LATE ITEMS
BUSINESS PAPER

General Meeting

Wednesday 26 September 2018

Roma Administration Centre

NOTICE OF MEETING

Date: 26 September 2018

Mayor:	Councillor T D Golder
Deputy Mayor:	Councillor J L Chambers
Councillors:	Councillor N H Chandler Councillor P J Flynn Councillor G B McMullen Councillor W M Newman Councillor C J O'Neil Councillor D J Schefe Councillor J M Stanford
Chief Executive Officer:	Ms Julie Reitano
Senior Management:	Mr Rob Hayward (Director Development, Facilities & Environmental Services) Ms Sharon Frank (Director Corporate, Community & Commercial Services)

Please find attached agenda for the **General Meeting** to be held at the Roma Administration Centre on **September 26, 2018 at 9.00AM.**

Julie Reitano
Chief Executive Officer

TABLE OF CONTENTS

COUNCILLOR REPORT

Meeting: General 26 September 2018 **Date:** 5 September 2018

Item Number: L.1 **File Number:** D18/70711

SUBJECT HEADING: Blue Lagoon Road

Classification: Open Access

Author & Councillor's Title: Cr Tyson Golder

Executive Summary:
Replacement of gravel surface on Blue Lagoon Road to reinstate as before rock crushing.

Councillor's Recommendation:
That Council replace gravel surface to allow former condition, as before the roadworks were done to Blue Lagoon Road.

Background:
Verbal request from Mr Allen to Mayor Golder.

Consultation:
Resident - Mr Allen of Injune

Policy Implications
Nil

Financial Resource Implications:
From Roads Maintenance budget.

Supporting Documentation:
Nil

OFFICER REPORT

Meeting: General 26 September 2018 **Date:** 26 September 2018

Item Number: L.2 **File Number:** D18/76480

SUBJECT HEADING: Capital Works Program 2018/19

Classification: Open Access

Officer's Title: Manager – Program & Contract Management

Executive Summary:
The 2018/19 Budget includes a number of Capital Works Projects to be delivered across the Maranoa Region. At the last meeting it was resolved that the report be represented as follows:

Resolution No. GM/09.2018/45

That:

1. ***Council receive and note the 2018/19 Capital Works Program – Scheduling Overview [Version 1].***

2. ***The item be re-tabled at the next General Meeting to provide additional time for Councillors to provide feedback.***

Officer's Recommendation:
That Council endorse the program as the baseline schedule for 2018/19.

Body of Report:
At the Special Budget Meeting on 26 July 2018 Council handed down the Budget for the 2018/19 financial year. This report presents a summary of the 2018-19 Capital Works Projects and the planned delivery schedule for these works.

The *2018-19 Capital Works Program – Scheduling Overview [Version 1]* is attached as supporting documentation to this report.

A number of key points to note:

- Each project on the program is linked to the Corporate Plan by function (i.e. water, sewerage, facilities etc).

- Each project is reported based on the "local area" in which the project is being delivered. For projects that aim to provide an overall regional benefit, the local area is noted as "Regional".

- The timeframes reported are based on physical delivery (i.e. when the residents will see the project happening).

- The planned delivery timeframes will be used a baseline reporting for the quarterly reports throughout the 2018/19 financial report.

The scope of the report includes only the new 2018/19 projects. The 2017/18 carry over projects will be added and reported in the Quarter 1 Capital Program Report (i.e. Traffic Light Report).

Consultation (internal/external):
Chief Executive Officer
Deputy CEO / Director, Development, Facilities & Environmental Services
Director – Infrastructure
Manager - Water Sewerage & Gas
Manager - Construction
Manager - Manager, Economic & Community Development
Manager - Airports (Roma, Injune, Surat, Mitchell)
Manager - Saleyards
Manager - Facilities (Land, Buildings & Structures)
Manager - Environment, Health, Waste & Rural Land Services
Manager - ICT Solutions
Manager - Procurement & Commercial Services
Operations Manager - Plant, Fleet & Workshops

Risk Assessment (Legal, Financial, Political etc.):
A number of constraints, considerations and programming risks have been detailed under the programmer's notes section of the *2018-19 Capital Works Program – Scheduling Overview.*

The program outlines a plan for the delivery of Capital Works throughout the 2018/19 year. There are a number of events that can occur throughout the year that may impact on the actual delivery of the projects listed on the program.

This could include events such as wet weather, additional projects that may be added to the program throughout the year, change in delivery priorities etc.

Policy Implications:
Nil

Financial Resource Implications:
Nil. The *2018-19 Capital Works Program – Scheduling Overview [Version 1]* presents budget figures as per those adopted at the Special Budget Meeting on 26 July 2018.

Link to Corporate Plan:
Corporate Plan 2018-2023
Strategic Priority 5: Managing our operations well
5.4 Keep our community informed of Council's decisions, services and projects
5.4.2 Progressively tailoring our communications to the needs, interests and preferences of our communities and stakeholders.

Supporting Documentation:

1⇩ 2018-19 Capital Works Program - Scheduling Overview V1 - Attachment 1 D18/72204

Report authorised by:

Director - Development, Facilities & Environmental Services

2018-19 CAPITAL WORKS PROGRAM - Scheduling Overview
Version 1 (10 September 2018)

Legend: S - Start, F - Finish

Link to Corporate Plan (Function)		Investment Type	Project Name	Local Area	Project Budget	Physical Delivery (i.e. when the residents will see)				Programmers Notes
						Q1	Q2	Q3	Q4	
1.01	Water	Renewal	Water main poly renewal Mungallala Railway line	Mitchell and Surrounds	30,000		S + F			
1.01	Water	Renewal	Water main renewal Mitchell - Oxford St, Ann St to Caroline St	Mitchell and Surrounds	85,000	S	F			Procurement Opportunity - combined purchasing for all main renewals in Mitchell.
1.01	Water	Renewal	Water main renewal Mitchell - Ann St, Oxford St to Cambridge St	Mitchell and Surrounds	100,000	S	F			
1.01	Water	Renewal	Water main renewal Mitchell - Adelaide St, Alice to Ann St	Mitchell and Surrounds	55,000		S + F			
1.01	Water	Renewal	Water main renewal Mitchell - Edinburgh, Alice St to Ann St	Mitchell and Surrounds	55,000		S	F		
1.01	Water	Renewal	Water main renewal Mitchell - Ann St, Liverpool St to Adelaide St	Mitchell and Surrounds	80,000		S + F			
1.01	Water	Renewal	Lining of Mitchell water tower	Mitchell and Surrounds	120,000				S + F	Delivery programmed to avoid peak water demand.
1.01	Water	New	SCADA for water supplies - regional sites	Regional	100,000		S		F	
1.01	Water	Renewal	Muckadilla water supply renewal	Roma and Surrounds	60,000			S + F		
1.01	Water	Renewal	Northern Road booster Station renewal, Roma	Roma and Surrounds	250,000			S	F	
1.01	Water	Upgrade	Upgrade chlorination at Roma Tower	Roma and Surrounds	250,000		S	F		
1.01	Water	New	Roma - Tiffin St Fire Flow augmentation	Roma and Surrounds	320,000			S	F	
1.01	Water	New	Meters for raw water in Surat stage 1	Surat and Surrounds	50,000			S + F		
1.02	Sewerage	Renewal	2018-19 Sewer Relining Progam	Regional	3,600,000		S		F	Early 18/19 tender expected to yield the most competitive rates.
1.02	Sewerage	New	SCADA for sewerage facilities supplies - Roma & regional sites	Regional	400,000		S		F	
1.03	Roads and Drainage	Renewal	Gunnewin West Road - [R2R] Gravel Resheet - Ch 21.82 to Ch 30.80	Injune and Surrounds	305,730			S + F		Funding Constraint - final year of current R2R Program. Works to be completed by 30 June.
1.03	Roads and Drainage	Renewal	Kooragan Road - Gravel Resheet - Ch 17.40 to Ch 22.60	Injune and Surrounds	159,244				S + F	
1.03	Roads and Drainage	Renewal	Westgrove Road - Gravel Resheet - Ch 47.38 to Ch 53.40	Injune and Surrounds	219,132				S + F	
1.03	Roads and Drainage	Upgrade - Resource	Injune - Taroom Road (IT3B) - Construct to 8.0m Bitumen Seal - Ch 29.56 to Ch 32.00	Injune and Surrounds	4,596,214			S		
1.03	Roads and Drainage	Upgrade - Resource	Injune - Taroom Road (IT3B) - Construct to 8.0m Bitumen Seal - Ch 32.00 to Ch 38.30	Injune and Surrounds	7,013,199			S		
1.03	Roads and Drainage	Upgrade - Resource	Bonnydoon Road (BD1) - Construct to 8.0m Bitumen Seal - Ch 0.00 to Ch 5.80	Injune and Surrounds	6,456,596				S	
1.03	Roads and Drainage	Renewal	Ronald Street, Injune - Kerb renewal from Third to Fourth	Injune and Surrounds	23,750				S + F	
1.03	Roads and Drainage	Renewal	Fourth Avenue, Injune - Kerb renewal from Hutton to Ronald	Injune and Surrounds	49,600				S + F	
1.03	Roads and Drainage	Renewal	Bollon Road - [TIDS/R2R] - Gravel Resheet - Ch 160.00 to Ch 174.00	Mitchell and Surrounds	1,060,000	S	F			Funding Constraint - unable to carry over TIDS. Works to be completed by 30 June.
1.03	Roads and Drainage	Renewal	Mt Moffatt Road - [TIDS/R2R] - Gravel Resheet - Ch 96.90 to Ch 103.90	Mitchell and Surrounds	580,000				S + F	Funding Constraint - unable to carry over TIDS. Large TIDS Project scheduled for 2019/20 - save on mobilisation.
1.03	Roads and Drainage	Renewal	Redford Road - [TIDS/R2R] - Gravel Resheet - Ch 84.00 to Ch 91.70	Mitchell and Surrounds	490,000	S + F				Funding Constraint - unable to carry over TIDS. Works to be completed by 30 June.
1.03	Roads and Drainage	Renewal	Ashmount Road - Gravel Resheet - Ch 38.63 to Ch 47.70	Mitchell and Surrounds	322,062			S + F		
1.03	Roads and Drainage	Renewal	Gunnawarra Road - Gravel Resheet - Ch 5.90 to Ch 17.50	Mitchell and Surrounds	408,319		S + F			
1.03	Roads and Drainage	Renewal	Pinelands Road - Gravel Resheet - Ch 0.00 to Ch 3.80	Mitchell and Surrounds	115,010				S + F	
1.03	Roads and Drainage	Renewal	Tomoo Road (a) - Gravel Resheet - Ch 42.20 to Ch 53.50	Mitchell and Surrounds	384,501		S	F		
1.03	Roads and Drainage	Renewal	Warrong Road (a) - Gravel Resheet - Ch 21.51 to Ch 23.52	Mitchell and Surrounds	67,033			S + F		
1.03	Roads and Drainage	Renewal	Warrong Road (b) - Gravel Resheet Ch 25.12 to Ch 28.92 and Ch 29.90 to Ch 38.82	Mitchell and Surrounds	161,627			S + F		
1.03	Roads and Drainage	Renewal	[Unallocated] Minor Projects <$50K	Regional	279,283	S			F	
1.03	Roads and Drainage	Renewal	Rural Road Bitumen Reseal Program	Regional	1,932,000		S	F		Complete within Optimum Bitumen Window (October - March).
1.03	Roads and Drainage	Renewal	Rural Road Bitumen Rehabilitation Program	Regional	611,748			S + F		Complete within Optimum Bitumen Window (October - March).
1.03	Roads and Drainage	Renewal	Urban Street Bitumen Reseal Program	Regional	401,376		S	F		Complete within Optimum Bitumen Window (October - March).
1.03	Roads and Drainage	Renewal	Urban Street Bitumen Rehabilitation Program	Regional	335,300			S + F		Complete within Optimum Bitumen Window (October - March).
1.03	Roads and Drainage	Renewal	Stormwater Pit and Lintel Renewal Program	Regional	256,250				S + F	
1.03	Roads and Drainage	Renewal	Upgrade of Footpaths - 50% Contribution	Regional	30,000					Not programmed. Budget allowance for contribution/s.
1.03	Roads and Drainage	Renewal	Donnybrook Road - Gravel Resheet - Ch 29.30 to Ch 35.10	Roma and Surrounds	157,684				S + F	
1.03	Roads and Drainage	Renewal	Eumina Road - Gravel Resheet - Ch 0.00 to Ch 2.40	Roma and Surrounds	77,700				S + F	
1.03	Roads and Drainage	Renewal	Glen Arden Road - Gravel Resheet - Ch 4.10 to Ch 12.10	Roma and Surrounds	251,797				S + F	
1.03	Roads and Drainage	Renewal	Orallo Road - Gravel Resheet - Ch 33.92 to Ch 39.10	Roma and Surrounds	182,927			S + F		
1.03	Roads and Drainage	Renewal	Orallo Road - Gravel Resheet - Ch 58.74 to Ch 62.94	Roma and Surrounds	102,080			S + F		
1.03	Roads and Drainage	Renewal	Seventeen Mile Lane (a) - Gravel Resheet - Ch 0.00 to Ch 3.00	Roma and Surrounds	81,664		S	F		
1.03	Roads and Drainage	Renewal	Seventeen Mile Lane (b) - Gravel Resheet - Ch 10.95 to Ch 22.45	Roma and Surrounds	368,000		S	F		
1.03	Roads and Drainage	Upgrade	Roma Southern Road / Duke Street	Roma and Surrounds	2,437,692			S		Funding Constraint - unable to carry over TIDS. Project CONFLICT - Duke Street Water Main (17/18 C/O).
1.03	Roads and Drainage	Renewal	Charles Street, Roma - Kerb renewal	Roma and Surrounds	34,300				S + F	
1.03	Roads and Drainage	Renewal	Raglan Street / Warrego Highway, Roma - Kerb renewal from Vanderfield to Vause	Roma and Surrounds	100,000				S + F	
1.03	Roads and Drainage	Renewal	Station Street, Roma - Kerb renewal from Wyndham to Charles	Roma and Surrounds	44,100				S + F	
1.03	Roads and Drainage	Renewal	Oberlina Road - Gravel Resheet - Ch 0.00 to Ch 3.00	Surat and Surrounds	108,885		S + F			
1.03	Roads and Drainage	Renewal	River Road - Gravel Resheet - Ch 16.50 to Ch 26.50	Surat and Surrounds	408,320		S + F			
1.03	Roads and Drainage	Renewal	Thomby Road - [R2R] Gravel Resheet - Ch 59.36 to Ch 70.76	Surat and Surrounds	504,480		S + F			Funding Constraint - final year of current R2R Program. Works to be completed by 30 June.
1.03	Roads and Drainage	Renewal	Kangaroo Creek Road - Gravel Resheet - Ch 3.50 to Ch 7.90	Yiwu and Surrounds	179,661		S + F			

2018-19 CAPITAL WORKS PROGRAM - Scheduling Overview
Version 1 (10 September 2018)

Legend: S - Start, F - Finish

Link to Corporate Plan (Function)		Investment Type	Project Name	Local Area	Project Budget	Physical Delivery (i.e. when the residents will see)				Programmers Notes
						Q1	Q2	Q3	Q4	
1.03	Roads and Drainage	Upgrade - Resource	Cottage Creek Road - Construct to 7.0m Bitumen Seal - Ch 0.00 to Ch 6.00	Y/W/J and Surrounds	3,781,000	S	F			
1.03	Roads and Drainage	Renewal - Resource	Angry Jungle - Gravel Resheet - Ch 0.00 to Ch 3.10	Y/W/J and Surrounds	170,500	S + F				
1.03	Roads and Drainage	Upgrade - Resource	Tornoweap Road - Gravel Resheet - Ch 0.00 to Ch 1.76 + Dust Seal	Y/W/J and Surrounds	352,000		S + F			
1.03	Roads and Drainage	Upgrade - Resource	Howards Road - Gravel Resheet - Ch 2.10 to Ch 3.10	Y/W/J and Surrounds	55,000	S	F			
1.04	Parks, Gardens and Reserves	Renewal	Refurbishment of the Big Rig Tourist train bridge	Roma and Surrounds	250,000				S + F	Manage around Easter / Wet Weather (Bungil Creek).
1.04	Parks, Gardens and Reserves	New	Cobb & Co Park Redevelopment Yuleba - Stage 2	Y/W/J and Surrounds	50,000					Stage 1 improvements to be completed in time for the 95th Anniversary Cobb & Co Festival in August 2019 - D18/30419.
4.04	Airports	Upgrade	Design works for movement area and lighting replacements for Injune Aerodrome	Injune and Surrounds	23,000		S	F		
4.04	Airports	Upgrade	Design works for movement area and lighting replacements for Mitchell Aerodrome	Mitchell and Surrounds	24,000		S	F		
4.04	Airports	Renewal	Roma Airport Lock Replacement	Roma and Surrounds	35,000			S + F		
4.04	Airports	Renewal	Roma Explosive Trace Detection Replacement	Roma and Surrounds	85,000	S	F			
4.04	Airports	New	Roma Airport UPS	Roma and Surrounds	140,000		S	F		
4.04	Airports	Upgrade	Design works for movement area and lighting replacements for Surat Aerodrome	Surat and Surrounds	23,000		S	F		
4.05	Saleyards	New	Roma Saleyards Improvement Plan Stage 3: Weighbridge area - detailed design	Roma and Surrounds	70,000	S	F			
4.05	Saleyards	Upgrade	Roma Saleyards Safety Improvements to Ramp 2	Roma and Surrounds	150,000	S		F		
4.05	Saleyards	New	Roma Saleyards Improvement Plan Stage 2: Safety, Security & Productivity Improvements - detailed designs	Roma and Surrounds	50,000	S	F			
4.05	Saleyards	New	Roma Saleyards Multi-Purpose Building	Roma and Surrounds	7,922,966		S			Funding Constraint (all Project Activities to be completed by 30 September 2020). Estimated construction ~ 10 months.
4.06	Gas	Renewal	Replace steel gas mains with PVC, Roma - Station Street, Whip Street & McDowall Street	Roma and Surrounds	55,000		S + F			
4.06	Gas	Renewal	Replacement meters program	Roma and Surrounds	20,000	S			F	
4.06	Gas	New	Extend gas main network – South Street, Roma	Roma and Surrounds	10,000		S + F			
4.06	Gas	New	Extend gas main network – Roma	Roma and Surrounds	100,000					Not programmed. Budget allowance included for possible request for extensions.
4.09	Facilities	Upgrade	Housing upgrade - 54 Ronald St Injune (Kitchen)	Injune and Surrounds	15,000		S	F		Property Tenanted. Procurement Opportunity - package housing upgrades by Town.
4.09	Facilities	Upgrade	Injune Rodeo Canteen & Bar - upgrade power supply	Injune and Surrounds	10,990		S + F			
4.09	Facilities	Upgrade	Injune swimming wade pool - upgrade and repair (fibreglassing)	Injune and Surrounds	30,619				S + F	Complete outside regular pool season.
4.09	Facilities	Upgrade	Housing upgrade - 36 Edinburgh St Mitchell (Restumping)	Mitchell and Surrounds	12,000		S	F		Property Tenanted. Procurement Opportunity - package Housing Upgrade by Town.
4.09	Facilities	New	Airconditioning Mitchell Library	Mitchell and Surrounds	70,000			S + F		
4.09	Facilities	Renewal	Mitchell Saleyards - fence replacement	Mitchell and Surrounds	25,000		S + F			
4.09	Facilities	New	New Ring fence for Mitchell Showground	Mitchell and Surrounds	15,000					Not programmed. Budget allowance only - for approximately 50% of project.
4.09	Facilities	New	Great Artesion Spa - construct compliant disability parking	Mitchell and Surrounds	10,000			S + F		After Tourist Season.
4.09	Facilities	Upgrade	Energy upgrades to Council facilities	Regional	1,500,000		S			Pool Component - review after completion of feasibility.
4.09	Facilities	Upgrade	Housing upgrade - Bassett Park Caretaker's Residence (Bathroom)	Roma and Surrounds	12,000		S	F		Property Tenanted. Procurement Opportunity - package Housing Upgrade by Town.
4.09	Facilities	New	Big Rig - supply and install new display fridge	Roma and Surrounds	10,600		S + F			
4.09	Facilities	Upgrade	Big Rig - upgrade of after-hours access into the Big Rig Café	Roma and Surrounds	9,000		S + F			Provision of after-hours access (Thai Restraunt) part of lease agreement.
4.09	Facilities	New	Bassett Park - KD Bar shade extension	Roma and Surrounds	10,000			S + F		Complete before Easter Rodeo.
4.09	Facilities	Upgrade	Construction of awning off lunch room Roma Infrastructure Depot	Roma and Surrounds	9,000		S + F			Before Typical Wet Season (Dec - Feb).
4.09	Facilities	New	Ramp and landing Roma & District Lapidary, Minerals Society	Roma and Surrounds	26,500			S + F		
4.09	Facilities	New	Aircondition Roma History Lodge (Reverse Cycle) - Contribution Only	Roma and Surrounds	5,000		S + F			Not programmed. Budget allowance for contribution/s.
4.09	Facilities	New	Exhaust canopy - Surat Recreation Grounds Canteen	Surat and Surrounds	15,000			S + F		
4.09	Facilities	Renewal	Surat Aquarium - refurbishment of display tanks	Surat and Surrounds	72,540			S + F		Before start of Tourist Season.
4.09	Facilities	New	Surat Administration Office - install generator	Surat and Surrounds	30,000		S + F			Purchase through Plant. Before Summer - high chance of power outages.
4.09	Facilities	Renewal	Surat wading pool replace pipework valves & outlets	Surat and Surrounds	38,000				S + F	Complete outside regular pool season.
4.09	Facilities	Renewal	Surat wading pool fibreglass the wading pool & walls	Surat and Surrounds	21,000				S + F	Complete outside regular pool season.
4.09	Facilities	Upgrade	Housing upgrade - 18 Stephenson St Yuleba (Kitchen/Laundry)	Y/W/J and Surrounds	25,000		S	F		Property Tenanted. Procurement Opportunity - package Housing Upgrade by Town.
4.09	Facilities	Upgrade	Housing upgrade - 18 Stephenson St Yuleba (Replace Guttering)	Y/W/J and Surrounds	8,000		S	F		Property Tenanted. Procurement Opportunity - package Housing Upgrade by Town.
4.09	Facilities	Upgrade	Housing upgrade - 50 Stephenson St Yuleba (Bathroom)	Y/W/J and Surrounds	18,000		S	F		Property Tenanted. Procurement Opportunity - package Housing Upgrade by Town.
4.12	Sport and Recreation	Upgrade	Bassett Park Rodeo Arena - upgrade fence and surface	Roma and Surrounds	90,000				S + F	Submitting application under Sport and Rec (Round 7). Works programmed after Easter in the Country.
4.12	Sport and Recreation	Upgrade	Bassett Park Dog Trial Area - rework sheep dog arena	Roma and Surrounds	25,000		S	F		To be completed before Roma Show.
4.13	Libraries	New	Temporary Wallumbilla Library - relocate and fitout	Y/W/J and Surrounds	40,000		S + F			
5.02	Information and Communication Technology	New	Photocopier schedule replacement program	Regional	44,000	S		F		
5.02	Information and Communication Technology	New	Host Server replacement programme	Regional	100,000		S	F		
5.02	Information and Communication Technology	New	Security System and CCTV Yuleba Service Centre	Y/W/J and Surrounds	12,925	S	F			
5.03	Human Resources	New	Drug and Alcohol testing equipment	Regional	22,000					
5.05	Plant, Fleet, Workshops and Depots	New	Electric forklift Mitchell depot	Mitchell and Surrounds	18,000	S + F				
5.05	Plant, Fleet, Workshops and Depots	New	Plant Capital Program 2018-19	Regional	2,590,000	S			F	
Program Total					**55,157,102**					

OFFICER REPORT

Meeting: General 26 September 2018 **Date:** 24 September 2018

Item Number: L.3 **File Number:** D18/76002

SUBJECT HEADING:	Response to Petroleum and Gas Lease Application Number APP0021716 - Armour Energy (Surat Basin) Pty Ltd
Classification:	Open Access
Officer's Title:	Manager – Program & Contract Management

Executive Summary:
Armour Energy (Surat Basin) Pty Ltd has submitted an application to the Department of Environment and Science to amend Environmental Authority EPPG00342913. Maranoa Regional Council has been referenced in the application without prior advice of the inclusion or consultation.

The report recommends that Council make submission to the Department of Environment and Science regarding the application APP0021716 specifically in relation to the current wording in the application about the sourcing of water.

Officer's Recommendation:
That Council:

1. Note that the matter was raised with Armour Energy on Friday 21 September 2018 seeking further information.

2. Note the verbal advice received by the Chief Executive Officer on 25 September 2018 that the public notice period is being extended by 20 business days (previously closing at 4.30pm on 3 October 2018).

3. Request a briefing for Council from Armour Energy no later than a week prior to the close of the public notice period.

4. Authorise the Chief Executive Officer (or delegate) to make a submission to the Department of Environment and Science regarding the application APP0021716 formally raising:

    - Lack of consultation with Maranoa Regional Council;

    - Concerns if there was or is any intention to source water from the town of Surat, noting that Council and the community is already needing to actively manage its water consumption within the allocation permitted by the State Government;

    - Any other issues that may emanate from the briefing to Councillors.

Body of Report:

Background

- Armour Energy (Surat Basin) Pty Ltd is authorised to conduct petroleum activities within Petroleum Lease (PL) 71 in accordance with Environmental Authority (EA) EPPG00342913.

- Armour Energy has submitted an application to the Department of Environment and Science to amend Environmental Authority EPPG00342913.

- The amendment seeks to include hydraulic fracture simulation (HFS) activities at twenty one (21) new well locations, within the tenure boundary of PL71.

Petroleum Lease 71

- PL71 is located in the local government area of Maranoa Regional Council. It is located approximately 30 kilometres south east of Surat.

- A locality map of PL71 is included as supporting documentation to this report.

Amendment Application

- Under the Amendment Application APP0021716, Maranoa Regional Council has been cited as being the intended supplier of the water for the HFS activities. Page 48 of the application notes:

  "In terms of aquifer drawdown, Armour Energy intends to source water from the Maranoa Regional Council for its HFS activities, so will not be extracting water from an aquifer."

- Section 3.1.2.2 of the application contemplates the amount of water that would be required for the HFS activities. Page 18 of the application notes:

  "Each well will be perforated at depth (i.e. within the section of casing located in the reservoir) so that the stimulation fluid can be pumped into that target formations.

  Approximately 2 - 3 megalitres of pre-mixed stimulation fluid (comprising of approximately 96% water, 3.5% or more of ceramic proppant and 0.5% or less of trace additives) will then be pumped from the surface down into the well casing under high pressure (around 6,000-7,000psi) to create controlled fractures in the target formations."

  Based on an assumption that 2.5ML was required for each well, this equates to 52.5ML of water. For context, the total annual water allocation for Surat is 350ML.

Summary of Water Management in Surat

- Refer Risk Assessment and Policy Implications sections of this report.

Public Notice and Submissions

- The proposed amendment to the EA is considered a "major amendment" and therefore triggers the requirement for the application to be open for public notice.

- Public notice provides an opportunity to make submissions on environmental authority applications. These submissions will be taken into consideration during assessment by the Department of Environment and Science.

- Submissions pertaining to application APP0021716 were to be submitted on or before 4.30pm on 3 October 2018.

- Verbal advice has been received that the public notice period is being extended by 20 business days.

Consultation (internal/external):
No consultation has occurred with Maranoa Regional Council prior to the statement about water appearing in the application.

The matter has been raised with the CEO of Armour Energy (Friday 21 September 2018). An officer made contact with Council yesterday (25 September 2018), in part advising that the public notice period is being extended.

This will also allow time for Council to provide a submission. .

Risk Assessment (Legal, Financial, Political etc.):

- Managing the Water Allocation – The water allocation for the town of Surat was exceeded in 2017/18. Sale of large quantities of water to any third party at Surat is likely to introduce additional risks to Council around exceeding this allocation.

Policy Implications:

- Council currently have in place water conservation measures for the town of Surat. Whilst these measures do not specifically mandate a restriction on the sale of water to a third party, one of the main objectives is to manage water consumption for the town with respect to our current water allocation limits.

- The sale of the assumed quantities of water would be seen as a conflict to the intent of the current measures in place.

Financial Resource Implications:

- Whilst the sale of potable water to third parties provides Council with an additional revenue stream, the past water usage in Surat has demonstrated that Council has little capacity within the allocation to supply large quantities of water for third party operations.

- There is a financial/revenue opportunity to supply water from other areas within the Maranoa Regional Council (i.e. Roma), however the location is likely to render these alternatives as cost prohibitive.

Link to Corporate Plan:

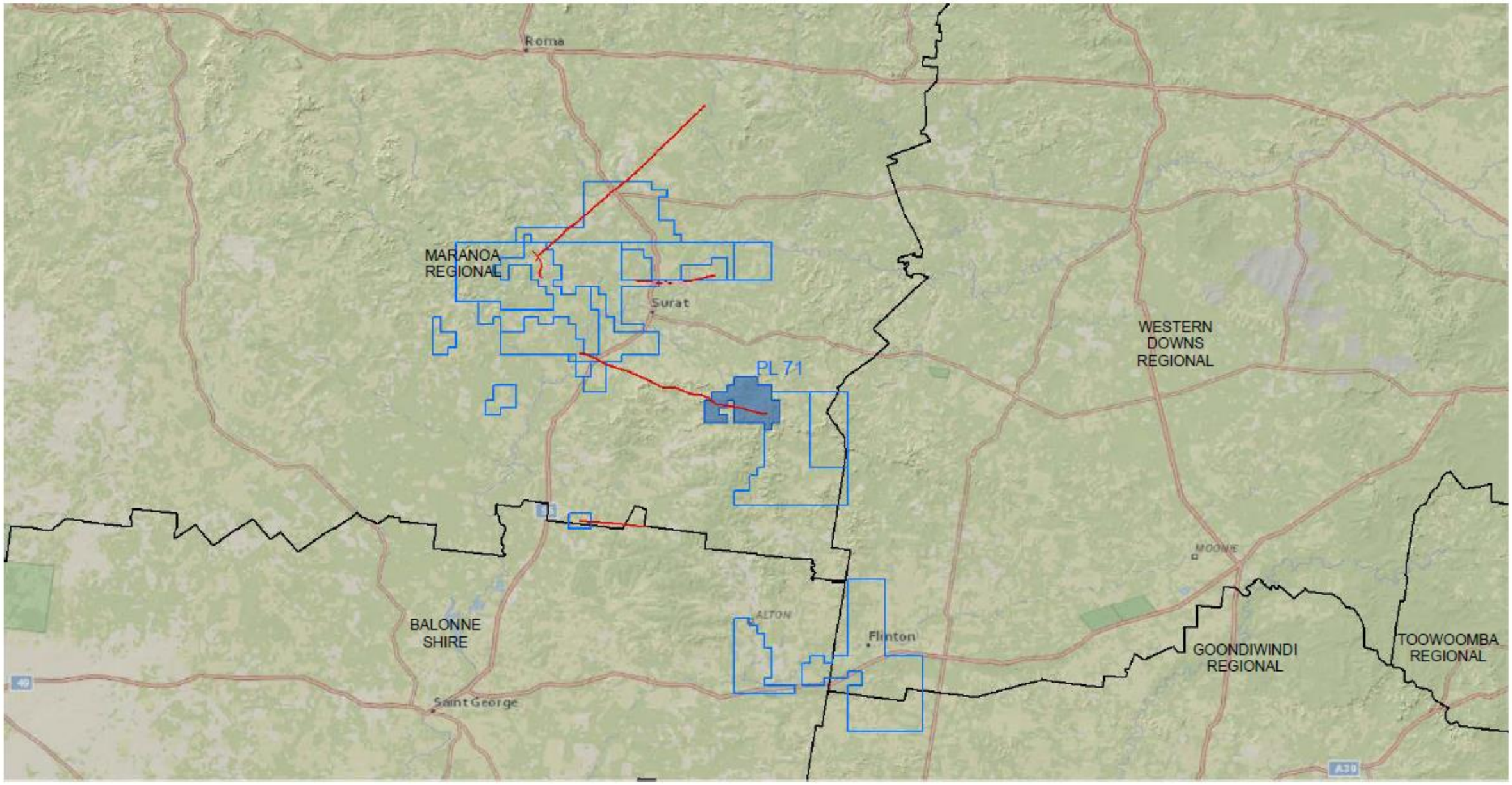
Corporate Plan 2018-2023
Strategic Priority 1: Getting the basics right
1.1 Supply water to our towns
1.1.6 Keep Council and the Surat community updated about water usage levels to ensure adherence to the State Government's annual allocation for water extraction from the Balonne River (Surat).

Supporting Documentation:

1⇩	PL 71 Locality Map - Armour Energy	D18/75938
2⇩	Armour Energy Environmental Authority (EPPG00342913) Amendment Application	D18/75949

Report authorised by:

Director - Development, Facilities & Environmental Services
Chief Executive Officer



PL 71 Locality Map

armour energy

Datum: GDA 94 Lat/Long Date: 15/07/2018

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Legend

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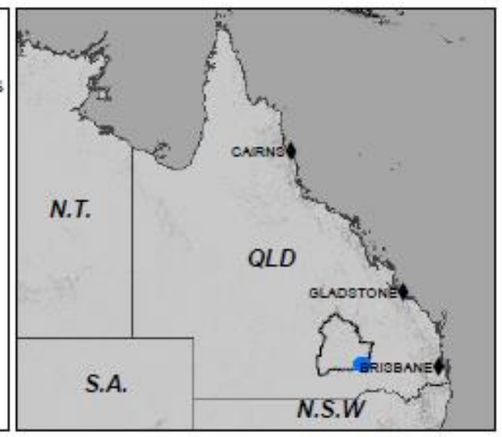
- Current Armour Energy Tenements
- Armour Energy PPL's
- Local Governmnet Boundaries



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Quality outcomes

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ENVIRONMENTAL AUTHORITY (EPPG00342913) AMENDMENT APPLICATION

Supporting Information Report

FINAL

August 2018

ENVIRONMENTAL AUTHORITY (EPPG00342913) AMENDMENT APPLICATION

Supporting Information Report

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Armour Energy (Surat Basin) Pty Limited

Project Director: Scott Dale
Project Manager: Scott Dale
Report No. 7033_R01_V1
Date: August 2018

Newcastle

75 York Street
Teralba NSW 2284

Ph. 02 4950 5322

www.umwelt.com.au

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	Scott Dale	6 August 2018	Scott Dale	6 August 2018

umwelt

Table of Contents

Figures

Tables

Appendices

Abbreviations

The following abbreviations are used throughout this Supporting Information Report.

Abbreviation	Description
AHD	Australian Height Datum
APLNG	Australian Pacific LNG
Armour Energy	Armour Energy (Surat Basin) Pty Limited ACN 607504905
ARI	Area of regional interest
AS	Australian Standard
BoM	Bureau of Meteorology
CMA	Cumulative management area
CSG	Coal Seam Gas
dB(A)	A-weighted decibel
DES	Department of Environment and Science
DNRM	Department of Natural Resources and Mines
EA	Environmental Authority EPPG00342913
EHP	Department of Environment and Heritage Protection
EP Act	*Environmental Protection Act 1994* (Qld)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPP Air	*Environmental Protection (Air) Policy 2008* (Qld)
EPP Noise	*Environmental Protection (Noise) Policy 2008* (Qld)
EPP Water	*Environmental Protection (Water) Policy 2009* (Qld)
ERA	Environmentally Relevant Activities
ESA	Environmentally Sensitive Areas
GAB	Great Artesian Basin
HFS	Hydraulic fracture simulation
IECA	International Erosion Control Association
Km	Kilometre
m	Metre
NA	Not Applicable
OGIA	Office of Groundwater Impact Assessment
PL	Petroleum Lease
RIDA	Regional Interests Development Approval
UWIR	Underground water impact report

1.0 Introduction

1.1 Overview

Armour Energy (Surat Basin) Pty Limited ACN 607504905 (Armour Energy), a wholly-owned subsidiary of Armour Energy Limited ACN 141 198 414 (Armour), is authorised to conduct petroleum activities within Petroleum Lease (PL) 71, located in the Surat Basin (refer to **Figure 1.1**), in accordance with Environmental Authority (EA) EPPG00342913.

This Supporting Information Report has been prepared to accompany an amendment application under section 224 of the *Environment Protection Act 1994* (EP Act) to the Department of Environment and Science (DES).

This EA amendment application seeks to authorise hydraulic fracture simulation (HFS) activities and the inclusion of twenty one (21) new well locations, within the tenure boundary of PL71. The location of these proposed wells are shown in **Figures 1.2** to **1.8**.

1.2 Assessment Level Decision

Section 223 of the EP Act defines a "major amendment" for an EA as an amendment that is not a "minor amendment."

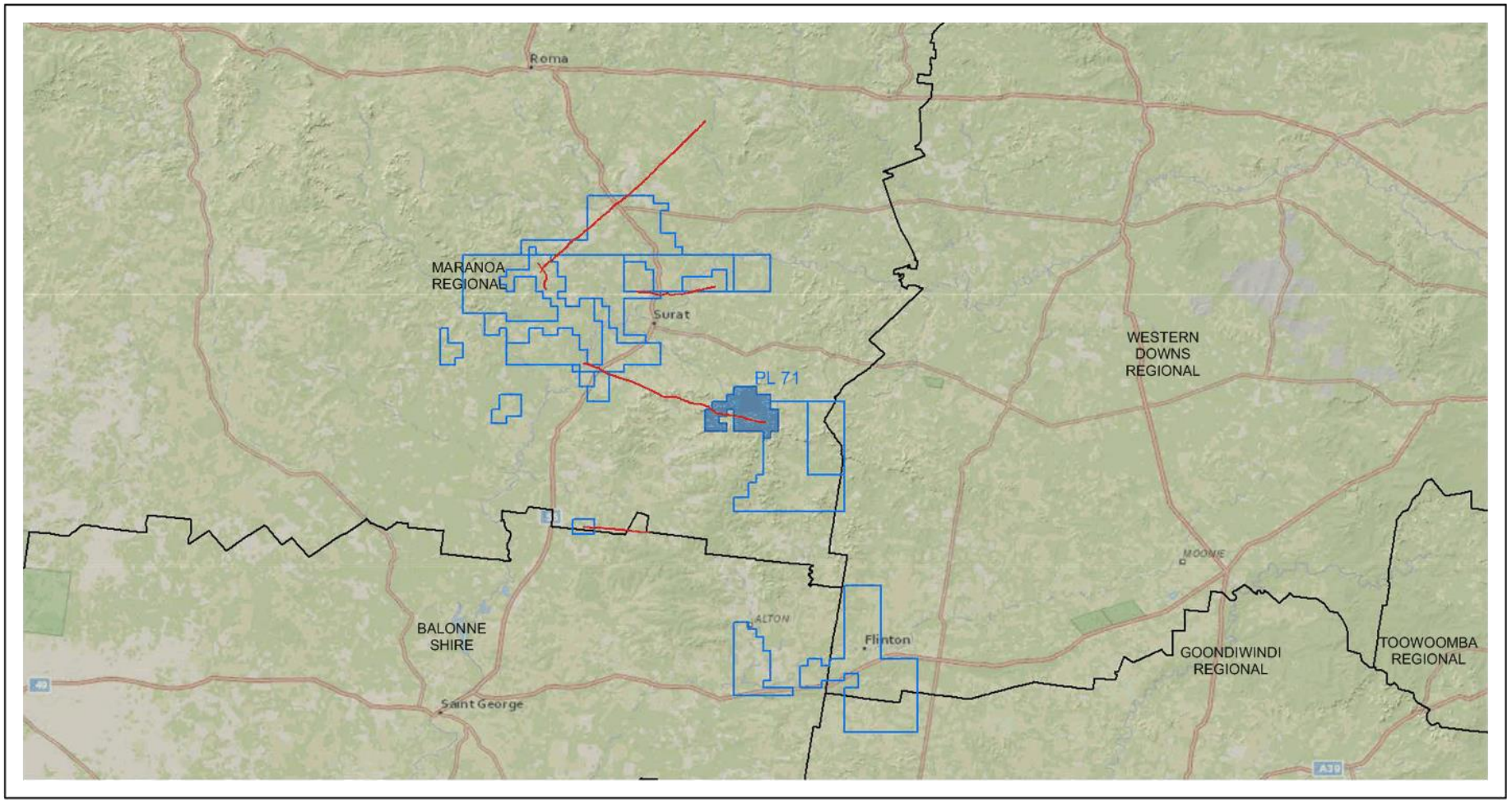
A "minor amendment" is an amendment that involves either a condition conversion or an amendment that meets the minor amendment threshold.

The proposed amendment does not involve a condition conversion and does not satisfy the minor amendment threshold and is therefore a major amendment.

1.3 Associated Document References

In support of this amendment application, associated documents include:

- Armour Energy (Surat Basin) Pty Ltd "Surat Operations Environmental Management Plan"
- Armour Energy (Surat Basin) Pty Ltd "Site Emergency Response Plan - Surat Basin"
- Armour Energy (Surat Basin) Pty Ltd "Well Integrity Management Plan"
- Armour Energy (Surat Basin) Pty Ltd "Unexpected Aboriginal Cultural Heritage Find"
- Armour Energy (Surat Basin) Pty Ltd "Erosion and Sediment Control Plan"



PL 71 Locality Map

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Datum: GDA 94 Lat/Long Date: 15/07/2018

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Armour Energy (Surat Basin) Pty Ltd gives no warranty to the data (including accuracy, reliability, completeness or suitability) and accepts no liability for any loss, damage or costs (including consequential damage) relating to any use of the data in this map.

Legend

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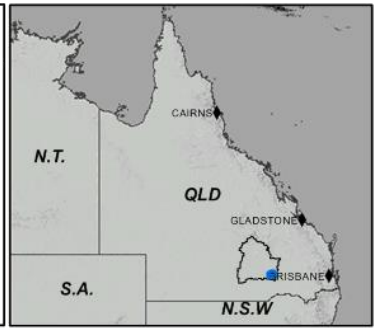
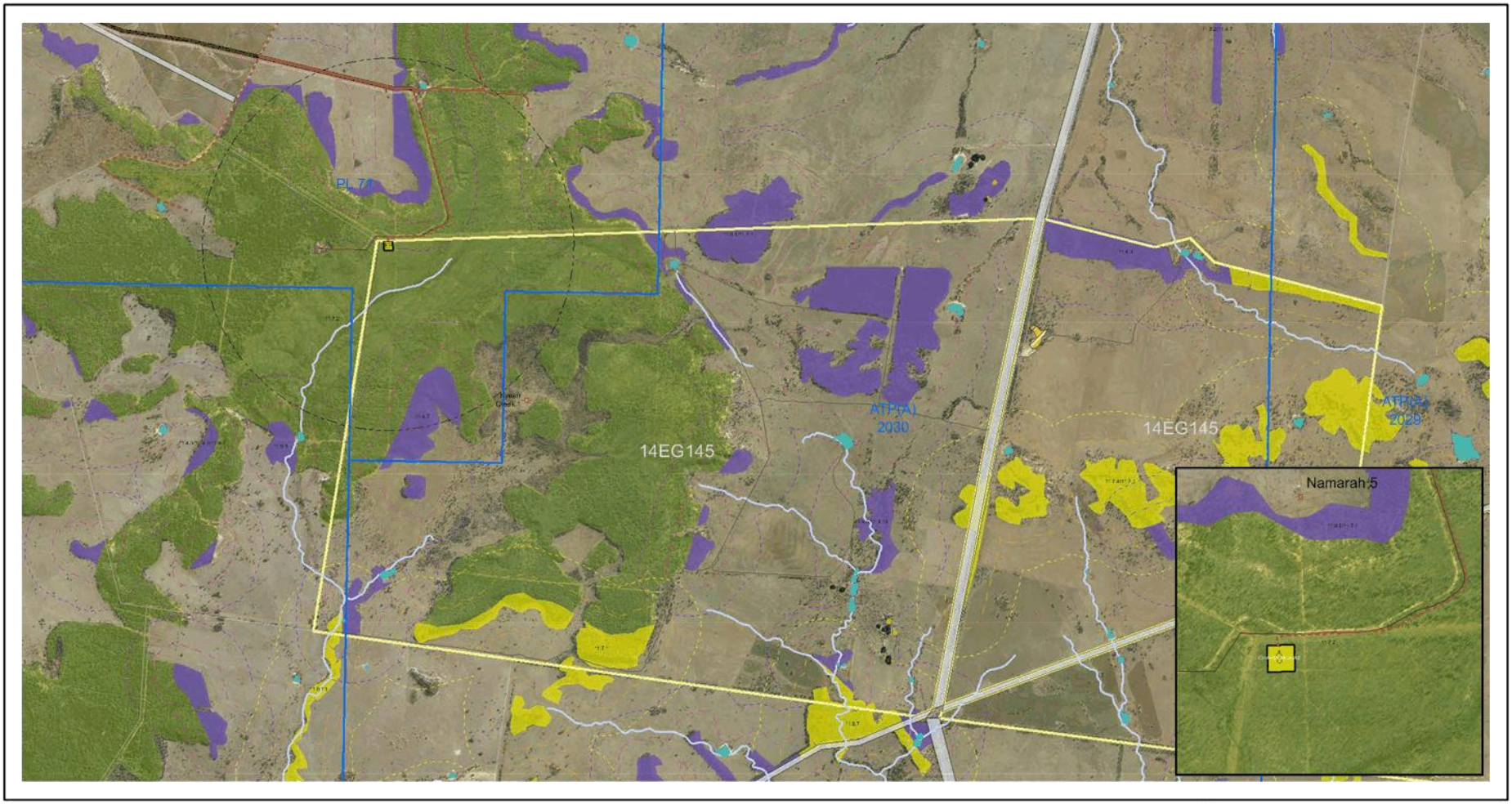
- Current Armour Energy Tenements
- Armour Energy PPL's
- Local Governmnet Boundaries





EA Amendment Review for Petroleum Licence 71 (PL 71)
Property Owner: DIANA MCLELLAND WARBY AND JOYCE EVA WARBY
Lot Plan: 14EG145
Property Address: 8841 Teelba Road Teelba QLD (Maranoa Regional)

armour energy

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- Landholder Structure
- Gazetted Easement
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- Gazetted Road
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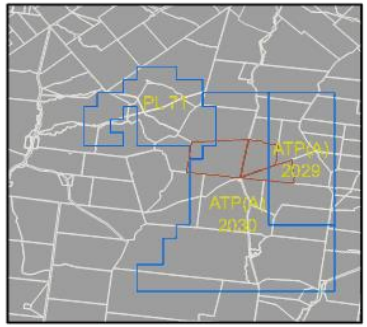

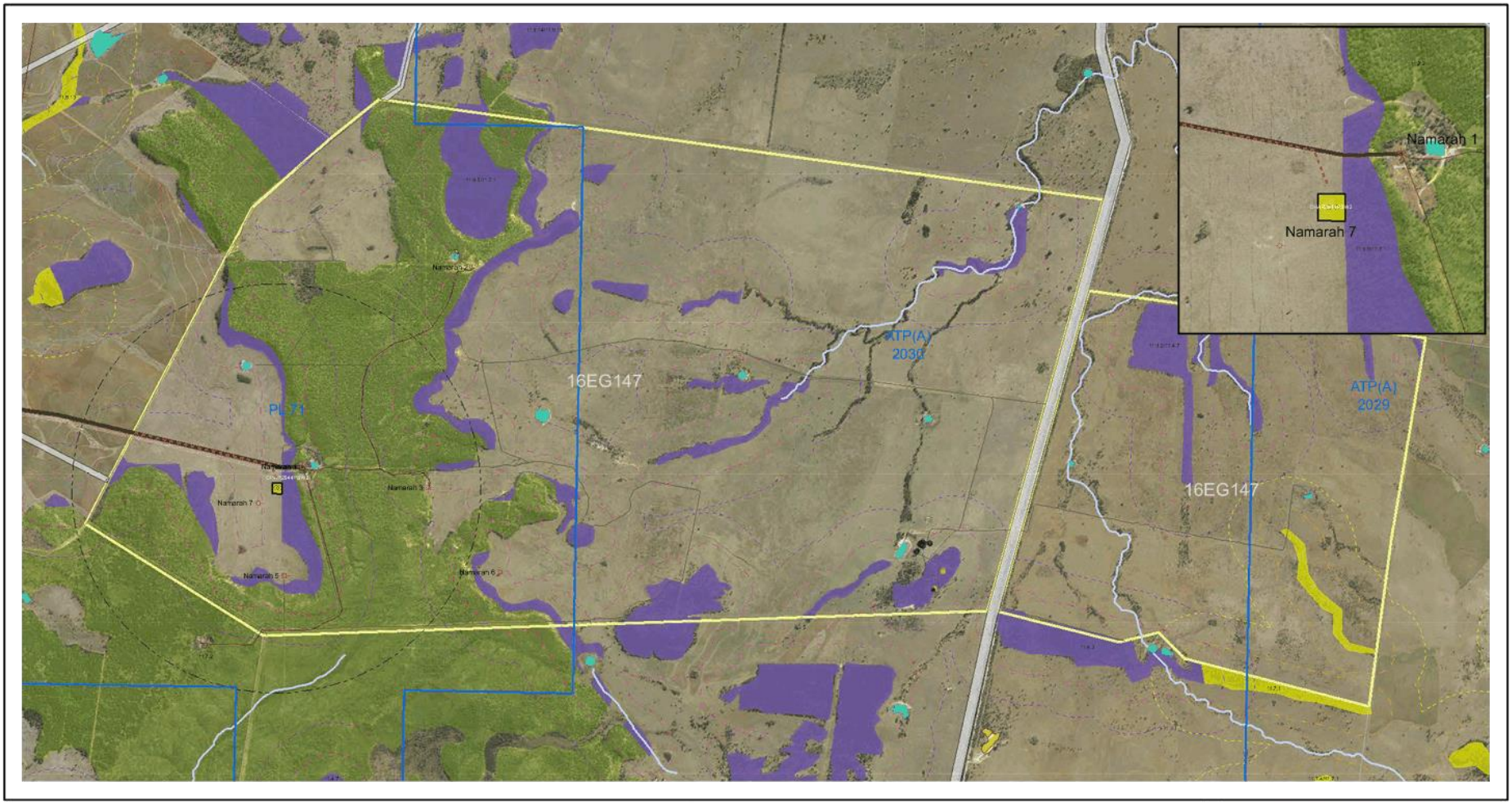

EA Amendment Review for Petroleum Licence 71 (PL 71)
Property Owner: SHIRLEY MCNAMARA
Lot Plan: 16EG147
Property Address: 9405 Teelba Road Teelba, QLD, 4423

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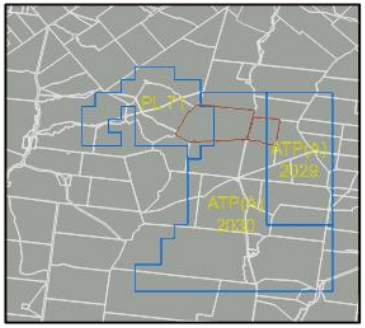

EA Amendment Review for Petroleum Licence 71 (PL 71)
Property Owner: DAVID HYNFORD SALTER and BETTY JUNE SALTER
Lot Plan: 17EG148
Property Address: Glenmorgan Glenearn Road Teelba QLD

armour energy

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- Proposed Flowline
- Proposed Camp
- Proposed Well Pad
- Armour Major Gas Pipelines
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- Tracks
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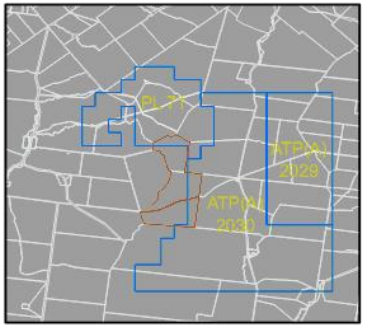

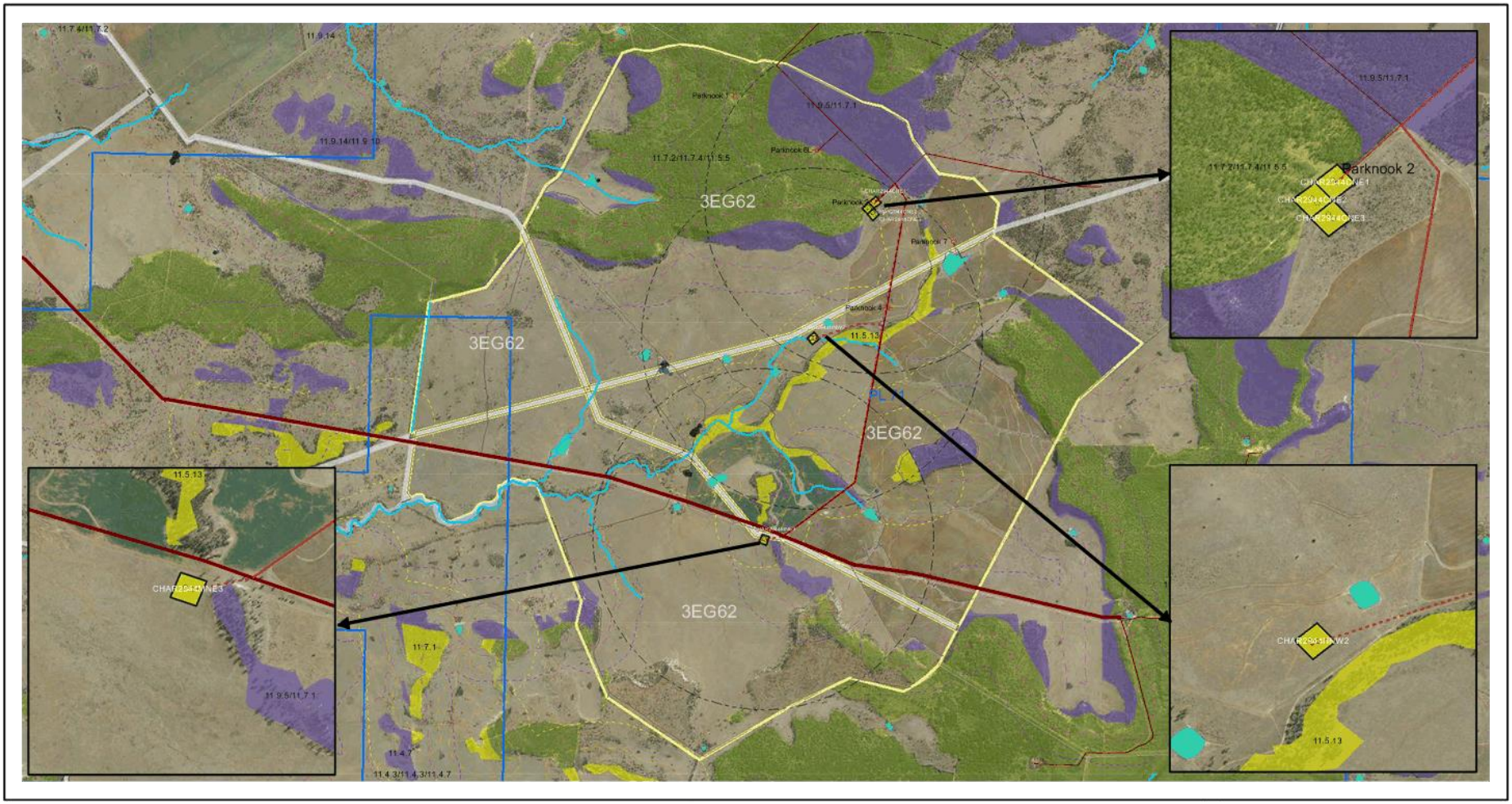

EA Amendment Review for Petroleum Licence 71 (PL 71)
Property Owner: DEBORAH JAN MORRISON AND BEVAN LAURENCE MURRAY
Lot Plan: 3EG62
Property Address: 1578 Parknook Road Parknook QLD (Maranoa Regional)

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- Facility
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- Well_2000m_Buffer
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- Tracks
- Landholder Dam
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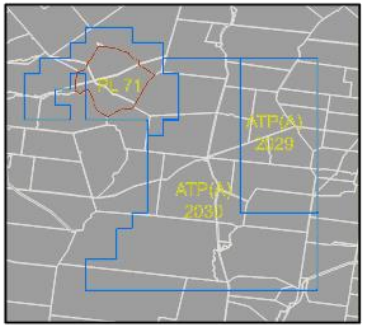

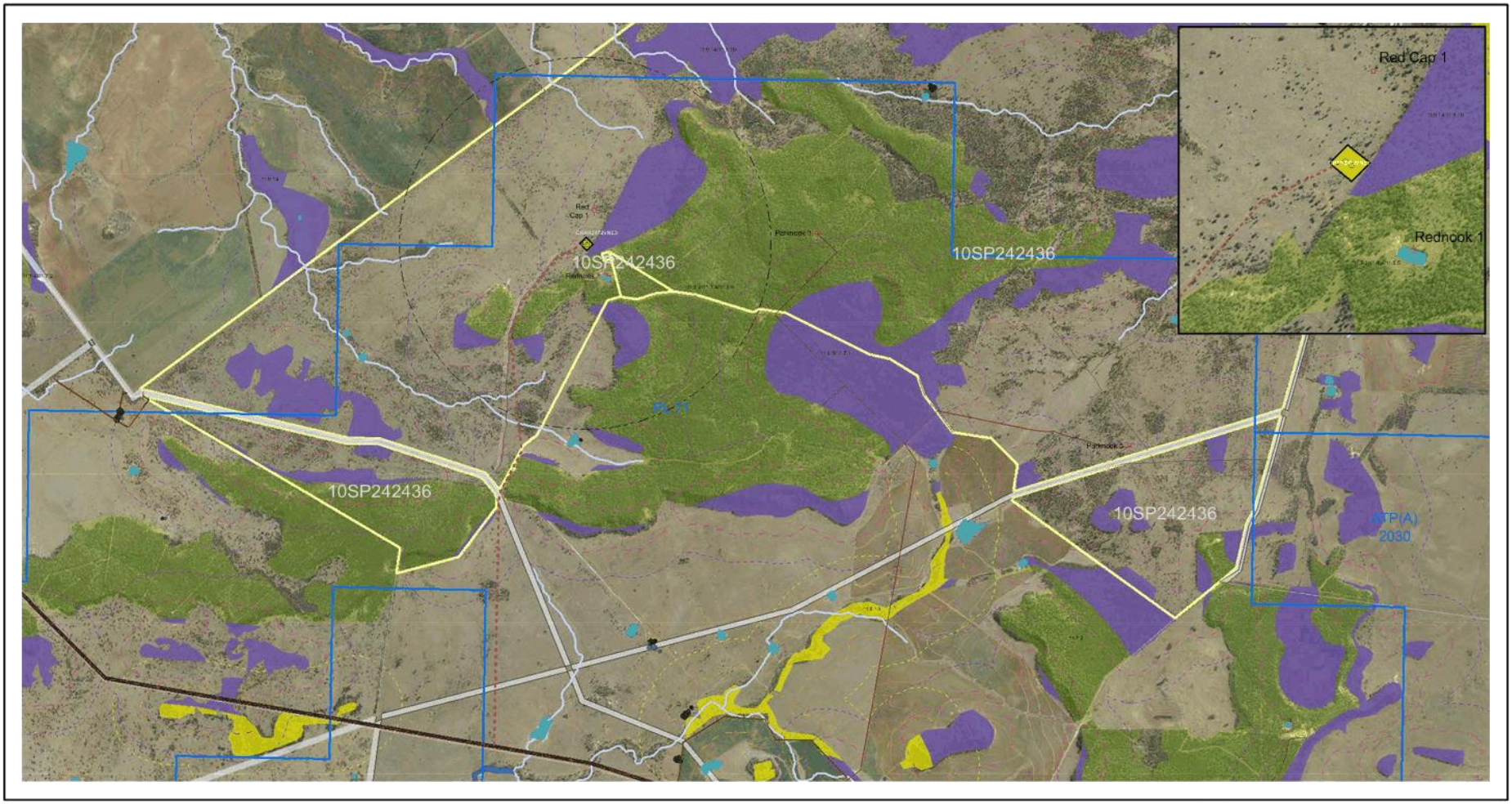

EA Amendment Review for Petroleum Licence 71 (PL 71)
Property Owner: GEORGE LESLIE SCHWENNESEN
Lot Plan: 10SP242436
Property Address: 823 Telgazlie Road Parknook QLD (Maranoa Regional)

armour energy

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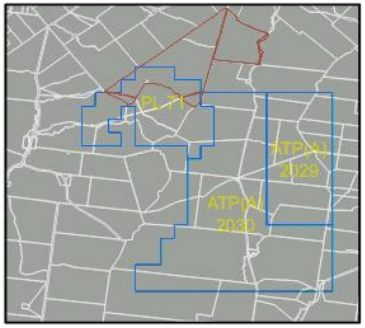

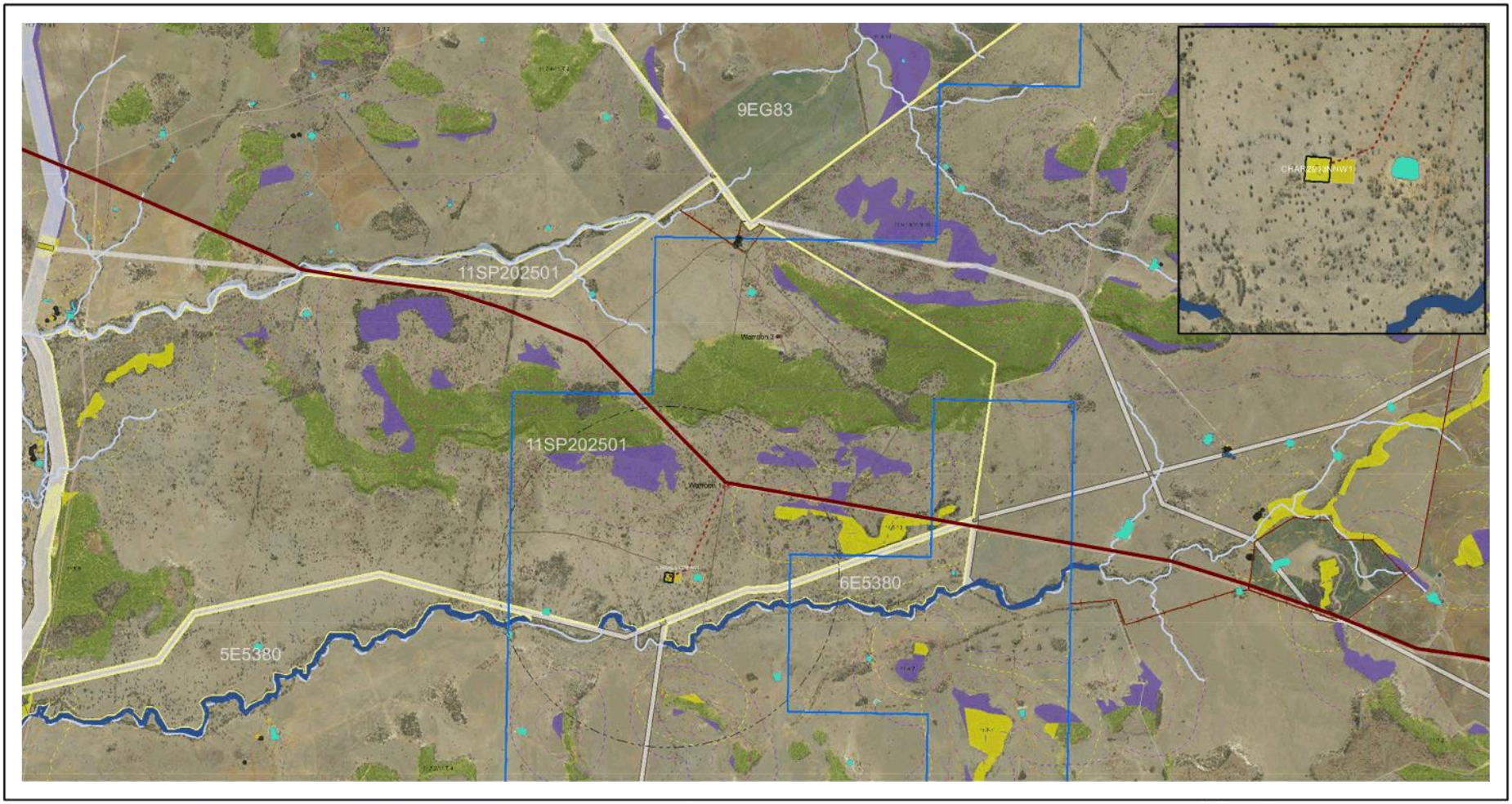

EA Amendment Review for Petroleum Licence 71 (PL 71)
Property Owner: LEON GREGORY PACKER
Lot Plan: 11SP202501 5E5380 6E5380 9EG83
Property Address: 27 Parknook Road Parknook, QLD, 4417

armour energy

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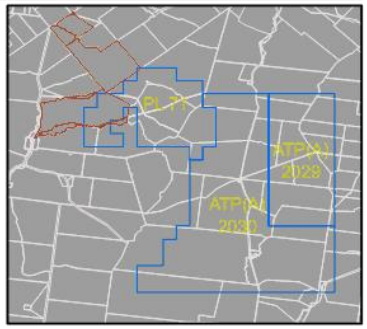

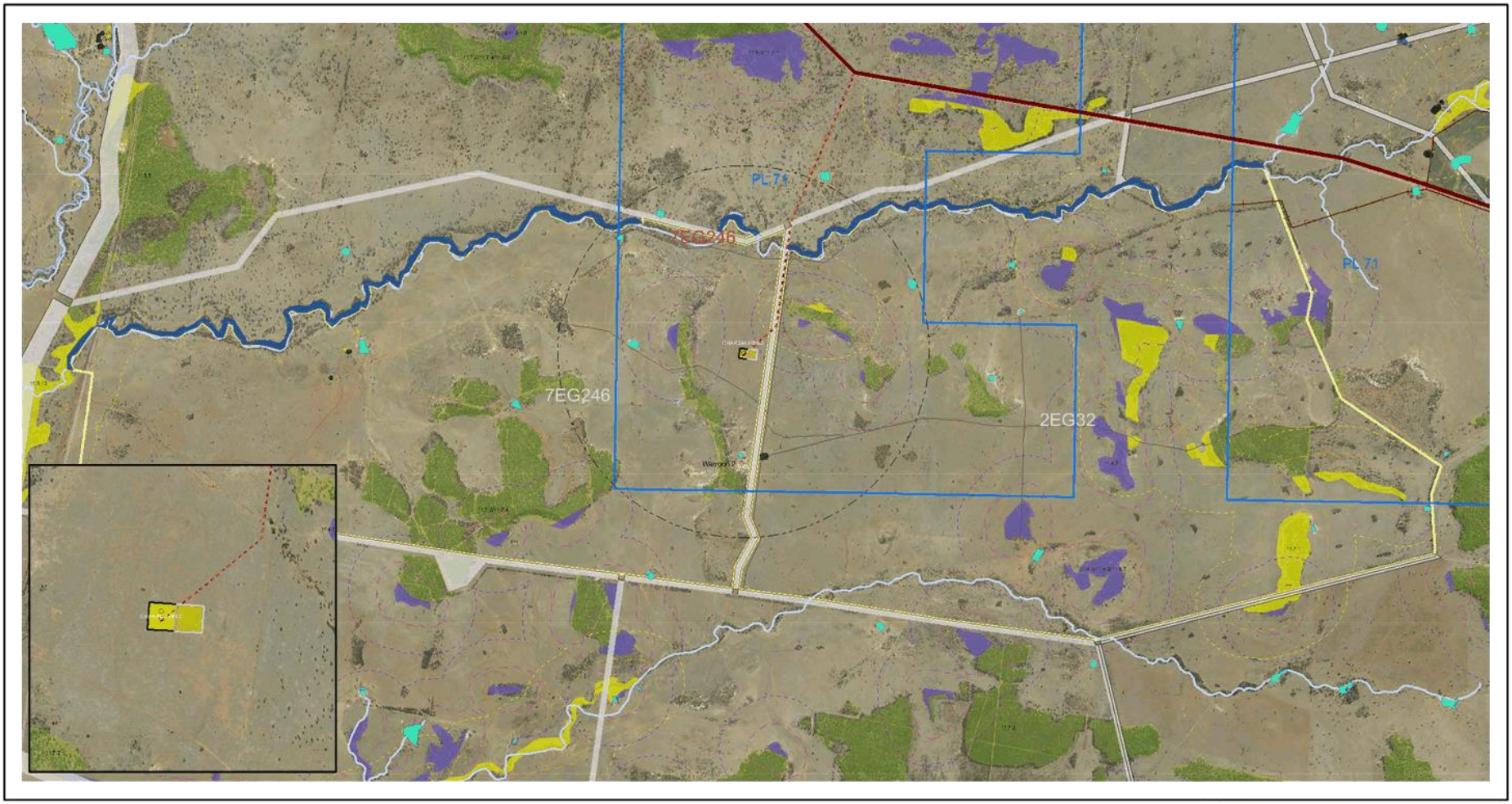

EA Amendment Review for Petroleum Licence 71 (PL 71)
Property Owner: GREGORY KENT AND MEGAN ELIZABETH WARREN
Lot Plan: 11SP202501 5E5380 6E5380 9EG83
Property Address: 823 Telgazlie Road Parknook QLD (Maranoa Regional)

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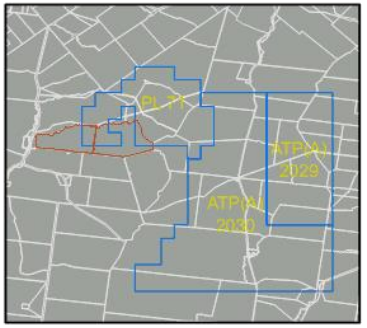


2.0 Application Requirements

Section 226, 227 and 227AA of the EP Act, sets out the requirements for making an application to amend an Environmental Authority. **Table 2.1** lists these requirements, with reference to where they have been addressed within this report.

Table 2.1 Mandatory Application Requirements

Application requirement	Where addressed in application material
s.226(1)(a) be made to the administering authority	Refer to attached application form
s.226(1)(b) be made in the approved form	Refer to attached application form
s.226(1)(c) be accompanied by the fee prescribed under a regulation	Refer to fee accompanying application
s.226(1)(d) describe the proposed amendment	Refer to Sections 3.0 of this Supporting Information Report
s.226(1)(e) describe the land that will be affected by the proposed amendment	Refer to Section 5.2 of this Supporting Information Report
s.226(1)(f) describe any development permits in effect under the Sustainable Planning Act 2009 for the carrying out of the relevant activity for the authority;	N/A
s.226(1)(g) state whether each relevant activity will, if the amendment is made, comply with any eligibility criteria for the activity;	N/A
s.226(1)(h)if the application states that each relevant activity will, if the amendment is made, comply with any eligibility criteria for the activity—include a declaration that the statement is correct;	N/A
s.226(1)(i) state whether the application seeks to change a condition identified in the authority as a standard condition;	N/A
s.226(1)(j) if the application relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—state whether the applicant seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit;	N/A
s.226(1)(k) Include an assessment of the likely impact of the proposed amendment on the environmental values, including:	
(i) a description of the environmental values likely to be affected by the proposed amendment;	Sections 5.1.2, 5.2.2, 5.3.2, 5.4.2, 5.5.2, 5.6.2, 5.7.2, 5.8.3 and 5.9.4
(ii) details of any emissions or releases likely to be generated by the proposed amendment;	Sections 5.1.3, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.4, 5.7.3, 5.8.4 and 5.9.5
(iii) a description of the risk and likely magnitude of impacts on the environmental values;	Sections 5.1.4, 5.2.4, 5.3.4, 5.4.4, 5.5.4, 5.6.4, 5.7.4, 5.8.5 and 5.9.6
(iv) details of the management practices proposed to be implemented to prevent or minimise adverse impacts; and	Sections 5.1.5, 5.2.5, 5.3.5, 5.4.5, 5.5.5, 5.6.5, 5.7.5, 5.8.6 and 5.9.7
(v) details of how the land the subject of the application will be rehabilitated after each relevant activity ceases;	Section 6.0

Application requirement	Where addressed in application material
s.226(1)(l) Include a description of the proposed measures for minimising and managing waste generated by any amendments to the relevant activity;	Section 5.7.5
s.226(1)(m) Include details of any site management plan or environmental protection order that relates to the land the subject of the application;	N/A
s.226(1)(n) Include any other document relating to the application prescribed under a regulation;	N/A – no other documents have been prescribed
s.226(2)(a),(b) Subsection (1)(k) does not apply for an application if— • the process under chapter 3 for an EIS for the proposed amendment has been completed; and • an assessment of the environmental risk of the proposed amendment would be the same as the assessment in the EIS.	NA - An Environmental Impact Statement (EIS) has not been undertaken. Therefore section (1)(k) applies.
s.226(3) Also, subsection (1)(d) to (f) and (i) to (n) does not apply to an application for a condition conversion.	NA - A condition conversion is not sought as part of the application. This section does not apply
s.227(1)(a),(b),(c) This section applies for an amendment application if— • the application relates to an environmental authority for a CSG activity; and • the proposed amendment would result in changes to the management of CSG water; and • the CSG activity is an ineligible ERA.	NA – this amendment application does not relate to an EA for a CSG activity
s.227(2)(a),(b) The application must also— • state the matters mentioned in section 126(1); and • comply with section 126(2).	
s.227AA (1)(a),(b) Requirements for amendment applications under water rights (1) This section applies for an amendment application if— the application relates to a site-specific environmental authority for— • a resource project that includes a resource tenure that is a mineral development licence, mining lease or petroleum lease; or • a resource activity for which the relevant tenure is a mineral development licence, mining lease or petroleum lease; and • the proposed amendment involves changes to the exercise of underground water rights.	Applicable
s.277AA (2) The application must also state the matters mentioned in section 126A(2).	Not applicable – see above
s.126(A)(2)(a) any proposed exercise of underground water rights during the period in which resource activities will be carried out under the relevant tenure	Refer section 5.7.3.2. Armour estimates that it will produce approximately 320L of water per day from the wells

Application requirement	Where addressed in application material
126(A)(2)(b) the areas in which underground water rights are • proposed to be exercised	The target gas formations are the Rewan, Bandana, Tinowon Sands (Bowen Basin, Late Permian) and Cattle Creek Formations.
126(A)(2)(c)(i) a description of the aquifer	Not applicable – the target formations are not designated as aquifers under UWIR
126(A)(2)(c)(ii) an analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers and surface water	Not applicable – see above
126(A)(2)(c)(iii) a description of the area of the aquifer where the water level is predicted to decline because of the exercise of underground water rights	Not applicable – see above
126(A)(2)(c)(iv) the predicted quantities of water to be taken or interfered with because of the exercise of underground water rights during the period in which resource activities are carried	Based on a 10 year production cycle for each well it is estimated that approximately 1.2ML of water will extracted in total from the wells as a result of this EA amendment
126(A)(2)(d) the environmental values that will, or may, be affected by the exercise of underground water rights and the nature and extent of the impacts on the environmental values	Refer section 5.8
126(A)(2)(e) any impacts on the quality of groundwater that will, or may, happen because of the exercise of underground water rights during or after the period in which resource activities are carried out	Refer section 5.8
126(A)(2)(f) strategies for avoiding, mitigating or managing the predicted impacts on the environmental values stated for paragraph (d) or the impacts on the quality of groundwater mentioned in paragraph (e).	Refer section 5.8

3.0 Need for Amendment

The current EA provides Armour Energy with broad authority to undertake a range of environmentally relevant activities, specifically:

- Schedule 2A – 3 - a petroleum activity that is likely to have a significant impact on a category A or B environmentally sensitive area
- Schedule 2A — 8 - a petroleum activity or GHG storage activity, other than an activity mentioned in items 1 to 7, that includes 1 or more activities mentioned in schedule 2 for which an aggregate environmental score is stated, namely:
    - ERA 10 Gas producing —manufacturing, processing or reforming 200 t or more of hydrocarbon gas in a year.
    - ERA 15 Fuel burning - using fuel burning equipment that is capable of burning at least 500kg of fuel in an hour

The EA does not currently authorise any additional production wells or HFS activities. Consequently, Armour Energy is seeking an amendment of its EA to authorise additional wells and the HFS of wells within PL71.

3.1.1 Scope

Armour Energy is seeking an amendment to its current EA to authorise both, HFS activities and the inclusion of 21 new well locations within PL71. The scope of this application is for DES to consider these proposed amendments, as outlined in **Table 3.1**.

In relation to the 21 wells, Armour has reviewed the existing conditions of the EA and determined that the only condition that requires amending to authorise the wells is their inclusion into Schedule A, Table 1 – Authorised Petroleum Activities. Armour is able to comply with the remaining conditions of the EA.

Additionally, whilst the current HFS program consists of 21 additional wells, Armour Energy is proposing that the HFS conditions be applicable to all wells within PL71 as the conditions are predominately outcome focussed and apply equally to any well that requires HFS within PL71.

With reference to the proposed conditions to be added, Armour Energy seeks the incorporation of HFS conditions which are consistent with the recently approved EA for PL 511 (EA EPPG00694213). These conditions are consistent with the HFS conditions identified in the:

- EHP's 'Eligibility criteria and standard conditions for Petroleum exploration activities – version 2' (2015); and
- EHP's 'Streamlined Model Conditions for Petroleum Activities' (2016).

Table 3.1 Proposed EA Amendment(s)

<table>
<tr><th>Proposed Condition
(with referenced Streamlined Model Condition (SMC))</th><th>Proposed Amendment</th></tr>
<tr><td>Schedule A, Condition (A1)</td><td>
<u>Existing condition:</u>
In the carrying out of the petroleum activity(ies), the holder of this environmental authority must not exceed the number and maximum size for each of the specified petroleum activities listed in Schedule A —Table 1 for each petroleum tenure.
Schedule A, Table 1 – Authorised Petroleum Activities
<table>
<tr><th>Tenure No.</th><th>Petroleum Activity</th><th>No. Existing Activities</th><th>No. Proposed Activities</th><th>Size (where applicable)</th></tr>
<tr><td rowspan="6">PL71</td><td>Sesmic (km)</td><td>596.44</td><td>None</td><td>N/A</td></tr>
<tr><td>Total Wells</td><td>19</td><td>None</td><td>N/A</td></tr>
<tr><td>- Exploration Wells (indicative)</td><td>7</td><td>None</td><td>N/A</td></tr>
<tr><td>- Appraisal Wells (indicative)</td><td>None</td><td>None</td><td>N/A</td></tr>
<tr><td>- Development Wells (indicative)</td><td>12</td><td>None</td><td>N/A</td></tr>
<tr><td>Compressor Station(s)</td><td>1</td><td>None</td><td><500 kg/hr</td></tr>
</table>
<u>Proposed condition:</u>
In the carrying out of the petroleum activity(ies), the holder of this environmental authority must not exceed the number and maximum size for each of the specified petroleum activities listed in Schedule A —Table 1 for each petroleum tenure.
Schedule A, Table 1 – Authorised Petroleum Activities
<table>
<tr><th>Tenure No.</th><th>Petroleum Activity</th><th>No. Existing Activities</th><th>No. Proposed Activities</th><th>Size (where applicable)</th></tr>
<tr><td rowspan="6">PL71</td><td>Sesmic (km)</td><td>596.44</td><td>None</td><td>N/A</td></tr>
<tr><td>Total Wells</td><td>19</td><td>22</td><td>N/A</td></tr>
<tr><td>- Exploration Wells (indicative)</td><td>7</td><td>None</td><td>N/A</td></tr>
<tr><td>- Appraisal Wells (indicative)</td><td>None</td><td>None</td><td>N/A</td></tr>
<tr><td>- Development Wells (indicative)</td><td>12</td><td>22</td><td>N/A</td></tr>
<tr><td>Compressor Station(s)</td><td>1</td><td>None</td><td><500 kg/hr</td></tr>
</table>
</td></tr>
<tr><td>K2 (SMC - General 12)</td><td>
Existing condition:
Subject to Condition (K1), the holder of this environmental authority must report spills of contaminants of the following volumes or kind: (a) releases of any volume of contaminants to water; and (b) releases of greater than 200E of hydrocarbons; and (c) releases of any volumes of contaminants where potential serious or material environmental harm has occurred or may occur.
Proposed condition:
In addition to the requirements under Chapter 7, Part 1, Division 2 of the Environmental Protection Act 1994, the administering authority must be notified through the Pollution Hotline and in writing, as soon as possible, but within 48 hours of becoming aware of any of the following events:
(a) any unauthorised <u>significant disturbance to land</u>
(b) potential or actual loss of structural or <u>hydraulic integrity</u> of a <u>dam</u>
(c) when the level of the contents of any <u>regulated dam</u> reaches the mandatory reporting level
(d) when a regulated dam will not have available storage to meet the <u>design storage allowance</u> on 1 November of any year
(e) potential or actual loss of <u>well integrity</u>
(f) when the seepage trigger action response procedure required under condition (Water 14(g)) is or should be implemented
(g) unauthorised releases of any volume of <u>prescribed contaminants</u> to waters
</td></tr>
</table>

Proposed Condition (with referenced Streamlined Model Condition (SMC))	Proposed Amendment
	(h) unauthorised releases of volumes of contaminants, in any mixture, to land greater than: i. 200 L of hydrocarbons; or ii. 200 L of stimulation additives; or iii. 500 L of stimulation fluids; or iv. 1 000 L of brine; or v. 5 000 L of untreated coal seam gas water; or vi. 5 000 L of raw sewage; or vii. 10 000 L of treated sewage effluent. (i) the use of restricted stimulation fluids (j) groundwater monitoring results from a landholder's active groundwater bore monitored under the stimulation impact monitoring program which is a 10% or greater increase from a previous baseline value for that bore and which renders the water unfit for its intended use (k) (k) monitoring results where two out of any 5 consecutive samples do not comply with the relevant limits in the environmental authority.
G5 (SMC - Waste 7; and SC PESCC 29)	**Existing condition:** NA **Proposed condition:** Produced water and stimulation flow-back water may be re-used in: a) Drilling and well hole activities; **and** b) Stimulation activities
Drilling Activities L1 (SMC – Well activities 2)	**Existing condition:** NA **Proposed condition:** Drilling activities must not result in the connection of the target gas producing formation and another aquifer
L2 (SMC – Well activities 3)	**Existing condition:** NA **Proposed condition:** Practices and procedures must be in place to detect, as soon as practicable, any fractures that have or may result in the connection of a target formation and another aquifer as a result of drilling activities.
L3 (SC – PESCC 36)	**Existing condition:** NA **Proposed condition:** Prior to undertaking well stimulation activities, written stimulation management procedures must be developed. *Explanatory note: The stimulation management procedures may incorporate other documents by reference*
L4 (SMC – Well activities 5)	**Existing condition:** NA **Proposed condition:** Polycyclic aromatic hydrocarbons or products that contain polycyclic aromatic hydrocarbons must not be used in stimulation fluids in concentrations above the reporting limit.

Proposed Condition (with referenced Streamlined Model Condition (SMC))	Proposed Amendment
L5 (SC – PESCC 37)	**Existing condition:** NA **Proposed condition:** Stimulation activities must not result in: (a) negative impacts to groundwater quality beyond the stimulation impact zone; or (b) negative impacts to water quality in landholder's active groundwater bore(s) which tap into the target formation; or (c) interconnectivity between the target formation and another aquifer.
L6 (SMC – Well activities 8)	**Existing condition:** NA **Proposed condition:** The internal and external mechanical integrity of the well system prior to and during stimulation must be ensured such that there is: (a) no significant leakage in the casing, tubing, or packer; and (b) there is no significant fluid movement into another aquifer through vertical channels adjacent to the well bore hole.
L7 (SMC - Well activities 9)	**Existing condition:** NA **Proposed condition:** Practices and procedures must be in place to detect, as soon as practicable, any fractures that cause the connection of a target gas producing formation and another aquifer.
L8 (SMC – Well activities 12)	Prior to undertaking any stimulation activity, a baseline bore assessment must be undertaken of the water quality of: (a) all landholder's active groundwater bores (subject to access being permitted by the landholder) that are spatially located within a 2 kilometre (km) horizontal radius from the location of the stimulation initiation point within the target gas producing formation; and (b) all landholders' active groundwater bores (subject to access being permitted by the landholder) in any aquifer that is within 200 metres (m) above or below the target gas producing formation and is spatially located with a 2 km radius from the location of the stimulation initiation point;
L9 (SMC – General 16)	**Existing condition:** NA **Proposed condition:** **Stimulation activities** cannot commence until the development of written contingency procedures for emergency environmental incidents which include, but are not necessarily limited to: (a) a clear definition of what constitutes an environmental emergency incident or near miss for the petroleum activity. (b) consideration of the risks caused by the petroleum activity including the impact of flooding and other natural events on the petroleum activity. (c) response procedures to be implemented to prevent or minimise the risks of environmental harm occurring. (d) the practices and procedures to be employed to restore the environment or mitigate any environmental harm caused.

Proposed Condition (with referenced Streamlined Model Condition (SMC))	Proposed Amendment
	(e) procedures to investigate causes and impacts including impact monitoring programs for releases to waters and/or land. (f) training of staff to enable them to effectively respond. (g) procedures to notify the administering authority, local government and any potentially impacted landholder.
Definitions	**"Dam"** means a land-based structure or a void that contains, diverts or controls flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or void and associated works.
	"Design storage allowance" means an available volume, estimated in accordance with the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635), published by the administering authority, as amended from time to time, that must be provided in a dam to an annual exceedance probability specified in that Manual.
	"Hydraulic integrity" refers to the capacity of a dam to contain or safely pass flowable substances based on its design.
	"Landholder's active groundwater bore" means bores that are able to continue to provide a reasonable yield of water in terms of quantity for the bores authorised purpose or use. This term does not include monitoring bores owned by the administering authority of the *Water Act 2000*.
	"Prescribed contaminants" has the meaning in section 440ZD of *the Environmental Protection Act 1994*
	"Produced water" as the meaning in Section 15A of the *Petroleum and Gas (Production and Safety) Act 2004* and means CSG water or associated water for a petroleum tenure.
	"Regulated dam" means any dam in the significant or high consequence category as assessed using the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635), published by the administering authority, as amended from time to time.
	"Reporting limit" means the lowest concentration that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions. For many analytes, the reporting limit is selected as the lowest non-zero standard in the calibration curve. Results that fall below the reporting limit will be reported as "less than" the value of the reporting limit. The reporting limit is also referred to as the practical quantitation limit or the limit of quantitation. For polycyclic aromatic hydrocarbons, the reporting limit must be based on super-ultra trace methods and, depending on the specific polycyclic aromatic hydrocarbon, will range between 0.005 ug/L–0.02 ug/L.
	"Well integrity" the ability of a well to contain the substances flowing through it.

Note: Armour Energy requests that Schedule L of the current EA be amended to read as Schedule M and Schedule L be replaced to include Stimulation conditions.

3.1.2 Description of Proposed Activities

3.1.2.1 Wells

Before the drill rig is mobilised to site, the drill site or 'well lease' and access tracks are prepared. This includes three main steps. Firstly, any vegetation is cleared within the well lease and for access tracks. Where larger vegetation is felled, a self-propelled mulcher may be used and the mulch stored at the edge of the lease for later rehabilitation use. Recoverable hollow timber, larger rocks and other features will be stored for later microhabitat rehabilitation.

Next, top soil is removed using earthmoving equipment. This is stockpiled to one side of the lease and/or access track for later rehabilitation use. Finally, earthmoving equipment moves in to cut and fill the lease site where necessary.

When the site is prepared, a drill rig arrives to install a large diameter conductor pipe. The drill rig sets up over the conductor pipe. The drill rig is usually made up of:

- a diesel motor that drives the rigs operation;
- a derrick, which is basically a vertical tower used to manage the long pieces of drill pipe for the drilling process;
- a mud pump which pumps drilling mud through the drill pipe and brings the cuttings to the surface. There the mud is circulated into tanks or ground sumps, where the drill cuttings settle out and the mud is re-used;
- an iron roughneck, which tightens the pieces of drill stem together as the hole is drilled deeper; and
- a generator to maintain power to equipment and associated ancillary site buildings.

The drill rig first drills the surface section of the hole which takes approximately one day. A casing is then cemented in place by pumping cement into the wellbore and circulating back through the casing/well ring. This cement isolates any shallow surface aquifers and prevents cross contamination.

The second stage is to drill the production section of the hole, which is cased with perforated casing across the target formations to allow gas to flow into the well. Above the target formations the casing is cemented back to surface to prevent any contamination. The drilling rig is then packed up and moved to the next well.

Following the drilling program, a completions rig is mobilised to site, assembled and the rig then drills through the cement barriers left by the drilling and installs the equipment required to operate the gas well. During the life of a well, a similar rig may need to be mobilised to the well lease to work-over the well to replace the down-hole pump or remediate a down-hole problem.

3.1.2.2 Hydraulic fracture simulation (HFS)

HFS will be undertaken in the Rewan, Bandana, Tinowon Sands (Bowen Basin, Late Permian) and Cattle Creek Formations at depths of more than 1,800 m. Each well will be perforated at depth (i.e. within the section of casing located in the reservoir) so that the stimulation fluid can be pumped into that target formations.

Approximately 2 - 3 megalitres of pre-mixed stimulation fluid (comprising of approximately 96% water, 3.5% or more of ceramic proppant and 0.5% or less of trace additives) will then be pumped from the surface down into the well casing under high pressure (around 6,000-7,000psi) to create controlled fractures in the target formations.

Downhole pressure and fluid viscosity will be closely monitored throughout the HFS process so as to be able to respond to unexpected pressure changes that could adversely affect well integrity.

The stimulation fluid will then be pumped back to the surface (flowback) with an expected 60% of the stimulation fluid returning to the surface. Note that PL71 is a "wet-gas" field (methane, plus various liquid hydrocarbon components) and so there is a much lower volume of flowback expected to return to the surface when compared to a conventional oil or coal seam gas well.

Well stabilisation dosing may be undertaken to preserve the HFS job between well completion and well production.

Flowback fluid will be collected and temporarily stored in modular, pre-fabricated tanks supplied by service and equipment supplier, Kinetic. Flowback fluid will be reused wherever possible and later disposed of offsite at a facility which can lawfully accept the fluid. A HFS operation takes up to a week for each well. Prior to the HFS operation, the well pad and temporary tanks for water fluid management are constructed. After the HFS operation is completed the flow back of fluids will be managed and the site will be rehabilitated leaving only the operating well-head facility.

Any hydrocarbon liquids will be collected and pumped to storage tanks and then will be transported to an offsite facility for processing.

3.1.3 Risk Content

Armour Energy has designed their operations to minimise potential environmental risks as far as practical.

Armour Energy has analysed the scope of the activities subject to this amendment and determined that the risk profile is aligned with DES' (formerly EHP) 'Eligibility Criteria and Standard Conditions for Petroleum exploration activities' (EHP, 2015) document due to the below reasons:

- whilst this is a production project not exploration, new land disturbance under this amendment relates to only 21 additional wells and HFS activities (approximately 15ha disturbance in total). This represents disturbance across the entire tenure area (13,400ha) of less than 0.12%
- does not propose any of the activities listed in PEEC4 including:
  - Injection of wastes (all wastes will be removed from site to a licensed facility)
  - Regulated dams (fluids will be stored in prefabricated tanks)
  - Any of the listed prescribed ERAs
- The target formations are not aquifers (which is the case for some coal seam gas activities) and the quantity of water proposed to be produced from each well is expected to be less than 320L /day, which over a 10 year estimated life of each well would result in approximately 1.2ML of water being removed from the target formations.

In relation to the last point, it is critical to note that the risk profile associated with HFS for conventional oil and gas activities such as those proposed to be carried out by Armour Energy, versus CSG are vastly different. This is explored in more detail in the Stimulation Activities section (refer to **Section 5.9**), however is centred around much greater separation of the target formation and formations used for water resources; the fact that there is very little water contained within the target formations, meaning there is much less produced water to be managed and lower well densities as a result of directional drilling.

As such, many of the standard requirements of DES' guiding material which is targeted at CSG activities are not relevant to Armour Energy's proposed activities.

4.0 Assessment Criteria

4.1 Introduction

Section 5.0 provides a description of the existing environment and environmental values that have the potential to be affected as a result of proposed activities within PL71. For each environmental value (air, land, natural environment, noise, community, heritage, waste and water) potential impacts and corresponding environmental management practices are identified. Environmental management, control strategies and commitments have been proposed to minimise the impact of the proposed activities on each environmental value.

This assessment has been undertaken considering the application requirements outlined in the DES document, 'Guideline *Environmental Protection Act 1994* Application requirements for petroleum activities' (EHP 2013), and the requirements of the EP Act and other relevant legislation.

To demonstrate that Armour Energy has considered all potential impacts of the proposed activities, the following assessment approach has been utilised.

4.2 Assessment Approach

Technical assessments undertaken by appropriately qualified and experienced persons for each relevant environmental value have been used to guide the process of assessment of potential impacts for the proposed activities, considering the residual risk and outlining management practices to mitigate these risks.

In accordance with Section 125 of the EP Act, the following is addressed as part of the assessment approach:

- description of the environmental values likely to be affected by each relevant activity;
- details of any emissions of releases likely to be generated by each relevant activity;
- description of the risk and likely magnitude of impacts of the environmental values;
- details of the management practices proposed to be implemented to prevent or minimise adverse impacts; and
- details of how the land will be rehabilitated after each relevant activity ceases.

These are discussed further **in Sections 4.2.1** to **4.2.4**.

4.2.1 Description of Environmental Values

Environmental value is described in the EP Act to include:

- a quality of physical characteristic of the environment that is conducive to ecological health or public amenity or safety (environmental value); or
- another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation (prescribed environmental value).

These values have been described for PL71 to inform an assessment of indirect impacts or cumulative impacts.

4.2.2 Emissions and Releases

Emissions and releases, as they relate to each environmental value, are identified with reference to the relevant production activities. Details of emissions and releases have been documented where available to consider both planned and unplanned emissions and releases.

4.2.3 Risks and Impacts

The potential impacts on the environmental values associated with the petroleum activities have been identified. The risk of these impacts have also been assessed, applying the Armour Energy risk matrix (refer to **Appendix A**).

The risk assessment has considered the magnitude, severity and duration of likely impacts following implementation of proposed management measures.

4.2.4 Management Practices

Management practices have been derived from site-specific environmental assessments, environmental best practice and Armour Energy's existing management plans and policies.

Armour Energy shall endeavour to implement appropriate management practices to manage overall risk and magnitude of impacts on environmental values that may result from the proposed activities.

5.0 Assessment of Environmental Impact

5.1 Air

5.1.1 Existing Environment

Air quality in the vicinity of PL71 is impacted to varying extents by dust emissions from traffic on unsealed roads, industrial activities, wind erosion and dust storms. In addition to dust, the surrounding industrial uses emit other gaseous emissions, including oxides of nitrogen (NOx), carbon monoxide (CO), sulphur dioxide (SO_2) and VOCs.

Historical data indicates the presence of fugitive gas emissions from natural gas seeps in and around Surat and the broader Roma region as early as 1889 (well before the expansion of the natural gas industry in the region) (APPEA, 2016).

To identify ambient air quality levels, data was obtained from the Queensland Government monitoring network (EHP, 2017). The nearest monitoring network station to PL71 is located at Miles Airport, approximately 100 km north-east of the tenure boundary. This station is one of four stations established by the Queensland Government for the Western Downs region monitoring network of South West Queensland.

Background levels established using monitoring data from Miles Airport are outlined in **Table 5.1.** Guideline values from the *Environmental Protection (Air) Policy 2008* (EPP Air) have been provided for reference.

Table 5.1 Background levels Adopted for PL71

Parameter	Adopted Background[1] (µg/m^3)	Averaging Period	Guideline[2] (µg/m^3)
PM_{10}	23	24 Hour	50
$PM_{2.5}$	7	24 Hour	25
NO_2	2	Annual mean	62
O_3	150	1 Hour	210
CO	1,500	8 Hour	11,000

Notes: [1] Queensland Government Monitoring at Miles Airport (EHP, 2017), [2] EPP Air

5.1.1.1 Sensitive Receptors

Figure 5.1 provides the location of petroleum infrastructure and sensitive receptors within and surrounding PL71. Within the tenure boundary, there is one sensitive receptor in the form of a residential dwelling located approximately 1,800 m from the closest proposed well.

5.1.1.2 Climate

The Surat Basin region is characterised by a subtropical climate. An overview of the climatic extremes as recorded by the Bureau of Meteorology (BoM) at the nearest meteorological station, Surat (043035), (located approximately 30 km north-west of PL71) between the years 1981 to 2018 indicate:

- annual average rainfall of 576.3 mm, with average mean rainfall of 74.5 mm in February and average minimum rainfall of 38.1 mm in July;

- average maximum temperature of 34.3°C in January and average minimum temperature of 9.9°C in July; and
- average 9am relative humidity of 77% in June and average 3pm relative humidity of 32% in September.

The local area is characterised by a distinct dry season between April and September and a wet season between October and March.

5.1.2 Environmental Values

Under the EPP Air, the environmental values for the air environment that are to be enhanced or protected include:

- the qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems;
- the qualities of the air environment that are conducive to human health and wellbeing;
- the qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures and other property; and
- the qualities of the air environment that are conducive to protecting agricultural use of the environment.

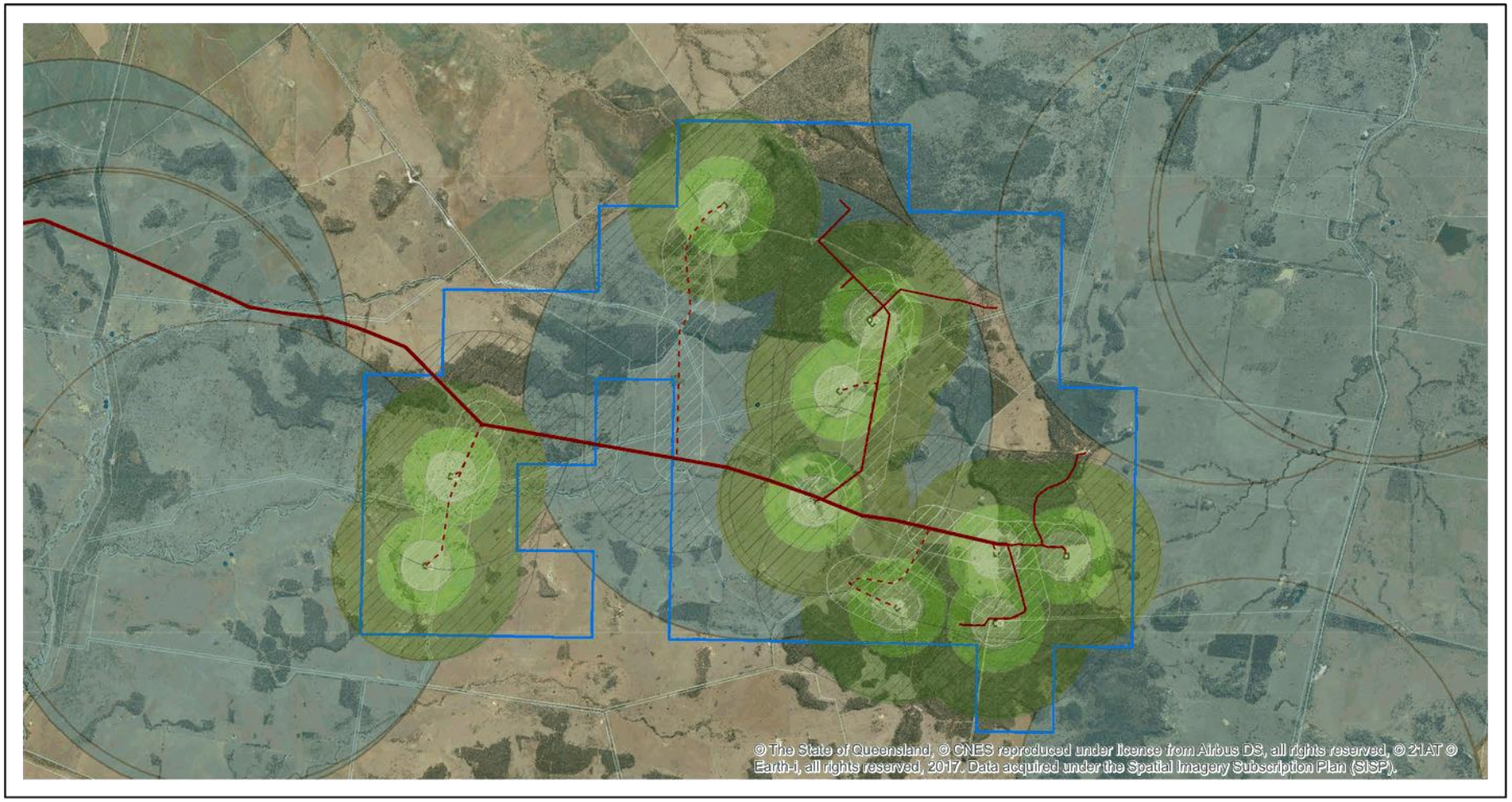
5.1.3 Emissions and Releases

The potential impacts upon air environmental values that may be associated with drilling and HFS activities include:

- dust and vehicle exhaust emissions from service provider vehicles;
- fuel combustion emissions from the generators during drilling, production and HFS activities at the well sites; and
- fugitive emissions from well heads and associated infrastructure.

The use of diesel-fired equipment during the proposed activities will also result in emissions of diesel combustion products. It should be noted, these exhaust emissions will occur over a relatively wide area and it is the fugitive dust emissions that would have the greatest potential for off-site impacts.

Note that no flaring of waste gas from HFS activities or these new wells is proposed to occur within PL71.



PL 71 - Proposed Infrastructure Noise Overview

armour energy

Datum: GDA 94 Lat/Long Date: 20/07/2018

N

S

0 1.5 3 4.5 6

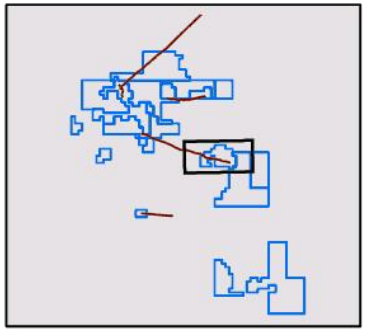
Kilometers

1:110,000

Armour Energy (Surat Basin) Pty Ltd gives no warranty to the data (including accuracy, reliability, completeness or suitability) and accepts no liability for any loss, damage or costs (including consequential damage) relating to any use of the data in this map.

Legend

- Flow Line, Gas, Proposed
- Trunk, Gas, Existing
- Flow Line, Gas, Existing
- Proposed Well Pad
- Proposed Camp
- Current Armour Energy Tenements
- Building
- Cadastral Boundary
- Proposed Pipeline 1000m Buffer
- Proposed Pipeline 2000m Buffer
- Proposed Pipeline 500m Buffer
- Proposed Well 1000m Buffer
- Proposed Well 2000m Buffer
- Proposed Well 500m Buffer
- Sensitive Recptor 5km Buffer



5.1.4 Risks and Impacts

Impacts to air quality are expected to be limited and short term in nature. The potential impacts on the environmental values for the air environment associated with the petroleum activities are described in **Table 5.2**.

Table 5.2 Identification of Potential Impacts to Air Environmental Values

Potential Impact	Description
Dust generation	Varying amounts of dust may be generated during periods of high vehicle movements and may potentially impact upon sensitive receptors in proximity to the sources.
Exhaust emissions	Exhaust emissions from stimulation equipment and onsite traffic, including emissions from diesel fuelled construction equipment and vehicles
Fugitive emissions	There is the potential for fugitive emissions to emanate from petroleum wells that have been poorly constructed and completed.
Fuel combustion	Gas may be flared during well appraisal, commissioning and when required during operations. The combustion of fuel may release several gases into the atmosphere, including carbon dioxide, carbon monoxide, nitrogen oxides, particulate matter and sulfur dioxide.

It is not anticipated that these emissions will be generated in quantities significant enough to impact the environmental values described above in **Section 5.1.2**.

As a result of implementing the management practices outlined in **Section 5.1.5**, the risks of environmental harm to air quality is assessed as being very low (in accordance with **Table 5.3**). This is supported by the rationale that:

- the nature of the potential emissions (exhaust, combustion and fugitive), the duration of those emissions and the distance between emission points and nearest receptors is such that any impact would be almost undetectable; and
- the low ambient concentration of the gases and the high assimilative capacity of the air catchment mitigates against severe impacts of air emissions from the petroleum activities.

Table 5.3 Likelihood and Consequence Ratings of Impacts

Likelihood	Consequence
1 (Rare)	1 (Minor)

5.1.5 Management Practices

Management practices that will be implemented to address the risk and magnitude of potential impacts discussed above are described in **Sections 5.1.5.1** to **5.1.5.3**.

5.1.5.1 Dust generation

Armour Energy shall manage dust emissions in accordance with the EPP Air management hierarchy for air emissions; that is to firstly avoid, secondly recycle, thirdly minimise and fourthly manage. Key management practices to be implemented include:

- vigilant observation of meteorological conditions, road conditions, etc. in the first instance to avoid dust generation;

- staff and contractors made aware through general site induction and training of the potential to generate dust emissions and mitigation and management measures that should be implemented;
- during construction and operating, disturbed areas and access roads watered using a water cart/truck on an as-required basis to minimise the potential for environmental nuisance due to dust; and
- vehicles, plant and machinery must comply with site-specific speed limits to minimise dust generation.

Armour Energy will also address the management of potential air quality impacts, such as dust, through a complaints-based process in accordance with EA conditions and regulatory requirements. Appropriate corrective actions will then be taken, commensurate to the magnitude of the impact.

5.1.5.2 Exhaust Emissions

Appropriate vehicle, plant and equipment maintenance shall be undertaken to ensure all machinery is in good working order and does not generate excessive air emissions. Vehicles will also be operated in a fuel-efficient manner and not be left idling longer than required.

Exhaust emissions shall be recorded and reported in accordance with the *National Greenhouse and Energy Reporting Act 2007* (Cth) and National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Cth).

5.1.5.3 Fugitive Emissions

Fugitive emissions can be largely mitigated through adherence to proper engineering standards and construction protocols. Armour Energy's petroleum wells are designed and constructed in accordance with Armour Energy's 'Well Integrity Management Plan' (2018) and accepted industry standards.

5.2 Land

5.2.1 Existing Environment

5.2.1.1 Topography

The topography of the general area is comprised of undulating plains (1 to 2%) and short slopes of 5% associated with ridges and crests (Armour Energy, 2016). Topography within PL71 varies between 300m AHD to 425m AHD.

5.2.1.2 Geology

PL71 is located in the Surat Basin, approximately 100 km, south-east of Roma and 30 km south-east of Surat. The geology of the Surat Basin comprises a mainly Jurassic to Cretaceous age sequence of alternating layers of sandstones, siltstones and mudstones.

PL71 is directly underlain by the lower GAB formations of the Surat Basin (Hutton, Evergreen and Precipice Sandstone) and the GAB formations of the upper Bowen Basin (Moolayember, Clematis Sandstone) (refer to **Figure 5.3**). The underlying Surat Basin geology is considered non-productive for PL71 and well casing will pass through these formations as they will not be targeted.

The gas bearing formations of interest to Armour Energy are the Rewan and to a lesser extent, the Bandanna Formation, Tinowon Sands (Bowen Basin, Late Permian), and the Cattle Creek Formations (if present). The Rewan Formation, a thick sequence of mudstone, siltstone and clayey sandstone, was deposited from rivers and lakes over the Bandanna Formation. The Bandanna Formation comprises mostly mudstone and siltstone with some clayey sandstone to a thickness of up to 370 m. The average thickness

of the coal in the Bandanna Formation is about 10 m. The Cattle Creek Formation is present at depths of up to 1,800 m below ground surface and approximately 500 m below the base of the Bandanna Formation. The Bowen Basin, Late Permian comprises a thick succession of marine and fluvial sediments, including extensive coal seams (OGIA 2016).

5.2.1.3 Soils

PL71 is comprised entirely of texture contrast soil (chromosols) as per the Australian Soil Classification guidelines. Texture contrast soil is soil that has an abrupt change in texture between the surface and subsoil and is neither acidic nor sodic. This type of soil is however susceptible to erosion once the vegetative cover is removed.

There are no known acid-sulfate soil-prone areas or acid-bearing rock formations within the vicinity of PL71.

5.2.1.4 Land Use

The predominant land use in the region is agriculture, including broadacre cropping, horticulture, grazing and lot feeding. Other land uses include urban, industrial, CSG and conventional petroleum and gas extraction, mining (mainly coal) and conservation (OGIA, 2016).

Good quality agricultural land (GQAL) mapping (Queensland Government, 2012) identified partial areas within PL71 as category A1/C1. The majority of the area is classified as Category C2 and C3, indicating that the area is predominantly pasture land that is only suitable for improved or native pastures due to limitations which preclude continuous cultivation for crop production (DAF, 2018).

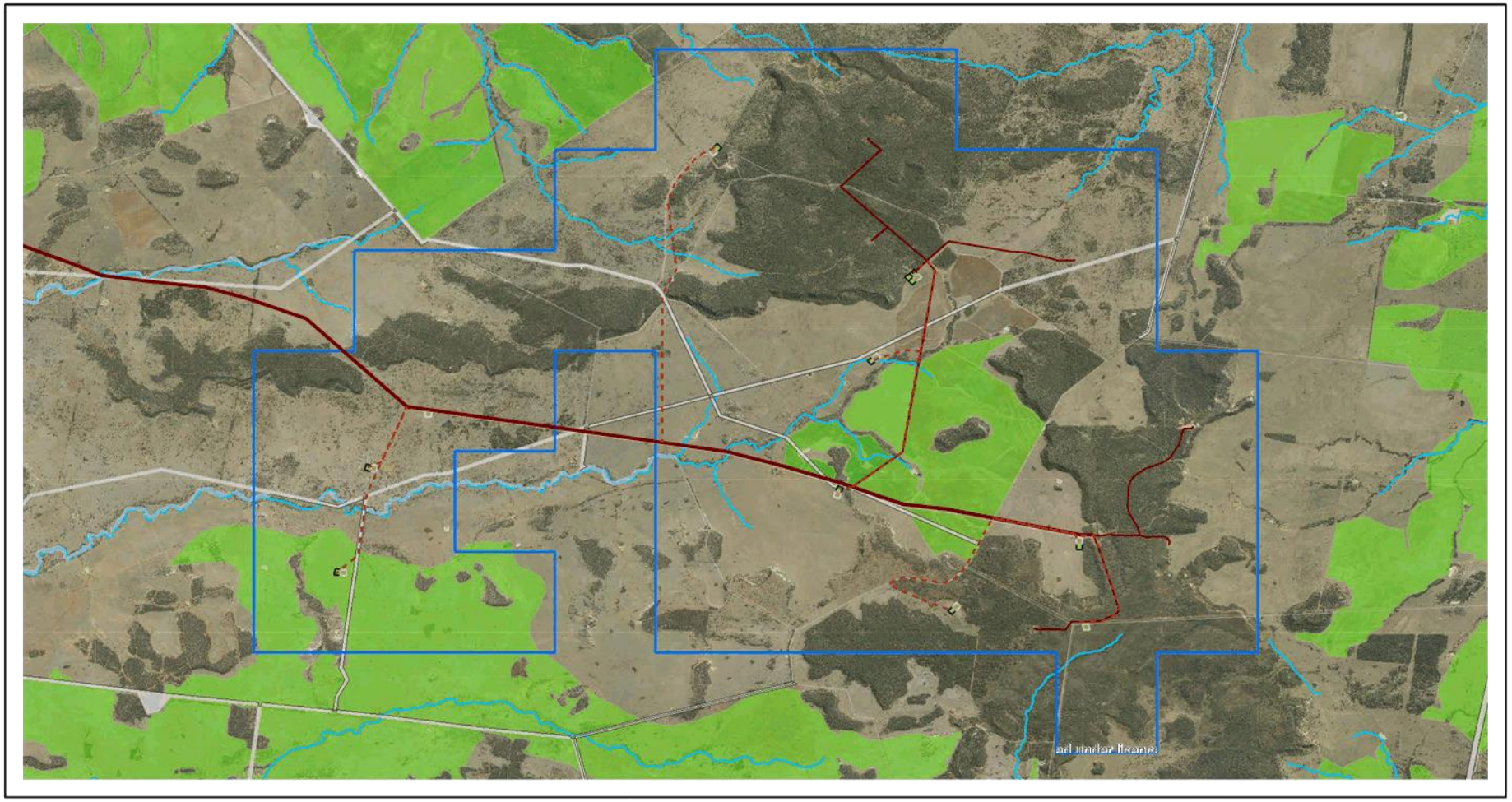
Approximately 15% of PL71 is mapped as Strategic Cropping Area (SCA) (an area of regional interest under the *Regional Planning Interests Act 2014* (RPI Act)) (refer to **Figure 5.2**). There are no other areas of regional interest located within the tenure boundary.

Two wells are proposed to be constructed in a mapped SCA shown as strategic cropping land (SCL) on **Figure 5.2**. In accordance with Section 22 of the RPI Act, Armour Energy's proposed activities are exempt and do not require a regional interest development approval.

5.2.2 Environmental Values

There are no prescribed legislative environmental values relating to land for PL71 under the EP Act or subordinate legislation. Based on the assessment of the existing environment, the environmental values of the land within PL71 to be protected or enhanced are:

- Strategic Cropping Areas including their health and biodiversity;
- the integrity of undisturbed land;
- the geological stability of landscape;
- soil health and function, including the physical and chemical attributes of soil, relative to propagation and growth of vegetation;
- the integrity of soil stability and structure for erosion protection; and
- the suitability of the land for continued agricultural use (grazing and cropping) post-closure.



PL 71 - Proposed Infrastructure
Potential Strategic Cropping Area Overview

armourenergy

Datum: GDA 94 Lat/Long Date: 26/07/2018

N

S

0 1 2 3 4

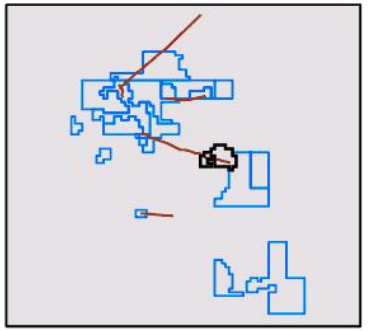
Kilometers

1:95,000

Armour Energy (Surat Basin) Pty Ltd gives no warranty to the data (including accuracy, reliability, completeness or suitability) and accepts no liability for any loss, damage or costs (including consequential damage) relating to any use of the data in this map.

Legend

- Flow Line, Gas, Proposed
- Trunk, Gas, Existing
- Flow Line, Gas, Existing
- Proposed Well Pad
- Proposed Camp
- Current Armour Energy Tenements
- Gazetted Easement
- Cadastral Boundary
- Gazetted Road
- Gazetted Watercourse
- QLD VM Watercourse V1_3
- Strategic Cropping Land



5.2.3 Emissions and Releases

The following unmitigated emissions and releases to land are possible from the proposed activities:

- increased surface runoff and soil erosion;
- losses of containment from construction plant and equipment; and
- Unplanned release of chemicals into surrounding land.

5.2.4 Risks and Impacts

The potential impacts on the environmental values associated with this amendment include:

- clearing of vegetation, good quality agricultural land and strategic cropping areas;
- damage to topsoil, resulting in loss of biological and chemical properties;
- increased soil erosion (refer to **Section 5.2.4.1**); and
- improper storage and handling of fuel, chemicals and flowback fluids has the potential to result in localised contamination of soil (refer to **Section 5.2.4.2**).

Overall, the risk and magnitude of impacts has been assessed as very low (in accordance with **Table 5.4**) as a result of the management measures presented in **Section 5.2.5**.

Table 5.4 Likelihood and Consequence Ratings of Impacts

Likelihood	Consequence
1 (Rare)	1 (Minor)

5.2.4.1 Soils and Erosion

Construction of drill wells will involve stripping and stockpiling of topsoil and associated vegetation to create areas for drill rigs and associated infrastructure. If inappropriately handled and managed, stockpiling of topsoils can damage the topsoil structure, causing nutrient leaching and loss of fertility. Erosion can have an adverse effect on soil productivity and the associated agricultural value.

5.2.4.2 Spills

During drilling activities, potential sources of contamination to soil include the onsite storage of diesel fuel, as well as chemicals required during HFS and drilling processes. Diesel will also be used to fuel power generation supplies and other construction related equipment. Unplanned release of chemicals has the potential to impact on the surrounding environment in PL71.

5.2.5 Management Practices

Management practices that will be implemented to address the risk and magnitude of potential impacts discussed above are as follows:

- to avoid spillage and environmental impacts, all chemicals (including HFS additives) will be stored and handled within the lease in accordance with the relevant legislative requirements and Australian Standards (AS) including:

- AS 3780:2008 – The storage and handling of corrosive substances;
- AS 1940:2004 – The storage and handling of flammable and combustible liquids;
- AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers; and
- *Waste Reduction and Recycling Act 2011.*

- spillage will be managed in accordance with the 'Surat Operations Environmental Management Plan' (Armour Energy, 2016) and 'Site Emergency Response Plan - Surat Basin' (Armour Energy, 2018);
- drilling muds and fluids will be managed in accordance with the EA;
- drill cutting and fluids used during drilling activities will be transported off site and disposed of at an approved waste facility;
- a site specific erosion and sediment control will be prepared and implemented in accordance with the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Guidelines 2008;
- disturbance to land will be minimised by using existing infrastructure where possible (e.g. roads, tracks and disturbed areas);
- infrastructure will be rehabilitated in accordance with the EA and **Section 6.1**; and
- proposed activities occurring within an area of regional interest will be managed in accordance with the RPI Act for which Armour Energy can meet the exemption requirements.

5.3 Natural Environment

5.3.1 Existing Environment

PL71 is located within the Queensland Brigalow Belt region. Native vegetation of the bioregion is characterised by acacia dominated open forests, woodland and scrublands with scattered ecosystems dominated by eucalypt dry woodlands on inland depositional plains (Queensland Government, 2018).

Regional Ecosystems (REs) in PL71 are largely modified and cleared due to agricultural activities. PL71 encompasses 9 RE communities identified in the 'Regional Ecosystem Description Database' (REDD) (Queensland Herbarium, 2018); including 4 REs with the Biodiversity Status listed as 'Endangered', 2 REs listed as 'Of Concern' and 3 REs listed as 'No Concern at Present' (refer to **Table 5.5**).

REs with a biodiversity status listed as 'Endangered' are classified as a "category B Environmentally Sensitive Area (ESA)" in accordance with Section 26 of the *Environmental Protection Regulation 2008.* REs listed as 'Of Concern' are "category C ESAs". Within PL71, there are category B and C ESAs present. These REs and their respective Biodiversity Status' are outlined in **Table 5.5** and **Figures 1.2** to **1.8.**

Table 5.5 Regional Ecosystem Types Located in PL71

Regional Ecosystem ID	Description	Biodiversity Status	ESA Matter
11.9.14	Lysiphyllum carronii, Atalaya hemiglauca +/- Eucalyptus melanophloia +/- Acacia excelsa open woodland	Endangered	Category B ESA
11.9.10	Eucalyptus populnea open forest with a secondary tree layer of Acacia harpophylla and sometimes Casuarina cristata on fine-grained sedimentary rocks	Endangered	Category B ESA
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks	Endangered	Category B ESA
11.4.7	Eucalyptus populnea with Acacia harpophylla and/or Casuarina cristata open forest to woodland on Cainozoic clay plains	Endangered	Category B ESA
11.7.1	Acacia harpophylla and/or Casuarina cristata and Eucalyptus thozetiana or E. microcarpa woodland on lower scarp slopes on Cainozoic lateritic duricrust	Of Concern	Category C ESA
11.5.13	Eucalyptus populnea +/- Acacia aneura +/- E. melanophloia woodland on Cainozoic sand plains and/or remnant surfaces	Of Concern	Category C ESA
11.7.2	Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	No Concern at Present	NA
11.7.4	Eucalyptus decorticans and/or Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius woodland on Cainozoic lateritic duricrust		
11.5.5	Eucalyptus melanophloia, Callitris glaucophylla woodland on Cainozoic sand plains and/or remnant surfaces. Deep red sands		

A desktop survey utilising Queensland Governments WildNet database (Queensland Government, 2017) identified the potential presence of two species as vulnerable (refer to **Table 5.6**).

Table 5.6 Threatened Species identified as Possible to occur within PL71

Species	Common Name	Status (EPBC/NCA)	Likelihood of Occurrence Category
Calyptorhynchus lathami lathami	**Glossy black-cockatoo (eastern)**	NCA – Vulnerable EPBC – Not available	May occur
Phascolarctos cinereus	**Koala**	NCA – Vulnerable EPBC – Vulnerable	May occur

5.3.2 Environmental Values

There are no prescribed legislative environmental values under the EP Act or subordinate legislation relating to the natural environment for PL71. Nonetheless, Armour Energy considers that the environmental values for PL71 are:

- Regional Ecosystems including their health and biodiversity; and
- protection of populations of significant species and ecological communities.

5.3.3 Emissions and Releases

An unplanned release of chemicals has the potential to impact on terrestrial ecosystems (as discussed in **Section 5.2.4.2**)

There are no expected emissions or releases to the identified natural environment environmental values.

5.3.4 Risks and Impacts

The potential impacts to flora and fauna during the proposed drilling and HFS activities include:

- inadvertent ignition of vegetation from Armour Energy's activities;
- fauna injury of damage to flora from fire;
- introduction of weeds and pests;
- clearing of vegetation, and regional ecosystems;
- disturbance or displacement of fauna species from foraging or roosting habitat, or breeding places;
- accidental release or spill of hazardous material;
- habitat fragmentation;
- flora or fauna harm by contact with inappropriately stored substances; and
- Fauna injury from vehicle strike.

The magnitude and severity of potential impacts have been determined based on technical assessments carried out by suitably qualified and experienced specialists. Indirect disturbances to terrestrial ecosystems relating to weeds and pests, displacement and degradation of habitat, as well as potential for mortality of fauna, will be effectively managed by implementing the environmental management practices outlined in **Section 5.3.5**.

Where impacts are unavoidable, Armour anticipates that those impacts will be localised, short-term and recoverable. The risk and magnitude of potential impacts has therefore been assessed as very low.

5.3.5 Management Practices

Key management practices to be implemented as a means of mitigating and managing potential impacts include:

- vegetation clearing be minimised to the greatest extent practicable;
- vegetation will not be cleared unless authorised under an Armour Energy Access to Work (ATW) permit. The ATW will be approved prior to any vegetation clearance or disturbance occurring;
- No clearing will be undertaken in ESAs
- ESAs will be delineated where works are occurring within close proximity;
- sediment and erosion control to be managed in accordance with the Armour Energy Erosion and Sediment Control Plan and the Contractor's erosion and sediment control procedures;

- erosion and sediment control structures must be inspected periodically as required and after rain events and maintenance carried out where required;
- natural vegetation buffers along creeks and rivers will not be disturbed unless authorised;
- where activities may impose barriers to the movement of fauna for extended period of time, reasonable measures will be implemented to facilitate fauna movement around or through active work areas; and
- where identified as required a qualified fauna spotter catcher will conduct a search immediately prior to clearing of vegetation for the presence of fauna species. Where fauna are detected, the spotter catcher will assess and implement the most appropriate method to avoid or minimise impacts on that fauna as a result of clearing.

Sections 5.3.5.1 to **5.3.5.3** address the management measures relevant to potential impacts associated with fire, pests and hazardous materials

5.3.5.1 Fire Management

Fire extinguishers will be fitted to all vehicles. Personnel will be made aware of fire restrictions and fire weather information as required. Smoking will be prohibited except in designated areas with proper receptacles. Where necessary, a Bushfire Management Plan shall be developed for the Surat operations and actions coordinated with neighbours and other stakeholders.

All fire-fighting equipment will be maintained in good working order and personnel will be trained in the use of this equipment and notified of nearby available sources of water

The fire prevention requirements during high fire risk periods will include a bare earth firebreak with a 5 m radius from a hot work area, fire-fighting equipment and stopping work during extreme weather conditions. Fire management shall be undertaken in accordance with the 'Surat Operations Environmental Management Plan' (Armour Energy, 2016) and 'Site Emergency Response Plan - Surat Basin' (Armour Energy, 2018).

5.3.5.2 Weed and Pest Management

Armour Energy's weed management procedures and practices aim to achieve consistency with the strategic goals of relevant Council Plans and industry weed advisory guidelines.

Declared weeds in PL71 may include Galvanised Burr, Bathurst Burr, Pimelea and Japanese Sunflower. Other priority weed species include Parthenium Weed, Mother of Millions, Harrisia Cactus and African Boxthorn.

Measures to minimise the spread of weeds include:

- incorporating weed management requirements into contracts and planning documents;
- educating personnel and contractors on the requirements of managing weeds;
- carrying out weed monitoring and eradication reporting;
- conducting wash downs and vehicle inspections;
- vehicles travelling into the Surat development area will undergo a risk-based assessment to determine whether they pose a weed transmission risk (i.e. the presence of weed seed or excessive mud);

- vehicles will be directed to approved wash-down facilities as appropriate whereby vehicles will be issued with Wash-down Certificates or Weed Hygiene Certificates upon treatment and must only travel on nominated tracks and roads when travelling within the project area; and

- daily movements of vehicles will be planned to minimise transit between properties and overall vehicle movements to reduce the risk of the vehicles coming in to contact with potential weeds. Vehicles will not be allowed access beyond the approved and designated areas, access roads and tracks. Access to the development area will only be allowed from approved access routes.

In the unlikely event that weeds are introduced or exacerbated due to the activities undertaken, follow up weed control will be undertaken per the 'Surat Operations Environmental Management Plan' (Armour Energy, 2016).

5.3.5.3 Appropriate Chemical Storage

As previously discussed, unplanned release of chemicals have the potential to impact on the natural environment. All chemicals will be stored and handled in accordance with the relevant legislative requirements and Australian Standard (AS) including:

- AS 3780:2008 – The storage and handling of corrosive substances;

- AS 1940:2004 – The storage and handling of flammable and combustible liquids;

- AS 3833:2007 – Storage and handling of mixed classes of dangerous goods in packaged and intermediate bulk containers; and

- *Waste Reduction and Recycling Act 2011*.

5.4 Noise

5.4.1 Existing Environment

Baseline noise values were determined from surveys of the ambient background noise environment, conducted in 2008, within the rural regions of the Surat and Bowen basins as part of the EIS for the GLNG Project (Santos, 2014), and in 2009 as part of the EIS for the APLNG Project EIS (Savery and Associates, 2009).

Consistent with the GLNG and APLNG studies in the region, the existing background noise environment within the vicinity of PL71 is typical of rural areas with prominent noise sources likely to be from agricultural activities and resource activities. As the noise levels are typical of a rural area, the night time background and ambient noise levels are expected to be lower than those experienced during the day.

Armour Energy notes that noise measurements recorded during the GLNG and APLNG studies were collected during the cooler winter months and represent worst case scenario conditions relating to noise propagation. Conversely, throughout the warmer months, the baseline noise environment is likely to contain additional insect noise.

No blasting activities are proposed and therefore no risk assessment has been undertaken for potential vibration impacts upon sensitive receptors.

5.4.2 Environmental Values

The following environmental values are prescribed under the Environmental Protection (Noise) Policy 2008 (EPP Noise):

- the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems
- the qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following:
  - sleep
  - study or learn
  - be involved in recreation, including relaxation and conversation
- the qualities of the acoustic environment those are conducive to protecting the amenity of the community.

5.4.3 Emissions and Releases

In general, HFS activities produce the highest noise levels and noise impacts have been considered against these noise levels.

Armour Energy anticipates that its HFS campaign will be materially similar to that of Santos GLNG in respect to overall design and equipment. It is noted that Santos GLNG had previously identified and provided to DES the following typical noise source values for key well stimulation apparatus:[1]

- Annulus – 1 off – SWL 90.3 dB(A)
- Stim Van – 1 off – SWL 98.8 dB(A)
- Power Pack – 1 off – SWL 106.7 dB(A)
- High pressure pump – 4 off – SWL 104.7-107.6 dB(A) – average SWL 106.1 dB(A)
- Low pressure pump – 1 off – 99.5 dB(A)
- Downhole Blender – 1 off – SWL 105.4 dB(A)
- Sand trailer – 1 off - SWL 100.2 dB(A)
- Pregel – 1 off – SWL 104.6 dB(A)
- LGC – 1 off – SWL 97.9 dB(A).

According to GLNG, the added noise sources provide a conservative, estimated of total noise emissions of SWL 115 dB(A) (assuming that all noise sources are operational at full load at the same time) and that, under neutral meteorological conditions, noise levels in the region of 50 dB LAeq 1- hour could be expected at a distance of 500 m from the HFS spread, and further reducing to falling 45 dB LAeq 1- hour at 1 km, 40 dB LAeq 1- hour at 2 km and about 35 dB LAeq 1- hour at 4 km.[2]

[1] https://www.santos.com/media/3778/glng-upstream-hydraulic-frac-risk-assessment-compendium-of-assessed-fluid-systems.pdf

[2] https://www.santos.com/media/3778/glng-upstream-hydraulic-frac-risk-assessment-compendium-of-assessed-fluid-systems.pdf

The estimated noise levels over distance are based conservatively on the simultaneous operation of all noise sources, and lower levels would be generated if some or all of the identified equipment were to be operated sequentially or intermittently.

There is one sensitive receptor identified as being within the PL71 and is located approximately 1,800 m from the closest proposed well (refer to **Figure 5.1**) . On this basis, prior to conducting drilling of this well, Armour will conduct noise modelling to determine the potential noise impact and associated mitigation measures to ensure noise levels remain acceptable. Mitigation may include the reaching of an alternative arrangement with the applicable landowner.

All other sensitive receptors are located outside of PL71 (refer to **Figure 5.1**) and are greater than 4km away from the proposed wells and noise limits should remain within the limits specified in the EA.

5.4.4 Risks and Impacts

The proposed HFS activities have the potential to impact on:

- acoustic environmental values (subject to separation distances to sensitive receptors, the level and duration of the noise, and the time of day that the noise occurs);
- ground borne noise; and
- sensitive receptors during drilling and HFS activities.

As discussed, estimated total noise emissions for HFS (with all noise sources operational) will be approximately SWL 115 dB(A). Under neutral meteorological conditions, noise levels in the region of 50 dB LAeq 1- hour could be expected at a distance of 500 metres from the HFS spread, and further reducing to falling 45 dB LAeq 1- hour at 1 kilometre, 40 dB LAeq 1- hour at 2 kilometres.

As a result of the management measures presented in **Section 5.4.5**, the extent of impacts to noise sensitive receptors will be minimised and as such the risk and magnitude impacts have been assessed as very low (in accordance with **Table 5.7**). A minor consequence score has been assigned due to HFS activities being restricted to daylight hours and anticipated duration for HFS activities equating to seven days or less for each well.

Table 5.7 Likelihood and Consequence Ratings of Impacts

Likelihood	Consequence
1 (Rare)	1 (Minor)

5.4.5 Management Practices

Armour Energy manages noise emissions in accordance with the 'Surat Operations Environmental Management Plan' (Armour Energy, 2016) and the EPP Noise hierarchy (avoid, minimise and manage). Armour Energy will implement the following management practices as a means of managing the potential impacts outlined in **Section 5.4.4**:

- preferentially locate nuisance sources away from near sensitive receptors and will utilise equipment that minimises the sources of environmental nuisance;
- notify landholders and owners of any adjacent sensitive places of the nature and expected duration of noisy activities, prior to stimulation activities;

- noise generating activities associated with drilling and HFS will be in accordance with EA conditions or have an alternative arrangement in place;
- operators of equipment will be aware of potential noise impacts and be required to employ techniques and/or equipment to minimise noise emissions as applicable; and
- HFS activities will be restricted to daylight hours in order to minimise noise impacts at sensitive receptors and minimise safety risks for personnel and contractors.

5.5 Community

5.5.1 Existing Environment

PL71 is located in the Maranoa Regional Council area which is home to approximately 12,850 people (ABS, 2017). More than half of the population lives within the township of Roma (est. 6,850) (ABS, 2016) which is a highly-urbanised centre and acts as the region's primary hub for commerce, education, health, transport, government, retail and financial services. In recent times the region has become a hub for the coal seam gas industry. Outside of Roma, the population density is considerably lower and consistent with a more traditional rural setting.

5.5.2 Environmental Values

Although there are no prescribed community environmental values for PL71 under the EP Act or its subordinate legislation, environmental values of importance to the local community exist, and require due consideration. These values include:

- the overall amenity, liveability and sense of community supported by profitable local businesses;
- access to social, community services and infrastructure in the region surrounding PL71 (including economic conditions and benefits within the affected community); and
- the qualities of the land that are conducive to human health and wellbeing.

5.5.3 Emissions and Releases

The proposed activities have the potential to generate the following emissions that may impact upon the local community:

- exhaust fumes from operation of drilling or HFS equipment and flaring of gas;
- dust generated by machinery and equipment usage and vehicle movements;
- fugitive emissions from well heads and associated infrastructure; and
- noise emissions.

5.5.4 Risks and Impacts

Potential impacts of the proposed petroleum activities on the community may include:

- minor impact upon accommodation availability during the proposed activities as the well stimulation service provider will not be utilising an onsite camp;

- impacts/co-existence with existing landholder activities;
- additional pressure on local housing and accommodation availability;
- aesthetic and nuisance impacts (light, noise, dust)
- cumulative impacts on community services (e.g. recreational facilities, service hire availability etc.), product availability (food, petrol, personal items etc.) and infrastructure;
- fugitive emissions.

Armour Energy recognises the benefits that can be achieved from community engagement and consultation and is committed to developing and maintaining community engagement to maintain good relationships and social licence during the proposed activities. Furthermore, Armour Energy will take all practicable measures to comply with Conduct and Compensation Agreements and the Land Access Code for all dealings with landholders and ensuring appropriate onsite behaviour by Armour Energy personnel and contractors.

With reference to **Table 5.8**, given the rural location, the implementation of management practices described below, and the distances to most residences, the risk of impacts has been assessed as very low.

Table 5.8 Likelihood and Consequence Ratings of Impacts

Likelihood	Consequence
1 (Rare)	1 (Minor)

5.5.5 Management Practices

While there are no prescribed community environmental values, Armour Energy will implement management practices to minimise impacts to the community. The environmental management and mitigation measures proposed for community environmental values are summarised below:

- preferentially locate infrastructure to minimise visual and nuisance impacts and to protect environmental values;
- develop and maintain a complaints management system ensuring, where practicable, issues and/or complaints are appropriately addressed;
- develop and implement policies relating to service provision and purchasing hierarchies (e.g. local personnel and business first if suitably qualified and commercially competitive);
- adhere to all Conduct and Compensation Agreements and the Land Access Code and 'Surat Operations Environmental Management Plan' (Armour Energy, 2016) for all dealings with landholders; and
- mitigate fugitive emissions through appropriate well design and construction, undertaken in accordance with an accepted industry standard and Armour Energy's 'Well Integrity Management Plan' (2018).

5.6 Heritage

5.6.1 Existing Environment

The Department of Aboriginal and Torres Strait Islander Partnership records indicate there are no Aboriginal cultural heritage sites recorded for PL71 (DATSIP, 2018).

There are also no recorded non-indigenous cultural heritage sites or artefacts (under state and local government heritage registers) within PL71.

5.6.2 Environmental Values

The following environmental values are relevant for indigenous and non-indigenous heritage within PL71:

- cultural and spiritual values of the land; and
- qualities of the land that are conducive to protecting the aesthetics of the environment, including the appearance of culturally significant buildings, structures and other property.

5.6.3 Emissions and Releases

Proposed activities may result in the inadvertent spillage of stimulation fluid or flow back proximate or within unrealised heritage site perimeters.

5.6.4 Risks and Impacts

There is the potential for culturally significant artefacts and sites to be impacted by drilling and HFS activities within PL71 via:

- disturbance of known heritage sites or artefacts during stimulation activities; and
- discovery of new sites or artefacts.

The magnitude and severity of potential impacts have been determined based on technical assessment carried out by suitably qualified and experienced specialists. Overall, the risk and magnitude of impacts has been assessed as low (in accordance with **Table 5.9**) as a result of the management measures presented in **Section 5.6.5**.

Table 5.9 Likelihood and Consequence Ratings of Impacts

Likelihood	Consequence
1 (Rare)	1 (Minor)

5.6.5 Management Practices

Armour Energy has a "duty of care" to ensure that it has appropriate measures in place in order to demonstrate that it has taken all reasonable and practical measures to ensure their activities do not harm cultural heritage.

HFS activities shall be conducted in a manner that avoids, or minimises to the greatest extent possible, impacts upon cultural heritage values. Where necessary, additional cultural heritage surveys will be undertaken with the assistance of a qualified archaeologist and local traditional owners prior to any works commencing.

Heritage register searches shall be undertaken prior to land disturbance activities. No works should be undertaken or access permitted within areas marked as cultural heritage 'no go' areas.

For new discoveries, Armour Energy's environmental procedure "Unexpected Aboriginal Cultural Heritage Find" will be followed. The Site Supervisor must be notified immediately if any cultural heritage sites, objects or remains are located. Should this occur, work will cease immediately.

5.7 Waste

5.7.1 Existing Environment

Within the tenure boundary and surrounds, solid and liquid wastes are generated from domestic and commercial premises as well as agricultural, industrial and resource activities. These wastes comprise general, recyclable and regulated wastes.

In Queensland, waste management is prescribed by the provisions of the EP Act, Environmental Protection Regulation 2008, *Waste Reduction and Recycling Act 2011*, Waste Reduction and Recycling Regulation 2011.

Armour Energy will generate both general and regulated wastes throughout the well stimulation activities. The major additional waste generated through the proposed amendment will be stimulation flowback fluids (likely mixed with small volumes of produced water existing in the target formation).

5.7.2 Environmental Values

Although there are currently no legislative prescribed environmental values under the EP Act or subordinate legislation for waste management, those previously prescribed under the Environmental Protection (Waste Management) Policy 2000 (repealed) provide some guidance on the matter. The former environmental values for waste were:

- the life, health and wellbeing of people;
- soil, air, and surface and groundwater quality; and
- land use capability, having regard to economic considerations.

5.7.3 Emissions and Releases

The following unmitigated emissions and releases discussed in **Sections 5.7.3.1** to **5.7.3.3** are possible from the proposed activities.

5.7.3.1 Stimulation Flowback

Flowback fluid is the key waste to be generated through the proposed amendment. It will be collected in modular pre-fabricated tanks and disposed of offsite at a suitably licensed waste disposal facility. A stimulation flowback monitoring program will be implemented, this will allow for accurate characterisation of the waste to be disposed of in order to ensure acceptance criteria will be met. Armour Energy will also use this monitoring to assist in determining the "cut-off" for when fluids flowing back from the well should cease being treated as flowback for licensed disposal and instead managed as "produced water" as per **Section 5.7.3.3**. This will be guided by the detailed risk assessment described in **Section 5.9.6.3** but key criteria will likely include:

- water quality within 10% of background as determined in accordance with **Section 5.9.2.1** (assuming sufficient produced water is available to undertake this sampling).

5.7.3.2 Produced Water

Relatively conservative volumes of produced water may be generated by the proposed activities which are to be re-used wherever possible. Armour Energy anticipates less than two barrels [3] per day of produced water. As the gas is transported to the Kincora processing facility for processing any water from PL71 will be extracted at the Kincora processing facility and where can't be reused will be stored in the onsite evaporation pond.

5.7.4 Risks and Impacts

Armour Energy has considered the types of waste that will be generated by the proposed activities. These are presented in **Table 5.10** and are categorised as:

- general waste - those not defined as regulated waste under legislation. General wastes comprise putrescible wastes (easily decomposed, recyclable by composting) and non-putrescible wastes (not easily decomposed, may be recyclable);
- recyclable waste – this waste type is able to be reconditioned, reprocessed or reused; and
- regulated waste - regulated wastes are those that require specific controls or actions as defined by legislation. Listed, hazardous, regulated, controlled or trackable wastes typically have unique handling and disposal requirements in order to manage specific associated hazards.

Table 5.10 Waste likely to be generated and key management measures

Waste Name	Description	PL71 Activity	Minimisation/Management Measures
General Waste			
Domestic wastes	– Food scraps, tea bags, coffee grounds etc. – Food wrappers and packaging – Textile materials – Plastic wrapping films, plastic bags – Pens and pencils – Polystyrene – Aluminium foil, waxed paper or cardboard – Non-recyclable plastics – No recyclables, hazardous wastes, liquids, chemicals or batteries.	All activities	Disposal to landfill.
Timber	Untreated and treated timber derived from packaging and uses that cannot be reused or recycled.	All activities	Recycled/reused where practical otherwise disposed to landfill.
Uncontaminated scrap metals and wiring	Uncontaminated scrap metals and wiring. No pressurised cylinders or drums with chemical or oily residue.	All activities	Recycled where practical otherwise disposed to landfill.
Spent stimulation fluid	Flowback fluid and excess stimulation fluid containing trace additives	Stimulation activities	Reused where practicable otherwise transported to appropriately licensed waste disposal facility

[3] 1 barrel equals 159L

Waste Name	Description	PL71 Activity	Minimisation/Management Measures
Produced water	If any, will be evaporated in existing licensed ponds at the Kincora processing facility	Production activities	Reuse wherever possible otherwise evaporated
Recyclable Waste			
General Recycling	– Plastic bottles and clean food containers – Glass bottles and jars, milk cartons, aluminium bottles and cans, metal lids from jars, tin cans, plastic and paper cups. – Cardboard and paper packaging – Folders, phone books, envelopes, office paper, magazines, cereal boxes, clean paper towels. – Scrap metals (uncontaminated) – No plastic food wrap or general waste.	All activities	Recycled at local facility wherever practicable.
Intermediate bulk containers	Containers used for transport of fluids and bulk materials.	All activities	Returned to supplier once no longer required.
Scrap Metals	Uncontaminated scrap metals and wiring No pressurised cylinders or drums with chemical or oily residue.	All activities	Reuse, sell or return to supplier wherever practicable.
Regulated Wastes			
Batteries	Lead, gel, nickel-cadmium and alkaline type batteries generated from equipment, vehicles, generators and electronics.	All activities	Transported by appropriately licensed transporter to an appropriately licensed disposal/recycling facility
Chemical waste and chemical containers (including plastic fuel, and lubricant containers)	Chemical wastes may include herbicides, pesticides, water treatment chemicals (biocides), paint and solvents. Regulated chemical containers are those containing any volume of free chemical that is regulated. These may include waste oil containers, and aerosol cans containing solvent or paint.	All activities	
Contaminated soil	Contaminated soils are generated where local spills of hydrocarbons and other contaminants may occur.	All activities	
Oily filters, rags, absorbents	Oily filters, rags and absorbents are generated from routine equipment and vehicle servicing, repair and filter changes.	All activities	
Tyres	Tyres and tubes are generated from tyre changes on work vehicles and equipment.	All activities	
Used spill kits	Used spill kits are generated from spill clean-up of chemicals and hydrocarbons.	All activities	
Waste oil (clean waste oil)	Quantities of waste oil are generated routinely from vehicle and equipment oil changes.	All activities	

It is not envisaged that the proposed activities will generate significant quantities of waste. Nonetheless, waste generated will be managed and disposed of appropriately. The Roma Landfill has an estimated lifespan of up to 30 years and sufficient capacity to deal with waste generated (Pacific Environment Limited, 2015), and pest access will be negligible due to waste management and containment practices. Additional vehicle movements associated with waste transport shall be minimised through appropriate waste segregation and onsite reuse, wherever possible.

On this basis, the likelihood of potential impacts to waste environmental values is rated as 2 (unlikely) and the corresponding consequence of impacts has been determined as minor. The risk of environmental harm to waste environmental values and the surrounding environment is therefore categorised as low.

5.7.5 Management Practices

In addition to the management measures outlined in **Table 5.10**, measures will be implemented so that waste is minimised and managed in accordance with general waste and resource management principles and EHP's standard Conditions for petroleum exploration activities (EHP, 2015).

Site specific waste management measures to be implemented within PL71 include:

- application of the waste management hierarchy in the *Waste Reduction and Recycling Act 2011* (Waste Act) to minimise waste volumes and the risk of causing harm to the environment;
- maximising operational efficiency and environmental performance;
- designing and planning the proposed activities to incorporate less resource-intensive and more efficient waste management processes;
- encourage waste avoidance and set provisions related to waste targets;
- identify and separate waste streams that can be re-used with minimal or no treatment or collected by a licensed waste transporter for recycling; and
- review and audit waste management practices to investigate improvements in existing processes.

The construction methods and workforce will aim to limit the amount of waste produced and ensure that wherever possible, waste materials are re-used or recycled, or sold to an organisation. Specialised sub-contractors will be engaged to transport and dispose of waste to licensed facilities as required.

5.8 Water

5.8.1 Surface water

PL71 is predominantly situated in the Condamine-Balonne Basin, with the south-east corner located in the Moonie Basin. Watercourses in the Condamine- Balonne Basin are mostly ephemeral with the exception of major watercourses (i.e. the Condamine and Balonne Rivers). The catchment is heavily impacted by anthropogenic pressures including land use, riparian management, water infrastructure and point source pollution and is also highly modified as a result of agricultural and grazing practices.

Existing surface water within PL71 includes non-perennial watercourses, Kyeen Creek (situated approximately 1.1 km from the closest proposed activities) and Christmas Creek (located in the south-eastern corner 400 m from the closest well).

5.8.2 Groundwater

5.8.2.1 Surat Cumulative Management Area

PL71 is located within the Surat Cumulative Management Area (CMA). Under the Queensland *Water Act 2000* (the Water Act), CMAs may be declared where two or more tenure holders exercise their underground water rights.

The Water Act establishes responsibilities for petroleum tenure holders to monitor and manage the impacts caused by exercising of their water rights, including a responsibility to 'make good' any impairment of private bore water supplies. These provisions exist because it is not practicable to produce petroleum without also extracting groundwater (OGIA, 2016).

Potential impacts associated with petroleum activities in a CMA are assessed and managed by the Queensland Office of Groundwater Impact Assessment (OGIA) (formerly the Queensland Water Commission), which is required to submit an Underground Water Impact Report (UWIR) for the CMA.

The initial UWIR for the Surat CMA was published in 2012, with a second UWIR published in 2016 (OGIA, 2016). Details of the conceptual hydrogeological model and numerical modelling undertaken for the Surat CMA are described in detail therein.

5.8.2.2 Hydrogeological Environment

The Surat Basin forms part of the Great Artesian Basin (GAB), a hydrological basin comprising of several aquifers and confining aquitards (refer to **Figure 5.3**).

Key aquitards are the Evergreen Formation, Walloon Coal Measures, Westbourne Formation, Orallo Formation, Wallumbilla Formation and Griman Creek Formation. Hydraulic properties for the identified aquitards are provided in **Table 5.11**.

Table 5.11 Hydraulic properties of underlying aquitards

Aquitard	OGIA (2016b) description
Evergreen Formation	Major regional aquitard between the Hutton sandstone and Precipice Sandstone; dominated by low-permeability siltstone, mudstone and subordinate fine-grained labile sandstone. Average thickness 125 m. Median horizontal permeability of 0.006 mD
Walloon Coal Measures	low permeability aquitard.
Westbourne Formation	Aquitard and confining bed for the Springbok Sandstone.
Orallo Formation	Leaky aquitard varying in thickness from 140 - 270 m (average 200 m)
Wallumbilla Formation	Acts as an aquitard although does have some minor discontinuous aquifers. Median permeabilities range between 0.26 - 37 mD.
Griman Creek Formation	Maximum thickness of 400 m. Median permeabilities range between 100 - 400 mD
Rewan Formation	Armour Energy's principle target formation, and the primary aquitard between the Bandanna Formation and overlying Precipice Sandstone Surat Basin sediments. Mean permeabilities range from 0.03 - 0.33 mD.

Armour Energy is not aware of any interactions between these formations with surface waters in or within close proximity to PL71.

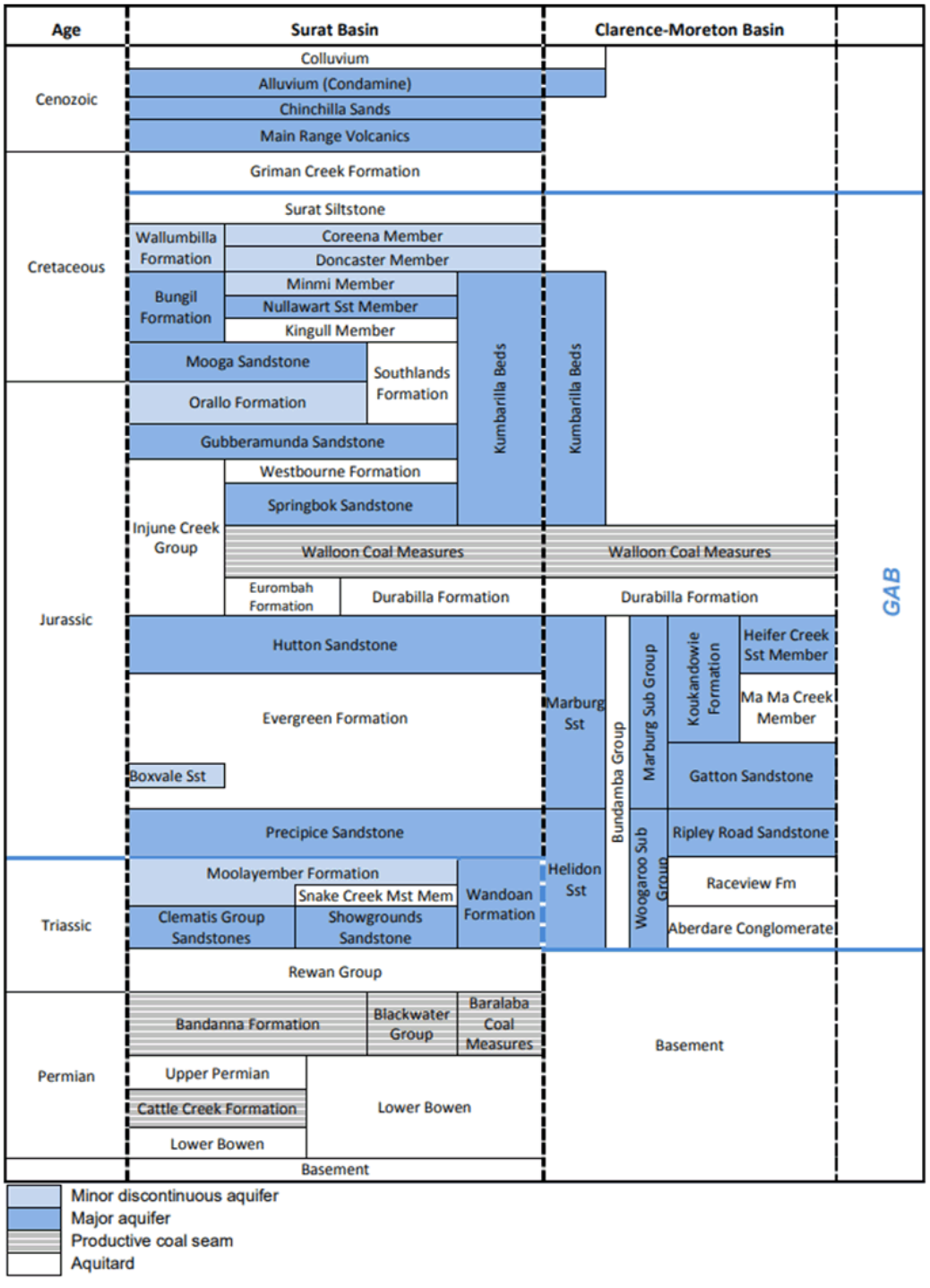


Figure 5.3 Regional Hydrostratigraphy
Source (UIWR, 2016)

5.8.2.3 Groundwater Usage

The primary use of water within the Surat region is for stock, the secondary use for domestic purposes and to a lesser extent for urban water supply, agriculture (including irrigation and intensive stock watering) and industrial purposes.

Queensland Governments online interactive mapping and data tool, Queensland Globe (Queensland Government, 2018) identifies 18 water bores within PL71 (refer to **Table 5.12**).

Table 5.12 Water bores located within PL71

Bore ID	Name	Depth (Metres)	Formation
29490	UOD RED CAP NO1	2500	Timbury Hills Formation
29513	Not available	140.20	Griman Creek Formation
22959	HPP WARROON 2	Not available	Not available
13641	Not available	140.20	Griman Creek Formation
22936	HPP WARROON 1	2077.50	Blackwater Group
23657	CON WARROON 3	2398.0	Timbury Hills Formation
22750	UOD RED CAP 1	2506.40	Timbury Hills Formation
23720	CON REDNOOK 1	2500.00	Timbury Hills Formation
22907	HPP PARKNOOK 1	2208.90	Bandanna Formation
100241	OCA PARKNOOK 3	Not available	Not available
23804	HEP PARKNOOK 2	2307.30	Timbury Hills Formation
100242	OCA PARKNOOK 4	Not available	Not available
100243	OCA PARKNOOK 5	Not available	Not available
100026	OCA NAMARAH 4	2249.10	Blackwater Group
100231	OCA NAMARAH 5	Not available	Not available
23109	HPP NAMARAH 1	2380.90	Timbury Hills Formation
100010	OCA NAMARAH 3	2244.50	Blackwater Group
23708	CON NAMARAH 2	2445.00	Timbury Hills Formation

A number of the above bores are located within a 2 km horizontal radius of the proposed well sites.

5.8.2.4 Groundwater Dependent Ecosystems

Groundwater-dependent ecosystems need permanent or intermittent access to groundwater to meet at least some of their water needs to maintain communities of plants and animals, ecological processes and ecosystem services (Richardson et al. 2011). These may include wetlands, vegetation, springs, river base flows and cave ecosystems.

There are no identified discharge or recharge springs located within the vicinity of PL71.

5.8.3 Environmental Values

The Environmental Protection (Water) Policy 2009 (EPP Water) prescribes the environmental values and water quality objectives for protection and enhancement, specifically:

- the aquatic ecosystems and the biodiversity functions they provide, including watercourses, wetlands, springs and groundwater dependent ecosystems (GDEs);

- the suitability for stock watering;
- the suitability for farm supply/use;
- the physical and chemical attributes of surface water; and
- the integrity of waterways bed and banks.

Environment values for groundwater include its ability to be used for:

- Aquaculture and human consumption of aquatic food;
- agricultural;
- recreation;
- drinking water;
- industrial; and
- cultural and spiritual values.

5.8.4 Emissions and Releases

The activities to be carried out in PL71 do not involve any planned emissions or releases to surface waters. There is the potential however for unmitigated HFS fluids to impact upon ground and surface waters, specifically:

- during storage and prior to stimulation activities being undertaken, stimulation chemical additives could inadvertently be spilled and impact upon nearby waterways or wetlands;
- stimulation fluid flowback could potentially be spilled into adjacent waterways or wetlands;
- losses of well integrity may cause stimulation fluids to leak into overlying or underlying aquifers;
- fracture pathways could migrate beyond the stimulation impact zone, resulting in interconnection of aquifers or HFS fluid vertically migrating into overlying and underlying aquifers; and
- remnant stimulation fluids in target formation.

5.8.5 Risks and Impacts

Potential impacts of the proposed petroleum activities on environmental values associated with water include:

- inadvertent spillage of HFS chemicals and associated impact upon nearby water ways (release of contaminants to water);
- inadvertent spillage of flowback fluid to waterways;
- losses of well integrity;
- excessive fracture migration; and
- residual fluid in target formation.

The water bodies present within PL71 are non-perennial with flow mainly occurring in response to heavy rainfall. Potential impacts from HFS fluid are only likely to occur during extreme rain events causing storage tanks to overflow, however this is extremely unlikely to occur. The consequence of such an event occurring would be minor with minimal, short term and have recoverable minor impact on water uses and biota.

In relation to groundwater, Armour Energy considers the likelihood of HFS fluid leaking into the overlying aquifers as rare (rating 1) for the following reasons:

- Predictive fracture modelling indicates well stimulation fractures with a maximum lateral length of 178 m and maximum vertical fractures of 17 m, and completely confined within the thick target formation; and
- The Rewan formation is separated from the nearest overlying aquifer by significant aquitards (Evergreen Formation, Walloon Coal Measures, Westbourne Formation, Orallo Formation, Wallumbilla Formation and Griman Creek Formation). The hydraulic properties and low permeability of these overlying aquitards indicate that it would be virtually impossible for fluid migration into overlying groundwater resources.

Furthermore, the low permeability of the target formation itself will preclude any migration of HFS fluid beyond the stimulation zone. This is further compounded by the pressure variant between stimulation fluids in the rock pore space and the petroleum well, whereby the resultant pressure gradient causes the fluid to flow back toward the well (i.e. as opposed to vertical or lateral migration away from the stimulation zone). Thus, the consequence for fluid migration is assessed as being rare (rating 1).

Although from a technical perspective it is virtually impossible for the HFS fluid to enter into an adjacent aquifer, the consequence of this occurring and impacting groundwater quality has nonetheless been considered. The stimulation additives that will be used will be at such low concentrations, and of relatively benign nature in those concentrations, that the consequence of interaction of stimulation fluid (which is predominantly water) and any groundwater resource would be minor (rating 1). On that basis, Armour Energy has determined the overall risk rating as very low.

In terms of aquifer drawdown, Armour Energy intends to source water from the Maranoa Regional Council for its HFS activities, so will not be extracting water from an aquifer.

Armour Energy has determined the overall risk rating to surface water and groundwater as very low.

5.8.6 Management Practices

The environmental management and mitigation measures proposed for water resources are outlined in **Sections 5.8.6.1** and **5.8.6.2**.

For management practices relevant to well construction and integrity and fracture migration, refer to **Sections 5.9.7.1** and **5.9.7.2**, respectively.

5.8.6.1 Appropriate Chemical Storage

Stimulation chemicals will be stored and handled in accordance with relevant standards and guidelines to prevent or minimise releases to the environment from spillage and inadvertent losses during overtop and flood events.

Armour Energy will minimise the risk of spillage by storing only the minimum volume of stimulation additives that are necessary to complete the proposed activities onsite. Where necessary, Armour Energy will have chemicals delivered to PL71 on an "as needed" basis (as opposed to stockpiling and storage of stimulation additives).

Stormwater will be diverted around chemical storage areas to ensure that surface runoff does not become contaminated and enter any nearby waterway.

5.8.6.2 Containment of Stimulation Fluid and Flowback

Post-stimulation, flowback fluid will be captured and stored within pre-fabricated tank storage systems. Tank construction is typically solid steel framing and lined with geotextile and polyethylene material and can be fitted with leak detection systems.

Suitable tank locations shall be determined in accordance with an appropriate constraints analysis. This would involve a review of GIS mapping layers to identify any environmental or other constraints identified and choosing an appropriate storage location that will avoid or minimise the impacts on environmental values wherever possible.

Armour Energy may also engage with landholders to identify on-ground constraints and to confirm preferred location(s) for tank locations.

A range of control measures may be implemented to ensure that flowback storage does not impact on the surrounding aquatic environmental values, such as:

- monitoring of modular structures to ensure that the hydraulic and structural integrity is maintained;
- visual inspection of structural components (fencing, free broad, tank super-structures, tank liner integrity) to ensure containment integrity; and
- operating each containment system in accordance with the advice of a suitably qualified and experienced person.

In the unlikely event that a spill or leak occurs, the spill should be contained and cleaned up as per conditions in the EA and the 'Armour Site Emergency Response Plan – Surat Basin' (Armour Energy, 2018).

5.9 Stimulation Activities

5.9.1 Activity Description

The main benefit of HFS in an oil and gas project is to reduce the total required number or density of drilled wells within the project area to effectively produce the optimal amount of oil and gas from a specific reservoir. Often there are concerns with whether the fracture is contained and how one can ensure that the fracture is not contacting aquifers. This section addresses these concerns and issues, specifically demonstrating the design of the HFS program.

5.9.1.1 Stimulation Program

Multiple fracture stages (also known as "multi stage fracs") within a highly deviated or lateral well increases the effective drainage area or Stimulated Reservoir Volume (SRV) as compared to a single, vertical, hydraulically fractured well in the same reservoir. When multiple wells are drilled from a single pad site, this further reduces the required number of drilled wells required within a project, often by an order of magnitude. Then, when multiple wells with laterals extending radially are sited on a single pad, the total process improves and reduces the environmental impact.

For example, the total water requirements decrease for a multi-well, multi-lateral wellsite as compared to single well sites as the flowback water from one well can be recycled for other wells on the same site resulting in lower losses and water management efficiencies. Armour Energy therefore plans to implement multi-well pads with multiple laterals each employing multiple sequentially staged fracs in order to minimise its long-term footprint on the environment.

The fracture stimulation decision making process is represented in **Appendix B**.

5.9.1.2 Stimulation Fluids

Which specific fracture stimulation fluids based additives are used depend on the unique properties of the fluid designed to create the optimal fracture in a given setting. Specific stimulation additives may be used in low concentrations and may typically include:

- acids (e.g., hydrochloric acid, ascorbic acid, acetic acid);
- bases (e.g., sodium carbonate, sodium bicarbonate, potassium carbonate, sodium hydroxide);
- salts (e.g., sodium chloride, potassium chloride);
- biocides (e.g., sodium hypochlorite, tetrakis (hydroxymethyl) phosphonium sulphate);
- polymers (e.g., guar gum, hydroxyl ethyl cellulose, xanthan gum);
- polymer stabilisers (e.g., sodium thiosulphate);
- polymer crosslinkers (e.g., boric acid, sodium borate, boric oxide);
- polymer breakers (e.g., hemicellulose enzyme breaker, sodium persulphate, ammonium persulphate, diammonium peroxidisulphate);
- iron control agents (e.g., ethylene diamine triacetic acid, nitrile triacetic acid, erythorbic acid; and
- surfactants.

The service companies performing the HFS campaign typically utilise the most ecologically friendly additives available to minimise surface and sub-surface environmental impacts. In almost all cases, the additives are commonly found in most homes and the polymers used are common thickeners used in foods and personal hygiene products. Oxidisers and enzymes are used to aid natural degradation, breaking down the long-chained polymers into small simple sugars that can be flowed back with the base water to the surface at the conclusion or clean-up of the stimulation treatment. Armour Energy will disclose all additives used by them in the HFS of any well to the regulator.

Proppants are used in fracture stimulation to hold open a specific portion of the fracture area within the desired oil and gas reservoir. This provides an artificial and preferential pathway for oil and gas production and increases the effective drainage area of the well. The proppant is comprised of fine-meshed selectively sized silica sand and may also include stable, polymeric-coated non-toxic resin-coated sands to improve the hardness or tackiness of the internal sand grain. In deeper wells a higher strength, manufactured ceramic or alumina bead may be required to maintain the created fracture width based on the depth and closing stress on the fracture. In each case, the proppant selected is designed to create a targeted, stimulated reservoir volume to enhance the extraction of oil and gas from the well.

Chemical composition and environmental persistence of each stimulation additive will be considered once each fracture event has been allocated to a service provider and detailed plans developed.

5.9.2 Stimulation Monitoring

5.9.2.1 Pre-stimulation groundwater monitoring

If any water is produced from the target hydrocarbon-producing formation while drilling, it will be water quality tested. This will enable a more accurate prediction of any possible contaminant concentrations in the post-stimulation flowback water. The parameters that will be tested will be in accordance with the stimulation management procedures developed under the proposed conditions.

Armour Energy will undertake water quality monitoring of landholders' active groundwater bores within a 2 km horizontal radius of the proposed stimulation activities, regardless of the vertical separation distance to the landholder's bore source.

5.9.2.2 Onsite Stimulation Design Assurance Monitoring Program

During the fracture stimulation treatment it is important to assure that the ongoing treatment is progressing as designed and that the design parameters used in accordance with the pre-stimulation stimulation risk assessments, an onsite diagnostics program will be implemented to assure that the treatment is progressing as per design.

For example, treating pressures are the primary diagnostic to assess whether the actual job is performing relative to design as the pressures to propagate the fracture are related to the *in situ* stress environment in the reservoir being stimulated. An onsite pressure diagnostic decision tree (refer to **Appendix C**) will be employed during the stimulation treatment to assure that the actual job is progressing as per design criteria.

If a variance between the design and actual job occurs, the Armour Energy onsite engineer will contact the office with the onsite information. Any identified risks will be assessed in accordance with Armour Energy's Risk Assessment Matrix (see **Appendix A**). Finally, after the HFS, zonal isolation will be assessed through post-fracture production history-matching, pressure monitoring and flowback stimulation fluid testing.

5.9.2.3 Post-Stimulation Flowback Monitoring Program

The key purpose of flowback monitoring is to ensure the flowback is properly characterised prior to disposal. As such, the post-stimulation flowback monitoring program will ensure compliance with the requirements of the proposed condition for stimulation management procedures and involves:

- full analysis of the fluid for all stimulation additives
- analysis of key parameters that may be present in the target formation:
  - metals
  - hydrocarbons

The monitoring will be undertaken within one week of flowback ceasing.

5.9.2.4 Post-Stimulation Groundwater Monitoring

Armour Energy will undertake post-stimulation water quality monitoring of landholders' active groundwater bores within a 2 km radius of the proposed stimulation activities, regardless of the target hydrocarbon producing formation's proximity to the landholder's bore source formation.

5.9.3 Existing Environment

Refer to **Section 5.2.1.2** for geological setting and **Section 5.8.2.2** for hydrogeological setting.

5.9.4 Description of Environmental Values

There are no prescribed environmental values under legislation relating to well stimulation activities for PL71. Based on the assessment of the existing environment, the environmental values to be protected or enhanced (in relation to stimulation activities) are:

- the integrity of underlying and overlying aquifers adjacent to the target formations; and
- the physical and chemical attributes of groundwater.

5.9.5 Emissions and Releases

Stimulation fluid (approximately 96% water, 3.5% or more of ceramic proppant and 0.5% or less of trace additives) will be pumped into the target formation, with at least 80% of the fluid expected to return to the surface in these conventional tight gas sandstone reservoirs (60% from flowback activities and 20%+ during production activities).

5.9.6 Risks and Impacts

There is the potential for HFS fluids to impact upon the surrounding environment, specifically:

- losses of well integrity may cause stimulation fluids to leak into overlying or underlying aquifers;
- although highly unlikely, due to the vertical separation, fracture pathways could migrate beyond the stimulation impact zone, resulting in interconnection of aquifers or HFS fluid vertically migrating into overlying and underlying aquifers;
- surface exposure to chemicals; and
- remnant stimulation fluid in formation.

The risk and magnitude of potential impacts have been assessed as very low (in accordance with **Sections 5.9.6.1** to **5.9.6.3**).

5.9.6.1 Fracture Migration Risks

Well stimulation pressures will be significantly less than actual well design specifications, thus preventing well casing failure during stimulation activities. Real-time logging services will monitor ongoing pressure and temperature effects during the HFS activities.

The likelihood of hydraulic fractures penetrating an aquifer is rare because of vast separation between the hydraulic fracture zones and any aquifers. Fracture modelling predicts a maximum fracture height (i.e. vertical) of 17 m and flowing fracture length (i.e. horizontal) of up to 178 m. The fracture would need to travel hundreds of metres within the formation to impact adjacent aquifers and this is not physically possible with the proposed pressures and geophysical properties of the formation.

The consequence rating is assessed as being 1 (minor) as even if the fracture did migrate far enough to join up with an adjacent aquifer (and it is emphasised that this is not physically possible under the proposed stimulation pressures and geophysical properties of the formation) the volume of fluid that could migrate that distance is negligible.

5.9.6.2 Target Formation Water Quality

As previously discussed, there will be some residual stimulation fluid that remains within the target formations following stimulation activities and flowback although the actual volume remaining from the proposed 3 megalitre fluid volume would be less than 600KL.

The low concentrations and relatively benign nature of the chemical additives used in the stimulation fluid would result in limited impact to groundwater quality (particularly because the target Rewan Formation is a liquid hydrocarbon bearing formation, and water that might be extracted would already be unsafe for domestic or agricultural uses). Armour Energy has determined the consequence of stimulation fluids negatively impacting upon water quality in all target formations as being minor.

5.9.6.3 Chemical Exposure

An overarching risk assessment has been prepared to support this application through highlighting key areas of concern and management strategies to be applied with regard to chemical exposure on site. A summary of the findings of this risk assessment is provided in **Table 5.14**.

Table 5.14 Chemical Exposure Hazard Assessment Summary

Hazard	Mitigation
Hazard from raw undiluted chemicals as delivered	
• Short Term health hazards for exposure to concentrated chemicals as they are delivered to the site are considered to be the most relevant risk. • Undiluted chemicals may be harmful to humans in their solid or liquid form. • All liquid chemical should be treated as hazardous to the environment if spilt directly into a water body. • Guar-gum (powder) may also be hazardous if spilt directly into surface water, however, guar-gum is a natural and easily biodegradable substance. The Cause of harm would be via oxygen depletion.	• All chemicals are to be transported to the site in accordance with the relevant hazardous substance regulation; and • handled on site in accordance with the Safety Data Sheet (SDS) for the product.
Hazard from mixed stimulation fluids and flowback fluids	
• The chemicals are diluted and mixed as a part forming the stimulation fluid and therefore have different hazardous properties than the raw chemicals • based on the dilution ratio of the chemicals, the likely hazard associated with the diluted chemicals would likely to extend as far as mild irritations to gastrointestinal effects. • Fluids are considered likely to be toxic to aquatic environment and to soil organisms due to the elevated salinity. This is a low risk as the wells sites are required to be at least 100m from a watercourse. • Fluids are expected to be of low toxicity to stock, however the water would still not be considered suitable for stock watering purposes.	• The chemicals that are present in the stimulation fluid are in lower concentrations than the undiluted product and are therefore have a lower hazard and health risk. • Ensure that the stimulation fluids is appropriately stored on site in lined ponds or storage vessel to avoid uncontained spills to soil. • Ensure that the fracture stimulation ponds are maintained behind a secure stock proof fence. • Ensure that a suitably certified, or regulated waste contractor is engaged for the removal of the flowback fluid from the ponds

Findings of the exposure assessment component of the overarching risk assessment are as follows:

- considering well integrity control measures and geological separation (refer to **Section 5.9.7.1**), there are no reasonable or plausible exposure pathways arising via the sub-surface;
- exposure pathways for raw chemicals are limited to the spillage scenarios. In the absence of a spill, there is no pathway for to any receptor;
- the only exposure pathway to chemicals into the environment is from the management of the flowback fluid;
- the only exposure pathway to humans under normal operating conditions is to Armour Energy staff and not the general public, due to the isolation of the drilling operation; and
- accidental releases of flowback fluid could result in serious damage to the local soils and potentially result in isolated near surface groundwater contamination. This would only be in the case of a major spill – for example a major containment failure. Any storage structures will be appropriately designed to relevant standards and accepted engineering practice and maintained with enough freeboard to avoid overtopping. Due to the very minor contributions of formation water to flowback, amount of flowback can be accurately quantified to assist in accurate fluid storage planning taking account of potential rainfall events.

Armour Energy has determined that the consequence of managed stimulation fluids or flowback being released in their diluted states is minor (rating 1), and the overall risk rating is very low.

5.9.7 Management Practices

A more detailed risk assessment will be undertaken based on specific chemicals to be used once each fracture event has been allocated to a service provider and detailed plans developed. This risk assessment will populate the Stimulation Management Procedures for the specific well and ensure compliance with the proposed conditions of the EA. The specific objectives of this assessment will be to:

- assess the toxicological and ecotoxicological information of chemicals'
- provide information on the persistence and bioaccumulation potential of the chemicals used;
- identify the stimulation fluid chemicals of potential concern derived from the risk assessment
- undertake an environmental hazard assessment of leaving chemicals used in the stimulation fluids in the target gas producing formation for extended periods subsequent to stimulation
- assess the human health exposure pathways to Armours personnel and the regional population; and
- develop the site-specific risk characterisation of environmental impacts based on the environmental hazard assessment scope of work.

While specific risk control measures will be fully determined based on the results of the detailed environmental risk assessment outlined above, Armour Energy provides the following commitments to good management practices with regards to; well construction and integrity (**Section 5.9.7.1**), fracture migration (**Section 5.9.7.2**), and chemical risk management (**Section 5.9.7.3**).

5.9.7.1 Well Construction and Integrity

Well construction shall be undertaken in accordance with the industry document, 'Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland' (DNRM, 2017) and Armour Energy's 'Well Integrity Management Plan' (Armour Energy, 2018).

The casing programme will consist of 9 5/8 -inch casing set below the Bungil Formation, followed by 7-inch casing to just above the Rewan Formation and 4 ½ inch casing cemented across the Rewan Formation to a total depth. This design will seal off water flows from the Bungil Formation to reduce the risk of cross-flows between aquifers and the uncontrolled release of well bore fluids to surface, throughout the life of the well.

All casing and tubing has been manufactured to strict standards and complies with the latest edition of ISO 11960, and shall be set at appropriate depths to provide an adequate safety margin between the formation fracture pressure and anticipated pressures during well control and casing cementation operations.

Well casing specifications (10,000psi) significantly exceed the proposed HFS surface pressures in order to maintain well integrity. Critical casing loads and safety factors have been calculated for each casing string, utilising specialised well analysis software and real-time monitoring undertaken of pressure and temperature effects during the proposed activities.

Purpose-designed cement and installation techniques shall be used address geologically-specific conditions for each petroleum well to provide a robust seal that isolates the well from the surrounding formations and protects the well materials from extreme formation conditions.

Appropriate cement laboratory testing procedures shall be carried out on representative samples of the mix water, cement and additives to confirm the resulting primary cement slurry meets the requirements of the well design.

5.9.7.2 Fracture Migration

In standard CSG activities, excessive fracture migration has the potential to create connectivity between target formations and adjacent aquifers and, in turn, impact upon the environmental values of the groundwater in those aquifers. However, for this project targeting much deeper hydrocarbon target formations, there are very large separation distances from aquifers used for water resources. This effectively means the chance of migration from the target formation to aquifers is remote as detailed further below.

The specific design of HFS operations for PL71 will ensure that the risk of fracturing beyond the boundaries of the target formation is minimized to the greatest extent practicable, and that the HFS fluid should remain contained within the target formation and the well bore.

The target Rewan Formation in PL71 is 200 - 800 m thick and more than 1,800 m below the earth's surface. Within PL71 there are 16 registered water bores (DNRM and private) and 2 water boreholes identified under the Petroleum and Gas Act. These water bores are located in between the Timbury Hills Formation (i.e. depth of 2,500 m) and the Griman Creek Formation (i.e. depth of 140 m)

Fracture modelling (taking into account the individual properties of the petroleum well, target formation, stimulation fluid, etc.) predicts a fracture height (i.e. vertical) and flowing fracture length (i.e. horizontal) of up to 17 m and 178 m, respectively.

This means that there will be at least 200 m vertical separation between the HFS and the nearest aquifers. This represents at least a x10 safety factor based on the HFS vertical fracture height. The likelihood therefore of a hydraulic fracture penetrating an overlying or underlying aquifer is extremely low. Furthermore, all stimulation activities will be conducted at depths below the Snake Creek Mudstone Member which acts as a geological seal therein preventing fluid migration and cross-flow between adjacent aquifers.

Fracture migration may be monitored using radioactive tracers (as an additive to the stimulation fluid).

5.9.7.3 Chemical Risk Management Procedures

The following commitments are to be implemented for the management of HFS chemicals:

- handling and storage of all chemicals will be undertaken in accordance with relevant standards for health and safety, transport, storage, handling, use and disposal;
- liquid chemicals will be transported in approved chemical tote tanks with a catchment tray as required by dangerous good regulations;
- dry chemicals will be carried in in compliance with dangerous goods regulations where relevant and in a manner that will protect against accidental discharge, such as in bulk on pallets;
- pumps, pipes and mixers will be designed ensuring they are of more than adequate capacity and be leak tested prior to use;
- biocides and surfactants will be contained in sealed plastic containers that dissolve in water, therefore requiring no human contact to add them to the stimulation fluid mix. Operators will be trained in the handling and storage of biocides and surfactants;
- A monitoring programme will be implemented, including testing of stimulation pond water after stimulation. Stimulation pond water will not be directed to any other non- stimulation pond or to the treatment system until test results show that it is acceptable in quality; and
- flowback will be stored in tanks.

The following chemicals will not be used in stimulation: naphthalene, phenanthrenes, benzene, fluorenes, ethylene glycol, toluene, ethylbenzene, xylene, phenol, ethylene, diesel, kerosene, aromatic solvents, formaldehyde.

6.0 Rehabilitation

6.1 Decommissioning Infrastructure

Decommissioning well stimulation infrastructure will be undertaken in accordance with the relevant provisions of the *Petroleum and Gas (Production and Safety) Act 2004*, the Petroleum and Gas (Production and Safety) Regulation 2008 and the EA.

Rehabilitation of disturbed areas shall take place progressively as works are staged and new areas are disturbed.

6.2 Transitional Rehabilitation

Transitional rehabilitation will ideally be undertaken on disturbed areas associated with stimulation activities where part of the area is no longer required for those activities.

Transitional rehabilitation aims to stabilise disturbed land prior to undertaking final rehabilitation, thereby minimising potential impacts on surrounding environmental values (e.g. minimising erosion and potential for weed establishment). Transitional rehabilitation involves re-contouring the land surface if required, replacing topsoil, and direct seeding of groundcover species (pasture or native grasses depending on the final post-disturbance land use), with ongoing maintenance required to meet the criteria specified in the EA.

6.3 Final Rehabilitation

Final rehabilitation will be undertaken once the site is no longer required for operational activities. Final rehabilitation can involve remediating any contamination, re-contouring of the landform, replacing subsoil and topsoil, ripping as required, and revegetation with appropriate species depending on the final post-disturbance land use.

6.4 Pre-fabricated Tanks

Pre-fabricated structures for storing HFS fluid and flowback fluids will be utilised during well stimulation activities.

All remaining flowback fluid should be removed and transported to an appropriate treatment/disposal facility. As with all waste, Armour Energy shall deal with the remnant water or flowback fluid in accordance with the waste management hierarchy (per the *Environmental Protection (Waste Management) Policy 2000*) and investigate possible re-use as per requirements of the relevant EA.

Synthetic liners (if used) shall be removed and possible recycling options explored. Where recycling is not an option, the liners shall be disposed of to landfill.

Associated pipework, pumps, water treatment systems, etc. should be decommissioned and removed from site unless the landowner indicates that they would prefer that the infrastructure remains in place for their use.

Where necessary, earthworks shall be undertaken to restore the location of the pre-fabricated tank so that the resultant landform is geo-technically and geo-chemically stable (with due consideration given to settlement, consolidation allowances, bearing capacity, erosion resistance). Compacted surfaces beneath the tank shall be ripped, if necessary. Topsoil shall be reinstated to a depth of 250mm, followed by re-vegetation.

6.5 Road and Access Tracks

Roads and access tracks are an integral part of the environmental management of any petroleum project. Roads and access tracks consolidate the trafficable areas into a discrete section of each project and avoids unnecessary disturbance to the remaining portion of each petroleum authority.

Roads and access tracks that have no further use should be decommissioned by ripping to remove compaction, re-spreading stockpiled topsoil, and revegetation.

6.6 Water Crossings

Waterway crossings should be rehabilitated by re-contouring disturbed areas to match the surrounding land as soon as practicable after petroleum activities have ceased. The surface will usually be lightly scarified before spreading the topsoil, to promote vegetation re-growth and protect against the topsoil loss. Temporary waterway barriers should be removed and reseeding should be undertaken to minimise erosion and promote regeneration of riparian vegetation.

6.7 Flare Pits

Flare pits should generally be decommissioned within 12 months of no longer being required.

As with other containment systems, flare pits should have all remaining liquids removed and transported to an appropriate treatment/disposal facility or, where appropriate, reused in accordance with the waste management hierarchy and the requirements of the relevant EA.

Synthetic liners (if used) should be removed and disposed of to landfill. Associated pipework, pumps, water treatment systems, etc, should be decommissioned and removed from site unless the landowner indicates that they would prefer that the infrastructure remains in place for their use.

Because of the nature and purpose of flare pits, investigations should be undertaken by a suitably qualified person to determine the presence or absence of soil contamination.

In all circumstances, soil investigations should be conducted in accordance with the National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 1999).

Backfilling should be undertaken in a manner that is complimentary to the natural contours of the existing landscape to ensure surface subsidence is avoided. In circumstances where backfilling is not practical, contours should be ripped and returned to a state similar to the surrounding environment. For gibber, erosion can be minimised by maintaining batter slopes of less than 2%. Seeding or revegetation should also be undertaken (subject to original state/distribution of vegetation).

6.8 Visual Amenity of Rehabilitated Areas

Visual aspects of rehabilitated areas can have a considerable impact upon the amenity of surrounding sensitive receptors. Armour Energy should undertake a review of the Planning Scheme of the relevant local government to ensure that its petroleum activities will not adversely impact on visual amenity of current or future sensitive receptors, such as residential dwellings and other industrial activities.

Armour Energy shall consider the following impact mitigation measures:

- where possible, obscure rehabilitated areas with native vegetation or natural landforms; and

- for infrastructure that is authorised to remain intact, utilising neutral colour schemes to facilitate better integration into the surrounding landscape.

Where complaints have been received in relation to visual amenity, Armour Energy shall endeavour to address the issue in an expeditious and cost-effective manner.

6.9 Rehabilitation Success

Rehabilitation can be considered successful when the site can be managed for its designated land-use (either similar to that of surrounding undisturbed areas or as otherwise agreed in a written document with the landowner/holder and administering authority) without any greater management input than for other land in the area being used for a similar purpose and there is evidence that the rehabilitation has been successful for at least three years.

Environmental indicators should be identified in order to effectively demonstrate rehabilitation success. This may involve the measurement of a single parameter or they may involve the amalgamation of measurements of several parameters into an index or model. There could be several indicators for one objective and one indicator may have relevance to more than one objective. Some may be important over a wide area while others may have a local significance or relate to how a particular objective is to be achieved for a particular mine. The general consensus is that a good and useful environmental indicator shall:

- have an agreed, scientifically sound meaning;
- represent an environmental aspect of importance to society;
- tell us something important and its meaning is readily understood;
- have a practical measurement process;
- help focus information to answer important questions; and
- assist decision making by being effective and cost-efficient.

Wherever possible, site-specific environmental indicators should be determined prior to the commencement of rehabilitation works. However, in the absence of site-specific indicators, the following generic indicators shall be applicable:

- final land use takes into account local and regional initiatives;
- land usage options obtain optimal economic and social return whilst minimising environmental impact;
- final land use is compatible with surrounding land function/usage requirements;
- final land use addresses the limitations of land capability and growing media;
- land use will be aligned to the relevant land zonings and regional Planning Schemes;
- weeds and pest animal species (distribution and impact) are broadly comparable to baseline or reference site;
- areas of bare ground are broadly comparable to reference site;
- live species, healthy species, trees with dieback, dead species, and species flowering is comparable to reference sites; and

- growth of trees, shrubs, grasses, etc, is comparable to reference sites with consideration of variable factors between reference and rehabilitation sites.

Rehabilitation shall be considered successful where the designated environmental indicators have been achieved for the stipulated monitoring period.

6.10 Rehabilitation Monitoring and Reporting

Ideally, rehabilitation monitoring should make critical comparisons with environmental monitoring results against rehabilitation objectives, and target and identify possible trends and areas for improvement. Monitoring shall be structured to assess effectiveness of environmental controls implemented and, where necessary, identify modifications required for the monitoring program, rehabilitation practices or areas requiring research.

Reporting shall be undertaken in accordance with statutory requirements.

7.0 Environmental Offsets

An environmental authority amendment application for a resource activity is a prescribed activity under the *Environmental Offsets Regulation 2014* for which an environmental offset may be required if the activity will have a significant residual impact on a prescribed environmental matter.

Prescribed matters are also identified in the *Environmental Offsets Regulation 2014* which under this application the applicable prescribed matter will be 'matters of state environmental significance' which are defined in Schedule 2.

The location of these additional wells and HFS activities has been designed to avoid any prescribed matter and as such do not trigger the need for an environmental offset.

8.0 References

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Environmental Protection (Water) Policy 2009

Environmental Protection (Noise) Policy 2008 (Qld)

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National Greenhouse and Energy Reporting Act 2007

National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Cth)

Petroleum and Gas (Production and Safety) Act 2004

Petroleum and Gas (Production and Safety) Regulation 2008

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Queensland Government, 2012, 'Queensland Spatial Catalogue', Land systems – lands of the Balonne-Maranoa area – Queensland – ZBA2, http://qldspatial.information.qld.gov.au/catalogue/ custom/ search.page?q=%22Land systems - lands of the Balonne-Maranoa area - Queensland - ZBA2%22

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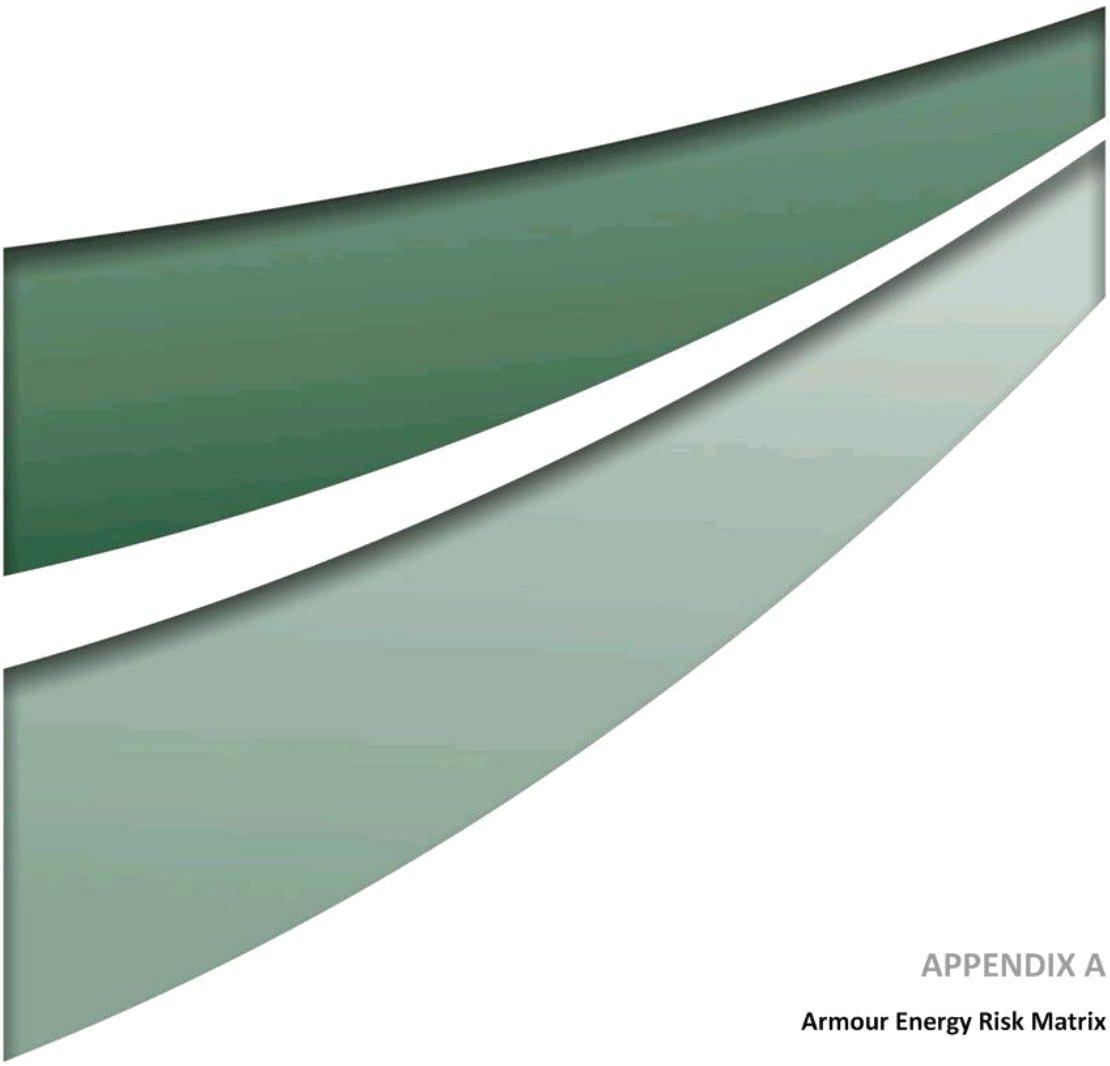


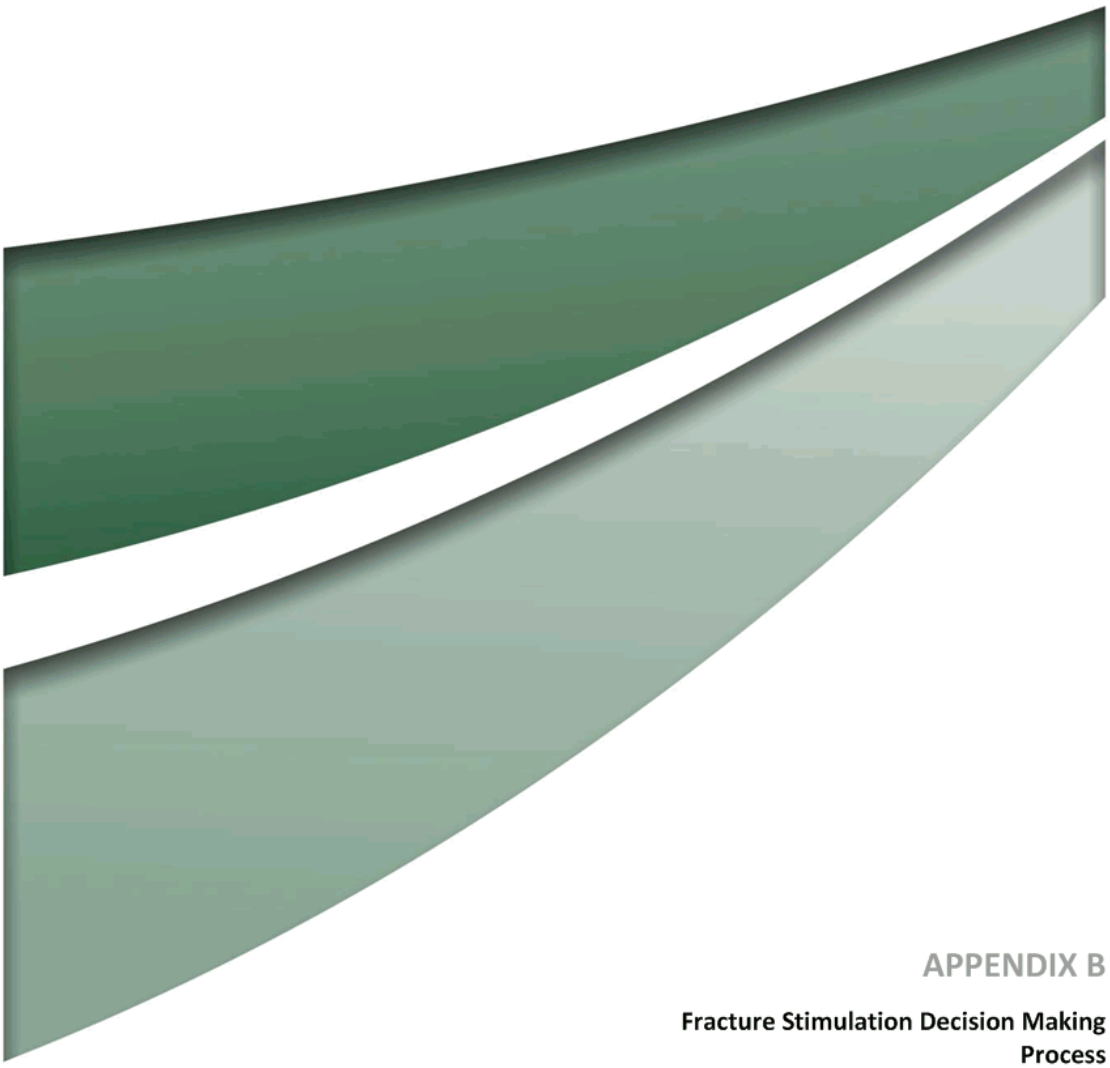
APPENDIX A

Armour Energy Risk Matrix

Armour Energy Risk Matrix

	Natural Environment		LIKELIHOOD				
			1 RARE May occur only in exceptional circumstances but no history of such an event occurring	2 UNLIKELY Unlikely to occur, but a history of the event in the industry or activity	3 POSSIBLE Might occur at some time. Clear evidence of such events / general view they could occur	4 LIKELY Will probably occur > 50% change of occurring	5 ALMOST CERTAIN Is expected to occur in most circumstances
MINOR 1	Minor environmental damage (e.g.) - Limited damage to minimal area of low significance - Little or no environmental harm	MINOR 1	Very low	Low	Low	Low	Medium
MODERATE 2	Moderate environmental damage (e.g.) - Environmental harm which is localised and easily rehabilitated - Spill of a small volume of contaminants which is contained on site - Short term damage to a small area of little environmental significance - Environmental nuisance complaint from resident	MODERATE 2	Low	Low	Medium	Medium	High
SERIOUS 3	Serious environmental damage (e.g.) - Spill released from site which does not impact on ecosystem function - Short term impact on protected species - Several environmental nuisance complaints from the community	SERIOUS 3	Low	Medium	High	High	Very high
MAJOR 4	Major environmental damage (e.g.) - Short-term harm that is widespread or of a high impact. - Harm caused to an area of high conservation value or special significance - Harm affecting the health of a group of people - Death of protected species - Spill with short to medium term impact on ecosystem function - Broad public concern at regional level due to environmental nuisance	MAJOR 4	Low	Medium	High	Very High	Extreme
CATASTROPHIC 5	Catastrophic environmental damage (e.g.) - Long-term harm that is widespread or of a high impact - Irreparable damage to an environmental value - Environmental harm which causes a fatality - Destruction of protected ecosystems - Spill with long term impact on ecosystem function - Action that contributes to the extinction of a species	CATASTROPHIC 5	Medium	High	Very high	Extreme	Extreme

CONSEQUENCE RATING

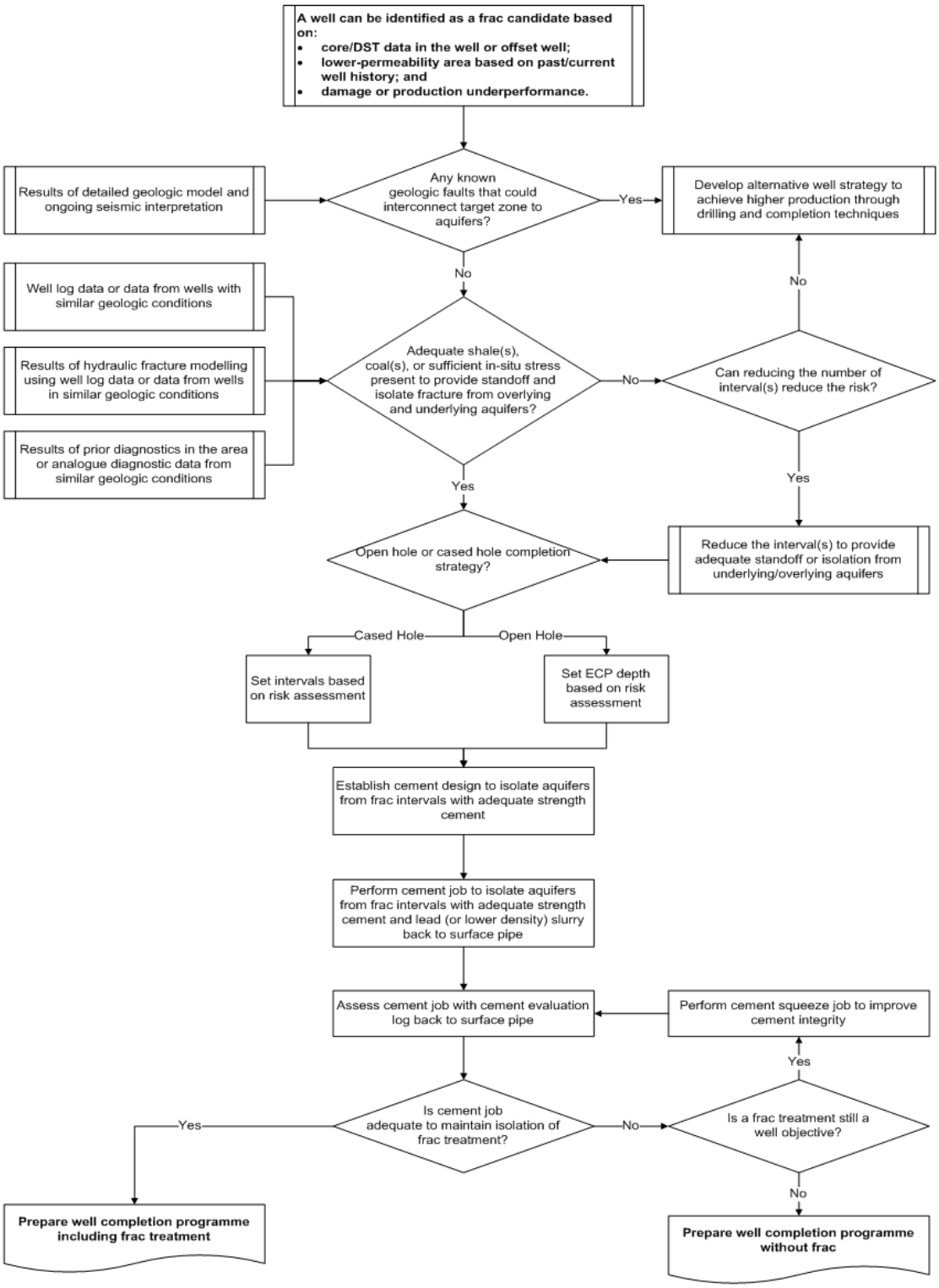


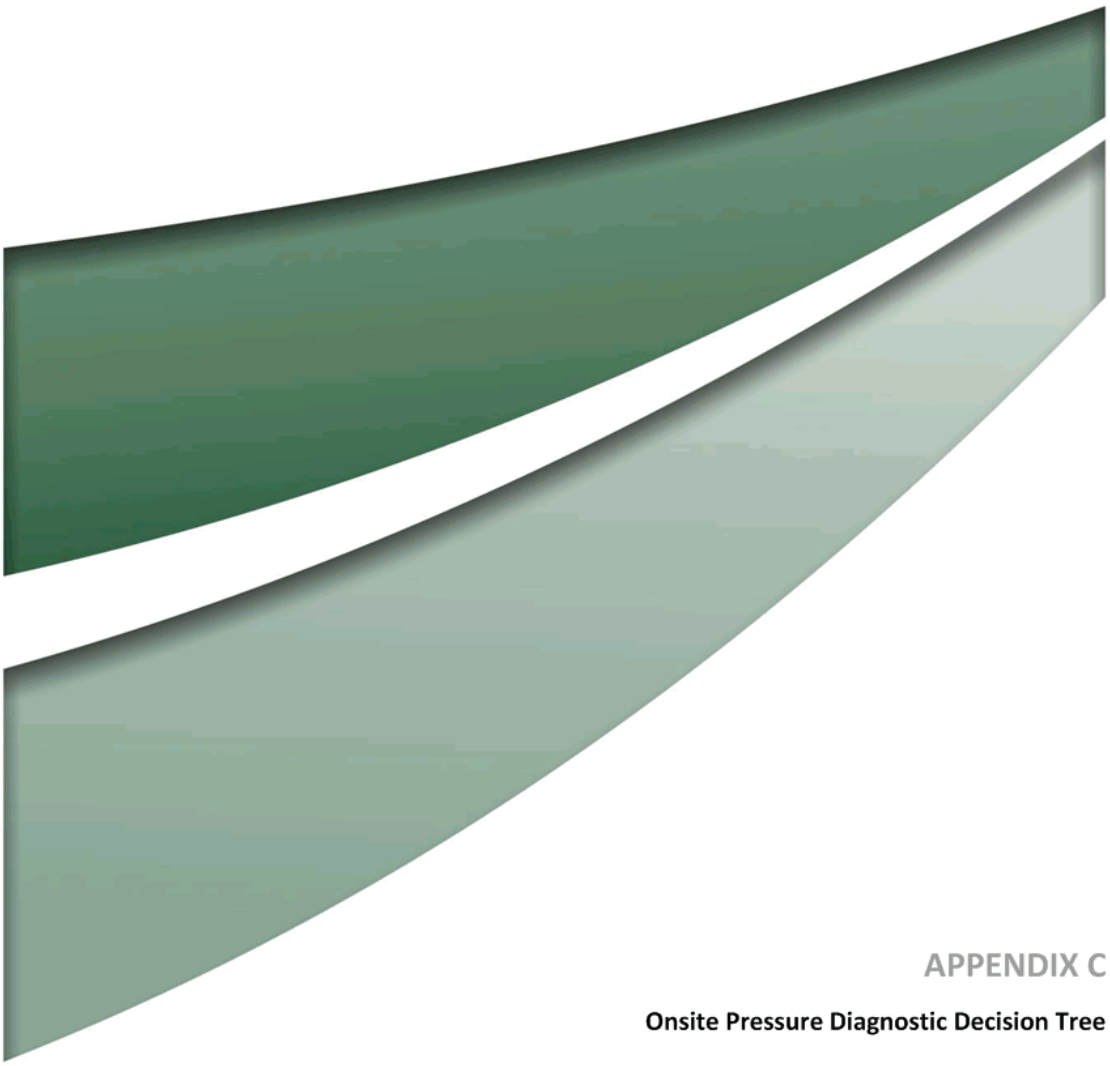
APPENDIX B

Fracture Stimulation Decision Making Process

umwelt

Fracture Stimulation Decision Making Process





APPENDIX C

Onsite Pressure Diagnostic Decision Tree

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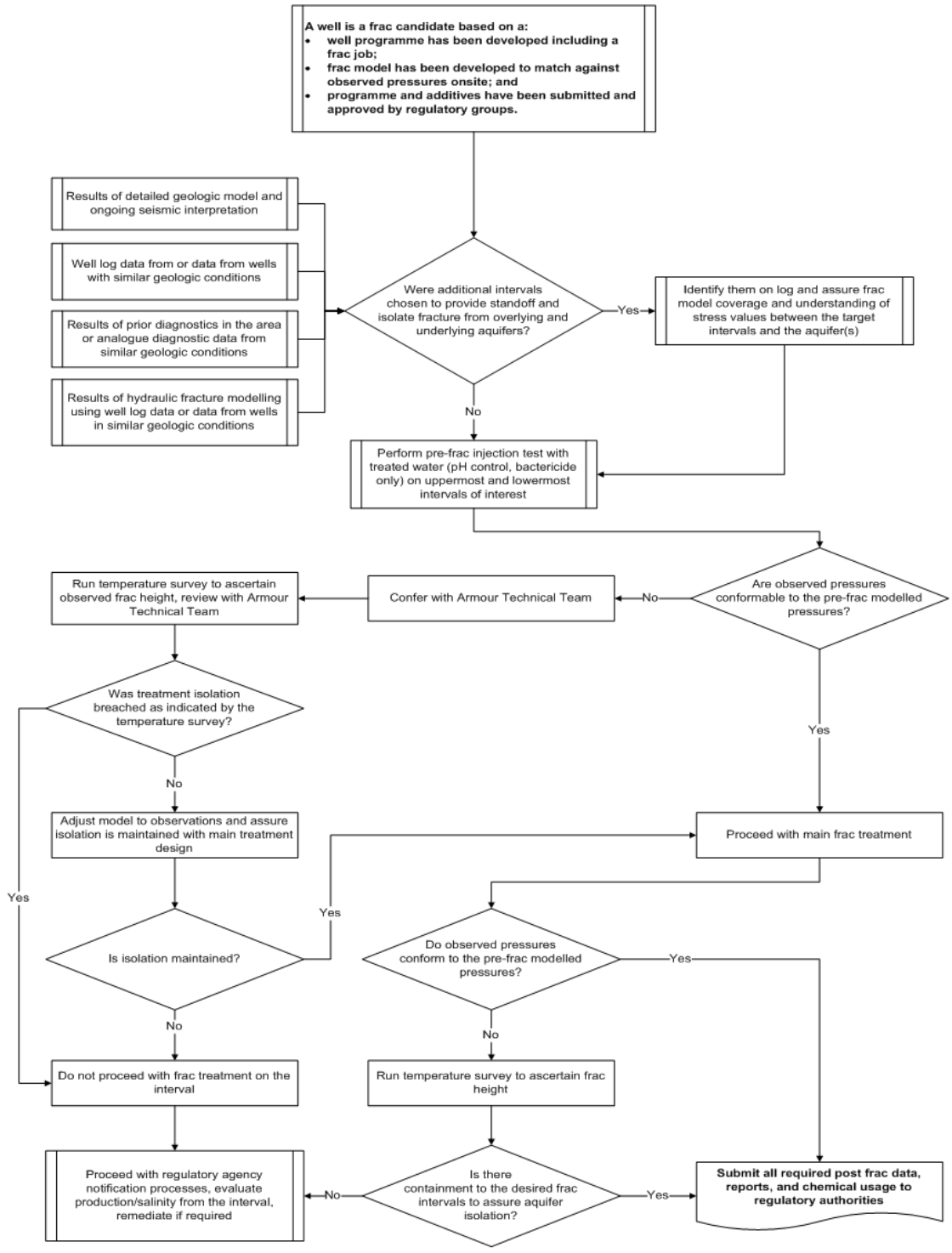
Onsite Pressure Diagnostic Decision Tree



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COUNCILLOR REPORT

Meeting: General 26 September 2018 **Date:** 26 September 2018

Item Number: L.4 **File Number:** D18/76478

SUBJECT HEADING: Membership Opportunity - South Queensland Natural Resource Management Ltd.

Classification: Open Access

Author & Councillor's Title: Cr Tyson Golder

Executive Summary:
This matter was laid on the table at the last meeting and is represented in accordance with the following resolution **GM/09.2018/84.**

Councillor's Recommendation:
That the information be considered.

Background:
Chairperson of the interim Southern Queensland Natural Resource Management (SQ NRM) Mark O'Brien, has emailed Mayor Golder to encourage Councillors and staff to consider applying for membership in the NRM.

Consultation:
Chair Mark O'Brien - SQNRM

Policy Implications:
Nil

Financial Resource Implications:
Nil

Supporting Documentation:

1⇩	South Queensland NRM formation - Media Release - 2018	D18/70061
2⇩	Mark O'Brien - Request for consideration of SQNRM membership - 4 September 2018	D18/70098

MEDIA RELEASE

For immediate release

27 August 2018

Members sought for Southern Queensland NRM

Southern Queenslanders are invited to help shape the future of natural resource management (NRM) in the region by becoming a member of Southern Queensland Natural Resource Management.

Southern Queensland Natural Resource Management (SQ NRM), a not-for-profit organisation, has been established to deliver quality natural resources management services and support for the communities across southern Queensland.

The NRM region extends from the eastern Toowoomba Regional Council boundary, to the northern boundaries of the Western Downs, Maranoa and Murweh Regional Councils, south to the southern Queensland border and includes Quilpie and Bulloo local government areas.

The new NRM body has been formed to deliver an inclusive, equitable and sustainable approach to natural resource management for Southern Queensland.

The formation is fully supported by South West NRM, Condamine Alliance and Queensland Murray Darling Committee. These existing NRMs are currently transitioning towards closure.

Chair of the interim SQ NRM board, Mark O'Brien, said it was an exciting time for the community to get involved in NRM.

"We are committed to delivering community-led natural resource management right across the region so we need a diverse membership which reflects our regions interests and industry" Mr O'Brien said.

"We invite individuals to become members before 30 September so they are eligible to vote at the first General Meeting on 31 October.

"We are also very keen to hear from people interested in forming the new Board of Directors" Mr O'Brien said.

Membership of SQ NRM is free. To join or find out more email members@sqnrm.com.au.

<ENDS>

Media contact: Bob Frazer, Acting CEO, 0487410382.

Photo: Interim SQNRM board from left, Hugh McMicking, Karen Tully, George Moore, Ann Noon, Jim Cavaye and Mark O'Brien (chair).

Michelle Filan

From: Mark O'Brien <mark@wwsale.com.au>
Sent: Tuesday, 4 September 2018 8:53 AM
To: Tyson Golder
Subject: SQNRM membership
Attachments: SQ NRM Membership Form 2018-2019 v2.docx

Follow Up Flag: Follow up
Flag Status: Flagged

Tyson

Could I encourage you and your councillors and staff to consider becoming members of the new NRM Regional Body called SQNRM.

Attached is a membership form.
It's free but application before the end of this month is imperative.

Thanks and regards

Mark

Mark O'Brien
Chairman
SQ NRM
0427 568 324
mark@wwsale.com.au

Southern Queensland Natural Resources Management Ltd
Individual Membership Application Form 2018/2019

Name:					
Of (street address):					
City/Town:		State:		Postcode:	
Email address:					
Phone number:					

I wish to apply for membership of Southern Queensland Natural Resources Management Ltd. and agree to be bound by the regulations of its Constitution.

My primary place of residence is in the (tick one only):

☐ Eastern Sub-region
☐ Western Sub-region
☐ Outside, but with a strong interest in the region.

I am interested/have knowledge and skills in (tick three only):

☐ Practical on-ground natural resource management	☐ Land management and Land Use planning
☐ Water and Water Quality	☐ Community participation and development
☐ Industry including Agriculture	☐ Conservation
☐ Catchment management	☐ Aboriginal interests and cultural assets
☐ Climate	☐ Weed and feral animal management.

Membership fee:

The membership fee for an individual applicant for the 2018/2019 Financial Year is: $0.00

Members commitment:

By applying for membership, you agree to be bound by the Constitution of Southern Queensland Natural Resources Management Ltd.

Signed by:

Name:		**Signature:**		**Date:**	

OPTIONAL:

Other relevant groups that I am a member of in the region (i.e. landcare):	

Office use only:

Date received:	Date:	
Entered on applicant register by:	Name: Date:	
Board approval:	Date:	
Entered on member register by:	Name: Date:	

Southern Queensland Natural Resources Management
PO Box 1670
Toowoomba Qld 4350
membersqnrm@gmail.com