the following information and authority for that information to be provided to a registered medical practitioner and subsequently if required to a relevant authority such as a regulator. This information will include:

- the name and date of birth of the worker;
- any known existing medical history including disease, injury or disability or medical condition, existing medications or other limitations;
- demographic and occupational history;
- audiometric testing results if available (otherwise the company will require testing of this for appropriate roles); and
- respiratory results (otherwise the company will require testing of this for appropriate roles).

Any medical testing required by the company and monitoring testing will be undertaken by a registered medical practitioner. Health monitoring programs will be established for 'at risk' personnel with repeat testing each two (2) years of employment or more frequently if suspicion of injury or illness exists or where excessive exposure is deemed to have occurred.

The company will give a copy of the health monitoring report relating to a worker to the regulator as soon as practicable after obtaining the report if the progressive health monitoring report contains:

- any advice that test results indicate that the worker may have contracted a disease, injury or illness as a result of carrying out the work using, handling, generating or storing hazardous chemicals that triggered the requirement for health monitoring; or
- any recommendation that the person conducting the business or undertaking take remedial measures, including whether the worker can continue to carry out the work using, handling,

generating or storing hazardous chemicals that triggered the requirement for health monitoring.

The company will maintain health monitoring records in compliance with the Act and Regulations and will keep these records confidential as required unless instructed by a relevant authority to release these records as required under law or if the worker provides written consent to release the record. The person subject of the record will be provided with a copy of the record.

4.7 Management of Change

It is recognised that poor change management processes are one of the greatest risks to safety at the operations site. The Management of Change Procedure is implemented to ensure changes/modifications to operating plant, systems, processes and procedures at work sites do not compromise safety. The change process includes:

- A definition of change;
- A defined change authorisation process;
- Processes to appropriately document change and risk assessments associated with the change;
- Requirements to communicate changes to relevant and effected personnel; and
- A post change review.

4.8 Contractor Management

The requirements established in the **Contractor Management Procedure** as well as the **Contractor Management OHS Aspects Procedure** are followed whenever a contractor is engaged to undertake work at the site.

OHS reporting relationships, lines of communication, responsibilities, accountabilities and system interfaces are established and documented between Imperial and their contractors. The actual OHS performance of contractors and their compliance with OHS requirements are specified in their contracts and are monitored through inspections and audits carried out by Imperial personnel. Appropriate corrective actions are applied to any deficiencies identified and are to be implemented by the contractor. All Imperial contractors are appropriately inducted and informed of their responsibilities prior to commencing work at the site.

An Imperial contract owner is appointed to oversee the contractor and to ensure they fulfil all their contractual requirements. The contract owner consults with the contractor to determine an agreed supervision and monitoring program to measure agreed KPIs. In addition, the contract owner is responsible for carrying out periodic inspections and/or audits of the contractor's activities, plant and equipment and for conducting a final inspection/review of works prior to acceptance of practical completion.

5.0 EMERGENCY PREPAREDNESS

The Emergency Response Plan outlines procedures to best manage an emergency. These procedures aim to minimise injury to personnel as well as damage to equipment, plant and installations.

All potential emergency situations have been identified and procedures documented for preventing and mitigating associated incidents. Management, Supervisors and employees periodically discuss and identify possible emergency situations to ensure that the Emergency Response Manual is relevant to current circumstances and operations. A current site plan showing quantities and locations of hazardous materials, isolation points, assembly/muster points and emergency equipment must be maintained and readily available to emergency services.

The Emergency Response Plan includes:

- A description of the potential emergency scenarios that could occur;

- Response procedures for identified potential scenarios;
- Procedures for safe evacuation of personnel;
- Communication processes including methods of calling emergency services and notification of regulatory agencies.

Contingency plans are in place for:

- Explosion, fire as a result of petroleum escape or ignition;
- Serious injury to person.

Drills and exercises are carried out to test emergency response procedures. The Emergency Response Plan is reviewed and where necessary amended after the occurrence of an incident or emergency situation or as an outcome to a drill/exercise.

5.1 Fire Fighting & Precautions against Fire

Each contractor or Line Manager is responsible for ensuring fire detection equipment and the like is installed and routinely inspected and tested and for ensuring that an adequate number of the correct type of fire extinguishers are located and clearly signposted throughout workplace. The location of fire-fighting equipment is shown in the Emergency Response Plan.

The drilling contractor's site supervisor will be in charge of fire-fighting on the rig. The operator's representative will be in charge of this procedure when at an Operator's site.

Fire extinguishers shall be provided, mounted and signed in compliance with AS2444[3]. An adequate water supply or other means of suppressing or extinguishing fires shall be available to compliment extinguishers.

Fire extinguishers are to be serviced and maintained by competent persons on a 6 monthly basis and a record kept at the workplace in accordance with AS1851.

5.1.1 Precautions against fire

Design factors:

- Provision of adequate fire detection, firefighting and emergency equipment/facilities;
- Design of workplace layout to facilitate firefighting and emergency procedures;
- Identification and correct storage of flammable products in designated areas as per AS1940[4];
- Maximisation of fire resistant furnishings and furniture in the workplace; and
- If required flare lines will be installed to a distance of not less than 30m from the well. The discharge end of the flare should be set up in a way so as not to cause damage to the environment and isolated from people & animals.

Engineering controls:

- Isolation of flammable materials and ignition sources from each other and from personnel;
- Prevention of build-up of flammable gases by using ventilation, pressurisation and exhaust systems;
- Maintaining an inventory of flammable products at the workplace and their location;
- Provision of appropriate types of fire extinguishers and other equipment for the class of fire risk;
- Identification, illumination and ease of access to emergency entry and exit points; and
- Provision of suitable automated and manual emergency facilities for fire prevention and firefighting.

Administrative measures:

- Implementation of housekeeping/inspection programs;

- Provision of a maintenance system for firefighting equipment and warning systems;
- Provision of emergency evacuation processes, procedures and regular drills and exercises;
- Provision of suitable training and induction to all personnel in fire prevention and emergency procedures; and
- No naked lights smoking or motor vehicles not fitted with a spark arrestor are allowed within 45m of the hole unless approved by the site manager and under the permit to work system.

Static & Lightning Protection

- Avoid venting flammable gas during storms (if practicable);
- Ensure that the earthing of lightning conductors is intact;
- Ensure that the process vent extinguishing system is in operational condition; and
- Ensure flame arrestors are maintained in a clean and effective condition.

Plant & Equipment

- No materials should be left near or stored on equipment that could become hot as a result of restricting natural ventilation;
- Vents and grills of ventilation systems should not be covered;
- Where necessary, drip trays should be used and emptied regularly. Where leaks and drips occur, the appropriate absorbent materials should be provided and used;
- Ensuring safety equipment, such as emergency fuel shut-offs, heat sensors and other safety devices are in good working order;
- Regular maintenance of compressed airline filters and drain traps should be carried out to prevent oil and grease collecting in airlines and spilling in areas where compressed air is used;
- Oily waste and other process consumables must be promptly disposed of as they may spontaneously ignite (especially if exposed to heat and flammable substances);
- Ensuring there is no accumulation of oil based substances under equipment housing, frames and gratings that are a fire hazard if exposed to heat or spillage;
- The maintenance of adequate ventilation in enclosed machinery areas so that any vapours given off or released from the process are dispersed rapidly to an area where they cannot ignite; and
- Ensuring electrical equipment installed in hazardous areas complies with relevant hazardous zone requirements;
- Internal combustion engines to be fitted with a spark arrestor.

Signage

Where necessary signage will be erected to warn and/or inform personnel of potential fire hazards. In particular, signs should be erected in the following circumstances:

- To show the location of fire alarms or other fire-fighting equipment;
- In areas where naked flames or activities such as smoking or hot work are prohibited;
- In locations where materials, substances liquids or gases that are explosive or flammable are used or stored; and
- In areas where automatic fire suppression is provided by means of flooding with Carbon Dioxide, Halon or Inergen.

6 RADIATION SAFETY

Radioactive sources will be used during routine wireline logging of exploration boreholes. The use of such sources will be restricted to specialist borehole logging Contractors whose formal engagement will be contingent upon the fact that any logging engineer who will carry out operations is appropriately licensed and will adhere to all aspects of the *Code of practice for the safe use of sealed radioactive sources in borehole logging (1989)* Radiation Health Series No. 28, issued by the National Health and Medical Research Council which are now available on the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) web site (www.arpansa.gov.au) 5/2002. Alternatively, it can be obtained from ARPANSA Administration (03) 9433 2339.

The use of radioactive sources in borehole logging is administered by the relevant state and federal departments which can include the Environmental Protection Authority (EPA), Radiation Control Section.

7 TRAINING AND COMPETENCE

Imperial is committed to ensuring personnel and contractors are appropriately trained, licensed and are able to demonstrate competence in the work that they are employed to do. To fulfil this commitment Imperial implements the Competence – OHS Aspects Procedure which:

- Ensures personnel attain a high level of OHS awareness;
- Ensures personnel develop and maintain a high level of job skills, competency and safe operating practice underpinned by appropriate safe behaviour;
- Identifies current and required OHS training, task competencies and licensing needs for all job tasks;
- Maintains records of training and licensing documentation for employees and contractors;
- Develops and maintains competency profiles for all personnel;

- Ensures all personnel understand their obligations and responsibilities regarding OHS legislation, including due diligence and the need for cooperation and consultation;
- Ensures appropriate training on procedures and safe systems of work; and
- Ensures all personnel understand the disciplinary consequences of failing to comply with requirements with regard to OHS policies and procedures.

7.1 Induction

Induction training is provided prior to, or when personnel first visit a site, office operated by Imperial. When an individual has received induction training, this is recorded in the Training / Site Personnel Register. The induction training covers important HSEC information, hazards, etc. that is applicable to the work location and the individual's position. This typically includes, but is not limited to the following.

- Imperial Policies;
- Responsibilities;
- Legislative requirements;
- Hazards;
- JSEA requirements;
- SLAM;
- Actions to be taken in the event of an emergency;
- Location of Emergency Equipment Staging Points;
- Muster locations;
- Incident & Hazard Reporting;
- Site Rules;
- Environmental / Cultural Heritage requirements; and
- General emergency response procedures.

Records are maintained of all inductions provided to individuals and of any qualifications, or certificates that they hold. This information is recorded in the Training / Site Personnel Register. It is the responsibility of each Department Manager to ensure that copies of training and competency records are forwarded to the HSEC Coordinator for incorporation in the Training Register and employee files.

7.2 Standards of Competency

Standards of competency have been established specifying the skills and knowledge required for each role. There are a number of generalised competencies applicable to all personnel, such as emergency plans, Permit to Work systems, hazards identification and incident reporting.

7.3 Competency Profiles

Competency profiles outline the training required for personnel to engage in safe work practices at all Imperial work sites is undertaken. The OHS training needs for all personnel are identified and documented via the completion and review of their competency profile on an annual basis. This includes any OHS training needs prescribed by legislation which require a skills assessment to be undertaken, identifying minimum skills, and knowledge and experience requirements for each person to carry out specific work. All OHS competencies are endorsed as part of the National Training Framework.

An OHS Competency Matrix is used as the main input to the development of the Training Plan.

7.4 Prescribed Occupations

Personnel will not engage in a prescribed occupation unless they are the holder of a relevant certificate or are a trainee in that occupation.

Prescribed occupations include:

- Scaffolding;
- Rigging and Dogging;
- Crane and hoist operator;
- Forklift operator;
- Pressure equipment operation including boiler operator, turbine and reciprocating steam engines; and
- Earthmoving equipment operation including dozer, excavator, front end loader, front end loader/backhoe, grader, roller, skid steer loader and scraper.

Training for any prescribed occupation at Imperial work skites adheres to the specifications established in the Competence – OHS Aspects Procedure.

8 INFORMATION MANAGEMENT

All Imperial personnel have access to OHS documents in order to perform their work safely. To ensure the most current version is being used, personnel retrieve OHS documents via the intranet. Only those OHS documents with a status of 'Issued for Use' are used.

8.1 Document Control

Control of OHS documentation is coordinated through the Imperial Corporate Office. The development, authorisation and issue of any OHS document is strictly adhered to and described in the OHS Document Control Procedure and the Development of OHS Documents Procedure.

8.2 Record Keeping and Reporting

All forms, checklists, records and registers are maintained and retained on site for evidential and auditing processes. Examples of documentation retained include but are not limited to:

- Inspections;
- Log books and maintenance records;
- Incident notifications and investigation reports;
- Induction records;
- Certificates of compliance;
- Training records, licenses and/or certificates of competency;
- Risk assessments;
- Outcomes of emergency response drills and exercises; and
- Meeting minutes and attendance records.

Information and documentation relating to contractors is recorded and maintained on site and at Sydney Head Office.

8.3 Legislation

All work practices and processes are conducted in compliance with relevant state and country legislation.

Access to OHS legislation, such as Acts, Regulations and industry codes of practice which are applicable to the Imperial work site are made available to necessary personnel. Efforts are made to ensure any changes to legislative requirement are incorporated into site documentation and communicated to all personnel who may be affected by the change.

8.4 Incident Investigation and Reporting

All accidents, incidents and near misses, no matter how trivial (whether or not they result in injury, harm or loss), are to be reported and documented. Incidents which require documentation and reporting as part of the Incident Reporting, Recording and Investigation Procedure include:

- Fatality;
- Lost Time Injury or Occupational Disease/Illness;
- Restrictive Injuries;
- Medical Treatment Injuries;
- First Aid Injuries;
- Dangerous Events;
- Equipment Damage;
- Environmental Incidents;
- Near Miss; and/or
- Unsafe Acts or Conditions.

All measures required to save a life and relieve suffering take precedence over damage to plant and equipment. Incidents are investigated based on their consequence severity and/or the risk posed by the potential for recurrence. Incidents are reported internally based on their consequence severity and externally as per legislative requirements.

Only personnel appropriately trained and competent in investigation processes are appointed to lead investigations. The incident investigation process is devised to determine the root causes of the incident so that appropriate action can be taken to prevent a recurrence.

Approved corrective or preventative actions are recorded and progress to close out monitored. Completion dates are determined, and adequate resources identified to ensure the completion of each action.

Requirements for Reporting to the Inspector

Reporting of the following occurrences is required by the Onshore Petroleum Exploration and Production Safety Requirements (1992); NT Onshore Petroleum Directions 1993 division 4 – Reporting and the Petroleum (Occupational Health And Safety) Regulations 2009 Part 5 Division 2 and by the Work Health And Safety (National Uniform Legislation) Act 2011 as in force at 1 January 2012; Work Health and Safety (National Uniform Legislation) Regulations as in force at 19 December 2013.

<u>Death or Serious Injury</u>
Serious injury means an injury which requires immediate attention by a medical practitioner:

- The tenement holder must submit a report of the death or injury immediately to an inspector; and
- Make a report in writing giving the full particulars of the death or injury and all related circumstances to be transmitted to the Minister within 5 days after the occurrence of the death or injury.

Written Records of death and Injury
A record of each death or injury shall be kept, the report shall include:

- Particulars of the injury or death and;
- The circumstances leading to the occurrence of the death or injury and;
- The treatment, if any, given to the injured person and the name of each medical practitioner (if any) consulted in relation to the injury.

Serious Damage

Serious damage means the loss or destruction of property exceeding $50,000, damage to property which would incur repair costs in excess of $50.000 or the loss, destruction or damage to property, by reason of which any person dies or suffers serious injury.

Where serious damage to property occurs and is a notifiable incident;

- A verbal report is to be made by the SSM to the inspector immediately;
- A report in writing is to be made within 5 days of the incident occurring specifying;
- Date, time and place;
- Particulars of the damage;
- The events so far as known, or suspected that caused or contributed to the occurrence;
- Particulars of repairs carried out, or proposed to be carried out; and
- Measures taken or to be taken to prevent reoccurrence.

Damage Less than $50,000

Where damage to property occurs, which is not serious damage, but results in a loss of structural integrity or load bearing capacity, or some other unsafe condition a report of the damage is to be immediately made to the inspector.

Potentially Hazardous Event

Where an event occurs that is not in the ordinary course of an operation, and which is professionally considered to be likely to cause injury or serious damage, but does not injure or cause serious damage, a report of the event is to be made by the SSM to the Inspector immediately.

Reporting Escape or Ignition of Petroleum & Other material

A report must be immediately made by the SSM to the inspector if any of the following occurs;

- Spillage of hydrocarbons which in areas of inland waters is in excess of 80 litres and in other areas is in excess of 500 litres.
- Escape of petroleum in a gaseous form in excess of 500 cubic metres or;
- Any uncontrolled escape or ignition of petroleum, any other flammable or combustible material or toxic chemical causing a potentially hazardous situation.

Reporting Radiation Monitoring

If an incident occurs with the use of radiation or a report is generated in accordance with any legislation relevant to radiation control a copy of the reports prepared in respect of the monitoring of radiation in connection with Petroleum operations, a copy of that report must be sent by the SSM to an inspector within 5 days.

9 AUDIT AND REVIEW

OHSMS performance and systems are monitored, audited and reviewed to identify existing or emerging trends; measure the effectiveness of current standards, objectives and goals; and to provide direction in the development of performance improvement plans.

OHSMS performance shall be verified by a system of audits, inspections and reviews, including:

- External audits;
- Internal audits;
- Scheduled inspections;
- Review process;
- Documented evidence of audits, inspections and reviews;
- Findings and corrective actions; and
- Process for prioritising, tracking and closing out actions.

The principles of risk management and continual improvement shall be applied to all audit programs and processes.

Annual management reviews shall be conducted to determine the continuing suitability, adequacy and effectiveness of OHS Management Systems. The reviews shall address results from audits, the extent to which objectives and targets have been met, and the continuing suitability of the system in the light of changing circumstances and commitment to continual improvement. The reviews shall be documented, including observations, conclusions, requirements, recommendations and follow-up.

Annual self-assessments (internal audits) shall be conducted at each operational level and shall include the requirements of these Standards, together with other requirements specific to the activity and/or location.

The Imperial HSEMS Policies and these Standards shall be reviewed and, where required, revised on an annual basis.

10 DEFINITIONS AND ABBREVIATIONS

Term	Explanation
OHS	Occupational Health and Safety
OHSMS	Occupational Health and Safety Management System
SMP	Safety Management Plan
SOP	Standard Operating Procedure
JSEA	Job Safety and Environmental Analysis
TNA	Training Needs Analysis
PPE	Personal Protective Equipment
KPI	Key Performance Indicators

11 REFERENCES

Relevant OHS Corporate Documentation	
Section	**Relevant Document**
1.0 Introduction	Drug, Alcohol and Contraband Policy Fit For Duty Policy Harassment and Discrimination Policy Occupational Health and Safety Management System Occupational Health and Safety Policy Safety Management Plan Right to Stop Work Policy Workplace Rehabilitation Policy
2.0 Responsibilities	Emergency Response Plan Hazard Register Health Safety & Environmental Management System Occupational Health and Safety Management System Safety Management Plan
3.0 Risk Management	Hazard Register JSEA Development Procedure Lifting Operations Procedure Risk Management Procedure Safety and Environment Hazard Report Form
4.0 Control Measures	Imperial Permit to Work System Chemical Management Procedure Confined Space Entry Procedure Contractor Management OHS Aspects Procedure Contractor Management Procedure Cylinder Safety Procedure Emergency Response Plan Energy Isolation Plan Form Excavation Procedure Isolation List Form Ladders Procedure Lifting Gear Procedure Lockout, Isolation and Tagging Procedure Machine Guarding Procedure Management of Change Procedure Mobile Plant Procedure

	Noise Procedure Occupational Health Safety & Environmental Management System OHS Communications Procedure OHS Documentation Deviation Procedure Power Tools Procedure Safety Management Plan Scaffolding Procedure Shift Handover Controls Procedure SLAM Form Schedule of Onshore Petroleum Exploration & Production Safety Requirements *Schedule of Onshore Petroleum Exploration and Production Requirements* *Work Health And Safety (National Uniform Legislation) Act;* Work Health and Safety (National Uniform Legislation) Regulations; Toolbox Meeting Record Form Working at Height Procedure
5.0 Emergency Preparedness	*Occupational Health & Safety Act* Occupational Health & Safety Regulations *Petroleum Onshore Act* (NSW) Schedule of Onshore Petroleum Exploration & Production Safety Requirements Schedule of Onshore Petroleum Exploration and Production Requirements Onshore Petroleum Directions (NT) Petroleum (Occupational Health and Safety) Regulations NT Petroleum (Submerged Lands) (Management of Environment) Regulations Work Health And Safety (National Uniform Legislation) Regulations (NT). *Work Health And Safety (National Uniform Legislation) Act (NT).*
6.0 Well Control	Grace, R. D. 1994 Advanced blowout and Well Control Enterprise Oil Well Control Manual 2nd revision October 2001 IADC Drilling Manual Version (V.11) 2000 Onshore Petroleum Directions (NT) Petroleum (Occupational Health and Safety) Regulations NT Petroleum (Submerged Lands) (Management of Environment) Regulations *Petroleum Onshore Act (NSW)* Schedule of Onshore Petroleum Exploration & Production Safety

	Requirements Schedule of Onshore Petroleum Exploration and Production Requirements Well Suspension Guidelines NT Dept. Mines and Energy guideline
7.0 Radiation Safety	Schedule of Onshore Petroleum Exploration & Production Safety Requirements Petroleum (Occupational Health and Safety) Regulations NT Petroleum (Submerged Lands) (Management of Environment) Regulations Code of practice for the safe use of sealed radioactive sources in borehole logging (1989*)* Work Health And Safety (National Uniform Legislation) Regulations (NT**)**. Work Health And Safety (National Uniform Legislation) Act (NT**)**. Code of practice for the safe use of sealed radioactive sources in borehole logging (1989) Radiation Health Series No. 28, issued by the National Health and Medical Research Council
8.0 Training and Competence	Competence – OHS Aspects Procedure
9.0 Information Management	Development of OHS Documents Procedure Incident Reporting, Recording and Investigation Procedure OHS Document Control Procedure

12 ATTACHMENT A –LOCATION MAP

13 ATTACHMENT B – HAZARD & RISK ASSESSMENT TEMPLATE

Safe Operating Procedure
Title:
Authors:
Date:
Functional Area & Job:

Task No.	Description of Task	Tools, equipment PPE	Hazards within the task	Raw Risk	Controls	Residual Risk
1						
2						
3						
4					.	
5						
6					.	
7						
8						

IMPERIAL ENERGY SEISMIC LINE AND DRILL PAD ARCHAEOLOGICAL SURVEY – FAVENC RANGE, NORTHERN TERRITORY

A report for Imperial Oil and Gas Pty Ltd (Imperial Energy)

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August 2019

Cover photo: RTF(QZ) bifacially retouched point and VH-RQJ at LZ10.

EXECUTIVE SUMMARY

Imperial Oil and Gas (Imperial Energy) are proposing to construct six seismic lines totalling 231.8km on the eastern edge of the Favenc Range, halfway between Daly Waters and Borroloola in the Northern Territory. An aerial survey was the most efficient method to cover a large area in the short time available. Two drill pads and four alternative drive pad sites are also planned including access tracks to those sites. These works required an archaeological assessment to mitigate their impact on cultural material.

Four low-density background scatters and one significant archaeological site were found. All of the sites occur in the vicinity of Balbirini Creek, an important water way in the north of the survey area. The proposed works will have little to no impact on three of the sites. The high-density artefact scatter, Imperial Energy Archaeological Site 1 (IEAS01) will, however, is directly impacted. A Restricted Work Area (RWA) is suggested for the site. A site boundary polygon has been recorded. All works should avoid the site.

Summary of recommendations:

- **Mitigation schedule of sites:**

No.	Site ID	Site Type	Individual site type	GPS Grid Reference (Centroid) Datum: WGS 84, Zone: 53L		Description	Significance	Recommendation
			Artefacts (n.)	Easting	Northing			
1	IEBS01	Artefact scatter	2			Low density, 50m radius	Low	Option 1. Avoid. Site is 100m to the west of Line 3
2	IEBS02	Artefact scatter	4			Low density, 145m radius	Low	Option 1. Avoid. Option 2. Destroy
3	IEBS03	Artefact scatter	4			Low density, 30m radius	Low	Option 1. Avoid. Site is 30m to the east of Line 6
4	IEBS04	Artefact scatter	3			Low density, 6m radius	Low	Option 1. Avoid. Site is 10m to the east of Line 4. Wpt No. 801 moved 10m to the east
5	IEAS01	Artefact scatter	>5 per m^2			High density artefact scatter with a range of tool types	High	Option 1. Avoid. Line 6 runs through the site. Refer to RWA (Fig. 11 and Appendix 2)

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1.0 INTRODUCTION

1.1 Background and consultancy brief

Imperial Oil and Gas Ltd Pty (Imperial Energy) are proposing to build 231.80kms of seismic survey lines and two drill pads on the eastern edge of the Favenc Range, off the Carpentaria Highway, half way between Daly Waters and Borroloola in the Northern Territory (Figs 1 and 2). An archaeological survey was required to assess the impact of the proposed works, if any, on archaeological sites, or objects.

A four-day aerial survey was conducted from 5 to 8 August 2019 by archaeologists Douglas Hobbs, Silvano Jung and with Traditional Owner Peter Ellis from the Lightning Ridge outstation off Broadmere Road. Our pilot was Clinton Brisk, who flew a Robinson R44 (VH-RQJ). The consultancy brief was specifically to:

- Identify any prescribed archaeological objects or places as defined under the Northern Territory *Heritage Act (2012)*, and any archaeological sites located within the entire survey area.

- Assess the nature, distribution and significance of these objects or places and discuss possible constraints to the works posed by the presence of archaeological and historic sites and an indication of what sites are likely to be the most sensitive in this respect.

- Present a final report including a summary of survey results, determination of significance of sites and the likely impact of the proposed development, and recommendations regarding management strategies or mitigation procedures as appropriate under the Northern Territory *Heritage Act (2012)*.

The 231.8kms of survey lines are divided into six lines. The lines will be approximately 10m wide i.e., five metres either side of the survey centre line. Line One, which runs parallel to the Carpentaria Highway, from east to west, is 33.6km long. Line Two, which runs parallel and to the south of Line One, is 25.3kms long. Line Three runs perpendicular to the previous two lines, and is 50.4kms long. This line runs from the north of the highway on the Balbirini Creek and crosses the highway in a south by southeasterly direction. Lines Four, Five and Six run in a similar direction and are 33kms, 34.4kms and 55.1kms long respectively.

Two drill pads are also proposed, one (SL-4) on Line Four, with four alternative sites (SL-4 ALT 1 - 4). The other proposed drill site is on Line Two (SL-3) with no alternative sites. The drill pad sites are 120m^2. Two access tracks to these drill pads from the highway were also part of the survey. The track to SL-4 is 6.3kms long and the track to SL-3 is 5.5kms long.

Several previously recorded archaeological sites north of the highway were relocated, but these were well outside of the construction corridor for the seismic lines. The corridor is ten metres wide. Four background scatter sites and one archaeological site were found during the survey. All sites were characteristically stone artefact scatters. The following describes the methods and outcomes of the survey, together with recommendations for the proposed works.

1.2 Environmental description

The survey area north of the Carpentaria Highway is characterised by open woodland and savannah, with a major waterway to the north of the highway, Balbirini Creek. This section of the survey area is heavily dissected across the Favenc Range, levelling out across black soil plain. North of the highway, quartzite outcrops occur.

In the southern section of the survey area, it is virtually all floodplain with only one major waterway, Relief Creek, which was dry at the time of the survey. The only permanent water sources are Cockatoo (near the eastern end of line 1) and at Eleanor Pool Yard1, off Broadmere Road.

Some ten kilometres southeast of the survey area is Paradise Pool, not far from the McArthur River, which would have been a significant refugia for Aboriginal People. It's triple waterfalls fill a permanent pool with abundant resources.

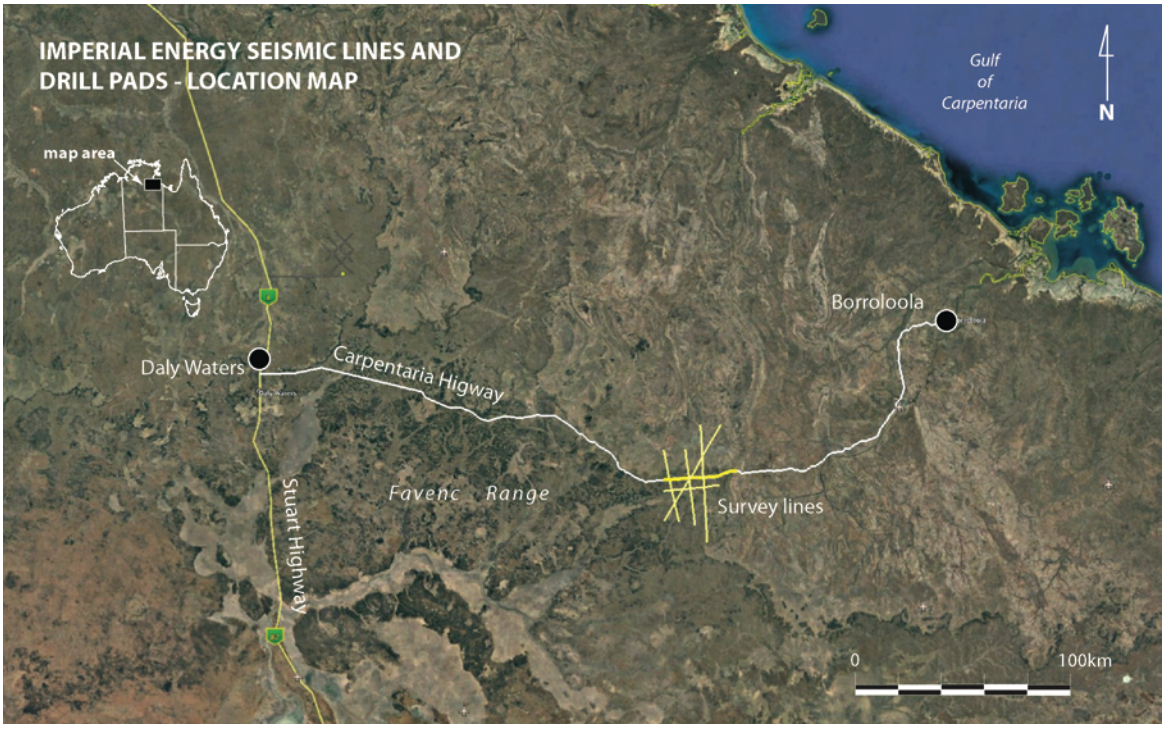

Figure 1. Location map of the study area, between Daly Waters and Borroloola on the Carpentaria Highway, on the eastern edge of the Favenc Range (After Google Earth).

The geology is recorded as predominately black soil plains north of the Carpentaria Highway and bounded at the northern end of the survey lines, associated with alluvial and lateritic deposits south of the highway. The following geological units occur in the survey area:

- KI Sandstone, lithic sandstone, clayey sandstone, conglomerate, sandy claystone and siltstone, commonly ferruginised and silicified; claystone may contain bivalve and brachiopod shell impressions and possible belemnite casts; sandstone commonly contains plant debris casts and leaf imprints.

- Czl – Pisolitic and mottled laterite: in situ and reworked remnants of standard laterite profiles (Fig. 2)

- Cz – Undifferentiated alluvial, colluvial and eluvial deposits: unconsolidated gravel, sand, silt, clay, ferruginous cemented detritus, minor calcrete, silcrete and ferricrete.

- Czb – Grey-black, earthy, clay-rich soil; black soil plain

- Pre – Ridge-forming: pseudo-karstically weathered, strongly jointed quartzarenite; feldspathic and ferruginous in places; predominantly planar cross-beds, ripple marks (Fig. 3).

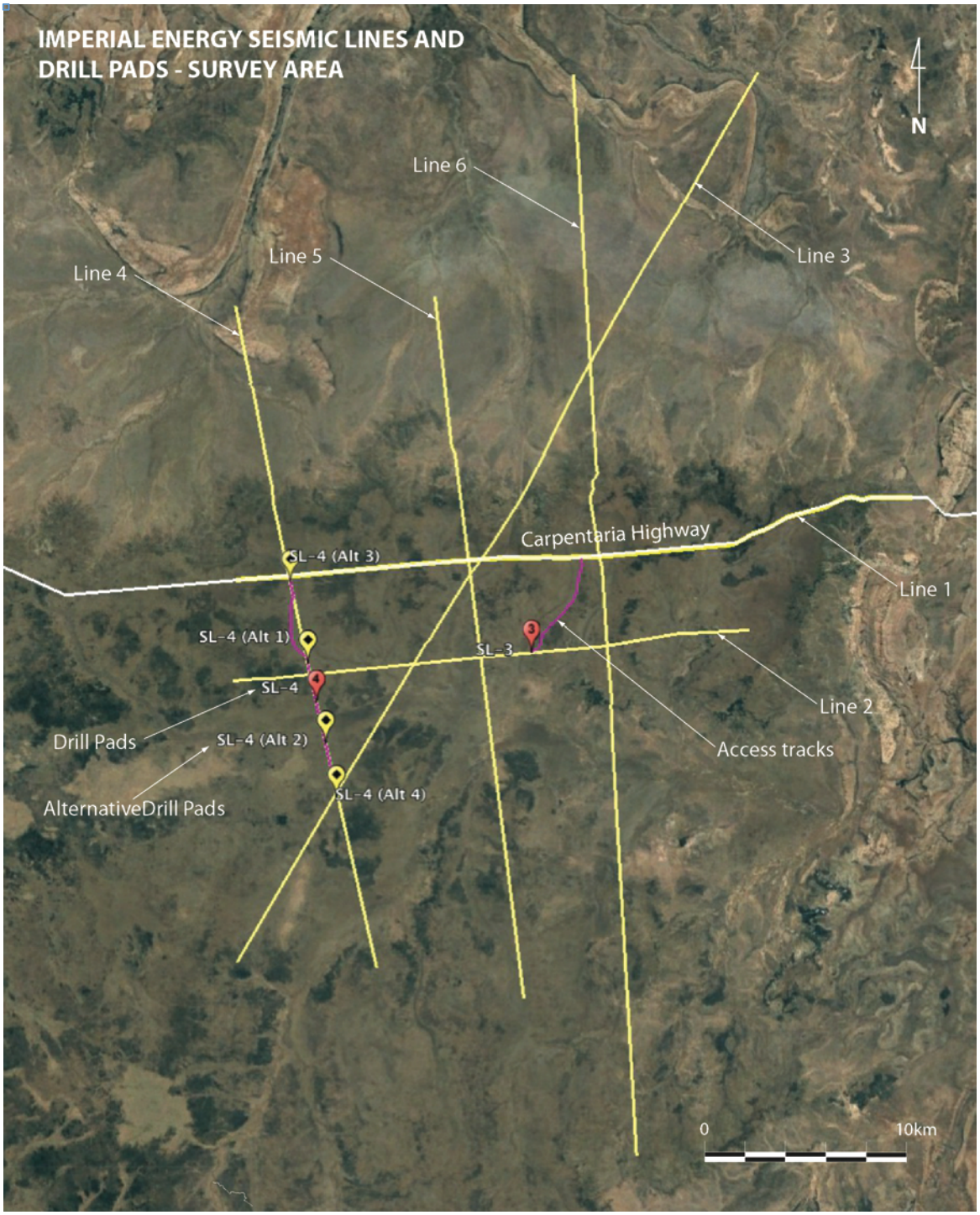

Figure 2. Location of the study area on the Carpentaria Highway, showing seismic lines, drill pads and access tracks (After Google Earth).

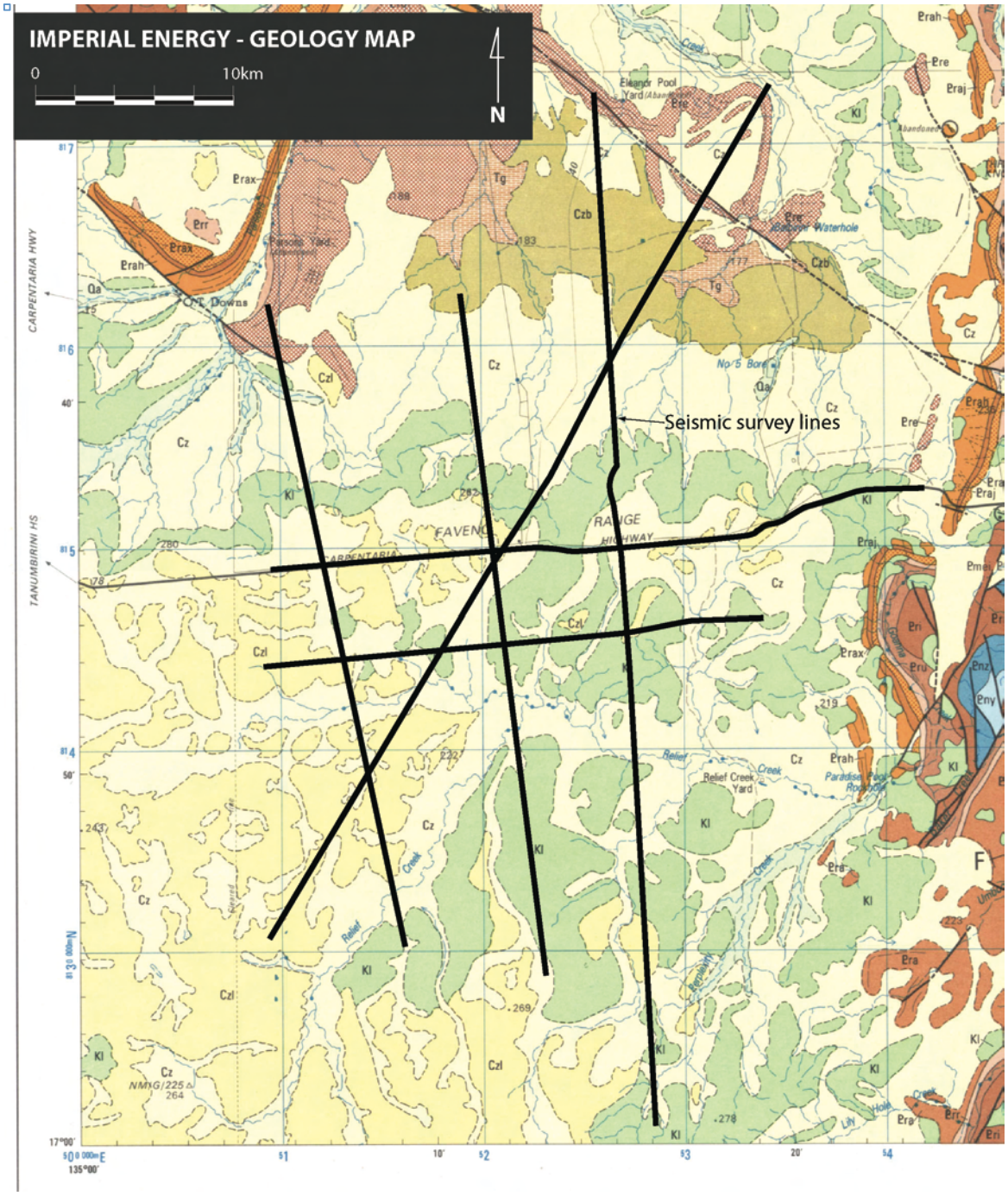

Figure 3. Geology map of the survey area with overlaid seismic survey lines (After BAUHINIA DOWNS se5303. Geoscience Australia. 1: 250 000 Geological Map, 1st edition 1991. http://scanned-maps.geoscience.gov.au/250dpi/se5303.jpg. Accessed 11 August 2019).

The vegetation communities are open woodland dry sclerophyll forests *of E. miniata* (Darwin Wooly Butt), *E. tetrodonta* (Stringybark) and *E. bleeseri* (Smooth-stemmed Bloodwood), extensively covered by an understorey of Mitchell and spinifex grasses. *E. pruinosa* (Silverleaf Box) occurs extensively in the survey area, south of the Carpentaria Highway on the Barkly Tablelands.

2.0 HERITAGE LEGISLATIVE FRAMEWORK

2.1. Northern Territory legislation

There are two kinds of heritage sites protected under the Northern Territory *Heritage Act* (2012), hereafter referred to as the Act, declared and prescribed places and objects. The Act places legal constraints on owners of private property, local government and the Crown:

- Places or objects listed on the Northern Territory Heritage Register are declared heritage places and objects that are protected under section 33 of the Act, and

- Prescribed archaeological places and objects, which may or may not be declared, are protected under sections 29 and 39 of the Act.

It is an offence under the Act to damage, destroy, alter or carry out work of any sort on declared or prescribed sites without the written consent of the Minister or Minister's delegate. If considered appropriate, the Heritage Branch may on occasion utilise the discretion available in the Act to give permission for small-scale disturbance (such as the relocation of isolated stone artefacts) without the need for a formal application. The discretion is allowed under s148 of the Act, which in effect says that a heritage officer (such as an archaeologist) may undertake actions (or authorize actions), not construed as an offence.

2.1.1 Declared heritage places and objects

Categories, which describe the status of each site on the Northern Territory Heritage Register database, are listed in Table 1.

Table 1. Site status on the Northern Territory Heritage Register database

Status	Description
D	Declared heritage place.
NR	Not recommended. HC* determined that the place did not meet heritage assessment criteria and did not hold sufficient value to warrant declaration under the *Act*.
RF	Refused by the Minister. HC* recommended for declaration and Minister refused to do so.
P	Proposed. HC* has determined that the place warrants declaration under the *Act* but has not yet made its recommendations to the minister.
RV	Revoked. Declaration as a heritage place pursuant to Section 26(1) of the *Act* is revoked.
N	Nominated. HC* has yet to complete its assessment of the heritage value of the place.

*Heritage Council

The Northern Territory Heritage Register contains places that possess special significance for the Northern Territory and have been recognized for a wide range of natural and cultural values. As a result it includes places that have been deemed significant because of their environmental and/or cultural characteristics. For the purposes of the current report, only places of historic or archaeological significance have been included. A search of the register indicates that the proposed Imperial Energy works will not impact on any sites listed in the Heritage Register.

2.1.2 Prescribed archaeological places and objects

Most archaeological places and objects are listed in the *Heritage Conservation Regulations* (1999) as prescribed places and objects. The Heritage Branch, Department of Tourism and Culture, formerly the Department Lands, Planning and Environment (DLPE), formerly the Department of Natural Resources Environment and the Arts (NRETAS) hold the Archaeological Sites Register. Included in this register are the protected prescribed sites that consist of all archaeological sites and objects pertaining to the past occupation by Aboriginal People. Any historic sites listed on this register do not indicate that these sites are protected or hold legal significance under the Northern Territory *Heritage Act* (2012).

2.2. Constraints

2.2.1 Ground Integrity (GI)

Assessing ground surface integrity provides an indicator of whether or not the landscape under study has been modified, and if so the degree of disturbance encountered. It then becomes possible to gauge the degree to which modification has influenced the environmental context within which artefacts and/or places of cultural and/or scientific interest are located. Ground surface integrity must also be assessed from the perspective of the current legislation.

The *Aboriginal Cultural Heritage Act 2003* (in Queensland, but equally applicable to the Northern Territory) provides a definition for GI that includes the removal of native vegetation as inferring the ground has been subjected to 'significant ground disturbance'. Under these criteria of modification, therefore, the *Act* assumes that archaeological integrity and significance is greatly reduced, is negligible, or even extinguished completely.

Contrary to this however, archaeologists are continually finding evidence that important cultural heritage material and/or places regularly survive not only land clearing activities but also invasive farming techniques such as ploughing.

Combined with this is the fact that, regardless of levels of GI, significant Aboriginal objects and/or significant Aboriginal areas can be defined on entirely cultural grounds, by Traditional Owners, not requiring any assessment of ground surface integrity.

Levels of GI are determined using a percentage range between 0-100% where 0% indicates all GI is gone, and 100% represents excellent preservation of the original context. Zero – 0%; Poor – 1-25%; Moderate- 26-50 %; Fair – 51-75 %; Good – 76-85%; Excellent 86-100%.

2.2.2 Ground Surface Visibility (GSV)

Assessments of ground surface visibility provide an indication of how much of the ground surface can actually be seen.

Ground surface visibility (GSV) is most commonly inhibited by vegetation but other inhibitors may include concrete, gravel and bitumen. Levels are determined using a percentage scale similar to that used for the calculation of Ground Integrity (GI), in that 0% represents zero visibility and 100% represents maximum visibility (bare ground). Zero – 0%; Poor – 1-25%; Moderate – 26-50 %; Fair – 51-75 %; Good – 76-85%; Excellent – 86-100%. The better the visibility, the more potential there is for locating cultural/archaeological material.

3.0 PREVIOUS RESEARCH

3.1 Literature review

The geologist Ernest Favenc mapped the Favenc Range in 1883 (Gibbney, 1972). The main concentrations of Aboriginal People that he saw were at Anthony Lagoon, Corella Lagoon and Brunette Creek, just to the south of the survey area and to the east of the former overland telegraph line (Sydney Mail, 1883). A map of expedition shows that he departed from Cresswell Creek in a north, northeasterly direction to Borroloola (National Archives of Australia. Series Number: A6128, Control Symbol: NTR119B and Series Number: A6128, Control Symbol: NTR119C).

The first archaeological survey conducted was in 1998 for the Nabre seismic line (Guse and Collis, 1998). The results of that survey discovered six archaeological sites, which occur in this year's survey area, most of which were stone artefact scatters (Table 2). Imperial Energy's proposed works, however, will directly impact none of those sites. The route of the 1998 survey is shown if Figure 4. The 1998 survey only covered one transect north of the Carpentaria Highway. No previous work has been conducted south of the highway.

Table 2. Previously recorded archaeological sites in the study area (Courtesy: Heritage Branch, NTG)

Site_Name	Easting	Northing	Zone	No#_Map _Sheet	Map_ Sheet	Site_Type	Contents	Comments
Balbirini Creek1			53	5964	O.T. Downs	Stone artefact scatter	Artefact scatter	
Balbirini Creek2			53	5964	O.T. Downs	Stone artefact scatter	Artefact scatter	
Eleanor Pool Yard1			53	5964	O.T. Downs	stone artefact scatter, historic site, stone arrangement, grindstone portable	Artefact scatter, stone arrangement, faunal remains	Contact site, knapped glass
OT Downs1			53	5964	O.T. Downs	Quarry	Quarry	
OT Down2			53	5964	O.T. Downs	Stone artefact scatter	Artefact scatter	
OT Down3			53	5964	O.T. Downs	Stone artefact scatter, grindstone portable	Artefact scatter	

Figure 4. Map of previously recorded archaeological sites in the survey area (After Guse and Collis, 1998: between pages 5 and 6).

4.0 METHODS

4.1 Survey method

The survey method was to use a helicopter to assay likely habitation areas. Water is a key determinate as to where people were in the environment. Waterways were targeted in the aerial survey, as well as low stoney laterite ridges on the edges of swamps and drainage channels. Rock outcrops were also investigated, as well as rocky ridges for possible stone arrangements and or quarries. A pedestrian survey was conducted along each of the survey lines from the helicopter land zones (LZs). Artefacts were photographed and a GPS grid reference was recorded. Previously recorded sites were relocated to confirm their locations with current GPS accuracy, as the GPS coordinates for sites recorded in 1998 were still being dithered.

4.1.1 Identification of archaeological material

Stone artefacts, including tools and debitage, the by-product of manufacture, are identified on the following criteria after McCarthy (1976), Holdaway and Stern (2004):

- Bulb of percussion
- Erailure scar (on the ventral surface)
- Point of force application (PFA) and associated ring crack
- Termination types (e.g. feathered, stepped, hinged, plunge)
- Flake scars (dorsal scars and ridges)
- Cores (identified by the presence of negative flake scars)
- Hammer stones (identified by the presence of end-crushing on pebble stones)
- Retouch (reworking of flake margins)
- Raw material type
- Grinding stones (very smooth wear on upper surface)

List of artefact type abbreviations:

- Ad – Adze
- An – Anvil
- Bl – Blade
- Co – core
- Cf – Core fragment
- Ct – Core tool
- F – flake
- Fp – flake piece
- Gs – Grindstone/Grinding plate
- Hs – Hammer stone
- M – Manuport
- Mp – Multi platform core
- Rtf – retouched flake
- S – Scraper
- Sp – Single platform core
- Ts – Top stone
- X – Axe/wasted cobble
- Z – Other e.g., ceremonial

List of artefact raw material abbreviations:

- Ch – Chert
- G – Greywacke
- Hs – Hornsfel

- Im – Indurated mudstone
- J – Japser
- SS – Sandstone
- S – Silcrete
- Q – Quartz
- Qz – Quartzite
- V – Volcanic

4.1.2 Definition of archaeological sites

4.1.2.1 Historical Sites

Historical sites in north Australia are those that have physical evidence of European and non-European activities. These range from Macassan sites to military sites of WWII. These sites may overlap with Aboriginal heritage sites.

4.1.2.2 Aboriginal Heritage Sites

Aboriginal archaeological sites can be classified by six main types: 1) stone knapping sites, including quarries, 2) background scatters, including isoliths, 3) stone arrangements, such as mounds, walls, fish traps or stone motifs, 4) shell middens, 5) burials, 6) scarred trees and 7) rock art sites.

Burke and Smith (2004:63) define an archaeological site as ‘any place that contains the physical evidence of past human activity. Australia, however, has what has been referred to as a background scatter of stone artefacts, which refers to low-density artefact scatters that either represent singular knapping events (‘dinner-time’ camps or ‘hunting camps’), or larger sites that have been buried or disturbed. To differentiate this site type from larger sites that may contain thousands of artefacts, the term Archaeological Site (AS) is used to describe home-camps or quarries i.e., places where people have been returning to for millennia, as opposed to sites that have very low artefact densities that represent sporadic visits i.e., background scatters (BS).

5.0 RESULTS

5.1 Archaeology

Thirty-four landings were made along the six survey lines and at the drill pads (Table 3 and Fig. 5). GSV was generally 80 – 90% across the survey area. GI was assessed as 90%. Cattle and pig damage accounted for lowering GI. Four low-density background scatters and a high-density archaeological site were located, all in proximity to Balbirini Creek. The location data and find descriptions are presented in Table 4 and mapped in Figure 6. Artefact photographs are listed in Appendix 1.

All previously recorded sites were relocated with the exception of OT Downs2, whereby only a chert core was found. No grindstone was found at OT Downs3. The stone arrangement at Eleanor Pool Yards1 was not found and was most likely destroyed during the construction of water tanks on top of the ridge. The drill pads SL-3 and SL-4 (and it's four alternative sites) were inspected, but no archaeological material was found. Figure 7 shows the drill site for SL-4, with typical vegetation and terrain for the area.

The two access tracks leading to the drill pad sites were assayed from the air, but no suitable habitation areas were seen along their routes.

Table 3. Location of LZs and descriptions

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[121]: WGS 84					
Name	**Description**	**Zone**	**Zone**	**Easting**	**Northing**
LZ01	OT Downs1	53	K		
LZ02	SL-4 (ALT3) drill pad, flat, open woodland	53	K		
LZ03	Line 1, eastern edge of range. Heavily dissected, narrow valley floors. Rocky ridges	53	K		
LZ04	Line 1, eastern edge of range. Heavily dissected, narrow valley floors. Rocky ridges	53	K		
LZ05	Line 1, eastern edge of range. Heavily dissected, narrow valley floors. Rocky ridges	53	K		
LZ06	Line 2, flat, open woodland with understory of Mitchell grass, laterised light brown soils	53	K		
LZ07	Line 2, ephemeral creek	53	K		
LZ08	SL-3 drill pad, flat, open woodland	53	K		
LZ09	Line 3, Balbirini Creek, northern bank. IEBS01	53	K		
LZ10	Line 3, Balbirini Creek, southern bank. IEBS02	53	K		
LZ11	Eleanor Pool Yard1	53	K		
LZ12	Balbirini Creek1	53	K		
LZ13	Line 3, small ephemeral creek, open woodland, flat	53	K		
LZ14	Line 3, Small creek line on edge of Broadmere Road	53	K		
LZ15	SL-4 (ALT4) drill pad, flat, open woodland	53	K		
LZ16	Line 4, Relief Creek, ephemeral, open	53	K		

	woodland, flat, bloodwoods, and stringy barks.				
LZ17	SL-4 (ALT2) drill pad, flat, open woodland	53	K		
LZ18	O T Down2	53	K		
LZ19	Line 4. On top of stoney ridge, quartzite outcrop. Adjacent to ephemeral creek, flat, yellow sandy, laterised soils – IEBS04	53	K		
LZ20	Line 4, ephemeral creek, flat, open woodland, underground of spinifex, stoney, laterised soils	53	K		
LZ21	Line 4, northern edge of Favenc Range, gentle slopping ridges from creek like to the base of the range	53	K		
LZ22	SL-4 (ALT-1), open woodland, flat, understory of Mitchell grass	53	K		
LZ23	SL-4 drill pad. Open woodland, flat, understory of Mitchell grass	53	K		
LZ24	Line 5, open woodland, flat, understory of Mitchell grass	53	K		
LZ25	Line 5, near Relief Creek, large creek with steep banks, adjacent to large black soil billabong (dry)	53	K		
LZ26	Line 5, gentle undulating rises, edge of Favenc Range	53	K		
LZ27	Line 5, rocky quartzite outcrop	53	K		
LZ28	OT Downs3	53	K		
LZ29	Line 6, Balbirini Creek	53	K		
LZ30	Line 6, Balbirini Creek IEBS03, IEAS01	53	K		
LZ31	Line 6, stoney quartzite outcrops	53	K		
LZ32	Line 6, edge of Favenc Range	53	K		
LZ33	Line 6, heavily dissected valleys, sandy floors with drainage lines	53	K		
LZ34	Line 6, flat open woodland, dry ephemeral creek bed, yellow soils	53	K		

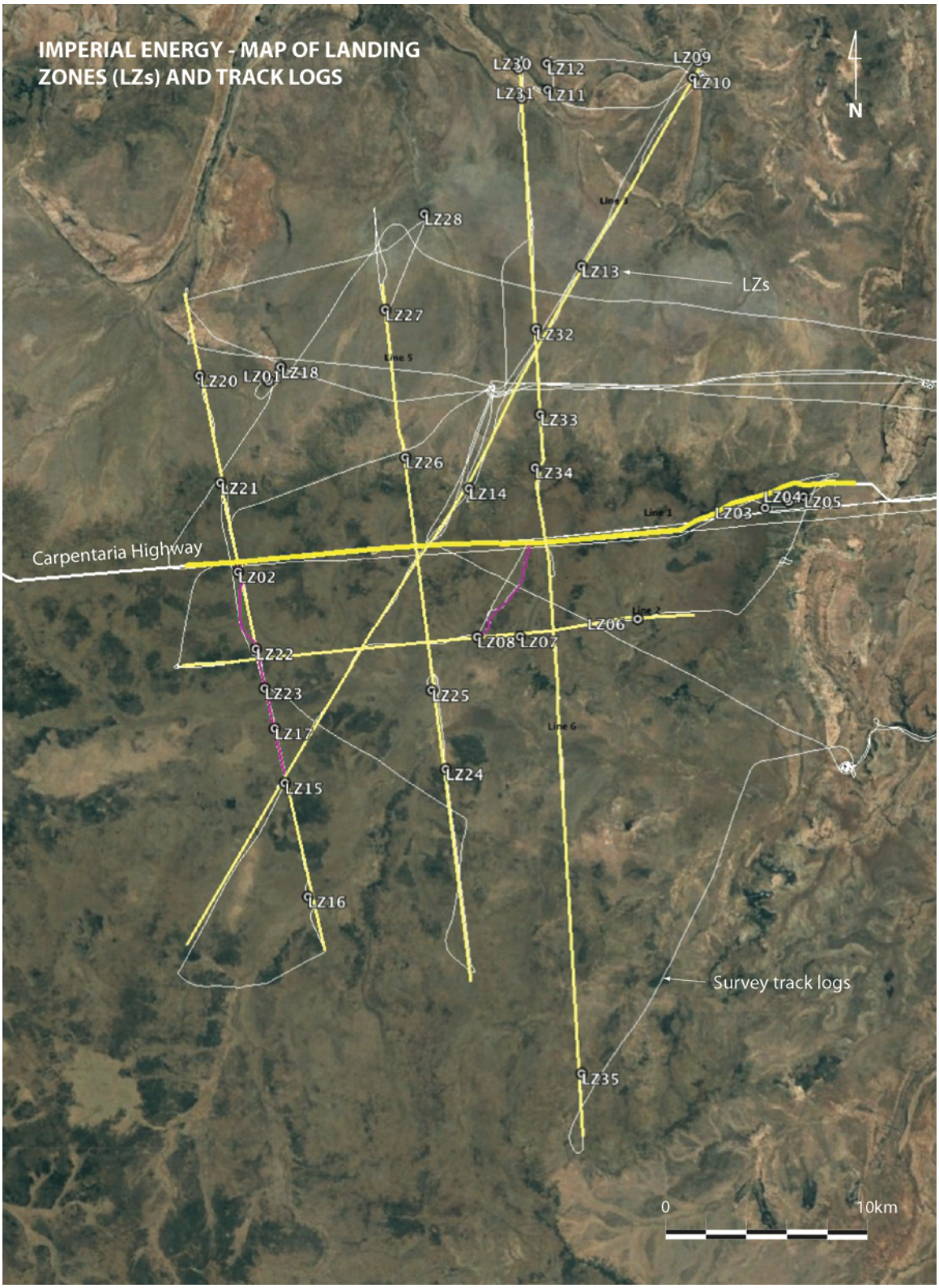

Figure 5. Map of Landing Zones (LZs) and survey track logs (After Google Earth).

Table 4. Background Scatters (BS) and Archaeological Sites (AS)

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[121]: WGS 84						
WPT Name	**Comment**	**Zone**	**Zone**	**Easting**	**Northing**	**Photo No.**
IEBS01						
796	F(S)	53	K			DSCN9203 DSCN9204 Site photo
IEBS02						
797	F(QZ)X1. FP(QZ) X2	53	K			DSCN9208
798	F(QZ)	53	K			
BALBIRINI CREEK1						
799	BALBIRINI SITE 01	53	K			
BALBIRINI CREEK2						
800	C(C)	53	K			DSC_7354
IEBS03						
804	FP(QZ)	53	K			DSCN9236
805	F(QZ)	53	K			DSCN9237
806	FP(QZ)	53	K			DSCN9238
807	F(C)	53	K			DSCN9239 DSCN9240 Site photo
IEBS04						
801	RTF(QZ) BIFACIAL, BROKEN TIP	53	K			DSCN9218 Obverse DSCN9219 Reverse
801-R (Relocated)		53	K			
803-1	FP(S)	53	K			DSCN9232
803-2	FP(S)	53	K			DSCN9233
OT Downs3						
802	C(C)	53	K			DSCN9228
OT Downs 2						
						DSCN9213
IEAS01						
808	F(S) DISTAL	53	K			DSCN9241
809	FP(QZ)	53	K			DSCN9242
810	F(QZ)	53	K			DSCN9243
811	F(QZ)	53	K			DSCN9244
812	S(QZ)	53	K			DSCN9245

						DSCN9246 Site photo
813	S(QZ)	53	K			DSCN9247
814	S(QZ)	53	K			DSCN9248
815	S(C)	53	K			DSCN9249
824	C(S)	53	K			DSCN9250
Paradise Pool						
835	Permanent water source	53	K			
Cockatoo						
	Near by permanent water source adjacent to the highway, just north of Line 1	53	K			

Figure 6. Map of all archaeological sites – red dots (After Google Earth).

Figure 7. Drill pad SL-4 environment with VH-RQJ virtually on the GPS mark.

5.2 Background scatters (BS) and archaeological sites (AS)

5.2.1 IEBS01

Low-density artefact scatter at the northern end of Line 3 at Balbirini Creek. On low laterite rise to the north of the creek. It is in an open woodland with Mitchell grass cover and is relatively flat (Fig. 8).

Figure 8. IEBS01 site photo.

5.2.2 IEBS02

Low-density artefact scatter on stoney rise at the northern end of Line 3. At base of stoney rise. Generally flat with low outcrops of silcrete and quartzite.

5.2.3 IEBS03

Low-density artefact scatter on top of stoney rise about 12m above ground flood plain. Outcrops of sandstone, quartzite and silcrete (Fig. 9). Site leads down to IEAS01.

Figure 9. IEBS03 site photo. Scale in 2m.

5.2.4 IEBS04

Low-density artefact scatter in reddish/brown laterite soils at the base of a quartzite and silcrete rise. Significantly, the only retouched point found in the survey was found here. It is bifacially retouched, which is rare. Retouched points are generally unifacially retouched in this region (Fig. 10). The point is virtually intact, except for the tip, which is broken.

Figure 10. Traditional Owner, holding the bifacially retouched point at IEBS04.

5.2.5 IEAS01

Just south of IEBS03 at the base of a rocky ridge near Balbirini Creek, lies a high-density artefact scatter with a range of tool types including scrapers, flakes and flake pieces. The site is at the edge of a waterway that runs at the base of the ridge and lies exposed on yellow/brownish laterite soils. It was dry at the time of the survey. The site is close to Broadmere Road. A Restricted Work Area (RWA) polygon was established around the site. Line 6 goes through the site. Figure 11 maps the site and shows it's proximity to Broadmere Road and it's relation to IEBS03 on top of the nearby ridge. Figures 12 and 13 show ground and aerial perspectives of the site. The light brown, yellowish laterite soils provide a clear view of artefacts with increased GSV.

Figure 11. IEAS01 site plan (After Google Earth).

Figure 12. IEAS01 site photo. Scale in 2m.

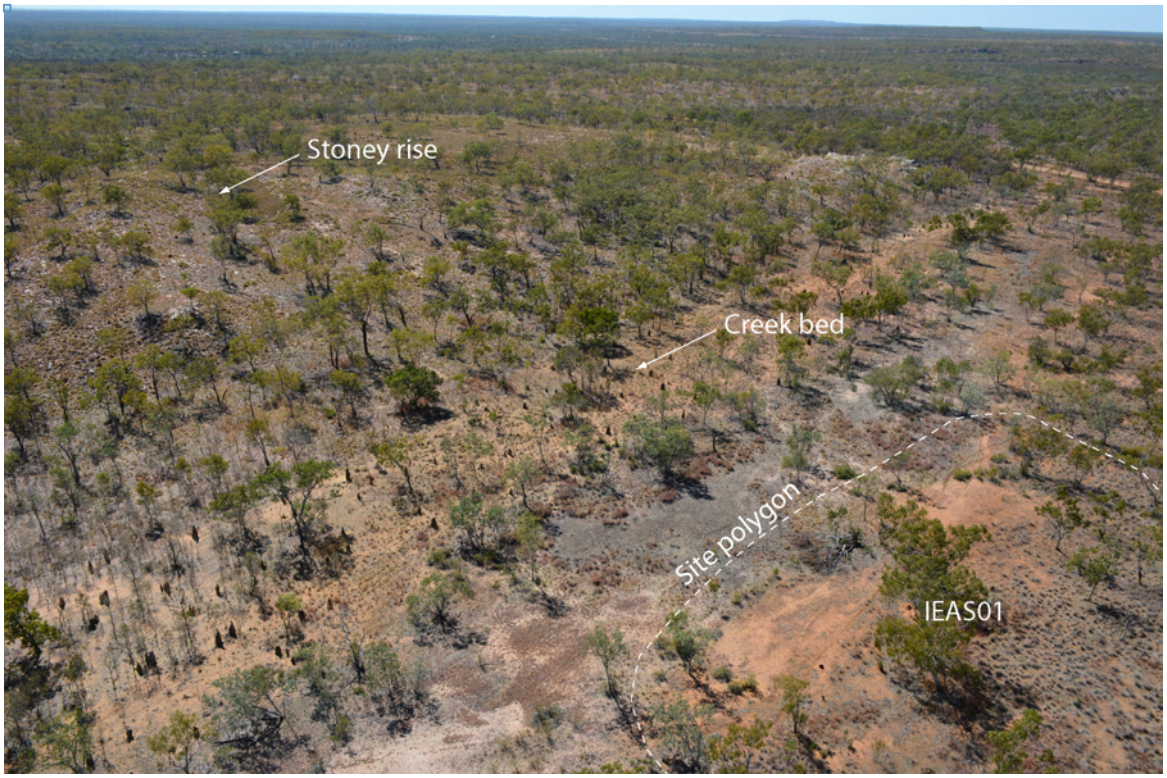

Figure 13. Aerial view of IEAS01 at the base of a stoney rise, adjacent to ephemeral creek.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The archaeological survey of Imperial Energy's proposed seismic line and drilling programme on the Favenc Range in the Northern Territory recorded five sites. Four of these were low-density artefact scatters, or Backgound Scatters and one is a high-density archaeological site near Broadmere Road. All of the finds occur in the northern section of the survey area in close proximity to Balbirini Creek.

No cultural material was found south of the Carpentaria Highway. There were no suitable rock outcrops found there and there is only one significant waterway, Relief Creek, which was dry at the time of the survey. No cultural material was found at the six proposed drill pad sites and access tracks.

The following recommendations arise from this report:

6.2 Recommendations

6.2.1 Recommendation 1: Site Avoidance

- The proposed works will have no impact on IEBS01 and IEBS03 (Line 3 and Line 6 respectively) as these sites were greater than ten metres from the centre line of the proposed seismic lines. No further action is required.
- IEBS04 is >10m to the east of Line 4. No further action is required.
- Line 6 will impact IEAS. A RWA has been established for the site and the site should be avoided. Appendix 2 lists the grid references for the RWA site polygon.

6.2.2 Recommendation 1: Site destruction

- IEBS02 covers a considerable area. It was impractical to move the finds. Site recommendations should be to avoid the last 1km northern section of Line 3 at Balbirini Creek. If not, the artefacts may be destroyed as they are of low archaeological significance.

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National Archives of Australia. Series Number: A6128, Control Symbol: NTR119C, Title: [shows track from Anthony's Lagoon to Borroloola]. Reduced 5/8 from E. Favenc's Exploration. National Archives of Australia, Canberra.

Newspapers:
Sydney Mail. 1883. 'Mr Ernest Favenc's expeditions in the Northern Territory'. Sydney Mail and New South Wales Advertiser (NSW: 1871 - 1912), Saturday 10 November 1883, page 905.

APPENDIX 1: Artefact photographs

Figure 14. Wpt No. 796 F(S). Scale in 1cm.

Figure 15. Wpt No. 797 FP(QZ) x 2, F(QZ). Scale in 1cm.

Figure 16. Wpt No. 801 RTF(QZ) Bifacially retouched point. Obverse. Scale in 1cm.

Figure 17. Wpt No. 801 RTF(QZ) Bifacially retouched point. Reverse. Scale in 1cm.

Figure 18. Wpt No. 804 FP(QZ). Scale in 1cm.

Figure 19. Wpt No. 805 F(QZ). Scale in 1cm.

Figure 20. Wpt No. 806 FP(QZ). Scale in 1 cm.

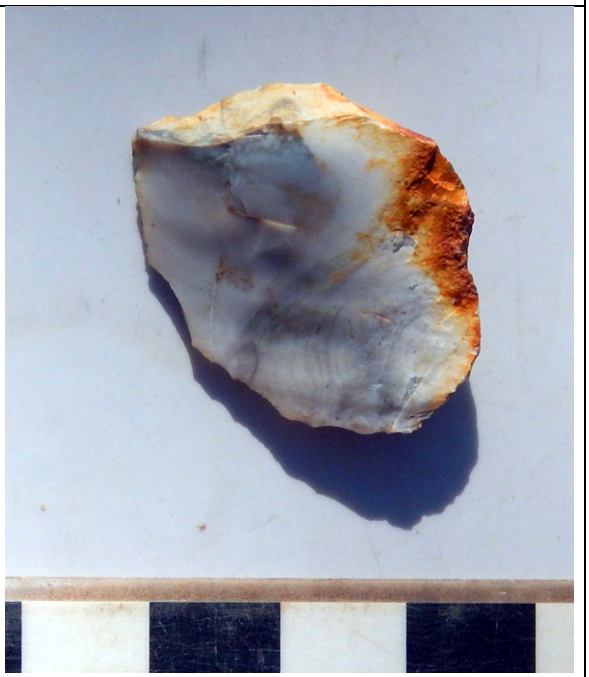

Figure 21. Wpt No. 807 F(C). Scale in 1 cm.

Figure 22. Wpt No. 808 F(S) distal. Scale in 1cm.

Figure 23. Wpt No 809 FP(QZ). Scale in 1cm.

Figure 24. Wpt No. 810 F(QZ). Scale in 1cm.

Figure 25. Wpt No. 811 F(QZ). Scale in 1cm.

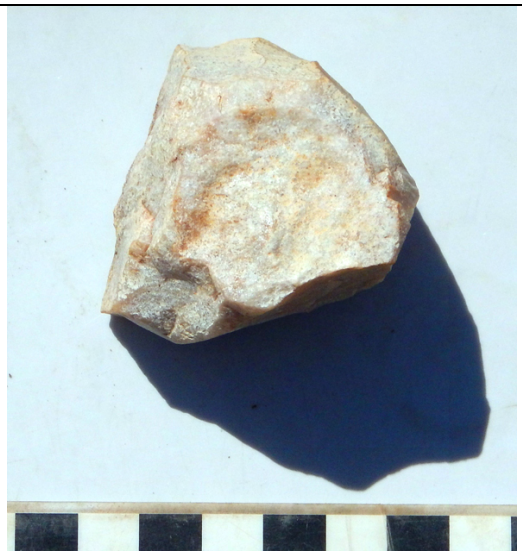

Figure 26. Wpt No. 812 C(QZ). Scale in 1cm.

Figure 27. Wpt No. 813 S(QZ). Scale in 1cm.

Figure 28. Wpt No. 814 S(QZ). Scale in 1cm.

Figure 29. Wpt No. 815 S(C). Scale in 1cm.

Figure 30. Wpt No. 824 C(S). Scale in 1cm.

Figure 31. Stone artefacts at OT Downs2. Scale in 1cm.

Figure 32. Silcrete core at OT Downs2. Scale in 1cm.

APPENDIX 2: IEAS01 Restricted Work Area (RWA) polygon coordinates

Format: UTM M/D/Y H:M:S 9.50 hrs Datum[121]: WGS 84				
ID	Zone	Zone	Easting	Northing
T	53	K		
T	53	K		
T	53	K		
T	53	K		
T	53	K		
T	53	K		
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T	53	K		
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