



IMP EMP2-6.1 Attachments

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Emergency Response Plan

Imperial 2020 Drilling Program

NT Exploration Permit (EP) 187

Version	Description	Date	Author(s)	Reviewer	Approved
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1. Introduction

This Emergency Response Plan (ERP) describes processes to be followed by Imperial Oil & Gas (Imperial) in the event of an emergency during Drilling and Completions activities at Exploration Permit 187 (EP187).

The ERP is designed to guide the Imperial response team for the project in conjunction with the support from the engineering and project management subcontractors, and relevant third parties to respond effectively and promptly to site-level emergencies and return the site to normal operations.

2. Scope

This plan applies to all employees, contractors, and visitors; involved with the Carpentaria 1 project including:

- Drilling, well completion, intervention or abandonment activities,
- Vehicle mobilisation and logistics,
- Earthworks (e.g. lease building, site remediation).

3. Background

The 2020 Drilling Program consists of drilling Carpentaria 1; an exploration well in the eastern margin of the Beetaloo Sub-Basin, within EP187. The project area is in the Northern Territory, approximately 200km to the East of Daly Waters, on the southern side of the Carpentaria Highway.

The works include well drilling, evaluation, logging and data gathering, rehabilitation and other associated activities, such as civil construction works, water bore drilling and temporary camp installation.

The location of the proposed activities that this ERP applies to is shown in **Figure 1** below.

4. Emergency Response Priorities

All actual or potential emergencies will be assessed under the following activation trigger principles:

- **People:** Serious injuries/loss of life or emotional harm,
- **Environment:** Serious impact to biological, physical environment or eco-system functions,
- **Asset:** significant damage or threat to property/assets,
- **Reputation:** serious impact to community, cultural heritage sites, or both,
- **Liability:** serious regulatory breach,
- **Continuity:** loss or extended disruption to critical services & ability to continue operations.

Refer to **Figure 2** and **Figure 3** for incident assessment and activation flowchart.

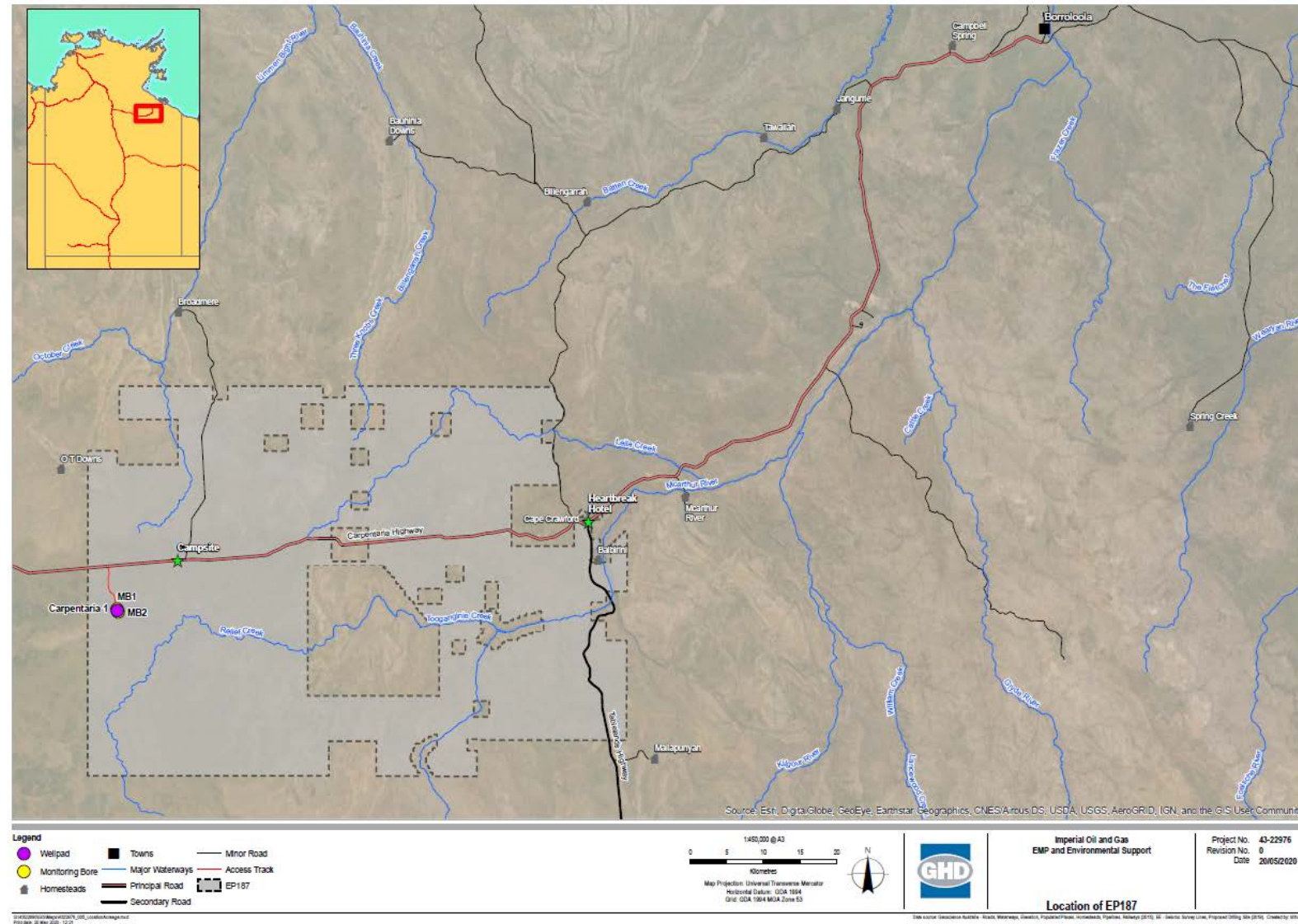


Figure 1. Proposed Drill Site, camp location and Existing Roads

5. Definition of Site Emergency

An emergency could be defined as an accident or deliberately caused situation that poses an immediate risk within a specific site. In many cases, the situation could be dangerous, requiring urgent/immediate intervention to prevent the situation from escalating or worsening. Incidents could have an impact on:

- **People:**
 - Death, injury or near-miss.
- **Environment:**
 - Uncontrolled release of a substance to air, land, or water.
- **Asset:**
 - Loss or damage to physical assets.
- **Reputation:**
 - Loss or damage to business,
 - Loss of control of any health, safety environment or community related incident.
- **Liability:**
 - The potential for any of the above.

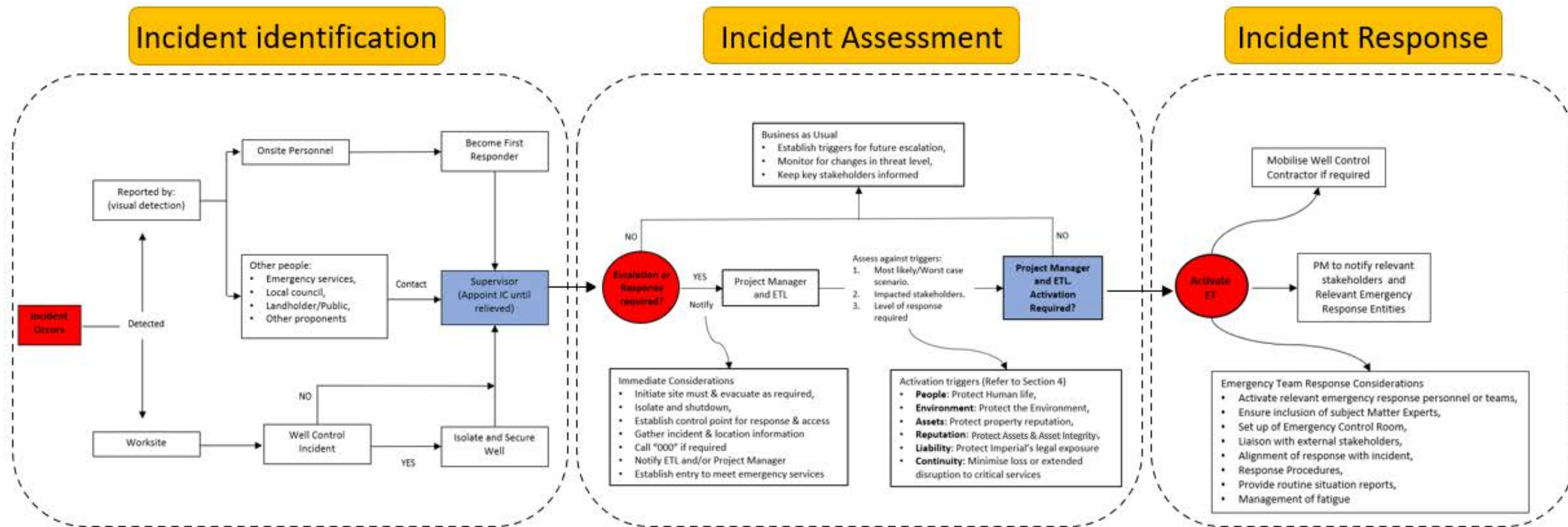


Figure 2. Identify, Assess, Response Flowchart

Activation Flow-Actions

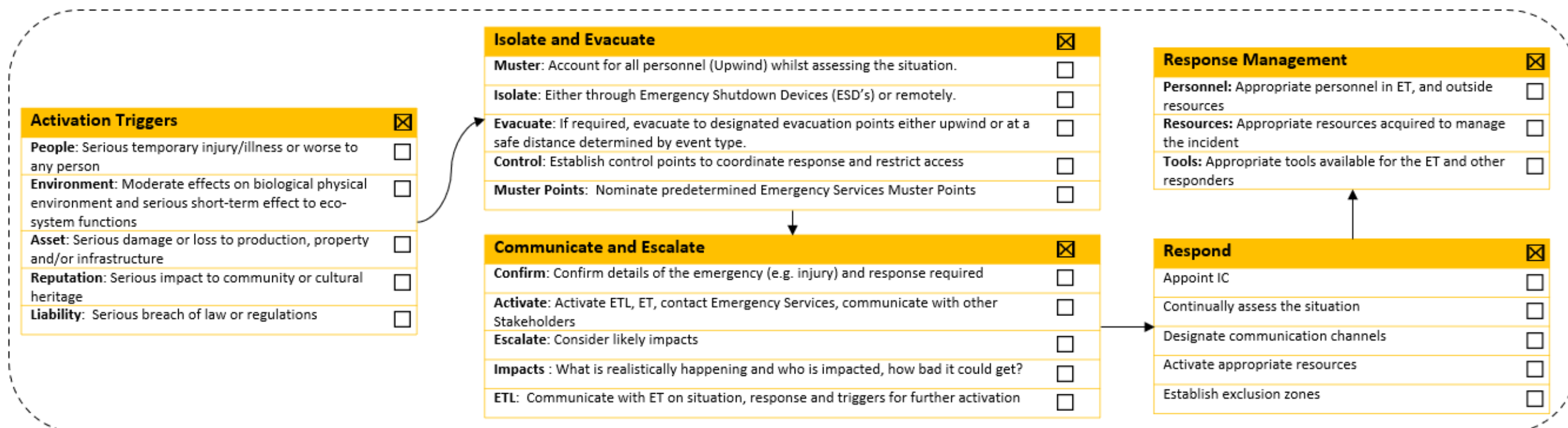


Figure 3. Activation Actions

1 Roles & Responsibilities

Person(S)	Responsibilities
First Responder Located at the scene, could be on-site personnel or a contractor	- Adhere to the Project Emergency Response Plan. - Maintain a high level of awareness of actions to be taken in the event of an emergency. - On identification of an emergency immediately report to the Site Supervisor indicating the location, type of emergency, need for assistance, and intentions to assist. - Check the area and assess any person for injuries, provide first aid to injured persons within training and ability levels. - Move injured, only if they are in immediate and/or further danger, to avoid any additional injuries/risk to persons - Note the impacts of the emergency and any potential requirements for evacuations.
First Aiders Located at site.	- Provide first aid treatment or assessment as needed, working within their skill level. - Determine the need for medical assistance and provide information to Medical personnel or Emergency services as required. - Ensure that first aid kits are maintained and complete, and items are in-date. - Ensure that all treatments provided, regardless of the type or complexities, are recorded.
Incident Commander (IC) - Located at the incident scene. - Manage first response at site level	- Act as the site Incident Commander (IC) and manage the first response at the site level. - Maintain familiarisation with Imperial site ERP and Contractor ERP's, key emergency respondents and respective notification and callout requirements. - Ensure all initial Emergency Response Resources (ERR) are available and in working order. - Ensure the Emergency Team Leader (ETL) is notified ASAP in the event of an alert or emergency event. - Escalate to the Operations/Project Manager and Emergency Services if required. - Monitor the safe suspension of operations and associated activities. - Ensure that emergency action plans are discussed regularly at Pre-Start / Toolbox meetings, so that all persons under their control are aware of the project emergency procedures. - Maintain log of incident events, actions, messages, and decisions made in chronological summary and provided to ETL. - Ensure the safety of other team members and establish exclusion zones around the incident scene if appropriate.
Emergency Team Leader (ETL) - Located at either the Site Emergency Control Room (ECR), or - In the main office	- Responsible for overall management of emergencies on Imperial controlled worksites - Nominate IC for the incident Alert emergency contact(s), Confirm details, Activate resources (as required)

Person(S)	Responsibilities
	• Ensure adequate personnel and resources are available to support, manage and close out any site emergency, • Conduct emergency response drills. • Arrange additional support staff for the Emergency Team (ET) communications/administrative activities as required. • Filter incident events information to ET. • Utilise Emergency Response Incident Log Sheets. • Ensure early notification and Site reports are sent to ET as appropriate.
Project Manager (PM) • Located in the main office	• Provide support to the ETL. • Act as journey contact for field teams. • Pass on information to Imperial relevant personnel to communicate to impacted/relevant stakeholders. • Support field team with emergency service direction/calls as requested.
Emergency Team (ET) • Located in the main office.	• Provide support to the ETL and Site Supervisor regarding operations, planning, logistics etc. • Provide tactical response to site incidents. • Provide direction and back-up support to Stakeholders. • Provide expertise and technical advice in support of the Emergency response effort. • Open, clear, and prepare the Emergency Control Room (ECR) for immediate use.
Crisis Management Team (CMT) • Located at the inGauge Operations Base in Brisbane	• The ET has a reporting responsibility to the CMT for all low-level incidents or greater, as per the Imperial Incident Report and Investigation Procedure. • The CMT will assume an operational support overview of incidents and will provide operational management support to site ET during incidents which present an actual or potential threat to Imperial operations. • The CMT will request emergency response drill as appropriate and ensure appropriate authority and equipment is in place to hold the emergency response drills. • Maintain log with all the information regarded to the incident. • Manage media in concert with the Imperial CEO and COO.
Personnel on site	• Avoid placing themselves or others in danger. • Maintain familiarisation with Imperial site ERP, relevant Contractor ERP's, and respective emergency notification requirements. • Be familiar with the site Muster Points and evacuation procedures. • Be alert for and report hazardous situations that could escalate into an emergency. • Immediately report any actual or potential emergencies. • Report any further emergency arising from an existing incident to the nominated Imperial Site Supervisor / ETL or designated IC. • MUST NOT communicate with the Media under any circumstances.

2 Response Scenarios

Imperial 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.

Table 1 describes some emergency response scenarios and recommended actions.

Table 1. Response Scenarios

Category	Response	☒
Basic Emergency Response	Remove yourself and others from danger	☐
	Raise the alarm – Notify Site Supervisors through the available channels of communication (e.g. radio) - Report location, - type and extent of incident	☐
	Stop all work and make sure the area is safe	☐
	Activate emergency shutdown devices/isolate equipment as necessary if safe to do so	☐
	Provide First Aid to any injured persons (DRSABCD)	☐
	Account for people	
	Reach Emergency Team Leader	☐
	Call emergency services if required	☐
	Follow the directions of emergency services or response personnel and assist as required if you feel safe and capable to do so	☐
	Follow the Response Procedure and Gather information (Table 2)	
	Notify appropriate Imperial contacts	☐
	Determine the recovery strategy and resources required: - Check for equipment integrity, - Ensure all protection systems are restored, - Replenish, replace or return emergency equipment.	☐
Fire, Building Evacuation	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.	☐

Category	Response	☒
	- You might inhale toxic smoke. - Your instincts tell you not to do so. - If the first attempts to put out the fire fail, evacuate the building immediately.	☒
	Close any doors if safe to do so	☐
	Call 000 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	☐
Fire, (Building Evacuation)	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 Incident Notification and Investigation Procedure	☐
Injury (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 000 and then the site paramedic if available	☐
	Continue first aid until assistance arrives	☐
	Follow Imperial Incident Notification and Investigation Procedure	☐
Criminal Activity (Civil disturbance)	Initiate Emergency Response Plan	☐
	Always avoid physical confrontation	☐
	Contact your supervisor, and police if necessary	☐
	Move to the muster location or safe location	☐
Snakebite	Initiate Emergency Response Plan	☐
	Life-threatening effects from a snakebite 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 a person is unconscious, check breathing & pulse and apply CPR	☐
		☐

Category	Response	☒
	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 from 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 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 the accident scene	☐
	If vehicle in contact with power lines, stay clear and advise occupants to stay in the vehicle	☐
	Do not try to remove casualties from the 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 Incident Notification and Investigation Procedure	☐
Environmental Incidents (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 state fire brigades should be contacted for emergency assistance - phone 000	☐
	Always pay attention to fire and health hazards	☐
	Activate containment operations immediately to prevent the spill from reaching a surface watercourse or groundwater	☐

Category	Response	☒
	Points to Remember: • Activate containment operations immediately • Do not allow vehicles to run over any 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 • 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 groundwater	☐
Missing/ Overdue Personnel	After being notify of a missing or overdue person, Journey Management plan timeframes will be utilised to escalate the tracing and notification processes. Refer to Section 6 .	☐
	Obtain information on time and location of the last sighting	☐
	Attempt to establish communication with the 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, e.g. hotel/motel/camp to determine if the person has arrived	☐
	If possible and safe to do so (i.e. 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 (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 Incident Notification and Investigation Procedure	☐
Weather- Related (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	☐

Category	Response	☒
	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 Incident Notification and Investigation Procedure	☐

3 Respond communication

The following flowchart (**Figure 4**) presents the communication between the first responders (internal or external personnel) and the organisation management team, including the contact of external support agencies.

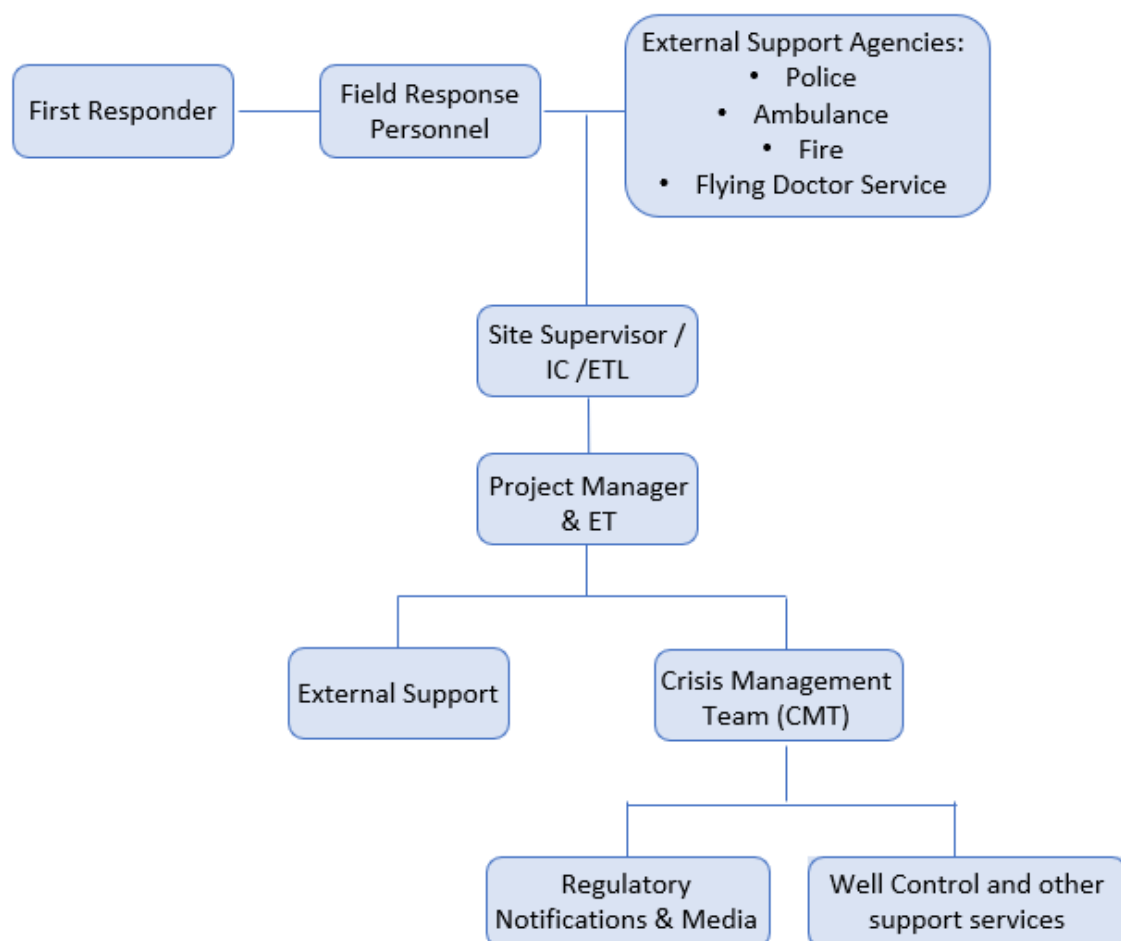


Figure 4. Communication Flow

3.1 Stakeholder Communication

The Project Manager may be required to communicate/liaise with relevant stakeholders that could potentially be impacted by the incident/emergency. Potential stakeholders include regulatory authorities (local councils, landowners, emergency services, etc.).

Initial information to be provided should include state/type of the emergency, possible cause, effects/consequences, likely duration, and potential impacts.

3.2 Regulatory Notification

A regulatory notifiable incident is an incident or non-compliance with a Mandatory External Obligation or Voluntary External Obligation that requires notification or reporting to a Regulator as prescribed by applicable Laws and Regulations. HSE regulatory notifiable incidents required to be reported to a regulator are listed in **Appendix 1**

The Project Manager must be consulted to determine contractual obligations for incident notification and reporting.

3.3 Media Enquiries

All personnel have been instructed to direct all media enquiries to the Project Manager, which in turn will redirect the calls to the questions to the Imperial representative as required.

It is important to remember that there is no such thing as “off the record”. Even if you are speaking informally, you could be quoted at any time.

4 Incident notification

Table 2 below provides some examples of the information required to be gathered during an incident. Refer to **Appendix 1** for Incident Notification Guideline.

Table 2. Incident notification examples

Element	Information examples	☒
Initial contact	- Name of the caller and receiver, - Personnel involved in the incident.	☐
Incident location	- Coordinates or landmarks, - Clear directions on how to get to the incident site.	☐
Incident Type and description	- Injury, - Explosion, - Vehicle accident, - Fire, - Well incident related, - Missing personnel.	☐
Description of the incident	- Time incident occurred, - Cause of incident if known, - Any actions taken on-site and emergency required.	☐
Incident size or injury severity	- Area, - Height,	☐

Element	Information examples	☒
	- Volume, - Description of injury, - Number of people involved, - Preliminary assessment of medical assistance required.	
Current status	- Has the incident or potential of the incident to cause more damage or injury stopped, - Level of emergency response required, - First aid applied to date and Degree/Level of controls in place, - Environmental situation (wind, rain, etc.).	☐

5 Emergency Response Equipment and Personnel

Table 3 presents the different emergency equipment available on-site at any one time to provide, where possible, the initial response required to avoid any incident from escalating.

Table 3. Emergency Response Equipment

Equipment	Location
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.
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.
Defibrillator	A defibrillator unit is located at the rig once rig operations commence
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.
Ambulance	An ambulance is located at the rig, once rig operations commence.
Paramedic	A Paramedic is located at the rig, once rig operations commence.
CareFlight	Available on-call; 1 hour 50 minutes to McArthur River Mine Airport (116km drive) 1 hour 15 minutes to Tanumbirini Station Airstrip (76km drive)

The rig is the most likely place of injury/incident and the likely location of the higher severity incidents. Therefore the rig will be the primary focus of the Paramedic; however the camp is included in the HSE regime and planning. The Camp and the Wellsite will maintain communications and the wellsite based Paramedic will attend any emergencies at both the camp and the wellsite.

The camp is located on the side of the Carpentaria highway which is 6.5 kms back along the rig access track and 9.5 kms along the highway towards Cape Crawford from the rig.

Subject to the recommendation of the Paramedic, the ambulance will either be parked on the rig site or co-located with the paramedic so that is is available at their position. If the ambulance is co-located with the Paramedic then the Paramedic will use it to transit between the rig and the camp.

6 Journey Management

All contractors engaged to carry out work at Imperial's well sites must have a sound Journey Management (JM) process. Each contractor will provide detail of their company journey management process (JMP) during prequalification. At a minimum, or where no journey management process is in place, the following procedures shall be complied with:

- All contractors shall have been inducted and trained in the JM system being utilised.
- Suitable safety equipment must be installed in each vehicle and must be operable (e.g. satellite phone, first aid kit).
- Should the contractor company not have their own JMP system, they shall utilize this Imperial procedure.
- All travelling personnel or groups shall have a Journey Coordinator (JC), who is allocated to assist with journey management. The Journey Coordinator and the travelling person must both be clearly aware who has been allocated to the JC role and the responsibilities of each party.
- The JC should advise the Site Supervisor (SS) of the impending journey, confirm their status as JC and keep the SS updated on the journey details. The SS may be used as the JC but it must be clear that the SS has this responsibility.

When a journey is undertaken, the Journey Coordinator should maintain close communication with the travelling person/group and ensure all information in regards to the journey has been gathered and is been tracked for the whole journey. Information should include:

- Full name(s) of person(s) travelling,
- Frequency and method of check-in during the journey,
- Contact details for all members of the travelling group and the JC,
- Next of kin of people travelling,
- Date of the trip,
- Estimated Time of Departure (ETD),
- Estimated Time of Arrival (ETA), and
- Route to be followed,
- Description of vehicle eg registration number and vehicle type.

Any changes to the above should be informed to the JC prior to departure.

It is critical that communication protocols be established between the JC and travelling person/group and clearly understood by both parties.

When ETA has not been fulfilled, the following actions will be taken by JC & SS:

Communication 1 Hour Overdue

- Call and keep monitoring all communication channels;
- Communicate with next of kin to check if person(s) has communicated;
- Supervisor to alert IC & ET of the situation as required;
- Confirm last known location of the vehicles tracker unit;
- Initiate a search party if the situation demands.

Communication 2 Hours Overdue

- Request the ERP be activated, if not already underway;
- If not already activated, ensure rescue party is underway, by road if suitable;
- Prepare for air search (if necessary) on latest coordinates and planned route; and
- Inform authorities and other parties in the area;
- Alert the most suitable Medical person(s) of the situation.

Action 4 Hours Overdue

- Authorities take control of incident;
- Keep monitoring progress of the search parties by road; and
- Relevant supervisor to keep PM and ET informed.

7 External support (Road & Air)

External support can be sourced to support during an emergency. This support can be either obtained by road (e.g. Ambulance) or air (e.g. CareFlight)

7.1 Road

- Ambulance services can be dispatched from:
 - o McArthur clinic and be on-site in approximately 1.5 hour(s),
 - o Boroloola clinic and be on-site in approximately 2 hour(s), and
 - o Mataranka Clinic and be on-site in approximately 4 hour(s).
- Emergency Services will be intercepted by an Imperial employee at a designated location along the Carpentaria Highway and directed to the site,
- On-site paramedic will provide an initial response until further assistance arrives on site.
 - o On-site ambulance will be use for emergency transport to the nearest and fit for purpose clinic/hospital (e.g. Tennant Creek Hospital 7 hours driving)
- Constant communication will be maintained with external support to avoid delays of service or to obtain assistance for adequate on-site response.

7.2 Aircraft

- CareFlight services will be contacted when the severity of incident/injury cannot be mitigated or responded by on Road assistance.
- Landing of aircraft can be conducted at Tanumbirini Airstrip (76km) or McArthur River Mine Airstrip (116km), as selected by Careflight.
 - o Ensure constant communication is held with aircraft personnel and IC.
 - o Do not approach aircraft until the pilot has given you approval to do so.
 - o Remove any loose clothing (e.g. hats) when approaching aircraft.
- Careflight may also choose to task a helicopter, as they have availability and deem appropriate. Helicopter landing site would be agreed subject to incident location in discussion with the paramedic and the IC.

8 Recovery Actions

Table 4 provides post-emergency actions required to be followed to return to pre-incident state operations.

Table 4. Recovery Actions

Action	Description
Review	• Discuss strength and weaknesses, • Necessary improvements for this plan and related procedures, • Identify actions to be undertaken.
Investigate	• Secure incident site and do not disturb area until the investigation has been completed • Collect any evidence that may assist in the investigation (e.g. testimonies, records of actions taken, photographs, etc.)
Recover	• Verify infrastructure integrity as well as security equipment restoration, • Replenish, replace, or return emergency equipment, • Ensure personnel impacted by the incident receive the require counselling, or information to continue with safe operations, • Revised ERP and implement changes or training as required.
Clean-up	• Assess for potential decontamination needs • Repair or replace damaged equipment and test for safe functionality • Attend to commissioning and site reinstatement.

9 Training

Personnel who receive the necessary training are more able to perform more effectively when responding to an emergency. The training will give the employee a greater understanding of their responsibilities, and in turn, build their confidence to accurately react during an emergency event to minimise or reduce the likelihood of an incident from escalating.

All personnel will be trained against this plan. Training will be provided in the form of:

- Practical drills,
- Simulated exercises,
- Competency-based training,
- Toolbox meetings,
- Resource and equipment checks,
- Desktop exercises.

10 Emergency Contact Details

See **Appendix 2** for the Site Emergency Response Display Sheet.

Imperial Oil and Gas

Name	Position	Contact Number
D [REDACTED]	Chief Operating Officer	[REDACTED]
A [REDACTED]	Chief Executive Officer	[REDACTED]
K [REDACTED]	Office Manager	[REDACTED]

inGauge Energy

Position	Name	Phone Number	E-mail
Principal Engineer	K [REDACTED]	[REDACTED]	[REDACTED]
Project Manager and Superintendent	J [REDACTED]	[REDACTED]	[REDACTED]
Civils and Approvals Coordinator	J [REDACTED]	[REDACTED]	[REDACTED]
Site Supervisor InGauge OCR	S [REDACTED]	[REDACTED] [REDACTED]	[REDACTED]

Schlumberger

Position	Name	Phone Number
Operations Manager	[REDACTED]	[REDACTED]
HSE Manager	[REDACTED]	[REDACTED]
Rig Manager	[REDACTED]	+ [REDACTED]
Rig Superintendant	[REDACTED]	[REDACTED]

Government and Stakeholders

Name	Location	Contact Number
Department of Primary Industry and Resources (DPIR)	Darwin	Ph: 08 [REDACTED] A.H: 0 [REDACTED] Emergency: 1300 935 250

Ngukurr Essential Services Officer	Ngukurr	08 [REDACTED]
Roper Gulf Shire Office		08 [REDACTED]

Other

	Name	Location	Contact Number
Medical Services	Royal Darwin Hospital	Darwin	(08) 8922 8888
	Katherine Hospital	Katherine	(08) 8973 9211
	St Johns Katherine Ambulance	Katherine	(08) 8972 8500
	St Johns Alice Springs Ambulance	Alice Springs	(08) 8959 6600
	Mataranka Clinic	Mataranka	(08) 8975 4547 (0830 – 1600 Mon-Fri only)
	Borooloola Health Clinic	Borooloola	(08) 8975 8757 (0900 – 1700 Mon-Fri only)
	Tennant Creek Hospital	Tennant Creek	(08) 8962 4399
Aeromedical Services	CareFlight	NT, WA & SA	(08) 8928 9777 24hr Emergency 1300 655 855
Police	Emergency		000 24h Assistance 131444
	Alice Springs Police	Alice Springs	(08) 8951 8823
	Katherine Police	Katherine	(08) 8973 8000 (0830 – 1600 Mon-Fri only)
Fire Services	NT Fire & Rescue AH	NT	(08) 8922 1555
	Katherine Fire Station	Katherine	(08) 8973 8014
	Alice Springs Fire Station	Alice Springs	(08) 8951 6688
Service Station	Heartbreak Hotel	Cape Crawford	(08) 8975 9928
	BP Service Station Katherine	Katherine	(08) 8971 9924 (08) 8971 9955
	Erlunda Roadhouse	Stuart Hwy	(08) 8956 0984
	Hi-way Inn Petrol Station	Daly Waters	(08) 8975 9925
	BP Service Station Adelaide River - NT	NT	(08) 8976 7047
	United Petroleum	Pine Creek	(08) 8976 1217

11 Appendixes

Appendix 1. Incident Notification Guideline

Regulation	Incident Description	Communication by	Contact Details	Timeframe
Work Health and Safety (National Uniform Legislation) Act 2014 Sections 35 - 39	PCBU must notify the regulator as soon as they become aware of a death, serious injury or illness or dangerous incident that arises out of the conduct of the business or undertaking. A dangerous incident includes: • Uncontrolled escape, spillage or leakage of a substance, gas or pressurised substance, • Uncontrolled implosion, explosion or fire, • Electric shock • Fall or release from height of plant, substance or thing, • Collapse, overturning, failure or malfunction of, or damage to, any plant/equipment/structure/excavation, • In-rush of water, mud or gas in an underground excavation tunnel or interruption of ventilation in said tunnel A serious injury or illness means that results in: • work related injury, • immediate hospital treatment as an in-patient, • immediate treatment for serious injuries (for example amputation, scalping, a spinal injury, loss of a bodily function or a serious laceration, burn, head injury or eye injury), or • medical treatment within 48 hours of exposure to a substance.	Telephone	1800 019 115 Worksafe ntworksafe@nt.gov.au	Immediately after becoming aware
Schedule of Onshore Petroleum Exploration and Production Requirements 2017	An incident involving death or serious injury (reports shall be in addition to, and not take precedence over reports required by NT WorkSafe) A serious injury is one which requires immediate attention by a medical practitioner	Telephone and in writing	1300 935 250 DPIR Petroleum.Operations@nt.gov.au	Immediately after becoming aware.

Schedule of Onshore Petroleum Exploration and Production Requirements 2017	An incident involving serious damage (other than Environmental Harm) including loss, destruction or damage to property exceeding \$50k or when any person dies or suffers serious injury	Telephone and in writing	1300 935 250 DPIR Petroleum.Operations@nt.gov.au	Immediately after becoming aware.
	An incident involving or could potentially involve the injury to a person or serious damage to property that is professionally considered to have been caused by an event that is not in the normal or ordinary course of an operation (Potentially Hazardous event)			
	An incident where damage to property occurs that is not serious damage to property, but which results in a significant loss of structural integrity or load bearing capacity in the property damaged or results in some other significant unsafe condition			
	An incident that is considered to be an emergency	Telephone		Immediately (after 000)
Petroleum Act 2016 and associated Regulations	Applicable to ON TENURE SPILLS (note Off tenure spills under Waste Management and Pollution Control Act 1998): Reportable Incident: <i>An incident, arising from a regulated activity, that has caused or has the potential to cause material environmental harm or serious environmental harm.</i> Material environmental harm means, harm that: a) Is not trivial or negligible in nature; b) Consists of an environmental nuisance of a high impact or on a wide scale; c) Results, or is likely to result, in not more than \$50k or the prescribed amount (whichever is greater) being spent in taking appropriate action to prevent or minimise the environmental harm or rehabilitate the environment; or d) Results in actual or potential loss or damage to the value of not more than \$50k or the prescribed amount (whichever is greater).	Telephone and in writing	1300 935 250 DPIR Petroleum.Operations@nt.gov.au	As soon as practicable (not later than 2 hours after the incident) <24 hours after oral notice (written notification) 3 days after the incident (initial report) 90 days intervals from the date of the initial report (interim reports) 30 days after clean up or rehabilitation (final)

	Serious environmental harm means environmental harm that is more serious than material environmental harm and includes environmental harm that: a) Is irreversible or otherwise of a high impact or on a wide scale; b) Damages an aspect of the environment that is of a high conservation value, high cultural value or high community value or is of special significance; c) Results or is likely to result in more than \$50k or the prescribed amount (whichever is greater) being spent in taking appropriate action to prevent or minimise the environmental harm or rehabilitate the environment; or d) Results in actual or potential loss or damage to the value of more than \$50k or the prescribed amount (whichever is greater).			
Petroleum Act 2016 and associated Regulations	Recordable Incident: An incident that has resulted in an environmental impact or environmental risk not specified in the current plan for the activity; or has resulted in the contravention of an 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; and is not a reportable incident.	In writing	1300 935 250 DPIR Petroleum.Operations@nt.gov.au	15 days after each 90 day period after then day on which the environmental management plan is approved.
Environmental Protection Biodiversity Conservation Act	Incidents considered to have an impact to Matters of National Environmental Significance	In writing	Compliance@environment.gov.au	within 5 business days of becoming aware
Energy Pipelines Act 2015 and associated Regulations	A reportable incident that involves: • Death or serious injury (or the potential to cause) • Significant damage to a pipeline (or potential to cause) • Immediate investigation	Telephone and in writing	1300 935 250 DPIR Petroleum.Operations@nt.gov.au	As soon as practicable
	A significant pipeline accident event that: • Is connected with work carried out on or in relation to a pipeline • Causes, or has the potential to cause human death			

Waste Management and Pollution Control Act 1998 and associated Regulations	Duty to notify of incidents causing or threatening to cause pollution. <i>Applicable to off tenure related spills (note ON tenure spills under Petroleum (Environment) Regulations):</i> 1) Where: a) an incident occurs in the conduct of an activity; and b) the incident causes, or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm, the person conducting the activity must notify the NT EPA in accordance with subsection (3) as soon as practicable after (and in any case within 24 hours after) first becoming aware of the incident or the time he or she ought reasonably be expected to have become aware of the incident." An incident that causes, or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm. Refer to the definition of material and <i>serious environmental harm</i> provided in <i>Petroleum Act</i> section above. Pollution means: a) A contaminant or waste that is emitted, discharged, deposited or disturbed or that escapes, or b) A contaminant, effect or phenomenon, that is present in the environment as a consequence of an emission, discharge, deposition, escape or disturbance of a contaminant or waste. Note: does not apply to incidents confined within petroleum activities land (including air and water above or below) – see the EMP for the area of petroleum activities land	Telephone	NT EPA Pollution Hotline, 24h: 1800 064 567 Pollution@nt.gov.au	As soon as practicable after (and in any case within 24 hours after) first becoming aware of the incident or the time he or she ought reasonably be expected to have become aware of the incident."
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Environmental Assessment Act 2013 and associated Regulations	Alteration of action in such a manner that the environmental significance of the proposed action may be changed	In writing	08 8924 4218 NT EPA ntepa@nt.gov.au	As soon as practicable
Bushfires Act 2016 and associated Regulations	Unable to control a fire on the land	All reasonable steps	08 [REDACTED] [REDACTED] DENR Note, also required to notify landholder	Following the fact
Heritage Act 2016 and associated Regulations	Discovery of archaeological places and objects	In writing	08 8999 5039 DTC - Heritage Branch heritage@nt.gov.au	As soon as practicable (within 7 days of discovery)
Weeds Management Act 2013	(a) First becoming aware of a declared weed that has not previously been, or known to have been, present on the land.	Not specified	08 8999 4567 DENR weedinfo@nt.gov.au	14 days of becoming aware
Dangerous Goods Act 2012 and associated Regulations	Becoming aware of theft, loss of, or unauthorised interference with explosives.	Not specified	08 8973 8000 Katherine Police	Immediately after becoming aware

Appendix 2. Site ERP Display Sheet

Project Name: EP187 ERP Drilling Program Coordinates: Tanumbirini Airstrip (YTNR); Latitude: 16°27'00.00"S Longitude: 134°38'59.98"E Emergency Response Meeting Point; Carpentaria 1 intersection on Carpentaria Highway Latitude: 16°44'21.78"S Longitude: 135°06'37.69"E Wellpad; Carpentaria 1 Latitude: 16°47'40.20"S Longitude: 135°07'22.98"E			
Emergency Contacts			
Entity	Location	Number	
General	Police - Emergency	-	000 24h Assistance 131444
	Ambulance	Mataranka	(08) 8975 4547
	Ambulance	Katherine	(08) 8972 8500
	Fire Services	Katherine	(08) 8973 8014
		NT	(08) 8922 1555
	Service Station	Heartbreak Hotel	(08) 8975 9928
Medical Services	Royal Darwin Hospital	Darwin	(08) 8922 8888
	Katherine Hospital	Katherine	(08) 8973 9211
	Borroloola Doctor	Borroloola	WH: 08 8975 8711 AH: 08 8975 9859
Aeromedical Services	Care Flight	NT	(08) 8928 9777 24hr Emergency 1300 655 855
inGauge Energy			
Position	Name		Number
Principal Engineer	[REDACTED]		[REDACTED]
Project Manager and Superintendent	[REDACTED]		[REDACTED]
Civils and Approvals	[REDACTED]		[REDACTED]

Traffic Management Plan

Carpentaria Highway – New Rural Intersection

ALDEBARAN CONTRACTING

Construct New Rural Intersection

July 2020

Declaration

I Zoe Breed WZ1 Accreditation 20997 declare that I have designed this Traffic Management Plan following a site inspection on 27 July 2020 Conducted by Zoe Breed. The Traffic Management Plan prepared, **subject to the variations approved**, is in accordance with prepared in accordance with Northern Territory Government, Road Projects – Permit to Work within the Northern Territory Government Road Reserve and the Australian Standard AS1742.3 – 2009.

Signature: Zoe Breed

Date: 30 July 2020

	Name / Company	Accreditation Details	Date	Signed
TMP designed by	Zoe Breed (ALD)	WZ1 – 20997 Expiry 10/06/2023	30-07-20	Zoe Breed
Utility Provider Acceptance		Refer DBYD		
Project Manager	Jacob Skewes (ALD)		30-07-20	Jacob Skewes

TMP No. 2020/03	Rev. No. 1.0	Date: 30 July 2020
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Traffic Management Plan Carpentaria Highway – New Rural Intersection

Change History (MANUAL)

V3.1 is the current version of the internal template, further description of changes is within the **Company Index Register (R-01)**.

Version	Date	Review / Change	By Whom
1.0	30-07-2020	First Issue	Zoe Breed

Monthly Reviews (MANUAL and TGS's)

Date	Review / Change	By Whom

NOTE: Reviews of this place are to occur monthly, any changes to be notified to workers including traffic controllers at Daily pre-start or Toolbox Meeting.

Changed to plans or TGS's are to be forwarded to DIPL as soon as possible for approval.

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Carpentaria Highway – New Rural Intersection

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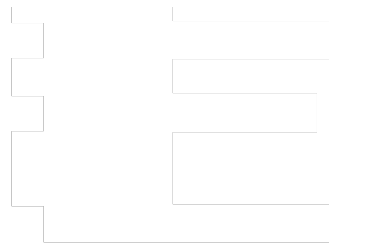
GLOSSARY

ALD	Aldebaran Contracting
DIPL	Department of Infrastructure Planning and Logistics
WHS	Work Health and Safety (National Uniform Legislation)
AS	Australian Standard
AS/NZS	Australian and New Zealand Standard

Traffic Management Plan

Carpentaria Highway – New Rural Intersection

PTW	Permit to Work
WZ1	Workzone Traffic Management Plan Designer
WZ2	Control Traffic with a Stop-Slow Bat
WZ3	Implement Traffic Management Plan
TAMS	Territory Asset Management Services
TMP	Traffic Management Plan
TGS	Traffic Guidance Scheme
PFES	Police Fire Emergency Services
TOC	DIPL Traffic Operations Centre
RSA	Road Safety Auditor



References

- AS 1742 – Manual of uniform traffic control devices

Part 1 – General introduction and index of signs

Part 2 – Traffic control for general use

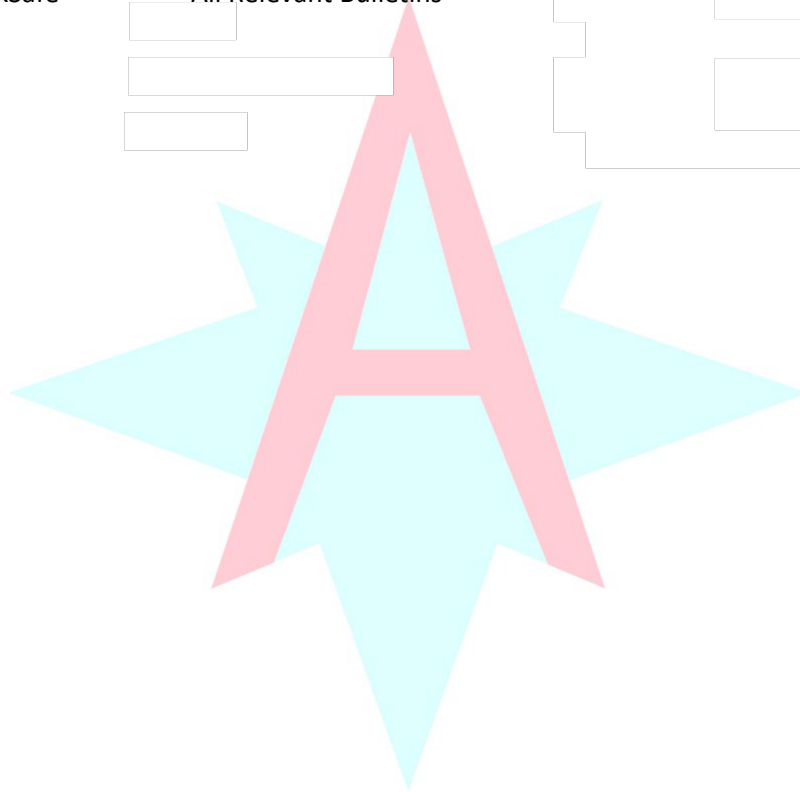
Part 3 – Traffic control for works on roads

Part 4 – Speed controls

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Carpentaria Highway – New Rural Intersection

- AS/NZS ISO 31000 Risk Management – Principles and Guidelines
- AS/NZS 4602 High visibility safety garments
- AS/NZS 1906.1 Retroreflective materials
- AS/NZS 3845 Road safety barrier systems
- AS 4191 Portable traffic signals
- AUSTROADS Guide to the Geometric Design of Rural Roads
- AUSTROADS Guide to the Geometric Design of Urban Roads
- AUSTROADS Bridge Design Code
- NT WorkSafe All Relevant Bulletins



1 Introduction

1.1 Purpose and Scope

Traffic management measures may include lane closures, traffic diversions, signage, other temporary measures and public communication. The Contractor and Subcontractors shall execute services with the least possible disruption to the flow of traffic and where disruption does occur, 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

Traffic Management Plan

Carpentaria Highway – New Rural Intersection

always. This document is designed to establish efficiencies, consistencies and good understanding of the commitment to safety. This Traffic Management Plan (TMP) outlines the traffic control and traffic management procedures to be implemented by the Project Manager and Project Contractors to manage potential hazards associated with the traffic environment during the project. This document addresses the minimum traffic management requirements for normal daily work activities through Traffic Guidance Scheme (TGS) as attached Appendix D. The document has been prepared in accordance with current versions of DIPL Provision for Traffic and Australian Standards 1742.3. WZ3 qualified traffic controllers are to set up traffic control devices for the required works as per TGS 1 to 4. The details for this traffic management plan and TGS requires the following activities:

- Signage placed to inform road users that there are road works in place.
- A vehicle movement plan is also in place to show workers entry and exit paths and path to get to the worksite from the road.

This Traffic Management Plan details proposed traffic management treatments for the following work activities: *Construct New Rural Intersection at Ch 202200 to Ch 202300.*

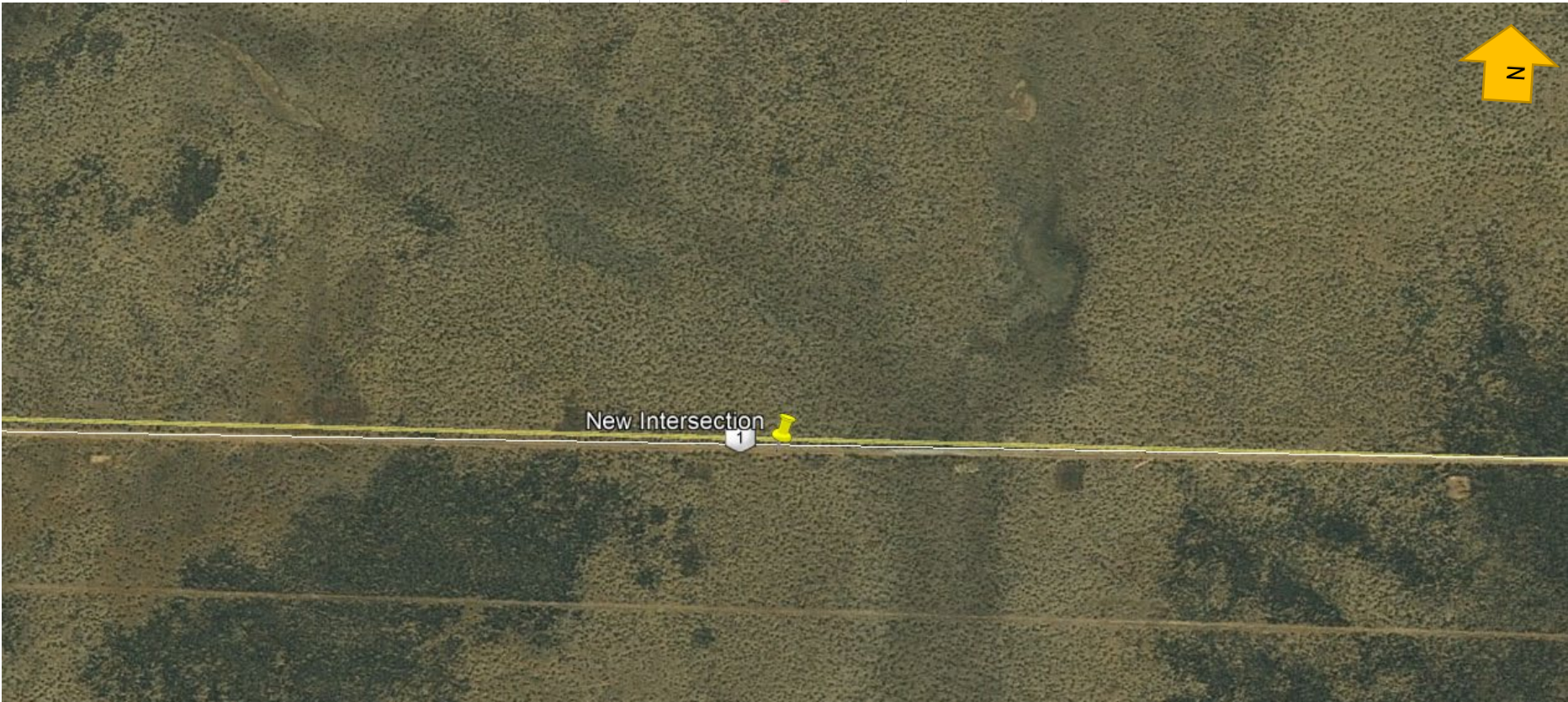
This Traffic Management Plan outlines the procedures and processes that will be engaged by the Contractors to manage potential hazards associated with the traffic environment whilst constructing the pavement reclaim, seal and associated works.

Traffic Management Plan

Carpentaria Highway – New Rural Intersection

1.2 Project Overview

1.2.1 Project Location



1.1 Site Images

Prior to works commencing onsite, digital images are to be taken with date and time stamps and stored in **SharePoint** for a minimum 6 months after works have been completed.

1.2 Site Constraints / Impacts

The only constraint is that the road must remain open to traffic. The impact on road users is expected to cause some delays, one lane road closure will be required using traffic lights or traffic controllers.

1.3 Risk Assessment Objectives and Strategies

The objectives of the Traffic Management Plan are:

- To provide protection to workers and the public from traffic hazards that may arise because 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.

To meet these objectives the Traffic Management Plan will incorporate the following strategies:

- Ensure delays are minimised.
- Ensure road users are managed
- Ensuring work activities are carried out sequentially to minimise adverse impacts.

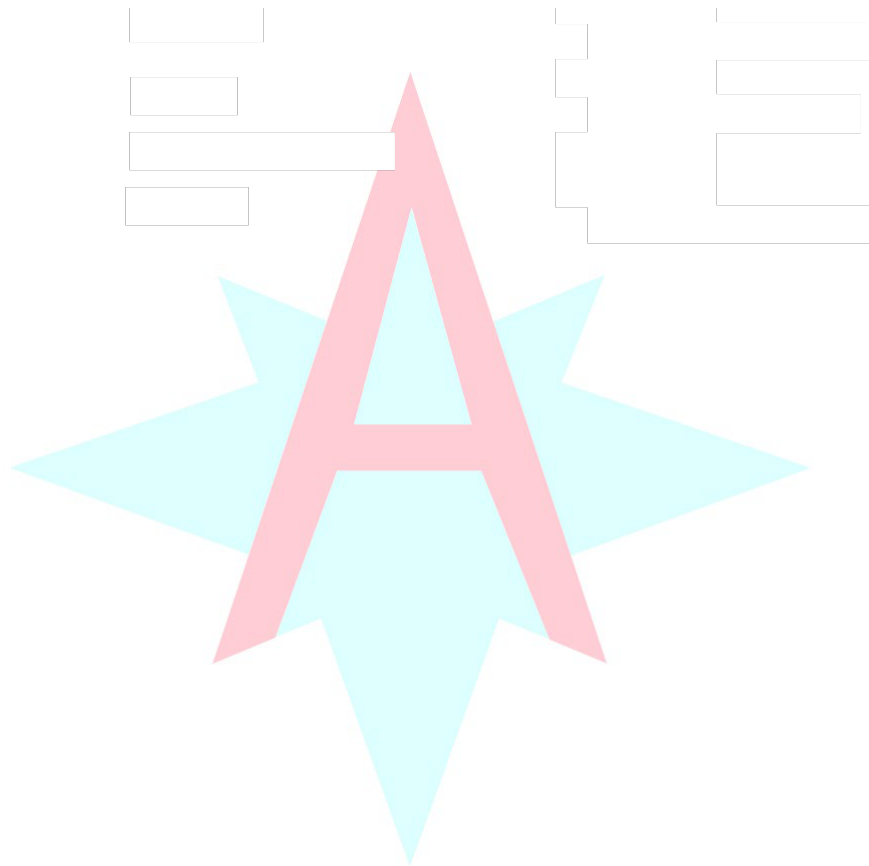
Provision will be made for work personnel to enter the work area in a safe manner in accordance with safety procedures. Entry and exit movements to and from traffic streams shall be in accordance with the requirements of safe working practices and the contract.

To clearly understand the risks associated with the traffic environment and determine the way identified hazards will be managed, the following schedule outlines the risk management process undertaken for traffic issues associated with the work activities related to 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 assumes 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”.

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.



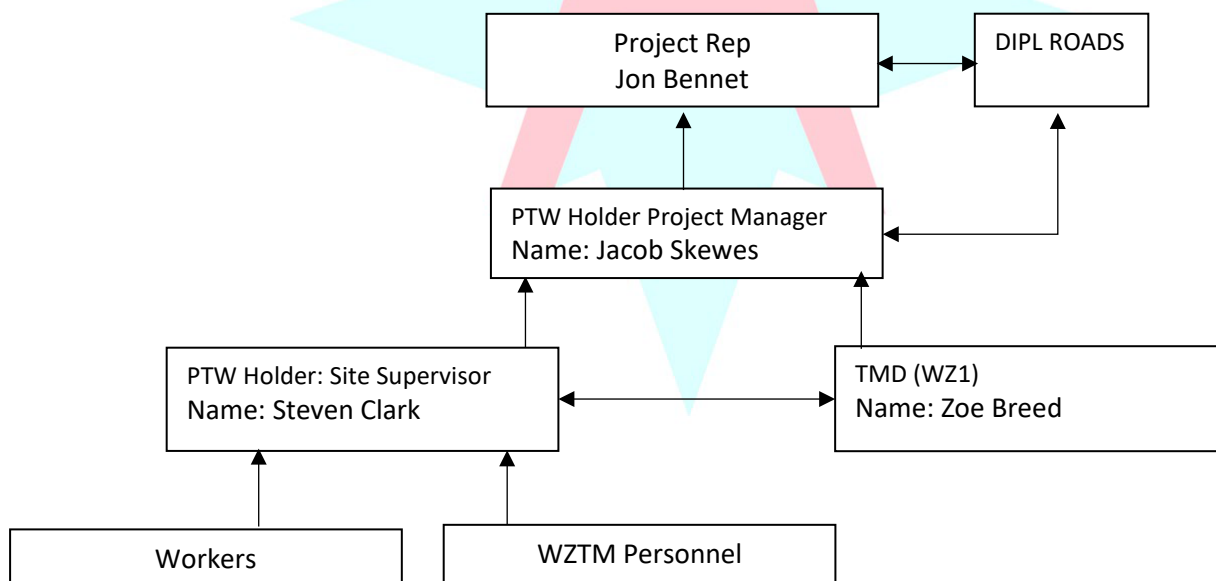
2 Project Details and Site Constraints/Impacts

ITEM	DETAILS									
Project Title	Carpentaria 1 Highway Intersection									
Principal Contractor / PTW Holder	Aldebaran Contracting Pty Ltd									
Client	Imperial Oil & Gas / InGuage									
Road Authority	Department of Infrastructure, Planning & Logistics (DIPL)									
Local Government	N/A to this TMP									
WZTM Sub-Contractor	N/A to this TMP									
Location of Works	Ch 202200 to Ch 202300									
Scope of Works	Construct new intersection									
Staging of Work	1. Mobilisation to site, 2. Implement traffic management as per traffic management plan, 3. Construct intersection, 4. Complete sealing works for intersection, 5. Complete Linemarking works, 6. Removal of traffic management devices, 7. Demobilisation									
Site constraints &/or Impacts	• Carpentaria Highway is single lane road									
Concurrent/adjacent Works or Projects	N/A for this TMP									
Project Commencement Date	10 August 2020				Project Completion Date	18 September 2020				
Road Category (Territory Road)	1	2	3		Site Risk Rating	HIGH MEDIUM LOW				
Existing Speed Limit/s	40	50	60	70	80	90	100	110	130	OTHER
Type of Works	Urban ☐		Day ☒		Short Term ☐		Static Works ☒			
	Rural ☒		Night ☐		Long Term ☒		Mobile Works ☐			

2.1 PROJECTS/WORKS CONTACT DETAILS

Position	Name	Contact Details
PC / PTW Project Manager	J [REDACTED]	PH: [REDACTED] Email: [REDACTED]
Road Authority Representative	Katherine Government Centre, First Street, Katherine NT 0850	PH: 8973 8665 Fax: 8973 8666 Email: roadskatherine.ntg@nt.gov.au
Local Government	N/A for this TMP	
PTW Site Supervisor	S [REDACTED]	PH: [REDACTED] Email: [REDACTED]
TMD (WZ1)	Z [REDACTED]	PH: [REDACTED] Email: [REDACTED]
TMI (WZ3)	S [REDACTED]	PH: [REDACTED]
Project Superintendents Representative	J [REDACTED]	PH: [REDACTED] Email: [REDACTED]

2.2 Org Chart



DIPL Road Authority	KATHERINE Katherine Government Centre, First Street, Katherine NT, 0850 Telephone: 8973 8665 Facsimile: 8973 8666 Email: roads Katherine.ntg@nt.gov.au
LGANT Road Authority	N/A for this TMP.

3 Safety Work Plan

3.1 Work Health and Safety

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

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

Traffic management works, and control devices shall be in accordance with:

- AS 1742 – Manual of uniform traffic control devices
 - Part 1 – General introduction and index of signs
 - Part 2 – Traffic control for general use
 - Part 3 – Traffic control for works on roads
 - Part 4 – Speed controls
- AS/NZS ISO 31000– Risk Management – Principles and Guidelines
- AS/NZS 4602– High visibility safety garments
- AS/NZS 1906.1Retroreflective materials
- AS/NZS 3845 Road safety barrier systems
- AS 4191 Portable traffic signals
- AUSTROADS Guide to the Geometric Design of Rural Roads
- AUSTROADS Guide to the Geometric Design of Urban Roads
- AUSTROADS Bridge Design Code

- NT WorkSafe All Relevant Bulletins

3.2 Health Surveillance

Aldebaran Contracting has a responsibility to provide health surveillance to employees and subcontractors. A risk assessment process is conducted through the **Project Risk Assessment** to identify whether health monitoring is required, by a competent person who has achieved a **Certificate IV WHS**. Health monitoring is assessed within the **Project Risk Assessment (PRA)** including but not limited to:

- Dust,
- Asbestos,
- Noise,
- Vibrations, Gases, and,
- Fumes

Ensuring that:

- The appropriate control measures are in place and effective,
- Evaluating and monitoring management strategies,
- Evaluating and implementing actions to the monitoring check results,
- Detect adverse health conditions at an early stage,
- Provide feedback of the accuracy, health issues identified of the risk assessments, and,
- Identify and protect individuals from any risk to their health.

Site personal will be notified as soon as practicable of any health monitoring required, through the **Daily Prestart Meeting** or **Toolbox Meeting**.

3.3 Communication / Mobile Phones

Traffic controllers will each have a handheld UHF when controlling traffic with a stop slow bat, at the end of each day it is the traffic controller's responsibility to place the UHF back in the charger ready for the next day.

Aldebaran vehicles are fitted with UHF's, this project will be communicating via channel 40.

Mobile phones are not to be used when controlling traffic or driving any company car, under any circumstances.

3.4 Working in Remote or Isolated Areas

Supervisors are to ensure employees are working in pairs when possible and are to conduct regular checks, this will be done via UHF radio.

Employees driving for long distances are to ensure they inform their manager or supervisors when leaving the yard and when they arrive to their destination. They are also to ensure they pack accordingly for the trip, this includes having a first aid kit in the vehicle and taking an appropriate amount of food and water.

3.5 Notifiable Incidents

Aldebaran Contracting reports Notifiable incidents to the client and/or relevant authority. Notifiable incidents include:

- A death of a person,
- A serious injury or illness of the person, or
- A dangerous incident.

When such incident has occurred, Senior Management ensures the site is preserved for investigation by the relevant authority.

Reporting occurs as per timeframes detailed below:

Notifiable Incidents	Report to	Timeframe
Serious incidents involving a death (fatality) or serious injury or illness	NT Work safe 1800 019 115, Client, PC Scheme Agent / Insurer	Verbal when aware of the incident, written within 48hrs, if requested.
Serious incidents involving injury or illness to non-workers at your workplace	NT Work safe 1800 019 115, Client, PC Scheme Agent / Insurer	Verbal when aware of the incident, written within 48hrs, if requested.
Other incidents involving an injury or illness where workers compensation is payable	Client, Scheme Agent / Insurer	Within 48 hours.

3.6 Competencies

Aldebaran Contracting have prepared this Traffic Management Plan and associated controls for the works in house with an accredited WZ1 personnel.

The Contractor will ensure that during working hours a supervisory person will be available who is accredited in "Workzone Traffic Supervisor (WZ3)" as well as ensuring that traffic controllers used on the project are experienced in high traffic volume situations and have completed the recommended accredited courses in traffic control.

6 Responsibilities

The 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 members of the public.

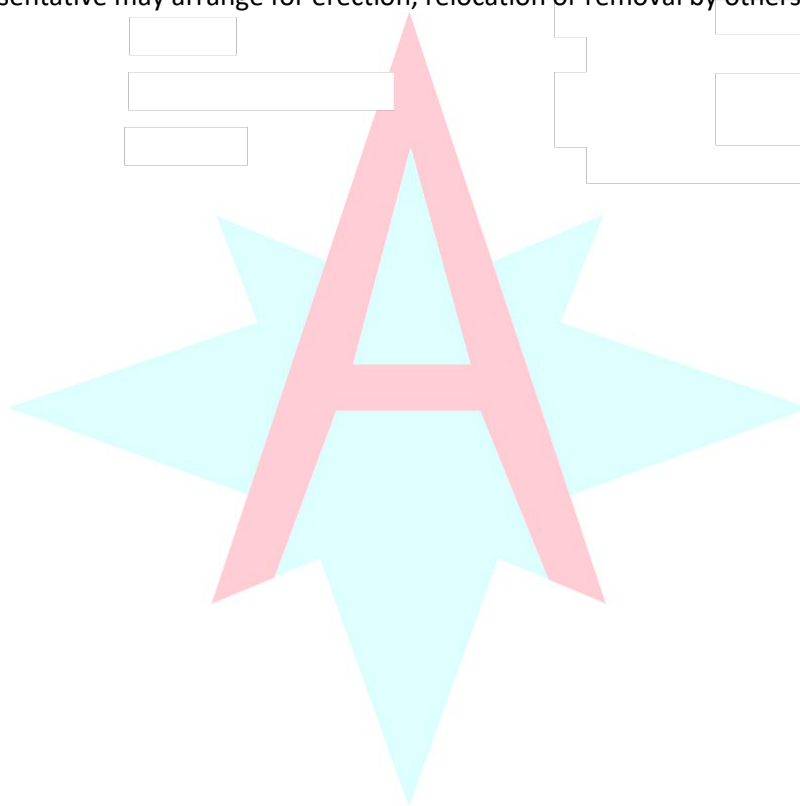
The Project manager will ensure site personnel are fully aware of their responsibilities, and that traffic controllers are appropriately trained and accredited and that sufficient controllers are available to ensure appropriate breaks are taken.

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

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

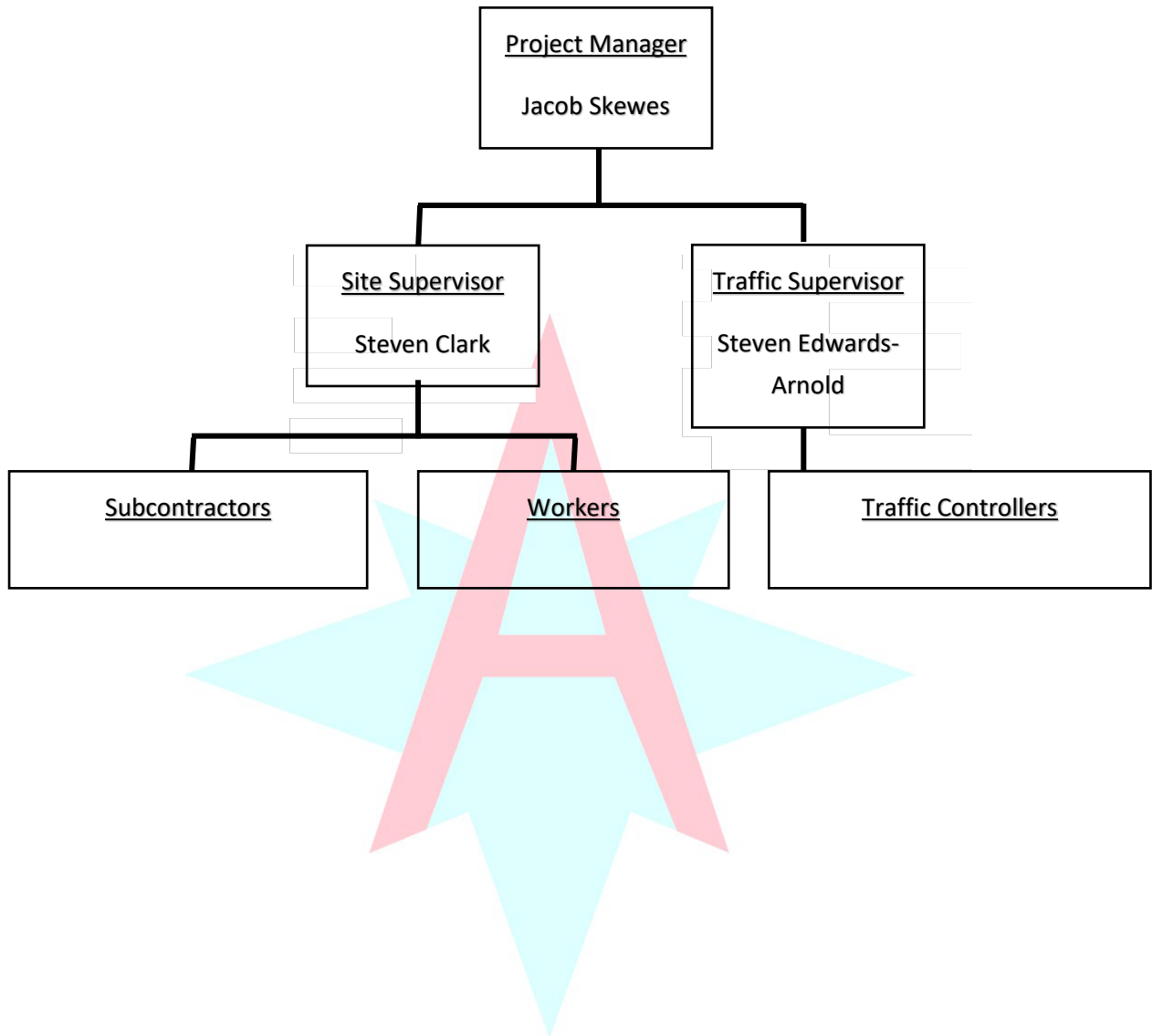
Personnel responsible for traffic control shall ensure that the number, type and location of signs, devices and barricades are to a standard not less than Appendix D of this plan and AS1742.3 (except where specifically detailed in this TMP with reasons for the variations). Should a situation arise that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

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



6.1 Specific Responsibilities

The following diagram outlines the responsibility hierarchy of this contact.



6.2 Project Manager

The project manager shall:

- Ensure 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
- 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 act to amend the traffic control measures as appropriate following approval from the Road Authority's Representative
- Arrange and/or undertake any necessary audits and incident investigations.

6.3 Site Supervisor

The site 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 garments shirts/vests/trousers etc
- 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,
- Conducting project inductions regarding company policies, procedures and work instructions.

6.4 Traffic Management Personnel

- At least one person on site shall be accredited in Workzone Traffic Supervisor (WZ3), and shall have the responsibility of ensuring the traffic management devices are set out in accordance with the TMP
- At least one person accredited in Workzone Traffic Management Plan Designer

WZ1 shall be available to attend the site at short notice to manage variations, contingencies and emergencies, and to take overall responsibility for traffic management.

6.5 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 the Traffic Section 4.10 and Appendix C of AS1742.3
- Be accredited in Workzone Traffic Supervisor (WZ3) if required to implement TMP
- Hold a current Traffic Controller's accreditation (WZ2)
- Take appropriate breaks as required by AS1742.3 and/or WHS Regulations.

6.6 Workers and Subcontractors

Workers and Subcontractors shall:

- Correctly wear of high visibility safety garments shirts/vests/trousers, in addition to other protective equipment required (e.g. footwear, eye protection, helmet sun protection etc), 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 public
- Enter and leave the site by approved routes and in accordance with safe work practices

6.7 Personal Protective Equipment

Personnel entering the work site shall correctly wear high visibility safety garments shirts/vests/trousers 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 whilst on the worksite).

7 Project Inductions

Project inductions include the site-specific requirements, inductions are conducted by a senior staff member for employees and subcontractors prior to the commencement of the works onsite.

Inductions cover;

- Description of the works, works in progress and the site layout,
- Project Management Plan,
- Notification of hazards, including understanding the project risk assessment for the site (PRA) including our company HIRAC process,
- Exclusion Zones,
- Hazardous and Dangerous Substance Management,

- Identification of any High-Risk construction activities where SWMS apply,
- Site rules, emphasis that health, safety and environmental compliance is everyone's business and that the company requires care and co-operation,
- Scared Site, Cultural and Heritage,
- First aid arrangements and contact details,
- Indicate the site QHSE advisor is Zoe Breed or the Supervisor,
- Explain when personal protective equipment, such as gloves, safety boots, UV protection and high visibility clothing must be worn,
- Explain the importance of maintaining the site as a safe work place. Cover items such as driving on site, electrical plugs, leads and tools, maintaining site in a clean and tidy condition,
- Point out any high-risk construction activities where safe work procedures apply,
- Site emergency procedures, including location of assembly area, amenities, first aid kits, fire extinguishers, spill kits and emergency contact numbers,
- Site specific Work Instructions,
- Identified hazards at worksite,
- Legislative requirements,
- Waste Management,
- Traffic management plan, traffic guidance scheme,
- Locations of traffic control devices,
- Explain daily traffic check process and

8 Plant and Equipment

Plant and equipment at the workplace shall meet statutory requirements and have the required registration, licences or certification where required. Mobile equipment shall be fitted with suitable reversing alarms. Mobile plant and vehicles shall be fitted with a rotating flashing yellow lamp in accordance with AS1742.3 clause 3.12.1. Workers will be made aware of the safe work practice at the time of the site induction.

9 Incident / Accident Procedures

In the event of an incident or accident, whether involving traffic or road users, work shall cease, and traffic shall be stopped as necessary to avoid further deterioration of the situation. First Aid shall be administered as necessary, and medical assistance shall be called for if required. For life threatening injuries an ambulance shall be called on telephone number 000. The Police shall also be called on 000 for traffic crashes where life threatening injuries are apparent. Any traffic crash resulting in non-life-

threatening injury shall immediately be reported to a NT Police Service on 131 444 and the project superintendent via email.

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 used 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 incidents and accidents shall be reported to the Site Supervisor and Project Manager using the incident report form at Appendix "C" (or similar).

9.1 Trip Hazards

The worksite and its immediate surroundings shall be suitably protected and free of hazards, which could result in tripping 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 preclude pedestrian 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.

9.2 Weather

Weather is not expected to adversely impact on the effectiveness of the traffic control detailed on the attached TGS. Notwithstanding this should adverse weather conditions be encountered during the works, the following contingency plans should be activated. Note: adjustments to the plan shall be risk assessed and approved by someone holding a WZ1 or Road Authority representative.

9.3 Rain

In the event of rain, an on-site assessment shall be made and sign spacing, and tapers may be extended by 25% to account for increased stopping distances. "Slippery When Wet" signs may be placed as required and changes shall be recorded in the daily diary.

Where rain occurs, Traffic Management Personnel shall audit the site and where signage and/or devices are not clearly visible, signage may need to be adjusted to improve visibility or if necessary provide additional signage and delineation. Where stopping distances are adversely affected by wet surfaces, spacing between signs may need to be adjusted to provide increased reaction time for

drivers. In cases where it is determined that the rain is so heavy that the risk is considered unacceptable, work shall cease until rain has cleared. Changes shall be noted in the daily diary.

9.4 Floods

Should works be affected by flooding to the extent that the worksite becomes impassable or risk is considered unacceptable, work shall cease immediately and Traffic Controllers (and other personnel if necessary) shall be deployed immediately to close the site and direct traffic around the flooded area (under the direction of the project manager or traffic manager). Emergency services and the Road Authority shall be notified immediately, and Traffic Controllers shall remain onsite until emergency services and the Road Authority personnel arrive and take control of the site.

9.5 Sun Glare

Where sun glare is identified as adversely affecting a driver's ability to sight signage and/or traffic control devices, sign locations may need to be adjusted and additional delineation and/or traffic control devices provided to address the risk from glare. If traffic control is adversely affected by glare at sunset and sunrise, traffic controllers may need to assist in maintaining low traffic speeds.

Changes are to be noted in the daily diary.

9.6 Fog / Dust / Smoke

Where fog, dust or smoke is identified as adversely affecting a driver's ability to sight signage and/or traffic control devices, sign locations may need to be adjusted and additional delineation and/or traffic control devices provided to address the risk. Changes are to be noted in the daily diary.

Should works be affected by fog, dust or smoke to the extent that risk is considered unacceptable, work shall cease immediately and Traffic Controllers (and other personnel if necessary) shall be deployed immediately to close the site. Emergency services and the Road Authority shall be notified immediately, and Traffic Controllers shall remain onsite until emergency services and the Road Authority personnel arrive and take control of the site

9.7 Terrain

The works are to complete upgrades on the existing on the Tablelands Highway, the Highway is a sealed single lane road.

9.8 Vegetation

The works are not in or near any National Parks or catchment areas. There is no vegetation which will be significantly damaged by the works.

9.9 Existing Traffic and Advertising Signage

Existing speed limit signs along Tablelands Highway will stay in place, existing signs placed where the traffic control devices are to be implemented will be covered for the duration of the works.

There are no other traffic signs in the vicinity which could cause distractions or confusion, or which restrict sight lines.

9.10 Structures

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

10 Work Access

10.1 Pedestrian Access

(Including Facilities for people with disabilities and other vulnerable road users)

N/A

10.2 Cyclists

N/A

10.3 Site Access for Works Vehicles

Works vehicles, plant and personnel entering and leaving the worksite shall do so at the designated location, Work vehicles are to turn amber flashing light on 30sec prior to reaching turn off to enter site and are to have their flashing light on when exiting the site.

10.4 Emergency Vehicle Access

Emergency services will have continual access to properties and the worksite; hence no specific facilities are required. Emergency services will not be affected.

10.5 Public Transport

N/A

10.6 Access to Adjoining Development / Properties

The site is located along the Tablelands Highway, Aldebaran contracting will be seeking permission from the station to set up camp, use an access track and source gravel from the station. None of Aldebaran's activities will affect access to the property.

10.7 Existing Parking Facilities

N/A

10.8 Special Events and Other Works

N/A

10.9 Railways

N/A

10.10 School Crossings

N/A

10.11 Impact on Adjoining Road Network

N/A

10.12 Heavy and Oversized Vehicles and Loads

Heavy and Oversized Vehicles and Loads may negotiate the works. Road authority's and Police have been advised to contact the Site Representative if additional traffic management is required. A minimum traffic lane clearance for adjacent lanes to work zone is a minimum of 3.5m, this will cater for oversized vehicles.

10.13 Hazard Identification, Risk Assessment and Legal Requirements

A detailed risk assessment can be found at Appendix F.

10.14 Noise and Vibration

The project is located away from residents and businesses, the public should not be affected by any noise from the works.

Noise and vibration will be controlled by:

- Mufflers and exhaust systems to be kept as per manufactures requirements for earthmoving and other vehicles on site,
- Hearing protection **must** be the correct type to reduce noise exposure to acceptable levels,
- Training **must** be carried out regarding safe use, fitting and maintenance of hearing protection,
- **Report** any hearing problems, ringing in the ears etc., as soon as possible.

Any work that is undertaken on Public Holidays or outside normal working hours will required the approval of the Superintendent. Reasonable practical steps will be undertaken to reduce maintenance activity noise and vibration from the site.

10.15 Legal and Other Requirements

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

- NT Work Health and Safety (National Uniform Legislation) Act
- NT Work Health and Safety (National Uniform Legislation) Regulations
- NT WorkSafe Relevant Bulletins
- NT Control of Roads Act
- NT Traffic Act
- NT DIPL Technical Requirements for Works Within the NT Government Road Reserve
- Department of Transport G7 - Information for Interstate and Overseas Visitors to the Northern Territory
- Department of Transport G9 – NT Workzone Traffic Management ID card
- Australian Standard AS 1742 – Manual of uniform traffic control devices
- Part 1 – General introduction and index of signs
- Part 2 – Traffic control for general use
- Part 3 – Traffic control for works on roads
- Part 4 – Speed controls
- AS/NZS ISO 31000– Risk Management – Principles and Guidelines
- AS/NZS 4602– High visibility safety garments
- AS/NZS 1906.1; Retro-reflective materials
- AS/NZS 4192; Illuminated flashing arrow signs
- AS 4191; Portable traffic signals
- AS/NZS 3845; Road safety barrier systems

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

11 Emergency Arrangements and Contingencies

11.1 Emergency Services

Emergency services shall be notified via phone of the proposed works nature, location, date and times as well as contact details for the site supervisor.

Refer to ALD-M-02 Emergency Response Plan for site specific emergency management details.

11.2 Dangerous Goods

Should any incident arise involving vehicles transporting dangerous goods, 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 via PFES of the proposed works nature, location, date and times as well as contact details for the site supervisor. Site personnel shall be briefed on evacuation and control procedures.

11.3 Damage to Services

If gas services are damaged, 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.

Site personnel shall be briefed on evacuation and control procedures.

12 Failure of Services

12.1 Failure of Traffic Signals

Traffic signals will be required for this project., if traffic signals fail, traffic controllers are to be used in place until Traffic signals can be fixed.

12.2 Failure of Street lighting

No street lighting is within the project.

12.3 Failure of Power

N/A for this Project.

13 Contingency Planning.

13.1 Road Crash or Vehicle Breakdown within Site.

Road plant within the work area that may impact on any services requiring access to a crash site will be cleared from the area quickly as necessary.

On-site traffic controllers will be equipped with mobile communications to advise and/or liaise with emergency services to ensure a prompt response should the need arise.

There will be accredited First Aid personnel on site to assist where required.

13.2 Serious Injury or Fatality.

In the case of serious injury or fatality occurring within the traffic control zone 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 road workers and traffic management personnel shall preserve the scene leaving everything in situ, until direction is given by Police or NT WorkSafe.

A site-specific detour route and/or road closure point 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 to cater for all types of vehicles required to use them. An example of how to manage an emergency can be found in Appendix B of AS1742.3.

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

13.3 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	E-mail/Website	Phone (Emergency)
NT Police Service	www.pfes.nt.gov.au	000 or 112 from mobile

St. John Ambulance	www.stjohn.org.au	000 or 112 from mobile
PFES	www.pfes.nt.gov.au	000 / 112 form mobile
Power	Power and water outages	1800 245 090
Gas	Local Gas Distribution Networks	1800 017 000
DIPL TOC	Roads Darwin	1800 246 144

14 Approvals

14.1 General

Prior to works commencing it is considered necessary to advise road users of the forthcoming works, the likely timeframe of the works and the road conditions likely to be encountered. Advice shall consist of the following:

- Liaison with emergency services (Police, St John Ambulance, Fire and Emergency Services)
- Liaison with Local authorities regarding local issues
- Liaison with other stakeholders (APA, DIPL)

Refer front cover for register of approvals by road and service authorities.

15 Notification

15.1 Public Notification

N/A for this TMP

15.2 Notification of Other Agencies

In accordance with the COP relevant agencies shall be notified using the **Application to work on public places** form attached at Appendix A.

16 Traffic Assessment & Analysis.

16.1 Existing & Proposed Speed Zones

The current speed limit for Carpentaria Highway is 110km/h. The speed limit will be reduced from 110km/h to 80km/h and then to 60km/h throughout the jobsite.

16.2 Volume and Composition

It is vital to determine the traffic volumes and composition of the impacted network before implementing any traffic management to ensure road users (including pedestrians, cyclists, buses, heavy vehicles, etc.) are catered for with minimum inconvenience.

16.3 Minimum Lane Requirements and Carriageway Impacts.

N/A for this project.

16.4 Traffic Flow Capacity (Mid-block and/or intersection) Analysis

Traffic flow should be maintained wherever possible. Traffic volumes and movements will be analysed against the requirements detailed in clause 4.13 of AS 1742.3 and risk tables to ensure levels of service are acceptable to the Road Authority.

16.5 Duration and Hours of Proposed Works

These works will be in place for 2 months. The job site is along the Carpentaria Highway the project is at following chainages:

Ch 202200km to Ch 202300

The hours of operation will be between 06:30 and 18:30.

16.6 Barrier Requirements

N/A for this TMP

16.7 Variable Message Signs

N/A for this TMP

16.8 Essential Services

Identify essential services e.g.: Water, Sewage, Electricity this is to ensure when setting up of traffic management devices is being completed no services are disrupted. Dial before you dig (DBYD) is obtained through contacting 1100, to obtain locations of underground services.

17 Traffic Management Implementation.

17.1 Staging of Work / Traffic Management.

Activities relating to installation, staging and removal of signage, lane closures and work activities shall be recorded in the Daily Diary detailing that the time at which they occur.

17.1.1 After Care

Remove Workers Symbolic

17.2 Traffic Guidance Scheme

The Traffic Guidance Scheme outlined in Appendix “D” and listed below have been provided for the following stages to demonstrate the type of controls that will be implemented throughout the term of the contract

Drawing Number	Version	Details
TGS 1	V1.0	Works at Intersection
TGS 2	V1.0	Aftercare

17.3 Signage and Device Requirements.

Signage requirements are shown on each Traffic Guidance Scheme.

Should the use of additional (not shown on the TGS or listing of devices) or reduced number of devices be required due to unforeseen needs, they shall be recorded within the Daily Diary as a variation to the TMP, following prior approval.

17.4 Site Access

Refer to vehicle movement plan for work vehicles entry and exit points.

18 Communication.

18.1 General

Prior to works commencing it is considered necessary to advise road users of the forthcoming works, the likely timeframe of the works and the road conditions likely to be encountered. Advice shall be provided to those agencies affected by the works. These details are will be provided via email to the businesses notifying the changes. A copy of the letter provided in appendix F.

19 Traffic Management Monitoring.

19.1 Daily Inspections

Prior to works commencing the Site Supervisor shall communicate the Traffic Management Plan to key stakeholders and affected parties.

On completion of setting out the traffic control measures, the site is to be monitored for a suitable period. If traffic speeds on the approaches to the work site are assessed as being above the temporary posted speed zone for the work site, the Site Supervisor is to initiate action to modify the approach signage and tapers in accordance with the requirements of AS1742.3, Actions are to be recorded in the Daily Diary. Should road users be observed to continue to travel more than the posted speed limit, the police are to be requested to attend the site to enforce the temporary posted speed limit.

The Workzone Traffic Management Plan Designer WZ1 accredited supervisory person at the worksite may conditionally approve changes made to a complex traffic management plan subject to review and endorsement of the change by a Road Safety Auditor/Road Authority Representative as soon as practicably possible.

The Traffic Management Contractor shall ensure that temporary signs, devices and controls are maintained. To achieve this, procedures in line with the requirements outlined in AS1742.3

The monitoring program shall incorporate inspections:

- Before the start of work activities on site,
- During the hours of work,
- Closing at the end of the shift period.

A daily record of the inspections shall be kept indicating

- When traffic controls were erected,
- When changes to controls occurred and why the changes were undertaken,
- Any significant incidents or observations associated with the traffic controls and their impacts on road users or adjacent properties.

The Traffic Management Contractor shall ensure that personnel are assigned to monitor the traffic control scheme.

Inspections shall at least satisfy the following requirements:

Before work starts:

- Inspect signs and devices to ensure they are undamaged, clean and comply with the requirements depicted on the Traffic Guidance Scheme.

- Confirm Traffic Management plan for the day's activities;
- After any adjustments have been made to the signs and devices, conduct a drive through inspection to confirm effectiveness.

During Work hours:

- Designate and ensure that appropriate work personnel drive through the site periodically to inspect signs and devices and ensure they are undamaged and comply with the requirements depicted on the Traffic Guidance Scheme.
- Re position signs or required by work processes throughout the day and keep records of any changes.

Closing Each Day:

- Conduct a pre-close inspection, allowing time for any appropriate maintenance works.

Closing down inspection covers, but not limited to excavations. Ensuring excavations are backfilled and if they are not and it's unsealed, **ROUGH SURFACE** signs and cones are to be put in place to ensure the public are aware there are excavations.

19.2 TMP Auditing

This TMP has been subject to a visual Suitability Audit. Due to the nature of the works a drive through of the site will be conducted during the works in accordance with DIPL specifications and TMP Audit Policy requirements.

Appropriately qualified and experienced auditing officers from DIPL may perform random audits/compliance checks of traffic management at work sites. The auditing/compliance officer will hold current NT accreditation as a WZ1. Project officers may collect information on behalf of the auditor.

Where the auditing officer deems modifications to traffic management are required for reasons of public safety or safety on the worksite, an ITC will be issued requesting immediate correction. If modifications are deemed necessary but not urgent, corrections are to be made at the earliest practicable opportunity.

19.3 Records.

A daily diary recording inspections including variations to the approved TMP shall be kept using Standard Forms "Daily Diary".

The Traffic Supervisor is to record inspections made daily and at those times prescribed by the Traffic Management Implementation Standards. Upon completion of each day the Traffic Supervisor shall provide copies of the daily diary record to the Project Manager.

The Traffic Supervisor is to record variations made to the approved Traffic Management Plan daily and indicate clearly the nature of the variations and the reason for the variations. Upon completion of each day the Traffic Supervisor shall provide copies of the variation record to the Project Manager.

20 Traffic Management Implementation Standards.

20.1 Sequence and Staging

Before work commences, signs and devices at approaches to the work area shall be erected in accordance with the adopted TGS, in the following order:

- Advance warning signs.
- Intermediate advance warning and regulatory signs and devices required in advance of the taper or start of the work area.
- Delineating devices required to form a taper including flashing arrow signs or temporary hazard markers where required.
- Delineation past the work area or into a side-track.
- Other warning signs or regulatory signs.

Delineation devices such as cones and bollards should be placed in the same sequence, i.e. those furthest in advance of the work placed first.

Where a work area is moving progressively along the road, relocation of the signs ahead should take place in the above sequence. Those behind should be relocated in the reverse sequence.

Signs and devices that are erected before they are required shall be covered by a suitable material. The cover shall be removed immediately prior to the commencement of work.

Removal of traffic control signs and devices should be undertaken in the reverse order of erection, progressing from the work area out toward the approaches.

Refer to Traffic Guidance Scheme in specific Traffic Management Plans for individual worksite details.

21 Signage

21.1 Alignments and signage details.

The requirements for the closure and realignment of lanes and any other traffic arrangement necessary to accommodate the works shall be detailed in specific Traffic Management Plan work staging and on the Traffic Guidance Scheme. Traffic control shall be implemented and maintained in accordance with the requirements of Australian Standard AS 1742.3, DIPL PTW Standard Practices.

21.2 Requirements for signs.

Signs used shall conform to the designs and dimensions as shown in Australian Standard AS 1742.3 and the DIPL PTW.

Prior to installation, signs and devices shall be checked by the Site Supervisor or a suitably qualified person to ensure that they are in good condition and meet the following requirements:

- Mechanical condition - Items that are bent, broken or have surface damage shall not be used.
- Cleanliness - Items should be free from accumulated dirt, road grime or other contamination.
- Colour of fluorescent signs - Fluorescent signs whose colour has faded to a point where they have lost their daylight impact shall be replaced.

Where signs do not conform either to the requirements of AS 1742.3 or would fail to pass any of the above checks, they shall be replaced on notice.

Signs and devices shall be positioned and erected in accordance with the locations and spacing's shown on the drawings. Signs shall be positioned and erected such that:

- They are properly displayed and securely mounted,
- They are within the driver's line of sight,
- They cannot be obscured from view,
- They do not obscure other devices from the driver's line of sight
- They do not become a possible hazard to workers or vehicles; and
- They do not deflect traffic into an undesirable path.

Signs and devices that are erected before they are required shall be covered by a suitable opaque material. The cover shall be removed immediately prior to the commencement of work.

Where there is a potential for conflict of information between existing signage and temporary signage erected for traffic control, the existing signs shall be covered. The material covering the sign shall ensure that the sign cannot be seen under conditions i.e. day, night and wet weather. The signs will be covered with material that will not damage the existing sign.

21.3 Tolerances on positioning of signs and devices

Where a specific distance for the longitudinal positioning of signs or devices with respect to other items or features is stated, for the spacing of delineating devices or for the length of tapers or markings, the following tolerances may be applied:

- (a) Positioning of signs, length of tapers or markings.
- (i) Minimum, 10% less than the distances or lengths given.

- (ii) Maximum, 25% more than the distances or lengths given.
- (b) Spacing of delineating devices.
- (i) Maximum, 10% more than the spacing shown.
- (ii) No minimum.

These tolerances shall not apply where a distance, length or spacing is already stated as a maximum, a minimum or a range.

21.4 Flashing Arrow Signs.

N/A for this project

21.5 Delineation General

700mm Cones with reflective tape fitted will be used for part road closure

21.6 Delineation spacing.

Cones will be spaced 18m apart

21.7 Speed zoning.

The posted speed limit is 110km/h. Speed restrictions will be required down to 60km/h when portable stop lights and Stop/Slop operations are required.

21.8 Provision for night works.

N/A for this TMP

21.9 Temporary Pavement Markings

N/A to this TMP

21.10 Aftercare Signage

Remove workers symbolic sign.

21.11 Taper Lengths

30m with taper cone spacing of 12m

22 Management Review

22.1 TMP Review and Improvement

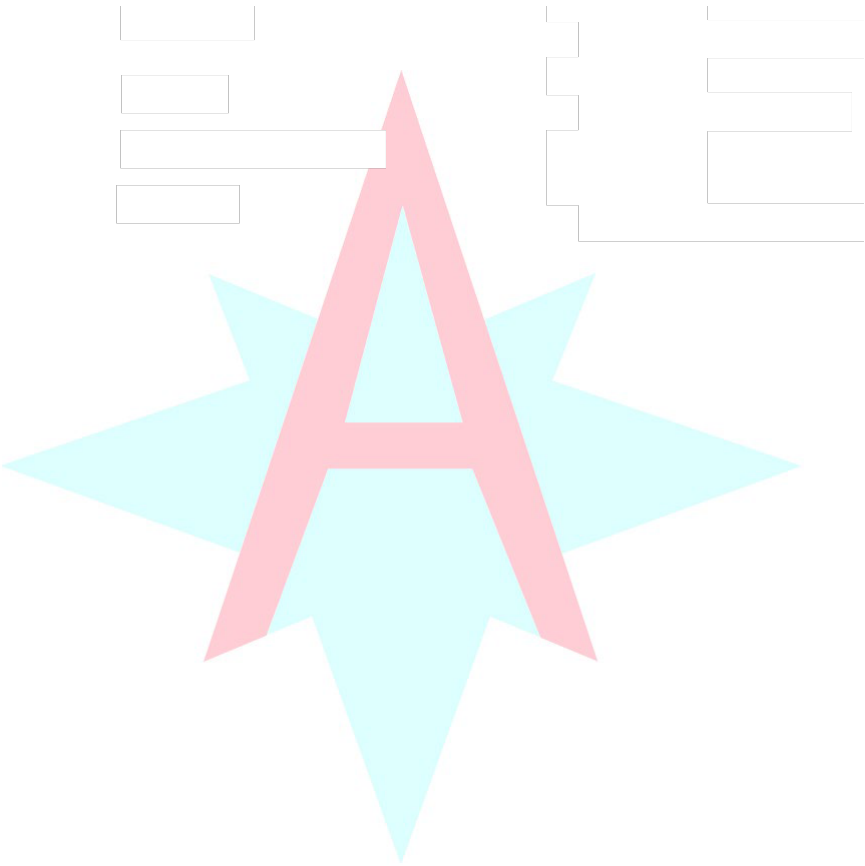
N/A For this TMP.

22.2 Variations to Standards and Plans

N/A For this TMP.

23 Appendix A - Application Procedures for a Permit to Work Within NT
Government Road Reserves

https://nt.gov.au/_data/assets/pdf_file/0004/237622/permit-to-work-within-the-ntg-road-reserve.pdf



24 Appendix B - Variation to Standards

N/A for this Project

APPLICATION FOR APPROVAL TO VARY REQUIREMENTS OF AUSTRALIAN STANDARDS AS1742.3 OR
DIPL PtoW

Request for Approvals to variations to be submitted at least one (2) week in advance, – except in an emergency This Approval for Variation shall be attached as a supplement to the Traffic Management Plan (TMP)

Form Instruction

1. **Section A** – Identify the Principal Agency / person commissioning the activity. (Does not include contractors, subcontractors or **traffic** management company/traffic planners etc).

2. **Section B** – Identify activity location, start / finish date and time, type of traffic management, description location of activity.

3. **Section C** – For Works undertaken on a Territory road or on behalf of DIPL or Local Government Authority the details of the risk assessment process identified in this application form must be documented and endorsed by an accredited WZ1 or RSA.

Applications to be addressed to the applicable DIPL Regional office. For contact information please refer to the DIPL PtoW.

For other applications the details of the risk assessment process identified in this application form must be documented and endorsed by the person responsible for approving the implementation of the traffic management plan.

Contact with the appropriate road authority should be made prior to lodgment of this application to determine its suitability and for any additional requirements. Applications to be addressed to the appropriate Authorised Body. If no listing can be found, refer this application to the appropriate DIPL Regional office.

4. **Section D** - Risk implication, identification and assessment process must be undertaken in accordance with Risk Management – Principles and Guidelines AS/NZS ISO 31000 and Risk Assessment Techniques IEC/ISO 31010. The likelihood and consequences should be rated after the application of any additional counter measures taken utilising Tables respectively.

Incomplete or applications not signed by the traffic planner will not be processed.

A	Applicant (Principal for the Works)				
Postal address					
Suburb		State		Postcode	
Project Manager			Telephone		
Email			Facsimile		

B	Anticipated start date				Anticipated finish date			
Daily work hours;	From		To		Weekend work applicable	Yes	Sat / Sun	No
Location of works (Road/Street Suburb),								
Road type (eg undivided, two lane)								
Description of works								
Are alterations to permanent traffic signals required?					Yes	No	N/A	
Posted Speed Limit		Worksite speed limit		After hours speed limit		80km/h		

C	Traffic Planner					
DIPL Certification	RSA ☐	WZ1 ☐	WZ1 ☐			
Accreditation Number						
Postal address						
Suburb				Postcode		
Email		Telephone		Facsimile		
Endorsement signature:		Date				

For Internal Use Only

Approving Road Authority			
Approving Officer Position			
Application Approved	Yes ☐ No ☐	If Not Why Not	
Additional Conditions			
Approved By: Signature	Title	Date	File

Type of Variation ☐ PtoW ☐ AS1742.3 ☐ Other.....					
D	Description of Variation Requested (If insufficient space use other side)	Specify Point of Departure from Standard / PtoW (List section and page number)	Justification (Why is this necessary)	Additional Counter Measures To Be Taken Identify additional counter measures to be used to negated the lesser treatment)	Identified Risk Implication2 Descriptor (Tick) v
					☐ Insignificant ☐ Minor ☐ Moderate ☐ Major ☐ Catastrophic Consequence ☐ Almost certain ☐ Likely ☐ Possible ☐ Unlikely ☐ Rare Likelihood ☐ Extreme ☐ High ☐ Moderate ☐ Low Residual Risk

25 Appendix C - Record Forms

Daily Diary

Record details of changes to the Traffic Management Plan.

PROJECT DETAILS:

LOCATION:

DATE:

Contract No.

TMP Document No.

TGS Dwg No.

Revision No. 0

Date:		Time:		Location:			
Inspection/ changes	By:		Signed:	Changes authorised	By:		Signed:
Detail/Comments:							

Date:		Time:		Location:			
Inspection/ changes	By:		Signed:	Changes authorised	By:		Signed:
Detail/Comments:							

Date:		Time:		Location:			
Inspection/ changes	By:		Signed:	Changes authorised	By:		Signed:
Detail/Comments:							

26 Daily Inspection Sheet



75 Acacia Gap Road, Manton NT 0822
ABN: 99 128020 299
Ph: 08 8978 4900

Onsite Traffic Inspection
ALD-F-20

TGS Number	
Project	Date

NOTES:

- Indicate by placing a tick in the appropriate box
- Items requiring modification and/or repair, detail in the comments box or on the back what was modified/repared
- For modifications that are different to the basic traffic management plan layout, give details of who authorised the changes
- Hand sheet to supervisors / manager at the end of each day.

Inspections			
Prior to works commencing		Midday	
Time of Inspection:		Time of Inspection:	
Signs & devices appropriate for the day's activities and conditions	☐ Satisfactory ☐ Modifications/Repairs Required	Signs & devices operating satisfactorily and seen by motorists	☐ Satisfactory ☐ Modifications/Repairs Required
Signs & devices positioned and mounted correctly	☐ Satisfactory ☐ Modifications/Repairs Required	Signs & devices positioned and mounted correctly	☐ Satisfactory ☐ Modifications/Repairs Required
Signs & devices clean and clearly visible	☐ Satisfactory ☐ Modifications/Repairs Required	Signs & devices clean and clearly visible	☐ Satisfactory ☐ Modifications/Repairs Required
Modifications and/or repairs completed	☐ Yes – Detail below ☐ No – Detail below	Traffic controllers correctly attired and operating correctly	☐ Satisfactory ☐ Modifications/Repairs Required
Comments:		Modifications and/or repairs completed	☐ Yes – Detail below ☐ No – Detail below
		Comments:	
End of Day		Night Time – After Work Hours	
Time of Inspection:		Time of Inspection:	
Signage Removed	☐ Satisfactory ☐ Modifications/Repairs Required	Arrow Boards / VMS operating	☐ Satisfactory ☐ Modifications/Repairs Required
Excavations correctly backfilled	☐ Satisfactory ☐ Modifications/Repairs Required ☐ N/A	Signs & Devices positioned and mounted correctly	☐ Satisfactory ☐ Modifications/Repairs Required
Driving surfaces adequate	☐ Satisfactory ☐ Modifications/Repairs Required	Signs & devices clean and reflective	☐ Satisfactory ☐ Modifications/Repairs Required
If excavation backfilling is unsealed, are ROUGH SURFACE signs and cones in place	☐ Satisfactory ☐ Modifications/Repairs Required ☐ N/A	Modifications and/or repairs completed	☐ Yes – Detail below ☐ No – Details below
Materials removed from medians	☐ Satisfactory ☐ Modifications/Repairs Required	Comments:	
Modifications and/or repairs completed	☐ Yes – Detail below ☐ No – Detail below		
Comments:			

Person Completing Form	
Name	
Signature	

Onsite Traffic Inspection
ALD-F-20

Version 6.0
"UNCONTROLLED WHEN PRINTED"

October 2018
Page 1 of 1

27 Incident Report Form


Incident / Accident Report Investigation
 ALD-F-12

Incident Type			
Near Miss (complete general & incident details only) ☐			
Personal Injury (complete general, incident details) ☐			
Personal Injury and Property Damage (complete general, incident details, property) ☐			
Fatality- Hospitalisation (Sections ALL) ☐			
Note: Contact Director or QHSE Manager Immediately; Director is the only person authorised to contact media and next of kin.			
General Details			
Name:		Date of Birth	
Address / Contact Details:		Male ☐	Female ☐
Details (To be completed by the person involved in the incident)			
Date of Incident		Time am/pm	Location of Incident
Number of hours worked this shift			
Where you being directly supervised	☐ Yes ☐ No (if YES provide details of who):		
Who and when was the incident reported to? (name, date, time)			
Were you working alone?	☐ Yes ☐ No		
Was there a third party involved?	☐ Yes ☐ No (if YES provide details of who):		
Injured?	☐ Yes ☐ No (if YES provide details of who):		
Witness: (Available)		Yes ☐	No ☐
Name		Male ☐	Female ☐
Address / contact details			
Activity conducted onsite			
Witnesses statement of the incident occurred			
Consequence of Incident			
☐ No Injury ☐ First Aid Treatment ☐ Medical Treatment ☐ Fatality			
Was the Incident a Notifiable to NT Worksafe including one of the following:			
☐ Yes ☐ No ☐ N/A			
Serious incidents involving a death (fatality) or a serious injury or illness			☐
Serious incidents involving injury or illness to non-workers at your work place			☐
Other incidents involving an injury or illness where workers compensation is payable.			☐
Client Notified of Incident ☐ Yes ☐ No ☐ N/A			

How did the incident/accident/near miss/hazard occur? (Basic facts, be accurate as possible of events)

Draw a sketch of the Incident

Contributing Factors
Root Cause
Personal Injury Minor
Treatment Given: None Required ☐ First Aid ☐ Doctor ☐ Hospital ☐
Name of First Aider:
Details of First Aid given:
Type of Injury:
Location of Injury:
Workers Compensation Form Required: Yes ☐ No ☐
Property Damage
Machine Damage: ☐ Property Damage ☐ Third Party Property Damage ☐ Near Miss ☐ Other ☐



Make: _____ Type: _____

Description of Property or Plant Damage:

Third Party Details

Has the Third Party been Notified?: Yes ☐ No ☐

Full Name: _____

Address: _____

Phone No: _____ Mobile: _____ Email: _____

PERSON MAKING THE REPORT:

Name: _____

Signature: _____

Date: _____



Incident / Accident Report Investigation
ALD-F-12

SUPERVISOR TO COMPLETE

Supervisors Name:-----

Was the person directly supervised at time of incident? : Yes ☐ No ☐

If No, was the person: Indirectly Supervised ☐ Not being Supervised ☐

Were instructions given to the employee/s prior to the incident: Yes ☐ No ☐

If Yes, How: Written ☐ Verbal ☐ If No, give explanation on why:

Did the Employee deviate away from the instructions given?: Yes ☐ No ☐

If Yes How:

What actions have been put into place to avoid this type of incident from happening again?

Have these actions been discussed with the employee-all onsite staff ? Yes ☐ No ☐ *(If no why not)*

Did the investigation findings relate to any process / procedure currently in place which needs to be reviewed?

Yes ☐ No ☐

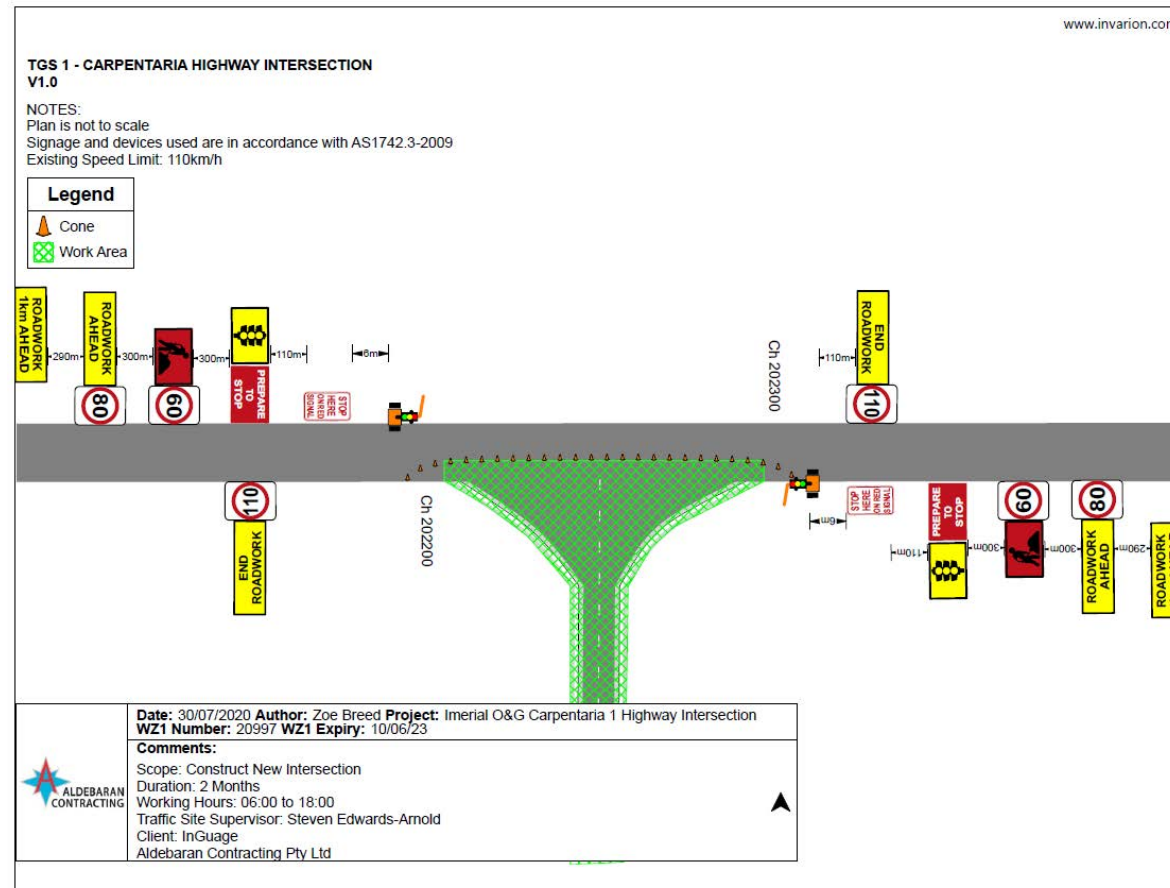
If Yes has been selected please provide additional information, including which procedures should are currently not effective?

Supervisors Signature:-----Date:-----

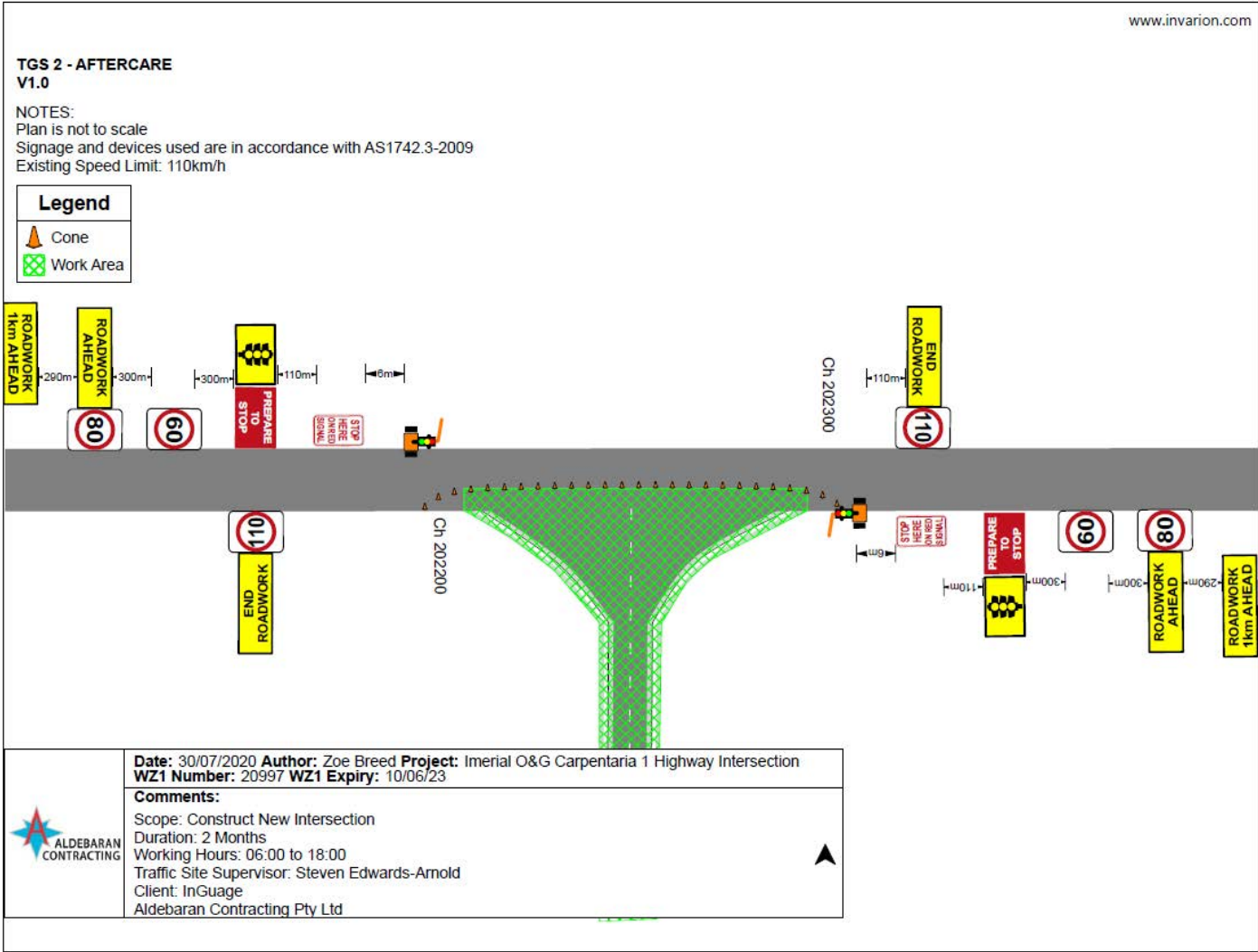
INVESTIGATION – QHSE Manager					
Incident Type					
☐ No Injury	☐ First Aid Treatment	☐ Medical Treatment	☐ Fatality		
Further Investigation Required: Yes ☐ No ☐ (No) only allowed for Injury – First Aid Treatment Only)					
Investigation Closed: Yes ☐ No ☐ Date _____					
Entered into the Incident, Accident, Register (R-01.8): Yes ☐ No ☐ Date _____					
Reviewed By: QHSE Manager Date:_____ Signature: _____					
Further Investigation: Yes ☐ No ☐ (Medical Treatment – Fatality Required):					
<i>Refer; Management Work Instruction; Clause 2 Incident / Accident Investigations</i>					
Has the site been closed due to Fatality			Yes ☐ No ☐ Date _____		
Has the site been preserved for the investigation			Yes ☐ No ☐ Date _____		
Medical of site treatment only			Yes ☐ No ☐ Date _____		
<i>Note: Further Investigation To be attached to this form once completed</i>					
When did NT Worksafe get notified		Yes ☐ No ☐		Date _____	Time _____
Director contacted Next of Kin		Yes ☐ No ☐		Date _____	Time _____
NT Worksafe Investigation Received		Yes ☐ No ☐		Date _____	Time _____
Media contacted by Director		Yes ☐ No ☐		Date _____	Time _____
NT Worksafe Findings:					
Director agrees with the findings from NT Worksafe:					
Yes ☐ No ☐ Date _____					
Director disagrees with the findings from NT Worksafe:					
Yes ☐ No ☐ Date _____					
Further Investigation Required:			Yes ☐ No ☐ Date _____		
Reviewed By: QHSE Manager			Date:_____Signature: _____		
Reviewed By: Director			Date:_____Signature: _____		

28 Appendix D – Traffic Guidance Scheme

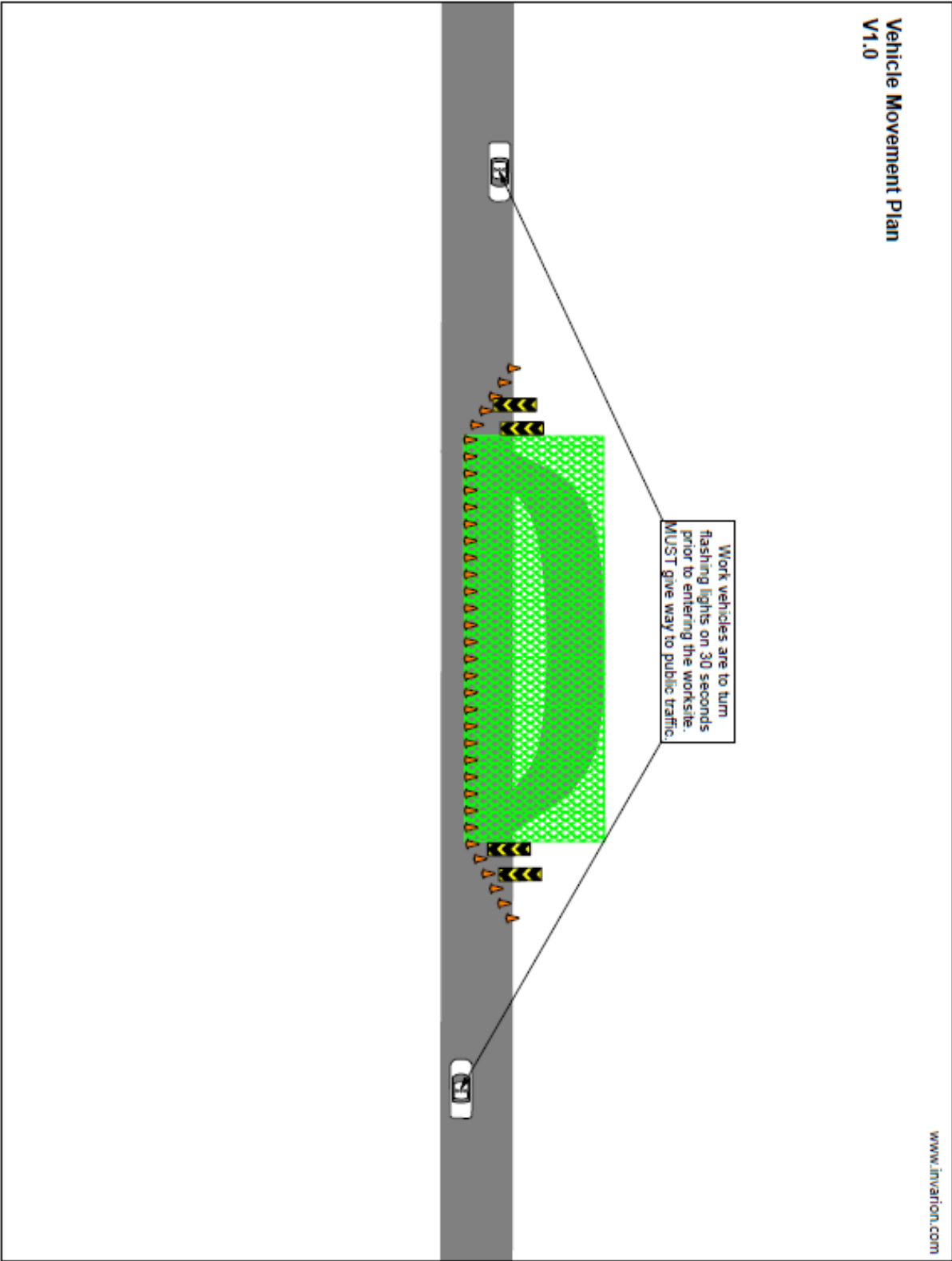
28.1 TGS 1



28.2 TGS 2



29 Appendix E – Vehicle Movement Plan



30 Appendix F – Detailed Risk Assessment

The following details the preliminary assessment of site hazards likely to be encountered, the level of risk associated with each and the control proposed. Note that the risk level is the level of assessed risk without the controls in place. The controls listed have been determined as being appropriate in reducing the risk to a level that is acceptable.

30.1 Risk Classification Tables

QUALITATIVE MEASURES OF CONSEQUENCE OR IMPACT

Level	Consequence	Description
1	Insignificant	Mid-block hourly traffic flow per lane is equal to or less than the allowable lane capacity detailed in AS1742.3. No impact to the performance of the network. Affected intersection leg operates at a Level of Service (LoS) of A or B. No property damage.
2	Minor	Mid-block hourly traffic flow per lane is greater than the allowable road capacity and less than 110% of the allowable road capacity as detailed in AS1742.3. Minor impact to the performance of the network. Intersection performance operates at a Level of Service (LoS) of C. Minor property damage.
3	Moderate	Midblock hourly traffic flow per lane is equal to and greater than 110% and less than 135% of allowable road capacity as detailed in AS1742.3. Moderate impact to the performance of the network. Intersection performance operates at a Level of Service (LoS) of D. Moderate property damage.
4	Major	Midblock hourly traffic flow per lane is equal to and greater than 135% and less than 170% of allowable road capacity as detailed in AS1742.3. Major impact to the performance of the network. Intersection performance operates at a Level of Service (LoS) of E. Major property damage.
5	Catastrophic	Midblock hourly traffic flow per lane is equal to and greater than 170% of allowable road capacity as detailed in AS1742.3. Unacceptable impact to the performance of the network. Intersection performance operates at a Level of Service (LoS) of F. Total property damage.

WHS QUALITATIVE MEASURES OF CONSEQUENCE OR IMPACT

Level	Consequence	Description
1	Insignificant	No treatment required
2	Minor	First aid treatment required.
3	Moderate	Medical treatment required or Lost Time Injury
4	Major	Single fatality or major injuries or severe permanent disablement
5	Catastrophic	Multiple fatalities.

QUALITATIVE MEASURES OF LIKELIHOOD

Level	Likelihood	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 time 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 0.02 to 0.1 times per year (i.e. once in 10 to 50 years).
E	Rare	The event or hazard: May occur only in exceptional circumstances, will probably occur with a frequency of less than 0.02 times per year (i.e. less than once in 50 years).

IMPORTANT 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 = Possible.

QUALITATIVE RISK ANALYSIS MATRIX – RISK RATING

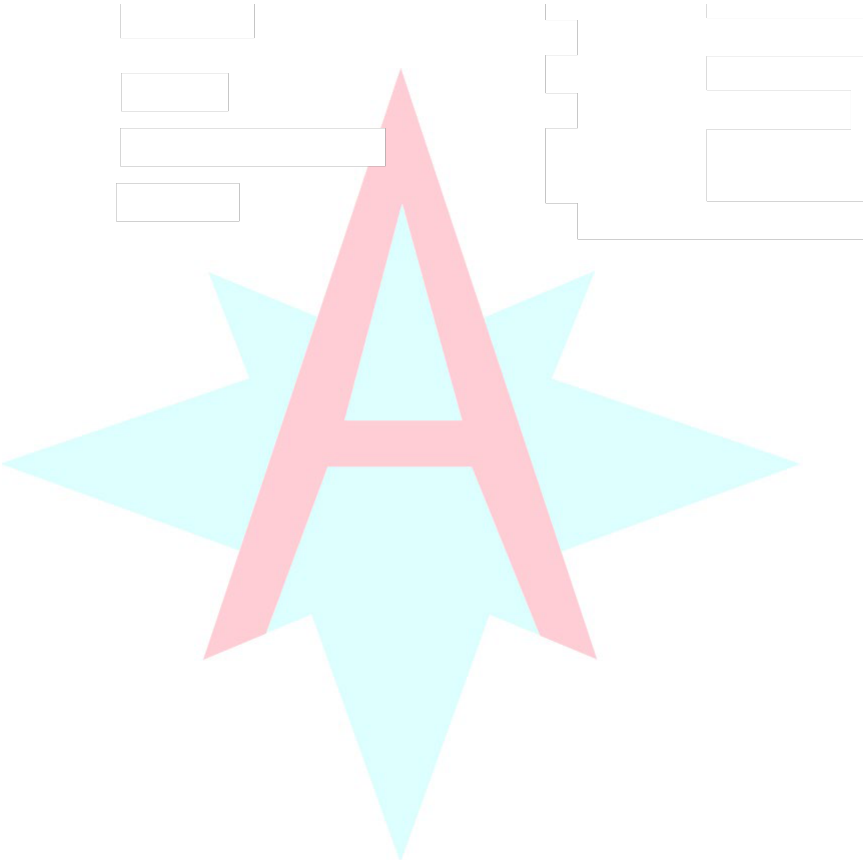
	Consequence				
Likelihood	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost certain (A)	17 High	22 Extreme	23 Extreme	24 Extreme	25 Extreme
Likely (B)	15 High	16 High	19 Extreme	20 Extreme	21 Extreme
Possible (C)	9 Moderate	8 Moderate	13 High	14 High	18 Extreme
Unlikely (D)	4 Low	5 Low	7 Moderate	11 High	12 High
Rare (E)	1 Low	2 Low	3 Low	6 Moderate	10 High

MANAGEMENT APPROACH FOR RESIDUAL RISK RATING

Residual Risk Rating	Required Treatment
Very High	Unacceptable risk. HOLD POINT. Work cannot proceed until risk has been reduced.
High	High priority, WHS and RSA/Road Authority Representative must review the risk assessment and approve the treatment and endorse the TGS prior to its implementation.
Medium	Medium Risk, standard traffic control and work practices subject to review by accredited WZ1 personnel prior to implementation.
Low	Managed in accordance with the approved management procedures and traffic control practices.

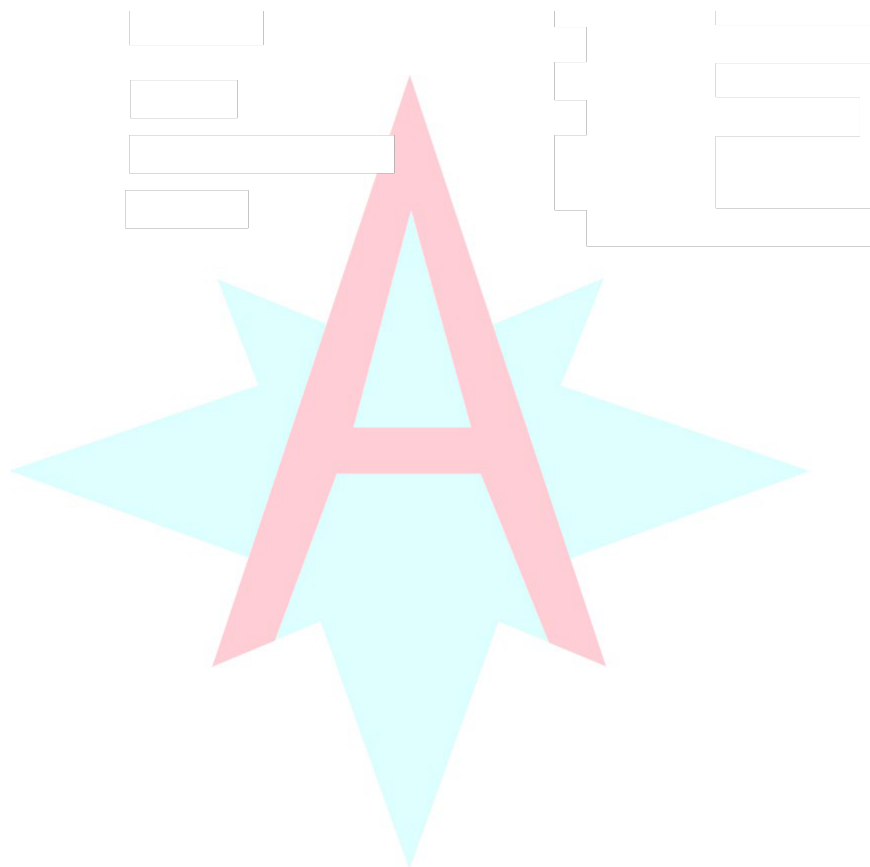
RISK	Root Cause	Pure Risk Rating			RISK RESPONSE	Residual Risk Rating		
		L	C	RTNG		L	C	RTNG
Construction activity causing an obstruction to or requiring Emergency Services	≈ Traffic congestion prevent access to the site. ≈ Traffic congestion delays Emergency vehicles	C	2	8 Moderate	Assistance to be provided for emergency services where practical No lane closures in place to interfere with emergency services path. Contact emergency services re timing of work	D	2	5 Low
Vehicle breakdown/crash causing obstruction to traffic	≈ Traffic congestion prevent access to the site. ≈ Poor direction from construction traffic	C	2	8 Moderate	Contractor to assist where practical for access by emergency assistance vehicles or removal and storage of affected vehicle. Contact with breakdown contractors	D	2	5 Low
Inappropriate placement and use of temporary signs lead to confusion and crashes.	≈ Incompetent persons. ≈ Not applying approved Plans ≈ Changes to work situations	C	4	14 High	Implementation and removal of temporary signs will be managed by competent personnel as required An audit will be undertaken of signage layout prior to opening to traffic. Site monitoring procedures to identify changes to signage requirements	D	3	7 Moderate
Parking of construction plant leading to traffic hazards	≈ No clear procedure for parking of vehicles. ≈ No designated parking areas	C	3	13 High	Construction traffic not in use to be parked out of highway work zones. Parking only in designated areas	D	2	5 Low
Construction activity creating a dust hazard for traffic moving past the site	≈ Cutting procedures don't wet down concrete ≈ Inadequate watering equipment	C	3	13 High	Concrete cutting equipment to be fitted with suitable dust attenuation facilities. Exposed subgrade and base course material to be kept damp to reduce dust impacts.	E	2	2 Low
Traffic flows along the road creating a hazardous work site leading to worker injury	≈ Inadequate worksite protection. ≈ Traffic Speed ≈ Inadequate separation from traffic ≈ Working at high traffic flow periods	A	4	24 Extreme	Control mechanism will be implemented to provide adequate separation of traffic from worksites and safe protection of workers. E.g., lane closures etc. Works personnel to have suitable high visibility vests. works will be done at off peak times Speed restrictions will be imposed	D	3	7 Moderate
Traffic flows along the road creating unsafe access to worksites leading to crashes	≈ Unclear delineation of access point. ≈ Traffic Speed ≈ Poor direction from construction traffic ≈ Entering worksites during peak traffic periods ≈ Vehicles follow traffic in to work zone	B	4	20 Extreme	Determine safe access points to the work site and outline safe entry and exit procedures for personnel. Undertake work activities when traffic flows have been reduced. 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	3	7 Moderate
Construction activities necessitating part road closures resulting in congestion	≈ Insufficient lane capacities at peak periods ≈ Vehicle breakdown adjacent to worksite	B	4	20 Extreme	No work during peak periods. Contact with breakdown contractors	C	2	8 Moderate
Inappropriate placement and use of temporary signs and line markings leads to confusion and crashes.	≈ Incompetent persons. ≈ Not applying approved Plans ≈ Changes to work situations	C	3	13 High	Implementation and removal of temporary signs and line markings will be managed by competent personnel An audit will be undertaken of signage layout prior to opening to traffic.	D	2	5 Low

RISK	Root Cause	Pure Risk Rating			RISK RESPONSE	Residual Risk Rating		
		L	C	RTNG		L	C	RTNG
					Site monitoring procedures to identify changes to signage requirements			
Construction activity causing an obstruction to or requiring Emergency Services	≈ Traffic congestion prevent access to the site. ≈ Traffic congestion delays Emergency vehicles	D	2	5 Low	Assistance to be provided for emergency services where practical No lane closures in place to interfere with emergency services path. Contact emergency services re timing of work	D	2	5 Low



31 Risk Register.

Item	Risk Event	Consequence	Pre-treatment Risk			Treatment	Residual Risk		
			L	C	RR		L	C	RR
1	Client/Worker Pedestrians	Hit by work/public vehicle walking through work site	B	4	20	Temporary fencing around worksite to stop access by unauthorised personnel	C	3	13
2	Set-up / Removal of traffic control devices	Hit by traffic Not qualified	B	4	20	Ensure vehicle has flashing lights WZ2 WZ3 personnel to be in front of the vehicle when setting up signage Correct PPE worn	C	3	13
3	Traffic	Hitting worker Following work vehicles into site Unaware of works	B	4	20	Correct Signage in place Speed limit from 10km/h Work vehicles to use amber lights 30seconds prior to entering site	C	3	13
4	Incorrect TGS's in place	Signage put up in wrong areas, Causing accident with traffic	C	3	13	Ensure TGS's are checked and approved by appropriate parties	C	2	8
5	Underground Services	Water pipe burst Cutting off service to area	C	4	14	Ensure Dial before you dig is completed prior to works commencing	C	3	13
6	No approval to work on road reserve	Fines from authorities Emergency services unaware of works in place	C	3	13	Ensure permit to work is completed and approved from the correct department or council Once permit to work is approved the department or council notifies emergency services	C	2	8
7	Weather conditions	Raining throughout works Fog makes signs hard to read	C	3	13	BOM website is checked prior to works starting to be able to have correct equipment / PPE for works in bad conditions	C	2	8
8	Personal Protective Equipment	Hit by car	B	3	19	Correct PPE for to be worn by workers	C	3	13





Spill Management Plan

**2020 Drilling Program
NT EP-187**

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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-XPEN-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		10/10/2019
Reviewed by	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

Imperial's 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 Imperial Oil & 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 more 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 banded 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 (<1m³), 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 addressed 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:
 - o Chemical handling procedures,
 - o Chemicals storage and handling inspection procedures,
 - o Spill prevention, detection and response procedures.
- Well sites are be designed and constructed to prevent spills of hazardous chemicals; this includes:
 - o Compacting the lease pad surface to prevent infiltration
 - o 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 and 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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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.

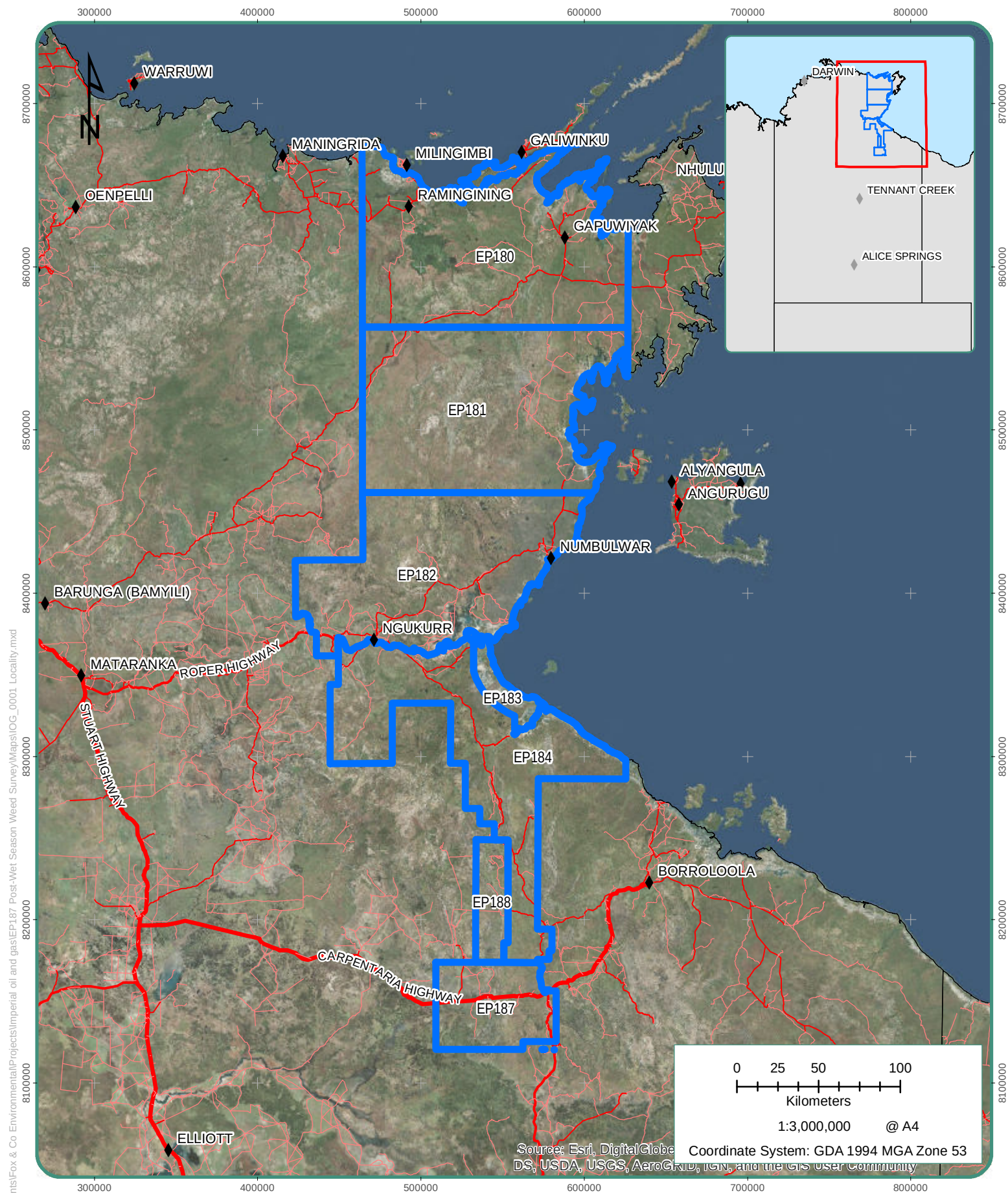
In this regard, to be proactive and demonstrate good environmental stewardship, IOG commissioned Fox & Co Environmental Pty Ltd to commence a baseline groundwater monitoring program on EP187. The focus of the survey was to gain an understanding of the groundwater quality in the area on EP187 associated 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		LEGEND ◆ Populated places ▭ Australian State Boundaries Roads - Principal Road - Secondary Road - Minor Road - Track Tenements	 FOX & CO ENVIRONMENTAL
MAP NO: IOG_0001			
PROJECT: EP187 Groundwater Investigation			
Date: 19/04/2019		Data Source:	

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 CaCO₃
- Dissolved Major Cations
 - o Calcium
 - o Magnesium
 - o Sodium
 - o Potassium
- Dissolved Metals
 - o Arsenic
 - o Cadmium
 - o Chromium
 - o Copper
 - o Lead
 - o Nickel
 - o Zinc
- Dissolved Mercury
- Nitrogen
 - o Nitrite + Nitrate as N
 - o Total Kjeldahl Nitrogen as N
 - o Total Nitrogen as N
- Total Phosphorus as P
- Laboratory Quality Assurance / Quality Control
- Total Petroleum Hydrocarbons
 - o C6 - C9 Fraction
 - o C10 - C14 Fraction
 - o C15 - C28 Fraction
 - o C29 - C36 Fraction
 - o C10 - C36 Fraction (sum)
- Total Recoverable Hydrocarbons
 - o C6 - C10 Fraction
 - o C6 - C10 Fraction minus BTEX (F1)
 - o >C10 - C16 Fraction
 - o >C16 - C34 Fraction
 - o >C34 - C40 Fraction
 - o >C10 - C40 Fraction (sum)
 - o >C10 - C16 Fraction minus Naphthalene (F2)
- BTEXN
 - o Benzene
 - o Toluene
 - o Ethylbenzene
 - o meta- & para-Xylene
 - o ortho-Xylene
 - o Total Xylenes
 - o Sum of BTEX
 - o Naphthalene
- TPH(V)/BTEX Surrogates
 - o 1,2-Dichloroethane-D4
 - o Toluene-D8
 - o 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

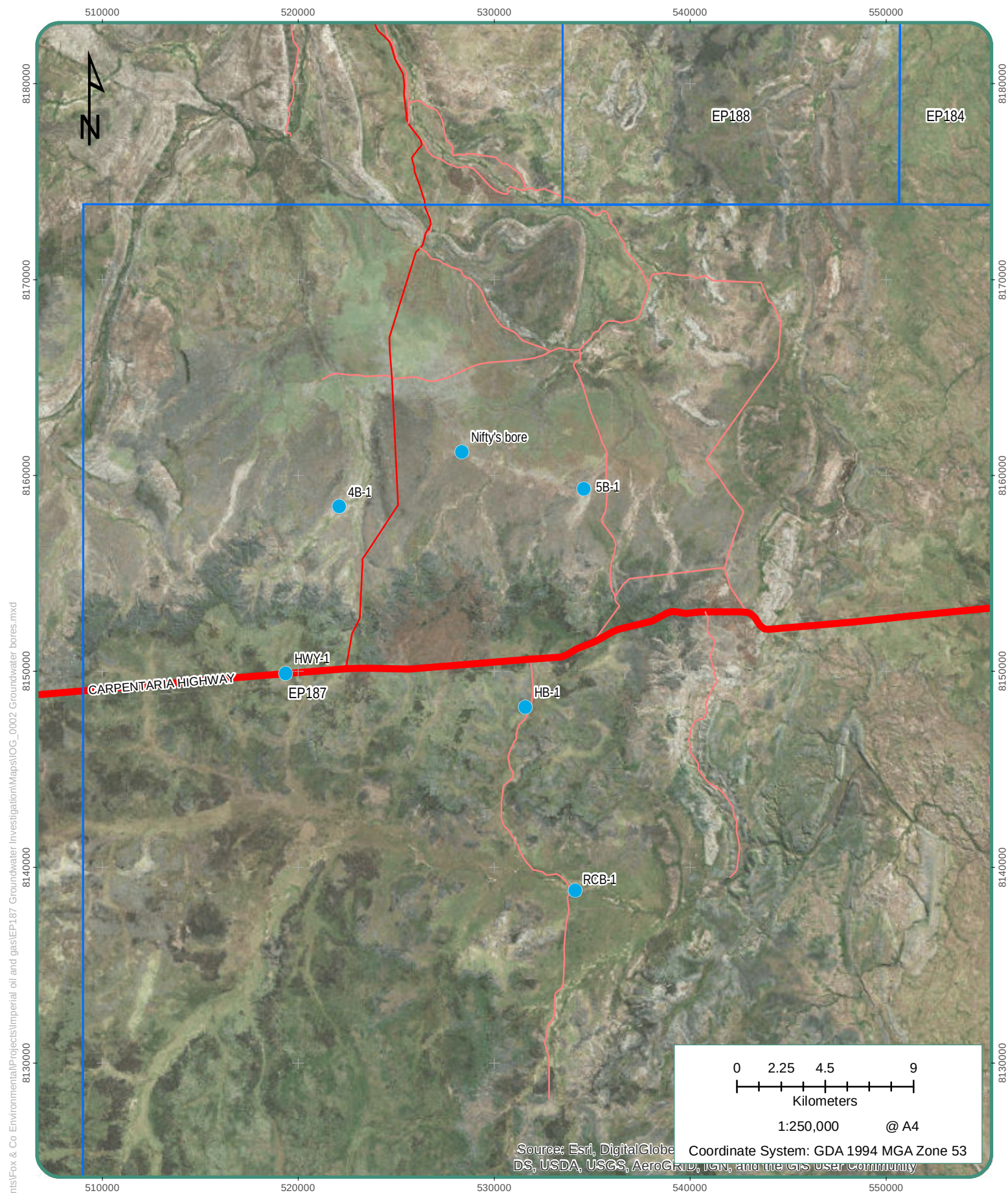
2.3.2 Quality Control

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.

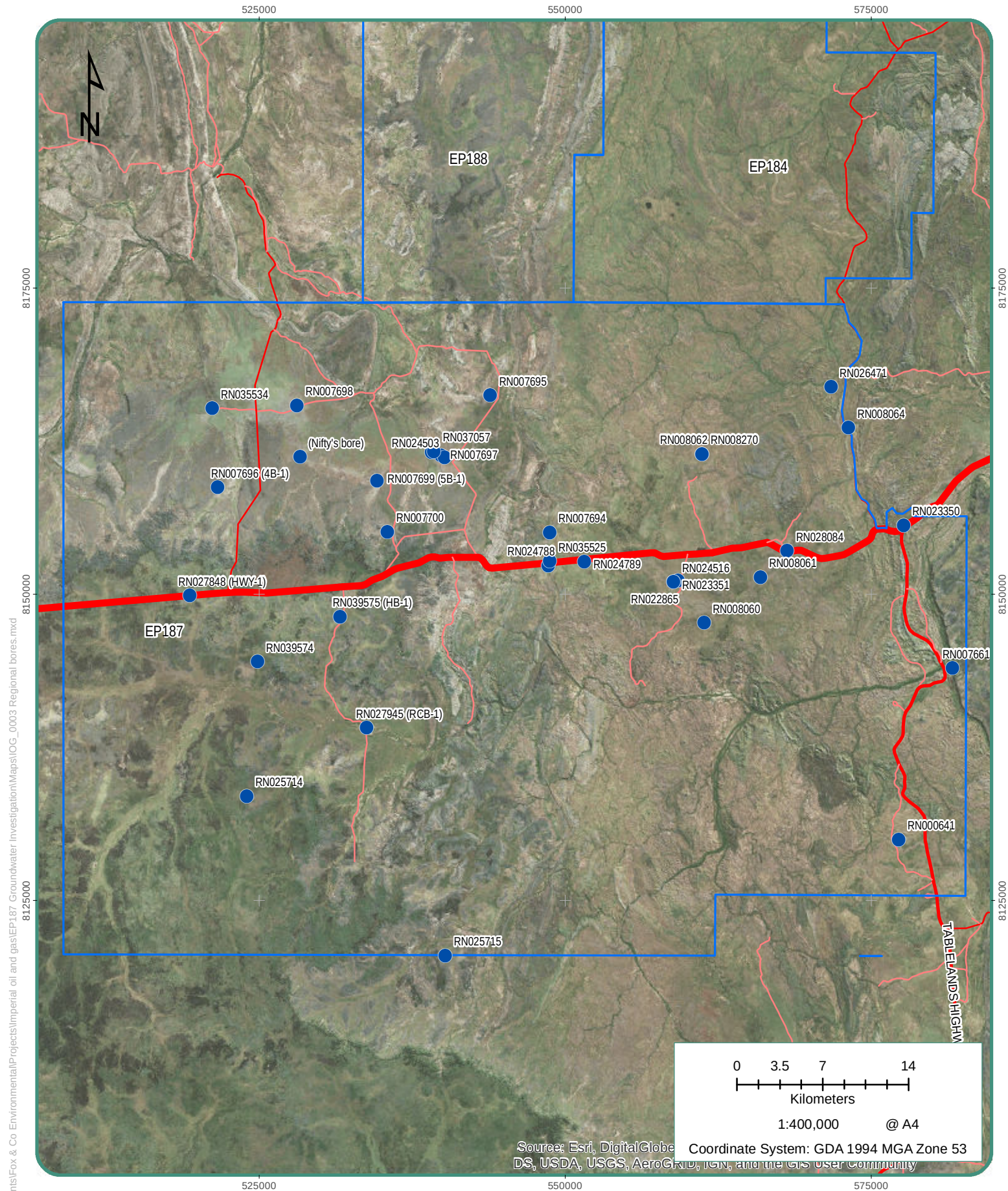
It is also noted, while no hydrocarbons were recorded above the laboratory level of reporting (LOR) (refer **Table 2**), anecdotal evidence reported practices of pouring diesel down bores during construction to lubricate augers, while diesel and engine oils have also been historically poured on the ground 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		LEGEND - Bores - Tenements Roads - Principal Road - Secondary Road - Minor Road - Track	
MAP NO: IOG_0002			
PROJECT: EP187 Groundwater Investigation			

Date: 26/04/2019

Data Source:



TITLE: Regional Bores		LEGEND - Regional bores - Tenements Roads - Principal Road - Secondary Road - Minor Road - Track	
MAP NO: IOG_0003			
PROJECT: EP187 Groundwater Investigation			

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 CaCO₃							
Total Hardness as CaCO ₃	mg/L		528	495	439	537	576
ED093F: Dissolved Major Cation							
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 (NO_x) by Discrete Analyser							
Nitrite + Nitrate as N	mg/L	0.005 ⁵	0.11	0.05	0.13	0.03	0.05
EK061G: Total Kjeldahl Nitrogen by Discrete Analyser							
Total Kjeldahl Nitrogen as N	mg/L		<0.1	<0.1	<0.1	<0.1	<0.1
EK062G: Total Nitrogen as N (T + NO_x) by Discrete Analyser							
Total Nitrogen as N	mg/L	0.2-0.3 ⁵	0.1	<0.1	0.1	<0.1	<0.1
EK067G: Total Phosphorus as P by Discrete Analyser							
Total Phosphorus as P	mg/L	0.01 ⁵	<0.01	<0.01	<0.01	<0.01	0.03
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

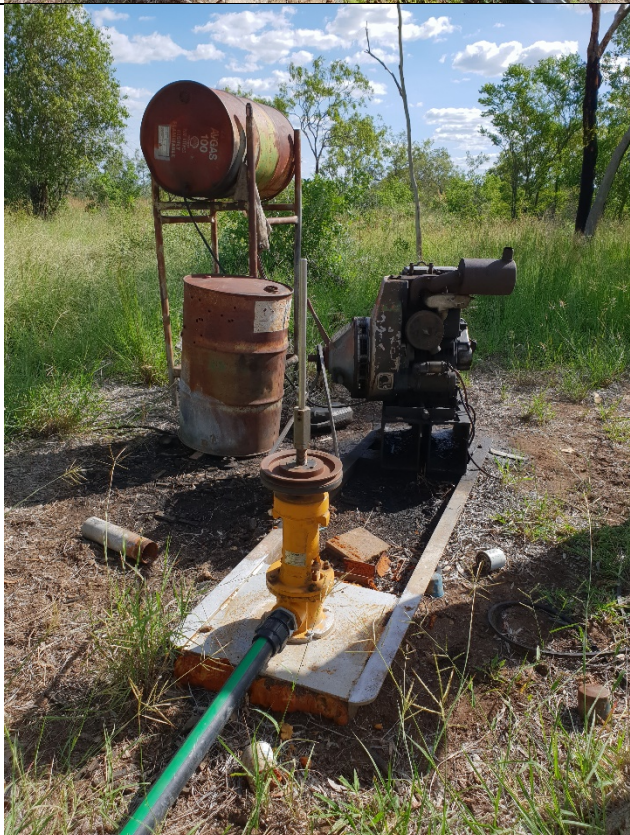
Task	Objective	Reference	Outcome	Achieved Compliance
Compare field data and analytical data	Visual and olfactory evidence relates to laboratory results		Field observations relate to laboratory results	Yes
Calibration of water quality meter	Adhere to machine specifications	AS4482.1-2005	Yes. Field pH 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: <u>N.L.C. DAVE DANIELS</u>				Registration No.: <u>039575</u>			
Location/Address: <u>CARPENTARIA DOWNS</u>				BC Permit No: _____			
Intended Use: <u>Spick</u>							
GPS Location:		Zone: <u>53 K</u>	GDA94 ☐	Other: ☒ <u>WGS 84</u>	Easting: <u>0531586</u>	Northing: <u>8148173</u>	

From	To	Particulars of Strata	Name of Drilling Company: <u>TREVOR HUGHES</u>
<u>0</u>	<u>70m</u>	<u>CLAY BROWN</u>	Name of Driller: <u>TREVOR HUGHES</u>
<u>70m</u>	<u>93m</u>	<u>LIMESTONE HARD</u>	Name of supervising driller: <u>TREVOR HUGHES</u>
			Date Commenced: <u>1-7-2016</u>
			Date Completed: <u>3-7-2016</u>
			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				PARTICULARS OF PERFORATIONS OR SCREEN STRINGS			
From	To	Dia (ID)	Type	From	To	Dia (ID)	Aperture
<u>0.2</u>	<u>5.8m</u>	<u>208mm</u>	<u>STEEL</u>				
<u>0.35</u>	<u>72m</u>	<u>156mm</u>	<u>STEEL</u>	<u>BLANK</u>			
<u>72m</u>	<u>93m</u>	<u>OPEN HOLE</u>					

Casing Suspended: Yes ☐ No ☒

Method: REVEILED

Height of Casing above GL: 350 mm (m)

Top of Packer Set at: _____ (m)

Length of Packer: _____ (m)

Method of Packer Connection: _____

CEMENTING/GRAVEL PACKING			WATER BEARING BEDS							
From	To	Type	Depth (m)	Yield (L/s)	SWL (m)	Duration (hr)	Quality	EC	pH	Bottle No.
<u>5.8m</u>	<u>Back to</u>	<u>SURFACE</u>	<u>79m</u>	<u>81m</u>	<u>3</u>	<u>66.2</u>	<u>2 HAS</u>	<u>Good</u>	<u>6.2</u>	
	<u>CEMENTER</u>									

STRATA / WATER SAMPLES	Completion Yield: <u>3</u> (L/s)	Method: <u>RIR</u>	Duration: <u>2</u> (hr)
Have been ☐ Will be ☐	Completion SWL from GL: <u>66.2</u> (m)		Depth of Lift: <u>72</u> (m)
Left at:			

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 m/km	m/km	
		NW ☐	North ☐	NE ☐
		West ☐		East ☐
		SW ☐	South ☒	SE ☐
		OF: Highway		
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 on 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: <u>TREYOR HUGHES 25</u>		Signature and licence number of licensed driller: <u>[Signature]</u> Date: <u>3-7-2016</u>		
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 ENTER 29/1/18				
Lease No:		Lot No:		
Portion No: <u>5706</u>		Section No:		
Class of Bore:		Hundred of:		
Town ☐		Town of:		
Domestic ☐				
Investigation ☐				
Agriculture ☐				
Mineral ☐				
Pastoral ☒				
Other ☐				
Use of Bore:				
Production ☒				
Investigation ☐				
Irrigation ☐				
Observation ☐				
Monitoring ☐				
Roads ☐				
None ☐				
Grid Reference:		Zone: <u>53</u>		
AMG ☒ Clark ☐		Scale:		
Easting: <u>531586</u>		Latitude:		
Northing: <u>8148173</u>		Longitude:		
		Index Map Number: <u>57/160</u>		
Date Registered:		Bore Plotted on the map? Yes ☐ No ☐		
Dept Officer:		Signature:		
Remarks:				

S/E 0902



RN027848

Regulation 8

THE NORTHERN TERRITORY OF AUSTRALIA

(Control of Water Act)

1-N. 57/67

WR4/3

FINAL STATEMENT OF BORE

R.N. 27848

RMD 8089

From	To	Description of Strata (including colour and hardness)	Name of Bore —																												
0	3	BLACKSOIL	R.N. 27848																												
3	53	CLAYS	Name of Property —																												
53	60	SANDSTONE	CARPENTARIA H'WAY																												
60	70	DOLAMITIC SANDSTONE	Description of Property —																												
70	101.5	NO CIRCULATION	PL 1021 CROWN LAND <u>VCL</u>																												
Location of Bore for supply sketch on the back hereof — km 1 S. SE of (b) <u>209 Km CHAINAGE</u> 2 NW <u>CARPENTARIA H'WAY</u> W SW 1 Circle appropriate direction. 2 Use known point such as existing bore, homestead, outstation, etc.			Name of Owner —																												
			N.T. GOVT																												
			Name of Contractor —																												
			GOREY & COE DRILLERS																												
			Name of Driller —																												
			S. RICHARDS																												
			Date of Commencement —																												
			23-10-91																												
			Date of Completion —																												
			24-10-91																												
			Total Depth —																												
			101.5m																												
Additional information of interest about bore: and Reference <u>510250 - 3149700</u> <u>485450 - 8160330</u> Map Number <u>1:100,000 SHEET 5864 OCTOBER</u> <u>1:100,000 SHEET 5964 OT DOWNS</u> Samples of Strata and Water Supplies have been <u> </u> at the following place — Name <u>Craig Olofshol</u> Signature Date non applicable			Particulars of Casing — <u>6.5m OF 219mm STEEL</u> <u>91.6m OF 168.3mm STEEL</u> Particulars of Perforations or Screens — <u>SLOTS BETWEEN 78.8 - 84.9m</u>																												
Office use only — <u>Noted 22/1/92</u>			<table border="1"> <thead> <tr> <th>Water</th> <th>1st Supply only</th> <th>2nd Supply only</th> <th>3rd Supply only</th> </tr> </thead> <tbody> <tr> <td>Struck at</td> <td>/</td> <td></td> <td></td> </tr> <tr> <td>Standing Water Level</td> <td>/</td> <td></td> <td></td> </tr> <tr> <td>Pumping Supply Litres/sec</td> <td>/</td> <td></td> <td></td> </tr> <tr> <td>Duration of Pump Test</td> <td>/</td> <td></td> <td></td> </tr> <tr> <td>Water Level During Test</td> <td>/</td> <td></td> <td></td> </tr> <tr> <td>Quality: Good, Fair or Bad</td> <td>/</td> <td></td> <td></td> </tr> </tbody> </table>	Water	1st Supply only	2nd Supply only	3rd Supply only	Struck at	/			Standing Water Level	/			Pumping Supply Litres/sec	/			Duration of Pump Test	/			Water Level During Test	/			Quality: Good, Fair or Bad	/		
			Water	1st Supply only	2nd Supply only	3rd Supply only																									
			Struck at	/																											
			Standing Water Level	/																											
			Pumping Supply Litres/sec	/																											
			Duration of Pump Test	/																											
			Water Level During Test	/																											
Quality: Good, Fair or Bad	/																														

G. L. DUFFIELD, Government Printer at the Northern Territory



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

Bottle No.

A559

Lab. Register No.

91/92/0649

27,848

Date Received in Lab.

11/11/91

Time Sampled

1610

Date Sampled

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:

SIGNATORY:

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.



This Laboratory is registered by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of registration. This document shall not be reproduced except in full.



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.

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

ESJ1Y Log-log 3 cycles x 3 cycles

$$\frac{15.8 \times 4 \times 8}{2 \times 50}$$

$$= \frac{15.8 \times 4 \times 1317}{2856}$$

$$= \frac{15.8 \times 4 \times 20}{2856}$$

$$\begin{array}{r} 158 \times 4 = 30 \\ \hline 2256 \end{array}$$

0.18

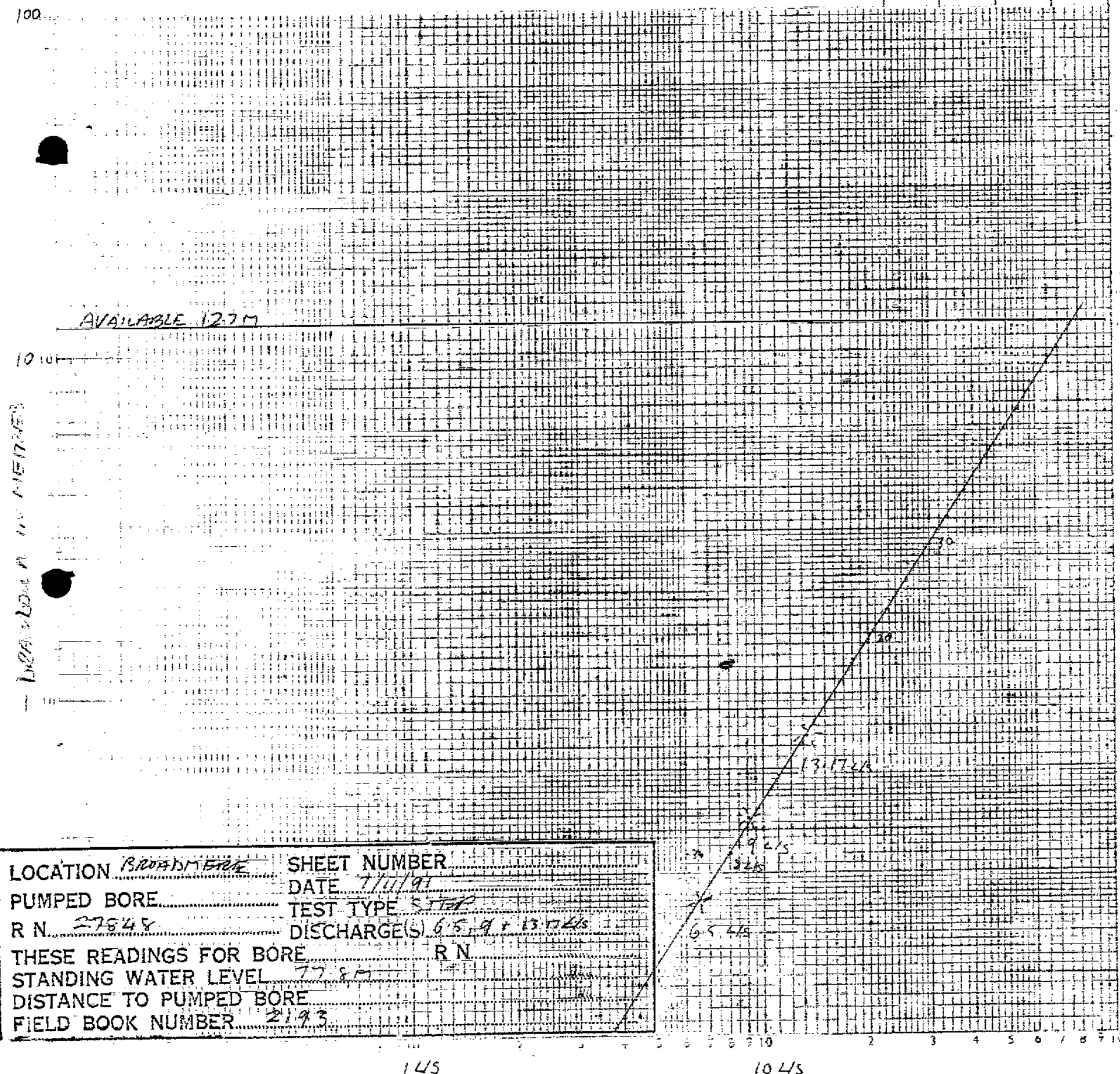
$$= 0.29$$

0.44

0-66

$$H_v.T = 2856 \text{ m}^2/\text{DAY}$$

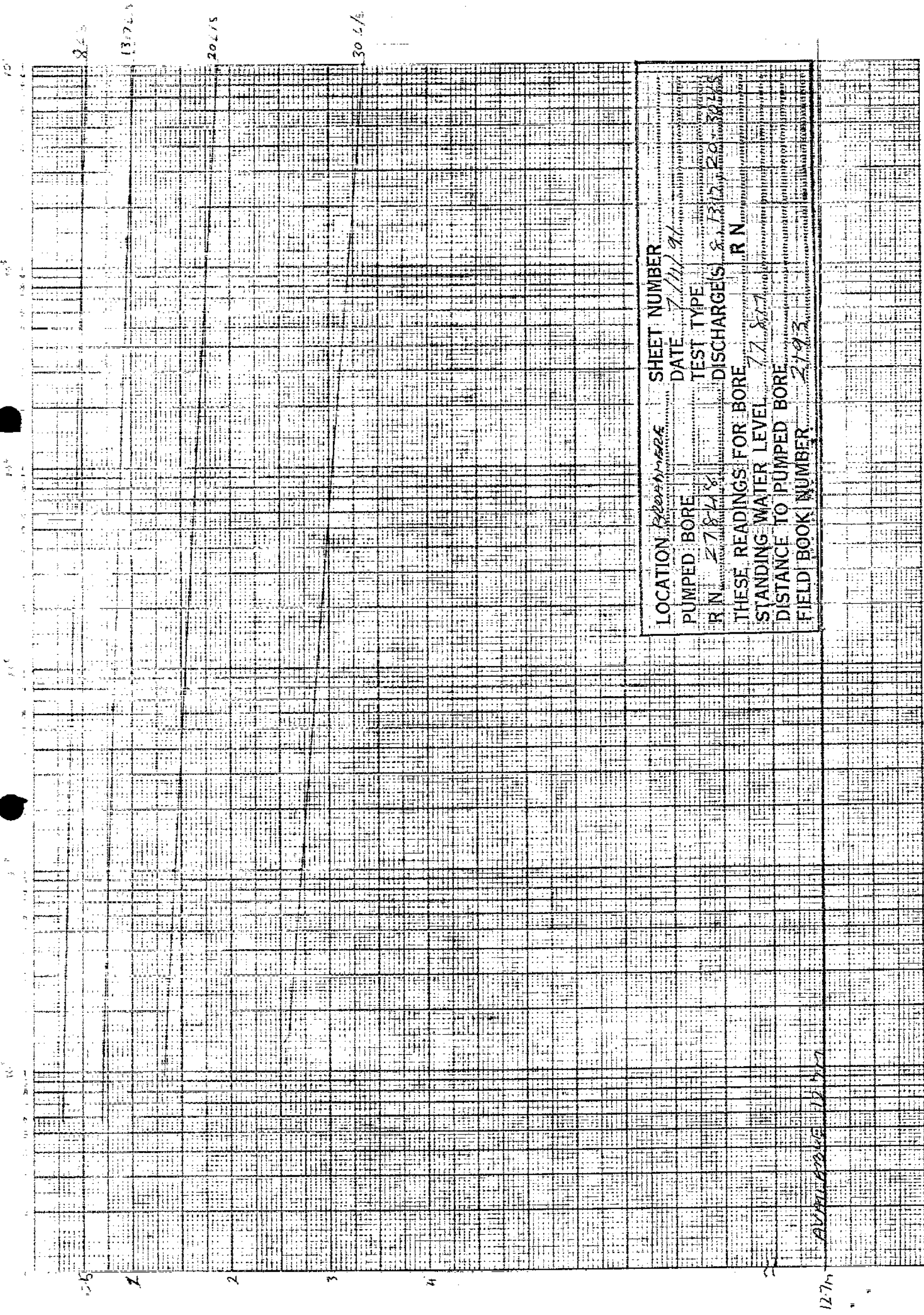
Q	10^2	10^4	10^6
8	0.34	0.18	0.52
13.17	0.75	0.29	1.04
20	1.42	0.44	1.86
30	2.7	0.66	3.36



DISCHARGE IN L/S

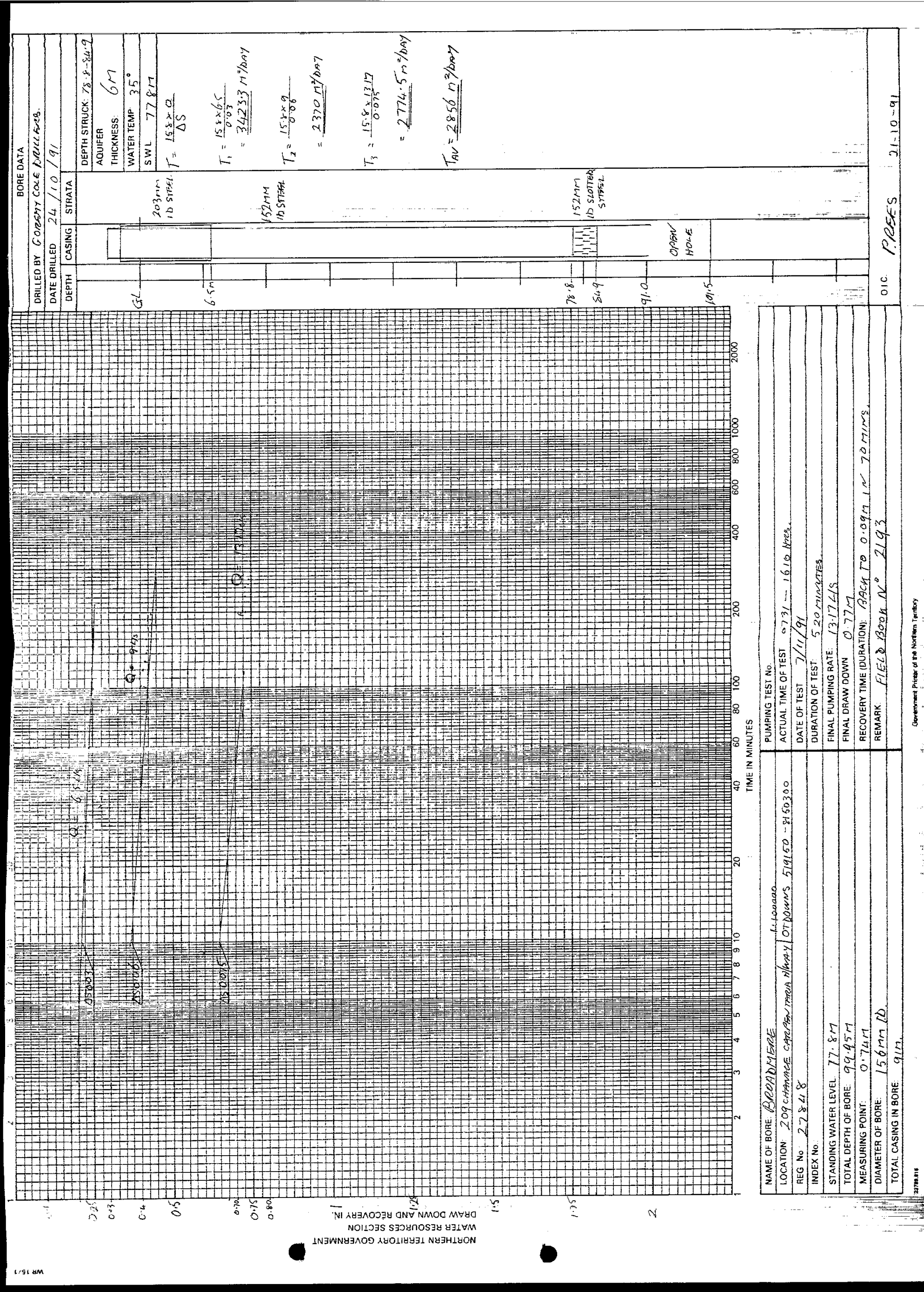
HEATH & HAYH PAPERS CHRISTCHURCH N Z

DAILY Log 6 cycle x mm



LOCATION	Blairmore	SHEET NUMBER	
PUMPED BORE		DATE	7/11/97
R N	27848	TEST TYPE	
THESE READINGS FOR BORE		DISCHARGE(S)	8.1315 20.30278
STANDING WATER LEVEL	7.7	R N	
DISTANCE TO PUMPED BORE			
FIELD BOOK NUMBER	2193		

12.7m



WR 9/1

DRILLERS LOG**Power and Water Authority**DATE 23.10.91BORE No. Ru 27848Supervisor: P. P. P.Driller: S. P. P.

Time	Depth	Metres drilled	Mins lapsed	Drillers remark, casing details	BIT DATA				STRING DATA				MUD DATA	WATER SAMPLES	
					No.	Size	Type	Worn cond'n	Item	O.D.	Length	Prog. tally		No.	Depth
11:00				Establish Rig on Site 115 Km SEALED ROAD											
11:30				Drill 6m - 250mm											
12:00				RW 6.5m - 219mm Casing CEMENT Anchors 4 Bags Cement 30min WORKTIME											
				0-3 Black Soil											
12:45				3.53 Clays					Ham						
				53 - 58.8 Sandstone					DP	4 1/2	6.1	11.0			
				58.8 - 70.0 Dolomitic SANDSTONE					DP	4 1/2	6.1	17.1			
				70.0 - 101.5 NO RETURNS					DP	4 1/2	6.1	23.2			
									DP	4 1/2	6.1	29.3			
									DP	4 1/2	6.1	35.6			
									DP	4 1/2	6.1	41.5			
									DP	4 1/2	6.1	47.6			
									DP	4 1/2	6.1	53.7			
15:00	38.8			NO CIRCULATION					DP	4 1/2	6.1	59.8			
				CONSTRUCT - Suspended 168.3mm at 91 mtrs					DP	4 1/2	6.1	65.9			
									DP	4 1/2	6.1	72.0			
									DP	4 1/2	6.1	78.1			
									DP	4 1/2	6.1	84.2			
				SLOTTED - 78.8 to 84.9 mtrs					DP	4 1/2	6.1	90.3			
				A/L (DRY) AT VARIOUS DEPTHS 1.5 HR WORKTIME					DP	4 1/2	6.1	96.4			
									DP	4 1/2	6.1	102.5			

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.
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.

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 BROADMERERegistered Number 2784Y

Index Number _____

Location 209hr CARRENTARIA H/WAYTotal Depth 99.95M

Depth Water Struck _____

Estimated Supply NONE OBTAINED BY AIRLIFT.

Aquifer Material _____

MAP O.T. DOWNNS 1:100,000 SHEET 5964
 GUB REF. 519150 - E150300
 Construction details casing screens, etc.

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

Distance to production bore _____

Bore name	Distance

Pump test crew _____

P. REESM. MOLINAW. ARCHARDPump type MONO G40 MADE 20Powered by 3 CYL LISTER UNIT 33Pump setting 90.35M 90.5MMethod measuring pump discharge DISCHARGE PIPE
ORIFICE PLATES

List any other equipment used _____

14 x 6.15M x 80MM MONO COLUMN1 x 2.15M " " "1 x 0.6M15MM CLASS 15 PVC X15 LENGTHS3MM S/S WIRE x 100M

Comments _____

6/11 TD 99.95M8/11 TD 99.75M6/11 SWL 77.8M8/11 SWL 77.78MCAG 0.65MMP 0.74MRUN G40 NO APPRECIABLE 1bTRIP OUT RUN 820

INDEX

[illegible]

Date: 6/11/91

Date: 6/11/91 01

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			640110100
	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

OBS Bore:

Standing Water Level: 77.8 m

Available Drawdown: 12.7 m

Time Started: 1641

Date: 6/11/91

Time Stopped: 1700

Date: 6/11/91 02

Test Type: *PRELIM STTR*

Step No.:

[illegible]

OBS Bore:

Standing Water Level: 77.8m

Available Drawdown: 12.7 m

Time Started: 1700

Date: 6/11/91

Time Stopped: 1720

Date: 6/7/91 03

Test Type: PRELIM STEP

Step No.: 2

[illegible]

OBS Bore:

Standing Water Level: 77.8m

Available Drawdown: 12.7m

Time Started: 1720

Date: 6/11/91

Time Stopped: 1740

Date: 6/11/91 04

Test Type: PRELIM STAFF

Step No.: 4

[illegible]

Water Sample Temp. (°C)	Con: nents	Step No.
	CFC	
34.9°	PH 6.66 COND 1104	
	CFC	
34.9°	PH 6.60 COND 1190	

Date: 7/11/91

Date: 7/11/91 05

Step No.: /

Time C.S.T.	Time (min)	D/Down (m)	PZh (cm)	Orifice Plate Size	Q (l/s)	Water Sample Bjt. 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		

OBS Bore:

Standing Water Level: 77.8m

Available Drawdown: 12.7M

Time Started: 0910

Date: 7/11/91

Time Stopped: 10 50

Date: 7/11/91 06

Test Type: STEP

Step No.: 2

[illegible]

Water Sample Temp. (°C)	Comments	Step No.: 2
	CLEAN + CLEAR	
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 6.57 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 07

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	1377						
	2	0.72									
	3	0.72						SLIGHT HAZY			
	4	0.72									
	5	0.72									
	6	0.72						CLEARING			
	7	0.72						C+C			
	8	0.72									
	9	0.72					35°	PH 6.62 COND 1103			
1100	10	0.72									
	12	0.72									
	15	0.73									
	20	0.72						C+C			
	25	0.73									
	30	0.73					35°	PH 6.60 COND 1101			
	35	0.73						C+C			
1130	40	0.73									
	50	0.73						C+C			
	60	0.74						C+C			
1200	70	0.74					35°	PH 6.64 COND 1132			
	80	0.74									
	90	0.75									
1230	100	0.75									
	120	0.75					35°	PH 6.62 COND 1167			
1310	140	0.76									
1330	160	0.77									
	180	0.76									
1410	200	0.77					35°	PH 6.67 COND 1162			

OES Bore:

Standing Water Level: 77.8m

Available Drawdown: 12.7m

Time Started: 1150

Date: 7/11/91

Time Stopped: 1620

Date: 7/11/91 08

Test Type: EXTENDED STEP

Step No.: 7

[illegible][illegible]

OBS Bore:

Standing Water Level: 77.8m

Available Drawdown: 12.7M

Time Started: 1610

Date: 7/11/91

Time Stopped: 17.20

Date: 7/11/91 09

Test Type: RECOVERY

Step No.:

[illegible]

Regulation 8

THE NORTHERN TERRITORY OF AUSTRALIA

Control of Waters Act

I.N. 56/103 WR4/3

FINAL STATEMENT OF BORE R.N. 27,945

From	To	Description of strata (including colour and hardness)	Name of Bore — R.N. 27945																									
0	3	BLACKSOIL	Name of Property — BALBIRINI PL 1021																									
	15	CLAYS	Description of Property — PASTORAL LEASE																									
	58.8	LIMESTONE	Name of Owner — M. HOAT																									
Location of Bore for supply sketch on the sketch hereon — Km S SE of (b) E NW W SW Circle appropriate direction. Use known point such as existing bore, homestead, outstation, etc.			Name of Contractor — GOREY & COE DRILLERS																									
			Name of Driller — S. RICHARDS																									
			Date of Commencement — 6.10.91																									
			Date of Completion — 6.10.91																									
Additional information of interest about bore: PUMP 4 HS and Reference 520940-8164700 FROM HOM. up Number 1-100,000 SHEET 5964 'OT DOWNS' Samples of Strata and Water Supplies have been at the following place — Signature: <i>Craig Oldfield</i> Date not applicable			Target 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 54.8																									
			<table border="1"> <thead> <tr> <th>Water</th> <th>1st Supply only</th> <th>2nd Supply only</th> <th>3rd Supply only</th> </tr> </thead> <tbody> <tr> <td>Struck at</td> <td>47m</td> <td>52m</td> <td></td> </tr> <tr> <td>Standing Water Level</td> <td>28</td> <td></td> <td></td> </tr> <tr> <td>Pumping Supply Litres/sec</td> <td>0.5 HS</td> <td>14 HS</td> <td></td> </tr> <tr> <td>Duration of Pump Test</td> <td>1 Hour</td> <td>AIR LIFT</td> <td></td> </tr> <tr> <td>Water Level During Test</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Quality: Good, Fair or Bad</td> <td>GOOD.</td> <td></td> <td></td> </tr> </tbody> </table>	Water	1st Supply only	2nd Supply only	3rd Supply only	Struck at	47m	52m		Standing Water Level	28			Pumping Supply Litres/sec	0.5 HS	14 HS		Duration of Pump Test	1 Hour	AIR LIFT		Water Level During Test				Quality: Good, Fair or Bad
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Water Level During Test																												
Quality: Good, Fair or Bad	GOOD.																											
Office use only — <i>Plotted 10/12/91</i>																												

G. L. DUFFIELD, GOVERNMENT PRINTER, ST. LAWRENCE, TERRITORY

RN027945

THE NORTHERN TERRITORY OF AUSTRALIA

Control of Waters Ordinance

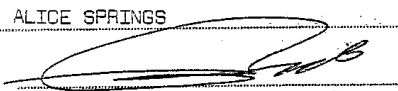
Regulation 8.



RN007699

FINAL STATEMENT OF BORE

IN 24 56/21

From	To	Description of Strata	Name of Bore—																									
0	10	CLAY	GC2-71																									
10	30	SANDY CLAY	Name of Property— BALBARINI STATION																									
30	40	CHERT, LIMESTONE	Description of Property— PASTORAL																									
40	60	CHERT, CLAY, LIMESTONE	Name of Owner— L.R.M. PASTORAL TRADING CO.																									
60	235	NO RETURNS OF CUTTINGS - CAVES ALL THE WAY	Name of Contractor— GOREY & COLE DRILLERS																									
Location of Bore (for supply sketch on back hereof)— _____ Miles (a) <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>N</td><td>NE</td></tr> <tr><td>S</td><td>SE</td></tr> <tr><td>E</td><td>NW</td></tr> <tr><td>W</td><td>SW</td></tr> </table> of (b) _____ (a) Circle appropriate direction. (b) Use known point such as existing bore, homestead, outstation, etc.			N	NE	S	SE	E	NW	W	SW	Name of Driller— OTTO LOZERIS																	
			N	NE																								
			S	SE																								
			E	NW																								
W	SW																											
Date of Commencement— 9.6.71																												
Date of Completion— 9.6.71																												
Additional information of interest about the bore— BORE DRILLED BY T3 DRILLMASTER			Total Depth— 235 FEET																									
			Particulars of Casing— 236 FEET OF 6" DIAMETER																									
Samples of strata and water supplies ~~will be~~ will be* left at the following trading place— WRB ALICE SPRINGS  *Strike out which does not apply.			Particulars of Perforations or Screens— 20' OF OXY PERFS ON BOTTOM																									
			<table border="1"> <thead> <tr> <th>Water</th> <th>1st Supply</th> <th>2nd Supply</th> <th>3rd Supply</th> </tr> </thead> <tbody> <tr> <td>Struck at</td> <td>NO RETURNS</td> <td>60'</td> <td>235'</td> </tr> <tr> <td>Standing Water Level</td> <td>120'</td> <td></td> <td></td> </tr> <tr> <td>Pumping Supply : G.P.H.</td> <td>2,400 G.P.H. AIRLIFT</td> <td></td> <td></td> </tr> <tr> <td>Duration of Pump Test</td> <td>4 HOURS</td> <td></td> <td></td> </tr> <tr> <td>Water Level During Test</td> <td>-</td> <td></td> <td></td> </tr> <tr> <td>Quality : Good, Fair or Bad</td> <td>GOOD</td> <td></td> <td></td> </tr> </tbody> </table>	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
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For office use only—																												

Ref:

THE NORTHERN TERRITORY OF AUSTRALIA

Control of Waters Ordinance

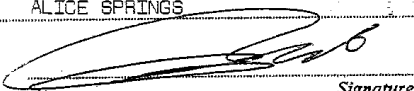


Regulation 8.

RN007596

FINAL STATEMENT OF BORE

IN 56/18

From	To	Description of Strata	Name of Bore—																												
0	10	SANDY CLAY, LATERITE	GC5-71																												
10	60	CLAY	Name of Property—																												
60	65	CLAY, LIMESTONE, SANDSTONE	BALBARINI STATION																												
65	110	SILTY CLAY, LIMESTONE	Description of Property—																												
110	135	CLAY, LIMESTONE	PASTORAL																												
135	160	SANDSTONE, LIMESTONE, QUARTZ	Name of Owner—																												
160	235	SANDSTONE, LIMESTONE, QUARTZ	L.R.M. PASTORAL TRADING CO.																												
235	240	LIMESTONE, SILTSTONE, SOAPSTONE	Name of Contractor—																												
240	285	LIMESTONE, SOAPSTONE, SANDSTONE, SLATE	GOREY & COLE DRILLERS																												
285	300	SOAPSTONE, SANDSTONE	Name of Driller—																												
			OTTO LOZERIS																												
Location of Bore (or supply sketch on back hereof)—			Date of Commencement—																												
Miles			13.6.71																												
(a) <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>N</td><td>NE</td></tr> <tr><td>S</td><td>SE</td></tr> <tr><td>E</td><td>NW</td></tr> <tr><td>W</td><td>SW</td></tr> </table> of (b)			N	NE	S	SE	E	NW	W	SW	Date of Completion—																				
N	NE																														
S	SE																														
E	NW																														
W	SW																														
			14.6.71																												
(a) Circle appropriate direction. (b) Use known point such as existing bore, homestead, outstation, etc.			Total Depth—																												
			300 FEET																												
Additional information of interest about the bore—			Particulars of Casing—																												
BORE DRILLED BY T3 DRILLMASTER			50 FEET OF 5" DIAMETER 240 FEET OF 6" DIAMETER																												
			Particulars of Perforations or Screens—																												
			20' OF OXY PERFS ON BOTTOM																												
			<table border="1"> <thead> <tr> <th>Water</th> <th>1st Supply</th> <th>2nd Supply</th> <th>3rd Supply</th> </tr> </thead> <tbody> <tr> <td>Struck at</td> <td>160'</td> <td>200'</td> <td>285'</td> </tr> <tr> <td>Standing Water Level</td> <td></td> <td></td> <td>30.48 100'</td> </tr> <tr> <td>Pumping Supply : G.P.H.</td> <td></td> <td></td> <td>6,000 GALS.</td> </tr> <tr> <td>Duration of Pump Test</td> <td></td> <td></td> <td>4 HOURS</td> </tr> <tr> <td>Water Level During Test</td> <td></td> <td></td> <td>-</td> </tr> <tr> <td>Quality : Good, Fair or Bad</td> <td></td> <td></td> <td>GOOD</td> </tr> </tbody> </table>	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
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Duration of Pump Test			4 HOURS																												
Water Level During Test			-																												
Quality : Good, Fair or Bad			GOOD																												
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—																															

Rate

N.T.A. 152

NORTHERN TERRITORY ADMINISTRATION—WATER RESOURCES BRANCH

WATER ANALYSISSample No. 71/0609 Date received in Laboratory 30.7.71Time and date of sampling -Location and details Balbarini G.C.5/71 R.N.7696300ft (no advice) IN 56/18Analysis in parts per million— p.p.m. (unless otherwise stated)—Appearance - Taste and odour -Conductivity (Micromhos/cm²) - pH 7.9at 25°C 1210Total dissolved solids 750 Hardness, total 484Suspended solids - Hardness, temporary 406Total solids - Hardness, permanent 78Anions—Chloride 93Sulphate 150Nitrate 1Nitrite -Carbonate -Bicarbonate 495Fluoride 1.0Silica 18Boron -Alkalinity 406Turbidity -Phosphate <1Cations—Sodium 76Potassium 8Calcium 74Magnesium 73Ammoniacal nitrogen -Iron 2.4Aluminium -Selenium -Arsenic -Copper -Lead -Manganese -Analysed by Miep DobbeDate 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		LOCATION		
RESIDENT GEOLOGIST'S OFFICE DARWIN N.T.		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		WATER		
Drilled by	Date Drilled to..	Total Depth.....	Struck at.....Supply (g.p.h.).....Quality.....	
Standing W. Level.....	Pump Level.....	Casing Diameter..... ins from.....to.....	Slotted } Perforated } Screened }	
			} from.....to.....	
LOG OF BORE				
from	to	~~Driller's Log~~	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 chert.		
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

CERTIFICATE OF ANALYSIS

Work Order : **ES1911589**
Client : **FOX & CO ENVIRONMENTAL**
Contact : **MR PAUL FOX**
Address : **5 GOULDIAN COURT**
PEREGIAN BEACH 4573
Telephone : ----
Project : ----
Order number : ----
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : ----
No. of samples received : **6**
No. of samples analysed : **6**

Page : 1 of 7
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61-2-8784 8555
Date Samples Received : 16-Apr-2019 09:00
Date Analysis Commenced : 16-Apr-2019
Issue Date : 30-Apr-2019 14:33



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	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.

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									
<i>Escherichia coli</i>	----	1	CFU/100mL		570	----	----	----	----
MW007: Coliforms by MF									
Coliforms	----	1	CFU/100mL		1700	----	----	----	----



Surrogate Control Limits

Sub-Matrix: **WATER**

		Recovery Limits (%)	
Compound	CAS Number	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

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		



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	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**

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**

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 (%)
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)									

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 Client : FOX & CO ENVIRONMENTAL
 Project : ----



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 (%)
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	2	µg/L	<2	<2	0.00	No Limit
			106-42-3						
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit
ES1911648-020	Anonymous	EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit
		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	2	µg/L	<2	<2	0.00	No Limit
			106-42-3						
		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**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
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 Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		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 Blank (MB) Report				Laboratory Control Spike (LCS) Report				
				Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
					LCS		Low	High
Method: Compound	CAS Number	LOR	Unit	Result				
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	2	µg/L	<2	10 µg/L	93.7	69	121
	106-42-3							
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**

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
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**

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	25 µg/L	95.9	70	130
			106-42-3				
		EP080: ortho-Xylene	95-47-6	25 µg/L	101	70	130
		EP080: Naphthalene	91-20-3	25 µg/L	93.2	70	130

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 SO ₄ 2- by DA	ES1911589--001	HWY-1	Sulfate as SO ₄ - 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		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		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,	----	----	----	17-Apr-2019	16-Apr-2019	1
RCB-1,	5B-1						
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Unspecified; Lab-acidified							
HWY-1,	HB-1,	----	----	----	17-Apr-2019	16-Apr-2019	1
RCB-1,	5B-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 - Semivolatle Fraction	0	5	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
TRH - Semivolatle 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	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		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	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		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		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			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	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		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 (SnCl ₂)(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 SnCl ₂ 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 (NO _x) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Combined oxidised Nitrogen (NO ₂ +NO ₃) 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 + No _x) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO ₃ -. 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 SO ₄ 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.

CULTURAL HERITAGE TRAINING



CULTURAL HERITAGE TRAINING

This program was designed and developed by redacted name 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.

Housekeeping

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

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.

Map





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>

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

Tradition

- Funerals
- Ceremony
- Initiation
- Tribal Structure

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

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)

Customs

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

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

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

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

Language groups



Traditional owners

- Yanyuwa – Sir Edward Pellew Islands, Borroloola
 - Redacted Names
- Mara – Limmin Bite Region
 - Redacted Names
 - Redacted Names
- Garawa – Robinson River / Wollograng
 - Redacted Names
- Gurdanji – South of Borroloola
 - Redacted Names

Indigenous organizations

- Mabunji Aboriginal Resource Services
 - CEO – Redacted Names
- Mawurli and Wirriwangkuma Aboriginal Corporation (MAWA)
 - Representative organization for the four language groups
 - Chairman – Redacted Names
- Robinson River (Mungoorbada Aboriginal Corporation)
 - CEO – Redacted Name, Chairperson – Redacted Name
- Northern Land Council (NLC)
 - Manager – Redacted Name
- Sea Rangers (auspiced by Mabunji)
 - Coordinator – Redacted

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

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

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

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

Assessment



SAFETY MANAGEMENT PLAN

EP187 Drilling Program

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

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A	Draft	22/08/19	Imperial	
0	Completed document	23/08/2019	Diana G.	Kelvin W.
0.1	Updated to reflect wet season	30/07/2020	Diana G.	

Executive Summary

The Safety Management Plan (SMP) describes the systems, procedures and management practices Imperial Oil & Gas ("Imperial") have in place for managing Health Safety and Environment during the carrying out of services, including the compliance with the clients Policy and Safety laws.

This document has been produced by InGauge Energy to detail the safety management methodology, and resultant risk reduction strategies to be used by Imperial, InGauge and its employees and subcontractors during EP187 project.

The requirements of this Project Safety Management Plan (SMP) will apply to Imperial plant and activities operating under this contract. Risks specific to each task being performed will be managed through supporting documents and processes

Abbreviations

Term	Definition
ALARP	As low as reasonably practicable
BOP	Blowout preventer
CEO	Chief Executive Officer
DPIR	Department of Primary Industry and Resources
HAZOP	Hazard and Operability Studies
JSEA	Job Safety and Environmental Analysis
KPI	Key Performance Indicators
NoK	Next of Kin
OHSE	Occupational Health, Safety and Environment
OHSEMS	Occupational Health, Safety and Environment Management System
PPE	Personal Protective Equipment
SHRR	Significant Hazard Risk Register
SLAM	Stop, Look, Assess, Manage
SMP	Safety Management Plan
SOP	Standard Operating Procedure

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1. Introduction

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, Safety and Environment Management System at a site level.

The requirements of this Project Safety Management Plan (SMP) will apply to Imperial personnel and plant and is applicable to all Imperial activities within the project scope. Risks specific to each task being performed will be managed through supporting documents and processes.

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). This SMP is also designed to provide a sound framework for the management of HSE and meet the overall Company objective of zero incidents. The success of the SMP and supporting procedures will, in part, be measured by the ongoing Company HSE performance.

It is Imperial's intention to provide the guidance necessary to facilitate the project and to ensure employees, subcontractors, consultants and the general public are provided with a working environment that is, as far as reasonably practicable, free from the risk of injury and illness, and also to minimise impact on the environment throughout the duration of the Campaign.

This plan provides health & safety guidelines to Imperial employees, service, providers, subcontractors and representatives.

Included within the plan are:

- Project risk assessments and controls.
- Stakeholder communication protocols.
- Journey management procedures.
- Competency standards.

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

2. Policies and Procedures

2.1. OHSEMS Interface

Activities at all Imperial sites fall under the umbrella of the Organisation Health, Safety and Environment Management System (OHSEMS).

The OHSEMS provides a consistent and planned approach to ensuring the health and safety of all personnel as well as the protection of the environment. It establishes expectations which implement through the minimum worksite standards, work practices and processes detailed within this SMP.

The supporting OHSEMS 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 the site.

The OHSEMS 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 OHSEMS 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.

2.2. Management Commitment

The company is committed to providing a safe and healthy working environment for all its employees, contractors and visitors. The Company is earnest in its pursuit of protecting the environment through the implementation of pollution control measures and sustainable practices. Managers and supervisors at all levels of the Company shall implement and actively enforce the Health, Safety and Environmental Policies of the Company as contained within this SMP and the associated procedures. This SMP is recognised as a vital part of the implementation of the OHS Policy and the Company commitment to OHSEMS.

Company policies to be complied with include:

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

The Company enforces these policies to assist in providing a safe and healthy working environment for personnel, for the protection of the Company's and client's property and safe and efficient operations.

Policies are displayed in prominent locations throughout the work site and the requirements are explained during site HSE inductions.

2.3. Key Performance Indicators

Key Performance Indicators (KPIs) are used to measure company and contractor progress towards the Imperial's target of zero incidents and 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

2.4. Standard Operating Procedures (SOP)

Standard Operating Procedures have been developed by the Company, in accordance with legislative requirements as controls 'to ensure that the risk of injury or damage is maintained to an acceptable level'.

Standard Operating Procedures (SOP's) are developed and improved over time and incorporate the operational steps as well as safety mitigations and controls to ensure a job is done safely. SOP's are the preferred means of planning and preparing for a task and if a job is to be carried out regularly a SOP must be developed, approved and reviewed prior to the task.

Where operations are not described in a SOP a JSA will be prepared as per section 2.6. If an operation becomes a standard operation, an SOP will be developed and submitted to Imperial for review and approval before being used on site.

SOP's shall be reviewed for risk on a regular basis by the personnel engaged in the task to ensure the procedure is still the safest method of doing the work, and to detail any improvement in risk mitigation and controls that have been found to be effective. Any review comments and improvements to an SOP will be sent to Imperial office for update and revision of the SOP.

2.5. Job Safety and Environmental Analysis (JSEA)

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.

2.6. 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.

The management of change procedure are then communicated throughout the Company via Toolbox Meetings or additional training as required.

2.7. Permit to work

The Permit to Work system is used for Company well site operations. This system is critical to safe execution of the wellsite activities and will be strictly adhered to.

The Wellsite Permit to Work System provides management practices and systems for control for the following work activities:

- Hot Work;
- Cold Work;
- Explosive/Radioactive Work;
- Confined Space Entry;
- Working at Heights;
- Excavation work;
- Electrical Work; and
- Pressure Work

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

2.8. Tagging and Isolation

An isolation, lockout and tag out process is in place to protect personnel, plant/equipment and the environment from hazards associated with equipment that is being worked on or is not operating correctly. 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.

Managers and supervisors are responsible for identifying work situations where the use of the Isolation System is required. Supervisors should 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

Isolation and tagout procedures should apply to any work or activity on equipment which may present a hazard to personnel performing the work, to other people or to the environment, including:

- Repair of equipment;
- Modification of equipment;
- Work on moving parts; and
- Any other task which may involve exposure of personnel to the hazards of stored energy

2.9. Handover Procedure

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

2.10. 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; and
- Collision of mobile plant with pedestrians or workers.

Control measures include complying with;

- Mobile Plant procedure; and
- Where possible utilise a spotter.

3. Project Planning

3.1. Duty of Care

All personnel must fulfil their obligations under 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.

The Company is bound by these obligations as an employer who has control over the conditions and circumstances under which work is performed and all personnel who perform duties on behalf of the Company.

All personnel must comply with the principles of their obligation and are therefore responsible for:

- Reading and complying with this SMP;
- Ensuring safe work practices and conditions are maintained;
- Ensuring they do not cause injury or harm to themselves or others;
- Cooperating with their employer and complying with all policies, procedures, standards and regulations;
- Bringing to the attention of their supervisor any hazards or potential hazards they may become aware of and promptly reporting all incidents including near misses; and
- Not recklessly interfering with or misusing anything provided for the safety or the welfare of persons.

All personnel will have these duties conveyed to them during their Site HSE Induction.

3.2. Employee Conduct

All personnel will be informed of Company policy, the SMP and any support document requirements. Failure to abide by any of these may result in disciplinary action, including dismissal in accordance with the Company's Disciplinary and Grievance Guide.

The following conduct must be adhered on all Company premises and client's leases:

- Horseplay or fighting is prohibited;
- Personnel must comply with all drug, alcohol and contraband restrictions;
- Personnel must not operate equipment for which they have not been trained competent and authorised or are unsupervised if there under training;
- Where seat belts are provided, they must be worn;
- Smoking is permitted in designated areas only;
- Personnel must not enter barricaded areas without permission or authorisation;
- Operation of equipment having a 'DANGER, DO NOT OPERATE' tag is prohibited.
- Finger rings, loose clothing, unsecured long hair, wrist-watches and other loose accessories, such as earrings or bracelets, are only permitted in Company administration facilities and ablution blocks. Once entering an operational area all such items must be removed;
- Food and drink must not be consumed in areas where there is a contamination risk; and
- Tampering with any Safety System or Safety Device.

3.3. 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.

Before engaging any contractors or sub-contractors Imperial shall carry out a pre-qualification process which assess that contractor for:

- Ability to supply the equipment / carry out the works
- Personnel to do the work to the required standard
- Financial capacity to manage the works
- Quality and control systems to manage the work to the required standards,
- Willingness and ability to comply with this SMP and all company procedures standards and regulations

When working at an Imperial work site; contractors, 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.

4. Roles and Responsibilities

All personnel are responsible for familiarising themselves with and understanding of 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.

4.1. General Duties & Responsibilities of Tenement Holders and Operators

It is the responsibility of all tenement holders and operators 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.
- 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.
- 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.
- Employ/ or engage suitably qualified persons in relation to the work being performed.

4.2. 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 OHSEMS 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

4.3. 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.

4.4. 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.

4.5. 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 programs;
- 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.

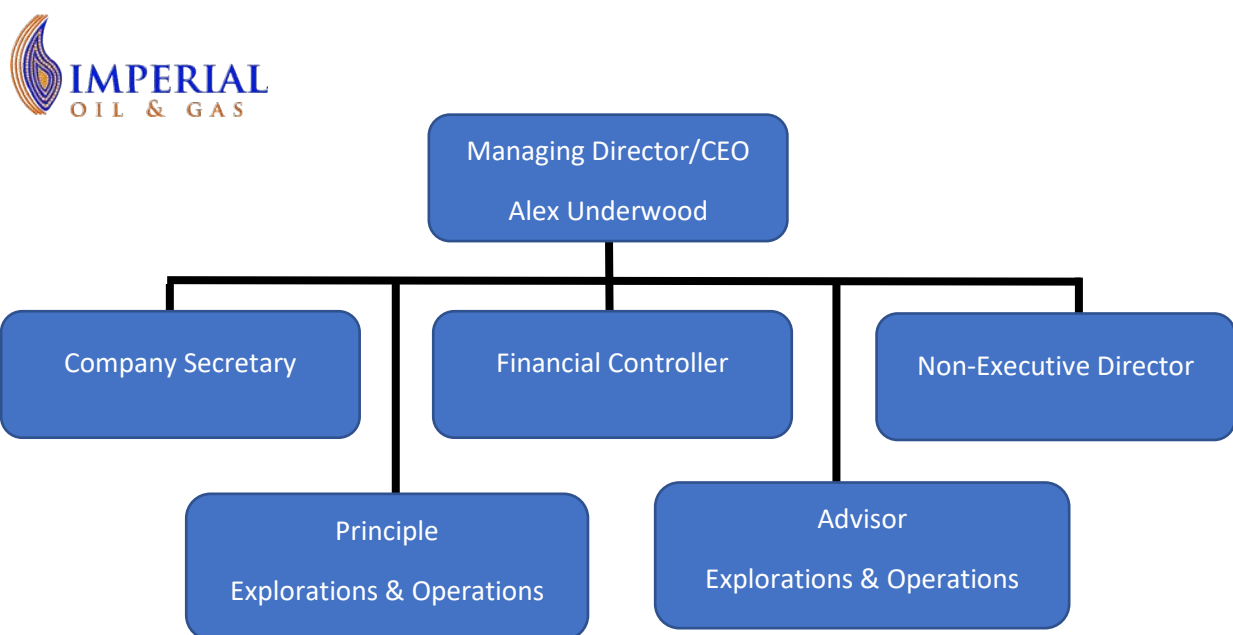
4.6. Contractors

When working on behalf of the Company, all contractors and sub-contractors are responsible for supporting the Company in achieving their HSE objectives. In particular, contractors and sub-contractors will be required to:

- All Contractors will undertake a site induction before commencing any work activities on site;
- Comply with all Company policies, procedures, standards and regulations;
- Comply with HSE provisions contained within Drilling contracts;
- Provide and maintain a healthy and safe workplace as well as equipment and systems of work;
- Provide Imperial with a copy of their Safety Work Management System for high risk construction work activities;
- Ensure their personnel are adequately trained and supervised;
- Provide and maintain adequate and appropriate PPE;
- Ensure their sub-contractors comply with Company policies, procedures, standards and regulations;
- Provide all sub-contractors with copies of this SMP and all Company policies, procedures, standards and regulations

4.7. 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.



5. Working Environment - General Safety

5.1. PPE requirements

All personnel are required to wear PPE appropriate to their work tasks.

All site personnel are to use the following PPE items:

- Wide brimmed sun hats (only to be used where no lifting activities are planned),
- Hard hats,
- Safety boots,
- Long sleeve cotton shirt,
- Long cotton pants,
- Gloves,
- Safety glasses,
- Hearing protection,
- Sunscreen.

The use of these items will be on the basis of the circumstances that are encountered. The following items however are considered a minimum requirement at all times: safety boots, long pants. Operation of any power tools requires the operator to wear safety glasses, long sleeve shirt & hearing protection. Work in environments that include overhead equipment and/or suspended loads (including work in the cellar) requires the inspectors to wear hard hats in addition to safety glasses and the minimum items.

Additional PPE requirements will be dictated by the task and associated SWPs, JSAs, Wellsite Permit to Work and/or Material Safety Data Sheets.

5.2. 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 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.

Standard for noise in relation to a person is:

- (a) LAeq,8h of 85 dB(A); or
- (b) LC, peak of 140 dB(C).

Where:

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

5.3. 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 Safety Data Sheets (SDSs) are available from the ChemAlert database for all Hazardous Substances and Dangerous Goods. SDSs 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.

5.4. Hazardous Manual Tasks

In determining the control measures that need to be 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.

5.5. 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 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.

5.6. 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 always adequately supervised by an experienced person. 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.

5.7. 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.

5.8. Risk of 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

5.9. 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.

5.10. 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

5.11. Journey Management

Travel and working on remote sites is a high risk activity for most of the company’s field activities due to the often isolated nature of wellsites and the potential risks inherent in long distance travel and work on irregular worksites. Therefore, the following travel & communications protocol shall be followed:

- A record of personnel movements will be maintained for safety purposes.

- All personnel are to sign-on/sign-off at the beginning and end of each shift.
- Personnel 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

5.11.1. Speed limits

Drivers shall abide by the national nominated speed limits on all roads. Where a road is deteriorating or when driving in adverse weather conditions, drivers must reduce speed in order to account for the road conditions.

Any operator designated speed limits should also be adhered to whilst in areas of existing operator's title.

5.11.2. Flooded Roads

Wet weather can create slippery conditions and flooding on roads. To minimise the risks, adhere to the following safe practices:

Do not enter waters where:

- The depth of water and the condition of the bottom cannot be safely verified,
- The flow appears excessive or unsafe, and/ or
- The water has a depth higher than 0.4 metres.
- If unsure do not cross water and contact the Journey Manager to agree an alternative plan.

Some general guidance in relation to driving through water includes:

- Do not change gears when driving a 4WD through water, maintain fast walking pace through crossing.
- Always begin the crossing in a low range gear with the hubs engaged.
- Be cautious when exiting the water crossing, as the ground can be steep and slippery.
- After exiting the water, function the brakes to ensure they are operational and dry.

5.11.3. Journey Management Escalation Protocol

This journey management emergency escalation protocol applies for all vehicle travel and all work on remote sites where there is no site office and site communication base.

Table 1. Journey contact escalation protocol

Elapsed Time (min)	Action	Party
30	Supervisor fails to make contact with Journey Manager (JM)	Supervisor
60	JM fails to make contact with Supervisor	JM
120	JM fails to make contact with other members of team and no coms are available on SPOT	JM
120	JM contacts accommodation and receives no update	JM
150	JM contacts local authorities including ARCC if required	JM
150-	JM advises NoK of situation and keeps all parties updated (including client)	JM

5.12. Vehicle specification

5.12.1. Vehicle Requirements

Vehicles operating in remote locations shall have 4WD capability and be fully comprehensively insured. Insurance and registration documentation are to be carried in the vehicle. Additionally, the letter of authority and contact details of the DPIR representative shall be carried in the vehicle for presentation to landowners and other interested members of the community.

Additionally, all vehicles are to be equipped with the following minimum safety equipment/accessories:

- 2 spare tyres and adequate wheel changing equipment (remote work only),
- UHF radio (remote work only),
- Maps of area,
- First aid kit,
- Emergency water (at least 5l per person),
- Emergency fuel (at least 20l) (remote work only),
- Fire extinguisher,
- Recovery kit,
- SPOT tracker (remote work only),
- GPS device,
- Torch.

It is not envisaged that staff will be required to work in isolated areas away from the vehicle, however in the event that this becomes necessary, the following items should be carried by the party where planning filed work within remote locations:

- First Aid Kit,
- Space blanket,

-
- Emergency warm clothing and wet weather gear,
 - Matches/lighter,
 - Torch or head torch,
 - GPS receiver (coordinates for vehicle should be recorded before setting off),
 - Handheld 2 Way Radio,
 - Spare batteries for GPS; UHF and Torch,
 - Spot Tracker,
 - Minimum 2L water per person.

5.12.2. Vehicle Pre-Start Inspection/Maintenance

Prior to operating any vehicle, the following checks shall be completed:

- Oil, water, brake fluid, coolant and transmission fluid levels,
- Tyre condition and pressure,
- Any leaks and the general vehicle condition,
- The working order of all warning systems, lights, wipers, fuel, horn, radio and other accessories,
- Confirmation that all required safety equipment is located within the vehicle and is operational,
- Confirmation that radio (and any other) communication tools are operational,
- Completion of vehicle inspection and any area specific weed hygiene requirements. If required, weed declaration certification must be carried in the vehicle.

At the completion of the journey, re-fuel the vehicle, and – if necessary – clean the inside and outside. Any defects to vehicles must be reported immediately to the Journey Manager.

The Journey Manager shall maintain a vehicle servicing schedule to ensure all vehicles undergo regular maintenance. Vehicles are to undergo standard services at least once a year or more regularly if prescribed under the manufacturer's instructions.

6. Induction

6.1. Induction

Induction is provided prior to, or when personnel first visit a site-office operated by Imperial. When an individual has received induction, this is recorded in the Training / Site Personnel Register. The induction 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.

6.2. Training

Training will be provided in accordance with the Company's Induction and Training Procedure.

Training can take the form of on-the-job training conducted by Company supervisors or be provided by an external provider or national body as required.

On-the-job training is conducted by a line supervisor or a designated mentor. During this time, the new employee is supervised and given instruction on their position and HSE requirements, this includes, but is not limited to:

- How to correctly handle and operate equipment;
- How to use PPE;
- How to interpret signs and warnings and make use of the isolation system;

- Location of documentation; and
- How to react in the event of an incident or emergency.

For remote work on wellsites the following basic training must be held by the field inspection team:

- Current Australian Drivers licence (all team members).
 - Must be valid for class of vehicle being used for the program.
- 4WD Vehicle training (all team members).
 - Demonstrable experience in operating a 4WD vehicle; and/ OR
 - Certificate from a Registered Training Organisation such as Drive & Recover a 4WD Vehicle.
- First aid (all team members)
 - Current Senior First Aid certificate (e.g. Provide first aid) or higher.
- Confined space entry - Gas detection (at least one team member)
 - Competencies required to safely enter and work in confined spaces, successfully monitor the atmosphere for gas and work in accordance with a permit system.
 - e.g. Enter and work in confined spaces, Work in accordance with an issued permit, Gas test atmosphere.

6.3. 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.

6.4. Competency Profiles

Competency profiles outline the training required for personnel to engage in safe work practices at all Imperial work sites. 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.

6.5. 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 sites adheres to the specifications established in the Competence – OHS Aspects Procedure.

7. 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 As Low As Reasonably Practicable (ALARP).

7.1. 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.

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.

7.2. Formal Risk Assessment

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.

7.3. Risk Management in Procurement

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).

7.4. Risk Management During Operations

An ice breaker and wellsite induction is mandatory for all personnel on site to appraise them of the operations and ensure risks on site are understood and managed.

General site safety is managed using Safe Operating Procedures (SOP's), Job Safety Analysis (JSEA's), Formal Risk assessments, Hazard observations, Step-back 5x5 process and regular toolbox meetings. In combination, these tools are used to ensure that all personnel are aware of the risk associated with each activity and are implementing the controls required.

Permits are used to control high risk activities on site including hot work, cold work, working at heights, pressure equipment, electrical equipment work and excavation work.

In addition to good design processes, the cement pressure charts, cement returns and bond logs are reviewed after the operation to ensure good cement jobs.

All high-pressure equipment and all well integrity barriers are pressure tested and most importantly the well and well head are pressure tested to ensure well integrity.

7.4.1. Well control

Imperial employs a two barrier well integrity policy that ensures that there are two barriers to well control failure at all times during well construction and operations. The primary well control barrier during drilling is drill fluid which is maintained with spare capacity on site. Additional equipment on and safety devices on site to manage risk during drilling of a well include the Blow Out Preventers, accumulator, casing and cemented annulus, packers and isolation tools, inside BOP valve and stabbing valves.

7.5. Document Control

In order to provide for the effective monitoring of safety systems the following processes regarding the approval, issue, control and review of documents will be adhered to in accordance with the Company's Document Control Procedure:

- All new documents must be authorised for use by the Managing Director, Executive Safety Manager or Operations Manager;
- All documents must clearly state the document number, revision number and issue date;
- All copies of superseded documents are to be disposed of to eliminate confusion about which version is to be used;
- All documents must be clearly titled so that they are readily identifiable; and
- Current versions of relevant documents must be available at relevant locations and issued to Managers on site.

7.6. Risk Hierarchy

Controls are implemented to manage, reduce or remove the level of risk caused by a hazard. Figure 1 – Hierarchy of Control illustrates the Imperial Hierarchy of Control which is used, in descending order, when assessing control options and their effectiveness:

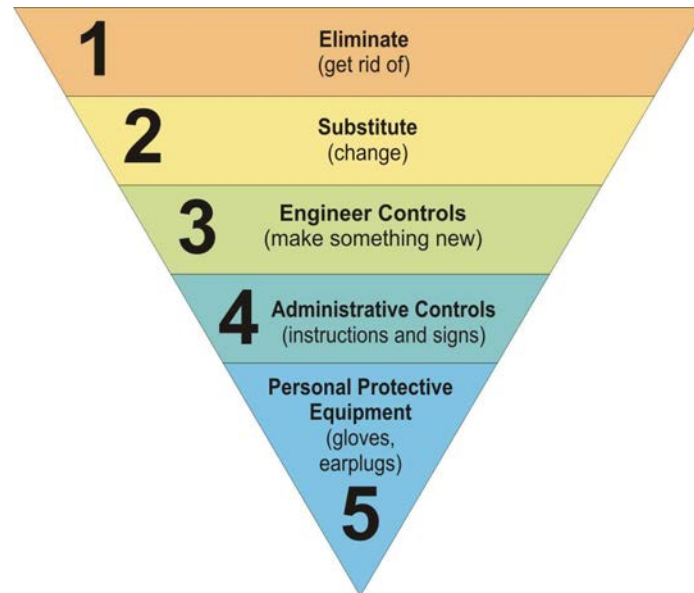


Figure 1. Hierarchy of Control

7.7. Significant Hazard Risk Register

A Significant Hazard Risk Register (SHRR) will be developed for larger projects detailing the most significant risks to the project and their controls and management. This SHRR will be reviewed with the Principal. The SHRR will determine a final risk level for each risk in accordance with the Project Risk Assessment.

The SHRR is a project specific document kept for larger project that outlines and categorises all key operations and details the necessary controls to manage the identified risks to as low as reasonably practicable (ALARP).

7.8. 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;
- Logbooks 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.

7.9. 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. Project Risk Assessment

In accordance with the principles of risk management outlined in Section 7 above, a Risk assessment for the project has been undertaken to identify and classify potential risks and to put in place either preventative or mitigating controls.

The risk assessment included in Table 6 below includes all general field activities.

The methodology employed by Imperial is commonly used by organisations in the resources industry and is outlined in brief below:

A risk assessment matrix (Table 2) is employed combining an evaluation of consequence with a corresponding evaluation of likelihood. The evaluation of controls to either eliminate or mitigate risk is also undertaken before a residual risk for the activity is determined.

There are 6 steps included in the process for risk determination;

1. Defining the activity / incident risk, i.e. what activity is being undertaken, identifying the break down event that leads to a release of energy and the consequences of that energy manifesting.
2. Evaluating the consequence of the incident happening (Table 3), i.e. considering the type of impact (Health and Safety, Environment, Reputation and Financial) what is the maximum credible consequence given any controls already in place. Where more than one type of impact is identified then the impact with the highest rating is used.
3. Evaluating the likelihood of the incident happening (Table 4), i.e. what is the level of frequency of the incident occurring taking into account knowledge of the personnel involved and existing controls.
4. Determining the initial risk level (Table 2), i.e. cross referencing consequence v. likelihood.
5. Identifying controls and determining control effectiveness using Table 5, below. Control effectiveness is determined based on its Type and its Level of quality;

- a. Type refers to,
 - i. Physical control (most effective) - elimination, substitution or engineering control,
 - ii. System control – administrative controls such as ERP's and Permit to Work,
 - iii. Behavioural control (least effective) - personal competency, relying on the use of PPE,
 - b. Level refers to,
 - i. High – control is fully implemented, there is a high level of conformance,
 - ii. Moderate – control is implemented or partially implemented, conformance is not consistent and non-serious deficiencies may have been identified, some improvement is required,
 - iii. Low – little or no implementation, minimal conformance and the control is generally ineffective and the risk is not being managed.
6. Determining the residual risk level (Table 2), the risk is again examined in light of current controls, suggested control improvements and likely effectiveness

Table 2. Imperial Risk Matrix

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

Table 3. Imperial Consequence Classification

Consequence	Environment	Reputation	People	Assets
Slight	Negligible financial consequences; local environmental risk; within containment area. Release to environment (lt/kg) <10	Customer and public awareness of the incident may exist; minimal concern.	Slight health effect/injury.	Slight or no damage.
Minor	Contamination; minor environmental damage. Single incidence of statutory or prescribed criteria; single complaint; no permanent effect on the environment. Release to environment (lt/kg) <100.	Some customer and local public concern; local media and/or local political attention with potentially negative impact for company operations.	Minor health effect/injury	Minor damage
Considerable	Localized damage to environment or repeated incidence of statutory or prescribed limit. Release to environment (lt/kg) <1,000	Local impact on customer/company reputation. Extensive negative attention in local media; slight national media and/or	Major health effect/injury	Localised damage

Consequence	Environment	Reputation	People	Assets
Major		local/regional political attention with possibly negative stance of local government.		
	Severe environmental damage; the company is required to take extensive measures to restore the contaminated environment to its original state. Extended incidence of statutory or prescribed limit. Release to environment (lt/kg) <10,000	National impact on customer/company reputation. Extensive negative attention in national media and/or regional national policies with potentially restrictive measures on future operations.	Single fatality	Major damage
Massive	Persistent severe environmental damage or severe nuisance extending over a large area. In terms of commercial or recreations use or nature conservancy, a major economic loss for the company. Constant high incidence of statutory or prescribed limit. Release to environment (lt/kg) <100,000	International impact on customer/company reputation. Extensive negative attention in international media and national/international policies with potentially severe impact on future operations.	Multiple fatalities	Extensive damage

Table 4. Imperial Likelihood Classification

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

Table 5. Imperial Risk Significance Rating

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

Table 6. Risk Assessment

Risk Issue	Cause	Impact	Initial Consequence	Residual Likelihood	Required or Expected Controls	Residual Consequence	Residual Likelihood	Residual Risk Rating
Sunburn, heat stress / exhaustion, sunburn & heat stroke	Personnel inadequately prepared or informed for conditions	Severe illness or fatality	High	Possible	Company training (including heat stress awareness) Heat stress procedures in plan ERP and JM plan Personnel to be fit for work, maintain adequate hydration Spare water in vehicle 1 st Aid training Use sunscreen and sun hat Dress appropriately for conditions Air conditioning in vehicles In vehicle communications such as radio or phones	Moderate	Unlikely	Low
Vehicle incident	Road conditions Fatigue Exceeding speed limits Excessive speed where conditions are poor Unsecured loads	Fatality or severe injury Equipment damage Injury to livestock Damage to property	Critical	Likely	Assess weather impacts prior to driving Driving policies, 4WD training Vehicle specification suitable for conditions Vehicle pre-start checks Journey management plan Fatigue Management Night Driving Restrictions Communications device (phone, SPOT) in vehicle Fire extinguisher (vehicle) Licenced drivers	Considerable	Unlikely	Moderate
Fall from height or into cellar	Open Cellars Elevated working positions	Injury to personnel Dropped objects Equipment Damage	Considerable	Likely	Pre work JSA ERP Operational procedures in place for cellar entry Appropriate supervision in place Appropriate PPE Good and effective communication No entry into deep cellars First aid training	Considerable	Unlikely	Moderate

Risk Issue	Cause	Impact	Initial Consequence	Residual Likelihood	Required or Expected Controls	Residual Consequence	Residual Likelihood	Residual Risk Rating
Confined space – gas exposure	Toxic gases present in cellar Cellar entry without precaution	Fatality	Considerable	Possible	Gas detection prior to entry Pre work JSA Confined space entry training Only 1 person to enter confined space at a time, second to supervise ERP PPE	Minor	Unlikely	Moderate
Ignition and bush fire	Lightning Strike Static Electricity Ignition Sources Bushfire	Fatality Injury to personnel Environmental impact Equipment damage	Considerable	Possible	Pre work JSA Operational procedures in place for interaction with wells Adequate supervision Training and Competency Appropriate PPE Fire extinguisher (vehicle) SPOT and ERP plan provisions	Minor	Unlikely	Moderate
Snake and insect bites	Contact with native animals Clearing brush Entering confined spaces Stings	Severe injury or potential for fatality Poisoning Anaphylactic shock	Considerable	Possible	ERP First Aid Kit First Aid Training In vehicle comms including SPOT Clear brush etc. prior to entry to area PPE such as long pants, glasses and gloves Ensure cellars are clear prior to entry Be aware of wildlife and insects Avoid snakes and allow them to move off	Minor	Unlikely	Moderate

Risk Issue	Cause	Impact	Initial Consequence	Residual Likelihood	Required or Expected Controls	Residual Consequence	Residual Likelihood	Residual Risk Rating
Floods and flooded roads	Heavy rain causing flood to spill over road Flash flooding Deep water over road Flowing or standing water Driving through water over roads Submerged debris Non-visible hazards Loss of control due to slippery driving conditions	Vehicle stranded in flood due to debris or road damage Vehicle carried away by flood Injury due to accident Worst case loss of vehicle and fatality	Major	Unlikely	Journey management plan ERP Assess weather impacts on journey plan Flooded road procedures 4WD training In vehicle comms including SPOT Appropriate vehicle (4WD) Do not enter water where depth is not known or greater than 0.4m	Slightly	Unlikely	Low
Breakdown in remote areas	Fuel shortage Loss of coolant Vehicle damage while off road Flat tyres Mechanical breakdown	Personnel stranded possibly overnight Danger of exposure Injury whilst effecting repair	Considerable	Likely	Journey management plan ERP SPOT Vehicle maintenance in date Pre-start checks 4WD training In vehicle comms Spare fuel Spare water First aid kit	Minor	Possible	Moderate
Sour gas	Leakage Build up in well Metal fatigue Injury due to equipment failure	Inhalation of toxic gas Build-up of gas in cellars Weakening or damage to wellheads	Major	Possible	ERP Gas monitors First aid equipment and training Confined space and gas environment training Observe for dead animals in cellar Observe for wellhead corrosion H2S Protocol No naked flames or smoking within specified radius 1 person in cellar at a time Well inspection protocol	Minor	Possible	Moderate

Risk Issue	Cause	Impact	Initial Consequence	Residual Likelihood	Required or Expected Controls	Residual Consequence	Residual Likelihood	Residual Risk Rating
Inhalation of gas	Entry into cellar Equipment failure venting gas	Inhalation of toxic gas, unconsciousness	Major	Possible	Confined space training Gas monitors First Aid training and equipment Test for pressure on well head prior to work ERP Observe for wellhead damage / corrosion H2S protocol Well inspection protocol	Minor	Possible	Moderate
Landowner confrontation	Entering property without notification Damaging property Leaving stock gates open Injury to stock Leaving rubbish Driving too fast	Access to site prevented Damage to company reputation and community relations Compensation claim	Moderate	Possible	Communications protocols Gate management protocols Stick to specified access routes No off track driving Exercise caution and drive slowly around stock Report all incidents Follow any directions to leave by landowner and inform Journey Manager	Slightly	Unlikely	Low
Weeds contamination	Contamination of sites with weeds or seeds from other sites	Introduction and spread of weeds	Moderate	Possible	Weeds and Seeds Protocols Journey Management Vehicle wash down prior to entering sensitive areas or after leaving know weed areas	Slightly	Unlikely	Low

8.1. Key Controls

The following lists the key controls which have been built into the project plan and associated protocols to ensure personnel and public safety, equipment protection and protection of the natural environment. In accordance with the hierarchy of controls, the key controls specified are physical or systems controls, these being the most effective barriers to the occurrence of an incident and are as follows;

- Gas Monitors – supply and training in the use of,
- PPE – supply and direction for the use of,
- Well inspection protocol – to outline procedures such as JSEA, clearance, observation and precautions to be taken prior to approaching and when working on the wellsite / wellhead,
- ERP – Procedures and protocol to be followed in the event of an emergency to ensure timely and effective response to prevent further injury or damage,
- SPOT (for remote sites only) - to enable vehicle tracking and location in the event of missed call in by the Site Supervisor,
- Vehicle Specification – to ensure the vehicle is suitable for the task, has adequate onboard supplies and equipment and is in good working condition,
- Journey Management – protocols to ensure the safety of personnel traveling between sites and to and from the project area. This protocol includes route planning, call in times and procedure in the event of a missed call,
- Training – 4WD, First Aid, Confined Entry, H2S training required to deal with hazards that might be experienced by supervisors.

9. Consultation and Communication

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.

9.1. Site OHSEMS Committee

The primary function of the Site OHSEMS Committee is to coordinate and assess implementation of the Imperial OHSEMS at a site level. This includes the coordination and completion of self-assessments against each of the OHSEMS elements and close out of non-conformances. The OHS Representative attends the Site OHSEMS 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.

9.2. Site OHSE 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.

9.3. Team OHSE 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 OHSE 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 teamwork areas.

9.4. 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.

10. 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.

10.1. 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.

Death or Serious Injury

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.

10.2. 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.

11. Emergency Response Procedure

The following emergency scenarios are contemplated by this plan:

- First aid injury on site;
- Medical treatment (or more severe) injury on site;
- Heat stress incident;
- Vehicle incident;
- Loss of containment or spill;
- Fire (bush fire or fire resulting from loss of containment at well-site);

Travel and works on site is preferably done with two or more people and in such cases the responsibility for care of the injured party and fulfilling the communications requirements of this plan will fall to the uninjured members of the party.

11.1. Emergency Response Details

The Emergency Response Details found in Appendix 1: Emergency Response Details, provides a summary of all projects specific emergency response details including contact numbers for Imperial,

contractors, emergency response personnel, and provides a map of all locations, access route details and hospitals locations and their address and contact details.

11.2. First aid injury on site

For the purposes of this plan a first aid injury is an injury not requiring medical intervention (e.g. laceration not requiring sutures etc.) that can be adequately dealt with at site by normal first aid practices. Where there is any doubt about the need for medical attention the patient shall be taken to a medical facility in accordance with the protocol below for medical treatment injuries.

Following is the communications and management protocol for a first aid injury incurred on site:

11.2.1. Site Supervisor

- Make location safe or evacuate to safe area;
- Stabilise injured party; apply first aid; Determine whether the injured party requires professional medical attention – if so follow procedure for medical treatment injury below. Otherwise, determine whether or not the injured party can continue to work for the day or whether to return to the accommodation. The best interests of the injured party take priority over other interests.
- Call Imperial Journey Manager as soon as practicable.
- Assist with preparation of incident report and investigation.

11.2.2. Imperial Incident Manager

- Lead incident investigation if required and prepare report.
- Ensure any incident corrective actions are implemented in accordance with the findings of the investigation

11.3. Medical treatment (or more severe) injury on site

For the purposes of this plan, a Medical Treatment Injury (MTI) is an injury requiring medical intervention (e.g. laceration requiring sutures, broken bone etc.). It is clearly the case that the detail of the response will have to be evaluated on site and will depend upon the severity of injuries. Where there is any doubt about the suitability of the injured party for travel, medical assistance is to be called to site.

Following is the communications and management protocol for a medical treatment or more serious injury incurred on site:

11.3.1. Site Supervisor

- Make location safe or evacuate to safe area;
- Stabilise injured party; apply first aid; Determine whether the injured party is safe to travel to medical centre/hospital (if there is any doubt – medical assistance to be called to site);

- If patient is unsuitable for travel:
- Call emergency Services if in cellular range – describe location and nature of incident.
- Activate SPOT by sending distress message if in remote area outside of cellular range – activation email to include nature of incident.
- Call Landowner for assistance if communications with landowner can be readily established.
- Call Imperial Incident Manager as soon as practicable.
- Continue to attend to patient, keep them cool and in shade and make as comfortable as possible.
- If required assist emergency services with access to the site.
- Assist with preparation of incident report and investigation.
- If patient is deemed suitable for travel:
- Utilise agreed Emergency Response Numbers (ERN) to identify the closest medical centre.
- Call Imperial Incident Manager as soon as practicable once inside mobile range.
- During travel to medical centre continue to assess patient's condition. If the condition deteriorates then revert to the plan for patients who are unsuitable for travel.
- Assist with preparation of incident report and investigation.

11.3.2. Imperial Incident Manager in Town

- Monitor SPOT message service at all times when inspectors are in field (i.e. away from accommodation).
- Activate Emergency Services if necessary.
- Provide town-side assistance as required.
- Notify Next of Kin (NoK) if required.
- Notify client representative for all notifiable incidents.
- Report any notifiable incident to regulator.
- Lead incident investigation and prepare report.
- Ensure any incident corrective actions are implemented in accordance with the findings of the investigation.

Appendices

Appendix 1. Emergency Contact Details

1. Imperial Oil & Gas Contacts

Name	Position	Contact Number
A [REDACTED]	Chief Executive Officer	[REDACTED]
K [REDACTED]	Office Manager	[REDACTED]

2. InGauge Energy Contacts

Position	Name	Phone Number	E-mail
Principal Engineer	[REDACTED]	[REDACTED]	[REDACTED]
Company Civils Coordinator	[REDACTED]	[REDACTED]	[REDACTED]
Site Supervisor	[REDACTED]	[REDACTED]	[REDACTED]

3. Government and other Stakeholders

Name	Location	Contact Number
Department of Primary Industry and Resources (DPIR)	Darwin	Ph: 08 [REDACTED] A.H: [REDACTED] Emergency: 1300 935 250
Ngukurr Essential Services Officer	Ngukurr	[REDACTED]
Roper Gulf Shire Office		[REDACTED]

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

Service	Location	Contact Number
	Nhulunbuy	08 8987 2727
Bushfire	Arnhem land	08 8922 0829
	Katherine	08 8973 8871 - 0401 115 744
	Gulf	08 8987 0365
Fire Station	Borrooloola	000
	Nhulunbuy	08 8987 1906
Community Health	Borrooloola	08 8975 8711
	Katherine	08 8973 8871
	Nhulunbuy	08 8987 0435 - 08 8987 0365
Aerial Medical services	Borrooloola	08 8973 8570
	Katherine	08 8999 4988
	Nhulunbuy	08 8987 0211
Remote Rural Health	Borrooloola	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
Borrooloola Doctor	Borrooloola	WH: 08 8975 8711
		AH: 08 8975 9859
Northern Land Council	Borrooloola	08 8975 8848
	Darwin	08 8920 5100
	Katherine	08 8971 9899
	Ngukurr	08 8975 4755
	Nhulunbuy	08 8986 8500

Appendix 2. Site ERP Display Sheet

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	Name	Number
Principal Engineer	[REDACTED]	[REDACTED]
Company Civils Coordinator	[REDACTED]	[REDACTED]
Site Supervisor	[REDACTED]	[REDACTED]
Imperial Oil & Gas		
Position	Name	Number
A [REDACTED]	Chief Executive Officer	[REDACTED]
K [REDACTED]	Office Manager	[REDACTED]
Medical Services		
Entity	Location	Number
Aerial	Borrooloola	08 8973 8570
	Katherine	08 8999 4988
Community Health	Borrooloola	08 8975 8711
	Katherine	08 8973 8871
	Nhulunbuy	08 8987 0435 - 08 8987 0365
Borrooloola Doctor	Borrooloola	WH: 08 8975 8711 AH: 08 8975 9859

Appendix 3. 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

IMPERIAL ENERGY SEISMIC LINE AND DRILL PAD ARCHAEOLOGICAL SURVEY – FAVENC RANGE, NORTHERN TERRITORY



A report for Imperial Oil and Gas Pty Ltd (Imperial Energy)

Dr. Silvano Jung
Principal
Ellengowan Enterprises – archaeological consultant
ABN: 47 208 214 348

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, be 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 120m². 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).

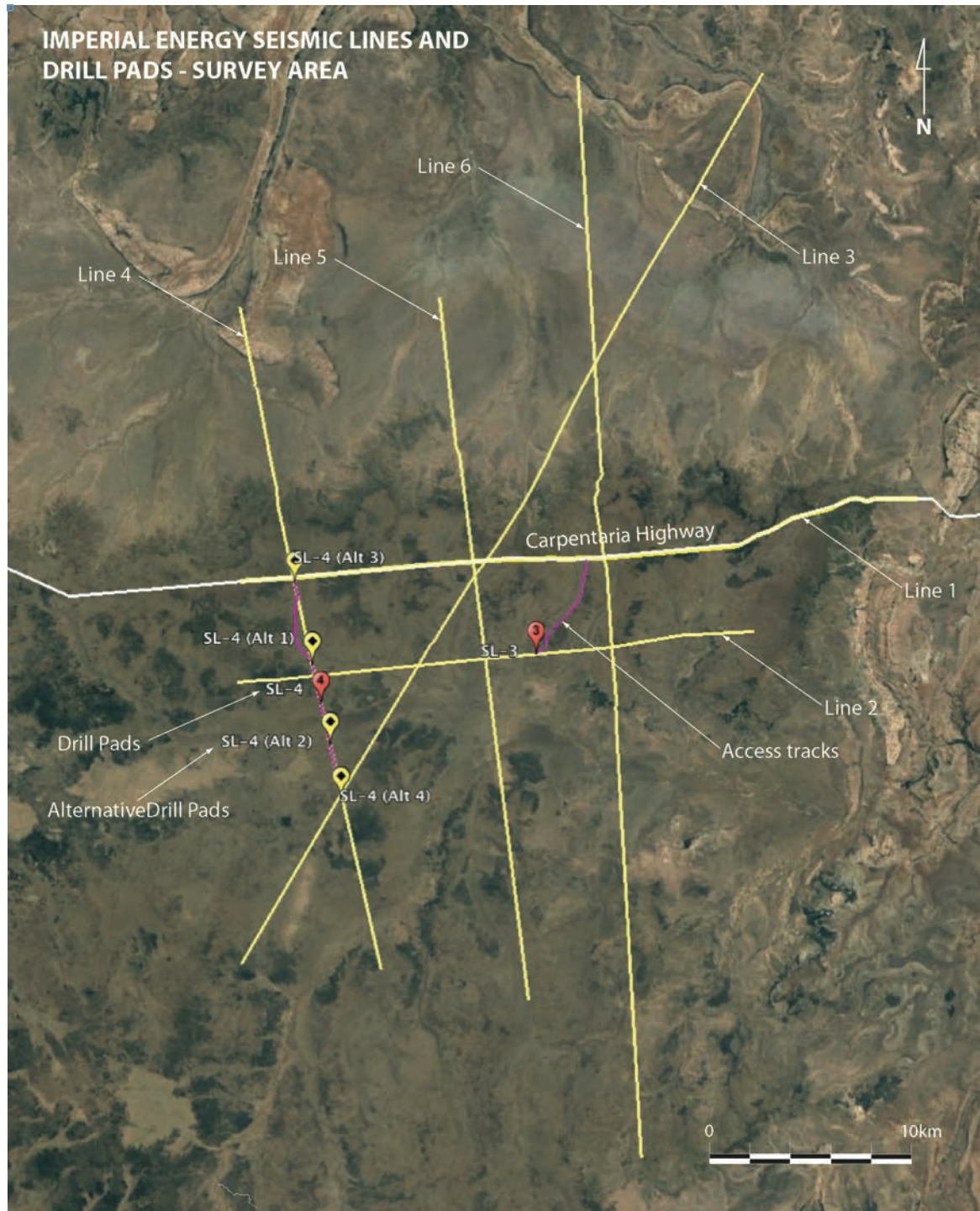


Figure 2. Location of the study area on the Carpentaria Highway, showing seismic lines, drill pads and access tracks (After Google Earth).

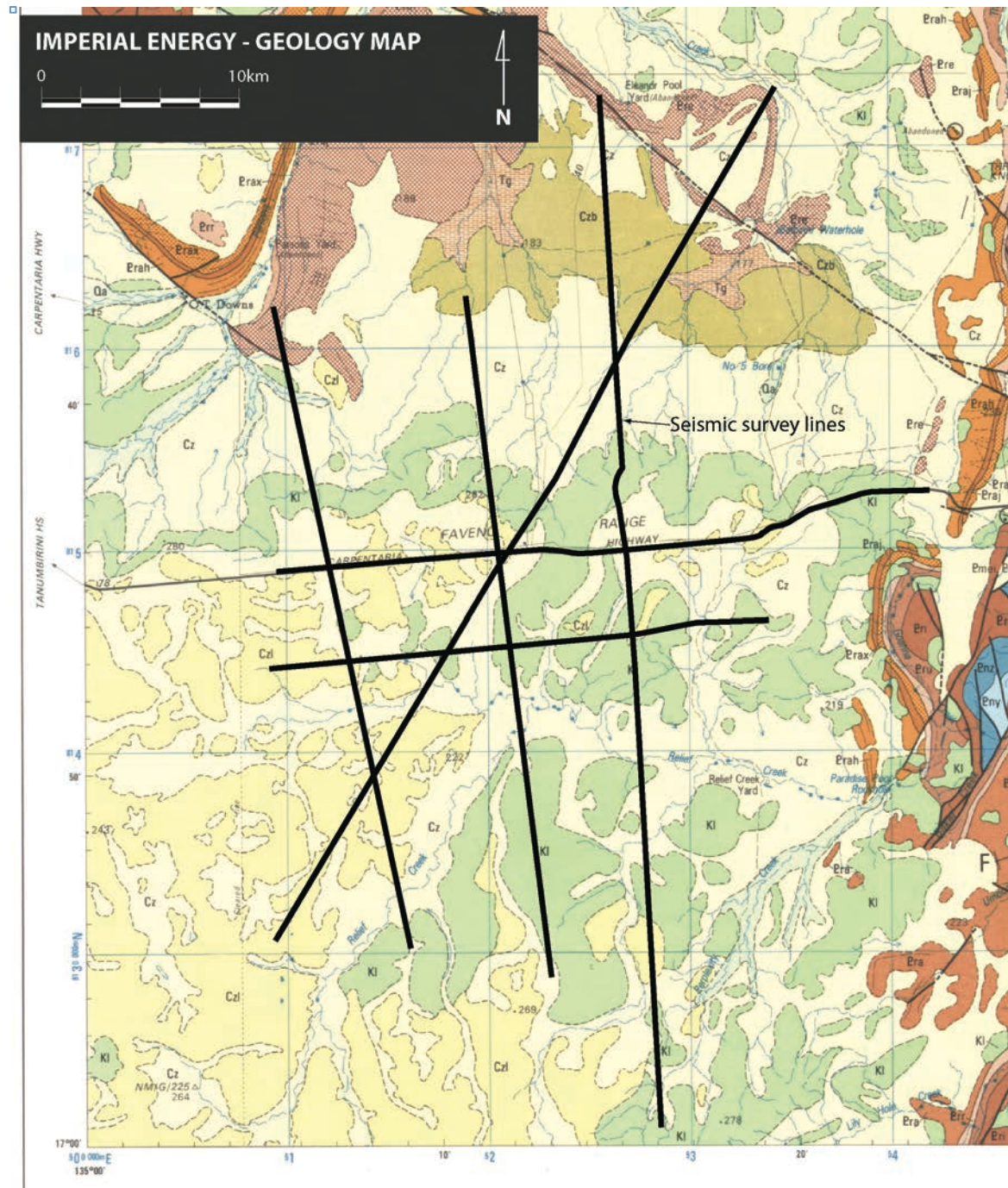


Figure 3. Geology map of the survey area with overlaid seismic survey lines (After BAUHINIA DOWNS se5303. Geoscience Australia. 1: 250 000 Geological Map, 1st edition 1991. <http://scanned-maps.geoscience.gov.au/250dpi/se5303.jpg>. Accessed 11 August 2019).

The vegetation communities are open woodland dry sclerophyll forests of *E. miniata* (Darwin Woolly Butt), *E. tetradonta* (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 <i>Act</i> .
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 <i>Act</i> but has not yet made its recommendations to the minister.
RV	Revoked. Declaration as a heritage place pursuant to Section 26(1) of the <i>Act</i> 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 in 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		O.T. Downs	Stone artefact scatter	Artefact scatter	
Balbirini Creek2			53		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	

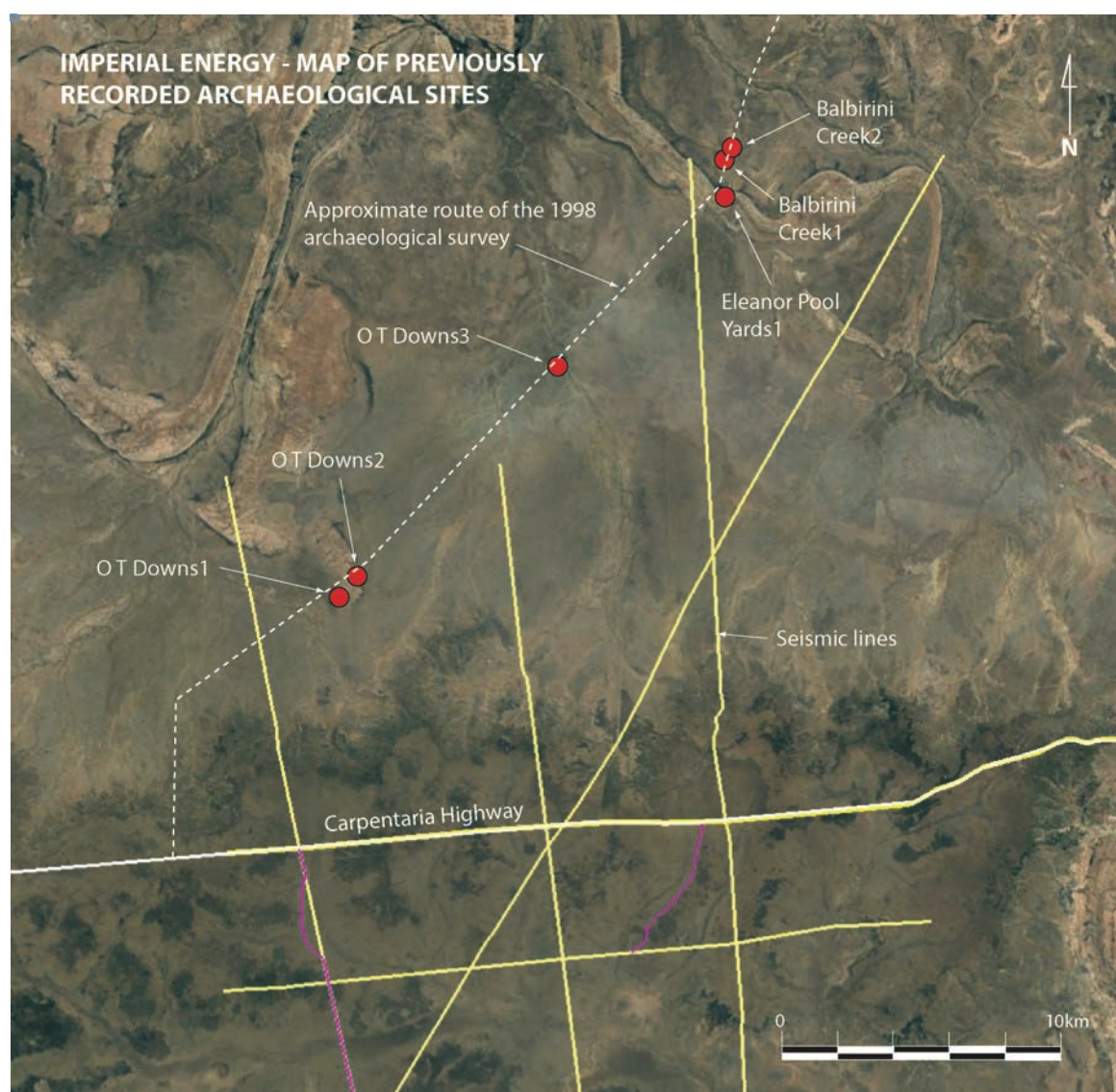


Figure 4. Map of previously recorded archaeological sites in the survey area (After Guse and Collis, 1998: between pages 5 and 6).

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
- Eralure 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 its 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		

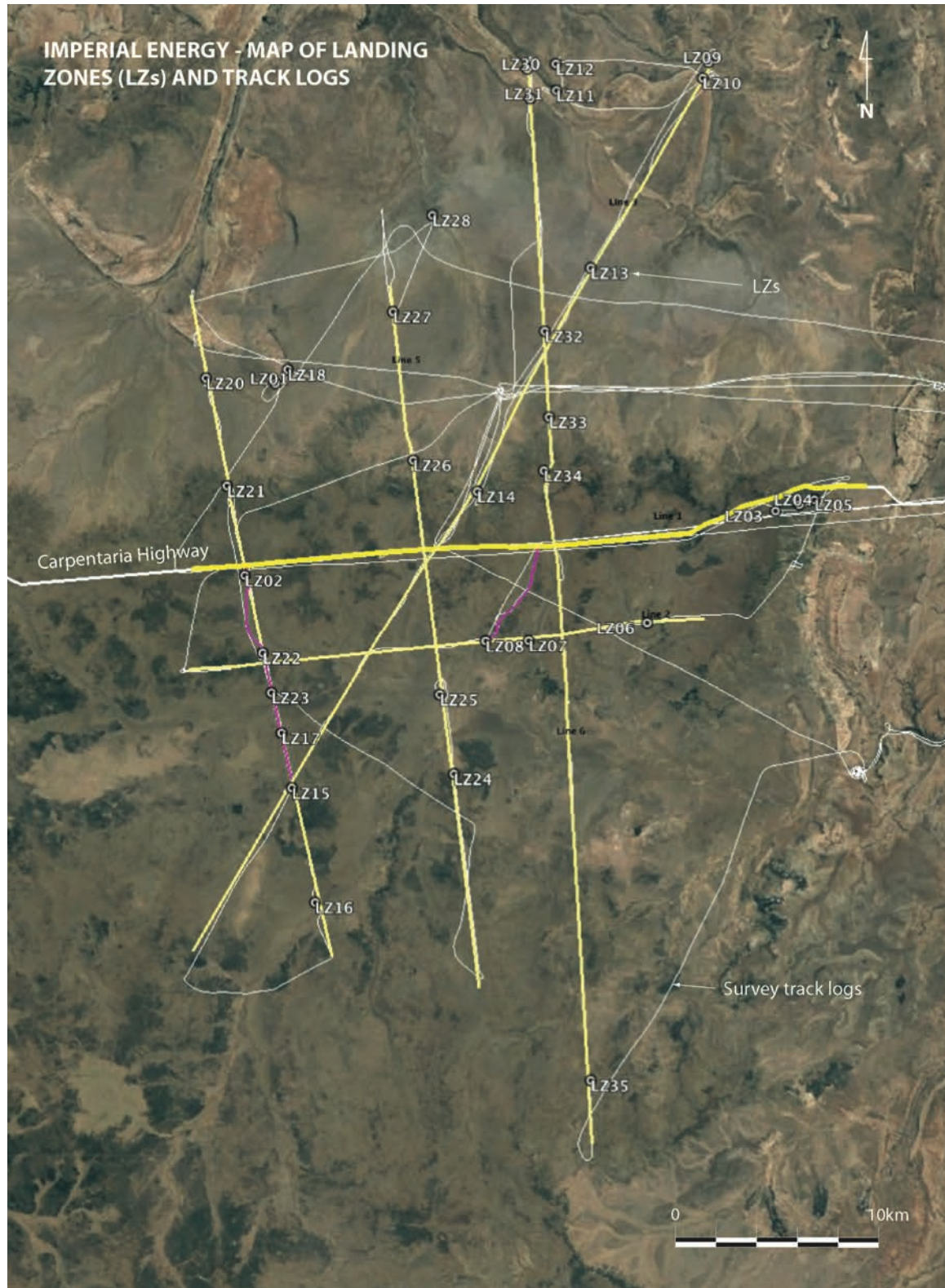


Figure 5. Map of Landing Zones (LZs) and survey track logs (After Google Earth).

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			

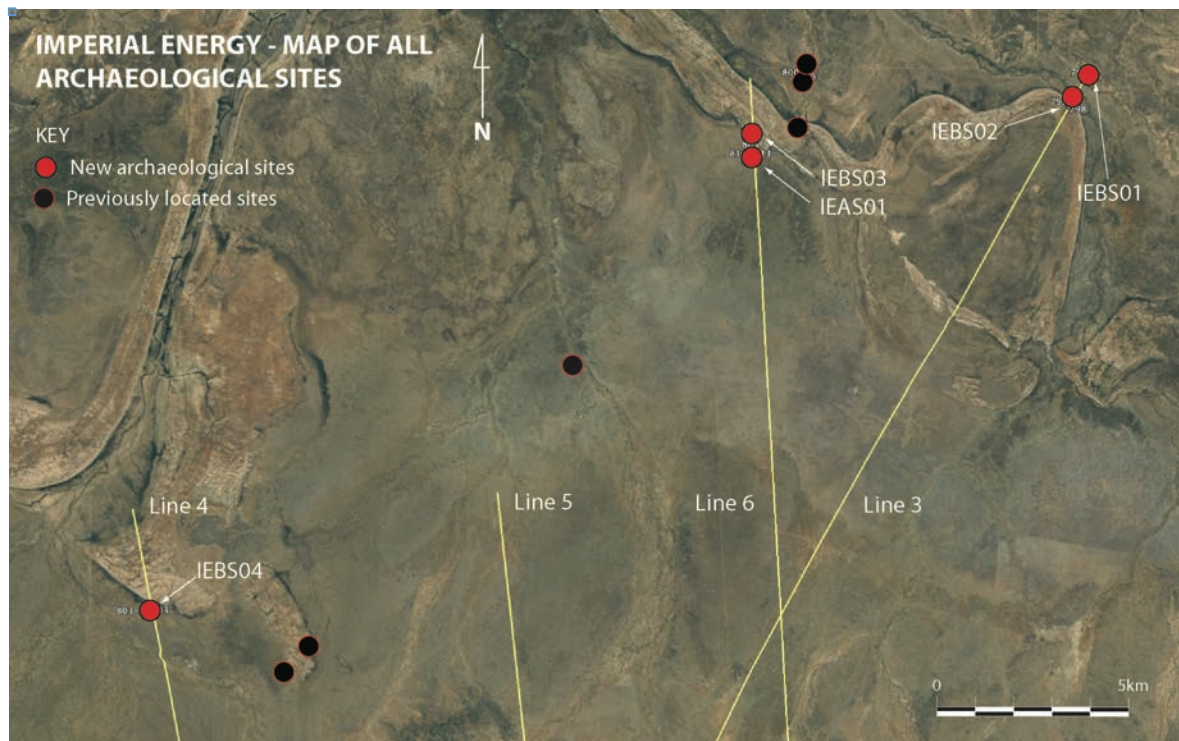


Figure 6. Map of all archaeological sites – red dots (After Google Earth).



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, Peter Ellis 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 its proximity to Broadmere Road and its 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 Background 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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Gibbney, H. 1972. 'Favenc, Ernest (1845–1908)'. Australian Dictionary of Biography, Volume 4. URL: <http://adb.anu.edu.au/biography/favenc-ernest-3506>. Accessed 12 August 2019.

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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 1 cm.



Figure 19. Wpt No. 805 F(QZ). Scale in 1 cm.



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		
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T	53	K		
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