Minor Amendment to EPPG00304213

Supporting Information

19 September 2023

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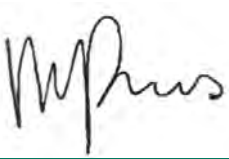

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Acronyms and Abbreviations

AGL	AGL Upstream Gas (Mos) Pty Limited and AGL Gas Storage Pty Ltd
BTEX	Benzene, toluene, ethylbenzene, xylenes
DES	Department of Environment and Science
DFIT	Diagnostic Fracture Injection Test
EA	Environmental Authority
EA Amendment	The application
EP Act	*Environmental Protection Act 1994*
ERA	Environmentally Relevant Activity
ERM	Environmental Resources Management Australia Pty Ltd
ESA	Environmentally Sensitive Areas
EV	Environmental Values
GAB	Great Artesian Basin
GDE	Groundwater Dependent Ecosystem
HHERA	Human Health and Ecological Risk Assessment
LOR	Limit of reporting
MEM	Mechanical Earth Model
Model Conditions	Streamlined Model Conditions for Petroleum Activities
MSES	Matter of State Environmental Significance
PBT Chemical	Persistent, bioaccumulative and toxic chemical
PAH	Polycyclic aromatic hydrocarbons
PL	Petroleum Lease
Project Area	PL213
Proposed Activity	The undertaking of hydraulic stimulation on PL213 at WN1 at coordinates 270 07’ 33.348” S, 1490 10’ 58.044” E
RPI Act	*Regional Planning Interests Act 2014*
SCL	Strategic Cropping Land
SRI	Significant Residual Impact
Target Formation	Upper Tinowon Sandstone formation
The Applicant	AGL Upstream Gas (Mos) Pty Limited and AGL Gas Storage Pty Ltd
TVD	True Vertical Depth
WN1	West Noorindoo 1

EXECUTIVE SUMMARY

AGL Upstream Gas (Mos) Pty Limited and AGL Gas Storage Pty Ltd (known collectively as AGL or 'the Applicant') propose to undertake hydraulic strata stimulation on Petroleum Lease (PL) 213. The well proposed to be subject to hydraulic strata stimulation is West Noorindoo 1 (WN1), located in a deep tight gas sandstone reservoir at coordinates 270 07' 33.348" S, 1490 10' 58.044" E.

To facilitate the planned stimulation activities, Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by AGL to assist with the preparation of the application to amend Environmental Authority (EA) EPPG00304213 (EA Amendment).

The existing conditions of EA EPPG0304213 are intended to be retained in this amendment application as the proposed stimulation activities are consistent with those conditions. What is sought in this amendment application is the addition of further conditions to expressly reflect and authorise the proposed hydraulic strata stimulation. In summary, the proposed EA Amendment seeks to facilitate the following:

- Enable AGL to undertake hydraulic strata stimulation of WN1 on PL213, located at coordinates 270 07' 33.348" S, 1490 10' 58.044" E; and
- Better align EA EPPG00304213 with neighbouring EAs under AGL's management. This alignment is proposed to occur via the adoption of relevant 'Streamlined Model Conditions for Petroleum Activities' (Department of Environment and Science (DES), 2016, ESR/2016/1989) ('Model Conditions') applicable to stimulation activities.

As part of this EA Amendment application, the potential socio-environmental risks associated with the proposed hydraulic strata stimulation activity have been assessed. Based on this assessment, it is considered that the overall level of environmental risk is low given the following:

- The pre-existing geological conditions act to isolate groundwater within the surrounding area and thereby limit the potential for off-site impacts;
- The potential impacts of hydraulic strata stimulation within the Surat Basin are well known, with AGL having successfully undertaken several stimulation activities within the adjacent lease area (PL192) without incident;
- Potential impacts related to the proposed stimulation activity are largely the same as existing impacts related to PL213, as previously assessed and approved by DES under EA EPPG00304213 (dated 15 May 2015);
- AGL has an existing understanding of the regulatory requirements and geological, hydrological, and environmental conditions on PL213 (and the surrounding area), and is confident that future hydraulic strata stimulation activities carried out on PL213 can comply with the relevant Model Conditions; and
- AGL will carry out the stimulation activity in accordance with similar management and control systems already in place for the adjacent lease area (PL192), given it permits hydraulic strata stimulation activities in accordance with the relevant Model Conditions.

It is considered that, given the existing approved activities on site, consistency with surrounding activities, physical site conditions, location of the activity in relation to sensitive receptors and low environmental risk of the proposed addition of hydraulic strata stimulation activity, it is submitted that the amendment readily meets the definition of a 'Minor Amendment (threshold)' under Section 223 of the *Environmental Protection Act 1994*.

1. INTRODUCTION

This Supporting Information document has been prepared to accompany the application to amend Environmental Authority (EA) EPPG00304213. EA EPPG00304213 is held by AGL Upstream Gas (Mos) Pty Limited and AGL Gas Storage Pty Ltd (known collectively as AGL or 'the Applicant') and relates to activities undertaken on Petroleum Lease (PL) 213 (refer to **Figure 1-1**).

For the purposes of this EA Amendment application, the terms used are defined as below:

- Proposed Activity – The undertaking of hydraulic stimulation on PL213 at West Noorindoo 1 (WN1) at coordinates 270 07' 33.348" S, 1490 10' 58.044" E;
- Project Area – This is broadly defined as PL213; and
- Target Formation – This is the Upper Tinowon Sandstone formation.

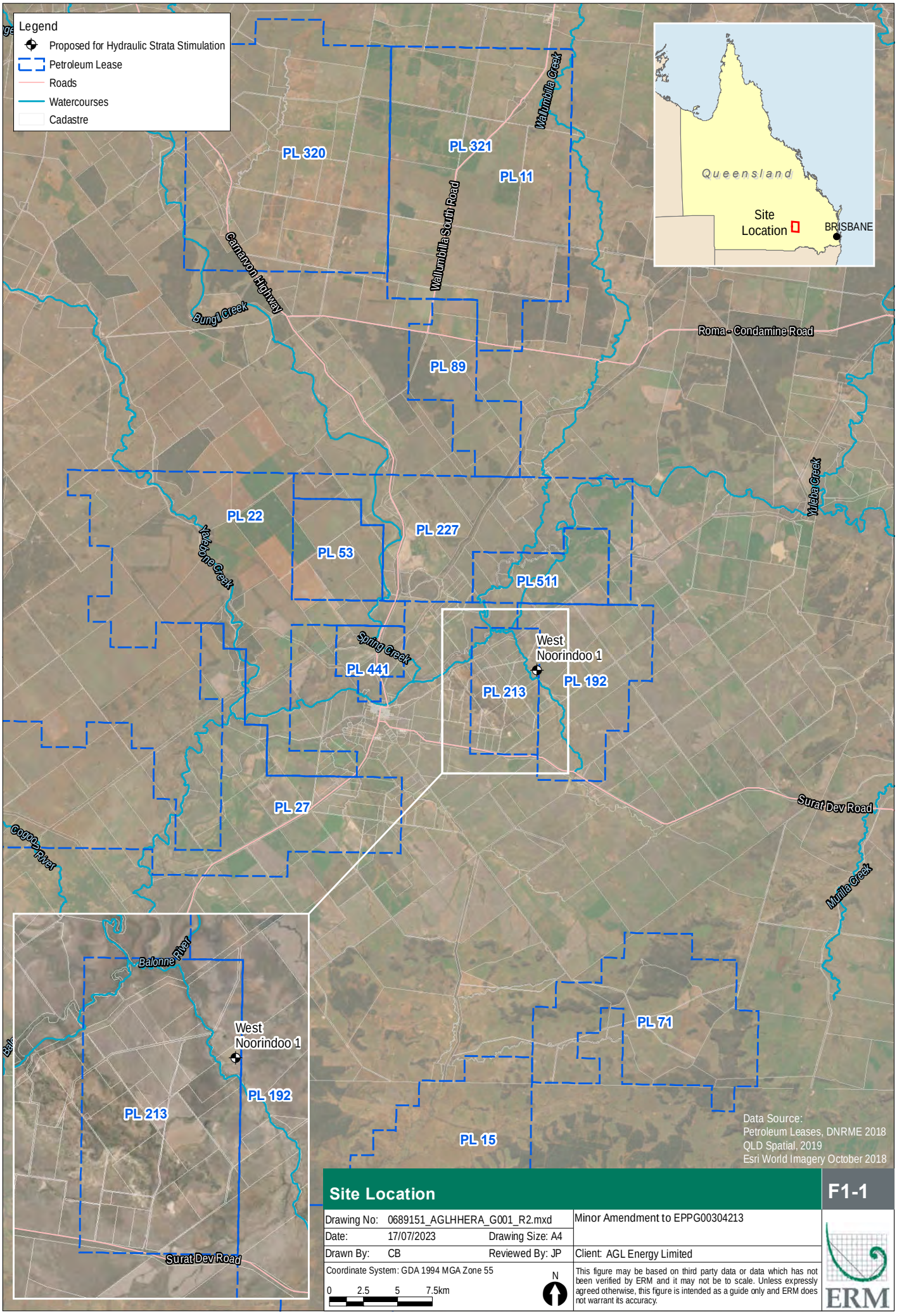
Specifically, the purpose of this EA Amendment application is to:

- Facilitate hydraulic strata stimulation of WN1 on PL213, located at coordinates 270 07' 33.348" S, 1490 10' 58.044" E; and
- Update the conditions of EA EPPG00304213 to account for the proposed hydraulic strata stimulation activity via the adoption of the relevant 'Streamlined Model Conditions for Petroleum Activities' (Department of Environment and Science (DES), 2016, ESR/2016/1989) ('Model Conditions') applicable to the Proposed Activity.

This Supporting Information document provides detail regarding the:

- Site background and context (refer to **Section 2**);
- Environmental Values of relevance and proximity to sensitive receptors in the vicinity of the Project Area (refer to **Section 3** and **Section 4**);
- Proposed hydraulic strata stimulation activities (refer to **Section 5**);
- Potential environmental risk assessment for the proposed activity (refer to **Section 6**); and
- Legislative considerations under the *Environmental Protection Act 1994* (EP Act) and Guideline - Major and Minor Amendments - EP Act ESR/2015/1684 (dated 4 May 2022) (refer to **Section 7**).

Based on the information considered as part of this Supporting Information document, it is considered that the proposed EA Amendment application meets the definition of a 'Minor Amendment' (threshold) under Section 223 of the EP Act. Further detail outlining how this is achieved is provided in **Section 7**.



Site Location

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Coordinate System: GDA 1994 MGA Zone 55

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2. SITE BACKGROUND AND CONTEXT

2.1 Site Information

PL213 is located approximately 15 km north-east of the Surat Township and 55 km north of the Silver Springs gas plant and is part of the larger AGL Energy Surat Basin tenements. Existing infrastructure on the adjacent PL192 contains the Churchie Processing Plant which currently processes production from the Churchie gas field, including gas from WN1. The well proposed for the Proposed Activity is located on Lot 2 on E533, which is registered as freehold land owned by a private landholders, with a PL (PL213) over the land.

Site details are generally consistent with the adjacent PL192 where hydraulic strata stimulation has been previously approved and carried out by AGL. **Table 2-1** provides the lease information relevant to PL213. Existing infrastructure for PL213 includes a producing and shut-in well. The existing petroleum wells located in PL213 are outlined in **Table 2-2**.

Table 2-1 Lease Summary

Lease	Area	Grant Date	Renewal Date	Permit Expiry	Ownership	Field Name
PL213	4,577 ha	30 March 2006	17 June 2021	31 March 2027	AGL Upstream Gas (MOS) and Gas Storage	Churchie West

Table 2-2 Petroleum Wells located in PL213

Field	Well name	Well status	Latitude	Longitude
Churchie	West Noorindoo-1	Shut-in	27^0 07’ 33.348” S	149^0 10’ 58.044” E
Churchie	Noorindoo-4	Plugged and abandoned	27^0 07’ 23.232” S	149^0 09’ 49.932” E
Churchie	Churchie West-1	Producing	27^0 06’ 43.092” S	149^0 10’ 55.96” E

2.2 Geology

PL213 is located within the Surat and Bowen Basin portions of the Great Artesian Basin (GAB) and situated to the east of the Roma Shelf, along the flanks of the Taroom Trough (**Figure 2-1**). A high level summary of the geology with approximate depths of formations present in PL213 is provided in **Table 2-3**.

Table 2-3 Geological Formation Summary for PL213

Basin	Age	Formation/Member	Top Depth (m)	Base Depth (m)
Surat Basin	Late Jurassic – Early Cretaceous	Bungil Formation	417	534
		Mooga Sandstone	534	747
	Late Jurassic	Orallo Formation	747	877
		Gubberamunda Sandstone	877	1,011
		Westbourne Formation	1,011	1,055
		Springbrook Sandstone	1,055	1,168
	Middle Jurassic	Walloon Coal Measures	1,168	1,425
		Hutton Sandstone	1,452	1,584
	Early Jurassic	Upper Evergreen Formation	1,584	1,666
		Boxvale Sandstone	1,666	1,669
	Early-Middle Triassic	Lower Evergreen Formation	1,669	1,736
		Moolayember Formation	1,736	1,995

Basin	Age	Formation/Member	Top Depth (m)	Base Depth (m)
		Snake Creek Mudstone	1,945	1,961
		Showgrounds Formation	1,961	1,971
		Rewan Formation	1,971	2,050
Bowen Basin	Late Permian	Bandanna Formation	2,050	2,114
		Black Alley Shale	2,114	2,128
		Winnathoola Coal	2,128	2,141
		Tinowon Siltstone	2,141	2,170
		Upper Tinowon Sandstone	2,170	2,183
		Tinowon Coal Member	2,183	2,190
		Lower Tinowon Sandstone	2,190	2,225
		Wallabella Coal Member	2,225	2,235
		Wallabella Formation	2,235	2,265
		Timbury Hills Formation	2,265	2,285

The Surat Basin is an established hydrocarbon province, with production from conventional fields in the basin totalling some 500 billion cubic feet of gas and 40 million barrels of oil and condensate (excluding coal gas fields). The bulk of the oil and gas has been recovered from Jurassic aged reservoirs (approximately 50%), Triassic aged reservoirs (approximately 47%) and Permian aged reservoirs (approximately 3%).

The structural framework for the Surat Basin is controlled by the underlying Bowen Basin that underwent a period of significant compression, uplift and erosion during the late Triassic period. Hydrocarbon traps are characterised as low relief anticlines, often associated with Triassic aged faulting.

Throughout the Project Area, the Upper and Lower Tinowon Sandstone sequence in the deeper Bowen Basin is separated by thick coal (Wallabella coal member). The coal may be 10 m to 15 m in thickness and frequently contains an Intra Wallabella Sandstone sequence (**Table 2-3**). These Permian coals are mature for oil and gas generation and are thought to charge many of the conventional clastic reservoirs within the stratigraphic column. The total thickness of the Tinowon Formation may be as great as 100 m.

Existing stratigraphic understanding based on wells installed across the basin shows great complexity of the fluvial sand development within all three horizons. Rapid lateral changes are observed in both the gross sandstone thickness as well as the net to gross ratios of the individual sandstone bodies.

Great Artesian Basin and Project Area Location

2-1

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2.3 Hydrogeology

The GAB is a complex hydrogeological system of aquifers stretching across Queensland, New South Wales, South Australia, and Northern Territory. The bounds of the GAB are defined by groundwater conditions as well as geological basins. The most impacted basins encompassed by the GAB are the Eromanga, Carpentaria, Clarence-Moreton, and the Surat Basins. The Bowen Basin, which underlies the Surat Basin within PL213 is considered an integral part of the GAB, due to its hydraulic connection to some sections of the GAB (refer to **Figure 2-1**).

Both the Surat and Bowen Basins are multi-layered mainly confined hydrogeological systems comprising of alternating layers of water bearing (permeable) sandstones, and non-water bearing (impermeable) siltstones and mud stones. These impermeable rocks hinder groundwater flow or leakage between the aquifers, limiting risk associated with the Proposed Activity.

There are several aquifers within the Surat Basin with significant water-bearing capacities due to their thickness, porosity, hydraulic conductivity, water storage capacity and water quality. The main GAB aquifers intersected by wells within PL213 are:

- Mooga Sandstone;
- Gubberamunda Sandstone;
- Springbok Sandstone;
- Hutton Sandstone; and
- Boxvale Formation.

Regionally, groundwater movement within the Surat Basin sequency is dominated by flow controls by the shallow dipping nature of the layered sequence, hydraulic conductivity and structural over prints. Groundwater is inferred to flow under the prevailing hydraulic heads along the plane of the layers, parallel with their bedding and contacts generally towards the centre of the Surat Basin. Groundwater flows in the Bandanna Formation coals are hypothesised to be limited in the Paroon Trough on the eastern edge of PL213. Overall, there is limited data available for deeper aquifers and aquitards of the Bowen Basin.

Within the Project Area, the early-middle Triassic Rewan Formation separates the lower Cretaceous to Jurassic aquifers of the Surat from those of the Bowen Basin acting as a semi-pervious boundary. The Rewan group comprises of lithic sandstone, mudstone, shale, siltstone and minor quartz sandstone. Silicification and clay alteration has significantly reduced the porosity and permeability of this layer so that no large aquifers exist within the Bowen Basin formations and members.

3. ENVIRONMENTAL VALUES

3.1 Water

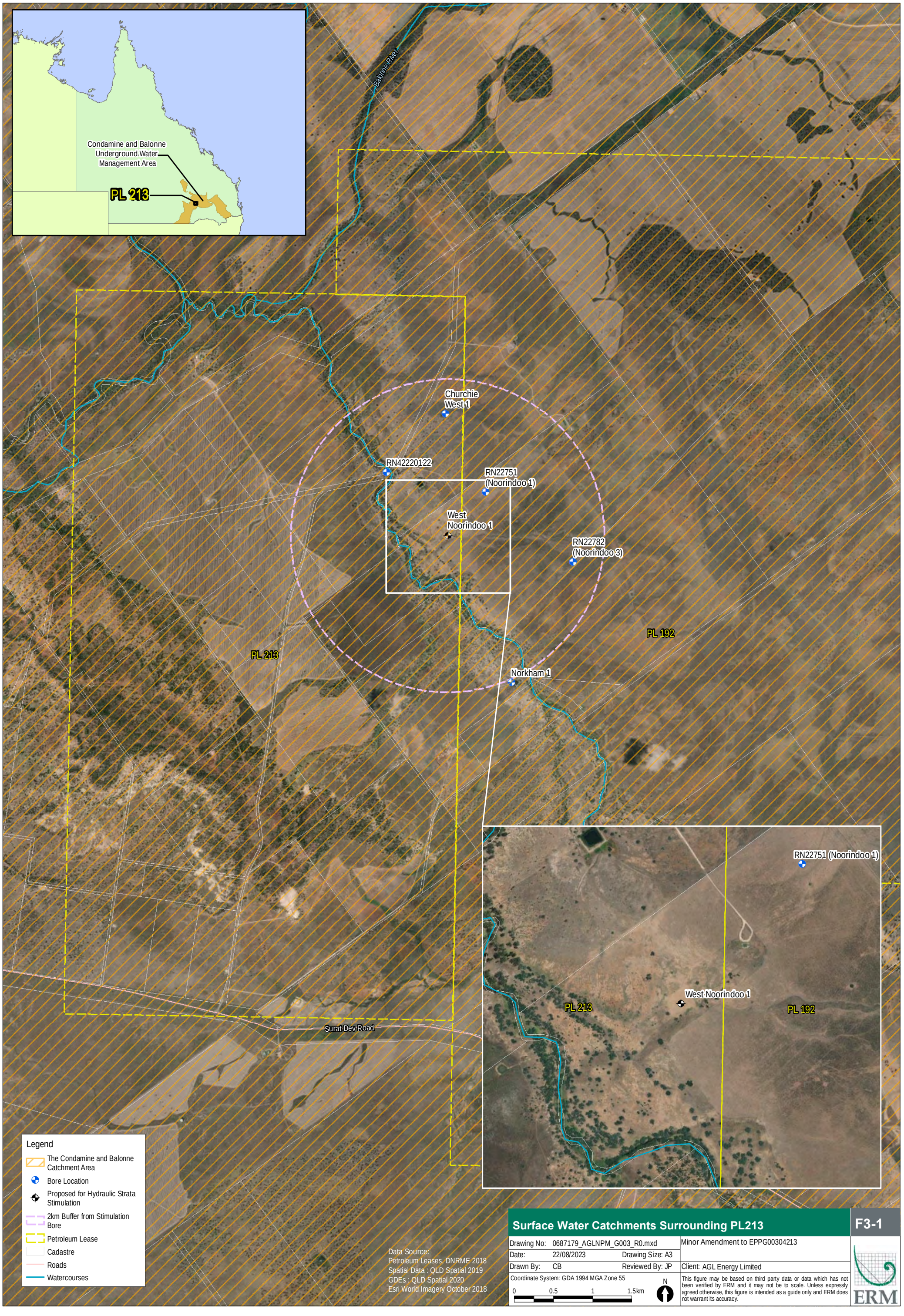
3.1.1 Surface Water

The Condamine-Balonne catchment lies above the GAB system (refer to **Figure 3-1** and **Figure 3-2**). The Condamine River becomes the Balonne River south of Surat. The Lower Balonne, south of PL213, is a complete floodplain channel system wherein several nationally significant wetlands are located. The Lower Balonne floodplain channel system covers approximately 19,880 km^2 and extends to northern New South Wales. The closest nationally significant wetland in the Lower Balonne floodplain channel system to PL213 is the Narran Lake Ramsar Site located in New South Wales approximately 280 km southwest of PL213. Due to the distance between PL213 and the Narran Lake Ramsar Site, limited interaction of groundwaters in the GAB and overlaying surface water on PL213 and limited risk to surface waters posed by the Proposed Activity, no impact to the Narran Lake Ramsar Site is anticipated to be generated by the activity.

The closest State-significant wetland to PL213 is an unnamed wetland located approximately 15km to the northeast. The Queensland government “Wetland Info” website maps this unnamed wetland as a Palustrine wetland comprised of regional ecosystem 11.3.3c. Regional ecosystem 11.3.3c is comprised of, “*Eucalyptus coolabah* woodland to open woodland (to scattered trees) with a sedge or grass understorey in back swamps and old channels”. Regional ecosystem 11.3.3c is not considered a wetland by the Queensland Governments regional ecosystem database; therefore despite mapping of regional ecosystem 11.3.3c over the wetland 15 km to the northeast, regional ecosystem 11 3.3c in other areas is not considered a wetland. The unnamed wetland is mapped as “Derived Groundwater Dependent Ecosystem – low confidence” based on expert opinion.

Assuming the unnamed wetland is groundwater dependent, there is unlikely to be any potential impacts upon it from the Proposed Activity. This is due to the large horizontal and vertical distance from the unnamed wetland, isolation of the formations being stimulated, and heterogeneous nature of the stratigraphy in PL213. More detail on the expected fracturing distance of formations and the basis on which it has been concluded that all potential environmental impacts from Proposed Activity can be managed is described in **Section 5**.

The Balonne River which transects the north- west corner of PL213 is ephemeral and largely reliant on rainfall. Several mapped surface watercourses are located within PL213 and are ephemeral tributaries of the Balonne River. The primary risk to surface waters posed by the Proposed Activity is potential for spills at surface and leakage to groundwater during simulation activities. The risk of potential impact to surrounding surface waters is considered very unlikely to occur. These potential impacts have been considered further in **Section 6.**



Surface Water Catchments Surrounding PL213

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Date:	22/08/2023	Drawing Size: A3	
Drawn By:	CB	Reviewed By: JP	Client: AGL Energy Limited

Coordinate System: GDA 1994 MGA Zone 55

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3.1.1.1 Surface Water Use

Water use within the Surat Basin is widespread, with the main uses being stock water, irrigation and domestic consumption. According to the Queensland Water Quality Guidelines (2019) (Maranoa-Balonne Rivers Basin Environmental Values and Water Quality Objectives Part of Basin 422, including all surface waters of the Maranoa and Balonne Rivers Basin, 2020) the Healthy Waters Management Plan Maranoa and Balonne River Basin (2019) and Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017, the Environmental Values (EVs) that require protection include:

- Aquatic ecosystems;
- Irrigation;
- Farm supply/use;
- Stock water;
- Human consumer (i.e. consumption of the organisms within the watercourse);
- Primary recreation;
- Secondary recreation;
- Visual recreation;
- Drinking water;
- Industrial use; and
- Cultural, spiritual, and ceremonial values.

The most sensitive human value identified is the protection of drinking water quality and the water quality standards that apply to the assessment of this value are the Australian Drinking Water Guidelines (NHMRC 2021). The degree of change that is acceptable in environmental condition for human use environmental values, such as drinking water, is limited to that which does not affect suitability for those uses.

Additionally, the Healthy Waters Management Plan Maranoa and Balonne River Basin (2019) states that the management intent of the system is to:

a. *protect and restore water-dependent ecosystems of the Murray-Darling Basin;*
b. *protect and restore the ecosystem functions of water-dependent ecosystems; and*
c. *ensure that water-dependent ecosystems are resilient to climate change and other risks and threats.*

To avoid and/or minimise impacts to surface waters, management strategies will be implemented that are consistent with those that have been previously implemented for the adjacent lease area PL192. These management actions are compliant with the relevant Model Conditions proposed to be adopted as part of this EA Amendment application and have been successful in managing the stimulation activities on PL192 without incident. Refer to **Section 6** for further detail.

3.1.2 Groundwater Environmental Values

3.1.2.1 Formations containing groundwater

All formations intersected by WN1 contain groundwater. The only formation containing groundwater where environmental values require protecting in relation to the Proposed Activity is the Upper Tinowon Sandstone, as it is the only formation which has the potential to be affected by the Proposed Activity. Further detail is provided in **Sections 5.1, 5.1.1** and **6.1.1.2.**

3.1.2.2 Target gas producing formations

The Target Formation for the Proposed Activity is the Upper Tinowon Sandstone (Late Permian sandstones). These are in the Bowen Basin, below the aquifers and formations of the GAB in the overlying Surat Basin (listed in **Section 2.3**). The Target Formation is not considered a beneficial aquifer due to the low permeability and subsequent low yield of groundwater within these horizons. Available data collected from the Bowen Basin indicates $NaHCO_3$ groundwater of relatively high salinity, with high fluoride occurrences (State of Queensland, 2020). Additionally, the Target Formation of the Proposed Activity may be somewhat limited in their beneficial uses due to the naturally occurring presence of hydrocarbons in the formations.

The Target Formation is comprised of sandstone. During drilling of the well, all other formations, and potential aquifers, are isolated by pressure cementing and casing during drilling, such that the only formation 'open' is the Upper Tinowon Sandstone. This eliminates any risk of interconnection between higher aquifers in the Surat Basin. The Proposed Activity in the Target Formation is limited to the immediate stratigraphic formation and no other formations or groundwater will be affected by the activities. Further information on the potential impact to surrounding formation due to the Proposed Activity is provided in **Section 5**.

To ensure any potential impacts caused by the Proposed Activity are identified, a baseline sampling event of applicable groundwater bores and surface water (if possible) will be undertaken prior to commencement. These sampling events will be undertaken in accordance with existing risk management and impact monitoring procedures required under the current EA conditions, supplemented by the further procedures required under stimulation related conditions as per the relevant Model Conditions proposed to be added to the environmental authority.

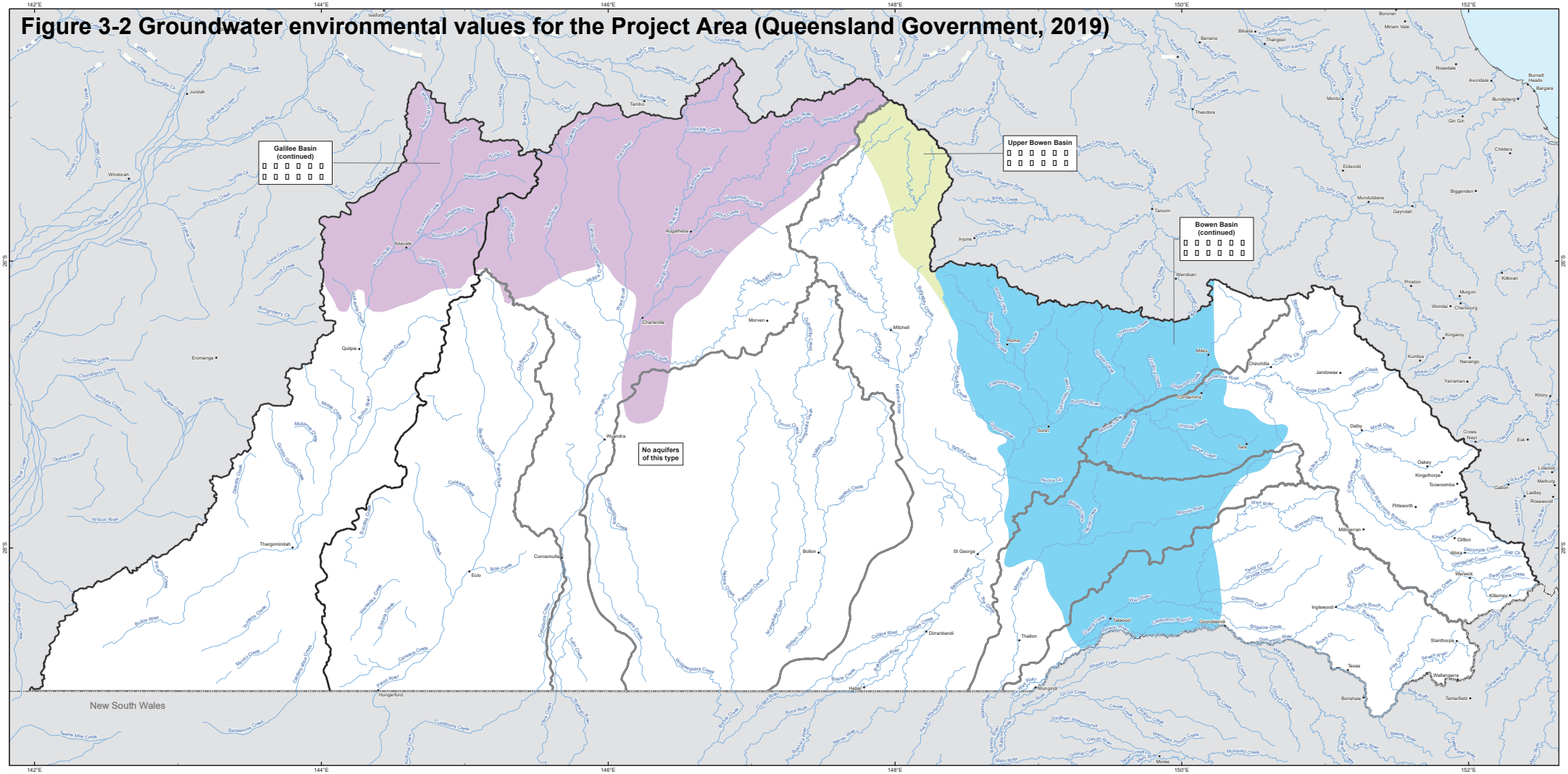
Groundwater Environmental Values for the Maranoa-Balonne Rivers Basin are detailed in the *Queensland Murray-Darling and Bulloo River Basins, Groundwater Environmental Values and Water Quality Objectives, All groundwater of the Queensland Murry-Darling and Bulloo River basins* (2020). For the Target Formation (i.e., Upper Tinowon Sandstone) proposed to be impacted by the Proposed Activity, the appropriate environmental values and beneficial uses to be protected are applicable to *Earlier Basins Partially Underlying the Great Artisan Basin (***Figure 3-2**). Due to the isolated nature of the Proposed Activity, there is a very low risk of impact to the groundwater environmental values of the potentially impacted formation (**Table 3-1**).

Table 3-1 Groundwater Environmental Values for the Bowen Basin and corresponding stratigraphic unit

Environmental Value	Detail	Stratigraphic Unit	Risk and Impact
Aquatic Ecosystem	'A community of organisms living within or adjacent to water, including riparian or foreshore area.' (EPP (Water and Wetland Biodiversity), schedule 2 – Dictionary) The intrinsic value of aquatic ecosystems, habitat and wildlife in waterways and riparian areas, for example, biodiversity, ecological interactions, plants, animals, key species (such as turtles, platypus, seagrass and dugongs) and their habitat, food and drinking water. Waterways include perennial and intermittent surface waters, groundwaters, tidal and non-tidal waters, lakes, storages, reservoirs, dams, wetlands, swamps, marshes, lagoons, canals, natural and artificial channels and the bed and banks of waterways.	Upper Tinowon Sandstone	Very low risk of a minor impact (see Section 3.1.3.1 in relation to groundwater dependent ecosystems)
Stock Watering	Suitability of water supply for production of healthy livestock.	Upper Tinowon Sandstone	Very low risk of a minor impact (see Section 3.1.3)
Cultural and Spiritual Values	Means scientific, social or other significance to the present generation or past or future generations, including Aboriginal people or Torres Strait Islanders Examples include: ■ custodial, spiritual, cultural and traditional heritage, hunting, gathering and ritual responsibilities: ■ symbols, landmarks and icons (such as waterways, turtles and frogs): and ■ lifestyles (such as agriculture and fishing).	Upper Tinowon Sandstone	Very low risk of a minor impact (there is no identifiable connectivity from the deep strata stimulation to the GAB groundwater-bearing units. Therefore, cultural and spiritual values would not be adversely impacted by the Proposed Activity – see Section 6.1.3 of the Human Health and Environmental Risk Assessment (HHERA))

 # Environmental values and definitions above have been sourced from Table 15 of the Queensland Murray-Darling and Bulloo River basins Groundwater Values and Water Quality Objectives

Figure 3-2 Groundwater environmental values for the Project Area (Queensland Government, 2019)



Legend

- Town
- Watercourse
- State border
- Drainage basin boundary
- Boundary of waters covered by the scheduling document

Earlier Basins Partially Underlying the Great Artesian Basin

- No aquifers of this type
- Bowen Basin (continued)
- Galilee Basin (continued)
- Upper Bowen Basin

Key to Environmental Values

Aquatic Ecosystems, Irrigation, Farm Supply, Stock Water, Aquaculture, Human Consumer, Primary Recreation, Secondary Recreation, Visual Recreation, Drinking Water, Industrial Use, Cultural & Spiritual Values

Notes:

1. The AWQG recommends the highest level of protection should be provided to underground aquatic ecosystems, given their high conservation value. Where groundwaters are in good condition the intent is to maintain existing water quality (20th, 50th and 80th percentiles).

Disclaimer

Whilst every care is taken to ensure the accuracy of this product, the Department of Environment and Science makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you may incur as a result of the product being inaccurate or incomplete in any way and for any reason.

Includes data © Commonwealth of Australia (Geoscience Australia, MDBA) 2020.

GWQ4169 - Queensland Murray-Darling and Bulloo Basins Groundwater

Earlier Basins Partially Underlying the Great Artesian Basin

Environmental Protection (Water and Wetland Biodiversity) Policy 2019

Queensland Murray-Darling and Bulloo Basins Map Series

This plan forms part of the Queensland Murray-Darling and Bulloo Basins Groundwater Environmental Values and Water Quality Objectives scheduling document, prepared pursuant to the Environmental Protection (Water and Wetland Biodiversity) Policy 2019.

Queensland Government

Prepared on: 18 September 2020

N

0 25 50 75 100 125 Kilometres

Scale: 1:1,500,000 @ A1

Projection: Geocentric Datum of Australia 1994 (GDA94)

Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

3.1.3 Groundwater Use in the Project Area

A search of the Queensland online groundwater database was completed on 18 January 2023. Registered groundwater bores within 2 km of the Proposed Activity, which is expected to be at the outermost limits of potential impacts resulting from the Proposed Activity, are provided below in **Table 3-2** and shown on **Figure 3-3**. Two artesian and one sub-artesian bore has been identified in available public records. Whilst artesian conditions are noted, 2 of the 3 bores are not used for water supply. The bore that is used for water supply is only 19 m deep. The landowner has also indicated this bore has been abandoned and is no longer used.

One additional known registered water bore (Norkham 1- not currently able to be identified within DNRME's Queensland Globe online database) is located just outside the 2km radius buffer to the south/south-east of WN1 (located on PL192). Norkham 1, located 2,042 m south, is understood to be used for stock watering, domestic and irrigation purposes. It is understood Norkham 1 was originally drilled to approximately 2,200 m depth in 2002. It was plugged at 2,150 m, at the end of the cased section just above the Upper Tinowon Sandstone which isolates the well to the Tinowon Siltstone formation located above. The well was subsequently converted for water supply.

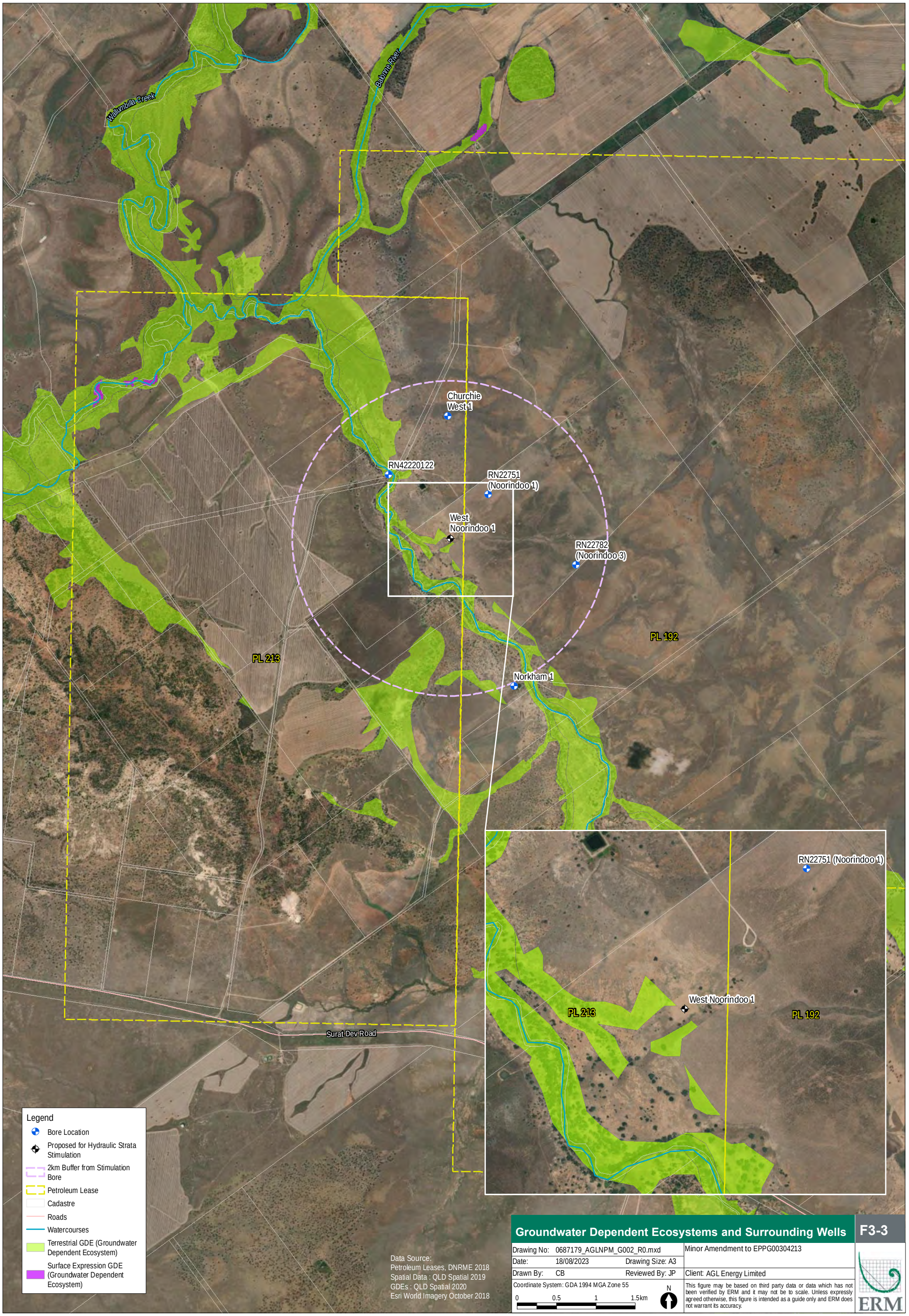
The closest bore to WN1 is Noorindoo 1. It is located 737m away and is not used for water supply. The bore was completed to 2,200 m depth and intersected similar stratigraphy as WN1. The bore is plugged at two depths, 1,715 m and 2,164 m which isolates the bore from the underlying Upper Tinowon Sandstone.

3.1.3.1 Groundwater Dependent Ecosystems

Ecosystems that rely on groundwater for some or all their water requirements are classified as Groundwater Dependent Ecosystems (GDE). Not all GDEs draw on groundwater directly and not all are solely reliant on groundwater. In many cases however, groundwater commonly provides an important and reliable source of water to many ecosystems and can be the main factor controlling the distribution of ecosystem types. In many cases the groundwater provides baseflow in rivers that ecosystems depend on. The impact of changes in groundwater quantity and quality on GDEs is determined by the degree and nature of their groundwater dependency.

GDE mapping by the Queensland Government indicates that there are Terrestrial GDE (low confidence) close to WN-1 (approximately 100m) and small pockets of surface expression derived GDE's (moderate confidence) within the vicinity of PL213, located approximately 5km to the north west of the Proposed Activity at WN1 (**Figure 3-3**). These are described as ecosystems intermittently connected to aquifers with brackish salinity and alkaline pH in unconsolidated Quaternary alluvia. It is considered unlikely that the Proposed Activity will increase the risk of impacts to GDE's due to the restriction of fracturing within the Target Formation and the very large vertical (>2km) and horizontal distances (>5km) between the location of the Proposed Activity at WN1 and the location of the derived GDEs (Refer sections 5 and 6 for more information). There are no known mapped structures or other potential pathways for groundwater from the Target Formation to reach these mapped GDEs at ground surface. Due to the large distances between the GDEs and the Proposed Activity, there will be very limited if any drawdown in groundwater levels in the Tinowon Formation to impact the GDEs. More detail on the Proposed Activity and potential impact to groundwater is provided in **Section 6**.

The composition of the vegetation community at the waterway is discussed in the Range Environmental Consultants report (Appendix A). It is highly unlikely an impact to aquatic flora and fauna will occur as part of the Proposed Activity.



Groundwater Dependent Ecosystems and Surrounding Wells

F3-3

Drawing No:	0687179_AGLNPM_G002_R0.mxd		Minor Amendment to EPPG00304213
Date:	18/08/2023	Drawing Size: A3	
Drawn By:	CB	Reviewed By: JP	Client: AGL Energy Limited

Coordinate System: GDA 1994 MGA Zone 55

0 0.5 1 1.5km

N

ERM

Table 3-2 Publicly registered bores within 2km of West Noorindoo 1 (Proposed Activity)

Date Completed	Bore Name	Tenure	Easting (MGA94 Zone 55)	Northing (MGA94 Zone 55)	Horizontal Distance from WN1 (m)	Depth (m)	Formation (deepest)	Notes	Screen Interval and Formation
Oct-70	RN22751 Noorindoo 1	PL192	716834	6998284	737	2287	Timbury Hills Formation	Plugged at 2,163-2,164 and 1,715-1,716. Not used for water supply.	2,195-2,201 and 2,203- 2,205 Upper Tinowon Sandstone
May-71	RN22782 Noorindoo 3	PL192	719081	6997446	1,637	2140	No information (assumed Winnathoola Coal Member)	Existing bore, artesian, controlled flow (Queensland Government, 2023).	Unknown.
Sep-01	RN42220122	PL213	715568	6998539	1,125	19	Grey calcareous silt	Existing bore, sub-artesian (Queensland Government, 2023), draws groundwater from near surface of Upper Cretaceous formations (high confidence per OGIA, 2021).	Unknown

3.2 Land

3.2.1 Regional Interest Areas

PL213 is mapped as containing Strategic Cropping Land (SCL) pursuant to the *Regional Planning Interests Act 2014* (RPI Act). It is noted however, that a resource activity authorised under EA EPPG00304213 is an exempt activity under Section 24 of the RPI Act if the activity was approved and lawfully able to be undertaken immediately before the land became land in an area of regional interest. As EPPG0030413 was approved originally in 2006, it is considered exempt from requiring a regional interest development approval.

3.2.2 Environmentally Sensitive Areas

There are Environmentally Sensitive Areas (ESAs) relevant to PL213 that will need to be considered prior to undertaking the Proposed Activity given these are protected in the current EA conditions.

In February 2023 Range Environmental Consultants undertook a review of ESAs within 500 m and 1000 m of 'West Noorindoo-1'. The associated report is provided in Appendix A.

Key findings of the Range Environmental Consultants report were:

- ESA mapping confirms 'West Noorindoo-1' is not located in Cat A ESA. The well is located within 500 m of Cat B and Cat C ESA; and
- Ground truthing surveys were undertaken in February 2023 to verify the presence of any ESAs as defined in Appendix A of the EA. The outcomes of the ground truthing confirmed that 'West Noorindoo-1' is not located within Cat A ESA (refer to **Figure 3-4**), however 'West Noorindoo-1' is located within approximately 315 m of Cat B ESA.

It is also noted that 'West Noorindoo 1' is located within the mapped boundary of a Category B ESA, however, ground truthing undertaken and observations from the field do not support this mapping. There is a Category C ESA located approximately 500m from the well, no mapped or observed category C ESA is located at the location of the well. There are no mapped Category A ESAs within 1,000m of the well. More detail is provided in the Range Environmental Consultants report in Appendix A.

No vegetation Is intended to be removed or disturbed for the initial Proposed Activity or for ongoing operations. Due to the presence of existing infrastructure on site, the Proposed Activity will have no impact on existing vegetation and no amendment is required to the following existing EA conditions as per **Table 3-3.**

Table 3-3 Existing EA conditions

Condition Number	Condition	Details
Condition 1	The holder of the environmental authority must ensure that petroleum activities do not cause more that 4ha of any land to be significantly disturbed at the petroleum works site at any one time.	***Complies*** ■ No significant disturbance involved in the Proposed Activity.
Condition 4(a)	The holder of the environmental authority must ensure that petroleum activities: (a) are not conducted within a category A or B environmentally sensitive areas	***Complies*** ■ Stimulation is not proposed to be conducted within Cat A or Cat B ESA.
Condition 4(b)	The holder of the environmental authority must ensure that petroleum activities: (b) do not cause a significant disturbance within 1km of a category A environmentally sensitive area or with 500m of a category B environmentally sensitive area.	***Complies*** ■ No wells are not located within 1 km of Cat A ESA and in any event will not involve any significant ground disturbance. ■ 'West Noorindoo-1' is located within approximately 315 m of Cat B ESA, but the Proposed Activity does not involve any disturbance to vegetation or other values protected by the Cat B ESA or "significant disturbance" as defined in the EA.
Condition 4(c)	The holder of the environmental authority must ensure that petroleum activities: (c) are not conducted in a category C environmentally sensitive area unless there is a written agreement to enter the area from the relevant administering authority.	***Complies*** ■ 'West Noorindoo-1' is within approx. 500 m of Cat C area, the Proposed Activity will not be conducted within the Cat C area itself.

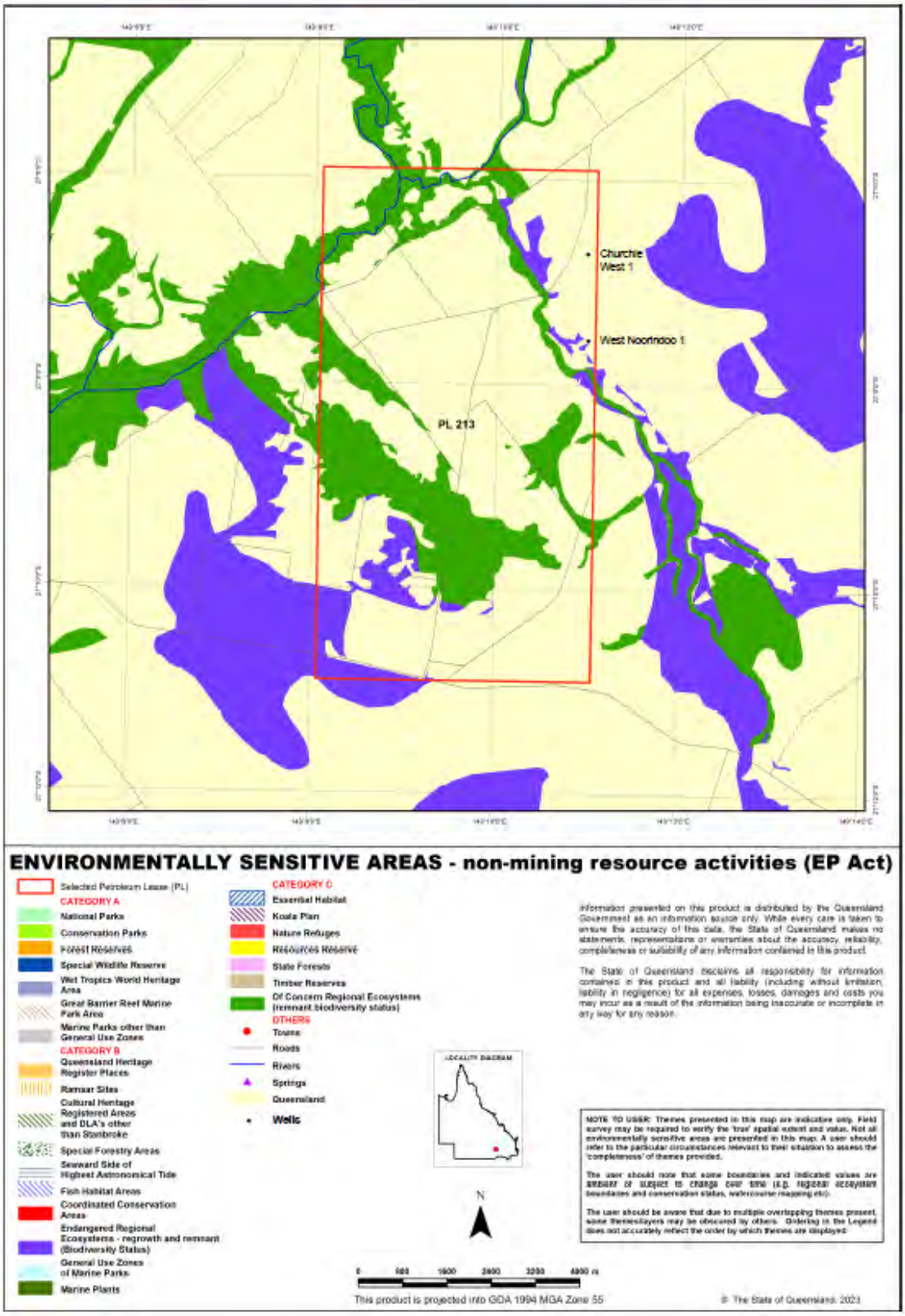


Figure 3-4 Environmentally Sensitive Areas in proximity to 'West Noorindoo-1'

3.2.3 Matters of State Environmental Significance

Matters of State Environmental Significance (MSES), also referred to as prescribed environmental matters, are defined in Schedule 2 of the Environmental Offsets Regulation 2014. PL213 is mapped as containing regulated vegetation described in the following section, that constitute MSES. Impacts to MSES may require offsets, should impacts be considered to have caused a Significant Residual Impact (SRI) as per the Significant Residual Impact Guideline (December 2014).

3.2.3.1 Regulated Vegetation (Defined Watercourse)

There are several ephemeral watercourses within PL213 that are mapped as containing Regulated vegetation that intersects with defined watercourse banks, a potential MSES pursuant to the Environmental Offset Regulation 2014. Prescribed regional ecosystems are MSES to the extent the ecosystem is located within a defined distance from the defining bank of a relevant watercourse. A prescribed regional ecosystem is defined in Schedule 2 of the Environmental Offset Regulation 2014 as **"**a regional ecosystem, other than a regional ecosystem mentioned in the Vegetation Management Regulation 2012, Schedule 5, located in a Category B area on the regulated vegetation management map, to the extent the ecosystem contains remnant vegetation."

Should vegetation be present, the defined distance for MSES vegetation (defined watercourse) is dependent on the stream order of the watercourse under the *Water Act 2000*. Watercourses within PL213 are primarily stream order 1 or 2 with the exception of the Balonne River and its primary tributary within PL213 which are stream order 8 and 4 respectively, **Table 3-4** provides setback requirements to ensure surface works avoid impacting MSES regulated vegetation (defined watercourse).

Table 3-4 Setback requirements for MSES regulated vegetation (defined watercourse)

Watercourse Stream Order	Distance from the defining bank (m)
1 and 2	10
3 and 4	25
5 or greater	50

The Proposed Activity is limited to adding permissions to undertake hydraulic strata stimulation within PL213, no additional surface clearing is required to undertake hydraulic strata stimulation. As such, it is unlikely direct or indirect adverse impacts to MSES regulated vegetation (defined watercourse) will result from the Proposed Activity so no SRI will arise. Due to the depth of the proposed hydraulic strata stimulation, confinement of aquifers and existing well infrastructure, the primary risk to surface waters and surface vegetation are incidental spills and leakage of hydraulic strata stimulation fluid. This risk will be managed through measures detailed in **Section 6.1.1.1**. Any wells constructed in the future under existing EA conditions will comply with the conditions of approval.

3.2.3.2 Regulated Vegetation (Category B – Endangered or of Concern)

Prescribed regional ecosystems that are endangered and of concern regional ecosystems are MSES, noting that prescribed regional ecosystem is necessarily located in a category B area on the regulated vegetation management map, to the extent the ecosystem contains remnant vegetation (refer to Schedule 2 of the Environmental Offset Regulation 2014). Where remnant vegetation means "vegetation forming the predominant canopy of the vegetation—

1. covering more than 50% of the undisturbed predominant canopy; and
2. averaging more than 70% of the vegetation's undisturbed height; and
3. composed of species characteristic of the vegetation's undisturbed predominant canopy."

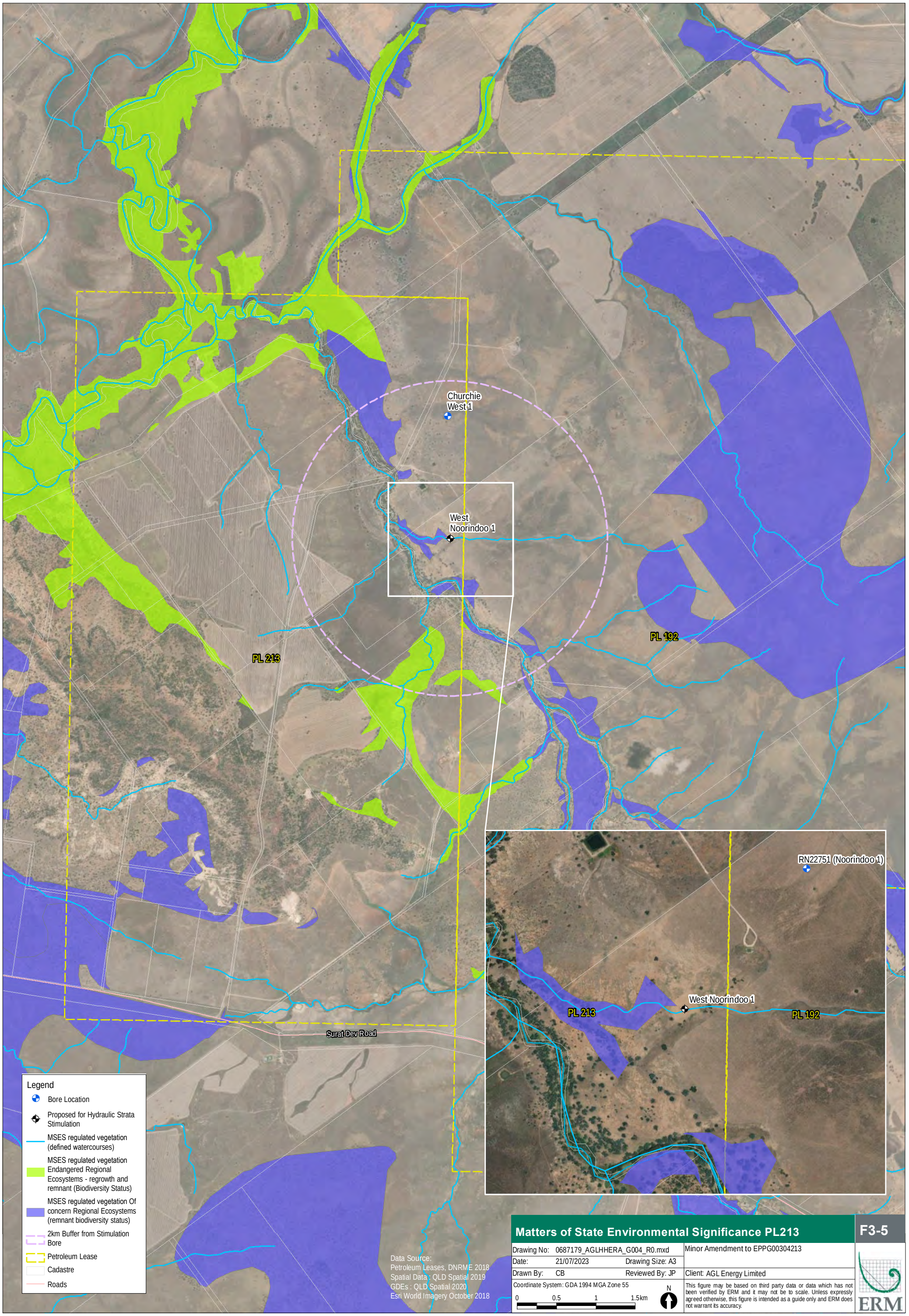
(Schedule 2 of the Environmental Offset Regulation 2014).

PL213 is mapped as containing areas of MSES regulated vegetation that is endangered or of concern (**Figure 3-5**). MSES regulated vegetation mapped as present within PL213 are provided at **Table 3-5**.

Table 3-5 MSES Endangered or Of Concern Vegetation Description

Regional ecosystem	Biodiversity status	Description
11.3.28	Of Concern	*Eucalyptus coolabah* +/- *Casuarina cristata* woodland on alluvial plains
11.3.25	Of Concern	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines
11.3.27	Of Concern	Freshwater wetlands
11.4.3	Endangered	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains
11.9.14	Endangered	*Lysiphyllum carronii, Atalaya hemiglauca* +/- *Eucalyptus melanophloia* +/- *Acacia excelsa* open woodland
11.9.10	Endangered	*Eucalyptus populnea* open forest with a secondary tree layer of *Acacia harpophylla* and sometimes *Casuarina cristata* on fine-grained sedimentary rocks
11.7.1	Of Concern	*Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *E. microcarpa* woodland on lower scarp slopes on Cainozoic lateritic duricrust

No vegetation is intended to be removed or disturbed for the initial Proposed Activity or for ongoing operations. Due to the presence of existing infrastructure on site and as the Proposed Activity does not result in clearing, no SRI will arise. As such, no amendment to clearing limits in the existing EA conditions is required as per **Table 3-3.** Refer to **Section 3.1.3.1** for details regarding any potential groundwater dependence and **Section 6** for risk assessment.


Churchie West 1
West Noorindoo 1
PL 213
PL 192
Surat Dev Road
RN22751 (Noorindoo 1)
West Noorindoo 1
PL 213
PL 192
Legend
Bore Location
Proposed for Hydraulic Strata Stimulation
MSES regulated vegetation (defined watercourses)
MSES regulated vegetation Endangered Regional Ecosystems - regrowth and remnant (Biodiversity Status)
MSES regulated vegetation Of concern Regional Ecosystems (remnant biodiversity status)
2km Buffer from Stimulation Bore
Petroleum Lease
Cadastre
Roads
Data Source:
Petroleum Leases, DNRME 2018
Spatial Data : QLD Spatial 2019
GDEs : QLD Spatial 2020
Esri World Imagery October 2018
Matters of State Environmental Significance PL213
F3-5
Drawing No: 0687179_AGLHHERA_G004_R0.mxd
Minor Amendment to EPPG00304213
Date: 21/07/2023
Drawing Size: A3
Drawn By: CB
Reviewed By: JP
Client: AGL Energy Limited
Coordinate System: GDA 1994 MGA Zone 55
0 0.5 1 1.5km
N
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

3.3 Air

It is accepted that there are emissions to air related to operating petroleum activities, however, the Proposed Activity does not change the likely emissions to air as would be previously considered under the original EA application. While fugitive emissions remain possible, this is consistent with the existing activities carried out on PL213 and the relevant Model Conditions.

Furthermore, it is not anticipated that there will be an additional risk to air posed by future activities to be undertaken in accordance with the relevant Model Conditions requested to be adopted by EA EPPG00304213.

3.4 Waste

Differences in waste production and management are not anticipated by the proposed amendment. Condition #11 of the existing EA provides for waste management on PL213. Condition #11 stipulates that the holder of the EA must ensure that contaminants are not released to land or water in a way that results in unlawful environmental harm and that as soon as practicable, regulated waste is removed and disposed of at a facility licenced to receive the regulated waste.

The primary waste that is likely to be generated by the Proposed Activity is flowback water, which, depending on the chemicals contained within the flowback water, may be considered regulated waste. The generation of this waste will be required to be managed to ensure containment and disposal process is compliant with the conditions of EA EPPG00304213 and the waste hierarchy. **Section 6** provides additional detail associated with the management intent for waste generated from the Proposed Activity.

4. PROXIMITY TO SENSITIVE RECEPTORS

A 'receptor' is the term used to describe a group of people, or an ecological system that could potentially be harmed by an activity. In this instance, it is the surrounding human receptors located in the vicinity of the Proposed Activity.

Identification of receptors is one of the key steps in understanding any risk that may be associated with an activity. The potential sensitive receptors that could come into contact directly with the chemicals, with land, surface water or groundwater at or near the wellheads, or may experience noise and/or other impacts have been considered and are identified in **Table 4-1**. AGL has taken a conservative approach to this aspect, with the probability of exposure for each of the identified receptors being limited, particularly those in excess of 2 km.

It is noted that through existing stakeholder engagement practices, AGL has developed positive relationships with all of their surrounding landholders, including those sensitive receptors listed in **Table 4-1**. AGL will continue to implement stakeholder engagement procedures throughout the life of PL213.

In addition to the sensitive receptors specified in **Table 4-1,** there is the potential that other sensitive receptors may be impacted by the Proposed Activity. These include agricultural workers that may have direct contact with flowback fluids or soils impacted by injection or flowback fluids at the wellsite.

Table 4-1 Distance between proposed location of Proposed Activity and human receptors

Residence	Distance from West Noorindoo 1
Ivan Price (Noorindoo property)	2.52 km
Geoff Scott – Rockton	4.71 km
Ruth Denhert – Pitsop	4.81 km
Steve Davies – New Rockton	5.06 km
Brandon Price (Cambridge Downs property)	5.76 km

Given that there have been no incidents, complaints or notifications recorded as a result of similar stimulation activities occurring at PL192, which are a comparable distance to the same identified human receptors, it is not anticipated that the amenity of the area will be impacted as a result of the Proposed Activity on PL213. Refer to **Section 6** for further detail.

5. PROPOSED ACTIVITY DETAIL

AGL intends to undertake the Proposed Activity on PL213, subject to approval. The intent is to initially undertake hydraulic strata stimulation at well 'West Noorindoo 1', located at coordinates 270 07' 33.348" S, 1490 10' 58.044" E. The Target Formation for the proposed well is the same as that targeted in existing wells located on PL193, the Upper Tinowon Sandstone.

The Proposed Activity and fluid composition is described in **Section 5.1** and **Section 5.2**, respectively.

5.1 Hydraulic Strata Stimulation Process

During a hydraulic strata stimulation, fluid (typically over 90% water) is pumped down the wellbore (casing or tubing) into the selected target sandstone formation. The fluid is pumped at pressure high enough to initiate or induce fractures in the target formation in the direction perpendicular to the minimum stress. As pumping continues, the fracture extends from the wellbore and grows based on the rock mechanics or the mechanical earth model which is revived through core analysis and or geophysical logs. This is then modelled using a numerical fracture stimulation model which incorporates the Mechanical Earth Model (MEM), geophysical logs and any offset well data from previous hydraulic strata stimulations within the same field and or reservoir.

Once the desired geometry of the fracture is initiated, proppant is added to the fluid and pumping continues until the proppant is placed into the fracture. When all the proppant is in the fracture, pumping is stopped. The pressure inside the fracture drops, allowing the fracture to close. The closing fracture occurs within minutes trapping the proppant inside the formation which creates a highly permeable and conductive pathway that extends laterally into the formation and connects the conductive pathway (fracture) back to the cased wellbore with the well completion designed and installed for purposes of hydraulic strata stimulation treatment.

The permeable path left in the formation is the main objective of the hydraulic strata stimulation. This flow path created within the Target Formation enhances hydrocarbon production flow from the Target Formation to the wellbore with minimised resistance.

AGL has developed a MEM of the target field (PL213) and target well to provide certainty regarding the risk of the Proposed Activity prior to commencing the fracture activity. A MEM will be run for any of the wells that are intended to be subject to hydraulic strata stimulation. A MEM has been completed at well Churchie #12 (located on PL192) and is representative of the Upper Tinowon reservoir, which will be targeted as part of the Proposed Activity in PL213. The results and data used in the Churchie #12 MEM informed the hydraulic strata stimulation of WN1. Some of the data used include:

- Petrophysical logs – used as input to develop rock properties model;
- CMI (image log);
- Rock mechanics core test – data was available for prospective Upper Tinowon and Lower Tinowon as well as the Wallabella formation;
- Closure pressure obtained from DFIT (Diagnostic Fracture Injection Test) in the Upper Tinowon and Wallabella formations;
- Mud weight data – extracted from daily drill reports for Churchie 12 well;
- Offset well information from the nearby Churchie field;
- Post hydraulic strata stimulation report from well Churchie #12 with simulation modelling pre hydraulic strata stimulation and post hydraulic strata stimulation;
- Post hydraulic strata stimulation report from nearby well Churchie West 1 with simulation modelling pre hydraulic strata stimulation and post hydraulic strata stimulation; and
- A geomechanical modelling report.

Results from the MEM from Churchie #12 suggested fracture length for wells within PL213 is likely to extend 90 m to 250 m laterally from the wellbore with vertical height growth determined by the formation rock properties and in-situ stresses. At the well depths for PL213, horizontal fracture components are not anticipated, due to the overburden weight creating high vertical stresses. The fracture is designed based on the MEM that confirms that fractures will be relatively contained to the target reservoirs ensuring the fracture is able to grow laterally within the reservoir.

The MEM for WN1 evaluated the three principal stresses (vertical 'overburden', and maximum and minimum horizontal stresses) through changing depth and rock strata to predict hydraulic fracture azimuth and geometry. The MEM was then incorporated into a hydraulic fracture model (pseudo three-dimensional) to simulate various fracture designs (fluids, injection rates etc.) to model and optimise the hydraulic strata stimulation design and economics based on job size and estimated total production from the well. In addition, the modelling acts as a level of confirmation that the fracture execution is relatively contained to the targeted zones and does not impact beneficial aquifers above and nearby. The 'stress' in coal stratigraphic units above the Wallabella and Tinowon Formations is higher than that in bounding formations. Therefore, these coals will act as choke points ('stress barriers') for the propagation of hydraulic fractures vertically. There are also streaks of high stress within the interburden that can act as choke points providing vertical containment of the fracture.

5.1.1 Predicted Lateral Fracture Extents

Two-dimensional simulation of the strata stimulation of WN1 shows that the total horizontal fracture length may extend up to 1,000 m from the well (**Figure 5-1**). However, this is the simulated proppant distribution, not necessarily effective stimulation of the formation for hydrocarbon recovery. The simulation shows hydrocarbon recovery by effective stimulation may extend only up to 600 to 700 m beyond the well, with good conductivity and connection achieved only to around 200 to 300 m from the reservoir to the wellbore (**Figure 5-1**).

The simulated potential fracture extent is based on the MEM which confirms that fractures will likely be relatively contained to the Target Formation and shows that the fracture is able to grow laterally within the reservoir.

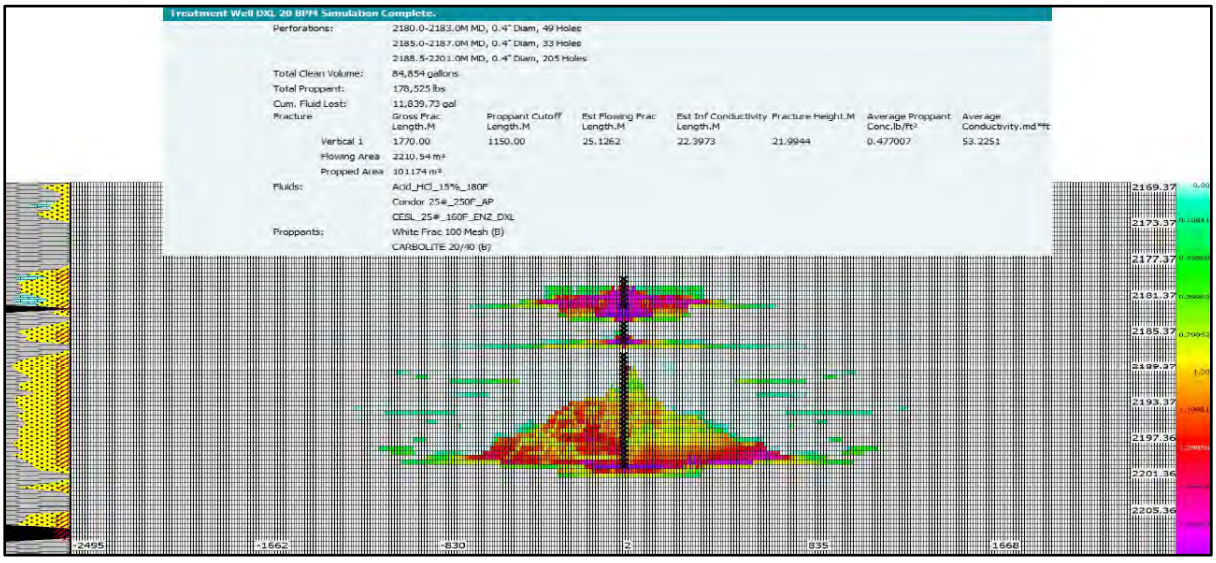


Figure 5-1 Two Dimensional Simulation of West Noorindoo 1

5.1.2 Predicted Vertical Fracture Extents

Due to the presence of siltstone and interbedded coal units immediately above perforated zones, very little vertical fracture growth outside the immediate Upper Tinowon Sandstone is expected (15 m thick in WN1). Vertical fractures will not grow beyond the bounding Winnathoola and Tinowon Coal Members in WN1.

5.2 Hydraulic Strata Stimulation Fluid Composition

For this Proposed Activity, the composition of the stimulation fluid was confirmed to be from the commercial products listed in **Table 5-1** and as a proprietary mixture shown in **Table 5-2**. As per the requirements of the Model Conditions (Well activities 11), a Human Health and Environmental Risk Assessment (HHERA) was undertaken based on the provided constituents of the hydraulic strata stimulation fluid (refer to Appendix B). All chemicals used will be compliant with the relevant regulatory requirements for hydraulic strata stimulation. The HHERA provides a risk assessment that meets the requirements of Model Conditions of an EA that allows for hydraulic strata stimulation at PL213. The HHERA specifically address the exposure pathways and potential impacts to human health, similar to the HHERA undertaken on well CH12 located on the adjacent PL192, which confirmed a low risk to human health and the environment.

Table 5-1 Expected Hydraulic Strata Stimulation Fluid Composition

Product	Chemical ingredients in product
KCl (Clay inhibitor)	■ Potassium chloride (100% of unspecified purity in SDS)
CFBE5 (Biocide)	■ Glutaraldehyde (20-50%) ■ Methanol (1-5%)
CF10GGC (Guar)	■ Guar gum (30-60%) ■ Aliphatic hydrocarbons (30-60%) ■ Glycol ether derivative (<10%) ■ Organophillic silicate (<5%)
CF150FBS (Flowback surfactant)	■ Ethylene glycol (10-30%) ■ Nonionic surfactant (10-30%) ■ Anionic surfactant (10-30%)
CF380DXL (Delayed crosslinker)	■ Sodium gluconate (15-40%) ■ Boric acid (7-13%) ■ Potassium hydroxide (15-40%)
CF8200E (Enzyme breaker)	■ Mannanase (<5%)
CF8550EA (Encapsulated oxidising breaker)	■ Ammonium persulfate (60-90%) ■ Talc (<5%)
HCl (Reduces near wellbore tortuosity issues)	■ Hydrochloric acid (>25%)
CA370FE (Prevents precipitation of metal oxides)	■ Sodium salt of organic acid (70-100%)
CAI500LT (Corrosion inhibitor)	■ Isopropanol (30-60%) ■ Ethoxylated C12-C16 alcohol (10-30%) ■ Ethoxylated decanol (5-10%) ■ Cinnamaldehyde (5-10%) ■ Ethoxylated tallow alkyl amine (1-5%) ■ Methanol (0.1-1%)
CF210PH (Contingency fluid system – lowers pH)	■ Citric acid (30-60%)
CF8500 (Contingency fluid system – oxidising breaker)	■ Ammonium persulfate (60-100%)
Wanli® ceramic proppant (All Mesh Sizes)	■ Corundum (55-65%) ■ Mullite (35-45%)
Holcim Graded Sand & Gravel Products (proppant)	■ Quartz (crystalline silica, i.e. sand; 99%)

Table 5-2 Hydraulic Strata Stimulation Fluid Composition (Condor Energy)

Constituent Name	CAS RN	Volume* (L)	Proportion of Total Volume* (%)	Purpose
Corundum	1302-74-5	17,000	4.6	Proppant
Mullite	1302-93-8	11,000	3.1	Proppant
Sand (crystalline silica, quartz)	14808-60-7	1100	0.31	Proppant
Ethoxylated branched C13 alcohol	78330-21-9	60	0.016	Surfactant (assumed)
Sulfonic acids, C14-16-alkane hydroxy and C14-16-alkene, sodium salts	68439-57-6	53	0.014	Surfactant (assumed)
Diisobutyl glutarate	71195-64-7	7.1	0.0019	Improve surface and interfacial tension
Diisobutyl succinate	925-06-4	2.4	0.00064	Improve surface and interfacial tension
Diisobutyl adipate	141-04-8	2	0.00055	Improve surface and interfacial tension
Sodium sulphate	7757-82-6	1.3	0.00036	By-product from alpha olefin sulfonate
Ethylene glycol	107-21-1	55	0.015	Surfactant
Glutaraldehyde	111-30-8	170	0.046	Biocide
Sodium gluconate	527-07-1	370	0.099	Delayed crosslinker
Boric acid	10043-35-3	180	0.05	Delayed crosslinker
Potassium hydroxide	1310-58-3	366	0.099	Delayed crosslinker
Mannanase	37288-54-3	0.19	0.000051	Enzyme breaker
Ammonium persulphate	7727-54-0	55	0.015	Encapsulated oxidising breaker
Talc	14807-96-6	1.9	0.00051	Encapsulated oxidising breaker
Hydrotreated light petroleum distillates	64742-47-8	780	0.21	Assumed to be part of liquid guar component
Guar gum	9000-30-0	660	0.18	Liquid guar
Nonylphenol ethoxylates	9016-45-9	200	0.053	Non-ionic surfactant
Bis(hydrogenated tallow alkyl)dimethyl ammonium bentonite salts	68953-58-2	200	0.053	Assumed part of liquid guar component
1,6-Hexanediol	629-11-8	20	0.0053	Coupling agent for bentonite clay
Crystalline silica	14808-60-7	2.0	0.00053	Filling agent (assumed)
Hydrochloric acid	7647-01-0	830	0.22	Reduces near wellbore tortuosity issues

Constituent Name	CAS RN	Volume* (L)	Proportion of Total Volume* (%)	Purpose
Sodium erythorbate	6381-77-7	6.8	0.0018	Iron control
Citric Acid	77-92-9	170	0.046	Lowers pH
Isopropanol	67-63-0	1.7	0.00045	Corrosion inhibitor
Ethoxylated C12-C16 alcohol	68551-12-2	1.1	0.00031	Corrosion inhibitor
Ethoxylated decanol	26183-52-8	0.38	0.00010	Corrosion inhibitor
Cinnamaldehyde	104-55-2	0.38	0.00010	Corrosion inhibitor
Ethoxylated tallow alkyl amine	61791-26-2	0.19	0.000051	Corrosion inhibitor
Methanol	67-56-1	0.038	0.000010	Biocide
Potassium chloride	7447-40-7	3400	0.92	Clay inhibitor
Water in additives	7732-18-5	270	0.072	Reduces near wellbore tortuosity issues
Potassium sorbate	24634-61-5	1.2	0.00034	Assumed biocide
Sodium benzoate	532-32-1	0.025	0.000007	Assumed biocide

Notes: ** Volumes and proportions are rounded to two significant figures in this report.*
CAS RN = 'Chemical Abstracts Service Registry Numbers' = unique identification number assigned by the Chemical Abstracts Service (USA) to each chemical.

5.3 Hazard Assessment of the Hydraulic Strata Stimulation Products and Mixed Fluid

ERM has assessed the health and environmental hazards of the chemical constituents in each product, with reference to the concentrations of each chemical in the strata stimulation fluid. These concentrations were estimated based on proportions of each constituent reported by AGL's strata stimulation subcontractor Condor Energy. Hazard assessment results are summarised in **Table 5-3.**

Table 5-3 Hazard Assessment of the Hydraulic Strata Stimulation Fluid Composition

CAS RN	Chemical Constituent	Approx. Concentration[a] (mg/L)	Persistent[b]	Bioaccumulative[b]	Toxic[b]	Environmental Hazard[c]	Human Hazard[c]
1302-74-5	Corundum	140,000	-	-	-	L	H
1302-93-8	Mullite	93,000	-	-	-	L	H
78330-21-9	Ethoxylated branched C13 alcohol	160	-	-	vT	H	M
68439-57-6	Sulfonic acids, C14-16-alkane hydroxy and C14-16-alkene, sodium salts	140	-	-	T	M	M
71195-64-7	Diisobutyl glutarate	19	-	-	T	M	L
925-06-4	Diisobutyl succinate	6.4	-	-	T	M	L
141-04-8	Diisobutyl adipate	5.2	-	-	T	M	L
7757-82-6	Sodium sulphate	9.8	-	-	-	L	L
107-21-1	Ethylene glycol	150	-	-	H	L	M
111-30-8	Glutaraldehyde	490	-	-	T	M	M
527-07-1	Sodium gluconate	1,400	-	-	-	L	L
10043-35-3	Boric acid	710	-	-	H	L	M
1310-58-3	Potassium hydroxide	1,400	-	-	-	L	L
37288-54-3	Mannanase	0.5	-	-	H	L	L
7727-54-0	Ammonium persulphate	270	-	-	H	L	M
14807-96-6	Talc	9.2	-	-	-	L	L
64742-47-8	Hydrotreated light petroleum distillates	2,300	-	-	T	M	M
9000-30-0	Guar gum	2,000	-	-	-	L	L
9016-45-9	Nonylphenol ethoxylates	530	-	-	T	M	H
68953-58-2	Bis(hydrogenated tallow alkyl)dimethyl ammonium bentonite salts	580	-	-	-	L	L
629-11-8	1,6-Hexanediol	53	-	-	-	L	L
14808-60-7	Crystalline silica (incl. proppant)	8,100	-	-	-	L	H
7647-01-0	Hydrochloric acid	2,700	-	-	-	L	M
6381-77-7	Sodium erythorbate	22	P	-	-	L	L

CAS RN	Chemical Constituent	Approx. Concentration[a] (mg/L)	Persistent[b]	Bioaccumulative[b]	Toxic[b]	Environmental Hazard[c]	Human Hazard[c]
77-92-9	Citric acid	550	-	-	-	L	L
67-63-0	Isopropanol	4.3	-	-	-	L	L
68551-12-2	Ethoxylated C12-C16 Alcohol	2.9	-	-	vT	H	L
26183-52-8	Ethoxylated decanol	1.0	-	-	vT	H	M
104-55-2	Cinnamaldehyde	1.0	-	-	H	L	M
61791-26-2	Ethoxylated tallow alkyl amine	0.5	-	-	H	L	L
67-56-1	Methanol	0.1	-	-	-	L	M
7447-40-7	Potassium chloride	18,000	-	-	-	L	L
7732-18-5	Water in additive	720	-	-	-	L	L
24634-61-5	Potassium sorbate	3.6	-	-	-	L	L
532-32-1	Sodium benzoate	0.1	-	-	H	L	M

Notes: *- (dash) denotes that a chemical is not classifiable for any of the PBT categories.*
(a) Rounded to two significant figures.
(b) Classification in accordance with criteria from the 'Chemical risk assessment guidance: for chemicals associated with coal seam gas extraction' (DoEE, 2017). Toxicity ratings are as listed in the DoEE guidance document and in descending toxicity: vT = very toxic, T = toxic, H = harmful.
(c) Hazard ratings (High, Medium, Low) for aquatic ecological receptors (also termed 'environmental') as described in section 5.2 of the HHERA (ERM, 2023)
(d) Hazard ratings (High, Medium, Low) for human receptors as described in section 5.2 of the HHERA (ERM, 2023).

5.3.1 Persistent, Bioaccumulative and Toxic Assessment

If the chemical is classified as persistent, bioaccumulative and toxic (i.e. meeting the criteria for all three categories), then it is considered a 'PBT chemical' (DoEE, 2017). The use of such chemicals for gas extraction would likely require additional regulation and management. Based on the PBT assessments completed for the HHERA (refer **Table 5-3** of Appendix B), none of the evaluated chemicals were considered a PBT chemical.

5.3.2 Chemical Mixtures and Compounds Formed During Stimulation

The strata stimulation fluid mixture is a saline solution with inert materials, and the remaining balance of the fluid comprises relatively low concentrations of organic chemicals. The stimulation fluid predominantly consists of proppants (the solid insoluble inert materials) with the next highest concentrations being due to the inorganic chemicals that then dissociate and exist in simple ionic forms. During the stimulation process, the cross-linked fluid system forms sufficient viscosity to deliver the proppant into the fractures, then the chemical breaker is used to split the gel and reduce the viscosity to enable flowback. Effects on the stimulation fluid following the breaking process can be described as follows:

- The majority of the fluid's components (the proppants) will remain unchanged as they are intended to remain in-situ in a stable and inert form;
- Many of the inorganic chemicals listed in the fluid will have already ionised into their component parts (e.g. potassium, hydroxide, chloride) upon mixing into the stimulation fluid. Many of these simple ions already exist naturally in aquifers and hydrostratigraphic layers in Queensland and across the world and are not likely to form extremely toxic organic molecules under environmentally relevant conditions. Like most reactions in the environment, these basic ionic components are likely to form other inorganic precipitates at extremely low concentrations in solution or stay in solution in its unreacted and ionised form; and
- The remaining low concentrations of organic molecules such as the ethoxylated alcohol group of chemicals (CAS RN 78330-21-9, 68551-12-2, 26183-52-8, 61791-26-2) will break down into smaller less reactive component parts than the parent compounds assessed herein.

While it is not possible to accurately predict the chemicals that will result from the stimulation process, it is considered unlikely that the concentrations of component parts in the flowback would be more hazardous than the original stimulation fluid.

5.3.3 Aromatic Hydrocarbons in Stimulation Fluids

Each key component that goes into the stimulation fluid, including the source water (Surat Bore sample), was analysed for key aromatic hydrocarbons of concern – Polycyclic aromatic hydrocarbons (PAHs) and Benzene, toluene, ethylbenzene, xylenes (BTEX) (refer to Appendix B).

5.3.3.1 Polycyclic Aromatic Hydrocarbons

Reported total PAH concentrations from the proposed strata stimulation fluid chemical products and the Surat Bore sample were below the laboratory limits of reporting (LORs). The LORs were <0.005 µg/L in most cases for the stimulation fluid chemical products, apart from two samples requiring further dilution prior to analysis. The diluted samples were analysed at an LOR of <0.012 µg/L. For the source water sample from Surat Bore, the LORs were <0.5 to <1 µg/L. No detectable PAHs were reported in the Surat Bore sample.

In relation to hydrotreated light petroleum distillates, external analytical studies have found that the level of PAHs in this chemical mixture is quite low at less than 0.01% (API, 2020; NICNAS, 2019b). This is supported by the recent analytical results provided by AGL, which indicate that PAH concentrations in the proposed strata stimulation chemical products containing light petroleum distillates are less than the laboratory limit of reporting (<0.005 µg/L to <0.012 µg/L).

Based on the above, the hazard related to PAH compounds is low.

5.3.3.2 Benzene, Toluene, Ethylbenzene, Xylenes

In Queensland, BTEX is strictly regulated and must not be used in stimulation fluids as it is prohibited by the legislation (State of Queensland, 2010). This is interpreted to be non-detectable BTEX concentrations and are below the levels of available standard laboratory LORs.

Reported BTEX concentrations from the proposed strata stimulation fluid chemical products and the source water were below the laboratory LORs (ranging from <1 µg/L specific to benzene and <2 µg/L to <5 µg/L for TEX).

The laboratory LORs used in these analyses were also below the most conservative of available national health-based regulatory thresholds for the protection of drinking water for humans (NHMRC, 2011) and ecosystems for aquatic ecological receptors (ANZG, 2018) as follows:

- Benzene 1 µg/L (NHMRC, 2011);
- Toluene 180 µg/L (95% species protection level; ANZG, 2018);
- Ethylbenzene 80 µg/L (95% species protection level; ANZG, 2018); and
- Total xylenes 75 µg/L (95% species protection level for lowest guideline value of xylene isomers; ANZG, 2018).

Based on the above, the hazard related to BTEX compounds is low.

5.4 Hazard Assessment Conclusions

Based on the findings of this hazard assessment, the overall composition of the strata stimulation fluid is generally considered as follows:

- **Low to medium human health hazard.** Some individual constituents may be considered a high health hazard based on reported adverse health effects. However, due to the relatively low concentrations of the higher hazard constituents (i.e. ethoxylated alcohol concentrations ranging from 1 mg/L to 160 mg/L) and the existing nature of the stimulation fluid itself (e.g. automatically wetting the dry solids such as crystalline silica, corundum and mullite), the overall stimulation fluid would likely be less hazardous to humans than the highest human hazard ratings identified herein; and
- **Based on toxicity to the aquatic environment, chemicals in the stimulation fluid overall reflects a higher environmental hazard as based on the parent compounds.** It is quite possible that the act of completing the strata stimulation process will effectively decrease the overall environmental hazard of the evaluated stimulation fluid composition. The organic chemicals of higher ecological concern in this fluid composition are those belonging to the ethoxylated alcohol group (CAS RN 78330-21-9, 68551-12-2 and 26183-52-8). For ethoxylated alcohols, ecotoxicity to sensitive aquatic invertebrates and fish generally decrease as carbon chain length decreases (HERA, 2009). Therefore, the act of completing the strata stimulation process will break down many of the organic chemicals in the fluid mixture, and aid in decreasing the potential environmental hazard profile of this fluid mixture.

These conclusions do not apply to undiluted chemical products that might be accidentally spilled at the surface during mixing at the wellsite. Although accidental spills of undiluted chemicals at the wellsite is considered unlikely, safety mitigation measures will be implemented as a matter of priority regardless. High-level safety mitigation measures are suggested in Section 2.5 of the HHERA (refer to Appendix B), alongside additional mitigation measures referenced in AGL's SSMP (2023b).

It is predicted that up to 40% of the stimulation fluid may remain in the Target Formation. It is concluded that there is a very low probability that chemicals would be able to migrate outside the Target Formation or migrate within the Target Formation. The Target Formation are not considered beneficial aquifers in the area of WN1, and they do not feed nearby surface waters. Risks to the environment and other environmental values from chemicals remaining in the Target Formation are therefore likely to be very low.

6. ENVIRONMENTAL RISK ASSESSMENT

The potential risk associated with the Proposed Activity is dependent on the type of operations being undertaken. Different environmental values may be impacted depending on the source and nature of the risk generated by the activity and relevant potential exposure pathway. Potential environmental risks associated with the Proposed Activity have been identified in the sections that follow which are expanded upon further in the HHERA (refer to Appendix B). The HHERA confirms that the level of risk is low and manageable.

6.1 Exposure Considerations

A 'source' is defined as a potential source of contamination under the scenario being investigated. The 'sources' identified and to be considered as part of a risk assessment to be completed prior to the commencement of the Proposed Activity at PL213 are:

- Chemicals stored and used at the surface in an undiluted form which are mixed with water to form the hydraulic strata stimulation fluid;
- Strata stimulation fluid mixture (diluted form). AGL proposes to use a 'cross-linked fluid system' strata stimulation fluid at WN1. It comprises approximately 98% water and proppant. Chemical additives including viscosifying agents and breaker fluids are added on the fly so the diluted form of strata stimulation fluid is minimal, further reducing risks. The strata stimulation fluid is designed to effectively create the fracture and transport high proppant concentrations within the fracture and enable efficient flow-back through the addition of a viscosity breaker; and
- Flowback water (diluted form). Once the proppant has been distributed to fractures, residual strata stimulation fluid (broken fluid, which has the viscosity of water) will flow back to a tank at the ground surface. This return water is expected to exhibit the same composition of the strata stimulation fluid mixture and may include produced water from the formation. Some of the injected fluid will be recovered as flowback water; however, due to the low permeability and low water content of the Target Formation, it is highly unlikely that more than 60% to 70% of the fluid will be recovered (AGL, pers. comms., 15 May 2023).

Once proppant has been distributed to fractures, residual hydraulic strata stimulation fluid will flow back to a tank at the ground surface. This return water is expected to exhibit the same composition of the hydraulic strata stimulation fluid mixture and may include produced water from the formation.

Flowback water is considered a broken and diluted form of the hydraulic strata stimulation fluid mixture (equivalent viscosity to water). The breaker fluids act to break down the viscosity of the fluid to avoid damaging the reservoir and therefore potential risks are conservatively evaluated by the hydraulic strata stimulation fluid mixture.

6.1.1 Exposure Pathways

An exposure pathway is a means by which chemicals that comprise the source may migrate to potential receptors identified for the site and surrounds. Migration pathways are the critical link in the development of a conceptual site model, because if a receptor is not connected to a source by a migration pathway that can result in exposure, then that receptor cannot be at risk from the source. This section summarises the pathways that were included in the assessment.

As there is no reasonable exposure pathway for air or noise associated with the proposed activity, these environmental values have not been considered further.

6.1.1.1 Surface

Under normal operation there is no operable migration pathway because migration requires release. Release of chemicals would occur only under accidental circumstances such as spillage during storage, mixing, or loss of containment from a flowback tank. There is no planned release to the environment of strata stimulation flowback waters at the wellhead. Flowback water is to be contained at all times at the surface within tanks prior to transport to an appropriate treatment facility. There is no pathway by which stimulation activities could impact surface water drainage or downstream nationally significant wetlands.

The surface pathways are considered to be potentially viable under accidental (i.e. spills or leaks) conditions only. Under accidental conditions, the potential exposure pathway is direct contact by ecological or human receptors with chemicals by spills and leaks of un-diluted chemicals or diluted strata stimulation fluids or flowback water to soils or surface waters at the well site.

6.1.1.2 Sub-surface

- Within the sub-surface, migration of diluted strata stimulation fluids or groundwater with compounds derived from the Target Formation during the stimulation process may extend into aquifers overlying the Target Formation only if the following conditions exist: Via new fractures developed during hydraulic strata stimulation, leading to connection with overlying aquifers; or
- Via pre-existing hydraulic continuity with overlying aquifers; or
- Via leakage around the cemented casing of the drilled well itself, into overlying aquifers.

Sub-surface migration is not considered a substantial risk for the proposed activity due to:

- Well construction design;
- The current high integrity status of the wells, which includes two barriers isolating the hydrocarbon zone from surface and from the shallower aquifer formations;
- Physical site details;
- Proximity of sensitive receptors to the wells on PL213; and
- Previous experience undertaking stimulation activities in comparable geologies.

The Target Formation (Upper Tinowon Sandstone) on PL213 is ultimately underlain by low permeable basement (Timbury Hills Formation) located 47m below and overlain by a bounding coal seam (Winnathoola Coal Member) located 32m above. Both the basement and coal seam horizons are likely to restrict the movement of chemicals and groundwater vertically.

Except in a circumstance where a fracture created a pathway to an aquifer, it is unlikely that significant migration of fracturing chemicals outside the Target Formation will occur.

It is concluded that the subsurface migration pathway from the Target Formation (Upper Tinowon Sandstone) to overlying aquifers, landholder bores or ESAs is not likely. This is because:

- The nearest beneficial uses aquifer (Boxvale Formation) is approximately 490 m vertically above the top of the Upper Tinowon Sandstone;
- There are no known pre-existing hydraulic connections between the Upper Tinowon Sandstone and overlying aquifers used for water supply; and
- The combined effects of very low permeabilities, sorption of organic compounds into the overlying coal seam (Winnathoola Coal Member, 14 m thick) and shale (Black Alley Shale, 13 m thick), the 74 m thick Rewan Formation (which has low porosity and permeability), and a flow regime drawn towards the well due to production pumping is considered sufficient to provide additional confidence that vertical subsurface migration is not a viable pathway.

The only viable pathway for fluid to reach a receptor, be it via an aquifer or an existing bore, is to directly fracture from the tight gas well to said bore or aquifer. Strata stimulation modelling which includes the MEM demonstrates this is not likely.

6.2 Flowback Operations

The majority of the fluids used during hydraulic strata stimulation are recovered from the well through the 'flowback' process. This is done by using a 'breaker' to react with the gel, breaking down its viscosity back to that of water so that the fluid's ability to flow is increased, allowing it to flow back to surface and not damaging the reservoir quality. The reservoir pressure is the main drive mechanism for the recovery of the flowback water.

AGL will engage a third party specialised contractor to manage the well flowback and production testing operations. The contractor will rig up all necessary equipment, which includes variable chokes, flow lines and open top ('gas buster') tanks to capture the flowback water.

The flowback water will then be transferred to a closed top tank and will then be trucked offsite by a licensed regulated waste transporter, and lawfully disposed of at a licensed regulated waste treatment and disposal facility, in accordance with the existing waste management conditions of EA EPPG00304213.

Chain of custody for flowback water disposal will be tracked and recorded and the third-party disposal company will be an EPA licensed company to handle flowback water.

Flowback water will be monitored in line with the Queensland Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland (16 December 2019) with the exception of the recovery of 150% flowback from the injected volume. The unconventional tight gas/condensate reservoir in the Target Formation has low permeability and very low water content and it is likely that not all of the injected volume will be recovered: the expectation is to recover 60-70%. This is not unusual in a tight unconventional reservoir. Nevertheless, water volumes will be monitored and recorded during the life cycle of the well.

During the production phase of the well, some flow back water may come out in association with the produced water. Outside the fractures created by the hydraulic strata stimulation, the permeability of the Target Formation is very low. As a consequence, groundwater transmissivity is also low and this restricts groundwater movement within the formation.

The environmental risks associated with flowback, and the associated management measures are summarised in **Table 6-1**.

Table 6-1 Flowback Operations Risk

Environmental Value/s	Risk	Management Measure/s
■ Surface Water ■ Groundwater ■ Waste ■ Land	Raw chemical spill with localised impact	■ Management via existing environmental management procedures. Under normal operating conditions there should be no substantial risk. ■ Any spills are only likely to have a localised risk of potential environmental harm and will be reported to the DES as per requirements under the EP Act and managed in accordance with existing Condition #14 of EA EPPG00304213, including the provision of remediation works to restore any area to pre-spill conditions. ■ Direct contact with the injection fluids is not possible under normal operating conditions as chemicals are added in the mixing trucks immediately prior to injection. Although an accidental release is possible, it is considered highly unlikely. ■ Additionally, safety risks from a failure of pressurised equipment are present, however operating procedures exclude personnel from the vicinity during pressurised operations. Any environmental impact that may be caused by a failure of pressurised equipment, is to be managed in accordance with existing Condition #14 of EA EPPG00304213.
	Direct contact with flowback waters	■ Potential health and safety risk associated with spills which requires management via environmental management procedures. ■ Direct contact with the flowback fluids is not possible under normal operating conditions as chemicals are added in the mixing trucks immediately prior to injection. Although an accidental release is possible during flowback, it is considered highly unlikely. ■ Additionally, safety risks from a failure of pressurised equipment are present, however operating procedures exclude personnel from the vicinity during pressurised operations. Any environmental impact that may be caused by a failure of pressurised equipment, is to be managed in accordance with existing Condition #14 of EA EPPG00304213.
	Discharge of flowback waters to surface water or ground	■ Flowback waters will be contained at the wellsite in closed tanks and will be transported and disposed of by a licenced operator for regulated waste transport and disposal. ■ Potential risk of release is present under accident or emergency conditions only. Any spills with the potential to cause environmental harm are to be reported to the DES as per EP Act requirements and managed in accordance with existing Condition #14 of EA EPPG00304213, including the provision of remediation works to restore any area to pre spill conditions

6.3 Hydrogeological Risks

Based on the information known to date by AGL regarding the physical circumstances of the Target Formation and the well construction (**Figure 6-1**), it is not anticipated there will be a viable exposure pathway for impacts to groundwater outside of the Target Formation.

However, appreciating that there is the potential that sub-surface pathways and other pre-existing characteristics can influence exposure pathways, ongoing management of hydrogeological risks will be undertaken.

Potential environmental risks associated with hydrogeology, and the associated management measures are summarised in **Table 6-2.**

Table 6-2 Hydrogeological Risk Summary

Environmental Value/s	Potential Risk	Management Measure/s
■ Groundwater	Migration via existing continuity between formation waters and adjacent aquifers	■ There has been no viable exposure pathway identified due to the confined nature of the aquifers within PL213, therefore exposure is unlikely. ■ The well construction effectively isolates the aquifers from each other, the surface and the Target Formation.
	Migration via fractures generated by allowing continuity between target horizon and adjacent aquifers	■ There has been no viable exposure pathway identified due to the confined nature of the aquifers and expected fracture patterns of PL213, therefore exposure is unlikely. ■ The well construction effectively isolates the aquifers from each other, the surface and the Target Formation.
	Migration via the outside of the drilled well should the seals between horizons prove to be incomplete to weakened during hydraulic strata stimulation	■ Proper well construction minimises this potential pathway, and well casing failure is a rare occurrence. ■ The top of cement extends above the upper most aquifer, providing isolation between the aquifers, the surface, and the Target Formation (refer to **Table 6-1**). ■ The top of cement meets the requirement of having a minimum of 150m of cement above the hydrocarbon (fracture target) formation. ■ Failure of the well head during a hydraulic strata stimulation operation would initiate an emergency stop of hydraulic strata stimulation injection. Limited injection fluid is anticipated to be released in such an event. Appropriate mitigation measures for well head or seal failure, contained within the existing AGL management procedure for hydraulic strata stimulation operations, will be implemented. In addition, a wellhead isolation tool will be used during the operations to ensure that the pressure is not exposed to the wellhead during the fracture treatment operations.
	Potential chemical impact to landholders bores	■ It is anticipated that there is a low probability that chemicals would be able to migrate outside the Target Formation or migrate within the Target Formation. Refer to risk mitigations outlined above. ■ Additionally, the Target Formation are not considered beneficial aquifers in the area surrounding ‘West Noorindoo 1’, and do not feed nearby surface waters. Risks from chemicals remaining in the Target Formation are therefore considered to be low.

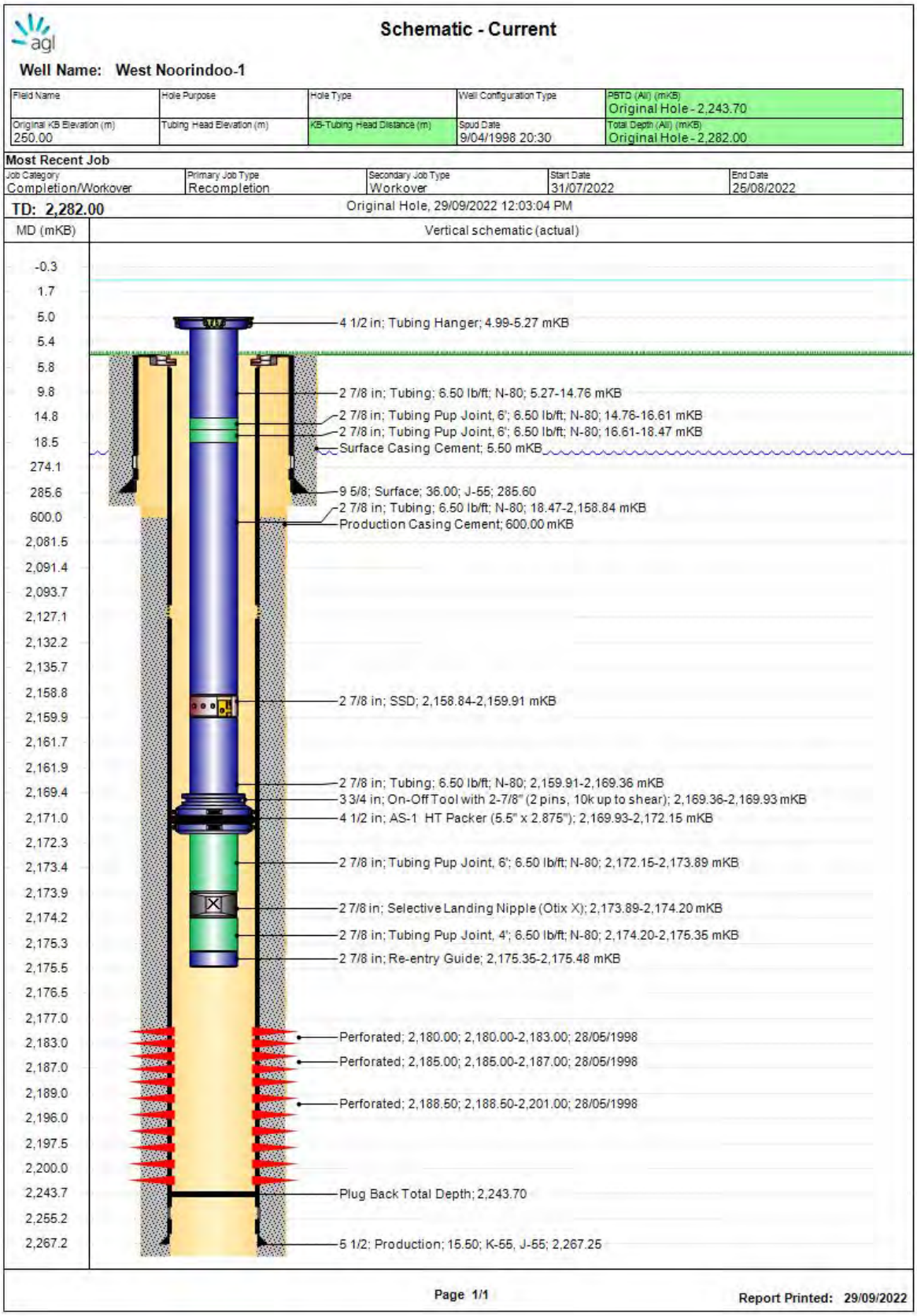


Figure 6-1 West Noorindoo 1 Well Design

6.3.1 Radius of Influence of Hydraulic Strata Stimulation

Both vertical and horizontal transport pathways need to be considered when assessing the radius of influence from the Proposed Activity. A maximum horizontal fracture length may extend at most 1,000 m laterally from well WN1. However, simulation shows that the hydrocarbon recovery by effective fracturing may extend only up to 600-700 m beyond the well with good conductivity and connection achieved around 200-300 m from the well.

The simulated potential fracture extent is based on the MEM from WN1 which confirms that fractures will likely be relatively contained to the target reservoirs and shows that the fracture is able to grow laterally within the reservoir. Due to the presence of siltstone (Tinowon Formation) and interbedded coal units immediately above the target zones, very little vertical fracture growth outside the immediate Upper Tinowon Sandstone is expected. Vertical fractures will not grow beyond the bounding Winnathoola Coal Member (overlying the Tinowon Formation) and Wallabella Coal Member (underlying the Lower Tinowon Sandstone). The strata stimulation process is designed to contain the fractures within the Target Formation (Upper Tinowon Sandstone), since fractures outside the formation do not contribute to production.

Field data from several thousand hydraulic strata stimulation operations in numerous types of reservoirs across North America have demonstrated that sedimentary features limit vertical fracture lengths, with inefficient fracture growth across layers and interfaces. A review by Fisher & Warpinski (2012) of the aforementioned field data has shown that lateral or penetration into the reservoir fracture lengths are typically considerably shorter than 1000 foot (approximately 300 m), with fractures usually measured in tens or hundreds of feet.

The maximum height of an upward propagating fracture, assessed from microseismicity data taken from several thousand hydraulic strata stimulation operations in shale gas formations in North America, was reported as approximately 588 m by Davies et al (2012). However, Davies et al (2012) indicated that the probability that a stimulated fracture would extend vertically beyond 350 m was less than 1%. This is consistent with the findings of the review completed by Fisher & Warpinski (2012). In addition, the mass balance of the fracturing fluid needs to be considered. In shale gas wells, the volumes of fracturing fluid are around an order of magnitude higher than that proposed for WN1.

The North American data described above include strata stimulation of horizontal shale gas wells in the United States where the fractures are designed to propagate vertically. The vertical propagation is due to the fact that fractures in many of the North American case studies tend to propagate parallel to the maximum stress field – of which (in the United States) is predominantly vertical due to their geology.

Based on MEM for WN1, literature available to review and project field experience, there is sufficient evidence that the probability of a fracture reaching the Boxvale Formation (>490 m above) is extremely low. The only known water supply bore, Norkham 1, which is at a similar depth to WN1 is located over 2 km away. This distant well has also been plugged and isolated from the Target Formation so hydraulic connection is even less likely. It is also located south, in the opposite direction of the proposed fracture orientation.

The single landholder bore within 2 km of WN1, (RN42220122) is installed to 19 m. It no longer provides water supply to the landowner and is abandoned. Therefore, this is not a complete pathway to human receptors. Two other bores located within 2 km of WN1, Noorindoo 1 and Noorindoo 3 are not used for water supply.

A schematic showing the distances and limited ability for connection between these wells is provided in **Figure 6-2** below.

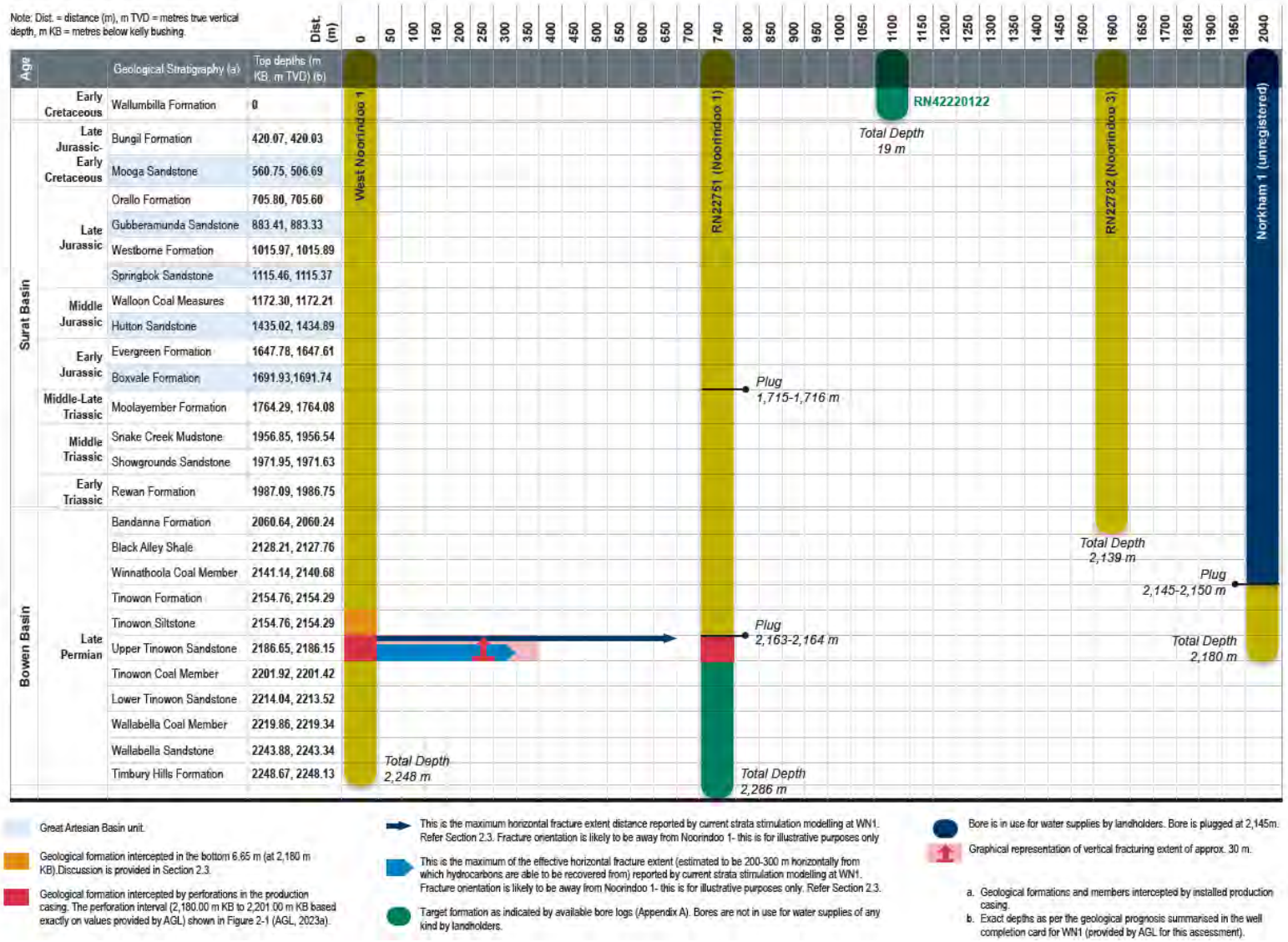


Figure 6-2 Schematic of West Noorindoo 1 and Surrounding Bores

6.4 Summary of Management/Mitigation Measures

Consistent with the relevant Model Conditions (proposed to be incorporated to the existing EA), AGL commits to the following management/mitigation measures for the purposes of the Proposed Activity:

- Stimulation Impact Monitoring Program;
- Stimulation Risk Assessment;
- Baseline Bore and Well Assessment; and
- Water quality sampling and data collection.

AGL will also implement environmental management measures at the well site. The Proposed Activity will be managed by AGL's experienced subcontractors, who will be required to comply with AGL's Environmental Management Plan for the Silver Springs Project (refer to Appendix C). The guidelines included in this Environmental Management Plan provide guidance for controls related to the storage, management and handling of the raw material products, mixes of hydraulic strata stimulation fluid and flowback. The guidelines are designed to ensure potential impacts to the environment are managed and compliance with relevant legislative and regulatory requirements.

6.5 Underground Water Rights

Section 227AA(1)(b) of the EP Act, states that an amendment application must state the matters mentioned in section 126A(2) of the EP Act, if the proposed amendment involves changes to the exercise of underground water rights.

Underground water rights are defined to include underground water rights within the meaning of the *Petroleum Act 1923* (Qld), section 87(3). That section states that underground water rights means the taking of water necessarily taken as part of petroleum production or testing for petroleum production under one or more *Petroleum Act 1923* (1923 Act) petroleum tenures.

The proposed amendment does not involve changes to the exercise of underground water rights.

In reaching this conclusion, consideration has been given to DES' guideline "Requirements for site-specific and amendment applications—underground water rights" (**Underground Water Rights Guideline**) (DES 2021).

The Underground Water Rights Guideline provides guidance at section 1.1.14 in relation to when the information requirements under sections 126A and 227AA of the EP Act must be provided for an amendment application.

Table 6-3 sets out AGL's position in relation to each of the examples included in the Underground Water Rights Guideline.

Table 6-3 Assessment Against Examples Where Amendments may Indicate a Change to the Exercise of Underground Water Rights

Example (As per Section 1.1.4 of the Underground Water Rights Guideline)	Response
There is a change in tenure, for example converting an ATP to a PL	***Not Applicable*** The EA Amendment does not involve a change in tenure.
Adding a new tenure to the EA	***Not Applicable*** The EA Amendment does not involve adding a tenure to the EA.
There is a significant change to the nature or scale of activities	***Not met*** The Proposed Activity is not considered a significant change to the nature or scale of activities currently permitted under the EA. The EA authorises a

	petroleum activity (petroleum lease) at PL213. The Proposed Activity does not involve any change to the nature or scale of the authorised activity itself, but rather would introduce strata stimulation activities as part of the processes used in carrying out the authorised activity.
There is a significant change to the volumes of water proposed to be taken	***Not met*** The Proposed Activity does not result in a significant change to the volumes of water proposed to be taken. Currently, the activities at PL213 do not result in any taking significant quantities of groundwater as part of petroleum production or testing for petroleum production It is difficult to accurately determine groundwater volumes which are likely to be taken during the Proposed Activity. The activities involve injecting fluids into the formation to induce fracturing and release hydrocarbons. The process can result in the abstraction of a relatively small volume of groundwater from the formation. However, the adjacent Churchie field (PL192) has historically taken very little, groundwater from the Tinowon Formation as part of the fracturing process. **Groundwater volumes taken as part of the fracturing process at the Churchie field are so low they have not been recorded**. This is likely due to the low permeability of the sandstone and the yield of the formation. It would be expected the same conditions are present in WN1 and PL213, such that any groundwater removed from injecting fluids would be extremely low. An extremely minor take of groundwater as part of the Proposed Activity would not result in a **significant** change to the volumes of water to be taken. The change would be nominal, if anything. The likely volume of groundwater to be taken as a result of the Proposed Activity should be considered in light of the fact that WN1 is a deep tight gas sandstone reservoir. By contrast, the majority of hydraulic strata stimulation in Queensland is undertaken in relation to CSG projects which involve shallow coal seam gas formations where groundwater, including the GAB units, will be a relevant consideration for the project.
There are likely to be different impacts on environmental value	***Not met*** As discussed in **Section 3** and **6**, there is not expected to be any significant impacts to environmental values as a result of the proposed stimulation activities. **Sections 5.3** and **5.4** set out the conclusions of a hazard assessment of the chemical compounds of the strata stimulation fluid. While some of the individual components of the stimulation fluid are considered to hold a high environmental hazard risk, the act of completing the stimulation process will break down many of the organic chemicals in the fluid mixture and assist in decreasing the environmental hazard profile of the fluid. It is also considered that there is very low risk of impact on environmental values as a result of chemicals remaining in the Target Formation. The Target Formation is not considered a beneficial aquifer in this region due to the low permeability and subsequent low yield of groundwater. In any event, available data collected from the Bowen Basin indicates $NaHCO_3$ groundwater of relatively high salinity, with high fluoride occurrences (DES, 2020). In summary, the Proposed Activity does not result in different impacts to environmental values due to: ■ The unlikelihood that stimulation activities could possibly cause connections between the Target Formation and surrounding aquifers; ■ The low permeability of the target formation and low yield of groundwater; ■ The poor water quality of the target formation making it unusable for other purposes; ■ The limited potential for stimulation fluid chemicals being able to contaminate the Target Formation or underground water in surrounding aquifers.

As the Proposed Activities do not involve a change to the exercise of underground water rights, the EA Amendment application is not required to provide the information stated in Section 126A.

7. LEGISLATIVE CONSIDERATIONS

7.1 Application Requirements

Sections 226 and 226A of the *Environmental Protection Act 1994* (EP Act) specify the minimum criteria that must be met in order to lodge an EA Amendment application. **Table 7-1** provides an outline of the minimum criteria required and specifies how this EA Amendment application meets the criteria. It is noted that Sections 226A(2) to 226A(4) of the EP Act, are not applicable to this amendment application and therefore have not been addressed.

Table 7-1 Minimum Environmental Authority Amendment Application Requirements

EP Act Reference	Application Requirement	Comment
Section 226 Requirements for amendment applications generally	An amendment application must— (a) be made to the administering authority; and	***Complies*** The EA Amendment application has been lodged with the Department of Environment and Science (DES) – the Administering Authority for the EP Act.
	(b) be in the approved form; and	***Complies*** Completed application form ESR/2015/1733 Version 20.00 provided.
	(c) be accompanied by the fee prescribed by regulation; and	***Complies*** The EA Amendment application has been submitted with the appropriate fee for assessment of a 'Minor Amendment', being $355.30.
	(d) describe the proposed amendment; and	***Complies*** Refer to **Section 5** of this Supporting Information document.
	(e) describe the land that will be affected by the proposed amendment; and	***Complies*** Refer to **Section 2** of this Supporting Information document.
	(f) include any other document relating to the application prescribed by regulation.	***Not Applicable*** No other documents relating to the application are prescribed by regulation.
Section 226A Requirements for amendment applications for environmental authorities	If the amendment application is for the amendment of an environmental authority, the application must also— (a) describe any development permits in effect under the *Planning Act 2016* for carrying out the relevant activity for the authority; and	***Complies*** The EA the subject of this application, EA EPPG00304213, is for a resource activity located on PL 213. Accordingly, pursuant to Schedule 6, Part 5, Section 22 of the Planning Regulation 2017, a development permit is not required for the Proposed Activity.
	(b) state whether each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity; and	***Complies*** EA EPPG0030413 and this proposed EA Amendment will not conflict with the Eligibility Criteria as stated in 'Eligibility criteria and standard conditions Petroleum exploration activities – Version 2' (DES, EM928). As the proposed amendment seeks to

EP Act Reference	Application Requirement	Comment
		permit the commencement of the Proposed Activity (when approved), the activity will be unable to comply with the relevant standard conditions as they do not permit hydraulic strata stimulation. As such, even though the activity may meet the eligibility criteria, the proposed amendment requests to add relevant 'Streamlined Model Conditions for Petroleum Activities' (Department of Environment and Science (DES), 2016, ESR/2016/1989) ('Model Conditions') regarding the stimulation activities to EA EPPG0030413.
	(c) if the application states that each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity—include a declaration that the statement is correct; and	***Complies*** As above, once amended the activity will continue to comply with the Eligibility Criteria but will not comply with the standard conditions. The proposed amendment requests to add relevant Model Conditions regarding the stimulation activities to EA EPPG0030413. A declaration has been provided in the approved application form.
	(d) state whether the application seeks to change a condition identified in the authority as a standard condition; and	***Complies*** The amendment sought does not seek to alter any of the standard conditions currently on EA EPPG0030413. The proposed amendment is restricted to the addition of Model Conditions relevant to stimulation activities to the existing permit. Further detail is provided in **Section 5** of this Supporting Information document.
	(e) 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; and	***Not Applicable*** The EA Amendment application does not relate to a new resource tenure.
	(f) include an assessment of the likely impact of the proposed amendment on the environmental values, including—	***Complies*** Refer to **Section 3** and **Section 6** of this Supporting Information document for detail.
	(i) a description of the environmental values likely to be affected by the proposed amendment; and	***Complies*** Refer to **Section 3** of this Supporting Information document for detail.
	(ii) details of emissions or releases likely to be generated by the proposed amendment; and	***Complies*** Refer to **Section 6** of this Supporting Information document for detail.
	(iii) a description of the risk and likely	***Complies***

EP Act Reference	Application Requirement	Comment
	magnitude of impacts on the environmental values; and	Refer to **Section 6** of this Supporting Information document for detail.
	(iv) details of the management practices proposed to be implemented to prevent or minimise adverse impacts; and	***Complies*** Refer to **Section 6** of this Supporting Information document for detail.
	(v) if a PRCP schedule does not apply for each relevant activity—details of how the land the subject of the application will be rehabilitated after each relevant activity ends; and	***Not Applicable***
	(i) include a description of the proposed measures for minimising and managing waste generated by amendments to the relevant activity; and	***Complies*** Refer to **Section 6** of this Supporting Information document for detail.
	(j) include details of any site management plan or environmental protection order that relates to the land the subject of the application.	***Not Applicable*** No compliance actions are relevant to PL213 or EA EPPG0030413.

7.2 Proposed EA Amendment

AGL is the holder of EA EPPG00304213 over PL213. EA EPPR00304213 was initially approved subject to standard conditions in 2006 and subsequently converted to its current EA reference number (EPPG00304213) in 2016.

EA EPPG00304213 contains the standard conditions in force at the time of initial approval. No changes to existing conditions are proposed as part of this application. Rather, AGL is seeking to align EA EPPG00304213 with the Model Conditions for stimulation activities previously adopted by AGL's neighbouring PL (PL192), specifically, Schedule J – Well Construction, Maintenance and Stimulation Activities of EPPG00770313 (EA EPPG00770313 is provided in Appendix C, for ease of reference). These conditions are outlined in **Table 7-2.**

Table 7-2 Model Conditions Proposed for Adoption

Condition Reference	Condition
Well activities 5.	Polycyclic aromatic hydrocarbons or products that contain polycyclic aromatic hydrocarbons must not be used in stimulation fluids in concentrations above the reporting limit.
Well activities 6.	Stimulation activities must not negatively affect water quality, other than that within the stimulation impact zone of the target gas producing formation.
Well activities 7.	Stimulation activities must not cause the connection of the target gas producing formation and another aquifer.
Well activities 8.	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.
Well activities 9.	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.
Well activities 10.	Prior to undertaking stimulation activities, a risk assessment must be developed to ensure that stimulation activities are managed to prevent environmental harm.
Well activities 11.	The stimulation risk assessment must be carried out for every well to be stimulated prior to stimulation being carried out at that well and address issues at a relevant geospatial scale such that changes to features and attributes are adequately described and must include, but not necessarily be limited to: (a) a process description of the stimulation activity to be applied, including equipment and a comparison to best international practice (b) provide details of where, when and how often stimulation is to be undertaken on the tenures covered by this environmental authority (c) a geological model of the field to be stimulated including geological names, descriptions and depths of the target gas producing formation(s) (d) naturally occurring geological faults (e) seismic history of the region (e.g. earth tremors, earthquakes) (f) proximity of overlying and underlying aquifers (g) description of the depths that aquifers with environmental values occur, both above and below the target gas producing formation (h) identification and proximity of landholder' active groundwater bores in the area where stimulation activities are to be carried out (i) the environmental values of groundwater in the area (j) an assessment of the appropriate limits of reporting for all water quality indicators relevant to stimulation monitoring in order to accurately assess the risks to environmental values of groundwater (k) description of overlying and underlying formations in respect of porosity, permeability, hydraulic conductivity, faulting and fracture propensity (l) consideration of barriers or known direct connections between the target gas producing formation and the overlying and underlying aquifers (m) a description of the well mechanical integrity testing program (n) process control and assessment techniques to be applied for determining extent of stimulation activities (e.g. microseismic measurements, modelling etc.) (o) practices and procedures to ensure that the stimulation activities are designed to be contained within the target gas producing formation (p) groundwater transmissivity, flow rate, hydraulic conductivity and direction(s) of flow (q) a description of the chemical compounds used in stimulation activities (including estimated total mass, estimated composition, chemical abstract service numbers and properties), their mixtures and the resultant compounds that are formed after stimulation (r) a mass balance estimating the concentrations and absolute masses of chemical

Condition Reference	Condition
	compounds that will be reacted, returned to the surface or left in the target gas producing formation subsequent to stimulation (s) an environmental hazard assessment of the chemicals used including their mixtures and the resultant chemicals that are formed after stimulation including: a. toxicological and ecotoxicological information of chemical compounds used b. information on the persistence and bioaccumulation potential of the chemical compounds used; and c. identification of the chemicals of potential concern in stimulation fluids derived from the risk assessment (t) an environmental hazard assessment of use, formation of, and detection of polycyclic aromatic hydrocarbons in stimulation activities (u) identification and an environmental hazard assessment of using radioactive tracer beads in stimulation activities (v) an environmental hazard assessment of leaving chemical compounds in stimulation fluids in the target gas producing formation for extended periods subsequent to stimulation (w) human health exposure pathways to operators and the regional population (x) risk characterisation of environmental impacts based on the environmental hazard assessment (y) potential impacts to landholder bores as a result of stimulation activities (z) an assessment of cumulative underground impacts, spatially and temporally of the stimulation activities to be carried out on the tenures covered by this environmental authority; and (aa) potential environmental or health impacts which may result from stimulation activities including but not limited to water quality, air quality (including suppression of dust and other airborne contaminants), noise and vibration.
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 two (2) kilometre 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 200m above or below the target gas producing formation and is spatially located with a two (2) kilometre radius from the location of the stimulation initiation point; and (c) any other bore that could potentially be adversely impacted by the stimulation activities in accordance with the findings of the risk assessment required by conditions (Well activities 10) and (RMW026).
RMW028.	Prior to undertaking stimulation activities at a well, there must be sufficient water quality data to accurately represent the water quality in the well to be stimulated. The data must include as a minimum the results of analyses for the parameters in condition (RMW029).
RMW029.	Baseline bore and well assessments must include relevant analytes and physico-chemical parameters to be monitored in order to establish baseline water quality and must include, but not necessarily be limited to: (a) pH (b) electrical conductivity [µS/m] (c) turbidity [NTU] (d) total dissolved solids [mg/L] (e) temperature [ºC] (f) dissolved oxygen [mg/L] (g) dissolved gases (methane, chlorine, carbon dioxide, hydrogen sulphide) [mg/L] (h) alkalinity (bicarbonate, carbonate, hydroxide and total as CaCO3) [mg/L] (i) sodium adsorption ratio (SAR) (j) anions (bicarbonate, carbonate, hydroxide, chloride, sulphate) [mg/L] (k) cations (aluminium, calcium, magnesium, potassium, sodium) [mg/L]

Condition Reference	Condition
	(l) dissolved and total metals and metalloids (including but not necessarily being limited to: aluminium, (a) arsenic, barium, borate (boron), cadmium, total chromium, copper, iron, fluoride, lead, manganese, (b) mercury, nickel, selenium, silver, strontium, tin and zinc) [ug/L] (m) total petroleum hydrocarbons [ug/L] (n) BTEX (as benzene, toluene, ethylbenzene, ortho-xylene, para- and meta-xylene, and total xylene) [ug/L] (o) polycyclic aromatic hydrocarbons (including but not necessarily being limited to: naphthalene, (c) phenanthrene, benzo[a]pyrene) [□g/L] (p) sodium hypochlorite [mg/L] (q) sodium hydroxide [mg/L] (r) formaldehyde [mg/L] (s) ethanol [mg/L]; and (t) gross alpha + gross beta or radionuclides by gamma spectroscopy [Bq/L].
RMW030.	A stimulation impact monitoring program must be developed prior to the carrying out of stimulation activities which must be able to detect adverse impacts to water quality from stimulation activities and must consider the findings of the risk assessment required by conditions (RMW025) and (RMW026) that relate to stimulation activities and must include, as a minimum, monitoring of: (a) the stimulation fluids to be used in stimulation activities at sufficient frequency and which sufficiently represents the quantity and quality of the fluids used (b) flow back waters from stimulation activities at sufficient frequency and which sufficiently represents the quality of that flow back water (c) flow back waters from stimulation activities at sufficient frequency and accuracy to demonstrate that 150% of the volume used in stimulation activities has been extracted from the stimulated well; and (d) all bores in accordance with condition (RMW027).
RMW031.	The stimulation impact monitoring program must provide for monitoring of: (a) analytes and physico-chemical parameters relevant to baseline bore and well assessments to enable data referencing and comparison including, but not necessarily being limited to the analytes and physicochemical parameters in condition (RMW029); and (b) any other analyte or physico-chemical parameters that will enable detection of adverse water quality impacts and the inter-connection with a non-target aquifer as a result of stimulation activities including chemical compounds that are actually or potentially formed by chemical reactions with each other or coal seam materials during stimulation activities
RMW032.	The stimulation impact monitoring program must provide for monitoring of the bores in condition (RMW030(d)) at the following minimum frequency: (a) monthly for the first six (6) months subsequent to stimulation activities being undertaken; then (b) annually for the first five (5) years subsequent to stimulation being undertaken or until analytes and physico-chemical parameters listed in conditions (RMW029(a)) to (RMW029(t)) inclusive, are not detected in concentrations above baseline bore monitoring data on two (2) consecutive monitoring occasions.
RMW033.	The results of the stimulation impact monitoring program must be made available to any potentially affected landholder upon request by that landholder.

7.3 'Minor Amendment' Determination

As this EA Amendment Application is not for a full condition conversion, it is understood that pursuant to section 223 of the EP Act, for an application to be determined a 'Minor Amendment' it must meet the definition for 'minor amendment (threshold)'. An assessment of the proposed EA Amendment against the amendment threshold criteria (outlined in Section 223 of the EP Act) is provided in **Table** 7-3.

It is submitted that the proposed EA Amendment readily meets the relevant threshold criteria and should be considered a 'Minor Amendment'.

Table 7-3 Minor Amendment (Threshold) Criteria Assessment

Definition	Comment
a) is not a change to a condition identified in the authority as a standard condition, other than— (i) a change that is a condition conversion; or (ii) a change that is not a condition conversion but that replaces a standard condition of the authority with a standard condition for the environmentally relevant activity to which the authority relates	***Complies*** The proposed amendment does not seek to amend standard conditions relevant to the existing EA. The proposed EA Amendment is limited to the addition of relevant Model Conditions for stimulation activities.
b) does not significantly increase the level of environmental harm caused by the relevant activity	***Complies*** The level of risk associated with the proposed stimulation activity does not increase the level of environmental harm beyond that of the existing activity given the following: ■ The existing geological and hydrological condition of PL213, comprising isolated aquifers, Mooga Sandstone; Gubberamunda Sandstone; Springbok Sandstone; and Hutton Sandstone (refer to **Section 2.3**). ■ The fracture pattern has also been well modelled, and it is anticipated length and behaviour of the fracture will be contained (refer to **Section 5.1**). In accordance with the relevant Model Conditions, the potential risk of exposure of sensitive receptors from the proposed activity is also consistent with the existing activity. Further modelling and risk assessment is proposed to be undertaken to further demonstrate the limited risk of the Proposed Activity, in accordance with the Model Conditions to be added subject to this application. ■ The well construction is compliant with the Queensland Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland (16 December 2019). ■ AGL will manage the Proposed Activity in accordance with the proven management actions implemented at the neighbouring P192 (EPPG00770313), where AGL have been undertaking stimulation activities in comparable areas with equivalent geological and hydrological conditions without incident.
c) does not change any rehabilitation objectives stated in the authority in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the authority	***Complies*** The proposed amendment does not alter rehabilitation objectives for EA EPPG00304213.

Definition	Comment
d) does not significantly increase the scale or intensity of the relevant activity	***Complies*** No additional wells or areas are proposed to be subject to petroleum related activities as a result of the proposed amendment.
e) does not relate to a new relevant resource tenure for the authority that is— (i) a new mining lease; or (ii) a new petroleum lease; or (iii) a new geothermal lease under the Geothermal Energy Act; or (iv) a new GHG injection and storage lease under the GHG storage Act; and	***Complies*** No additional tenure is proposed to be added to the existing EA as a result of the proposed amendment.
f) involves an addition to the surface area for the relevant activity of no more than 10% of the existing area	***Complies*** No additional surface area is proposed to be added to the existing EA as a result of the proposed amendment.
g) for an environmental authority for a petroleum activity— (i) involves constructing a new pipeline that does not exceed 150km; or (ii) involves extending an existing pipeline so that the extension does not exceed 10% of the existing length of the pipeline	***Complies*** The proposed amendment does not involve the addition or extension of pipelines. If the stimulation proves sufficiently productive, the installation of a new 1.6 km pipeline between WN1 and Churchie West 1 will be considered in the future, subject to any necessary further statutory approvals.
h) if the amendment relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—seeks, in the amendment application under section 224, 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.	***Not Applicable*** The proposed amendment does not relate to a new relevant resource tenure.

7.4 'Major Amendment' Consideration

In addition to the 'Minor Amendment' determination (refer to **Section 7.3**), consideration of what defines a significant impact by reference to the Guideline - Major and Minor Amendments - EP Act ESR/2015/1684 (dated 04 May 2022) to further support a minor amendment decision level decision is provided in **Table 7-4**.

Table 7-4 Major Amendment Considerations

The following matters will usually be significant, and therefore be assessed as major amendments	Relevance to the proposed stimulation activities
Increasing impacts to Category A or B environmentally sensitive areas (ESA)	***Not Major Amendment*** No increased impacts, refer to **Section 3.2.2.**
Increasing impacts to waters with limited assimilative capacity measured against environmental values and management objectives as prescribed in the Environmental Protection (Water) Policy 2019 (e.g. a discharge to a river which is already not meeting the required water quality objectives prescribed in the Environmental Protection (Water and Wetland Biodiversity) Policy 2019).	***Not Applicable***

The following matters will usually be significant, and therefore be assessed as major amendments	**Relevance to the proposed stimulation activities**
Increasing impacts to air quality such that the air quality objectives in the Environmental Protection (Air) Policy 2019 may not, or will not be achieved	***Not Major Amendment*** No increased impacts, refer to **Section 3.3**
Increasing noise emissions such that the acoustic quality objectives in the Environmental Protection (Noise) Policy 2019 may not, or will not be achieved	***Not Major Amendment*** No increased emissions, refer to **Section 4**
Increasing scale and nature of disturbances by a prescribed activity that will, or are likely to, result in a significant residual impact on a prescribed environmental matter (Note - these changes may trigger a requirement for an offset under the Environmental Offsets Act 2014).	***Not Major Amendment*** No, potential impacts related to the Proposed Activity are generally the same as existing impacts related to PL213
Diverting a natural watercourse	***Not Applicable***
Changing fuel type being used (i.e. from gas to coal or coal to waste)	***Not Applicable***
Discharging contaminants directly to groundwater	***Not Major Amendment*** Low risk of groundwater transmissivity, and any risk to be managed (refer to **Section 3.1.2**, **Section 6.1.1.2**, **Table 6-1** and **Table** 6-2**)**.
Deeper extraction that intersects groundwater or where the depth of groundwater is not known	***Not Applicable***
Increasing the height or area of a mine tailings dam by more than 10% of the existing height or area of that dam	***Not Applicable***
Constructing and/or operating a new coal seam gas brine dam	***Not Applicable***
Using emerging technologies (e.g. a new type of mining)	***Not Applicable***
Changes to the final landform design that compromise landform stability and increase erosion potential (e.g. increasing the gradient of final slopes)	***Not Applicable***
Changes which are part of staged development	***Not Applicable***
A 5% volume increase of waste production with potentially acid forming or neutral mine drainage properties	***Not Applicable***
A change in the type of minerals being mined	***Not Applicable***
A change of a post-mining land use for an area	***Not Applicable***
The addition of a mining lease to an EA, due to the increase in the risk of environmental harm	***Not Applicable***
The following matters may be significant (and therefore major amendments), or may not be significant, depending on the nature of the amendment	
Discharging contaminants which differ to those authorised in the existing EA	***Not Major Amendment*** No. Flowback water not to be released to the environment, refer to **Section 6.1.1**, **Section 6.2**, and **Table** 6-1.
Increasing emissions to the environment either by substantial volume or concentration or load	***Not Major Amendment*** No increased emissions, refer to **Section 6**
Changing the final rehabilitation acceptance criteria for an activity to a lower standard such that proposed rehabilitated land has a lower environmental value than that originally authorised in the existing EA	***Not Major Amendment*** No. The proposed amendment does not alter rehabilitation objectives for EA EPPG00304213.
Moving a contaminant release location to a place with different environmental values	***Not Applicable***

The following matters will usually be significant, and therefore be assessed as major amendments	Relevance to the proposed stimulation activities
Using different industrial processes which will result in different emissions and impacts which are not authorised by the EA	***Not Applicable***
Changing the design of an engineered capping layer to be installed over a waste rock dump	***Not Applicable***
Increasing annual throughput for the relevant activity beyond that authorised in the existing EA	***Not Applicable***
Increasing the quantity of chemicals, hazardous materials or wastes stored on the site beyond that authorised in the existing EA	***Not Major Amendment*** No increase to storage of chemicals, hazardous materials or wastes beyond what is authorised in EA EPPG00304213.
Increasing operating hours into evening hours and Sundays where not previously authorised in the existing EA and the site of the activity(ies) is within close proximity to sensitive receptors.	***Not Applicable***

7.5 Public Notice Considerations

To further support the view that a major amendment is not appropriate in this instance, set out in **Table 7-5** are the public notice considerations listed in the Guideline - Major and Minor Amendments - EP Act ESR/2015/1684 (dated 04 May 2022) which are not applicable to the Proposed Activity.

Table 7-5 Public Notice Considerations

In relation to consideration of what may trigger public notification if the amendment is for a resource activity and the administering authority decides that	Relevance to the Proposed Activity
The amendment is likely to lead to a substantial increase in the risk of environmental harm under the amended EA; and	**No,** there is no substantial increase in the risk of environmental harm, refer to **Section 6**.
The risk is the result of a substantial change in:	
The quantity or quality of contaminant permitted to be released to the environment; or	**No**, refer to **Section 6**
The results of the release of a quantity or quality of contaminant permitted to be released into the environment.	**No**, refer to **Section 6**
Also, the notification stage will apply to an application if any part of the application is for a mining activity relating to a new mining lease.	***Not Applicable***
Public notification applies to applications for a major amendment of a PRCP schedule, except to the extent that the proposed change to the PRCP schedule:	***Not Applicable***
reduces the area of a non-use management area under the schedule; or	***Not Applicable***
is likely to reduce, or cause no change to, the impacts on environmental values raised by the activities the subject of the schedule.	***Not Applicable***

8. CONCLUSION

The purpose of this Supporting Information document is to accompany the application to amend EA EPPG00304213, held by AGL, relating to PL213.

Specifically, the purpose of this EA Amendment application is to facilitate hydraulic strata stimulation on PL213, starting with 'West Noorindoo 1' (located at coordinates 270 07' 33.348" S, 1490 10' 58.044" E).

Based on the information considered as part of this Supporting Information document, it is concluded that the proposed EA Amendment application meets the definition of a 'Minor Amendment' (threshold) under Section 223 of EP Act as it:

- Does not increase the environmental risk associated with the activity;
- Does not increase the surface area or lease area subject to the existing environmental authority; and
- Does not amend the approved activity permitted under EA EPPG00304213.

Accordingly, it is respectfully requested that DES determine this application is a 'Minor Amendment (threshold)' and issue an amended EA for PL213 within the relevant legislative timeframe to enable AGL to commence hydraulic strata stimulation activities for 'West Noorindoo 1'.

9. REFERENCES

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APPENDIX A REVIEW OF ENVIRONMENTALLY SENSITIVE AREAS PETROLEUM LEASE 213

REVIEW OF ENVIRONMENTALLY SENSITIVE AREAS

Petroleum Lease 213

Client: AGL Energy Ltd

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Project Number: J001292
Status: Final
Date: 8/09/2023

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Document Version Register

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3	Final	LMT	LMT	LMT	08/09/2023

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1. Introduction

1.1 Overview

Range Environmental Consultants were commissioned by AGL Energy Ltd to undertake a review of Environmentally Sensitive Areas (ESAs) within 500m and 1000m of proposed hydraulic stimulation works at West Noorindoo on Petroleum Lease 213 (PL 213).

Works involve hydraulic stimulation activities of the target gas formation at one (1) existing gas well (WN1). Hydraulic stimulation activities would firstly focus on WN1 and then possibly CW1 in the future if this deemed necessary. If that stimulation proves sufficiently productive, then consideration will be given to installation of a pipeline approximately 1.6km long between the two wells.

Works are proposed on land formally described as Lot 2 on Plan E533 and Lot 7 on Plan E532 (herein referred to as 'the site' and shown in Figure 1).

This report has been prepared as a technical document to support the proposed amendment to the existing Environmental Authority (EA) (EPPG00304213). It is important to note that the proposed EA amendment applies only to the proposed hydraulic stimulation activities described earlier for WN1.

CW1 does not fall within the scope of the application as it has not been determined if hydraulic stimulation of this well will be required. Furthermore, the potential pipeline also does not form part of the EA amendment. If needed, that pipeline would be the subject of a separate future approvals process as it is not yet clear if the pipeline will be required.

1.2 Objective and Scope

The objective of the assessment was to evaluate the presence and/or absence of ESAs within 500 m and 1000 m of the existing gas wells (WN1 and CHW1) and potential pipeline. The spatial extent of assessed areas is shown in Figure 2.

It must be noted that although the report has considered ESAs with respect to both the WN1 and CW1 wells, only WN1 is relevant for the purpose of the EA amendment application. CW1 does not fall within the scope of the application.

1.3 Site Context

The site is located on grazing lands in the locality of Noorindoo, within the Maranoa Regional Council Local Government Area (Figure 1). The site is currently grazed by cattle, with existing gas wells present. The majority of the assessment area contained native pastures, with scattered retained shade trees for stock.

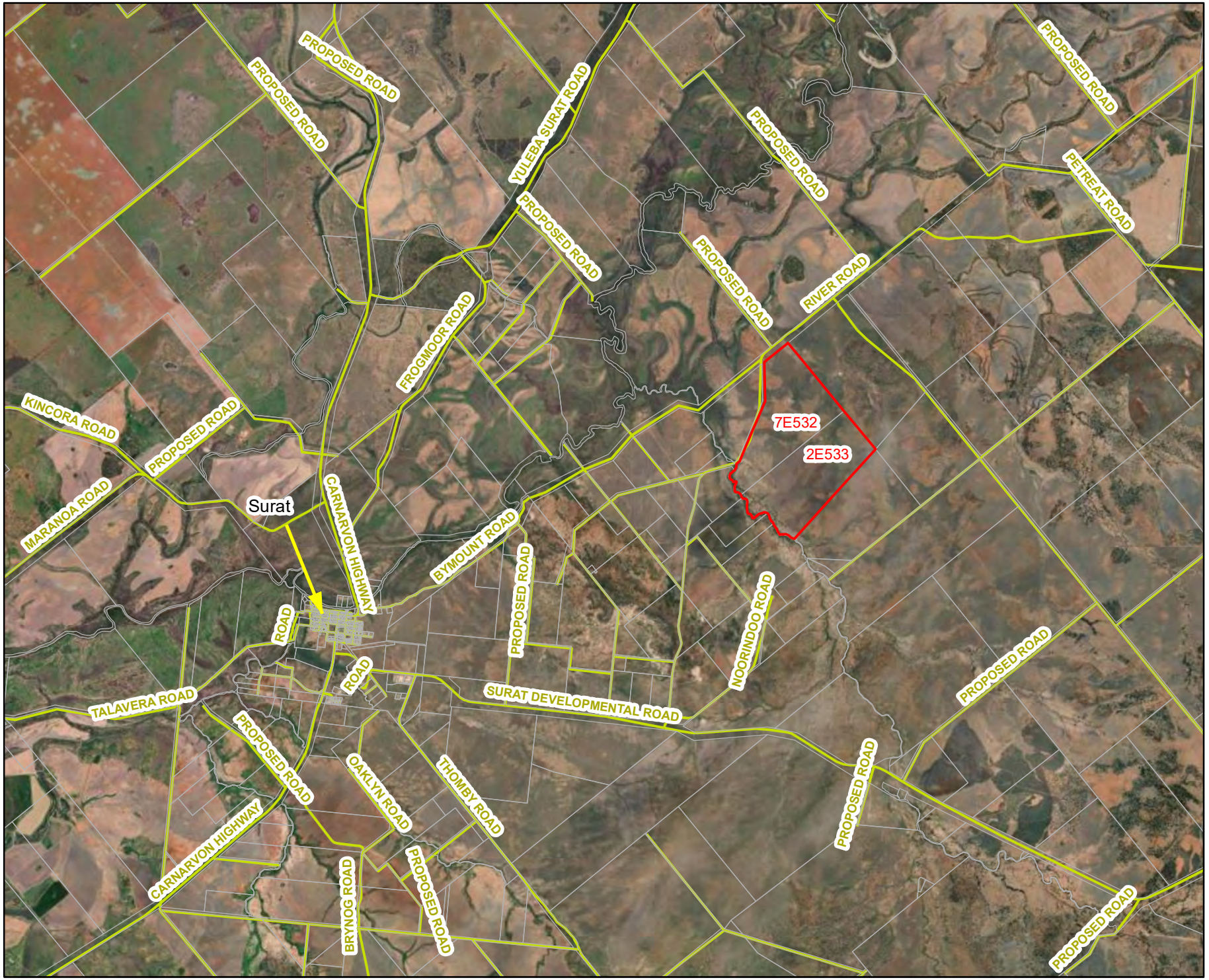

Figure 1 Site Locality

Project: Ecological Assessment

Client: AGL

Project No.: J001292

Compiled by: HB Date: 02/03/2023
Approved by: WG Date: 02/03/2023

Metres
0 1,750 3,500

Legend

- Cadastre
- Roads
- Site

The content of this document includes third party data. Range Environmental Consultants does not gaurantee the accuracy of such data.

Source: Cadastral data sourced from DNRME (2021)

N

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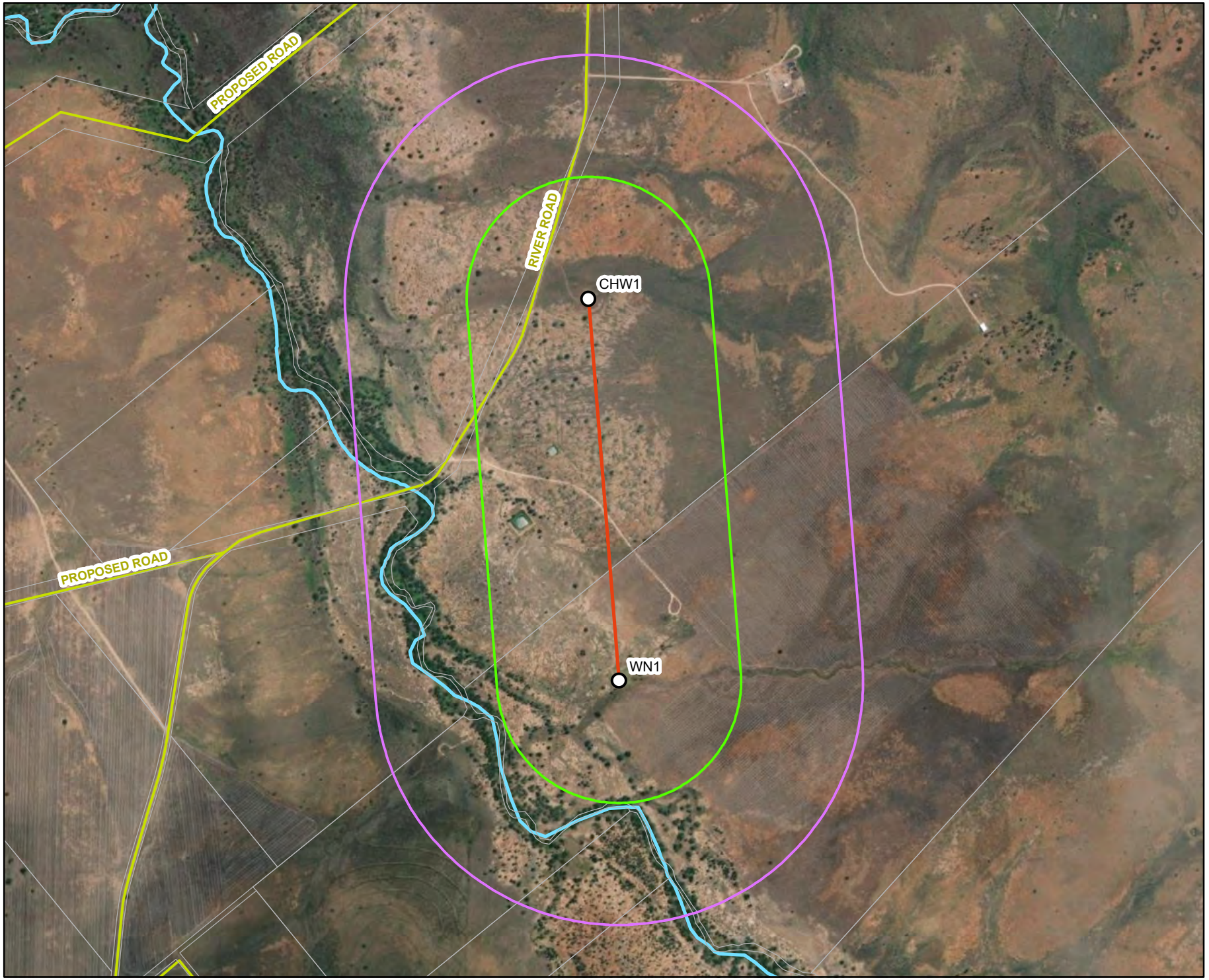

Figure 2 Potential Pipeline

Project: Ecological Assessment

Client: AGL

Project No.: J001292

Compiled by: HB Date: 02/03/2023
Approved by: WG Date: 02/03/2023

Metres
0 275 550

Legend

- Cadastre
- Roads
- Griman Creek
- Existing gas wells
- WN1 to CHW1 potential pipeline
- 500m buffer
- 1000m buffer

Source: Cadastral data sourced from DNRME (2021)

N

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2. Methods

2.1 Desktop Assessment

A desktop assessment was undertaken to review the following.

- *Environmental Protection Act 1994* (DES) (Qld):
  - ESA mapping for 'Petroleum Lease' from the Department of Environment and Science (DES) website for a search from the approximate centre of the pipeline (-27.11849, 149.18253).
- *Vegetation Management Act 1999* (VM Act) (Qld):
  - Regulated Vegetation Management Map as issued by the Department of Resources (DOR);
  - Vegetation Management Report (DOR); and
  - Vegetation Management Pre-Clear Regional Ecosystem Map.

A copy of the obtained search results is provided as Appendix A:.

2.2 Field Assessment

Information collected during the field assessment of ESA on 13th February 2023 included the following:

- Vegetation community species composition; and
- Vegetation cover and height.

Based on the above collected data an assessment of the following was made for vegetation communities at the site:

- Alignment of vegetation with mapped Regional Ecosystems (REs);
- The corresponding status of vegetation (Remnant, regrowth or non-remnant);
- The Vegetation Management Act class; and
- The Biodiversity status.

Six (6) quaternary assessments and two (2) biocondition assessments were conducted over the site, with the results provided in Appendix B:. The locations of completed vegetation surveys in relation to mapped ESAs are shown in Figure 3.

The two biocondition assessments were conducted within a 100m long and 50m wide survey area. The biocondition surveys also included assessing canopy cover over the 100 m length using the canopy intercept method. Quaternary assessments were also conducted to provide greater spatial coverage/resolution of ESAs.

A combination of Garmin GPSMAP 64S and Trimble Global Positioning System (GPS) devices were used to record field data and locations. Captured data was validated, mapped, and assessed using a geographical information system (datum GDA20/MGA zone 56).

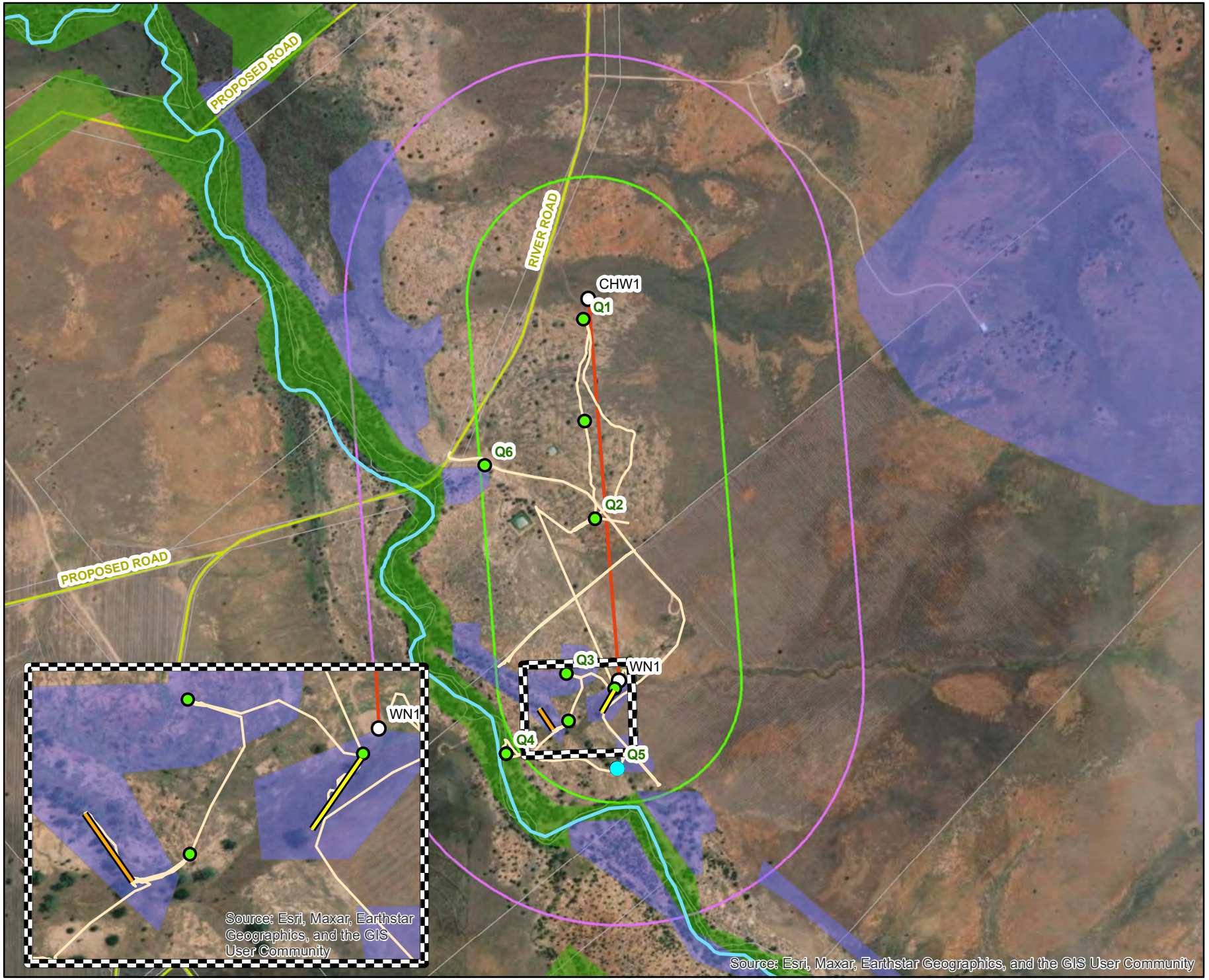

Figure 3 Survey Locations

Project: Ecological Assessment

Client: AGL

Project No.: J001292

Compiled by: HB Date: 10/03/2023
Approved by: WG Date: 10/03/2023

Metres
0 275 550

Legend

- Cadastre
- Roads
- Griman Creek
- Category B: Endangered Regional Ecosystsems - regrowth and remnant (Biodiversity Status)
- Category C: Of Concern Regional Ecosystems (remnant biodiversity status)
- existing wells
- WN1 to CHW1 potential pipeline
- 500m buffer
- 1000m buffer
- Quaternary
- Biocondition 1
- Biocondition 2
- Tracks

Source: Cadastral data sourced from DNRME (2021)

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3. Results

3.1 Desktop Assessment

3.1.1 ESA Mapping

ESA mapping for the site showed the following (Figure 4):

- No Category A ESA within 1000 m of the two wells (WN1 and CHW1) or potential pipeline.
- Category B ESA - Endangered Regional Ecosystems - regrowth and remnant (Biodiversity Status) within 500 m of well WN1 and the potential pipeline. No Category B ESA within 500 m of CHW1.
- Category C ESA - Of Concern Regional Ecosystems (remnant biodiversity status) within 500 m of well WN1 and the potential pipeline. No Category C ESA within 500 m of CHW1.

As there were no mapped Category A ESA within 1000 m of the two wells (WN1 and CHW1) or potential pipeline, the study then focussed on ESA within 500 m of the two wells (WN1 and CHW1) and potential pipeline (as per Condition 4 of EA EPPG00304213).

3.1.2 Vegetation Community Mapping

The two wells (WN1 and CHW1) and potential pipeline are within an area mapped as Category B Regulated Vegetation (remnant vegetation) which is described as Regional Ecosystem (RE) 11.9.3 (Figure 5). This vegetation is not classified as an ESA.

The balance of land within 500 m of the two wells (WN1 and CHW1) and potential pipeline included:

- Category X (non-remnant) vegetation.
- Category B Regulated Vegetation with areas mapped as RE 11.3.17 and 11.3.25. RE 11.3.17 is a Category B ESA and RE 11.3.25 is a Category C ESA.

The description of the mapped REs within 500m of the two wells (WN1 and CHW1) and potential pipeline is included in Table 1.

Table 1 Regional Ecosystem descriptions

RE	VM Act Status	Biodiversity Status	Short Description
11.9.3			
	Least Concern	No Concern	*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks
Detailed description			
Dichanthium sericeum and/or *Astrebla* spp. (*A. lappacea*, *A. elymoides* and *A. squarrosa*) tussock grassland. May contain high cover of short-lived perennial grasses, annual grasses and annual forbs, depending on seasonal conditions. Other frequently occurring species may include the grasses *Aristida leptopoda, A. latifolia*, *Bothriochloa erianthoides, Digitaria brownii, D. divaricatissima, Enneapogon* spp., *Eriochloa crebra*, *Heteropogon contortus, Panicum decompositum, P. queenslandicum, Paspalidium globoideum, Themeda triandra* and *Thellungia advena* and the forbs *Abelmoschus ficulneus, Boerhavia dominii, Corchorus trilocularis*, *Cyperus bifax, Glycine latifolia, Ipomoea lonchophylla, Phyllanthus maderaspatensis, Tribulus micrococcus* and *Rhynchosia minima*. Isolated low shrubs and trees and open woodland occur in some areas. Typical species include *Eucalyptus melanophloia, E. orgadophila, Corymbia erythrophloia, Lysiphyllum carronii, Atalaya hemiglauca, Acacia pendula, A. omalophylla* and *Geijera parviflora*. Occurs on gently undulating to undulating plains and rises with cracking clay soils derived from fine-grained sediments.			
RE	**VM Act Status**	**Biodiversity Status**	**Short Description**
11.3.17	Of concern	Endangered	*Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains
Detailed description			
Eucalyptus populnea woodland with *Casuarina cristata* and/or *Acacia harpophylla* clumps or scattered trees and a low tree layer dominated by *Geijera parviflora*. A shrub layer usually occurs, including *Eremophila mitchellii*, *Geijera parviflora, Acacia melvillei* (Darling Downs), *Alectryon oleifolius* and *Acacia pendula*. Localised areas may be dominated by *Acacia harpophylla* or other understorey species. A lower shrub layer commonly occurs. The ground layer is dominated by tussock grasses, including *Bothriochloa decipiens, Aristida ramosa*, *Enteropogon acicularis* and *Paspalidium* spp. with *Chloris ventricosa, Eragrostis lacunaria, Aristida jerichoensis*, *Paspalidium constrictum*, and *Tripogon loliiformis* on scalded areas. Occurs on back plains, levees and terraces formed on Quaternary alluvial deposits. Soils are generally deep texture contrast with thin sandy surfaces.			
RE	**VM Act Status**	**Biodiversity Status**	**Short Description**
11.3.25	Least Concern	Of Concern	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines
Detailed description			
Eucalyptus tereticornis or *E. camaldulensis* woodland to open forest. Other tree species, including *Casuarina cunninghamiana*, *E. coolabah, Melaleuca bracteata, Melaleuca viminalis, Livistona* spp. (in north), *Melaleuca* spp. and *Angophora floribunda*, may occur. An tall shrub layer may occur, including *Acacia salicina, A. stenophylla* and *Lysiphyllum carronii*. Low shrubs are present, but rarely form a conspicuous layer. The ground layer is open to sparse and dominated by perennial grasses, sedges or forbs. Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays with or without some texture contrast. These are usually moderately deep to deep, soft or firm, acid, neutral or alkaline brown sands, loams or black cracking or non-cracking clays, and may be sodic at depth (Burgess 2003).			

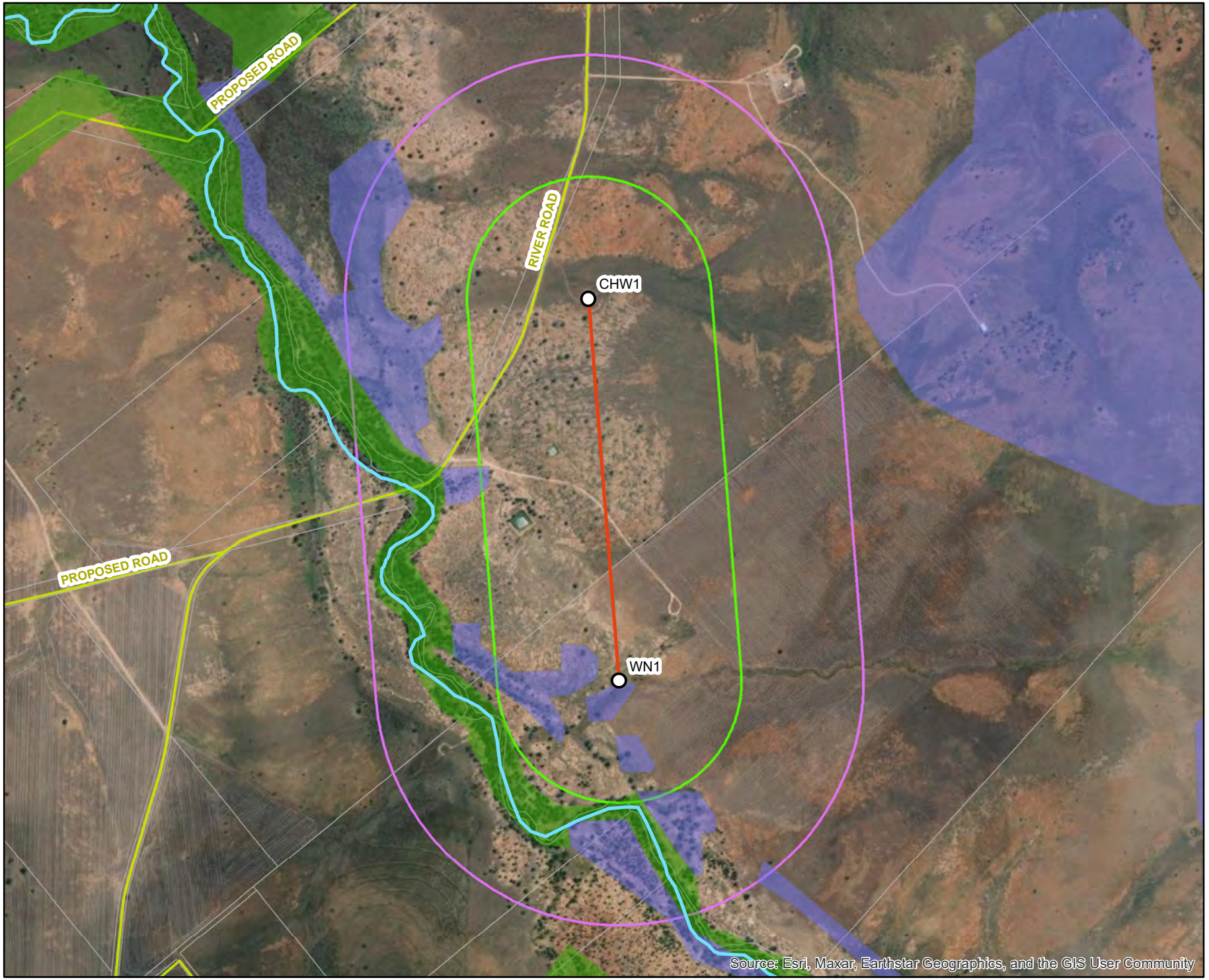

Figure 4 Environmentally Sensitive Areas

Project: Ecological Assessment

Client: AGL

Project No.: J001292

Compiled by: HB Date: 10/03/2023
Approved by: WG Date: 10/03/2023

Metres
0 275 550

Legend

- Cadastre
- Roads
- Griman Creek
- Category B: Endangered Regional Ecosystsems - regrowth and remnant (Biodiversity Status)
- Category C: Of Concern Regional Ecosystems (remnant biodiversity status)
- Existing wells
- WN1 to CHW1 potential pipeline
- 500m buffer
- 1000m buffer

Source: Cadastral data sourced from DNRME (2021)

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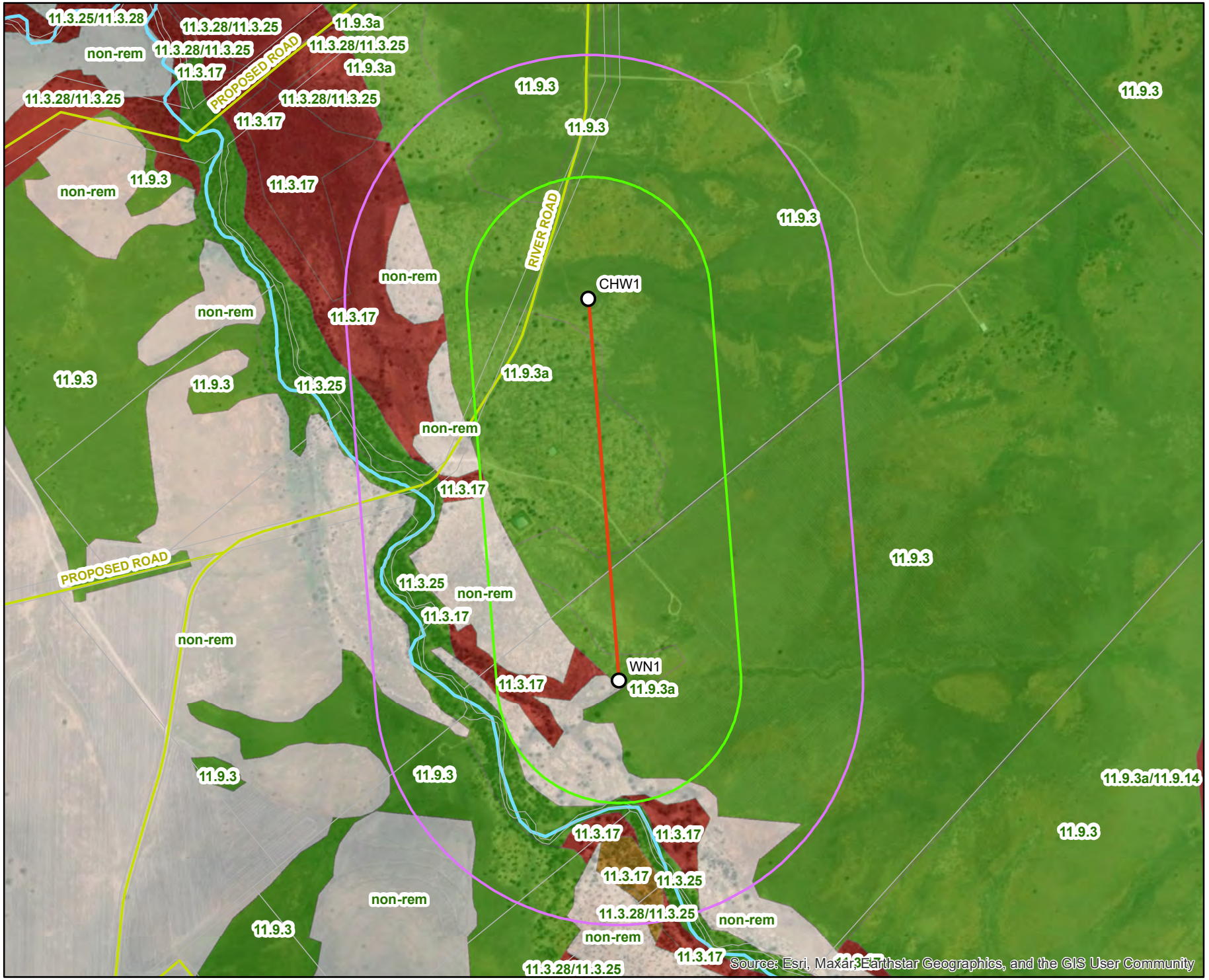

Figure 5
Regulated Vegetation and Regional Ecosystem Map

Project: Ecological Assessment

Client: AGL

Project No.: J001202

Compiled by: HB Date: 02/03/2023
Approved by: WG Date: 02/03/2023

0 275 550 Metres

Legend

- Cadastre
- Roads
- Griman Creek
- Existing wells
- WN1 to CHW1 potential pipeline
- 500m buffer
- 1000m buffer
- Category A or B containing of concern
- Category A or B that is of least concern
- Category C or R containing of concern
- Category C or R that is of least concern
- Non-remnant

Source: Cadastral data sourced from DNRME (2021)

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3.2 Field Findings

3.2.1 Ground-truthed Vegetation Communities and Regional Ecosystems

The field assessment identified three (3) vegetation communities within 500 m of the two wells (WN1 and CHW1) and potential pipeline (Figure 6):

- Vegetation Community 1 (VC1) - remnant RE 11.9.3 with scattered canopy trees and groundcover comprising native and non-native species. This VC was not an ESA.
- Vegetation Community 2 (VC2) - remnant RE 11.3.17 comprising of scattered native canopy species, limited shrub layer and grasses. Occurred in association with a dry drainage line. This VC was consistent with a Category B ESA.
- Vegetation Community 3 (VC3) - remnant RE 11.3.25 comprising of native canopy species, mixed composition understory and grasses. This VC was consistent with a Category C ESA.

Quaternary vegetation assessment and biocondition assessment data are provided at Appendix B:).

The actual on ground extent and location of regional ecosystems within 500 m of the two wells (WN1 and CHW1) and potential pipeline varied from the mapped extents shown in Figure 5.

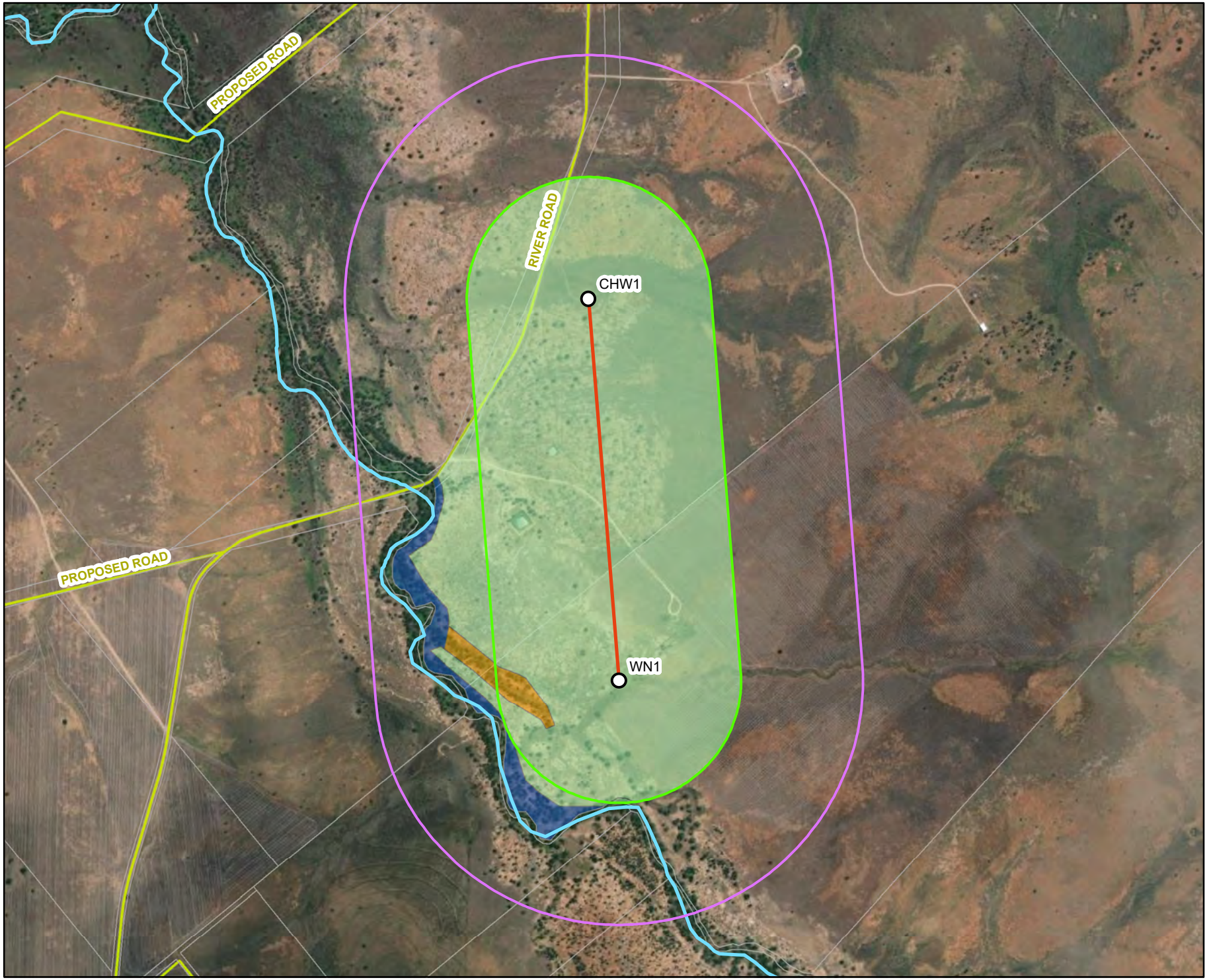

Figure 6 Ground-truthed Vegetation Communities

Project: Ecological Assessment

Client: AGL

Project No.: J001292

Compiled by: HB Date: 02/03/2023
Approved by: WG Date: 02/03/2023

Metres
0 275 550

Legend

- Cadastre
- Roads
- Griman Creek
- Existing gas wells
- WN1 to CHW1 potential pipeline
- 500m buffer
- 1000m buffer

Vegetation Communities

- VC1
- VC2
- VC3

Source: Cadastral data sourced from DNRME (2021)

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3.2.1.1 Vegetation Community 1 - Grassland with scattered canopy trees (remnant RE 11.9.3)

The majority of the vegetation within 500 m of the two wells (WN1 and CHW1) and potential pipeline was contained within this vegetation community aligned with the mapped RE 11.9.3. Scattered, native species occurred through a very sparse canopy layer, with a shrub layer absent, and groundcover layer containing mixed native/non-native composition. VC1 is currently used as grazing lands for cattle.

Within the very sparse canopy layers *Eucalyptus melanophloia* (silver-leaved ironbark), *E. populnea* (poplar box), *E. coolabah* (Coolibah), *E. camaldulensis* (river red gum) were observed as occurring. The subcanopy layer consisted of a very sparse cover of *Lysiphyllum carronii* (ebony tree) and *Acacia mitchellii* (Mitchell's wattle). The shrub canopy was limited with scattered *Harrisia* sp. (Harrisia cactus), *Salsola australis* (roly poly), and *Opuntia tomentosa* (velvety tree pear). The groundcover consisted of native species and non-native species. Native groundcover species included *Dicanthium sp.*, *Poa* sp. (meadow grass), *Enteropogon ramosus* (curly windmill grass), *Astrebla lappacea* (curly Mitchell grass), *Chloris truncata* (windmill grass), *Panicum decompositum* (native millet), *Suaeda* sp., *Digitaria hystrichoides* (umbrella grass), *Chrysocephalum apiculatum* (yellow buttons), and *Paspalidium globoideum* (sago grass). Non-native groundcover species included *Convolvulus arvensis* (field bindweed), *Cenchrus ciliaris* (buffel grass), *Eragrostis* sp. (lovegrass), *Lepidium* sp., and *Cirsium vulgare* (spear thistle).

Photograph 1 View of VC1

Photograph 2 View of VC1

3.2.1.2 Vegetation Community 2 - RE 11.3.17 comprising of scattered native canopy species, limited shrub layer and grasses

VC2 was present along a dry drainage line approximately 315 m west of the WN1 well and potential pipeline. It had mature trees present but with limited natural recruitment. Canopy and subcanopy species comprised of Coolibah, ebony tree, *Casuarina cristata* (Belah), and Mitchell's wattle. The shrub layer was limited and contained roly poly, and groundcover included *Dicanthium sp.*, buffel grass, lovegrass, curly windmill grass, native millet, yellow button, and sago grass.

Photograph 3 Vegetation located within VC2

Photograph 4 View of VC2

3.2.1.3 Vegetation Community 3 - RE 11.3.25 comprising of native canopy species, mixed composition understory and grasses

VC3 was located approximately 500 m from the WN1 well and potential pipeline. Predominantly comprising an open woodland of riverine vegetation species. The canopy was dominated by Coolibah with suppressed river red gums. Poplar box, Belah, *Angophora* sp., *Melaluca* sp., and Mitchell's wattle comprised the subcanopy layer. The shrub layer was limited with roly poly and velvety tree pear, and groundcover included *Dicanthium sp*., buffel grass, *Poa* sp., lovegrass, and windmill grass.

Photograph 5 Vegetation located within VC3

Photograph 6 Vegetation located within VC3

3.2.2 Fauna Habitat

Few incidental fauna observations were recorded within the assessment area, potentially due to the timing of the survey (diurnal) and the largely disturbed nature of the assessment area. The following bird species were recorded:

- Torresian crow (*Corvus orru*)
- Australian magpie (*Cracticus tibicen*)
- Noisy miner (*Manorina melanocephala*)
- Square-tailed kite (*Lophoictinia isura*)
- Apostlebird (*Struthidea cinerea*)
- Pied currawong (*Strepera graculina*)
- Superb fairy wren (*Malurus cyaneus*)
- Pied butcherbird (*Cracticus nigrogularis*)

Habitat availability within the vicinity of the two wells (WN1 and CHW1) and along the alignment of the potential pipeline was reduced due to current land use and previous vegetation management. Better quality habitat for fauna was in vegetation communities (VC2 and VC3)away from the two wells (WN1 and CHW1) and potential pipeline. Mature canopy trees, particularly regrowth vegetation, contained numerous flowering/fruiting tree species and are likely to provide foraging resources for nectivorous mammals and birds as well as decorticating bark for small reptiles. Potential fauna habitat and resources identified within VC2 and VC3 included:

- Arboreal termitarium;
- Fallen trees;
- Large stags;
- Mature trees with potential hollows;
- Decorticating bark, which may provide potential habitat for microchiropteran bats and arboreal reptiles; and
- Flowering trees and shrubs that provide a source of nectar for birds and flying-foxes.

3.3 Assessment of Environmentally Sensitive Areas

Based on the results at Section 3.2.1, a refined ground-truthed ESA map has been prepared for the two wells (WN1 and CHW1) and potential pipeline (Figure 7). ESA are defined at Appendix A of EA EPPG00304213. As shown at Figure 7:

- There are no Category A ESA within 1000 m of the two wells (WN1 and CHW1) or potential pipeline.
- There is a Category B ESA located approximately 315 m from WN1 well and the potential pipeline.
- There is a Category C ESA located approximately 500 m from WN1 well and the potential pipeline.
- There are not Category B or C ESA within 500 m of CHW1 well.

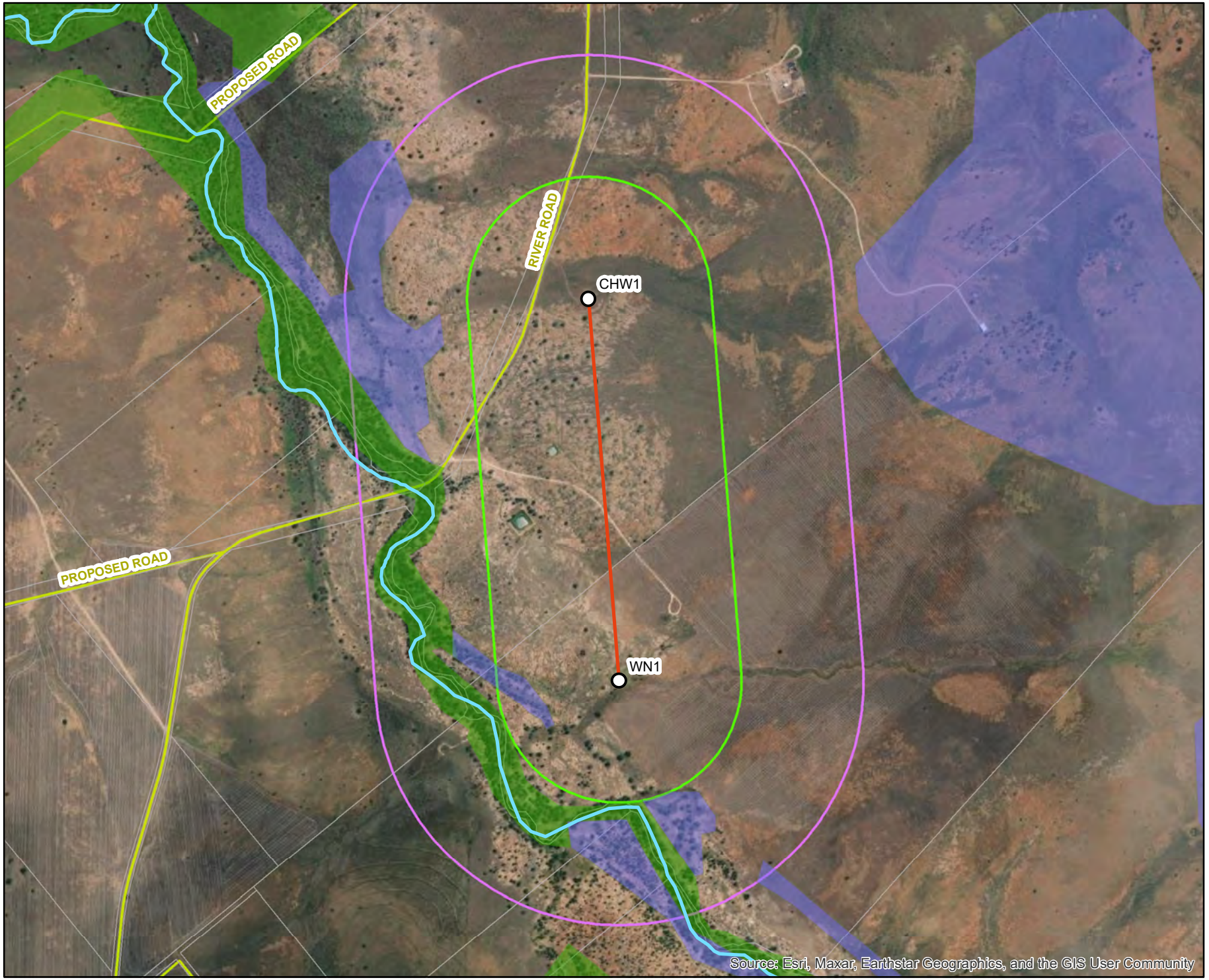

Figure 7 Ground-truthed ESA

Project: Ecological Assessment

Client: AGL

Project No.: J001292

Compiled by: HB Date: 10/03/2023
Approved by: WG Date: 10/03/2023

0 275 550 Metres

Legend

- Cadastre
- Roads
- Griman Creek
- Category C: Of Concern Regional Ecosystems (remnant biodiversity status)
- Category B: Endangered Regional Ecosystsems - regrowth and remnant (Biodiversity Status)
- Existing wells
- WN1 to CHW1 potential pipeline
- 500m buffer
- 1000m buffer

Source: Cadastral data sourced from DNRME (2021)

N

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4. Summary

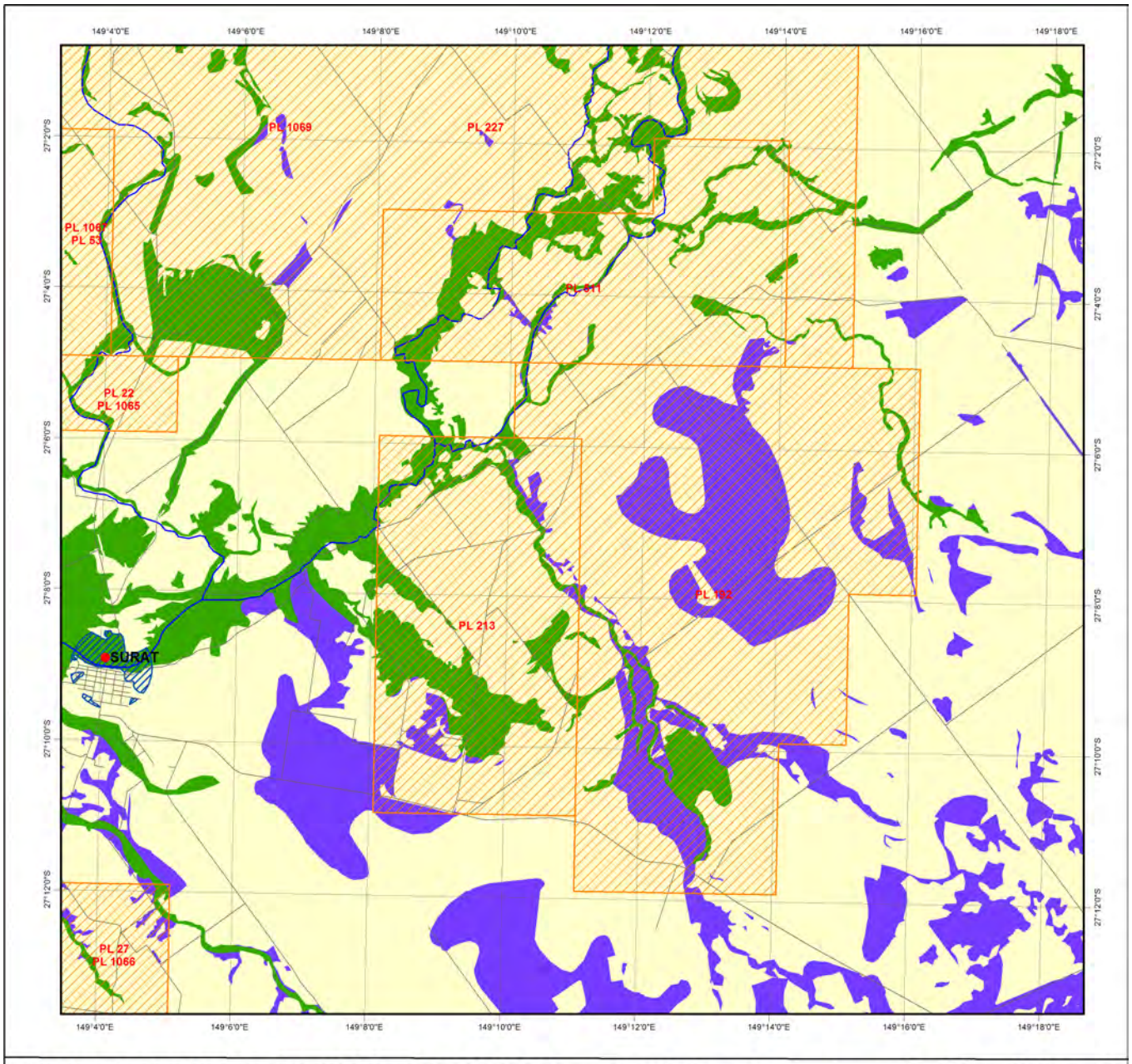
- The existing gas wells (WN1 and CHW1) and potential pipeline and are not located within an ESA.
- There are no Category A ESA within 1000 m of the two wells (WN1 and CHW1) or potential pipeline.
- There is a Category B ESA located approximately 315 m from WN1 well and the potential pipeline.
- There is a Category C ESA located approximately 500 m from WN1 well and the potential pipeline.
- There are not Category B or C ESA within 500 m of CHW1 well.

Appendix A: Desktop Searches

Tenure type: Petroleum Lease

Map requested: 12/03/2023 06:16:31

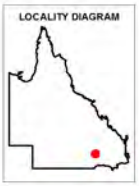
Centred on point position: Longitude: 149.18253 Latitude: -27.11849



ENVIRONMENTALLY SENSITIVE AREAS - non-mining resource activities (EP Act)

- Petroleum Lease
- CATEGORY A
- National Parks
- Conservation Parks
- Forest Reserves
- Special Wildlife Reserve
- Wet Tropics World Heritage Area
- Great Barrier Reef Marine Park Area
- Marine Parks other than General Use Zones
- CATEGORY B
- Queensland Heritage Register Places
- Ramsar Sites
- Cultural Heritage Registered Areas and DLA's other than Stanbroke
- Special Forestry Areas
- Seaward Side of Highest Astronomical Tide
- Fish Habitat Areas
- Coordinated Conservation Areas
- Endangered Regional Ecosystems - regrowth and remnant (Biodiversity Status)
- General Use Zones of Marine Parks
- Marine Plants
- CATEGORY C
- Essential Habitat
- Koala Plan
- Nature Refuges
- Resources Reserve
- State Forests
- Timber Reserves
- Of Concern Regional Ecosystems (remnant biodiversity status)
- OTHERS
- Towns
- Roads
- Rivers
- Springs
- Queensland

LOCALITY DIAGRAM



N

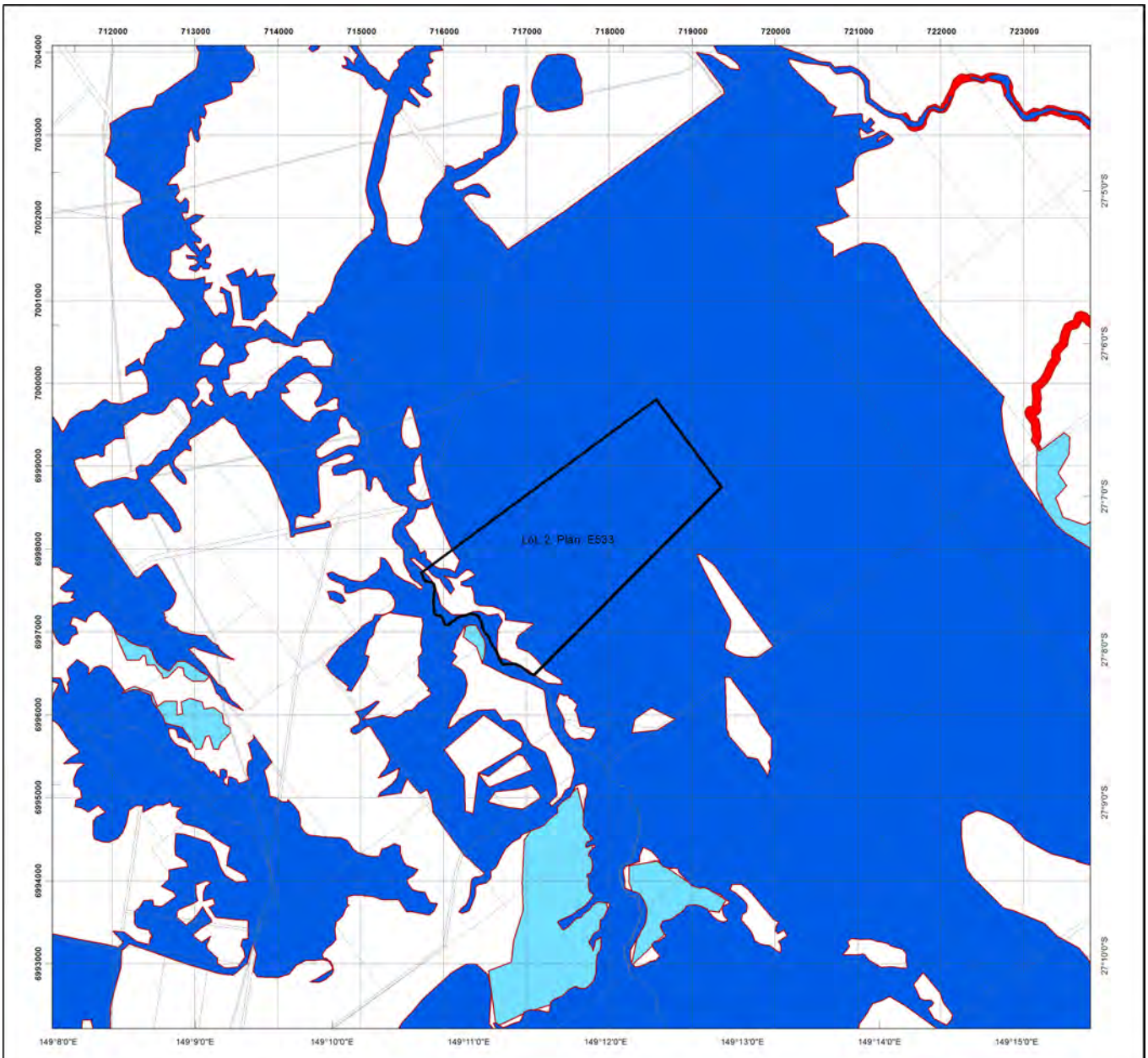
0 1300 2600 3900 5200 6500 m

This product is projected into GDA 1994 MGA Zone 55

NOTE TO USER: Themes presented in this map are indicative only. Field survey may be required to verify the 'true' spatial extent and value. Not all environmentally sensitive areas are presented in this map. A user should refer to the particular circumstances relevant to their situation to assess the 'completeness' of themes provided.

The user should note that some boundaries and indicated values are ambient or subject to change over time (e.g. regional ecosystem boundaries and conservation status, watercourse mapping etc).

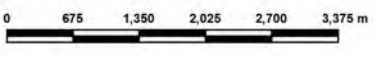
The user should be aware that due to multiple overlapping themes present, some themes/layers may be obscured by others. Ordering in the Legend does not accurately reflect the order by which themes are displayed.



Regulated Vegetation Management Map

Legend

- Selected Lot and Plan
- Category A area (Vegetation offsets/compliance notices/VDecs)
- Category B area (Remnant vegetation)
- Category C area (High-value regrowth vegetation)
- Category R area (Reef regrowth watercourse vegetation)
- Category X area (Exempt clearing work on Freehold, Indigenous and Leasehold land)
- Water
- Other land parcel boundaries



This product is projected into:
GDA 1994 MGA Zone 55

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Resources makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

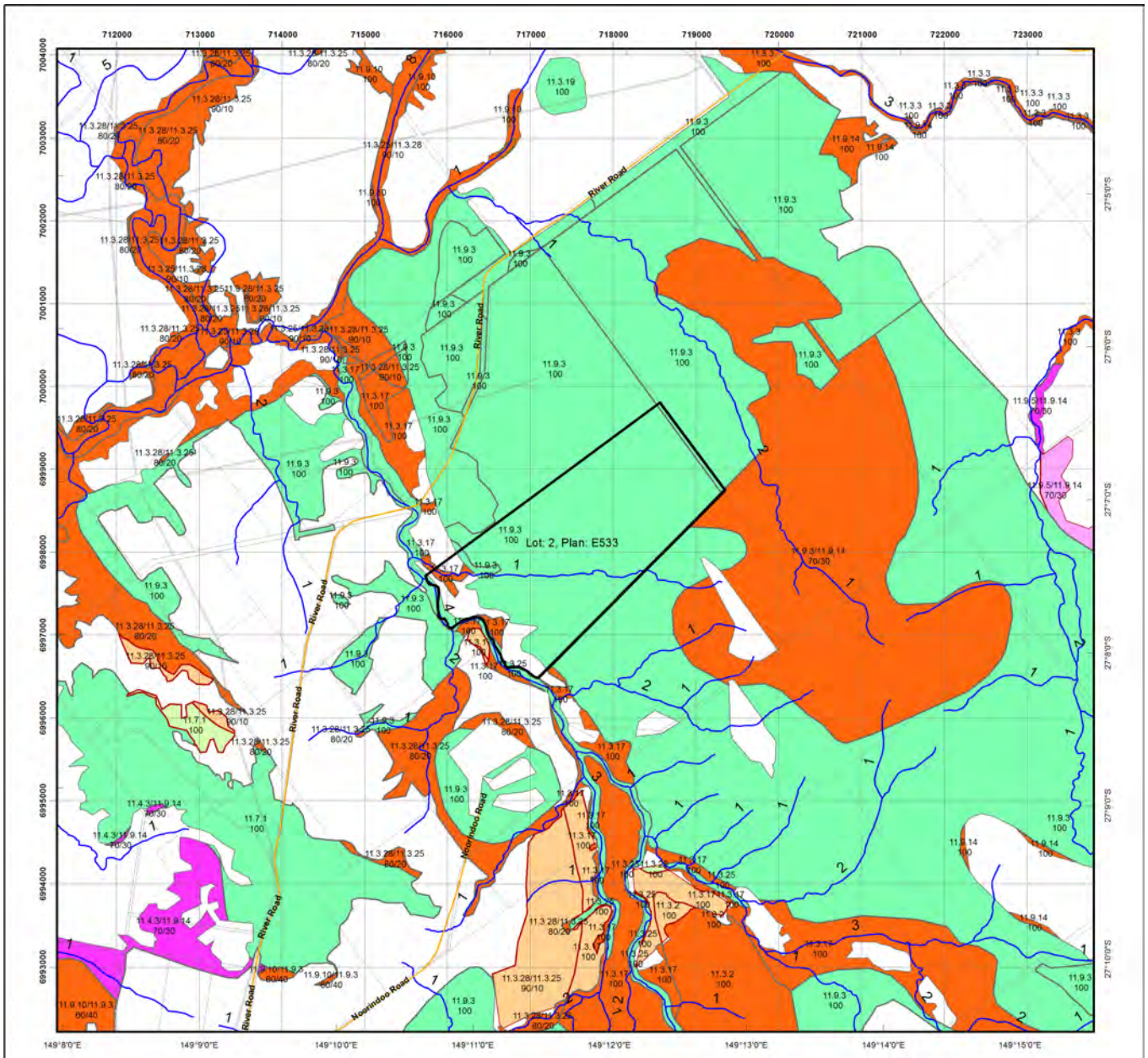
Additional information required for the assessment of vegetation values is provided in the accompanying "Vegetation Management Supporting map". For further information go to the web site: www.resources.qld.gov.au or contact the Department of Resources.

Digital data for the regulated vegetation management map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.

This map is updated on a monthly basis to ensure new PMAVs are included as they are approved.

Queensland Government



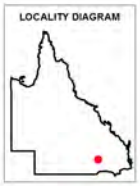
Vegetation Management Supporting Map

Legend

- Selected Lot and Plan
- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category C or R area containing endangered regional ecosystems
- Category C or R area containing of concern regional ecosystems
- Category C or R area that is a least concern regional ecosystem
- Category X area
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourses and drainage features on the vegetation management watercourse and drainage features map (Stream order shown as black number against stream where available)
- Highway
- Connector
- Street/Local Road
- National Parks, State Forest and other reserves
- Other land parcel boundaries

Queensland Government

LOCALITY DIAGRAM



N

0 480 960 1,440 1,920 2,400 m

This product is projected into: GDA 1994 MGA Zone 55

Labels for Essential Habitat are centred on the area of enquiry.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/- 100 metres.

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Additional information may be required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: www.resources.qld.gov.au or contact the Department of Resources.

Digital data for the vegetation management watercourse and drainage feature map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

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Vegetation Management Act 1999 - Extract from the essential habitat database

Essential habitat is required for assessment under the:

- State Development Assessment Provisions - State Code 16: Native vegetation clearing which sets out the matters of interest to the state for development assessment under the *Planning Act 2016*; and
- Accepted development vegetation clearing codes made under the *Vegetation Management Act 1999*

Essential habitat for one or more of the following species is found on and within 1.1 km of the identified subject lot/s on the accompanying essential habitat map.

This report identifies essential habitat in Category A, B and Category C areas.

The numeric labels on the essential habitat map can be cross referenced with the database below to determine which essential habitat factors might exist for a particular species.

Essential habitat is compiled from a combination of species habitat models and buffered species records.

The Department of Resources website (http://www.resources.qld.gov.au) has more information on how the layer is applied under the State Development Assessment Provisions - State Code 16: Native vegetation clearing and the *Vegetation Management Act 1999*.

Regional ecosystem is a mandatory essential habitat factor, unless otherwise stated.

Essential habitat, for protected wildlife, means a category A area, a category B area or category C area shown on the regulated vegetation management map-

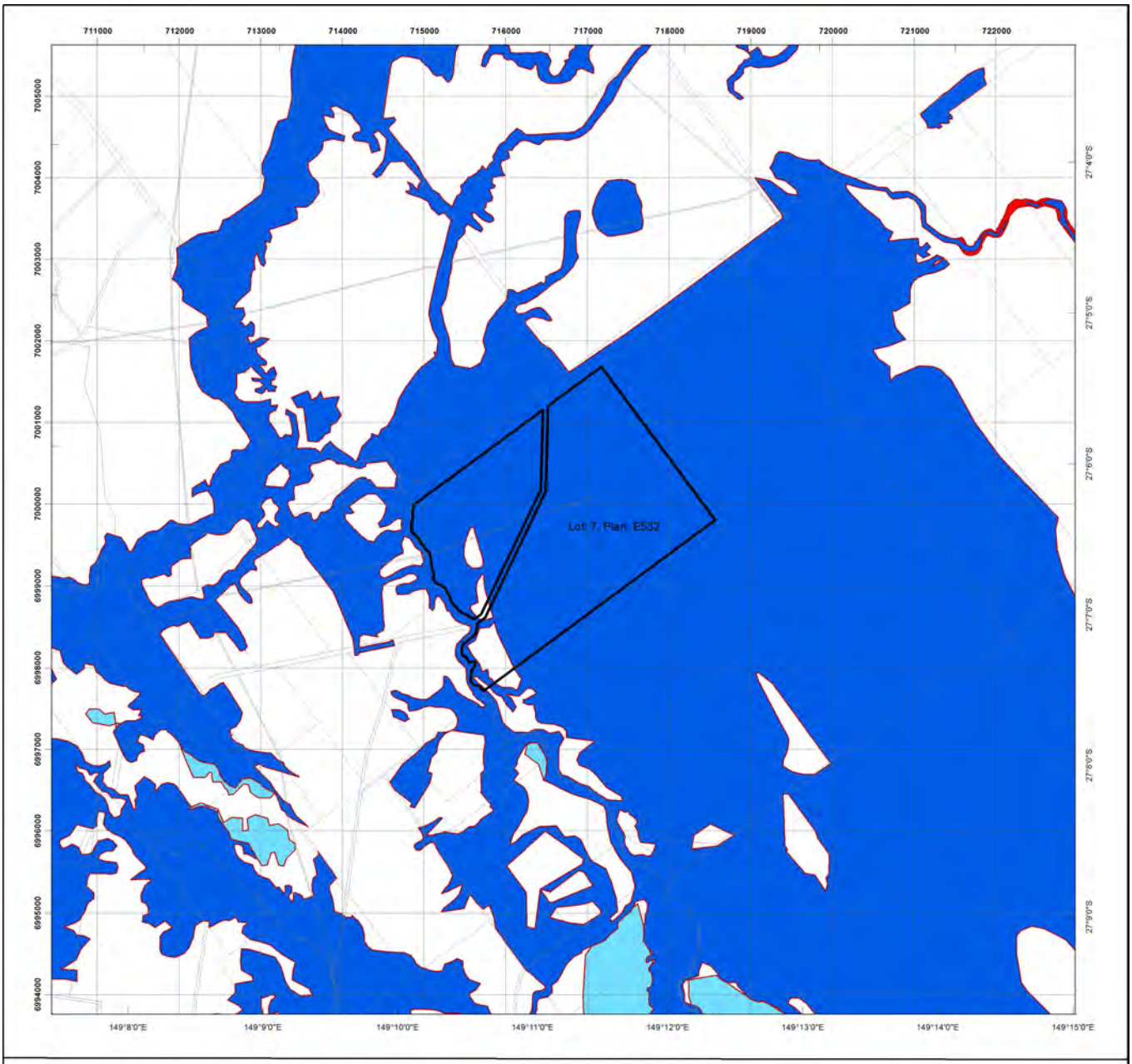
1) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or

2) in which the protected wildlife, at any stage of its life cycle, is located.

Protected wildlife includes critically endangered, endangered, vulnerable or near-threatened native wildlife prescribed under the *Nature Conservation Act 1992*.

Essential habitat in Category A and/or Category B and/or Category C

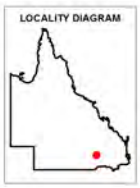
No records



Regulated Vegetation Management Map

Legend

- Selected Lot and Plan
- Category A area (Vegetation offsets/compliance notices/VDecs)
- Category B area (Remnant vegetation)
- Category C area (High-value regrowth vegetation)
- Category R area (Reef regrowth watercourse vegetation)
- Category X area (Exempt clearing work on Freehold, Indigenous and Leasehold land)
- Water
- Other land parcel boundaries



N

0 675 1,350 2,025 2,700 3,375 m

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GDA 1994 MGA Zone 55

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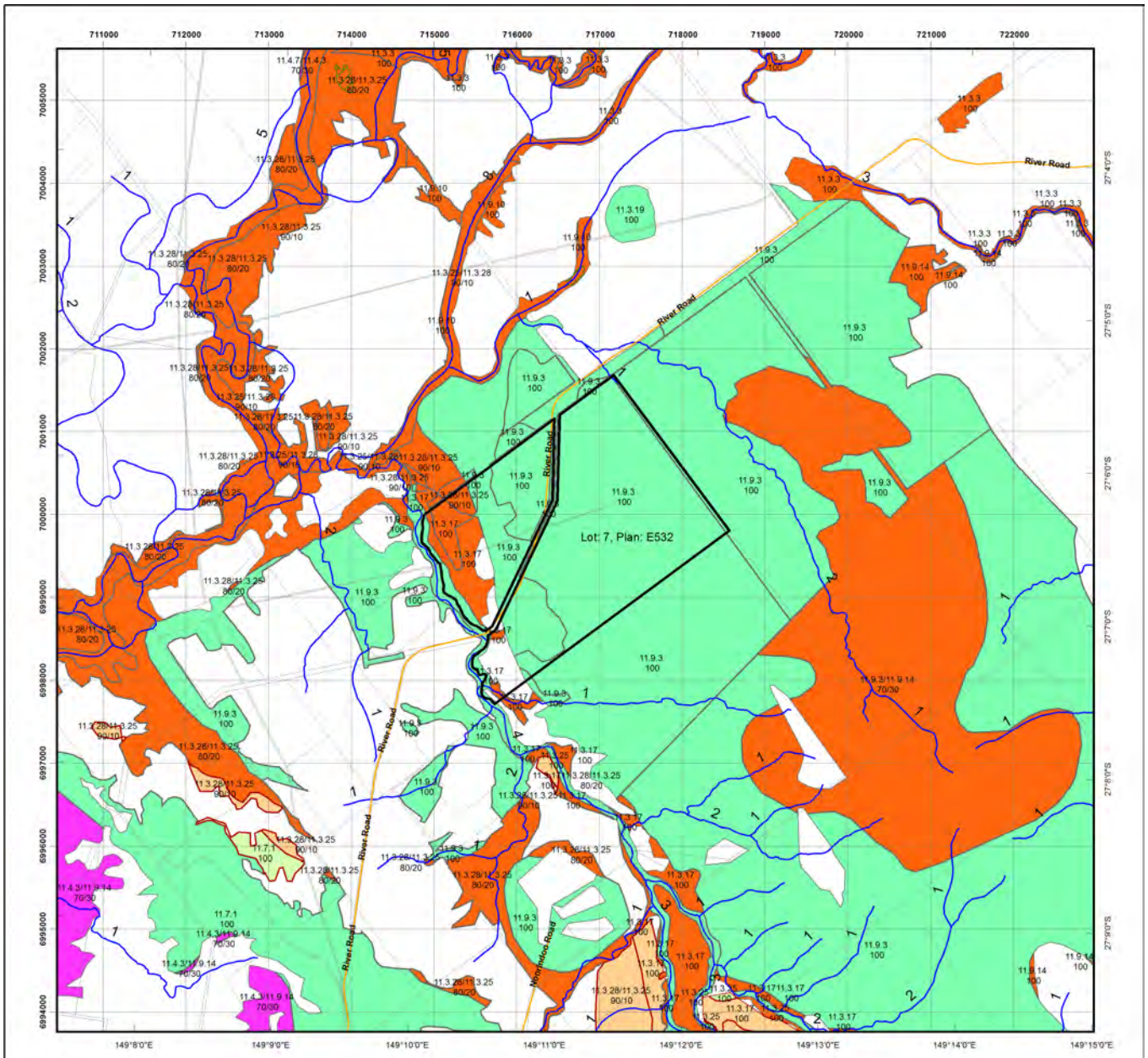
Queensland Government



Vegetation Management Supporting Map

Legend

- Selected Lot and Plan
- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category C or R area containing endangered regional ecosystems
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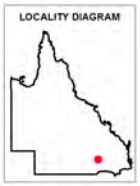
- Category C or R area that is a least concern regional ecosystem
- Category X area
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourses and drainage features on the vegetation management watercourse and drainage features map (Stream order shown as black number against stream where available)
- Highway
- Connector
- Street/Local Road
- National Parks, State Forest and other reserves
- Other land parcel boundaries

Queensland Government

LOCALITY DIAGRAM



N

0 480 960 1,440 1,920 2,400 m

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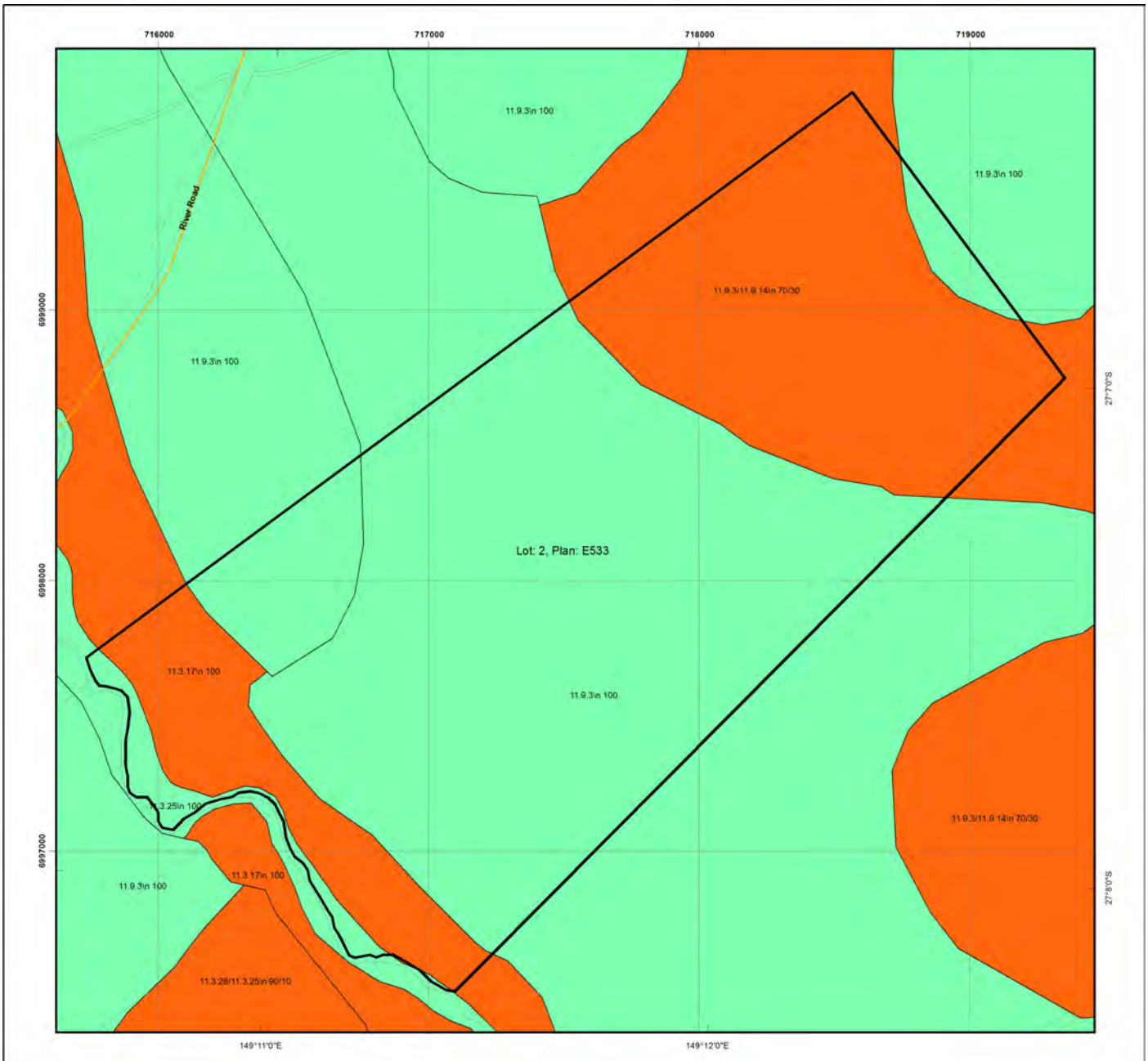
Essential habitat in Category A and/or Category B and/or Category C

No records



Vegetation Management Pre-clear Regional Ecosystem Map

Legend

- Selected Lot and Plan
- Pre-clearing area containing Endangered RE
- Pre-clearing area containing Of Concern RE
- Pre-clearing area that is a Least Concern RE
- Water
- Highway
- Connector
- Street/Local Road
- Other land parcel boundaries

Queensland Government

LOCALITY DIAGRAM

N

0 150 300 450 600 750 m

This product is projected into:
GDA 1994 MGA Zone 55

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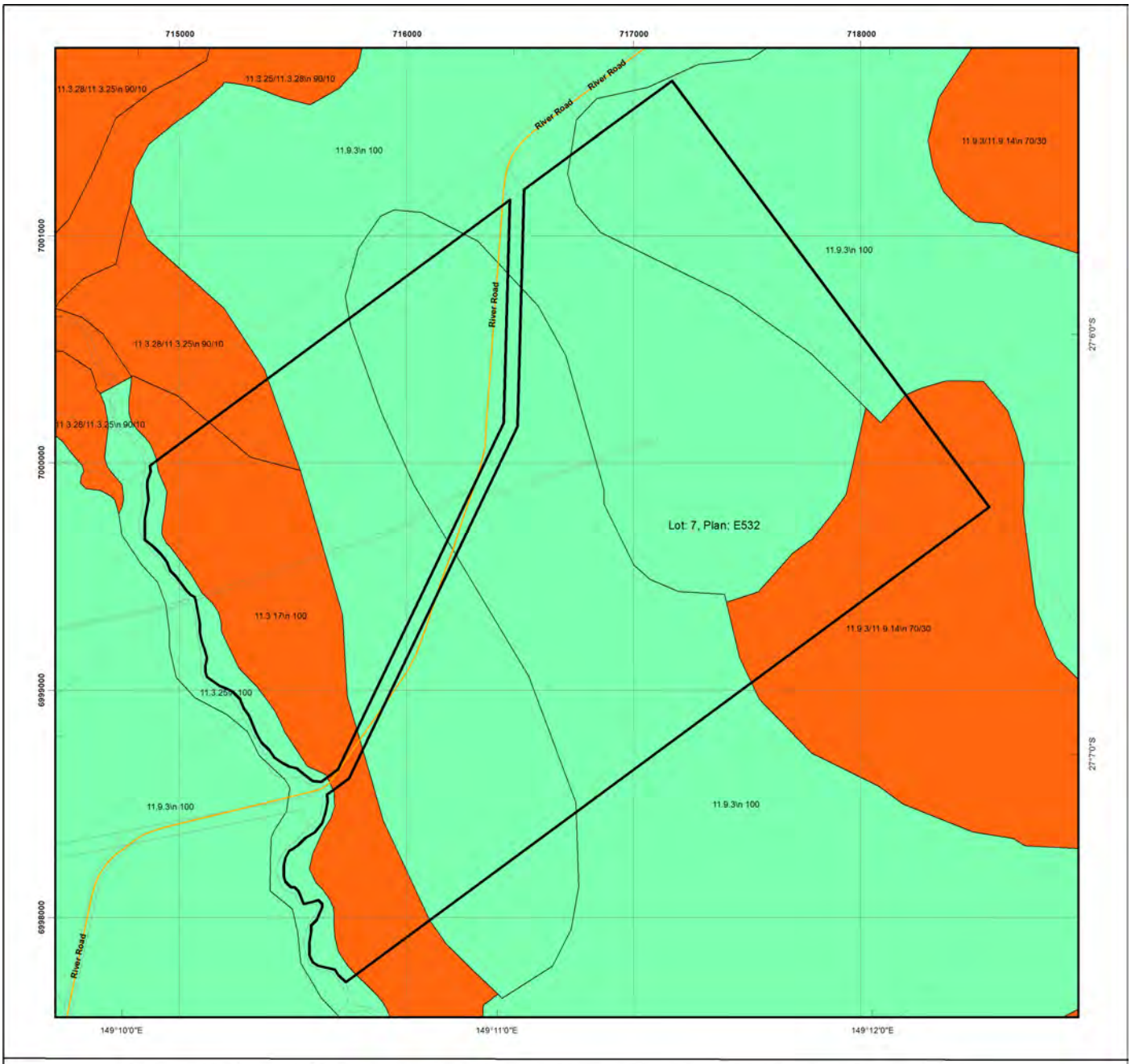
Pre-clearing regional ecosystem line-work reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only.

Digital data for the Pre-clearing regional ecosystem map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries shown are provided as a locational aid only.



Vegetation Management Pre-clear Regional Ecosystem Map

Legend

- Selected Lot and Plan
- Pre-clearing area containing Endangered RE
- Pre-clearing area containing Of Concern RE
- Pre-clearing area that is a Least Concern RE
- Water
- Highway
- Connector
- Street/Local Road
- Other land parcel boundaries

Queensland Government

LOCALITY DIAGRAM

N

0 175 350 525 700 875 m

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GDA 1994 MGA Zone 55

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Digital data for the Pre-clearing regional ecosystem map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries shown are provided as a locational aid only.

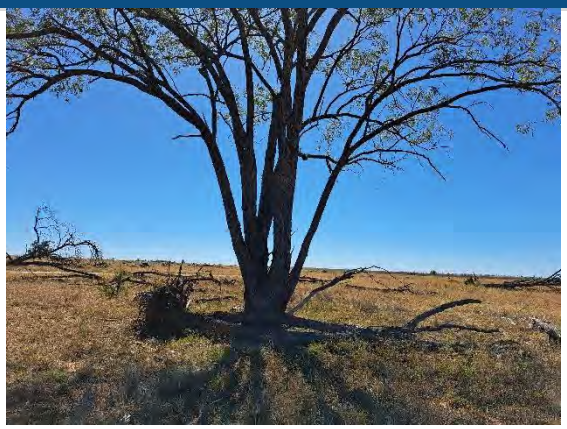
Appendix B: Results of Quaternary Assessments and Biocondition Summary Sheets

Quaternary Site 1 (Overall Observations – not 50mx10m)	
Mandatory Information	
Date	13/02/2023
Collector Name(s)	Will Gibson & Hannah Bakker
Coordinate in GDA 94 UTM	Coordinate -27.112709, 149.18191
Way-point ID	099
Project Site ID	West Noorindoo
Species Present (species that are absent or from nearby areas (e.g. on hills in distance) should be recorded in field notes section below)	Eucalyptus melanophloia Lysiphyllum carronii Salsola australis Opuntia tomentosa Lepidium sp. Eragrostis sp. Suaeda sp. Paspalidium globoideum Poa sp. Cenchrus ciliaris Astrebla lappacea Panicum decompositum
Remnant / Regrowth Vegetation Cover	Mapped remnant
Regional Ecosystem	11.9.3a
Notes (e.g. species absent on site but observed nearby, geology, landform, land zone, BVG, disturbance, weeds, fire, grazing etc.)	Active grazing Heavily disturbed Near gas well
Vegetation Structure (ie Open Woodland, Open Forest, Closed Woodland etc) Emergent, T1, T2, S1, S2, Understory)	Very sparse
EDL height	
EDL cover as % (0-10, 10-30, 30-50, 50-70, 70-100)	0-10%
Land Zone	9
Context in Landscape	Paddock currently used for grazing and location of a gas well

Quaternary Site 1 (Overall Observations – not 50mx10m)	
Images (north, east, south, west)	   

Quaternary Site 2 (Overall Observations – not 50mx10m)		
Mandatory Information		
Date	13/02/2023	
Collector Name(s)	Will Gibson & Hannah Bakker	
Coordinate in GDA 94 UTM	Coordinate -27.120101, 149.182156	
Way-point ID	101	
Project Site ID	West Noorindoo	
Species Present (species that are absent or from nearby areas (e.g. on hills in distance) should be recorded in field notes section below)	Eucalyptus melanophloia Eucalyptus populnea Lysiphyllum carronii Harrisia sp. Chrysocephalum apiculatum Enteropogon ramosus	Digitaria hystrichoides Cirsium vulgare Eragrostis sp. Cenchrus ciliaris Astrebla lappacea Panicum decompositum
Remnant / Regrowth Vegetation Cover	Mapped remnant	
Regional Ecosystem	11.9.3a	
Notes (e.g. species absent on site but observed nearby, geology, landform, land zone, BVG, disturbance, weeds, fire, grazing etc.)	Active grazing Heavily disturbed	
Vegetation Structure (ie Open Woodland, Open Forest, Closed Woodland etc) Emergent, T1, T2, S1, S2, Understory)	Open woodland/grassland	
EDL height	7 - 14m	
EDL cover as % (0-10, 10-30, 30-50, 50-70, 70-100)	0-10%	
Land Zone	9	
Context in Landscape	Paddock currently used for grazing	
Images (north, east, south, west)		

Quaternary Site 2 (Overall Observations – not 50mx10m)



Quaternary Site 3 (Overall Observations – not 50mx10m)	
Mandatory Information	
Date	13/02/2023
Collector Name(s)	Will Gibson & Hannah Bakker
Coordinate in GDA 94 UTM	Coordinate -27.125799, 149.180767
Way-point ID	105
Project Site ID	West Noorindoo
Species Present (species that are absent or from nearby areas (e.g. on hills in distance) should be recorded in field notes section below)	Acacia mitchellii Salsola australis Eragrostis sp. Cenchrus ciliaris
Remnant / Regrowth Vegetation Cover	Mapped remnant, some regrowth
Regional Ecosystem	11.3.17
Notes (e.g. species absent on site but observed nearby, geology, landform, land zone, BVG, disturbance, weeds, fire, grazing etc.)	Active grazing Heavily disturbed
Vegetation Structure (ie Open Woodland, Open Forest, Closed Woodland etc) Emergent, T1, T2, S1, S2, Understory)	Very sparse/grassland
EDL height	N/A
EDL cover as % (0-10, 10-30, 30-50, 50-70, 70-100)	0-10%
Land Zone	3
Context in Landscape	Paddock currently used for grazing
Images (north, east, south, west)	

Quaternary Site 3 (Overall Observations – not 50mx10m)

Quaternary Site 4 (Overall Observations – not 50mx10m)	
Mandatory Information	
Date	13/02/2023
Collector Name(s)	Will Gibson & Hannah Bakker
Coordinate in GDA 94 UTM	Coordinate -27.128692, 149.178187
Way-point ID	109
Project Site ID	West Noorindoo
Species Present (species that are absent or from nearby areas (e.g. on hills in distance) should be recorded in field notes section below)	Eucalyptus coolabah Eucalyptus camaldulensis (supressed) Angophora sp. Melaluca sp. Harrisia sp. Poa sp. Cenchrus ciliaris Chloris truncata
Remnant / Regrowth Vegetation Cover	Remnant
Regional Ecosystem	11.3.25
Notes (e.g. species absent on site but observed nearby, geology, landform, land zone, BVG, disturbance, weeds, fire, grazing etc.)	
Vegetation Structure (ie Open Woodland, Open Forest, Closed Woodland etc) Emergent, T1, T2, S1, S2, Understory)	Open woodland
EDL height	18-24m
EDL cover as % (0-10, 10-30, 30-50, 50-70, 70-100)	30-50%
Land Zone	3
Context in Landscape	Along dried creek, fenced off from livestock
Images (north, east, south, west)	

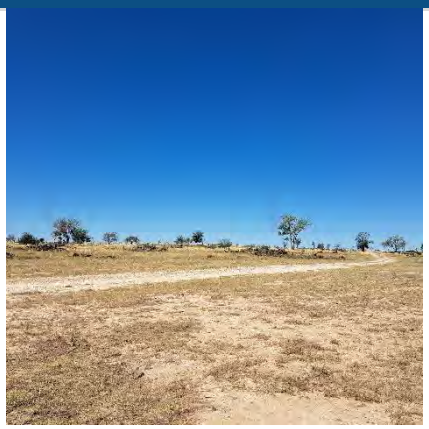
Quaternary Site 4 (Overall Observations – not 50mx10m)

Quaternary Site 5 (Overall Observations – not 50mx10m)	
Mandatory Information	
Date	13/02/2023
Collector Name(s)	Will Gibson & Hannah Bakker
Coordinate in GDA 94 UTM	Coordinate 27.129365, 149.182744
Way-point ID	110
Project Site ID	West Noorindoo
Species Present (species that are absent or from nearby areas (e.g. on hills in distance) should be recorded in field notes section below)	Eucalyptus coolabah Eucalyptus camaldulensis Lysiphyllum carronii Poa sp. Astrebla lappacea Cenchrus ciliaris Chloris truncata
Remnant / Regrowth Vegetation Cover	Mapped Category X
Regional Ecosystem	N/A
Notes (e.g. species absent on site but observed nearby, geology, landform, land zone, BVG, disturbance, weeds, fire, grazing etc.)	Active grazing Heavily disturbed Shrub canopy absent Next to an area of cropping
Vegetation Structure (ie Open Woodland, Open Forest, Closed Woodland etc) Emergent, T1, T2, S1, S2, Understory)	Very sparse/grassland
EDL height	N/A
EDL cover as % (0-10, 10-30, 30-50, 50-70, 70-100)	0-10%
Land Zone	N/A
Context in Landscape	Paddock currently used for grazing
Images (north, east, south, west)	

Quaternary Site 5 (Overall Observations – not 50mx10m)

Quaternary Site 6 (Overall Observations – not 50mx10m)	
Mandatory Information	
Date	13/02/2023
Collector Name(s)	Will Gibson & Hannah Bakker
Coordinate in GDA 94 UTM	Coordinate -27.118002, 149.17765
Way-point ID	116
Project Site ID	West Noorindoo
Species Present (species that are absent or from nearby areas (e.g. on hills in distance) should be recorded in field notes section below)	Eucalyptus coolabah Lysiphyllum carronii Casuarina cristata Salsola australis Astrebla lappacea Cenchrus ciliaris Eragrostis sp. Chloris truncata
Remnant / Regrowth Vegetation Cover	Mapped remnant
Regional Ecosystem	11.9.3a
Notes (e.g. species absent on site but observed nearby, geology, landform, land zone, BVG, disturbance, weeds, fire, grazing etc.)	Active grazing Heavily disturbed
Vegetation Structure (ie Open Woodland, Open Forest, Closed Woodland etc) Emergent, T1, T2, S1, S2, Understory)	Very sparse/grassland
EDL height	N/A
EDL cover as % (0-10, 10-30, 30-50, 50-70, 70-100)	0-10%
Land Zone	9
Context in Landscape	Paddock currently used for grazing with previous felling activity
Images (north, east, south, west)	

Quaternary Site 6 (Overall Observations – not 50mx10m)



Biocondition plot 1 - assessed against mapped area of ESA correlating to RE 11.3.17					
Attribute	Benchmark				
	Threshold	Weighting (%)	Value	Sub-score	Score
Large trees - Eucalyptus - Non Eucalyptus	38cm - (6) 30cm - (32)	15	2 0	5 0	2.5
Tree canopy height (m) **- Canopy** **- Sub-canopy**	**17** **8**	**5**	**15** **9**	5 5	5
Recruitment of canopy species (%)	100%	5	33	3	3
Tree canopy cover (%)	**29%**	5	**9.8**	2	2
Shrub cover (%)	8%	5	0	0	0
Coarse woody debris (m/ha)	453	5	460	5	5
Native plant spp. Richness - Trees - Shrubs - Grass - Other/forbs	6 11 12 12	20	3 1 5 4	2.5 0 2.5 2.5	7.5
Non-native plant cover (%)	0	10	5	5	5
Native perennial grass cover (%)	29	5	25	5	5
Organic litter cover (%)	27	5	11	3	3
Landscape context	Patch size Context Connectivity	10 5 5	Not assessed	Not assessed	Not assessed
Total score		**80**			**38**
Comment:		**Area assessed as aligning with RE 11.9.3a**			

Biocondition plot 2 - assessed against mapped area of ESA correlating to RE 11.3.17					
Attribute	Benchmark		Bio condition Plot 2 (RE 11.3.17)		
	Threshold	Weighting (%)	Value	Sub-score	Score
Large trees - Eucalyptus - Non Eucalyptus	38cm - (6) 30cm - (32)	15	26 18	15 10	12.5
Tree canopy height (m) - Canopy - Sub-canopy	17 8	5	16 7	5 5	5
Recruitment of canopy species (%)	100%	5	100	5	5
Tree canopy cover (%) Sub canopy	29% 12%	5	33 25.4	5 3	4
Shrub cover (%)	8%	5	2.5	3	3
Coarse woody debris (m/ha)	453	5	850	5	5
Native plant spp. Richness - Trees - Shrubs - Grass - Other/forbs	6 11 12 12	20	4 2 8 4	2.5 0 2.5 2.5	7.5
Non-native plant cover (%)	0	10	6	5	5
Native perennial grass cover (%)	29	5	25	3	3
Organic litter cover (%)	27	5	16	5	5
Landscape context	Patch size Context Connectivity	10 5 5	Not assessed	Not assessed	Not assessed
Total score		**80**			**55**
Comment		**Area assessed as aligning with remnant RE 11.3.17**			

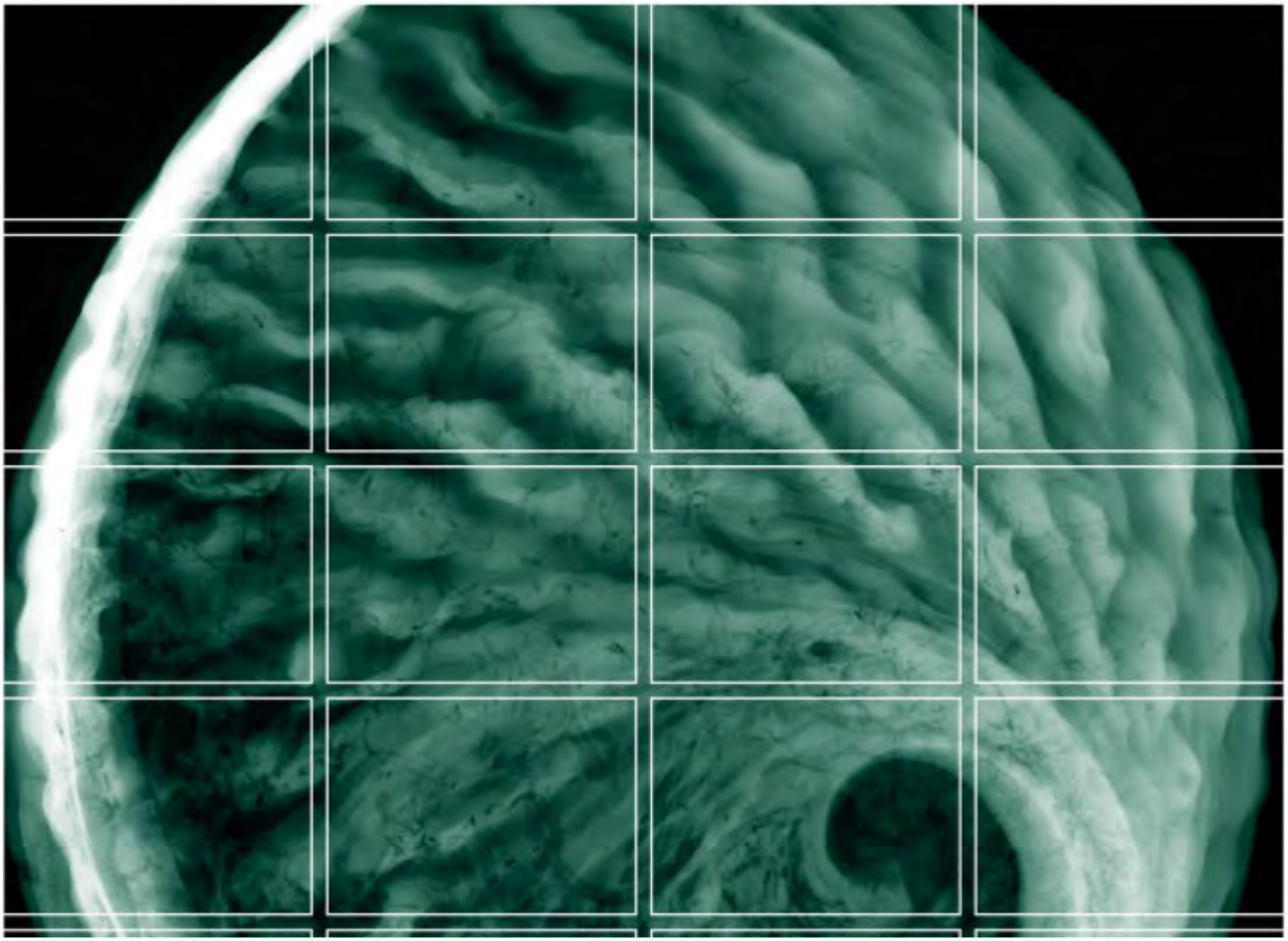
Images of Biocondition Plot 1 (50m mark)

Images of Biocondition Plot 2 (50m mark)

Appendix C: Flora Species List

Species	Common Name	Status
Acacia mitchellii	Mitchell's wattle	Native
Angophora sp.		Native
Astrebla lappacea	Curly Mitchell grass	Native
Casuarina cristata	Belah	Native
Cenchrus ciliaris	Buffel grass	Introduced
Chloris truncata	Windmill grass	Native
Chrysocephalum apiculatum	Yellow button	Native
Cirsium vulgare	Spear thistle	Introduced
Convolvulus arvensis	Field bindweed	Introduced
Dicanthium sp,	Bluegrass	Native
Digitaria hystrichoides	Umbrella grass	Native
Enteropogon ramosus	Curly windmill grass	Native
Eragrostis sp.	lovegrass	Introduced
Eucalyptus camaldulensis	River red gum	Native
Eucalyptus coolabah	Coolibah	Native
Eucalyptus melanophloia	Silver-leaved ironbark	Native
Eucalyptus populnea	Poplar box	Native
Eucalyptus tereticornis	Forest red gum	Native
Harrisia sp.	Harrisia cactus	Introduced
Lepidium sp.		Introduced
Lysiphyllum carronii	Ebony tree	Native
Melaluca sp.		Native
Opuntia tomentosa	Velvety tree pear	Introduced
Panicum decompositum	Native millet	Native
Paspalidium globoideum	Sago grass	Native
Poa sp.	Meadow grass	Native
Salsola australis	Roly poly	Native
Suaeda sp.		Native

APPENDIX B HUMAN HEALTH AND ENVIRONMENTAL RISK ASSESSMENT (PETROLEUM LEASE 213)



Human Health and Environmental Risk Assessment

Proposed Hydraulic Strata Stimulation at West Noorindoo 1 (Petroleum Lease 213)

8 September 2023

Project No.: 0689151

The business of sustainability

ERM

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Signature Page

22 August 2023

Human Health and Environmental Risk Assessment

Proposed Hydraulic Strata Stimulation at West Noorindoo 1 (Petroleum Lease 213)

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Acronyms and Abbreviations

Name	Description
AGL	AGL Energy Limited
AICIS	Australian Industrial Chemicals Introduction Scheme
BTEX	Benzene, toluene, ethylbenzene and xylenes
CAS RN	Chemical Abstracts Service Registry Numbers
CoP	Code of Practice (Queensland)
DFIT	Diagnostic Fracture Injection Test
EA	Environmental Authority
EC	Electrical Conductivity
GAB	Great Artesian Basin
GDE	Groundwater dependent ecosystems
HHERA	Human Health and Environmental Risk Assessment
IMAP	Inventory Multi-tiered Assessment and Prioritisation
LOR	limits of reporting
m AHD	metres Australian Height Datum
m KB	metres below Kelly Bushing
m TVD	true vertical depth
MEM	Mechanical Earth Model
MGA	Map Grid of Australia
MSES	Matters of State Environmental Significance
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NTU	Nephelometric Turbidity Units
PAH	Polycyclic Aromatic Hydrocarbons
PBT	Persistent, bioaccumulative and toxic
PL213	Petroleum Lease 213
Project Area	Broadly defined herein as PL213.
Proposed activity/activities	The undertaking of hydraulic strata stimulation on PL213 at West Noorindoo 1 (WN1) at coordinates 270 07’ 33.348” S, 1490 10’ 58.044” E. If the hydraulic strata stimulation term and its related terms are described in general context and is non-specific to this project, then reference to the original terms (i.e. hydraulic strata stimulation, strata stimulation and stimulation) are made.
RCBL	Radial Cement Bond Log
SPR	Source-Pathway-Receptor
SSMP	Strata Stimulation Management Plan
SW	Surface water
Target Formation	Refers to the Upper Tinowon Sandstone.
TDS	Total dissolved solids
WN1	West Noorindoo 1

1. INTRODUCTION

AGL Energy Limited (AGL) has appointed Environmental Resources Management Australia Pty Ltd (ERM) to prepare a Human Health and Environmental Risk Assessment (HHERA) for AGL's upcoming Hydraulic Strata Stimulation Project at West Noorindoo 1 (WN1) located in Petroleum Lease 213 (PL213) (herein referred to as 'the project'). Hydraulic strata simulation involves injecting fluids and proppant under relevant pressures within a targeted hydrocarbon bearing formation in the subsurface to create a more efficient flow path for gas and liquids to flow into the wellbore. For this report, 'hydraulic strata stimulation', 'strata stimulation', and 'stimulation' is referred to as 'proposed activity' or 'proposed activities' if it relates specifically to this project' (i.e. the undertaking of hydraulic stimulation on PL213 at WN) at coordinates 270 07' 33.348" S, 1490 10' 58.044" E). For this report, the 'Project Area' is broadly defined as 'PL213'.

1.1 Project Appreciation

PL213 is located in AGL's Churchie gas field, located approximately 70 km south-east of Roma, and 10 km east of Surat. PL213 is subject to the conditions stipulated within Environmental Authority (EA) number EPPG00304213. EPPG00304213 is held by AGL Upstream Gas (Mos) Pty Limited and AGL Gas Storage Pty Ltd (known collectively as AGL) and relates to activities undertaken on PL213. WN1 is a gas well located in the Churchie gas field, Surat, Queensland in the AGL Silver Springs Production Area, under PL213 (shown on Figure 1).

According to the provided WN1 Strata Stimulation Monitoring Program (AGL, 2023a), the Churchie gas field is a tight gas condensate field targeting one to three zones of interest, the Upper Tinowon, Lower Tinowon and Wallabella Sandstones, with a depth ranging from 1950 m to 2200 m true vertical depth (m TVD) across the field. The project's primary target at WN1 is the Upper Tinowon Sandstone and is referred to as the 'Target Formation' (i.e. the Upper Tinowon Sandstone) herein in this report.

The overarching business objective is to recomplete WN1 as a hydraulic strata stimulation candidate targeting the Upper Tinowon Sandstone. WN1 was suspended post drilling in 1999 and based on the successful stimulation of other Churchie wells, the Upper Tinowon Sandstone has been selected as an economical candidate to enhance production from this well.

1.2 Objectives and Scope

The objective of this HHERA is to provide a risk assessment that meets the requirements of model conditions of an EA that allows for the proposed activity at PL213. The model conditions upon which this HHERA references is adapted from the model conditions available at the adjacent PL192, where the proposed activity is allowed upon adherence to the stipulated conditions.

It is noted that this HHERA does not include a health and safety risk assessment for workplace exposures during the proposed activity. This is dealt with elsewhere within AGL's procedures. This HHERA considers health and environmental risks that may result from the use, storage and transport of the chemical products and the stimulation fluid.

1.3 Risk Assessment Methodology

The HHERA was completed following the relevant Australian guidance provided in:

- Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction - Exposure draft (DoEE, 2017);
- Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards. Department of Health and Ageing and enHealth Council, Commonwealth of Australia (enHealth, 2012); and
- National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) (the ASC NEPM).

The above guidelines all adopt the framework for carrying out environmental health risk assessment that is outlined in enHealth (2012) and involves four main stages:

- Issues Identification;
- Hazard Assessment;
- Exposure Assessment; and
- Risk Characterisation.

The guidelines all describe risk assessments as being carried out at differing levels of complexity depending on the circumstances and the amount of data necessary to assess potential risks to an adequate level of confidence. This is often referred to as the "tiered" approach by which the assessment commences with a simple qualitative assessment (referred to as 'Tier 1') which adopts conservative assumptions to account for a high level of uncertainty. The assessment progresses to Tier 2 if a potential risk is predicted at Tier 1. Tier 2 would typically involve a higher level of site-specific data and a more complex assessment. Risk assessments may be qualitative or quantitative, with quantitative assessments generally being carried out at the higher assessment tiers.

This HHERA provides a qualitative risk assessment consistent with Australian guidance (ASC NEPM, DoEE, 2017 and enHealth, 2012) as part of a tiered approach to identify potential issues that may require further management and/or assessment. The assessment relies on the development of a conceptual site model which describes source-pathway-receptors (SPR) relationships. This provides qualitative description of the plausible mechanisms by which receptors may be exposed to chemicals used in the proposed activity. For exposure to be considered possible, a mechanism ('pathway') must exist by which contamination from a given source can reach a given receptor. This is described as a complete SPR linkage. When a SPR linkage is not complete, there is no potential for exposure or any related potential risks. The assessment of the SPR linkages considers the proposed activities and the corresponding controls and management systems to manage potential health or environmental risks.

2. PROPOSED ACTIVITY PROCESS

2.1 Proposed Activity

WN1 is located in the Churchie field which is a tight gas condensate field targeting one to three zones of interest, the Upper Tinowon Sandstone, Lower Tinowon Sandstone and Wallabella Sandstone, with a depth ranging from 1950 m to 2200 m true vertical depth (m TVD) across the field (AGL, 2023a).

The objective of the proposed activity is to create a conductive flow path (fracture) between the wellbore and the reservoir and placing proppant in the fracture increasing effective permeability and ultimately the production potential of the targeted reservoir.

During the proposed activity, fluid (typically over 90% water) will be pumped down the wellbore (casing or tubing) into the Target Formation. The fluid is pumped at a pressure high enough to initiate the failure of the Target Formation in a direction perpendicular to the minimum stress. As pumping continues, the fracture extends from the wellbore and grows based on the rock mechanics or the mechanical earth model (MEM) which is derived through core analysis and or geophysical logs. This is then modelled using a numerical fracture stimulation model which incorporates the MEM, geophysical logs and any offset well data from previous hydraulic strata stimulations within the same field and/or reservoir.

Once the desired geometry of the fracture is initiated, proppant is added to the fluid and pumping continues until the proppant is placed into the fracture. When all the proppant is in the fracture, pumping is stopped. The pressure inside the fracture drops, allowing the fracture to close. The fracture closing occurs within minutes trapping the proppant inside the Target Formation, which creates a highly permeable and conductive pathway that extends laterally into the Target Formation and connects the conductive pathway (fracture) back to cased wellbore with the well completion designed and installed for purposes of the proposed activity.

2.2 Well Construction

The construction of a well is often influenced by whether or not the proposed activity is going to be performed. If a well is to be stimulated, then it needs to be designed and completed to accommodate for the requirements of the fracture as per the requirements of the *Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland* (the CoP; State of Queensland, 2019). Treatment pressures, zonal isolation, flow rates, monitoring and flowback requirements can greatly influence a well's construction.

A schematic of the well downhole construction provided by AGL is shown in Figure 2-1 and well completion details (historical and current) are summarised in Table 2-1. A photograph of WN1's wellhead construction is provided in Figure 2-2. A copy of the original well completion details is also provided in Appendix A.

According to AGL's records for well WN1 (2023a):

- WN1 is located in Rockton approximately 12 km from Surat Township;
- WN1 was drilled in April 1998 updip of well Noorindoo 1 to explore for prospective hydrocarbon horizontals in favourable stratigraphy in the Western Surat Basin, Queensland;
- The target Upper Tinowon Sandstone has a gross interval of 15.4 m with a net reservoir interval of approximately 11 m;
- WN1 was recompleted in August 2022, which included the removal of the existing well completion, a casing scraper was run followed by a Radial Cement Bond Log (RCBL) and a corrosion log suite to evaluate the casing and cement integrity;
- The new completion for WN1 included the installation of the 2.875" frac completion which includes a packer and bottom hole components designed for the proposed activity isolating the production casing and cement with pressure rated tubulars;

- Cement integrity tests (via RCBL) of the production casing conducted prior to recompletion in 2022 by AGL indicated that the cement quality was fair to good; and
- All pressure testing and ratings of equipment are in line with the CoP.

Table 2-1. West Noorindoo 1 Well Construction – Overview

Item	Description
Initial well completion date	29 April 1998
Second well completion date (preparation for the proposed activity)	25 August 2022
Primary target	Upper Tinowon Sandstone
Latitude (degrees, minutes, seconds)	27°07'33.35"S
Longitude (degrees, minutes, seconds)	149°10'58.04"E
Easting (MGA 94 Zone 55)	716354.954
Northing (MGA 94 Zone 55)	6997737.07
Ground elevation (m AHD)	244.82
Kelly bushing elevation (m AHD)	250.32
Well depth (surface to bottom) (m KB)	2282
Well depth (surface to bottom) (m TVD)	2282
Deviation of well installation	Maximum of 3 degrees deviation at 2,083 m KB
Casing size and depth – surface	9.625” to 285.6 m KB
Casing size and depth – production	5.5” to 2267.25 m KB
Perforation intervals (shown on Figure 2-1; AGL, 2023a)	Three perforation clusters located at: 1) 2180.0-2183.0 m KB; 2) 2185.0-2187.0 m KB; and 3) 2188.5-2201.0 m KB.

Note: The wellbore is constructed in accordance with the CoP. MGA = Map Grid of Australia; m AHD = metres above Australian Height Datum; m TVD = metres true vertical depth, m KB = metres below kelly bushing.

Table 2-2. West Noorindoo 1– Geological Stratigraphy

Age		Geological Stratigraphy [a]	Top depths (m KB, m TVD) [b]
	Early Cretaceous	Wallumbilla Formation	0
		Bungil Formation	420.07, 420.03
		Mooga Sandstone	560.75, 506.69
	Late Jurassic	Orallo Formation	705.80, 705.60
		Gubberamunda Sandstone	883.41, 883.33
		Westborne Formation	1015.97, 1015.89
		Springbok Sandstone	1115.46, 1115.37
	Middle Jurassic	Walloon Coal Measures	1172.30, 1172.21
		Hutton Sandstone	1435.02, 1434.89
	Early Jurassic	Evergreen Formation	1647.78, 1647.61
		Boxvale Formation	1691.93,1691.74
Bowen Basin	Middle-Late Triassic	Moolayember Formation	1764.29, 1764.08
	Middle Triassic	Snake Creek Mudstone	1956.85, 1956.54
		Showgrounds Sandstone	1971.95, 1971.63
	Early Triassic	Rewan Formation	1987.09, 1986.75
	Late Permian	Bandanna Formation	2060.64, 2060.24
		Black Alley Shale	2128.21, 2127.76
		Winnathoola Coal Member	2141.14, 2140.68
		Tinowon Formation	2154.76, 2154.29
		Tinowon Siltstone	2154.76, 2154.29
		Upper Tinowon Sandstone	2186.65, 2186.15
		Tinowon Coal Member	2201.92, 2201.42
		Lower Tinowon Sandstone	2214.04, 2213.52
		Wallabella Coal Member	2219.86, 2219.34
		Wallabella Sandstone	2243.88, 2243.34
	Basement	Timbury Hills Formation	2248.67, 2248.13

Note: m TVD = metres true vertical depth, m KB = metres below kelly bushing.
Blue = Great Artesian Basin unit.
Yellow = Geological formation intercepted in the bottom 6.65 m (at 2,180 m KB). Discussions on this is provided in Section 2.3.2.
Orange = Geological formation intercepted by perforations in the production casing (also referred to as the 'Target Formation' in this report). The perforation interval (2,180.00 m KB to 2,201.00 m KB based exactly on values provided by AGL) shown in Figure 2-1 (AGL, 2023a).
(a) Geological formations and members intercepted by installed production casing.
(b) Exact depths as per the geological prognosis summarised in the well completion card for WN1 (provided by AGL for this assessment).

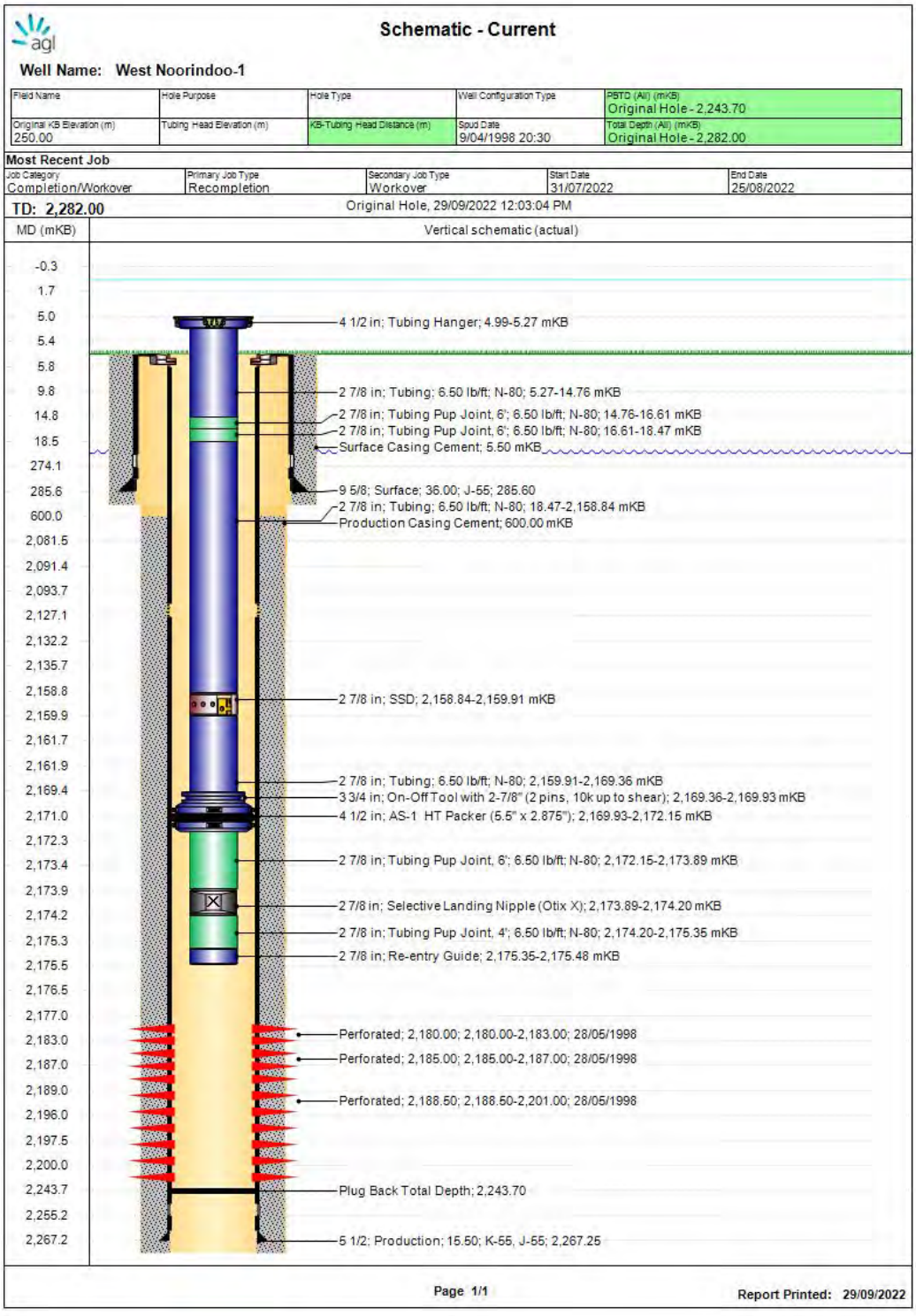

Figure 2-1. Downhole Schematic of West Noorindoo 1 (AGL, 2023a)

Figure 2-2. Wellhead of West Noorindoo 1 (AGL, 2023b)

2.3 Fracture Modelling

To be able to effectively design and model the proposed activity, AGL developed an MEM incorporating open hole log information and using offset well data. AGL indicated that MEMs from other wells in the Churchie field (Churchie 12 and Churchie West 1) and were used to inform the MEM for WN1 as these data are representative of the same target Upper Tinowon Sandstone for the proposed production well (2023b). According to the Strata Stimulation Management Plan (SSMP) for WN1 (AGL, 2023b):

- Direction of minimum and maximum stresses was used to determine the likely direction of the hydraulic fracture propagation. The fracture will propagate along the direction of maximum horizontal stress (opening against the minimum stress direction). Interpretation of sonic logs by AGL show the principal horizontal stresses direction for wells in the Churchie field, allowing geologists and engineers to predict the orientation that the fracture will propagate;
- In addition, AGL has retrieved physical cores during the drilling of the nearby Churchie 12 well. Laboratory testing from the cores as well as geophysical logging information informed an MEM for the Churchie 12 well. This information can also be inferred and used for the design of the proposed activity at WN1;
- Data available from the Churchie 12 MEM and a geomechanical modelling report has been incorporated for the design of the proposed activity at WN1 and includes additional information:
  - Petrophysical logs – used as input to develop rock properties model;
  - CMI (image log);
  - Rock mechanics core test – data was available for prospective Upper Tinowon and Lower Tinowon as well as the Wallabella formation;
  - Closure pressure was obtained from DFIT (Diagnostic Fracture Injection Test) in the Upper Tinowon and Wallabella formations;
  - Mud weight data – extracted from daily drill reports for Churchie 12 well;
  - Offset well information from Churchie field and Waggamba North-1;
  - Post hydraulic strata stimulation report from Churchie 12 with simulation modelling pre hydraulic strata stimulation and post hydraulic strata stimulation;
  - Post hydraulic strata stimulation report from Churchie West 1 with simulation modelling pre hydraulic strata stimulation and post hydraulic strata stimulation; and
  - The geomechanical modelling report (AGL citing GMI Geomechanics Services).
- The MEM evaluated the three principal stresses (vertical ‘overburden’, and maximum and minimum horizontal stresses) through changing depth and rock strata to predict hydraulic fracture azimuth and geometry. The MEM was then incorporated into a hydraulic fracture model (pseudo three-dimensional) to simulate various fracture designs (fluids, injection rates etc.) to model and optimise the design and economics of the proposed activity based on job size and estimated total production from the well. In addition, the modelling acts as a level of confirmation that the fracture execution is relatively contained to the targeted zone and does not impact beneficial aquifers above and nearby. The ‘stress’ in coal stratigraphic units above the Wallabella and Tinowon Formations is higher than that in bounding formations. Therefore, these coals will act as choke points (‘stress barriers’) for the propagation of hydraulic fractures vertically. There are also streaks of high stress within the interburden that can act as choke points providing vertical containment of the fracture.

2.3.1 Predicted Lateral Fracture Extents

Two-dimensional simulation of the strata stimulation of WN1 shows that the total horizontal fracture length may extend up to 1,000 m from the well. However, this is the simulated proppant distribution, not necessarily effective stimulation of the formation for hydrocarbon recovery. The simulation shows hydrocarbon recovery by effective stimulation may extend only up to 600 to 700 m beyond the well, with good conductivity and connection achieved around 200 to 300 m from the reservoir to the wellbore (Figure 2-3).

The simulated potential fracture extent is based on the MEM which confirms that fractures will likely be relatively contained to the Target Formation and shows that the fracture is able to grow laterally within the reservoir.

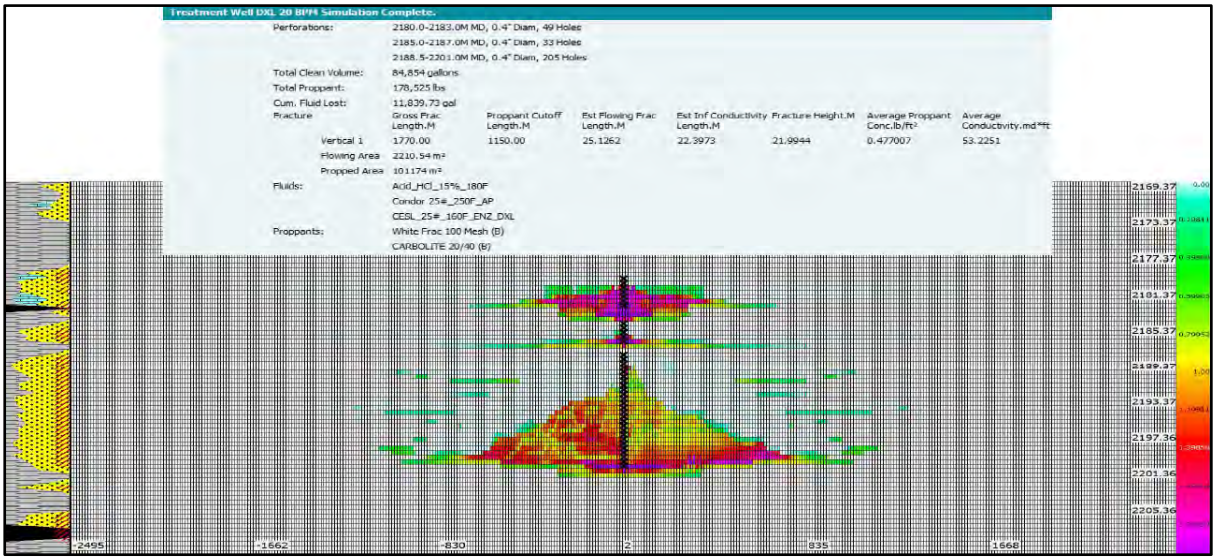

Figure 2-3. Two-Dimensional Simulation of West Noorindoo 1 (AGL, 2023)

2.3.2 Predicted Vertical Fracture Extent Beyond Well Perforation Intervals

The upper extent of the perforation interval of well WN1 (where the perforation interval marginally reaches to the bottom 6 m of the Tinowon Siltstone; refer Table 2-2) was completed in 1998 due to the exploration purpose of the originally drilled well. This decision was made on petrophysical interpretation at the time which indicated that this interval may also contain hydrocarbons. Based on current interpretation by AGL's specialist geologists, this well would not have been perforated above the primary Target Formation (the Upper Tinowon Sandstone).

The result of this upper perforation interval means that it will be fractured. However, this does not pose a risk to the non-target formation above as the fracturing process will propagate in the path of least resistance. Due to the presence of siltstone and interbedded coal units immediately above perforated zones, very little vertical fracture growth outside the immediate Upper Tinowon Sandstone is expected (15 metres thick in WN1). Vertical fractures will not grow beyond the bounding Winnathoola and Tinowon Coal Members. Therefore, there will be negligible vertical growth of the fracture above the uppermost perforation during the proposed activities (Figure 2-3). This conclusion is supported by multiple gas field-specific lines of evidence, as follows:

- The current job-specific strata simulation by Condor Energy (showing no growth of fracture above the upper most perforations due to bounding stratigraphy);
- Third-party reviews of gas field geomechanics by Schlumberger (2019), which indicated that there are streaks of high stress within the interburden that can act as choke points or stress barriers in addition to the coal layers; and

- Radioactively traced testing and modelling (a technique no longer in use in Australia) of fracture geometry behind the casing and identification of containment at the coal layers by GMI Geomechanics (2013).

If the assumptions of the modelling simulations are incorrect, there is still little risk for extreme vertical growth of the fractures based on the natural geological barriers that exist which limit fractures outside the Winnathoola and Tinowon Coal Members. The stratigraphic column shown in the simulation (Figure 2-3) indicates that the next high contrast choke point coal seam is at 2141 m (the Winnathoola Coal Member) and therefore the fracture height could not penetrate above this point.

2.4 Flowback Operations

According to the SSMP (AGL, 2023b), most of the fluid used during the proposed activity is recovered from the well through the 'flowback' process. This is done by using a "breaker" to react with the high viscous gel at bottom hole temperature, breaking down its viscosity back to that of water so that the fluid's ability to flow is increased, allowing it to flow back to surface. The reservoir pressure is the main drive mechanism for the recovery of the flowback water.

AGL will engage a third-party specialist contractor to manage well flowback and production testing operations. The contractor will rig up the necessary equipment, which includes variable choke flow lines and gas buster open top tanks to capture the flowback water. The flowback will then be transferred to closed top fracture tank and will then be trucked offsite and lawfully disposed of to an appropriate facility in accordance with the requirements set out in AGL's EPPG00304213 permit for WN1. Chain of custody for flowback water disposal will be tracked and recorded and the third-party disposal company will be an EPA licensed company to handle flowback water.

Flowback water will be monitored in-line with the Queensland Code of Practice except for the recovery of 150% flowback of the injected volume. It is understood that the unconventional tight gas/condensate reservoir in the Churchie gas field has low permeability and very low water content. As such, it is likely that not all of the injected volume will be recovered. In verbal discussions with AGL on 15 May 2023 (pers. comms.), ERM understands that the expected recovery of flowback water is approximately 60% to 70% of the injected volume. This is not unusual in a tight unconventional reservoir. Nevertheless, water volumes will be monitored and recorded during the life cycle of the well.

During the production phase of the well some stimulation fluid may then come out in association with the produced water. Outside the fractures created by the stimulation, the permeability of the target sandstone formation is very low. As a consequence, groundwater transmissivity is also low and restricts groundwater movement within the formation.

2.5 Environmental Management at and Around the Wellsite

The proposed activity will be managed by AGL's subcontractor Condor Energy Services Limited (Condor Energy), under the direction of AGL, who will be required to comply with AGL's Environmental Management Plan, Health and Safety Management Plan and Emergency Response Plan. These procedures provide controls on storage, management and handling of the raw material products, mixed fluid and flowback from the proposed activity. The procedures are designed to minimise impacts on the environment and to comply with legislative and regulatory requirements relevant to the project. Further information is provided in the SSMP (AGL, 2023b).

For this project, AGL provided additional confirmation on the safety controls that will be in place for the duration of the project (AGL, pers. comms., 15 May 2023). AGL indicated that:

- The strata stimulation of West Noorindoo 1 will involve the mobilisation of light and heavy vehicles and machinery to the well pad at various times to support operations;
- All vehicles and machinery will follow an existing access track (unsealed) from River Road to the well pad;

- The access track traverses grazing and cropping land, on an almost flat topography and provides a degree of weather proofing to traffic. The track is wide enough to accommodate heavy vehicles and machinery and it will not be necessary to traverse any other areas other than the access track and well pad;
- AGL expects most of the activity to occur over a two to three-day period when the strata stimulation takes place. Outside of those times, vehicle and machinery movements will be minimal and as required to support operations, monitoring and testing activities;
- AGL will have various environmental controls in place to mitigate potential loss of containment events and biosecurity risks. This includes the use and operation of tanks to manage fluids (as opposed to excavations), the use of bunds around pipeline joints and valves, the use of spill pallets for hazardous materials and the requirement by AGL to have a dedicated vacuum truck on location to suck out the contents of treating lines and hoses post operations and in the event of a minor spill;
- The only contents to be mixed in the tanks will be potassium chloride, the other strata stimulation chemicals are mixed as required using specialised hydration and chemical additive unit that therefore reduces the risk of strata stimulation fluids from tanks;
- and a strict program in place to manage the washdown of vehicles and machinery (weed and seed certification) with further independent inspection of those certificates by the AGL Environmental Business Partner or the AGL Supervisor onsite;
- AGL also holds icebreaker sessions with all contractors and has an induction program in place to manage health, safety and environment risks; and
- AGL uses third party waste transporters to collect and dispose of all regulated wastes accordingly.

Additionally, ERM highlights (but not limited to) the following key environmental management strategies to employ throughout the project to further mitigate the potential for terrestrial impacts:

- Materials storage at the wellsite will be sufficient to keep all chemicals dry (i.e., under cover or in waterproof containers) and with segregation of hazardous substances in accordance with relevant regulations;
- Materials storage at the wellsite will be sufficient to contain and mitigate adverse impacts from incidental spills of dry and wet chemicals (the form of this containment will have to be determined by AGL and its strata stimulation subcontractor);
- Materials handling training for staff and contractors will include both health and safety and environmental protection training, with particular emphasis on avoiding and reporting spills; and
- For minimisation of harm to terrestrial organisms, implementation of emergency spill protocols should be considered as a first response. However, it is noted that accidental spillage of diluted chemical mixtures would cause less impact to the terrestrial environmental surrounding the wellsite and to the broader environment compared to accidental spillage of neat mixtures.

It is noted that AGL's SSMP (AGL, 2023b) indicates that AGL staff will also reference the storage and chemical management strategies from its 'Contractor Risk Management' protocols which include environmental duckponds (contain minor spills) and the availability of a vacuum truck to clean contents of minor spills from duckponds or equipment.

3. CONCEPTUAL SITE MODEL

3.1 Study Area

The site selected for the proposed activity is located within the Surat Basin of the Great Artesian Basin (GAB). The Churchie field is located to the east of the Roma Shelf along the flanks of the Taroom Trough (Troup et al, 2018). A summary of AGL's well assets in the Churchie field is provided in Table 3-1. The location and visual aerial context of the study area for this project is provided in Figure 1 and Figure 2, respectively.

Table 3-1. AGL's Well Assets in PL213 (AGL, 2023b)

Well Name	Elevation (m KB)	Total Depth (m KB)	Spud Date	Current Status
Churchie West 1	253.0	2185.0	27 October 2006	Producing
West Noorindoo 1	250.32	2282.0	09 April 1998	Suspended

The land in which WN1 is located is in a rural area used for stock grazing. The well is accessed by turning off River Road (sealed) and travelling approximately 1.5 km along an unsealed access track through relatively flat grazing land with a very sparse density of trees. The well pad occupies an area of 250 m^2 during the production phase and 10,000 m^2 during the proposed activity. The wellhead itself is protected by a fence.

3.2 Geology

The project is targeting tight gas in the Late Permian Upper Tinowon Sandstone Formation. Site-specific geology captured from geological logging of WN1 is summarised in Table 2-2. Geological conditions of the broader basin are summarised below (AGL, 2023b):

- The Surat Basin is an established hydrocarbon province, with production from conventional and unconventional fields in the basin totalling some 500 billion cubic feet of gas and 40 million barrels of oil and condensate (excluding coal gas fields). The bulk of the oil and gas has been recovered from Jurassic aged reservoirs (approximately 50%), Triassic aged reservoirs (approximately 47%) and Permian aged reservoirs (approximately 3%);
- The structural framework for the Surat Basin is controlled by the underlying Bowen Basin that underwent a period of significant compression, uplift and erosion during the late Triassic period. Traps are characterised as low relief anticlines, often associated with Triassic aged faulting. The Tinowon Formation is of Permian age and was first penetrated by Union Oil in 1964 at the Myall Creek 1 well;
- Throughout the Churchie Field, there is an Upper and a Lower Tinowon Sandstone sequence separated by thick coal (Wallabella Coal Member). The coal may be 10 m to 15 m in thickness and frequently contains an Intra Wallabella Sandstone sequence. These Permian coals are mature for oil and gas generation and are thought to charge many of the conventional clastic reservoirs within the stratigraphic column. The total thickness of the Tinowon Formation may be as great as 100 m. A simplified geological map displaying basin and sub-basin stratigraphy is provided in Figure 3-1;
- The fluvial sandstones in the Tinowon Formation are known to be hydrocarbon productive in the area include all three intervals mentioned above – the Upper Tinowon sands (above the Wallabella coal), the Lower Tinowon sands (below the coal) and the Intra Wallabella sands (immediately above and often within the coal); and
- Existing stratigraphic understanding based on wells installed across the basin shows great complexity of the fluvial sand development within all three horizons. Rapid lateral changes are observed in both the gross sandstone thickness as well as the net to gross ratios of the individual sandstone bodies.

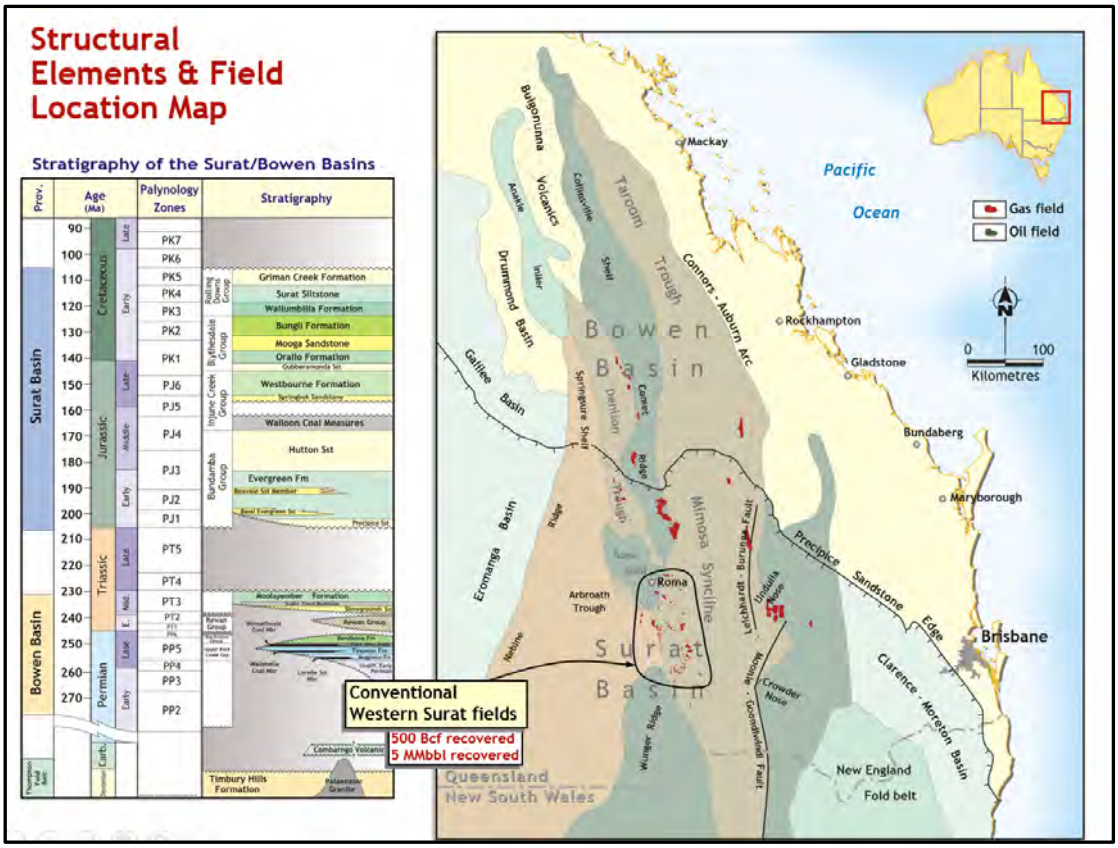

Figure 3-1. General Stratigraphy and Gas Field Locations (AGL, 2023b)

3.3 Hydrogeology

The GAB is a complex hydrogeological system of aquifers stretching across Queensland, New South Wales, South Australia and the Northern Territory. The bounds of the GAB are defined by groundwater conditions as well as geological basins. The most important basins encompassed by the GAB are the Eromanga, Carpentaria, Clarence-Moreton and the Surat Basins. The Bowen Basin, which partly underlies the Surat Basin has traditionally been considered an integral part of the GAB due to its hydraulic connection with some sections of the GAB (IESC, 2014).

Both the Surat and Bowen Basins are multi-layered and contain mainly confined hydrogeological systems comprising of alternating layers of water-bearing (permeable) sandstones and non-water-bearing (impermeable) siltstones and mudstones. These impermeable rocks hinder, but do not totally prevent groundwater flow or leakage between the aquifers (QWC, 2012).

There are several aquifers within the Surat Basin with significant water-bearing capacities, due to their thickness, porosity, hydraulic conductivity, water storage capacity and water quality.

Regionally, groundwater movement within the Surat Basin sequence is dominated by flow controlled by the shallow dipping nature of the layered sequence, hydraulic conductivity and structural overprints. Groundwater is inferred to flow under the prevailing hydraulic heads along the plane of the layers, parallel with their bedding and contacts generally toward the centre of the Surat Basin. Groundwater flows in the Bandanna Formation coals are hypothesised to be very limited in the Taroom Trough on the eastern edge of the Project Area (IESC, 2014). Overall, limited data is available for deeper aquifers and aquitards of the Bowen Basin.

3.3.1 Project-Specific Hydrogeological Considerations

The main GAB aquifers intersected by the broader construction of the WN1 well in descending vertical depth are summarised in Table 3-2. It is noted that the perforation intervals do not intercept these listed aquifers (refer Section 2.2 for well construction details). 'Interception' in this section indicates interception by the well casing and associated cement construction.

Table 3-2. Aquifers Intersected by the Construction of West Noorindoo 1

Unit	Vertical Depth (below ground level)	Thickness (m)
Mooga Sandstone	560.75	145.05
Gubberamunda Sandstone	883.41	132.56
Springbok Sandstone	1115.46	56.84
Hutton Sandstone	1435.02	212.76
Boxvale Formation	1691.93	72.36

In general, there is low connectivity between aquifers across the Surat, Bowen and Galilee Basins (Gasfields Commission Queensland, 2014 citing Australian Government, 2014; CSIRO, 2012a and b; Marsh et al., 2008; QWC, 2012; and RPS, 2012). It can be assumed that water movement within the Tinowon and other sandstone aquifers in the Bowen Basin is very slow and groundwaters have long residence times. It is expected that the system will have significant lag times associated with responses to stresses and significant recovery times should impacts occur (ISEC, 2014).

Groundwater within the intercepted Lower Cretaceous to Jurassic aquifers of the Surat Basin (from the Mooga Formation down to the Boxvale Formation) generally have an expected salinity range of 500 mg/L to 1,500 mg/L (as total dissolved solids; TDS) and ranges in pH from 7.5 to 8. In general, the groundwater is typically low salinity and slightly acidic in recharge zones and calcium-magnesium-bicarbonate-chloride-type groundwater to sodium bicarbonate-chloride-type groundwater toward discharge zones (ISEC, 2014).

Within the Project Area, the early Triassic Rewan Formation separates the Lower Cretaceous to Jurassic aquifers of the Surat from those of the Bowen Basin acting as a semi-pervious boundary. The Rewan group comprises of lithic sandstone, mudstone, shale, siltstone and minor quartz sandstone. Silicification and clay alteration has significantly reduced the porosity and permeability of this layer so that no large aquifers exist within the group (Comet Ridge Limited, 2014).

Due to the low permeability of the strata leading to low yield, the Upper Tinowon Sandstone is not considered to be a beneficial aquifer in the region of the Project Area. The top of the Upper Tinowon Sandstone (Target Formation) is separated from the base of the Boxvale Formation and Hutton Sandstone by 495 m and 752 m, respectively.

3.4 Groundwater Use in the Project Area

A search of the Queensland Online groundwater Database was completed on 18 January 2023. Water bores (DNRME, 2023) within 2 km of WN1 are shown in Table 3-3. Three registered and one unregistered water bores were identified. Two artesian and one sub-artesian bore has been identified in available public records. Whilst artesian conditions are noted, no registered bores are used for water supply (Table 3-3). The shallow bore that was previously used for water supply has since been abandoned and is no longer used. For this HHERA, it is understood that model EA conditions (based on model conditions for PL192, an adjacent petroleum lease) for strata simulation require the following data before strata stimulation:

- Risk assessment: *Identification and proximity of landholder' active groundwater bores in the area where stimulation activities are to be carried out*;
- Baseline monitoring activities: *All landholder's active groundwater bores (subject to access being permitted by the landholder) that are spatially located within a two (2) kilometre horizontal radius from the location of the stimulation initiation point within the target gas producing formation*;
- Baseline monitoring activities: *All landholders' active groundwater bores (subject to access being permitted by the landholder) in any aquifer that is within 200m above or below the target gas producing formation and is spatially located with a two (2) kilometre radius from the location of the stimulation initiation point*; and
- Baseline monitoring activities: *Any other bore that could potentially be adversely impacted by the stimulation activities in accordance with the findings of the risk assessment required by conditions (above)*.

Table 3-3. Bores within 2 km of West Noorindoo 1 (DNRME, 2023)

Bore Name	Distance from WN1 (m)	Date	Depth (m)	Formation (deepest)	Easting, Northing (MGA 94, Zone 55)	Notes	Triggers EA Model Condition?
RN22751 (Noorindoo 1)	740	Oct 1970	2287	Timbury Hills Formation	716834, 6998284	Existing bore, artesian, controlled flow (State of Queensland, 2023)	No – AGL understands that this bore is currently not to be used for water supplies by the landholder.
RN22782 (Noorindoo 3)	1,600	17 May 1971	2140	No strata information provided (assumed just before Winnathoola Coal Member)	719081, 6997446	Existing bore, artesian, controlled flow (State of Queensland, 2023)	No – AGL understands that this bore is currently not to be used for water supplies by the landholder.
RN42220122	1,100	Sept 2001	19	Grey calcareous silt (unspecified)	715568, 6998539	Existing bore, sub-artesian (State of Queensland, 2023), draws groundwater from near surface of Upper Cretaceous formations (high confidence per OGIA, 2021).	No – Landholder indicated to AGL that this bore has been abandoned.
Churchie West 1	1,570	2006	2190	Upper Tinowon Sandstone	716324, 6999284	Production bore	No - This is a production bore, however historical results have been utilised to inform baseline conditions.

There is one additional known unregistered water bore (currently registered as a petroleum bore in Queensland Globe) located just outside the nominal EA 2 km radius buffer to the south / south-east of WN1. Norkham 1, located 2,040 m south, is understood to be used for stock watering, domestic and irrigation purposes. It is understood through AGL's records that Norkham 1 was originally drilled to approximately 2200 m depth by Mosaic Oil in 2002 for gas production. It was plugged at 2151 m depths, at the end of the cased section just above the Tinowon Formation, which isolates the well to the Tinowon Siltstone Formation. The well was subsequently converted for water supply.

The closest bore to WN1 is Noorindoo 1 (RN22751). It is located 737 m away and is not used for water supply. The bore was completed to 2,200 m depth and intersected similar stratigraphy as WN1. The bore is plugged at two depths, 1,715 m and 2,164 m which isolates the bore from the perforated sections in the Upper Tinowon Sandstone.

The MEM for WN1 shows a maximum horizontal fracturing length of 1,000 m from the well. This is the simulated proppant distribution, not necessarily effective fracturing of the formation for hydrocarbon recovery. The simulation shows hydrocarbon recovery by effective fracturing may extend only up to 600 to 700 m beyond the well, with good conductivity and connection achieved around 200 to 300 m from the well (Section 2.3). The proposed fracture orientation of WN1 is 15 degrees north, not in the direction of Noorindoo 1 which is located east of WN1. Even if there was a connection between WN1 and Noorindoo 1, bridge plugs located within the casing would not allow groundwater to flow up the casing. Review of the cement bond behind the casing in Noorindoo 1 indicated that the cement at this well is of 'very good' quality (AGL, pers. comms., 10 July 2023). A copy of these results is provided in Appendix A.

3.4.1 Groundwater Dependent Ecosystems

Ecosystems that rely on groundwater for some or all of their water requirements are classified as groundwater dependent ecosystems (GDEs). Not all GDEs draw on groundwater directly and not all are solely reliant on groundwater. However, in many cases groundwater commonly provides an important and reliable source of water to many ecosystems, and can be the main factor controlling the distribution of ecosystem types. In many cases the groundwater provides baseflow in rivers that ecosystems depend on. The impact of changes in groundwater quantity and quality on GDEs is determined by the degree and nature of their groundwater dependency.

GDE mapping by the Queensland Government indicates that there are small pockets of terrestrial GDE's (high confidence) within 50 m of WN1. These are described as ecosystems intermittently connected to aquifers with brackish salinity and alkaline pH in unconsolidated Quaternary alluvial (i.e. shallowest depth) aquifers. There is very low potential for the Target Formation (Upper Tinowon Sandstone) to have connection with shallow Quaternary-aged aquifers which are the source of groundwater that support these terrestrial GDEs, given the large vertical distance between the units.

The nearest surface expression GDEs are located approximately 5 km to the northwest of WN1 in the northwest corner of PL213 (Figure 2). Surface expression GDEs are reliant upon the expression of groundwater to surface water in this area. There is very low potential for the Target Formation (Upper Tinowon Sandstone) to have connection with these GDEs, given the large horizontal and vertical distance from WN1.

Therefore, the proposed activity of WN1 will have no impact on aquifers which could possibly be providing groundwater flow to these GDEs. All aquifers are isolated and sealed during well construction (in accordance with the Queensland CoP) and there is no evidence to suggest the Target Formation (Upper Tinowon Sandstone) has a pathway to provide groundwater to surface GDEs. The MEM for WN1 suggest fracturing growth is bound by coal and siltstone units immediately above and below the Upper Tinowon Formation which will limit any potential groundwater flow.

3.4.2 Environmental Values of Groundwater

Groundwater Environmental Values for the Maranoa-Balonne Rivers Basin are detailed in the guidance *Queensland Murray-Darling and Bulloo River Basins, Groundwater Environmental Values and Water Quality Objectives, All groundwater of the Queensland Murray-Darling and Bulloo River basins* (DES, 2020a). For this Project Area and the Target Formation proposed to be impacted by the proposed activities, the appropriate environmental values and beneficial uses to be protected are applicable to *Earlier Basins Partially Underlying the Great Artisan Basin*. These include:

- Aquatic ecosystems;
- Stock watering; and
- Cultural and spiritual values.

The Target Formation for the proposed activity is the Upper Tinowon Sandstone (Late Permian). This is located in the Bowen Basin, below the aquifers and formations of the GAB in the overlying Surat Basin (listed in Table 2-2). Generally, the Target Formation is not considered a beneficial aquifer in this region due to the low permeability and subsequent low yield of groundwater. Available data collected from the Bowen Basin indicates NaHCO3 groundwater of relatively high salinity, with high fluoride occurrences (DES, 2020a). Additionally, the Target Formation in the proposed activity may be somewhat limited in its beneficial uses due to the presence of hydrocarbons in the formation.

The Target Formation is comprised of sandstone. During drilling of the well, all other formations, and potential aquifers, are isolated by pressure cementing and casing during drilling, such that the only formation ‘open’ is the Upper Tinowon Sandstone.. This eliminates any risk of interconnection between higher aquifers in the Surat Basin. The proposed activity of the Target Formation is limited to the immediate stratigraphic formation and no other formations or groundwater will be affected by the activities. Further information on the impact to surrounding formation due to the proposed activity is provided in Section 6.

To ensure any potential impacts caused by the proposed activity are identified, a baseline sampling event of applicable groundwater bores was undertaken prior to commencement. The sampling events were undertaken in accordance with existing risk management and impact monitoring procedures required under the model EA conditions, supplemented by the further procedures required under stimulation related conditions as per the relevant Model Conditions proposed to be added to the environmental authority.

3.4.3 Baseline Groundwater Assessment

A baseline assessment of groundwater was completed by ERM in February 2019 (ERM, 2019) and in May 2023 for wells that have been identified as relevant to this project. Figure 2 shows the relevant baseline sampling locations from both rounds.

Groundwater sampled from Churchie West 1 in 2019 is considered representative of the Tinowon formation within the Project Area. A pH value of 8.23 at the bore shows groundwater to be moderately alkaline. Electrical conductivity (EC) at Churchie West 1 was recorded as 2,185 µs/cm indicating brackish conditions. Groundwater is low in turbidity (0.5 Nephelometric Turbidity Units; NTU) and is dominated by sodium bicarbonate-chloride-type water with low levels of potassium, calcium and fluoride (ERM, 2019). Churchie West 1 has since been turned into a production well and is not a water bore.

Groundwater was sampled from Norkham 1 in 2019 and 2023 and is also considered representative of the Tinowon Siltstone Formation (located just above the Upper Tinowon Sandstone). A pH value of 8.22 and 8.17 respectively in groundwater from the well shows groundwater to be slightly alkaline. EC at Norkham 1 was recorded as 2,360 µs/cm and 2,420 µs/cm (respectively), indicating brackish groundwater conditions. Groundwater is low in turbidity (0.5 NTU and 0.2 NTU) and is dominated by sodium bicarbonate-chloride-type water, with low levels of potassium, calcium and fluoride.

Three other bores are located within a 2 km radius of WN1. These bores were not included part of the baseline as these bores are not in use and had no way of sampling them. Bores are shown on Figure 2. Surrounding bores outside the 2 km radius have also been shown on Figure 2, however due to their distance from the stimulation activities, these bores are not considered a risk.

3.4.4 Illustrative Summary of Nearest Groundwater Uses to West Noorindoo 1

A schematic has been created to provide a visual summary that correlates the reported physical relationship between relevant identifiable groundwater bores (and its reported uses to landholders) and the well proposed to be stimulated (WN1). The schematic is provided below as Figure 3-2.

The following aspects are highlighted:

- The target hydrostratigraphic layers and respective depths of the well in proposed activity (WN1), identifiable groundwater bores within a 2 km radius, and identifiable groundwater bores located just outside the 2 km radius (refer Section 2.2 and Section 3.4 above);
- The perforation sequence of the well to be stimulated (WN1) in relation to the intercepted geological layer (refer Section 2.2);
- The horizontal distance of estimated **total** stimulation fracture extent (i.e. 600-700m horizontally from the well; refer Section 2.3.1);
- The horizontal distance of estimated **effective** stimulation fracture extent (i.e. 300 m of the estimated 200-300 m range simulated from the well; refer Section 2.3.1);
- Bridge plugs present in surrounding wells limiting groundwater and hydrocarbon movements within these wells and no connection to wells extracted groundwater for use (refer section 3.4);
- The limited vertical extent of stimulation within the Upper Tinowon Sandstone (appropriately 30 m), and no connection to overlying formations and aquifers (refer Section 2.3.2); and
- Current understood uses of groundwater from the identified bores, if any.

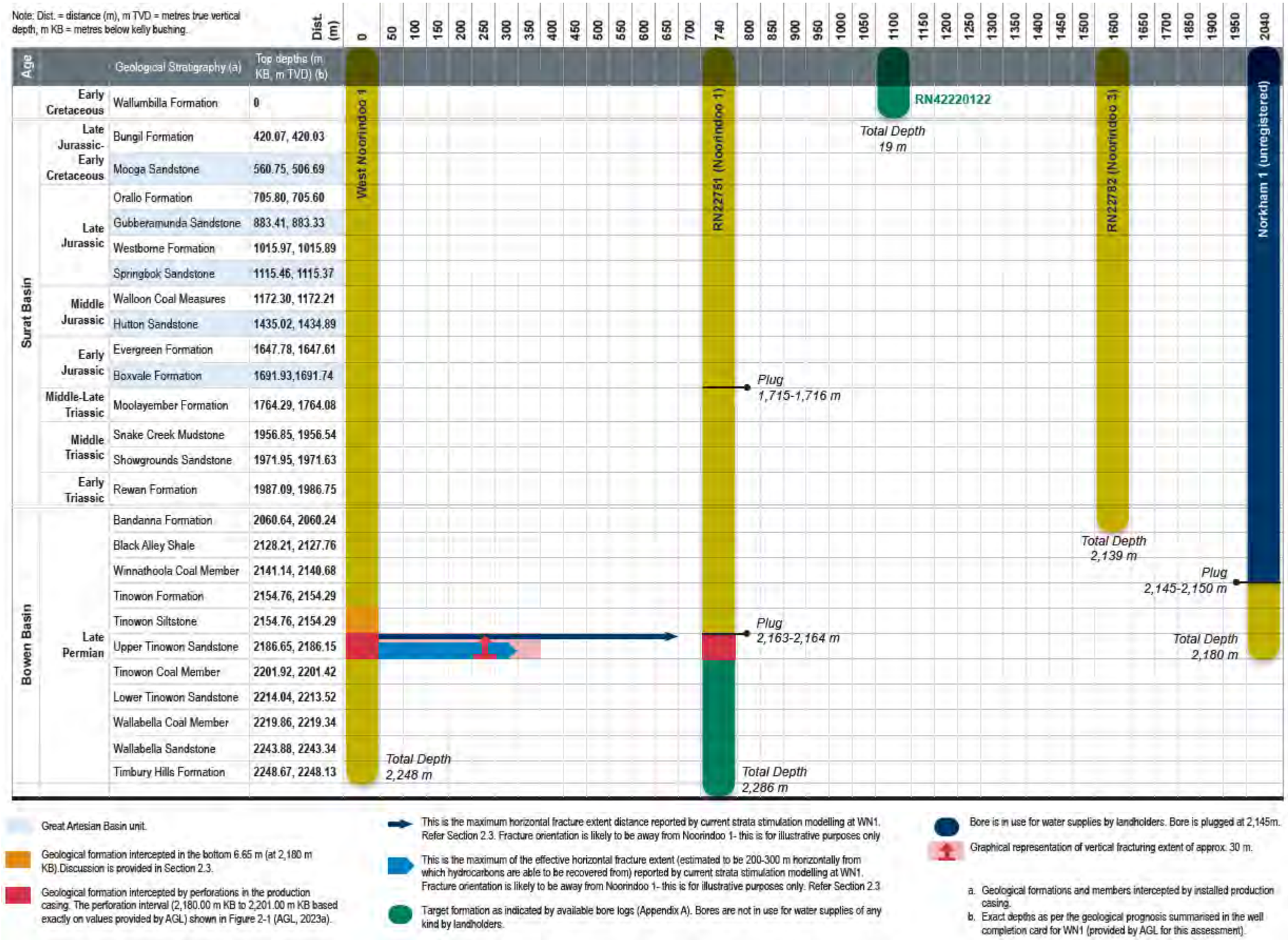

Figure 3-2. Schematic of Estimated Fracture Extents vs. Distances to Identified Groundwater Bores Near West Noorindoo 1

3.5 Surface Water

The Project Area lies in the Condamine-Balonne catchment. There is some interaction between water of the GAB and overlying surface water or shallower groundwater. The Condamine River becomes the Balonne River south of Surat. The lower Balonne, south of the project site, is a complex floodplain channel system where a number of nationally significant wetlands are located. Wetland mapping in the Surat region indicates there is riverine wetland approximately 480 m southwest of NW1. Two remnant regional ecosystem (1-50%) wetlands are located within PL213 and PL192 (directly to the east of PL213) and approximately 4.5 km and 4.2 km (respectively) from WN1.

There are dams located approximately 700 m to the northwest, 800m to the west southwest and 1.9 km south southeast of the well pad. The closest surface water feature is an unnamed watercourse (drainage channel), located approximately 7m north of the well pad. Larger unnamed watercourses which form tributaries of the Balonne River are located approximately 750 m southwest and 530 m south of the well pad.

The Balonne River is located approximately 3.6 km to the west of the well pad. There are no residential dwellings within the vicinity of WN1. One residence is located approximately 2.5 km south of WN1.

3.5.1 Environmental Values

According to the 'Maranoa-Balonne Rivers Basin Environmental Values and Water Quality Objectives' document (DES, 2020b), surface waters within the Project Area are considered to be waters from tributaries of the Balonne River. Therefore, the human and ecological values that require protection within the Project Area are those listed under the 'Balonne River (waterway only)' segment. Specifically, these environmental values were identified to be as follows:

- Aquatic ecosystems;
- Irrigation;
- Farm supply/use;
- Stock water;
- Human consumer;
- Primary recreation;
- Secondary recreation;
- Visual recreation;
- Drinking water; and
- Cultural, spiritual and ceremonial values.

The most sensitive human value identified is the protection of drinking water quality and the water quality standards that apply to the assessment of this value are the *Australian Drinking Water Guidelines* (NHMRC, 2011).

In order to avoid and/or minimise impacts to surface waters, management strategies will be implemented (by AGL and its proposed subcontractor Condor Energy) that are consistent with those that have been previously implemented for the adjacent lease area PL192. To ensure any impacts caused by the proposed activities are identified, a baseline sampling event of nearby surface water, where possible, was undertaken prior to commencement. The sampling events were undertaken in accordance with existing risk management and impact monitoring procedures required under model EA conditions.

3.5.2 Baseline Surface Water Assessment

A surface water sample was collected from the Balonne River during baseline monitoring in 2019 (location SW-CH1 shown on Figure 2). The river is ephemeral at this location with opportunistic sampling completed when possible (ERM, 2019). The closest surface water feature is an unnamed watercourse (drainage channel), located approximately 7m north of the well pad. Larger unnamed watercourses which form tributaries of the Balonne River are located approximately 750 m southwest and 530 m south of the well pad. ERM has collected an additional surface water sample (SW) located approximately 1.2 km northwest of WN1 as part of the baseline monitoring works and included for further evaluation in this HHERA. Baseline monitoring locations are shown in Figure 2 and results are presented in the Baseline Report (ERM, 2023).

4. EXPOSURE ASSESSMENT

Exposure assessment is the process of estimating the magnitude, frequency, extent and duration of exposure of identified receptors to the chemicals of concern at and surrounding the site of chemical release. The exposure assessment uses the understood conceptual site model (i.e. sources, pathways and receptors) to qualify and quantify (where possible) the understanding of exposure scenarios for further characterisation of potential risk posed to the identified receptors of interest.

4.1 Source

A 'source' is defined as a potential source of contamination under the scenario being investigated. The 'sources' considered in this risk assessment were the following:

- Chemicals stored and used at the surface in an undiluted form which are mixed with water to form the fluid used during the proposed activity;
- Strata stimulation fluid mixture (diluted form). AGL proposes to use a 'cross-linked fluid system' strata stimulation fluid at WN1. It comprises approximately 98% water and proppant. Chemical additives including viscosifying agents and breaker fluids are added as required so the diluted form of strata stimulation fluid is minimal, further reducing risks. The strata stimulation fluid is designed to effectively create the fracture and transport high proppant concentrations within the fracture and enable efficient flow-back through the addition of a viscosity breaker; and
- Flowback water (diluted form). Once the proppant has been distributed to fractures, residual strata stimulation fluid (broken fluid, which has the viscosity of water) will flow back to a tank at the ground surface. This return water is expected to exhibit the same composition of the strata stimulation fluid mixture and may include produced water from the formation. Some of the injected fluid will be recovered as flowback water; however, due to the low permeability and low water content of the Target Formation, it is highly unlikely that more than 60% to 70% of the fluid will be recovered (AGL, pers. comms., 15 May 2023).

Characterisation of the proposed chemical composition of the strata stimulation fluid mixture is carried out in Section 5 (Chemical Hazard Assessment). As flowback water is considered a broken and diluted form of the stimulation fluid mixture and therefore potential risks are conservatively evaluated by the stimulation fluid mixture.

4.2 Pathways

An 'pathway' is a means by which chemicals that comprise the source may migrate to potential receptors identified for the site and surrounds. Migration pathways are the critical link in the development of a conceptual site model, because if a receptor is not connected to a source by a migration pathway that can result in exposure, then that receptor cannot be at risk from the source. This section summarises the pathways that were included in this risk assessment.

4.2.1 Surface

Under normal operation there is no operable migration pathway because migration requires release. Release of chemicals would occur only under accidental circumstances such as spillage during storage, mixing, or loss of containment from a flowback tank. There is no planned release to the environment of strata stimulation flowback waters at the wellhead. Flowback water is to be contained at all times at the surface within tanks prior to transport to an appropriate treatment facility. There is no pathway by which the proposed activity could impact surface water drainage or downstream nationally significant wetlands.

The surface pathways are considered to be potentially viable under accidental (i.e. spills or leaks) conditions only. Under accidental conditions, the potential exposure pathway is direct contact by ecological or human receptors with chemicals by spills and leaks of un-diluted chemicals or diluted strata stimulation fluids or flowback water to soils or surface waters at the well site.

4.2.2 Sub-Surface

Within the sub-surface, migration of injected diluted strata stimulation fluids from the proposed activity or groundwater with compounds derived from the Target Formation during the proposed activity may extend into aquifers overlying the Target Formation only if the following conditions exist:

- Via new fractures developed during the proposed activity, leading to lateral or vertical connection within the target aquifer or overlying aquifers; or
- Via pre-existing hydraulic continuity with overlying aquifers; or
- Via leakage into overlying aquifers from around the cemented casing of the drilled well itself.

For the above pathways to be complete and result in exposure to human receptors or ecological systems, there must be an extraction well, or a groundwater fed water body with a hydraulic connection to the aquifer that could be connected to the Target Formation by fractures. The viability of these subsurface migration pathways is discussed below. A schematic summary of installed groundwater wells within and just outside a 2 km radius of WN1 (the well proposed to be fractured), their respective target formations, and key vertical and horizontal distances is also provided in Figure 3-2.

4.2.2.1 Fate and transport of chemicals from the proposed activity in Target Formation

It is likely that 60-70% of the fluids from the proposed activity will return to the surface as flowback water. This flowback recovery range is considered reasonable based on the understanding of the broader reservoir provided from AGL's specialists. AGL indicated that flowback recoveries are a function of reservoir permeability (AGL, pers. comms., 15 May 2023). Generally, it can be extremely difficult to recover fluids in tight gas deposits as they are held in the formation by capillary forces. These forces also apply to the groundwater flow through these units, indicating that flow is very slow.

The permeability of tight gas deposits is naturally low (estimated to be <0.1 milli-darcys or $3x10^{-10}$ m^3/year) (Geoscience Australia, 2019) and strata stimulation is necessary to create a conductive flow path within the reservoir back to the wellbore in order to allow economic gas to flow. The fact that the gas has migrated to a reservoir and remains in place indicates that the reservoirs themselves are surrounded by low permeability strata. The Target Formation (Upper Tinowon Sandstone) at WN1 is ultimately underlain by low permeable basement (Timbury Hills Formation) located approximately 47 m below and overlain by a bounding coal seam (Winnathoola Coal Member) located approximately 32 m above. Both the basement and coal seam horizons are likely to restrict the movement of chemicals and groundwater vertically.

ERM considers that except in a circumstance where a fracture created a pathway to an aquifer, it is unlikely that significant migration of fracturing chemicals outside the Target Formation will occur in a relevant timeframe.

It is concluded that the subsurface migration pathway from the Target Formation (Upper Tinowon Sandstone) to overlying aquifers and landholder bores is not plausible. The conclusions are based on the following:

- The nearest beneficial uses aquifer (Boxvale Formation) is approximately 490 m vertically above the top of the Upper Tinowon Sandstone;
- There are no known pre-existing hydraulic connections between the Upper Tinowon Sandstone and overlying aquifers used for water supply; and
- The combined effects of very low permeabilities, sorption of organic compounds into the overlying coal seam (Winnathoola Coal Member, 14 m thick) and shale (Black Alley Shale, 13 m thick), the 74 m thick Rewan Formation (which has low porosity and permeability), and a flow regime drawn towards the well due to production pumping is considered sufficient to provide additional confidence that vertical subsurface migration is not a viable pathway.

The only viable pathway for fluid to reach a receptor, be it via an aquifer or an existing bore, is to directly fracture from the tight gas well to said bore or aquifer. The stimulation modelling (AGL, 2023b) which includes the MEM demonstrates this is not likely.

4.2.2.2 Radius of influence from proposed activity

Both vertical and horizontal transport pathways need to be considered when assessing the radius of influence from the proposed activity. The modelled fracture geometry for the Target Formation is shown in Figure 2-3. The horizontal fracture length is likely to extend at most 1,000 m laterally from the well; however, the simulation shows that the hydrocarbon recovery by effective fracturing may extend only up to 600-700 m beyond the well (WN1) with good conductivity and connection achieved around 200-300 m from the well.

The simulated potential fracture extent is based on the MEM which confirms that fractures will likely be relatively contained to the target reservoirs and shows that the fracture is able to grow laterally within the reservoir. Due to the presence of siltstone (Tinowon Formation) and interbedded coal units immediately above the perforated zones, very little vertical fracture growth outside the immediate Upper Tinowon Sandstone is expected. Vertical fractures will not grow beyond the bounding Winnathoola Coal Member (overlying the Tinowon Formation) and Wallabella Coal Member (underlying the lower Tinowon Formation). The process of the proposed activity is designed to contain the fractures within the Target Formation (Upper Tinowon Sandstone), since fractures outside the formation do not contribute to production.

Field data from several thousand hydraulic strata stimulation operations in numerous types of reservoirs across North America have demonstrated that sedimentary features limit vertical fracture lengths, with inefficient fracture growth across layers and interfaces. A review by Fisher & Warpinski (2012) of the aforementioned field data has shown that lateral or penetration into the reservoir fracture lengths are typically considerably shorter than 1000 foot (approximately 300 m), with fractures usually measured in tens or hundreds of feet.

The maximum height of an upward propagating fracture, assessed from microseismicity data taken from several thousand hydraulic strata stimulation operations in shale gas formations in North America, was reported as approximately 588 m by Davies et al (2012). However, Davies et al (2012) indicated that the probability that a stimulated fracture would extend vertically beyond 350 m was less than 1%. This is consistent with the findings of the review completed by Fisher & Warpinski (2012). In addition, the mass balance of the fracturing fluid needs to be considered. In shale gas wells, the volumes of fracturing fluid are around an order of magnitude higher than that proposed for WN1.

The North American data described above include strata stimulation of horizontal shale gas wells in the United States where the fractures are designed to propagate vertically. The vertical propagation is due to the fact that fractures in many of the North American case studies tend to propagate parallel to the maximum stress field – of which (in the United States) is predominantly vertical due to their geology.

Based on the MEM for WN1, literature available to review and project field experience, there is sufficient evidence that the probability of a fracture reaching the Boxvale Formation (>490 m above) is extremely low. The only known water supply bore, Norkham 1, which is at a similar depth to WN1 is located over 2 km away. This distant well has also been plugged and isolated from the Target Formation so hydraulic connection is even less likely. It is also located south, in the opposite direction of the proposed fracture orientation.

The single landholder bore within 2 km of WN1, (RN42220122) is installed to 19 m. It no longer provides water supply to the landowner and is abandoned. Therefore, this is not a complete pathway to human receptors.

Two other bores located within 2 km of WN1, Noorindoo 1 and Noorindoo 3 are not used for water supply.

4.2.2.3 Well failure

The design of the well includes a 5.5 inch diameter casing from surface to drilled depth, pressure cemented into place between the inside of the well and all overlying aquifers (detailed well construction in accordance with the CoP is provided in Section 2.1). Based on the SSMP (AGL, 2023b), WN1 has been recompleted with a 2.875 inch tubing packer completion to isolate the casing with a maximum pressure of 7,500 psi and has been confirmed as meeting the required standards as per the QLD CoP. It is understood that AGL has gained extensive knowledge of the rock mechanics of the zones of interest through previous exploration and proposed activities. Based on previous experience in this geological region, average treating pressures are expected to range from 4400 to 5700 psi.

The potential for leakage pathways around the well include the scenario that the production casing, production tubing and/or production packer and pressure cement failed, and that the failure propagated to the stratigraphic level of one of the overlying aquifers. For strata stimulation fluids to be lost to the aquifer, the cement quality behind the casing would have to be of extremely poor quality or non-existent. The well integrity program includes the diagnostics of the cementing operations, which includes laboratory testing of the cement to the bottom hole conditions, the Radial Cement Bond Log (RCBL) provides a method to evaluate the quality of the cement and the bonding of the cement to the casing and the formation. The RCBL log was run from the 5.5 inch casing permanent bridge plug isolating the lower Tinowon Sandstone back to the top of the casing prior to the recompletion of the well in 2022. The RCBL confirmed that the cement quality is fair to good. In addition, a corrosion log was run in 2022 as part of the well integrity management system. Overall, no issues were identified at WN1.

The cement strength is typically about a magnitude greater than the formation, so the fracture is induced in the formation and not the bonded cement sheath between the formation and the casing. Nevertheless, the pressure is intensively monitored and recorded in real time, and a catastrophic failure of this nature would result in immediate shutdown of the process to investigate the failure and take corrective action to repair a well integrity issue.

Industry experience suggests that casing failures are very rare, both in Australia and internationally. Procedures are in place to mitigate against casing failure as well as to prevent injection of fracturing fluids into a well with casing failure and would be put into effect as soon as casing failure is identified. In summary, it is concluded that the controls to prevent well failure are sufficient to provide confidence that this pathway is highly unlikely to occur.

4.3 Receptors

A ‘receptor’ is the term used to describe a group of people, or an ecological system that could potentially be harmed through exposure to chemicals. At the receptor identification stage, all receptors that could come into contact directly with the chemicals, with land, surface water or groundwater at or near the wellhead, or within a nominal 2 km radius of the wellhead are included to demonstrate that consideration has been given to all possible receptors.

Identifiable receptors are based on the environmental values identified for groundwater in the vicinity of WN1 (Section 3.4.2), as follows:

- Aquatic ecosystems;
- Stock watering; and
- Cultural and spiritual values.

Human and ecological receptors include:

- Agricultural workers that may have direct contact with chemicals in the soils or flowback fluids due to surface releases from a wellsite;

- Wildlife and plant species occurring in the vicinity of the wellsite that may have contact with chemicals in the soils or flowback fluids;
- Terrestrial (stock and wildlife) at the landholder properties that may be in contact with bore water used for irrigation and stock watering;
- Aquatic and terrestrial ecological receptors at groundwater dependent ecosystems that rely on groundwater for some of their water supply; and
- Cultural and spiritual values of groundwater and surface water. Given the lack of available guidance around the assessment of adverse impacts to waters to be protected for these uses, this environmental value will be conservatively considered alongside the evaluation of aquatic ecological receptors. It is believed that if aquatic ecological receptors are adversely impacted, quite a significant portion of cultural and spiritual activities cannot be completed as such activities depend on a thriving environment.

The AGL and subcontractor workforce undertaking the proposed activities and related works (who are expected to have direct contact with fracturing fluids and flowback water) are not further considered in this assessment since potential exposure to these fluids are considered health and safety risks that will be dealt with separately under AGL's safety management systems.

During the baseline assessment (ERM, 2023), the Balonne River was the only watercourse observed to have standing water. The nearest mapped watercourse according to QLD Globe is an unnamed watercourse (drainage channel), located approximately 7m north of the well pad. Larger unnamed watercourses which form tributaries of the Balonne River are located approximately 750 m southwest and 530 m south of the well pad. This larger tributary was observed to have some water within a waterhole of the watercourse that was collected for the surface water (SW) sample. It was noted that a rainfall event had occurred a couple of weeks earlier and was likely the source of the water. The tributary was not flowing at the time of sampling. Additional surface water bodies in the vicinity of the wellsite include three stock watering dams which are not considered receptors within the range of possible surface spillage movement.

4.4 Source-Pathway-Receptor Linkages

Based on the data discussed above and the conceptual understanding of the proposed activity, the subsurface pathways via fractures, pre-existing hydraulic connectivity and well casing failure are generally not likely to be viable.

Surface exposure pathways via leakage and spillage of raw material chemicals and flowback at the wellsite are plausible under accidental or emergency scenarios only.

This conclusion is consistent with the findings of the Department of Climate Change, Energy, the Environment and Water research report (Mallants et al, 2017) on the risks generally posed to deeper groundwater by chemicals used in the proposed activity.

5. CHEMICAL HAZARD ASSESSMENT

The hazard assessment consists of the evaluation of both qualitative and quantitative information about the chemicals proposed to be use for the proposed activity. The chemical hazard assessment process is further explained in Section 5.2.1. This is done to understand the potential nature and incidence of adverse health effects which might occur in humans and ecological receptors at different exposure levels. For this project, it is understood that AGL has committed to only use the chemicals listed in Section 5.1. If other chemicals are proposed for use as part of this project, a supplementary risk assessment of such chemicals and uses will have to be conducted.

5.1 Chemical Information

For this chemical hazard review, AGL (through its strata stimulation subcontractor Condor Energy) supplied ERM with a list of commercial products and a summary proprietary composition of chemical constituents that are planned to be used for the proposed activity at WN1. The commercial products and the disclosed chemicals by percentage are summarised in Table 5-1 The detailed composition (chemical constituents and their purpose, and approximate mixed proportions) of the fluid for the proposed activity to be used at WN1 is summarised in Table 5-2. Relevant safety data sheets (SDS) for the chemical products that make up the stimulation fluid are provided in Appendix B. Based on this information, toxicity profiles were compiled from a set of key resources for this HHERA (refer Table C1 of Appendix C).

It is noted that ERM was supplied with a disclosed fluid composition for the proposed activity but the stimulation contractor de-linked the individual chemical constituents from the supplied commercial product list for proprietary reasons. This is not considered a data gap for the HHERA as:

- The chemical hazard assessment is primarily based on the individual chemical constituents and their proportions in the stimulation fluid; and
- The testing of for restricted substances (the key aromatic hydrocarbons of concern – polycyclic aromatic hydrocarbons (PAHs), and benzene, toluene, ethylbenzene and xylenes (BTEX) was supplied for the commercial products specifically.

The overall strata stimulation fluid will comprise solids that form suspensions in the fluid mixture or are in aqueous solution. The volume of water to be used in the proposed activity is approximately 330 kL. ERM understands that the water will be sourced from a licenced water supply bore (RN123703; bore report in Appendix A). This water bore was drilled in 2020 by Surat town council to supplement their town water supply and is sourced from the Mooga Sandstone artesian GAB unit.

Table 5-1. Strata Stimulation Fluid – Commercial Products (Condor Energy)

Product	Chemical ingredients in product
KCl (Clay inhibitor)	■ Potassium chloride (100% of unspecified purity in SDS)
CFBE5 (Biocide)	■ Glutaraldehyde (20-50%) ■ Methanol (1-5%)
CF10GGC (Guar)	■ Guar gum (30-60%) ■ Aliphatic hydrocarbons (30-60%) ■ Glycol ether derivative (<10%) ■ Organophillic silicate (<5%)
CF150FBS (Flowback surfactant)	■ Ethylene glycol (10-30%) ■ Nonionic surfactant (10-30%) ■ Anionic surfactant (10-30%)
CF380DXL (Delayed crosslinker)	■ Sodium gluconate (15-40%) ■ Boric acid (7-13%) ■ Potassium hydroxide (15-40%)
CF8200E (Enzyme breaker)	■ Mannanase (<5%)
CF8550EA (Encapsulated oxidising breaker)	■ Ammonium persulfate (60-90%) ■ Talc (<5%)
HCl (Reduces near wellbore tortuosity issues)	■ Hydrochloric acid (>25%)
CA370FE (Prevents precipitation of metal oxides)	■ Sodium salt of organic acid (70-100%)
CAI500LT (Corrosion inhibitor)	■ Isopropanol (30-60%) ■ Ethoxylated C12-C16 alcohol (10-30%) ■ Ethoxylated decanol (5-10%) ■ Cinnamaldehyde (5-10%) ■ Ethoxylated tallow alkyl amine (1-5%) ■ Methanol (0.1-1%)
CF210PH (Contingency fluid system – lowers pH)	■ Citric acid (30-60%)
CF8500 (Contingency fluid system – oxidising breaker)	■ Ammonium persulfate (60-100%)
Wanli® ceramic proppant (All Mesh Sizes)	■ Corundum (55-65%) ■ Mullite (35-45%)
Holcim Graded Sand & Gravel Products (proppant)	■ Quartz (crystalline silica, i.e. sand; 99%)

Table 5-2. Strata Stimulation Fluid Composition (Condor Energy)

Constituent Name	CAS RN	Volume* (L)	Proportion of Total Volume* (%)	Purpose
Corundum	1302-74-5	17,000	4.6	Proppant
Mullite	1302-93-8	11,000	3.1	Proppant
Sand (crystalline silica, quartz)	14808-60-7	1100	0.31	Proppant
Ethoxylated branched C13 alcohol	78330-21-9	60	0.016	Surfactant (assumed)
Sulfonic acids, C14-16-alkane hydroxy and C14-16-alkene, sodium salts	68439-57-6	53	0.014	Surfactant (assumed)
Diisobutyl glutarate	71195-64-7	7.1	0.0019	Improve surface and interfacial tension
Diisobutyl succinate	925-06-4	2.4	0.00064	Improve surface and interfacial tension
Diisobutyl adipate	141-04-8	2	0.00055	Improve surface and interfacial tension
Sodium sulphate	7757-82-6	1.3	0.00036	By-product from alpha olefin sulfonate
Ethylene glycol	107-21-1	55	0.015	Surfactant
Glutaraldehyde	111-30-8	170	0.046	Biocide
Sodium gluconate	527-07-1	370	0.099	Delayed crosslinker
Boric acid	10043-35-3	180	0.05	Delayed crosslinker
Potassium hydroxide	1310-58-3	366	0.099	Delayed crosslinker
Mannanase	37288-54-3	0.19	0.000051	Enzyme breaker
Ammonium persulphate	7727-54-0	55	0.015	Encapsulated oxidising breaker
Talc	14807-96-6	1.9	0.00051	Encapsulated oxidising breaker
Hydrotreated light petroleum distillates	64742-47-8	780	0.21	Assumed to be part of liquid guar component
Guar gum	9000-30-0	660	0.18	Liquid guar
Nonylphenol ethoxylates	9016-45-9	200	0.053	Non-ionic surfactant
Bis(hydrogenated tallow alkyl)dimethyl ammonium bentonite salts	68953-58-2	200	0.053	Assumed part of liquid guar component
1,6-Hexanediol	629-11-8	20	0.0053	Coupling agent for bentonite clay
Crystalline silica	14808-60-7	2.0	0.00053	Filling agent (assumed)

Constituent Name	CAS RN	Volume* (L)	Proportion of Total Volume* (%)	Purpose
Hydrochloric acid	7647-01-0	830	0.22	Reduces near wellbore tortuosity issues
Sodium erythorbate	6381-77-7	6.8	0.0018	Iron control
Citric Acid	77-92-9	170	0.046	Lowers pH
Isopropanol	67-63-0	1.7	0.00045	Corrosion inhibitor
Ethoxylated C12-C16 alcohol	68551-12-2	1.1	0.00031	Corrosion inhibitor
Ethoxylated decanol	26183-52-8	0.38	0.00010	Corrosion inhibitor
Cinnamaldehyde	104-55-2	0.38	0.00010	Corrosion inhibitor
Ethoxylated tallow alkyl amine	61791-26-2	0.19	0.000051	Corrosion inhibitor
Methanol	67-56-1	0.038	0.000010	Biocide
Potassium chloride	7447-40-7	3400	0.92	Clay inhibitor
Water in additives	7732-18-5	270	0.072	Reduces near wellbore tortuosity issues
Potassium sorbate	24634-61-5	1.2	0.00034	Assumed biocide
Sodium benzoate	532-32-1	0.025	0.000007	Assumed biocide

Notes: ** Volumes and proportions are rounded to two significant figures in this report.*
CAS RN = 'Chemical Abstracts Service Registry Numbers' = unique identification number assigned by the Chemical Abstracts Service (USA) to each chemical.

5.2 Human Health and Environmental Hazard Assessment

ERM has assessed the health and environmental hazards of the chemical constituents in each product, with reference to the concentrations of each chemical in the strata stimulation fluid. These concentrations were estimated based on proportions of each constituent reported by AGL's strata stimulation subcontractor Condor Energy. Hazard assessment results are summarised in Table 5-3.

5.2.1 Hazard Rating Approach

ERM's assessment considered human and ecological persistence, bioaccumulative, and toxicity potential. The assessment is provided in Table C1 of Appendix C and used the information provided in the SDS, together with publicly available online information from the following key sources where required, as follows:

- Australian Industrial Chemicals Introduction Scheme (AICIS) formerly National Industrial Chemicals Notification and Assessment Scheme (NICNAS);
- Safe Work Australia (Hazardous Chemicals Information System (HSIC));
- European Chemicals Agency (ECHA); and
- The Hazardous Substances Data Bank (HSDB).

This assessment address potential hazard of the chemical constituents pure form without consideration of the diluted form in the fracture fluids or environmental media as well as potential degradation in the environment.

5.2.1.1 Persistent, Bioaccumulative and Toxic Assessment

The persistent, bioaccumulative and toxic (PBT) classification of a chemical was identified for each chemical in-line with the '*Chemical risk assessment guidance: for chemicals associated with coal seam gas extraction*' (DoEE, 2017). PBT criteria are available within the guidance document.

5.2.1.2 Environmental (Ecological) Hazard Potential

To determine the environmental (also referred to as 'ecological') hazard potential to aquatic ecological receptors, a qualitative multiple-lines of evidence approach was undertaken. Essentially, where the toxicity of a chemical was indicated to be 'very toxic', an environmental hazard rating of 'high' was selected as a default. 'Medium' and 'low' hazard ratings were assigned to chemicals identified as 'toxic', and 'harmful' or not classifiable as to its toxic potential, respectively.

In some cases, a holistic review of multiple chemical properties was warranted. For example, if a chemical was indicated to be persistent in the environment, but of low to not classifiable bioaccumulative and toxic potential, then a rating of 'low' could be assigned.

5.2.1.3 Human Health Hazard Potential

To determine the human health hazard potential, a qualitative multiple-lines of evidence approach was undertaken. Hazard ratings of 'low' to 'high' were assigned to each chemical using rationales like those from the Inventory Multi-tiered Assessment and Prioritisation (IMAP) framework (established by former NICNAS, now AICIS) and the 'GreenScreen® for Safer Chemicals – Hazard Assessment Guidance' (Clean Production Action, 2018).

It is noted that ERM did not seek to identically replicate the details of the screening approaches within these frameworks as these frameworks are not intended for use in the health risk assessment of the oil and gas chemicals in this industry on a project-specific basis. Rather, as the basic principles of human health risk assessment adopted by these agencies overlap with the guidance underpinning this risk assessment (enHealth, 2012), ERM has adopted the same hazard prioritisation schemes of reported adverse health effects to qualitatively determine suitable hazard ratings for each chemical.

In these frameworks, a higher hazard potential is indicated for chemicals with more severe reported adverse health effects such as carcinogenicity, reproductive effects, and more. Additionally, the human health hazard ratings presented herein do not include perceived or mitigated decreased risk from the use and enforcement of standard personal protective equipment and/or other occupational safety control measures. Such safety mitigation measures are discussed within AGL's existing strata simulation management plans and procedures as appropriate.

For this chemical hazard assessment overall, key routes of exposure (i.e. oral, dermal and inhalation) for which data were available were reviewed. If data on other routes of exposure were available from the available data sources, then it would have been included in this evaluation. In some cases, additional qualitative evidence – such as those based on chemical structural alerts – can be used as a specific line of evidence to determine the most appropriate hazard rating for each chemical.

For the purposes of this HHERA, human health hazard ratings were assigned based on the following conditions:

- Low concern:
  - Those that have already been reviewed via the IMAP Framework and listed as 'low concern' within the '*National assessment of chemicals associated with coal seam gas extraction in Australia*' (NICNAS, 2017); or
  - Those that were categorised as 'low concern' via the broader IMAP Framework via other Tier 1 assessments (NICNAS, 2013). These reports were reviewed prior to the assignment of 'low concern' for the purposes of this HHERA; or
  - Those that were not currently classifiable for any category in the '*Globally Harmonized System of Classification and Labelling of Chemicals*' as indicated through the product's SDS or through other reliable publicly available data sources.
- Moderate concern:
  - Those that were indicated to cause severe acute toxic effects through the oral, ocular, dermal and/or inhalation exposure pathways; or
  - Those that were indicated to cause severe repeated dose toxic effects through the oral, ocular, dermal and/or inhalation exposure pathways; or
  - Those that were sensitising or were indicated to cause other adverse health effects potentially warranting additional safety mitigation measures (e.g. severe irritation of skin and respiratory system, among others); or
  - Those that were reported to be of 'moderate' toxicity for any exposure pathway.
- High concern:
  - Those that were listed of high toxicity for any exposure pathway, including reports of potential fatality or severe outcomes at extremely low doses of exposure; or
  - Those that were listed as genotoxic, carcinogenic and/or with evident adverse reproductive and/or developmental effects. If the evidence indicates that there is still a paucity of data for the reported severe effect, then the hazard rating may be adjusted based on such considerations.

Table 5-3. Hazard Assessment Summary

CAS RN	Chemical Constituent	Approx. Concentration[a] (mg/L)	Persistent[b]	Bioaccumulative[b]	Toxic[b]	Environmental Hazard[c]	Human Hazard[d]
1302-74-5	Corundum	140,000	-	-	-	L	H
1302-93-8	Mullite	93,000	-	-	-	L	H
78330-21-9	Ethoxylated branched C13 alcohol	160	-	-	vT	H	M
68439-57-6	Sulfonic acids, C14-16-alkane hydroxy and C14-16-alkene, sodium salts	140	-	-	T	M	M
71195-64-7	Diisobutyl glutarate	19	-	-	T	M	L
925-06-4	Diisobutyl succinate	6.4	-	-	T	M	L
141-04-8	Diisobutyl adipate	5.2	-	-	T	M	L
7757-82-6	Sodium sulphate	9.8	-	-	-	L	L
107-21-1	Ethylene glycol	150	-	-	H	L	M
111-30-8	Glutaraldehyde	490	-	-	T	M	M
527-07-1	Sodium gluconate	1,400	-	-	-	L	L
10043-35-3	Boric acid	710	-	-	H	L	M
1310-58-3	Potassium hydroxide	1,400	-	-	-	L	L
37288-54-3	Mannanase	0.5	-	-	H	L	L
7727-54-0	Ammonium persulphate	270	-	-	H	L	M
14807-96-6	Talc	9.2	-	-	-	L	L
64742-47-8	Hydrotreated light petroleum distillates	2,300	-	-	T	M	M
9000-30-0	Guar gum	2,000	-	-	-	L	L
9016-45-9	Nonylphenol ethoxylates	530	-	-	T	M	H
68953-58-2	Bis(hydrogenated tallow alkyl)dimethyl	580	-	-	-	L	L

CAS RN	Chemical Constituent	Approx. Concentration[a] (mg/L)	Persistent[b]	Bioaccumulative[b]	Toxic[b]	Environmental Hazard[c]	Human Hazard[d]
	ammonium bentonite salts						
629-11-8	1,6-Hexanediol	53	-	-	-	L	L
14808-60-7	Crystalline silica (incl. proppant)	8,100	-	-	-	L	H
7647-01-0	Hydrochloric acid	2,700	-	-	-	L	M
6381-77-7	Sodium erythorbate	22	P	-	-	L	L
77-92-9	Citric acid	550	-	-	-	L	L
67-63-0	Isopropanol	4.3	-	-	-	L	L
68551-12-2	Ethoxylated C12-C16 Alcohol	2.9	-	-	vT	H	L
26183-52-8	Ethoxylated decanol	1.0	-	-	vT	H	M
104-55-2	Cinnamaldehyde	1.0	-	-	H	L	M
61791-26-2	Ethoxylated tallow alkyl amine	0.5	-	-	H	L	L
67-56-1	Methanol	0.1	-	-	-	L	M
7447-40-7	Potassium chloride	18,000	-	-	-	L	L
7732-18-5	Water in additive	720	-	-	-	L	L
24634-61-5	Potassium sorbate	3.6	-	-	-	L	L
532-32-1	Sodium benzoate	0.1	-	-	H	L	M

Notes: *- (dash) denotes that a chemical is not classifiable for any of the PBT categories.*
(a) Rounded to two significant figures.
(b) Classification in accordance with criteria from the 'Chemical risk assessment guidance: for chemicals associated with coal seam gas extraction' (DoEE, 2017). Toxicity ratings are as listed in the DoEE guidance document and in descending toxicity: vT = very toxic, T = toxic, H = harmful.
(c) Hazard ratings for aquatic ecological receptors (also termed 'environmental') as described in Section 5.2.
(d) Hazard ratings for human receptors as described in Section 5.2.

5.3 Persistent, Bioaccumulative and Toxic Assessment

If the chemical is classified as persistent, bioaccumulative and toxic (i.e. meeting the criteria for all three categories), then it is considered a 'PBT chemical' (DoEE, 2017). The use of such chemicals for the proposed activity would likely require additional regulation and management. Based on the PBT assessments completed for this HHERA (refer Table 5-3), none of the evaluated chemicals were considered a PBT chemical.

5.4 Chemical Mixtures and Compounds Formed During Proposed Activity

The strata stimulation fluid mixture is a saline solution with inert materials, and the remaining balance of the fluid comprises relatively low concentrations of organic chemicals. The stimulation fluid predominantly consists of proppants (the solid insoluble inert materials) with the next highest concentrations being due to the inorganic chemicals that then dissociate and exist in simple ionic forms. During the proposed activity, the cross-linked fluid system forms sufficient viscosity to deliver the proppant into the fractures, then the chemical breaker is used to split the gel and reduce the viscosity to enable flowback. Effects on the stimulation fluid following the breaking process can be described as follows:

- The majority of the fluid's components (the proppants) will remain unchanged as they are intended to remain in-situ in a stable and inert form;
- Many of the inorganic chemicals listed in the fluid will have already ionised into their component parts (e.g. potassium, hydroxide, chloride) upon mixing into the stimulation fluid. Many of these simple ions already exist naturally in aquifers and hydrostratigraphic layers in Queensland and across the world and are not likely to form extremely toxic organic molecules under environmentally relevant conditions. Like most reactions in the environment, these basic ionic components are likely to form other inorganic precipitates at extremely low concentrations in solution or stay in solution in its unreacted and ionised form; and
- The remaining low concentrations of organic molecules such as the ethoxylated alcohol group of chemicals (CAS RN 78330-21-9, 68551-12-2, 26183-52-8, 61791-26-2) will break down into smaller less reactive component parts than the parent compounds assessed herein.

While it is not possible to accurately predict the chemicals that will result from the proposed activity, it is considered unlikely that the concentrations of component parts in the flowback would be more hazardous than the original stimulation fluid.

5.5 Aromatic Hydrocarbons in Stimulation Fluids

Each key component that goes into the stimulation fluid, including the source water (Surat Bore sample), was analysed for key aromatic hydrocarbons of concern – PAHs and BTEX. Analytical results provided by AGL are provided in Appendix D.

5.5.1 Polycyclic Aromatic Hydrocarbons

Reported total PAH concentrations from the proposed strata stimulation fluid chemical products and the Surat Bore sample were below the laboratory limits of reporting (LORs). The LORs were <0.005 µg/L in most cases for the stimulation fluid chemical products, apart from two samples requiring further dilution prior to analysis. The diluted samples were analysed at an LOR of <0.012 µg/L. For the source water sample from Surat Bore, the LORs were <0.5 to <1 µg/L. No detectable PAHs were reported in the Surat Bore sample.

In relation to hydrotreated light petroleum distillates, external analytical studies have found that the level of PAHs in this chemical mixture is quite low at less than 0.01% (API, 2020; NICNAS, 2019b).

This is supported by the recent analytical results provided by AGL, which indicate that PAH concentrations in the proposed strata stimulation chemical products containing light petroleum distillates are less than the laboratory limit of reporting (<0.005 µg/L to <0.012 µg/L).

Based on the above, the hazard related to PAH compounds is low.

5.5.2 Benzene, Toluene, Ethylbenzene, Xylenes

In Queensland, BTEX is strictly regulated and must not be used in stimulation fluids as it is prohibited by the legislation (State of Queensland, 2010). This is interpreted to be non-detectable BTEX concentrations and are below the levels of available standard laboratory LORs.

Reported BTEX concentrations from the proposed strata stimulation fluid chemical products and the source water were below the laboratory LORs (ranging from <1 µg/L specific to benzene and <2 µg/L to <5 µg/L for TEX).

The laboratory LORs used in these analyses were also below the most conservative of available national health-based regulatory thresholds for the protection of drinking water for humans (NHMRC, 2011) and ecosystems for aquatic ecological receptors (ANZG, 2018) as follows:

- Benzene 1 µg/L (NHMRC, 2011);
- Toluene 180 µg/L (95% species protection level; ANZG, 2018);
- Ethylbenzene 80 µg/L (95% species protection level; ANZG, 2018); and
- Total xylenes 75 µg/L (95% species protection level for lowest guideline value of xylene isomers; ANZG, 2018).

Based on the above, the hazard related to BTEX compounds is low.

5.6 Hazard Assessment Conclusions

Based on the findings of this hazard assessment, the overall composition of the strata stimulation fluid is generally considered a:

- **Low to medium human health hazard.** Some individual constituents may be considered a high health hazard on the basis of reported adverse health effects. However, due to the relatively low concentrations of the higher hazard constituents (i.e. ethoxylated alcohol concentrations ranging from 1 mg/L to 160 mg/L) and the existing nature of the stimulation fluid itself (e.g. automatically wetting the dry solids such as crystalline silica, corundum and mullite), the overall stimulation fluid would likely be less hazardous to humans than the highest human hazard ratings identified herein; and
- **Based on toxicity to the aquatic environment, chemicals in the stimulation fluid overall reflects a higher environmental hazard as based on the parent compounds.** It is arguable that the act of completing the proposed activity will effectively decrease the overall environmental hazard of the evaluated stimulation fluid composition. The organic chemicals of higher ecological concern in this fluid composition are those belonging to the ethoxylated alcohol group (CAS RN 78330-21-9, 68551-12-2 and 26183-52-8). For ethoxylated alcohols, ecotoxicity to sensitive aquatic invertebrates and fish generally decrease as carbon chain length decreases (HERA, 2009). Therefore, the act of completing the proposed activity will break down many of the organic chemicals in the fluid mixture, and aid in decreasing the reported environmental hazard profile of this fluid mixture.

The above conclusions do not apply to undiluted chemical products that might be accidentally spilled at the surface during mixing at the wellsite. Although accidental spills of undiluted chemicals at the wellsite is considered unlikely, safety mitigation measures are suggested to be in place as a matter of priority regardless. High-level safety mitigation measures are suggested in Section 2.5, alongside additional mitigation measures referenced in AGL's SSMP (2023b).

6. RISK CHARACTERISATION

Based on the findings on the sources, pathways, receptors and identified hazard rankings to humans and aquatic ecological receptors, risks have been characterised and summarised within Table 6-1.

6.1 Hydrogeological Risks

6.1.1 Impacts to Landholder Bores

The assessment of the potential for sub-surface pathways to pre-exist or be created during the proposed activity is presented in Section 4.2.2. It is concluded that none of these pathways are viable, and therefore there is no significant risk that chemicals from the stimulation fluid could reach Norkham 1 which is the nearest known water supply bore at over 2 km away from the well that is proposed to be strata stimulated (WN1).

6.1.2 Impacts to Surface Water Receptors

Surface water receptors have been identified (refer Section 3.5); however, given the safety mitigation measures in place (refer Section 2.5 and Section 5.6), there is no viable pathway from the proposed activities to downstream sensitive ecosystems.

6.1.3 Impacts to Cultural and Spiritual Values of Surface Water and Groundwater

There is no viable pathway from the proposed activities to these downstream sensitive surface water receptors and no identifiable connectivity from the deep strata stimulation to the GAB groundwater-bearing units. Therefore, cultural and spiritual values would not be adversely impacted from the proposed activities.

6.1.4 Risks from Chemicals Remaining in Target Formation

It is predicted that up to 40% of the fluid from the proposed activity may remain in the Target Formation. The assessment presented in Section 4.2.2 concludes that there is a very low probability that chemicals would be able to migrate outside the Target Formation or migrate within the Target Formation. The Target Formation is not considered a beneficial aquifer in the area of WN1, and it does not feed nearby surface waters. Risks from chemicals remaining in the Target Formation are therefore considered very low.

6.2 Overall Commentary on Potential Impacts from Proposed Activities

Based on the results of this HHERA, it is considered that no significant human health or environmental impacts are likely to result from the proposed activity. The well construction (completed in accordance with the Queensland CoP), the depth of the Target Formation and the basin restrictive geology (e.g. the coal members) prevent potential sub-surface migration of chemicals from the proposed activity.

Controls on risks from surface spillage of raw material chemicals, strata stimulation fluids and flowback fluids are established and maintained by implementation of AGL’s environmental and health and safety management procedures.

Table 6-1. Risk Characterisation

Source	Pathway	Receptor	Link? (Y/N)	Discussion
Raw material chemicals	Spillage to ground	Resident landholder or agricultural workers at wellhead Terrestrial ecological and stock	N	Potential risks present under accident or emergency conditions only: requires management via environmental management procedures. Under normal operating conditions there should be no significant risk.
Stimulation fluids prior to injection	Direct contact with water prior to injection	Resident landholder or agricultural workers at wellhead	N	Direct contact with the injection fluid is not possible under normal operations as chemicals are added in the mixing trucks immediately prior to injection in the well. Although an accidental release is possible, it is highly unlikely. Additionally, safety risks from a failure of pressurised equipment are significant, and operating procedures exclude personnel from the vicinity during pressurised operations. There will be no access to the wellsite for the landholder and agricultural workers during the proposed activity.
	Spillage to ground	Ecological receptors, stock, resident landholder and agricultural workforce	N	Under normal operating conditions there is no risk. As above, accidental release is considered highly unlikely. Should a release occur, AGL's Environmental Management Plan and Emergency Response Plan require that any spillage would be contained and impacted soils remediated. There are no surface waters sufficiently close to the wellsite to be potentially affected by a spillage.
Water in the Subsurface	Migration via existing continuity between formation waters and adjacent aquifers	Human health (groundwater users) Ecological (livestock and irrigation)	N	This pathway is not considered to be viable, and therefore no exposure is possible.
	Migration via fractures generated allowing continuity between the Target Formation and adjacent aquifers	Human health (groundwater users) Ecological (livestock and irrigation)	N	
	Migration via the outside of the drilled well should the seals between horizons prove to be incomplete or weakened during stimulation	Human health (groundwater users) Ecological (livestock and irrigation)	N	Proper well construction in accordance with the CoP minimizes this potential pathway, and well casing failure is a rare occurrence. Failure of the well head during proposed activity operations would initiate an emergency stop of fluid injection. Thus, limited stimulation fluid is anticipated to be released in this event. Mitigation measures for well head or seal failure are within the management procedures undertaken during the operations of the proposed activity
Flowback water at the surface	Direct contact with flowback waters	Ecological receptors, stock, resident landholder and agricultural workforce	N	Flowback waters will be contained at the wellsite in closed tanks. There is no access to the wellsite for the landholder and agricultural workforce, or for stock.
	Discharge of flowback waters to surface water or ground	Ecological receptors, stock, resident landholder and agricultural workforce	N	Potential risks present under accident or emergency conditions only: requires management via environmental management procedures. Under normal operating conditions there should be no significant risk.

7. CONCLUSIONS

A HHERA for the strata stimulation fluid proposed for use at well WN1 in AGL's Churchie Field, Surat, Queensland was completed. The chemical composition of the stimulation fluid was provided by AGL's strata stimulation subcontractor, Condor Energy. This HHERA considered:

- Human and ecological receptors that could potentially be impacted by the chemicals proposed for use;
- The potential human and environmental hazards of the chemical constituents in the stimulation fluid; and
- In the event of spillage, viability of potential exposure and migration pathways were also considered.

This HHERA report is designed to be read in combination with AGL's Strata Stimulation Management Plan (SSMP) (AGL 2023b) for the stimulation of WN1. It is noted that this HHERA does not include a health and safety risk assessment for workplace exposures during the proposed activity. This aspect is dealt with elsewhere within AGL procedures.

The findings of this HHERA indicates that the stimulation fluid presents a:

- Low to medium human health hazard. Some individual constituents may be considered a high health hazard on the basis of reported adverse health effects. However, due to the relatively low concentrations (i.e. ethoxylated alcohol concentrations ranging from 1 mg/L to 160 mg/L) and the existing nature of the stimulation fluid itself (e.g. automatically wetting the dry solids such as crystalline silica, corundum and mullite), the overall stimulation fluid would likely be less hazardous to humans than the highest human hazard ratings identified herein; and
- Based on toxicity to the aquatic environment, and the physico-chemical properties of the parent chemicals in the stimulation fluid overall reflects a higher environmental hazard than compared to identified human hazards. It is arguable that the act of completing the proposed activity will effectively decrease the overall environmental hazard of the evaluated stimulation fluid composition. The organic chemicals of higher ecological concern in this fluid composition are those belonging to the ethoxylated alcohol group. For ethoxylated alcohols, ecotoxicity to sensitive aquatic invertebrates and fish generally decrease as carbon chain length decreases (HERA, 2009). Therefore, the act of completing the proposed activity will break down many of the organic chemicals in the fluid mixture, and aid in decreasing the reported environmental hazard profile of this fluid mixture.

The above conclusions do not apply to undiluted chemical products that might be accidentally spilled at the surface during mixing at the wellsite. Although accidental spills of undiluted chemicals at the wellsite is considered unlikely, safety mitigation measures are suggested to be in place as a matter of priority regardless. High-level safety mitigation measures are suggested in Section 2.5, alongside additional mitigation measures referenced in AGL's SSMP (2023b). It is suggested that mixing of the strata stimulation fluid occurs off-site and only diluted mixtures are transported to the wellsite.

Findings of this HHERA indicates that the possible risks posed by the proposed activities are as follows:

- There is no significant risk that stimulation fluid chemicals from the proposed activity could reach the nearest known water supply bore (Norkham 1) at over 2 km away from the Project Area (WN1);
- Given the safety mitigation measures in place at the surface, there is no viable pathway from proposed activities conducted at surface to downstream sensitive surface water ecosystems;

- There are no viable pathways from the proposed activities to downstream sensitive surface water receptors and there is no identifiable connectivity from the deep proposed activities to the shallow GAB groundwater-bearing units. Therefore, cultural and spiritual values would not be adversely impacted from the proposed activities; and
- It is predicted that up to 40% of the stimulation fluid may remain in the Target Formation. It is concluded that there is a very low probability that chemicals would be able to migrate outside the Target Formation or migrate within the Target Formation. The Target Formation is not considered a beneficial aquifer in the area of WN1, and it does not feed nearby surface waters. Risks to the environment and other environmental values from chemicals remaining in the Target Formation are therefore likely to be very low.

No critical risks to human and ecological receptors were identified in this HHERA. This is supported by the following lines of evidence:

- None of the chemicals were considered a PBT chemical;
- The proposed stimulation fluid does not contain BTEX and PAH compounds, and these are not considered likely to be generated during the proposed activity;
- The nearest human receptors are the landholders and agricultural workers at the wellsite, and the residents and workforce of the property where the nearest groundwater extraction well is in use;
- The ecological receptors are terrestrial ecology and stock at the wellsite, and terrestrial and aquatic ecology and stock at the landholder properties with groundwater bores with abstractive uses confirmed by the landholders;
- There are no surface water receptors close enough to WN1 to be potentially exposed to chemicals formulated from the proposed activity. This is especially considered in the context that safety mitigation measures in place at the surface to mitigate potential hazards from accidental surface spills of undiluted and diluted forms of the chemicals proposed to be used in the proposed activity;
- A subsurface migration pathway to overlying or underlying aquifers is not considered viable because:
  - The Target Formation (Upper Tinowon Sandstone) is at a total depth of 2,187 m;
  - There are no underlying aquifers because the lowest Target Formation is underlain by basement rocks;
  - The vertical distance from the Target Formation (Upper Tinowon Sandstone) to the base of the closest overlying aquifer (Boxvale Formation) is >400 m;
  - The estimated fracture is up to 1,000 m horizontally; however, the effective fracture was modelled to up to 300 m horizontally away from the stimulated well;
  - The permeability of the formations outside the fractures is extremely low, and the Target Formation is overlain by low permeability strata. Movement of groundwater and chemicals would be very slow through these layers;
  - The proposed activity has been designed such that fractures are contained within the Target Formation. There is no benefit to fracturing a wider area as fractures outside the Target Formation do not contribute to production. Due to the presence of siltstone and interbedded coal units immediately above the perforated zones, very little vertical fracture growth outside the immediate Target Formation is expected. Vertical fractures also will not grow beyond the bounding Winnathoola and Tinowon Coal Members. Therefore, there will be negligible vertical growth of the fracture above the uppermost perforation during proposed activities (Figure 2-3). This conclusion is supported by multiple gas field-specific lines of evidence, as follows:

  - The current job-specific simulation for the proposed activity by Condor Energy (showing no growth of fracture above the upper most perforations due to bounding stratigraphy as discussed in Section 2.3);
  - Third-party reviews of gas field geomechanics by Schlumberger (2019), which indicated that there are streaks of high stress within the interburden that can act as choke points or stress barriers in addition to the coal layers;
  - Radioactively traced testing and modelling (a technique no longer in use in Australia) of fracture geometry behind the casing and identification of containment at the coal layers by GMI Geomechanics (2013);
  - The consideration that if the assumptions of the modelling simulations were incorrect, there is still little risk for extreme vertical growth of the fractures. The stratigraphic column shown in the simulation (Figure 2-3) indicates that the next high contrast choke point coal seam is at 2141 m (the Winnathoola Coal Member) and therefore the fracture height could not penetrate above this point;
- The probability of well casing failure leading to stimulation fluids coming into direct contact with overlying aquifers is very low. The well completion is designed to the requirements of the QLD CoP to protect the well casing and withstand stimulation pressures, and there are controls in place to detect and manage a failure in the unlikely event that it occurred; and

- AGL and Condor Energy will conduct the proposed activity in accordance with AGL's Environmental Management Plan. This includes providing sufficient control measures at the project site to prevent loss of containment of hazardous substances and flowback fluids, and appropriate vehicle migration paths that do not impede on any sensitive terrestrial ecological receptors. Emergency events will be managed in accordance with AGL's Emergency Response Plan.

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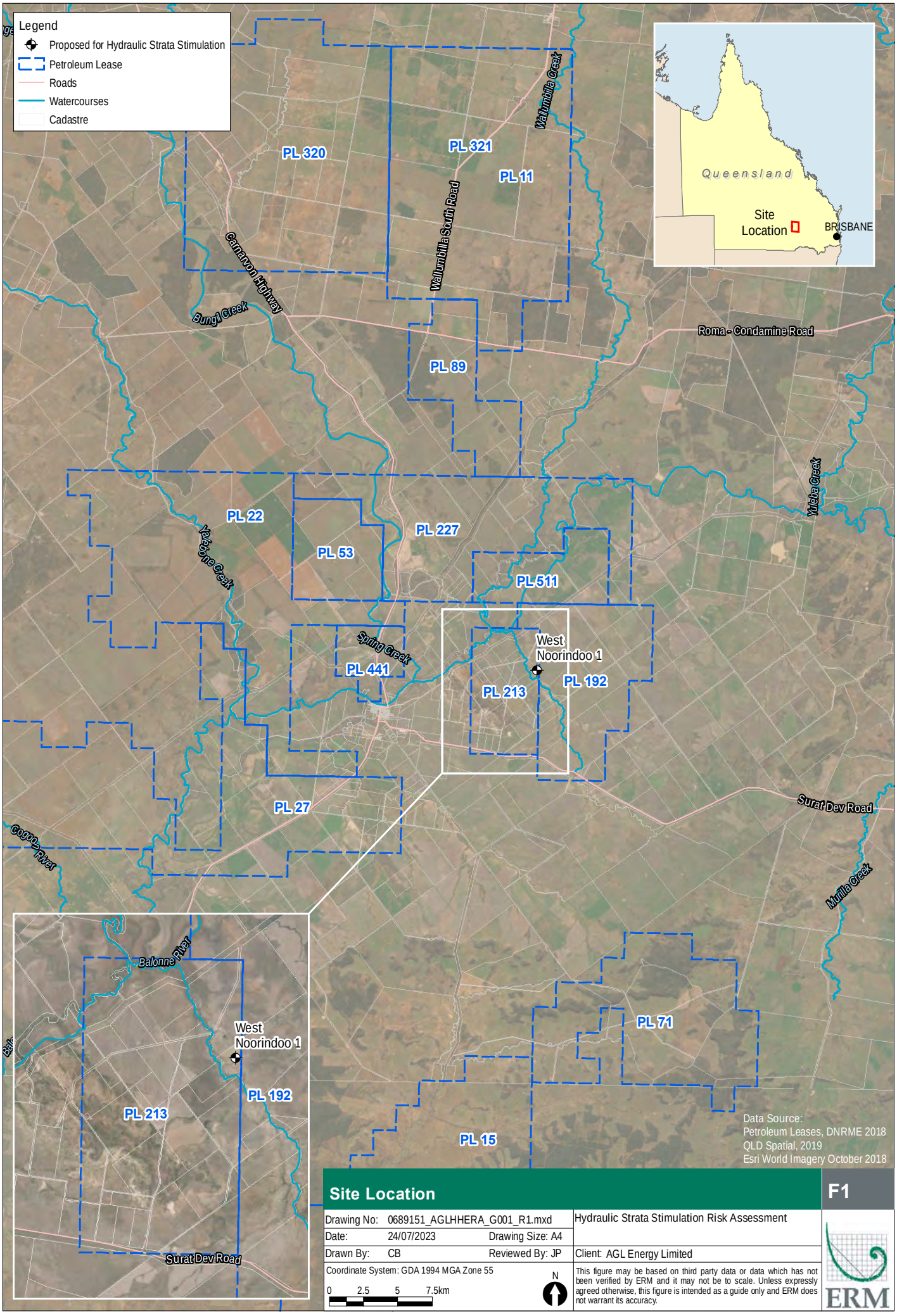
FIGURES



Site Location

F1

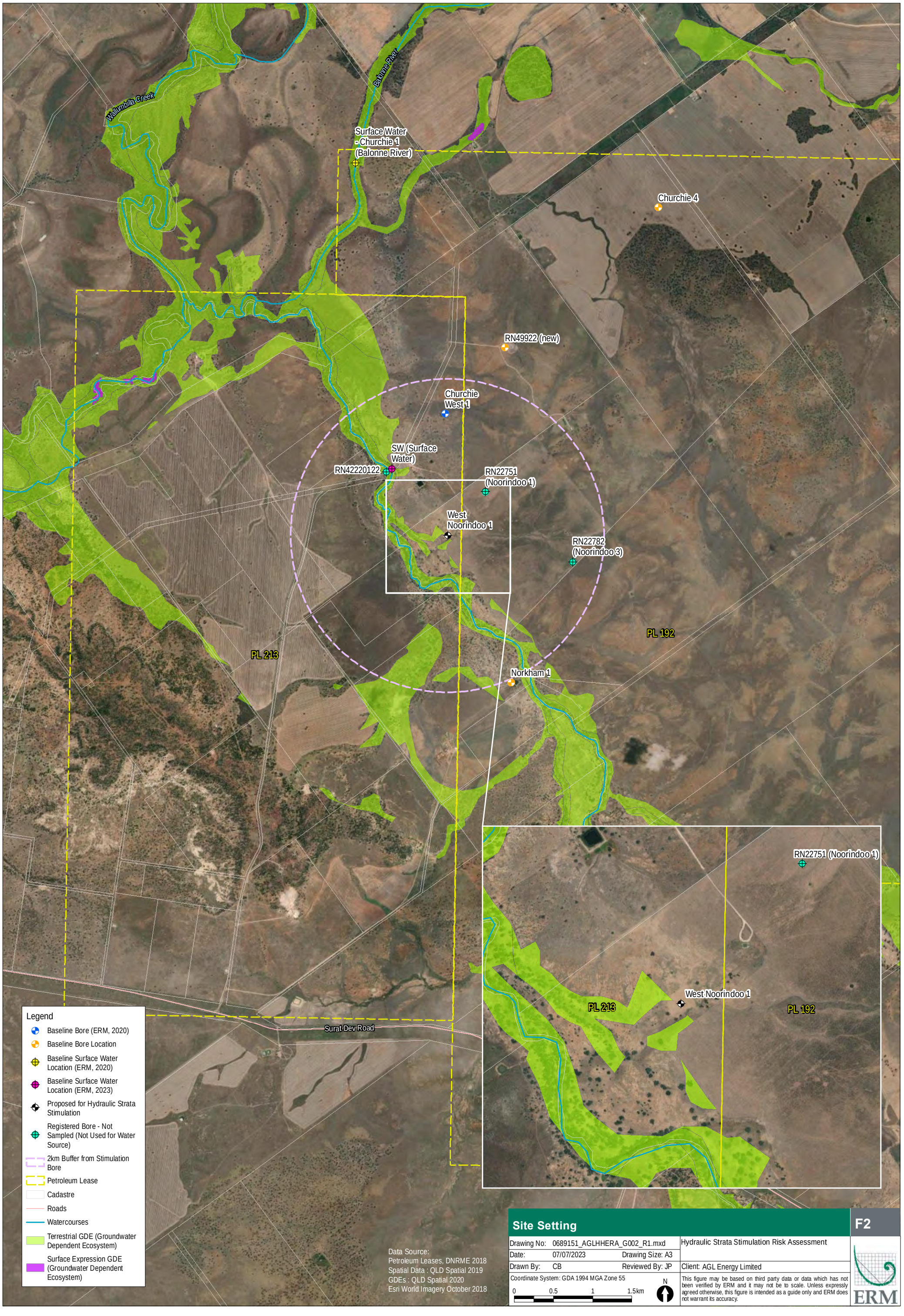
Drawing No:	0689151_AGLHHERA_G001_R1.mxd		Hydraulic Strata Stimulation Risk Assessment
Date:	24/07/2023	Drawing Size: A4	
Drawn By:	CB	Reviewed By: JP	Client: AGL Energy Limited

Coordinate System: GDA 1994 MGA Zone 55

0 2.5 5 7.5km

N

ERM



Site Setting

F2

Drawing No:	0689151_AGLHHERA_G002_R1.mxd		Hydraulic Strata Stimulation Risk Assessment
Date:	07/07/2023	Drawing Size: A3	
Drawn By:	CB	Reviewed By: JP	Client: AGL Energy Limited

Coordinate System: GDA 1994 MGA Zone 55

0 0.5 1 1.5km

N

ERM

APPENDIX A BORE REPORTS

WELL PROGNOSIS SUMMARY SHEET

WELL	West Noorindo-1		GEOLOGY	Updip target of Noorindoo-1 of a four way dip closed structute	
WELL TYPE	Vertical				
OPERATOR	AGL Energy Ltd		GEOPHYSICS	SP 535 on Line 85-B33	
PARTICIPANTS	AGL Energy Ltd	100.00%			
			TARGET ZONES	Primary Target - Tinowon SST Secondary Target - Boxvale SST and Showgrounds SST	
BASIN	Surat Basin				
BLOCK/LICENCE	PL 213				
STATE	QLD				
LOCATION	27° 07' 33.35"S	*Lattitude*	REMARKS	Maximum of 3 deg deviation at 2083m KB.	
	149° 10' 58.04"E	*Longitude*			
MGA 94 (Zone 55)	716354.954	*X (m)*			
	6997737.07	*Y (m)*			
ELEVATION (m AHD)	244.82 (GL) 250.32 (KB)		CASING PROGRAM		
TD (m MD)	2282 (driller)		CASING SIZE	SHOE DEPTH (m MD)	TYPE
RIG	Century Rig#1		9.625"	285.60	Surface
SPUD DATE	9 April 1998		5.5"	2267.25	Production
RIG RELEASE DATE	23 April 1998				
COMPLETIONS DATE	29 April 1998		WELL STATUS	Shut-in	

DRILLING PROGRAM

BIT NO	SIZE	DEPTH (m MD)	PROGNOSED FORMATION	Make
1	12.25"	288.00	Wallumbilla Formation	Smith L1I7
2	8.5"	2882.00	Timbury Hills	Varel ETD417M

GEOPHYSICAL LOGGING PROGRAM

RUN NO	RUN NAME	LOG TYPE	INTERVAL (m MD)
1	Sonic-Resistivity	DLL-MSFL-BCS-SP-GR-CAL	2281.4 - 285.6
2	Neutron-Density	PDS-CNS-GR-Cal	2281.4 - 1595
3	Cement Bond Log	CBL-VDL-GR-CCL	2243.6 - Surface

INDICATIVE WELL TESTING PROGRAM

TEST NO	TEST TYPE	CONFIGURATION On Penetration / Straddle	INTERVAL (m MD)		
			From	To	Thickness (m)
1	DST	Straddle	2186.30	2200.00	13.70

GEOLOGICAL PROGNOSIS

	AGE	FORMATION / MEMBER	TOP DEPTH (m MD)	TOP DEPTH (m TVD)	TVD Subsea (m SS)
	Early Cretaceous	Wallumbilla Formation	0.00	0.00	250.3
		Bungil Formation	420.07	420.03	-169.7
		Mooga Sandstone	560.75	560.69	-310.4
	Late Jurassic	Orallo Formation	705.80	705.60	-455.3
		Gubberamunda Sandstone	883.41	883.33	-633.0
		Westborne Formation	1015.97	1015.89	-765.6
		Springbok Sandstone	1115.46	1115.37	-865.1
	Middle Jurassic	Walloon Coal Measures	1172.30	1172.21	-921.9
		Hutton Sandstone	1435.02	1434.89	-1184.6
	Early Jurassic	Evergreen Formation	1647.78	1647.61	-1397.3
		Boxvale Formation	1691.93	1691.74	-1441.4
BOWEN BASIN	Middle-Late Triassic	Moolayember Formation	1764.29	1764.08	-1513.8
	Middle Triassic	Snake Creek Mudstone	1956.85	1956.54	-1706.2
		Showgrounds Sandstone	1971.95	1971.63	-1721.3
	Early Triassic	Rewan Formation	1987.09	1986.75	-1736.4
	Late Permian	Bandanna Formation	2060.64	2060.24	-1809.9
		Black Alley Shale	2128.21	2127.76	-1877.4
		Winnathoola Coal Member	2141.14	2140.68	-1890.4
		Tinowon Formation	2154.76	2154.29	-1904.0
		Tinowon Siltstone	2154.76	2154.29	-1904.0
		Upper Tinowon Sandstone	2186.65	2186.15	-1935.8
		Tinowon Coal Member	2201.92	2201.42	-1951.1
		Lower Tinowon Sandstone	2214.04	2213.52	-1963.2
		Wallabella Coal Member	2219.86	2219.34	-1969.0
		Wallabella Sandstone	2243.88	2243.34	-1993.0
	Basement	Timbury Hills Formation	2248.67	2248.13	-1997.8
		Total Depth	**2282.00**	**2282.00**	**-2031.7**

WELL PROGNOSIS SUMMARY SHEET

WELL	Norkam-1		**GEOLOGY**	Appraisal well of the Noorindoo gas field utilising underbalanced drilling	
WELL TYPE	Vertical				
OPERATOR	AGL Energy Ltd		**GEOPHYSICS**	SP 247 on line MY00-11	
PARTICIPANTS	AGL Energy Ltd	100.00%	**TARGET ZONES**	Primary Target - Tinowon SST Secondary Target - Rewan	
BASIN	Surat Basin				
BLOCK/LICENCE	PL 192		**REMARKS**	Drilled underbalanced with nitrogen across Tinowon Formation (2170 m RT to TD). No gas to surface, Upper Tinowon absent	
STATE	QLD				
LOCATION	27° 08' 29.472"S	*Lattitude*			
	149° 11' 25.548"E	*Longitude*			
MGA 94 (Zone 55)	717082.301	*X (m)*			
	6995996.372	*Y (m)*			
ELEVATION (m AHD)	246.94 (GL), 251.99 (KB)		**CASING PROGRAM**		
TD (m MD)	2220.0 (driller), 2221.5 (logger)		CASING SIZE	SHOE DEPTH (m MD)	TYPE
RIG	Century Rig#1		9.625"	232.07	K-55
SPUD DATE	19 August 2002		7.0"	2167.00	K-55
RIG RELEASE DATE	2 September 2002				
COMPLETIONS DATE	3 September 2002		**WELL STATUS**	Suspended	

DRILLING PROGRAM

BIT NO	SIZE	DEPTH (m MD)	PROGNOSED FORMATION	Make
1	12.25"	234.00		Smith
2	8.5"	1752.00		Hycalog
3	8.5"	2168.00		Reed
4	6.125"	2220.00		Varel

GEOPHYSICAL LOGGING PROGRAM

RUN NO	RUN NAME	LOG TYPE	INTERVAL (m MD)
1	Quad Combo	HLLD-HLLS-GR-SP-HCAL-Sonic	2152.0 - 232.1
1	Denisty Neutron	MCFL-TNPH-RHOX-PEFZ	2152.0 - 306.5
2		HALS-BHC-SP-GR	2219.0 - 2095.2

INDICATIVE WELL TESTING PROGRAM

TEST NO	TEST TYPE	CONFIGURATION On Penetration / Straddle	INTERVAL (m MD)		
			From	To	Thickness (m)
NIL					

GEOLOGICAL PROGNOSIS

	AGE	FORMATION / MEMBER	TOP DEPTH (m MD)	TOP DEPTH (m TVD)	TVD Subsea (m SS)
	Early Cretaceous	Wallumbilla Formation	5.05	5.05	246.94
		Bungil Formation	416.05	416.02	-164.03
		Mooga Sandstone	560.28	560.23	-308.24
	Late Jurassic	Orallo Formation	701.02	700.92	-448.93
		Gubberamunda Sandstone	874.94	874.73	-622.74
		Westborne Formation	1006.40	1006.10	-754.11
		Springbok Sandstone	1116.17	1115.82	-863.83
	Middle Jurassic	Walloon Coal Measures	1200.39	1200.03	-948.04
		Hutton Sandstone	1421.92	1421.53	-1169.54
	Early Jurassic	Evergreen Formation	1642.11	1641.68	-1389.69
		Boxvale Formation	1686.23	1685.78	-1433.79
BOWEN BASIN	Middle-Late Triassic	Moolayember Formation	1753.23	1752.76	-1500.77
	Middle Triassic	Snake Creek Mudstone	1952.95	1952.41	-1700.42
		Showgrounds Sandstone	1969.30	1968.75	-1716.76
	Early Triassic	Rewan Formation	1974.91	1974.36	-1722.37
	Late Permian	Bandanna Formation	2058.33	2057.74	-1805.75
		Black Alley Shale	2123.34	2122.74	-1870.75
		Winnathoola Coal Member	2143.70	2143.09	-1891.10
		Tinowon Formation	2157.02	2156.40	-1904.41
		Tinowon Siltstone	2157.02	2156.40	-1904.41
		Upper Tinowon Sandstone	Absent	Absent	-
		Tinowon Coal Member	Absent	Absent	-
		Lower Tinowon Sandstone	2193.79	2193.00	-1941.01
		Wallabella Coal Member	2196.34	2195.54	-1943.55
		Wallabella Sandstone	Absent	Absent	-
		Total Depth	**2220.00**	**2220.00**	**-1968.01**

Water bore drilling log

GENERATE LOG ID

Authorisation details
Registered number _____ Development permit number 2105-22524 Works reference number 575697

Log ID # 99996729

SECTION A—LOCATION DETAILS

Name of landholder AGL Gas Storage Pty Ltd Phone No. _____
Postal address Locked Bag 3013, Australia Square, NSW Postcode 1215
Real property address Churchie, 960 River Road, Surat, QLD Postcode 4417
Real property description Lot 7 Plan E532 or Bore location GPS. Latitude 27 16' 15" S Longitude 149 11' 23" E Datum _____
Easting _____ Northing _____ Zone _____

SECTION B—BORE COMPLETION DETAILS

Date commenced 13/7/21
Date completed 22/7/21

SECTION C—DRILLING METHOD

☑ Rotary mud ☐ Cable tool
☐ Auger ☐ Rotary air
☐ Other _____

SECTION D—HOLE SIZE

Diameter (mm)	Location (metres) From	To
457	0	2
314	2	114.2
205	114.2	458

SECTION E—CASING DETAILS

Type (PVC, steel etc)	Size O.D. (mm)	Wall thickness (mm)	Location (metres) From	To
Steel	355.6	6.4	0	2
Steel	244.5	8.9	0	113.5
Steel	168.3	6.4	-.2	451.2
Steel	141.3	6.6	437.5	662.5

SECTION F—CENTRALISERS

Type	Location (metres) From	To
Steel	0	113.5
Steel	0	451

SECTION G—PERFORATIONS/ SLOTS/ SCREENS

Type	Size O.D. (mm)	Aperture (mm)	Location (metres) From	To
Slots	200	10	485.6	509.4
			521.4	545.2
			580.9	628
			640.5	652.5

SECTION H—CEMENTING/GRAVEL PACK/ANNULAR FILL DETAILS

Type & material size	Hole diameter (mm)	Casing diameter (mm O.D.)	Location (metres) From	To
Cement	457	355.6	0	2
Cement	314	244.5	0	113.5
Cement	205	168.3	-.2	451.2

SECTION I—BORE PURPOSE

☑ Domestic ☑ Stock ☐ Irrigation ☐ Commercial
☐ Urban ☐ Industrial Other (please specify) _____

SECTION J—PARTICULARS OF STRATA

From (metres)	To (metres)	Strata description (use more than one line if required)	Water bed thus(*)
0	1.5	Top Soil	
1.5	24.5	Yellow Sandstone, Yellow/Grey Clay	
24.5	26	Grey Mudstone	
26	27	Yellow Mudstone	
27	120	Grey Mudstone	
120	210	Grey/Green Mudstone	
210	237	Grey Muddy Sandstone	*
237	260	Brown Mudstone, Grey Sandstone	
260	415	Grey Mudstone	
415	453	Grey Sandstone	*
453	495	Grey Brown mudstone	
495	500	Sandstone Small Coal	*
500	526	Grey mudstone	
526	540	Muddy sandstone .sandstone	*
540	587	Grey .Brown mudstone	
587	589	Limestone	
589	620	Sandstone, Muddy Sandstone	*
620	643	Brown Grey mudstone	
643	652	Medium White Sandstone	*
652	662.5	Brown Grey mudstone	

SECTION K—WATER BEARING BEDS

Depth struck (metres)	Water rose to (metres)	Supply (litres/second)	Quality (e.g. potable, brackish, salty)
495	flow		
589	flow		
643	flow	1.5	potable

Conductivity (µS/cm) 1660 pH 8.5

SECTION L—SUB ARTESIAN BORE ON COMPLETION

Depth to standing water level from ground level (metres)
Depth to pump suction or bottom of drill stem (metres)
Type of test used ☐ Air ☐ Bail ☑ Pump
Estimated supply (litres/second)
Duration of test (hours)
Drawdown level from surface (metres)

SECTION M—ARTESIAN BORE ON COMPLETION

Shut-in pressure 138 (kPa)
Free flow 1.5 (litres/second)
Temperature +- 48 (°C)

SECTION N—REMARKS

5 9/16" Left Hand PW Double Start Box. Sharpe Serial No: 20175
Johnson - J116.
Air Test - 4 L/s @ 56m

SECTION O—CERTIFICATION

I hereby certify that the bore is drilled and constructed according to the conditions of my driller's licence and the information provided is true and accurate.

Driller Daniel Johnson Driller's licence no. 3357
Trainee driller _____ Driller's licence no. _____
Signature of driller _____ Date 22/7/2021
Contractor _____

Bore Report

From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
49922	Artesian - Condition Unknown	Existing	22/07/2021	St. George	4860 - MARANOA REGIONAL

Details

Description	DRILL LOG 99996729		
Parish	6000 - NO LONGER USED		
Original Name			
Driller Name	JOHNSON, DANIEL		
Drill Company	JOHNSON DRILLING		
Const Method	ROTARY MUD		
Bore Line			
D/O File No	STG/515/222 (2103)	**Polygon**	
R/O File No		**Equipment**	
H/O File No		**RN of Bore Replaced**	
Log Received Date	18/08/2021	**Data Owner**	
Roles	Water Supply		

Location

Latitude	27-06-15	**Basin**	4222
Longitude	149-11-23	**Sub-area**	
GIS Latitude	-27.1043003438	**Lot**	7
GIS Longitude	149.1896485973	**Plan**	E532
Easting	717076		
Northing	7000121	**Map Scale**	
Zone	55	**Map Series**	
Accuracy		**Map No**	
GPS Accuracy		**Map Name**	
Checked	Yes	**Prog Section**	

Casing

13 ***records for RN*** **49922**

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	22/07/2021	1	0.00	2.00	Steel Casing	6.400	WT - Wall Thickness	356
A	22/07/2021	2	0.00	113.50	Steel Casing	8.900	WT - Wall Thickness	245
A	22/07/2021	3	-2.00	451.20	Steel Casing	6.400	WT - Wall Thickness	168
A	22/07/2021	4	437.50	662.50	Steel Casing	6.600	WT - Wall Thickness	141
A	22/07/2021	5	0.00	113.50	Centraliser			

Bore Report

From Year:

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	22/07/2021	6	0.00	451.00	Centraliser			
A	22/07/2021	7	485.60	509.40	Perforated or Slotted Casing	10.000	AP - Aperture Size	200
A	22/07/2021	8	521.40	545.20	Perforated or Slotted Casing	10.000	AP - Aperture Size	200
A	22/07/2021	9	580.90	628.00	Perforated or Slotted Casing	10.000	AP - Aperture Size	200
A	22/07/2021	10	640.50	652.50	Perforated or Slotted Casing	10.000	AP - Aperture Size	200
X	22/07/2021	11	0.00	2.00	Grout			457
X	22/07/2021	12	0.00	113.50	Grout			314
X	22/07/2021	13	-2.00	451.20	Grout			205

Strata Logs

20 ***records for RN*** **49922**

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	1.50	TOP SOIL
2	1.50	24.50	YELLOW SANDSTONE, YELLOW/GREY CLAY
3	24.50	26.00	GREY MUDSTONE
4	26.00	27.00	YELLOW MUDSTONE
5	27.00	120.00	GREY MUDSTONE
6	120.00	210.00	GREY/GREEN MUDSTONE
7	210.00	237.00	GREY MUDDY SANDSTONE *
8	237.00	260.00	BROWN MUDSTONE, GREY SANDSTONE
9	260.00	415.00	GREY MUDSTONE
10	415.00	453.00	GREY SANDSTONE *
11	453.00	495.00	GREY BROWN MUDSTONE
12	495.00	500.00	SANDSTONE, SMALL COAL *
13	500.00	526.00	GREY MUDSTONE

Bore Report

From Year:

Rec	Top (m)	Bottom (m)	Strata Description
14	526.00	540.00	MUDDY SANDSTONE , SANDSTONE *
15	540.00	587.00	GREY BROWN MUDSTONE
16	587.00	589.00	LIMESTONE
17	589.00	620.00	SANDSTONE, MUDDY SANDSTONE *
18	620.00	643.00	BROWN GREY MUDSTONE
19	643.00	652.00	MEDIUM WHITE SANDSTONE *
20	652.00	662.50	BROWN GREY MUDSTONE

Stratigraphies
0 *records for RN* **49922**

Aquifers
0 *records for RN* **49922**

Pump Tests Part 1
0 *records for RN* **49922**

Pump Tests Part 2
0 *records for RN* **49922**

Bore Conditions
0 *records for RN* **49922**

Elevations
0 *records for RN* **49922**

Water Analysis Part 1
0 *records for RN* **49922**

Water Analysis Part 2
0 *records for RN* **49922**

Water Levels
0 *records for RN* **49922**

Wire Line Logs
0 *records for RN* **49922**

Field Measurements
0 *records for RN* **49922**

Bore Report

From Year:

Special Water Analysis

0 *records for RN* **49922**

Bore Report

From Year:

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Bore Report

From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
123703	Artesian - Condition Unknown	Existing	04/10/2020	Roma	4860 - MARANOA REGIONAL

Details

Description			
Parish	6000 - NO LONGER USED		
Original Name			
Driller Name	JOHNSON, DANIEL		
Drill Company	D JOHNSON		
Const Method	ROTARY MUD		
Bore Line			
D/O File No	RA2378	**Polygon**	
R/O File No		**Equipment**	
H/O File No		**RN of Bore Replaced**	
Log Received Date	24/11/2020	**Data Owner**	
Roles	Town Water Supply		

Location

Latitude	27-09-33	**Basin**	4222
Longitude	149-04-11	**Sub-area**	
GIS Latitude	-27.15912926	**Lot**	
GIS Longitude	149.069861	**Plan**	
Easting	705098		
Northing	6994248	**Map Scale**	
Zone	55	**Map Series**	
Accuracy	GPS	**Map No**	
GPS Accuracy	10	**Map Name**	
Checked	Yes	**Prog Section**	

Casing

11 ***records for RN*** **123703**

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	04/10/2020	1	0.00	129.90	Steel Casing	9.500	WT - Wall Thickness	324
A	04/10/2020	2	0.00	153.00	Steel Casing	9.300	WT - Wall Thickness	273
A	04/10/2020	3	153.00	521.20	Steel Casing	8.200	WT - Wall Thickness	219
A	04/10/2020	4	510.80	700.00	Steel Casing	6.400	WT - Wall Thickness	168
A	04/10/2020	5	0.00	130.00	Centraliser			

Bore Report

From Year:

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	04/10/2020	6	0.00	521.20	Centraliser			
A	04/10/2020	7	523.50	547.00	Perforated or Slotted Casing	11.000	AP - Aperture Size	200
A	04/10/2020	8	654.00	690.00	Perforated or Slotted Casing	11.000	AP - Aperture Size	200
X	04/10/2020	9	0.00	129.90	Grout			375
X	04/10/2020	10	0.00	153.00	Grout			313
X	04/10/2020	11	153.00	521.20	Grout			251

Strata Logs

15 ***records for RN*** **123703**

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	1.70	TOPSOIL
2	1.70	23.00	YELLOW AND GREY CLAY
3	23.00	40.00	GREY MUDSTONE, GREEN SILTSTONE
4	40.00	80.00	GREY MUDSTONE, SANDSTONE
5	80.00	205.00	GREY MUDSTONE
6	205.00	215.00	GREY MUDSTONE
7	215.00	280.00	GREY MUDSTONE, GREEN SILTSTONE
8	280.00	404.80	DARK GREY MUDSTONE
9	404.80	408.00	FINE GREY SANDSTONE *
10	408.00	460.00	GREY MUDSTONE / SANDSTONE
11	460.00	521.00	COAL BROWN MUDSTONE, FINE SANDSTONE
12	521.00	532.00	SANDSTONE / MUDSTONE *
13	532.00	652.00	MUDSTONE / FINE SANDSTONE
14	652.00	682.00	SANDSTONE FINE TO COARSE *
15	682.00	700.70	BROWN / GREY MUDSTONE

Bore Report

From Year:

Stratigraphies

0 *records for RN* **123703**

Aquifers

1 *records for RN* **123703**

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	523.50	690.00	SDST - Sandstone	04/10/2020	10.00	Y	POTABLE	10.00	Y	SC	MOOGA SANDSTONE

Pump Tests Part 1

0 *records for RN* **123703**

Pump Tests Part 2

0 *records for RN* **123703**

Bore Conditions

0 *records for RN* **123703**

Elevations

0 *records for RN* **123703**

Water Analysis Part 1

0 *records for RN* **123703**

Water Analysis Part 2

0 *records for RN* **123703**

Water Levels

0 *records for RN* **123703**

Wire Line Logs

0 *records for RN* **123703**

Field Measurements

0 *records for RN* **123703**

Special Water Analysis

0 *records for RN* **123703**

Bore Report

From Year:

User Licence and Conditions

Bore Report

From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
42220122	Sub-Artesian Facility	Existing	15/09/2001	Roma	4860 - MARANOA REGIONAL

Details

Description			
Parish	6000 - NO LONGER USED		
Original Name			
Driller Name	A MILLER		
Drill Company	DNR		
Const Method	ROTARY AIR		
Bore Line			
D/O File No		**Polygon**	
R/O File No		**Equipment**	NE
H/O File No		**RN of Bore Replaced**	
Log Received Date		**Data Owner**	MDS
Roles			

Location

Latitude	27-07-08	**Basin**	4222
Longitude	149-10-29	**Sub-area**	
GIS Latitude	-27.11881822	**Lot**	21
GIS Longitude	149.17471512	**Plan**	USL45078
Easting	715568		
Northing	6998539	**Map Scale**	104 - 1: 100 000
Zone	55	**Map Series**	M - Metric Series
Accuracy	GPS	**Map No**	8743
GPS Accuracy	3	**Map Name**	SURAT
Checked	Yes	**Prog Section**	

Casing

7 ***records for RN*** **42220122**

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	15/09/2001	1	0.00	14.70	Polyvinyl Chloride	3.350	WT - Wall Thickness	61
A	15/09/2001	2	12.70	14.70	Perforated or Slotted Casing	1.600	AP - Aperture Size	61
X	15/09/2001	3	16.00	19.00	Gravel Pack			150
X	15/09/2001	4	15.00	16.00	Bentonite Seal			150
X	15/09/2001	5	4.00	15.00	Gravel Pack	5.000	GR - Gravel Size	150

Bore Report

From Year:

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
X	15/09/2001	6	3.00	4.00	Cuttings or other fill between casing and hole wall			150
X	15/09/2001	7	0.00	3.00	Grout			150

Strata Logs

10 ***records for RN*** **42220122**

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	1.00	LIGHT BROWN CLAYEY TOP SOIL
2	1.00	4.50	LIGHT BROWN SANDY CLAY
3	4.50	6.00	WHITE SLST PARTLY WEATHERED
4	6.00	9.50	LIGHT BROWN SEMI WEATHERED MDST
5	9.50	12.00	GREY CALACREOUS SLST SEMI WEATHERED
6	12.00	13.00	MOISTURE, GREY CALCAREOUS SLST
7			SEMI WEATHERED
8	13.00	17.00	PRODUCED WATER, GREY CALCAREOUS SLST
9			FRACTURED
10	17.00	19.00	GREY CALCAREOUS SLST

Stratigraphies

0 ***records for RN*** **42220122**

Aquifers

0 ***records for RN*** **42220122**

Pump Tests Part 1

0 ***records for RN*** **42220122**

Pump Tests Part 2

0 ***records for RN*** **42220122**

Bore Conditions

0 ***records for RN*** **42220122**

Elevations

0 ***records for RN*** **42220122**

Bore Report

From Year:

Water Analysis Part 1

1 *records for RN* 42220122

Pipe	Date	Rec	Analyst	Analysis No	Depth (m)	Meth	Src	Cond (uS/cm)	pH	Si (mg/L)	Total Ions (mg/L)	Total Solids (mg/L)	Hard	Alk	Fig. of Merit	SAR	RAH
A	09/10/2001	1	GCL	209412	15.33	AI	GB	1061	8.2	24	899.75	631.19	263	482	0.8	4.1	4.38

Water Analysis Part 2

1 *records for RN* 42220122

Pipe	Date	Rec	Na	K	Ca	Mg	Mn	HCO3	Fe	CO3	Cl	F	NO3	SO4	Zn	Al	B	Cu
A	09/10/2001	1	152.3	2.6	43.8	37.3	0.01	575.6	0.00	6.0	68.8	0.15	0.0	13.2	0.03	0.00	0.22	0.00

Water Levels

8 *records for RN* 42220122

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project		Quality
A	09/10/2001		-9.21	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	02/06/2004		-9.37	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	17/11/2005		-9.35	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	02/02/2006		-9.16	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	07/04/2006		-9.62	R	Reference Point		ACT	Actual	DG	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements
A	03/03/2014		-8.96	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	07/05/2014		-8.66	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130	Data is of unknown quality
A	16/09/2015		-8.95	R	Reference Point		ACT	Actual	DH	MA	Manual/Hand	GWAN	1	Good - Actual Manual Measurements

Wire Line Logs

0 *records for RN* 42220122

Field Measurements

2 *records for RN* 42220122

Pipe	Date	Depth (m)	Conduct (uS/cm)	pH	Temp (C)	NO3 (mg/L)	DO2 (mg/L)	Eh (mV)	Alkalinity (mV)	Samp	Method		Samp	Source
A	09/10/2001	15.33	1168							AI	Air Lifting		GB	Groundwater - from Bore

Bore Report

From Year:

Pipe	Date	Depth (m)	Conduct (uS/cm)	pH	Temp (C)	NO3 (mg/L)	DO2 (mg/L)	Eh (mV)	Alkalinity (mV)	Samp	Method	Samp	Source
A	03/03/2014	16.20	287	7.0						BA	Bailer - Other	GB	Groundwater - from Bore

Special Water Analysis

0 ***records for RN*** **42220122**

Bore Report

From Year:

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Bore Report

From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
22751	Artesian - Controlled Flow	Existing	26/10/1970	Roma	4860 - MARANOA REGIONAL

Details

Description	P2		
Parish	3593 - NOORINDOO		
Original Name	UOD NOORINDOO 1		
Driller Name			
Drill Company			
Const Method	ROTARY RIG		
Bore Line			
D/O File No		**Polygon**	
R/O File No		**Equipment**	NE
H/O File No	04522	**RN of Bore Replaced**	
Log Received Date		**Data Owner**	
Roles			

Location

Latitude	27-07-15	**Basin**	4222
Longitude	149-11-15	**Sub-area**	
GIS Latitude	-27.120928083	**Lot**	
GIS Longitude	149.187513501	**Plan**	
Easting	716834		
Northing	6998284	**Map Scale**	104 - 1: 100 000
Zone	55	**Map Series**	M - Metric Series
Accuracy		**Map No**	8743
GPS Accuracy		**Map Name**	SURAT
Checked	No	**Prog Section**	

Casing

0 ***records for RN*** **22751**

Strata Logs

1 ***records for RN*** **22751**

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	2286.90	NO STRATA RECORDS AVAILABLE

Stratigraphies

29 ***records for RN*** **22751**

Source	Rec	Top (m)	Bottom	Strata Description

Bore Report

From Year:

			(m)	
DME	1	3.60		GRIMAN CREEK FORMATION
DME	2			SURAT SILTSTONE
DME	3			WALLUMBILLA FORMATION
DME	4			COREENA MEMBER
DME	5	282.60	430.70	DONCASTER MEMBER
DME	6	430.70	539.50	BUNGIL FORMATION
DME	7	539.50	696.80	MOOGA SANDSTONE
DME	8	696.80	886.40	ORALLO FORMATION
DME	9	886.40	1005.20	GUBBERAMUNDA SANDSTONE
DME	10	1005.20	1492.90	INJUNE CREEK GROUP
DME	11	1005.20	1130.20	WESTBOURNE FORMATION
DME	12	1130.20	1207.60	SPRINGBOK SANDSTONE
DME	13	1207.60	1427.70	WALLOON COAL MEASURES
DME	14	1427.70	1492.90	EUROMBAH FORMATION
DME	15	1492.90	1649.00	HUTTON SANDSTONE
DME	16	1649.00	1753.50	EVERGREEN FORMATION
DME	17	1649.00	1693.00	EVERGREEN FORMATION
DME	18	1671.20		EVERGREEN FORMATION
DME	19	1692.90	1700.50	BOXVALE SANDSTONE MEMBER
DME	20	1700.50	1753.50	EVERGREEN FORMATION
DME	21	1753.50	1765.40	PRECIPICE SANDSTONE
DME	22	1765.40	1977.50	MOOLAYEMBER FORMATION
DME	23	1765.40	1962.00	MOOLAYEMBER FORMATION
DME	24	1962.00	1977.50	SNAKE CREEK MUDSTONE MEMBER
DME	25	1977.50	1991.90	SHOWGROUNDS SANDSTONE
DME	26	1991.90	2069.00	REWAN GROUP

Bore Report

From Year:

			(m)	
DME	27	2069.00	2136.70	BLACKWATER GROUP
DME	28	2136.70	2286.90	BACK CREEK GROUP
DME	29	2286.90		TIMBURY HILLS FORMATION

Aquifers

1 *records for RN* 22751

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	0.00									XX	NO UNIT IDENTIF

Pump Tests Part 1

0 *records for RN* 22751

Pump Tests Part 2

0 *records for RN* 22751

Bore Conditions

0 *records for RN* 22751

Elevations

1 *records for RN* 22751

Pipe	Date	Elevation (m)	Precision		Datum	Meas	Point	Survey Source
A	26/10/1970	277.20	BAR	Aneroid Barometer	STD - State Datum	N	Natural Surface	

Water Analysis Part 1

0 *records for RN* 22751

Water Analysis Part 2

0 *records for RN* 22751

Water Levels

0 *records for RN* 22751

Wire Line Logs

7 *records for RN* 22751

Date	Run	Type		Source	Top (m)	Bottom (m)	Operator	Comments
01/01/2100	1	BHC	Borehole Compensated Sonic	DME	235.60	2283.000		

Bore Report

From Year:

Date	Run	Type		Source	Top (m)	Bottom (m)	Operator	Comments
01/01/2100	1	GR	Gamma Ray	DME	235.60	2283.000		
01/01/2100	1	IEL	Induction Electric	DME	235.90	2286.600		
01/01/2100	1	SP	Spontaneous Potential	DME	235.90	2286.600		
01/01/2100	1	MLL	Microlaterlog	DME	1432.60	2286.000		
01/01/2100	1	NL	Neutron	DME	1859.30	2286.300		
01/01/2100	1	CDM	Continuous Dipmeter	DME	1859.30	2284.800		

Field Measurements

0 ***records for RN*** **22751**

Special Water Analysis

0 ***records for RN*** **22751**

Bore Report

From Year:

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WELL PROGNOSIS SUMMARY SHEET

WELL	Noorindoo-1		GEOLOGY	Flank of a structural nose to test sands of the Evergreen, Wandoan, Cabawin and Kianga Fm
WELL TYPE	Vertical (Exploration)		GEOPHYSICS	
OPERATOR	AGL Energy Ltd			
PARTICIPANTS	AGL Energy Ltd	100.00%	TARGET ZONES	Primary Target - Tinowon SST Secondary Target - Evergreem, Wandoan, Cabawin and Kianga Formations
BASIN	Surat Basin			
BLOCK/LICENCE	PL 192		REMARKS	Plug back Total depth to 2268.00m KB on 12/11/2001
STATE	QLD			
LOCATION	27° 19' 19.308"S	*Lattitude*		
	149° 11' 14.964"E	*Longitude*		
MGA 94 (Zone 55)	716828.47	*X (m)*		
	6998161.117	*Y (m)*		
ELEVATION (m AHD)	277.06 (GL), 280.72 (KB)			
TD (m MD)	2286.94 (driller), 2284.81 (logger)			
RIG	O.D.E IIdeal National 55			
SPUD DATE	15 September 1970			
RIG RELEASE DATE	26 October 1970			
COMPLETIONS DATE	26 October 1970		WELL STATUS	Suspended

CASING PROGRAM

CASING SIZE	SHOE DEPTH (m MD)	TYPE
9.625"	235.61	Surface
7.0"	2243.94	Production

DRILLING PROGRAM

BIT NO	SIZE	DEPTH (m MD)	PROGNOSED FORMATION	Make

GEOPHYSICAL LOGGING PROGRAM

RUN NO	RUN NAME	LOG TYPE	INTERVAL (m MD)

INDICATIVE WELL TESTING PROGRAM

TEST NO	TEST TYPE	CONFIGURATION On Penetration / Straddle	INTERVAL (m MD) From	To	Thickness (m)
1	DST	Off Bottom	2002.56	2019.32	16.76
2	DST	Off Bottom	2193.06	2212.27	19.21
3	DST	Off Bottom	2213.48	2220.80	7.32
4	DST	Off Bottom	2215.92	2231.16	15.24
5	DST	Cased Hole	2194.59	2205.25	10.66
6	DST	Cased Hole	2194.59	2205.25	10.66

GEOLOGICAL PROGNOSIS

	AGE	FORMATION / MEMBER	TOP DEPTH (m MD)	TOP DEPTH (m TVD)	TVD Subsea (m SS)
	Early Cretaceous	Wallumbilla Formation	3.66	3.66	277.06
		Bungil Formation	428.74	428.69	-147.97
		Mooga Sandstone	560.04	559.98	-279.26
	Late Jurassic	Orallo Formation	691.61	691.54	-410.82
		Gubberamunda Sandstone	885.80	885.72	-605.00
		Westborne Formation	1005.41	1005.32	-724.60
		Springbok Sandstone	1118.39	1118.30	-837.58
	Middle Jurassic	Walloon Coal Measures	1170.77	1170.67	-889.95
		Hutton Sandstone	1434.70	1434.57	-1153.85
	Early Jurassic	Evergreen Formation	1647.97	1647.79	-1367.07
		Boxvale Formation	1691.61	1691.42	-1410.70
BOWEN BASIN	Middle-Late Triassic	Moolayember Formation	1764.37	1764.16	-1483.44
	Middle Triassic	Snake Creek Mudstone	1960.18	1959.86	-1679.14
		Showgrounds Sandstone	1976.65	1976.33	-1695.61
	Early Triassic	Rewan Formation	1990.18	1989.84	-1709.12
	Late Permian	Bandanna Formation	2066.21	2065.81	-1785.09
		Black Alley Shale	2138.10	2137.53	-1856.81
		Winnathoola Coal Member	2150.23	2149.63	-1868.91
		Tinowon Formation	2163.38	2162.75	-1882.03
		Tinowon Siltstone	2163.38	2162.75	-1882.03
		Upper Tinowon Sandstone	2185.58	2184.88	-1904.16
		Tinowon Coal Member	2209.03	2208.26	-1927.54
		Lower Tinowon Sandstone	2215.09	2214.31	-1933.59
		Wallabella Coal Member	2232.96	2232.13	-1951.41
		Wallabella Sandstone	2255.84	2254.95	-1974.23
	Basement	Timbury Hills Formation	2262.73	2261.82	-1981.10
		Total Depth	**2286.94**	**2286.94**	**-2006.22**

Weatherford®

SECUREVIEW
ULTRAVIEW
1:200

COMPANY	AGL
WELL	NOORINDOO 1
FIELD	SURAT BASIN
PROVINCE/COUNTY	QUEENSLAND
COUNTRY/STATE	AUSTRALIA
LOCATION	PL 48

FIELD PRINT

Latitude	27° 07' 25" S
Longitude	149° 11' 11" E
UTM Easting	
UTM Northing	

Other Services

Permanent Datum M.S.L, Elevation 0.00 metres
Log Measured From DF, 280.72 metres above Permanent Datum
Drilling Measured From DF

Elevations:	metres
KB	
DF	280.72
GL	277.06

Date	3-OCT-2018	
Run Number	1	
Service Order	90404	
Type Log	INSPECTION	
Depth Driller	2215.00	metres
Depth Logger	2210.50	metres
Top Log Interval	0.00	metres
Bottom Log Interval	2210.50	metres
Hole Fluid Type	WATER + KCL	
Hole Fluid Level	0.00	metres
Restriction ID	6.360	inches
Max Recorded Temp		
Well Head Pressure		
Well Head Equipment		
Time Well Ready	0800/3	
Time Logger Bottom	1318/03	
Unit	13354	
Equipment Name	SECUREVIEW	
Base	ROMA	
Recorded By	O. SANTILLA	
Witnessed By	M. GREGORY	

PERFORATION RECORD

Shot Density	Number of Shots	Depth From metres	Depth To metres

Gun Type

Gun Size

CASING / TUBING RECORD

Size inches	Weight pounds/ft	Depth From metres	Depth To metres
9.625	36.00	0.00	235.61
7.000	23.00	0.00	2215.00

BOREHOLE RECORD

Last Edited: 03-OCT-2018 11:46

Bit Size inches	Depth From metres	Depth To metres
12.250	0.00	237.00
8.750	237.00	2284.78

CASING / TUBING RECORD

Type	Grade	TypeJoint	Size inches	Depth From metres	Shoe Depth metres	Weight pounds/ft
SURFACE	K-55		9.625	0.00	235.61	36.00
PRODUCTION	N-80		7.000	0.00	2215.00	23.00

REMARKS

DEPTH CORRELATED TO A SCHLUMBERGER OH BOREHOLE COMPENSATED SONIC LOG - 07-OCT-1970

SOFTWARE ISSUE: VERSION 18.03.9328 26 JULY 2018.

CUSTOMER SCALES AND INTERVALS LOGGED.

#CLIENT REQUESTED TO CANCEL JB GAUGE RUN AS THER DRIFT RUN DUE TO A PREVIOUS RUN DONE BY RIG WITH BIT SCRAPER.

Run 1: CBH - XOV - WCC - CCL - UGR - HBC - URS RAN IN COMBINATION.

FREE PIPE AMPLITUDE FOR 7 INCH CASING = 62 MILLIVOLTS.

THE 7 INCH PRODUCTION CASING USED IN THE WELL WERE TWO TYPES - 26 LBS/FT AND 23 LBS/FT. FREE PIPE CALIBRATION REMAINS THE SAME FOR BOTH CASINGS 62 MILLIVOLTS.

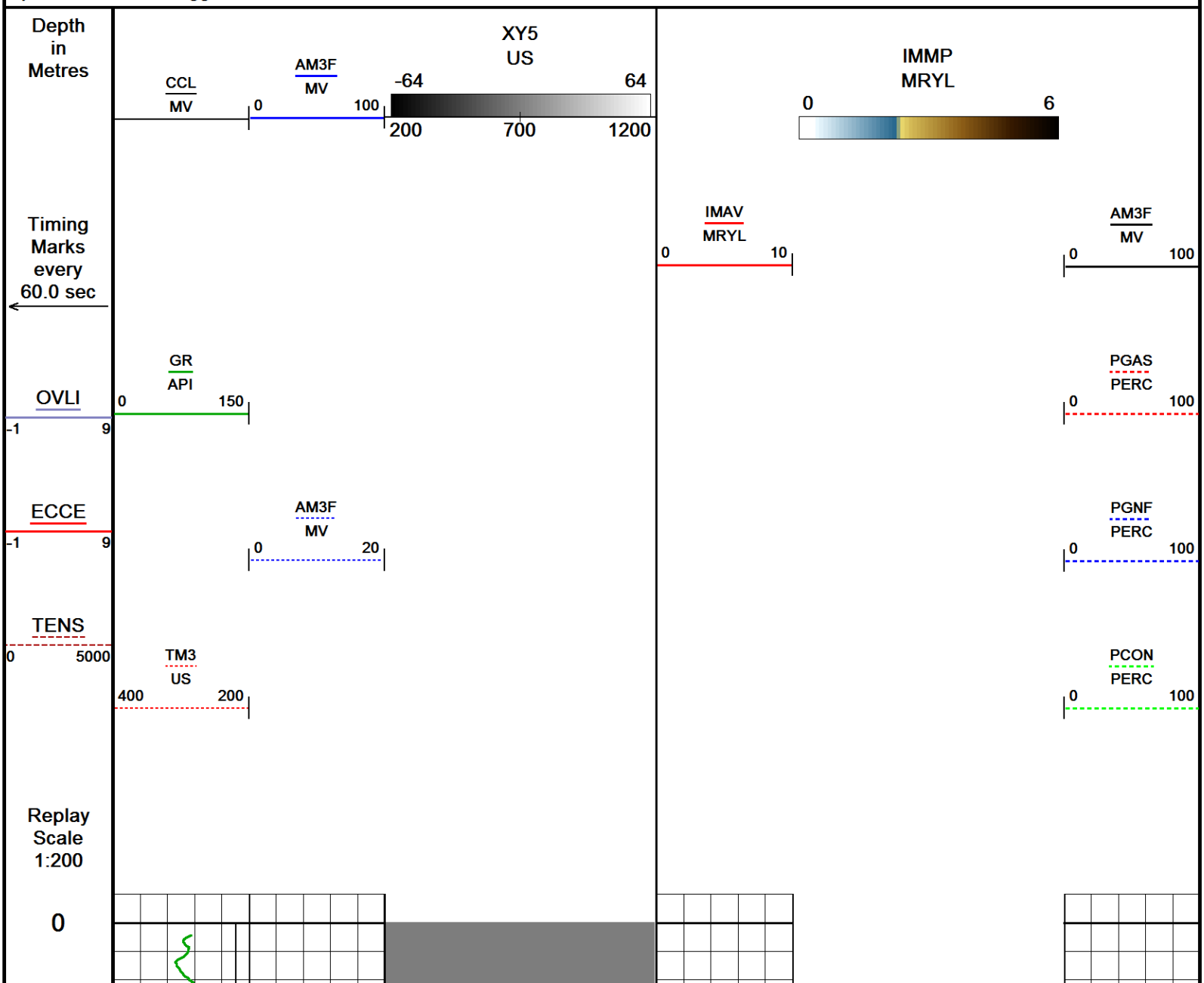
GR USED FOR CORRELATION ONLY.

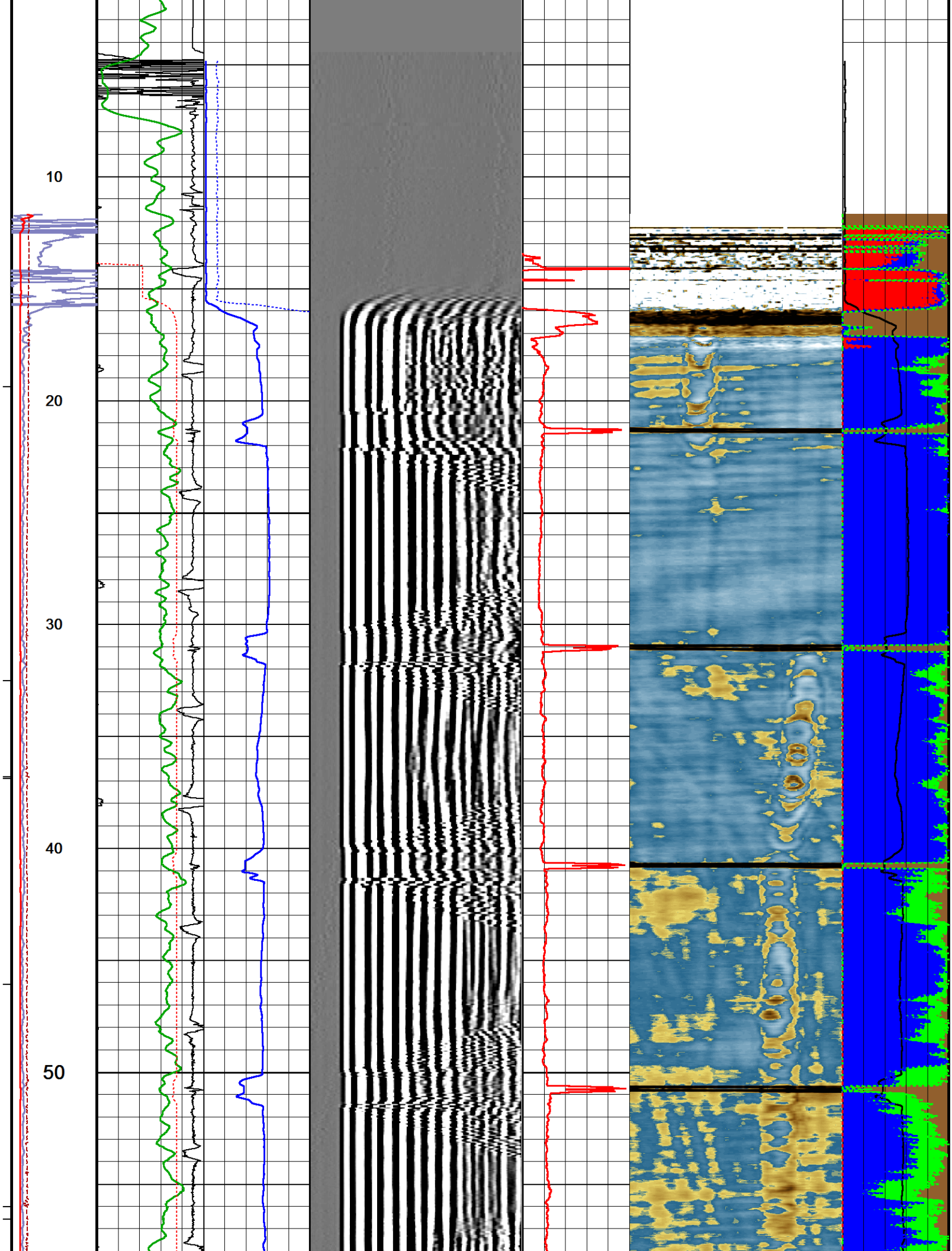
RIG: WILDDESERT 10

LOGGING CREW: ENGINEER; O. SANTILLA, OPERATORS, S. PEARCE, J. NICHOL

MAINPASS 1:200

Depth Based Data - Maximum Sampling Increment 2.5cm — Plotted on 03-OCT-2018 17:46
Filename: C:\Users\ADMINI~2\AppData...\NOORINDOO 1_RUN 1_URS-CBL-CCL-GR_MAINPASS.dta — Recorded on 03-OCT-2018 13:18
System Versions: Logged with 18.03.9328 Plotted with 17.03.9215

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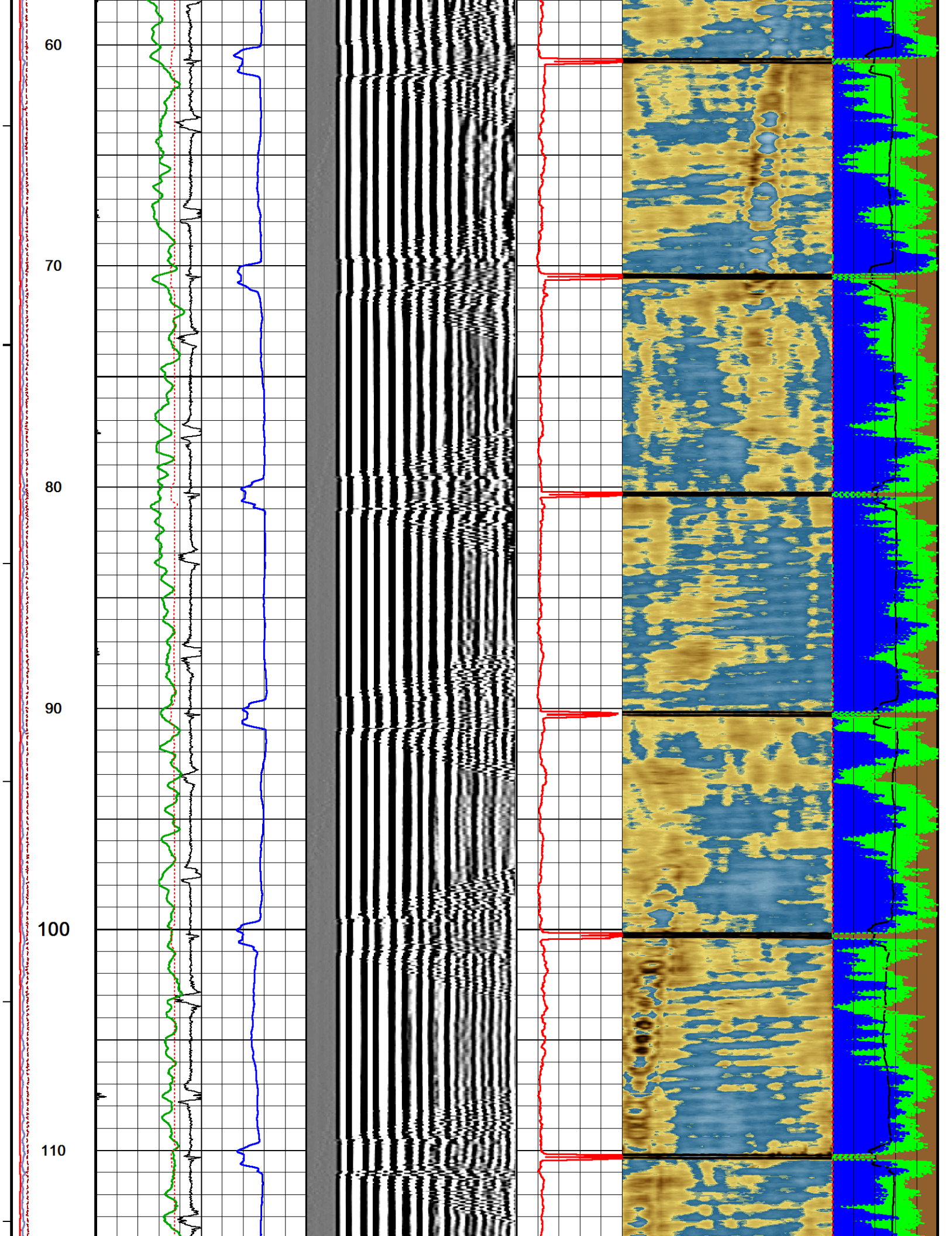
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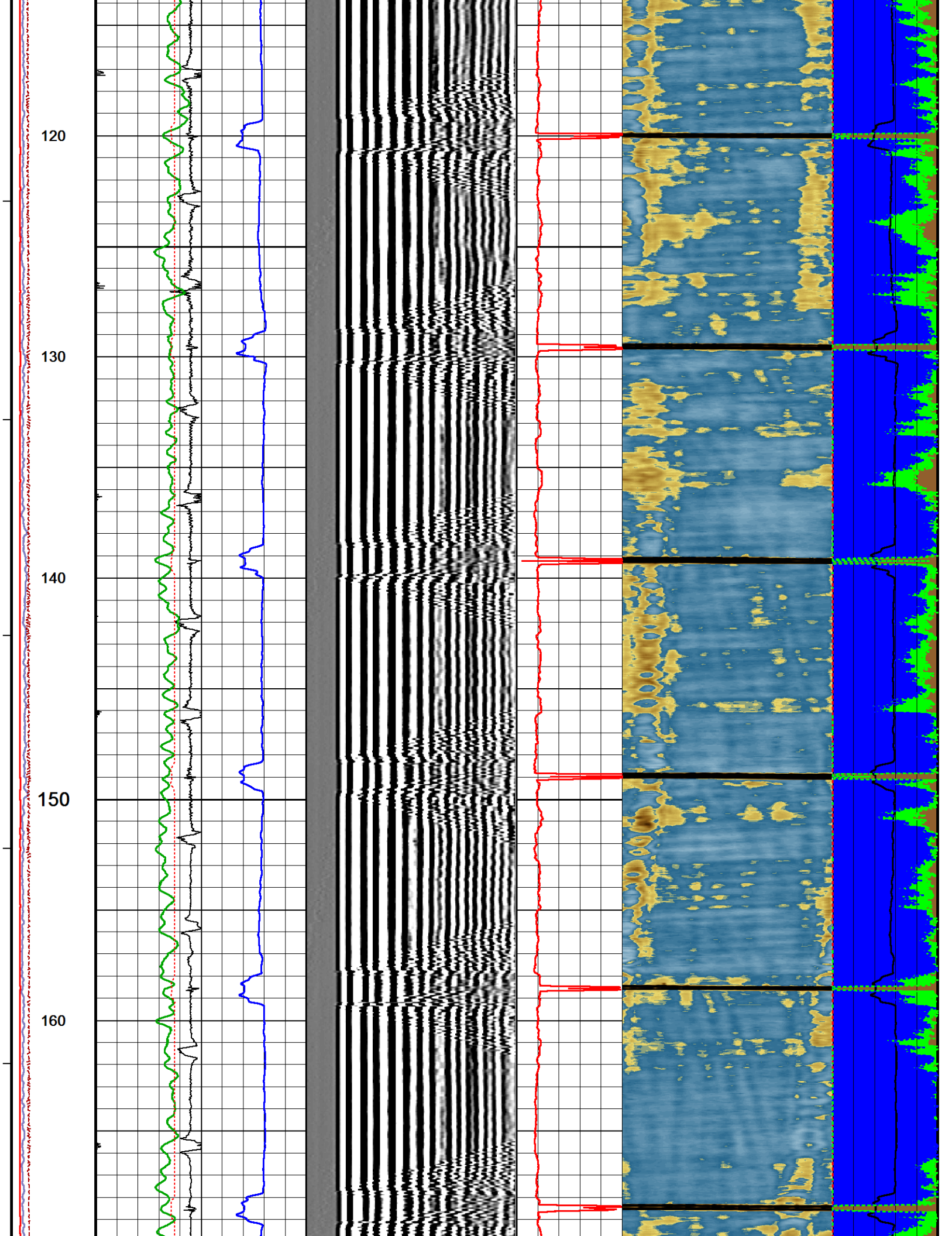
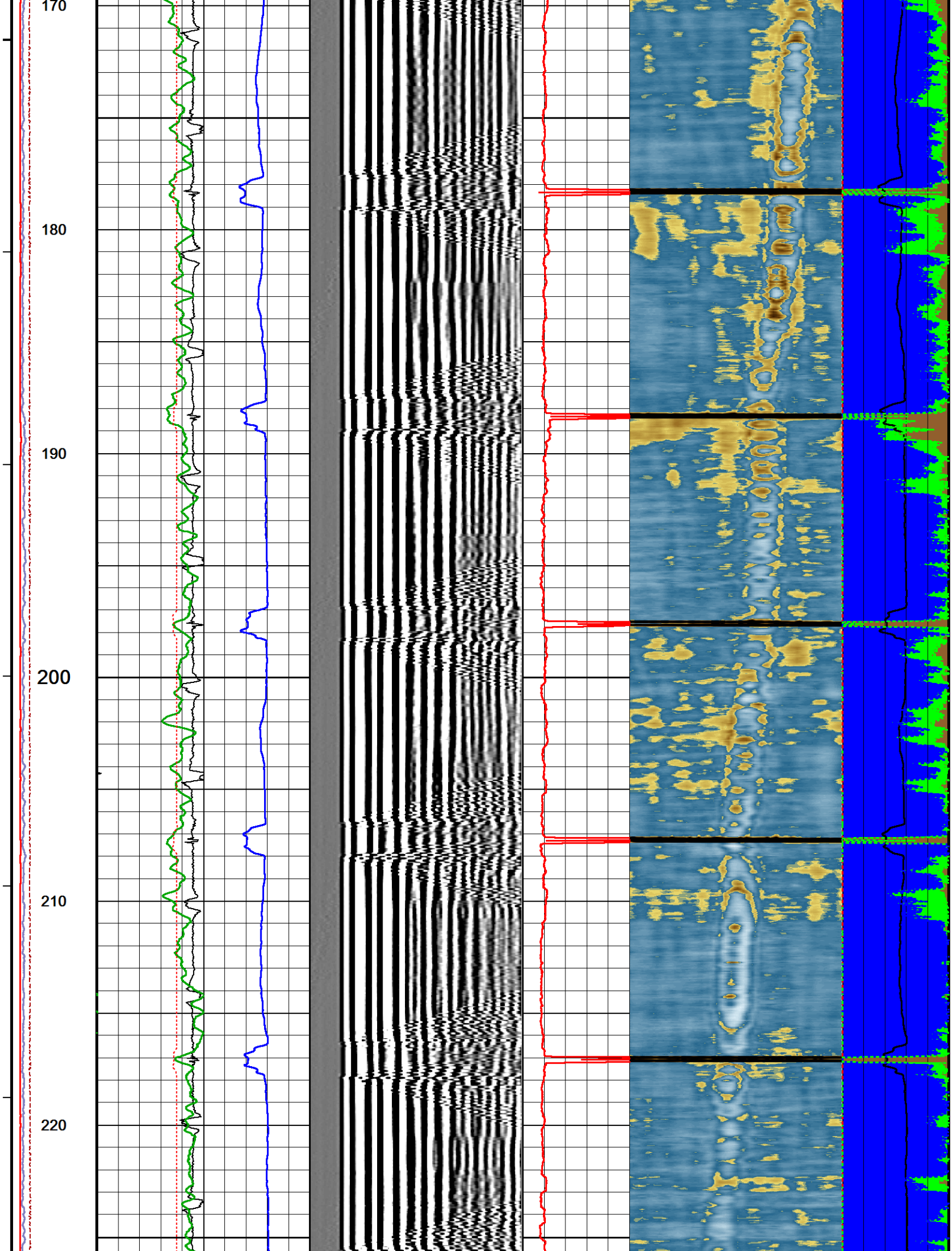
70
80
90
100
110


120
130
140
150
160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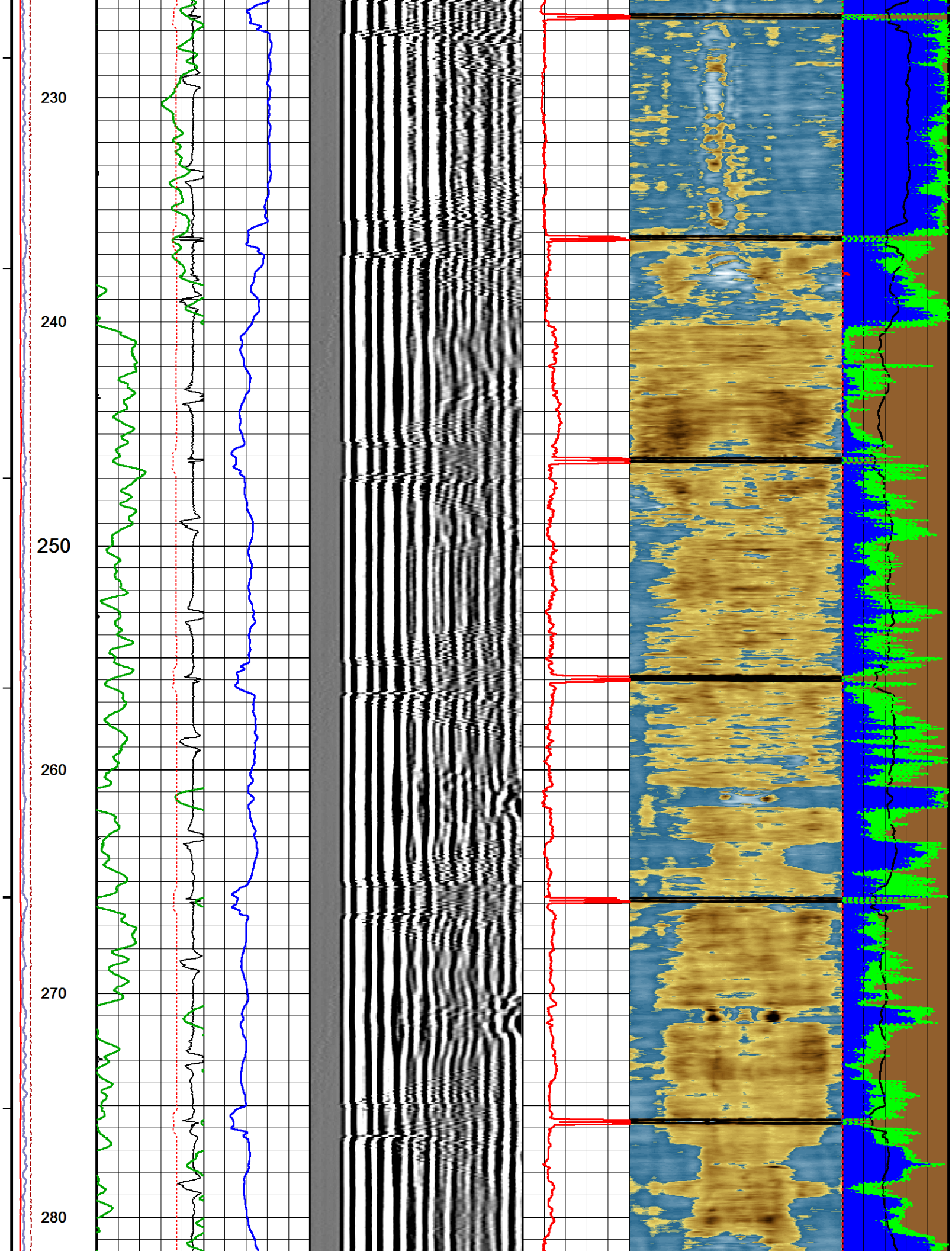
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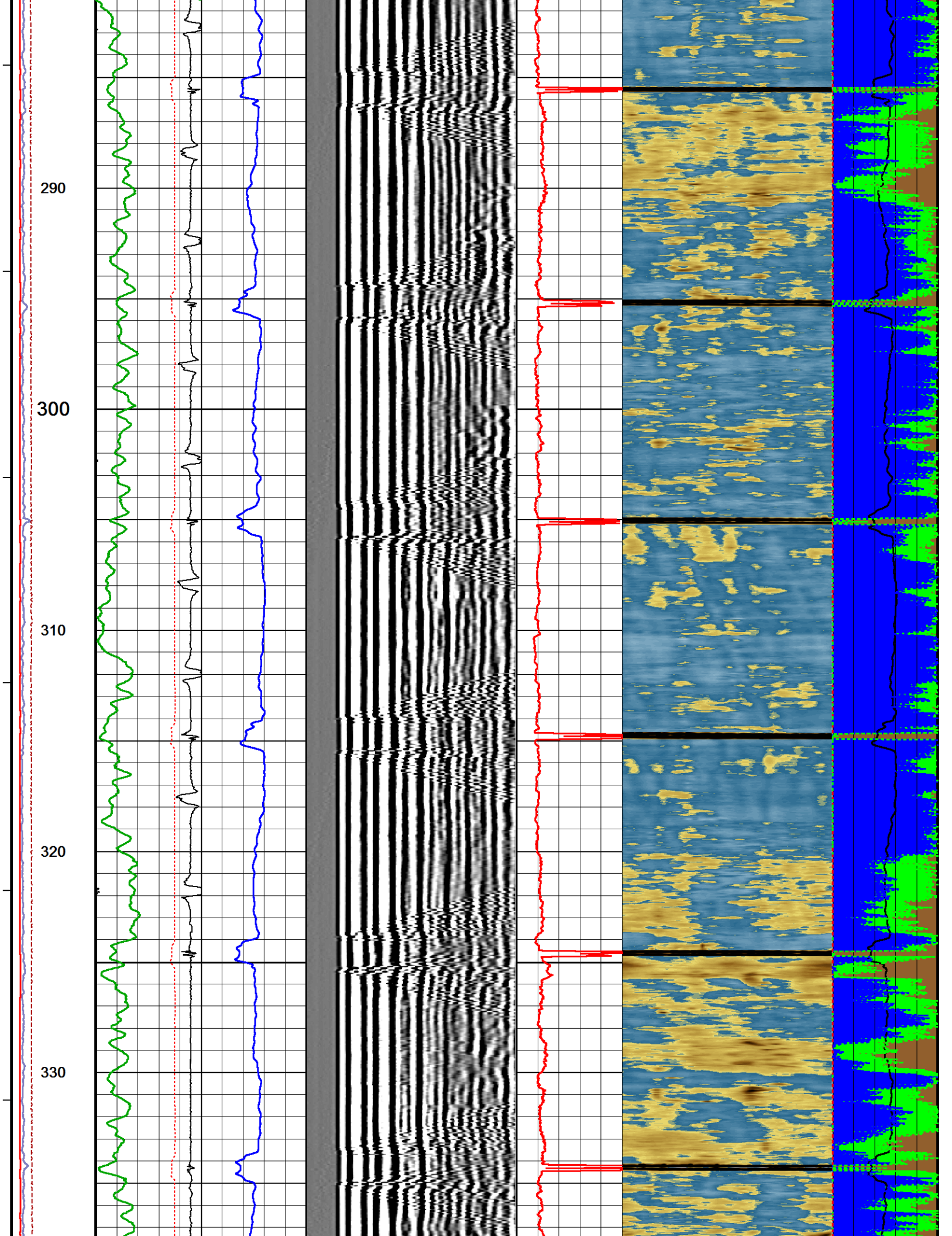
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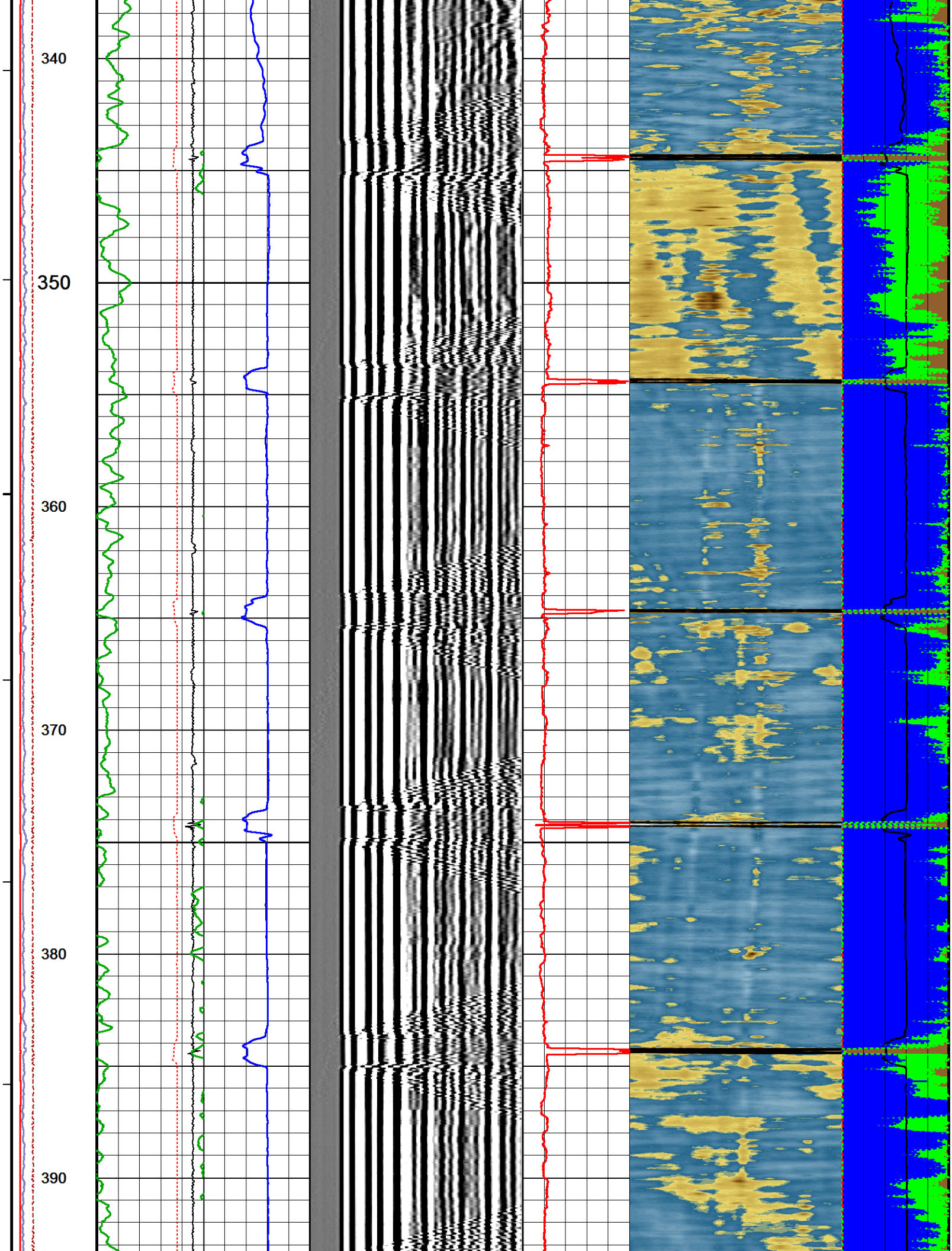
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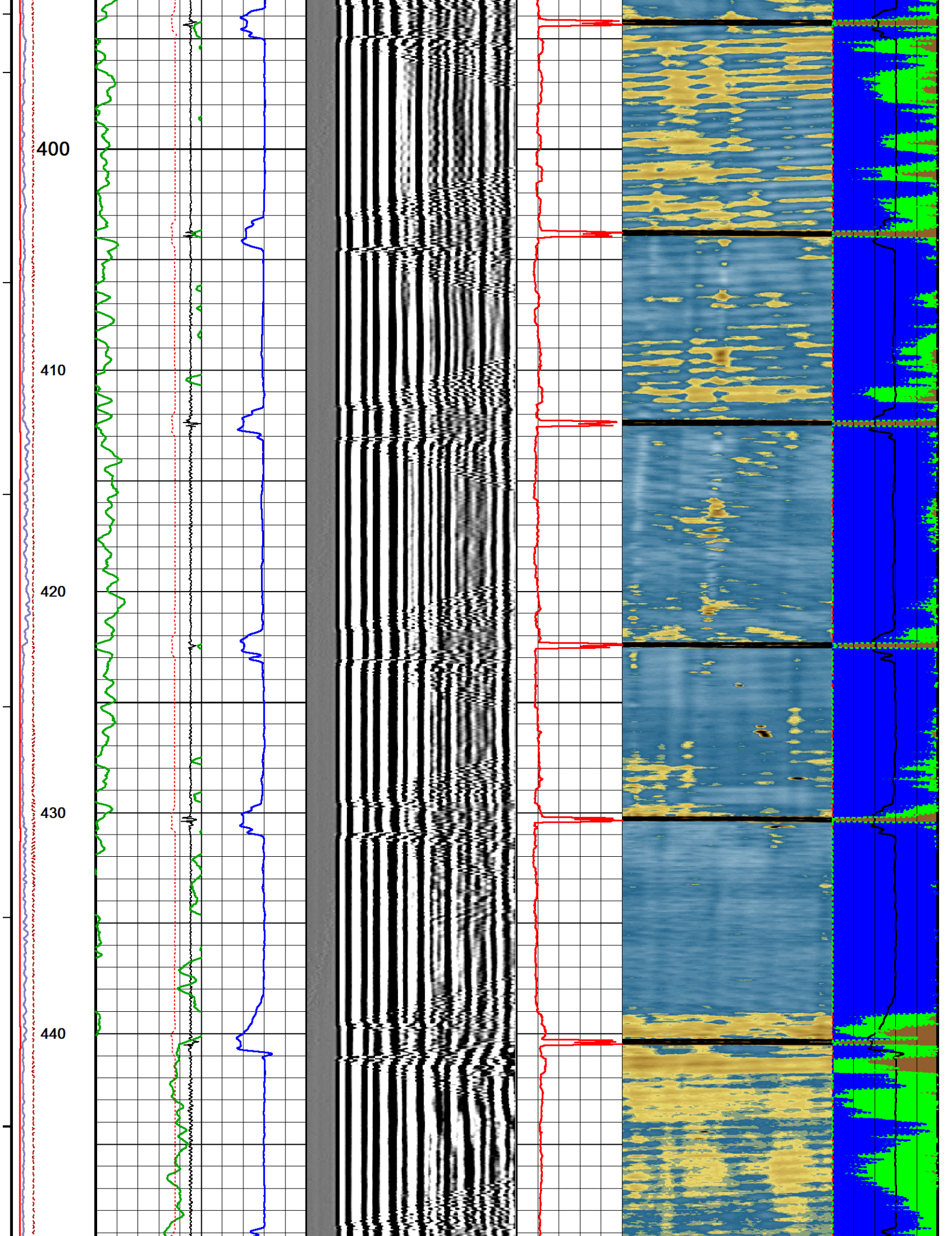
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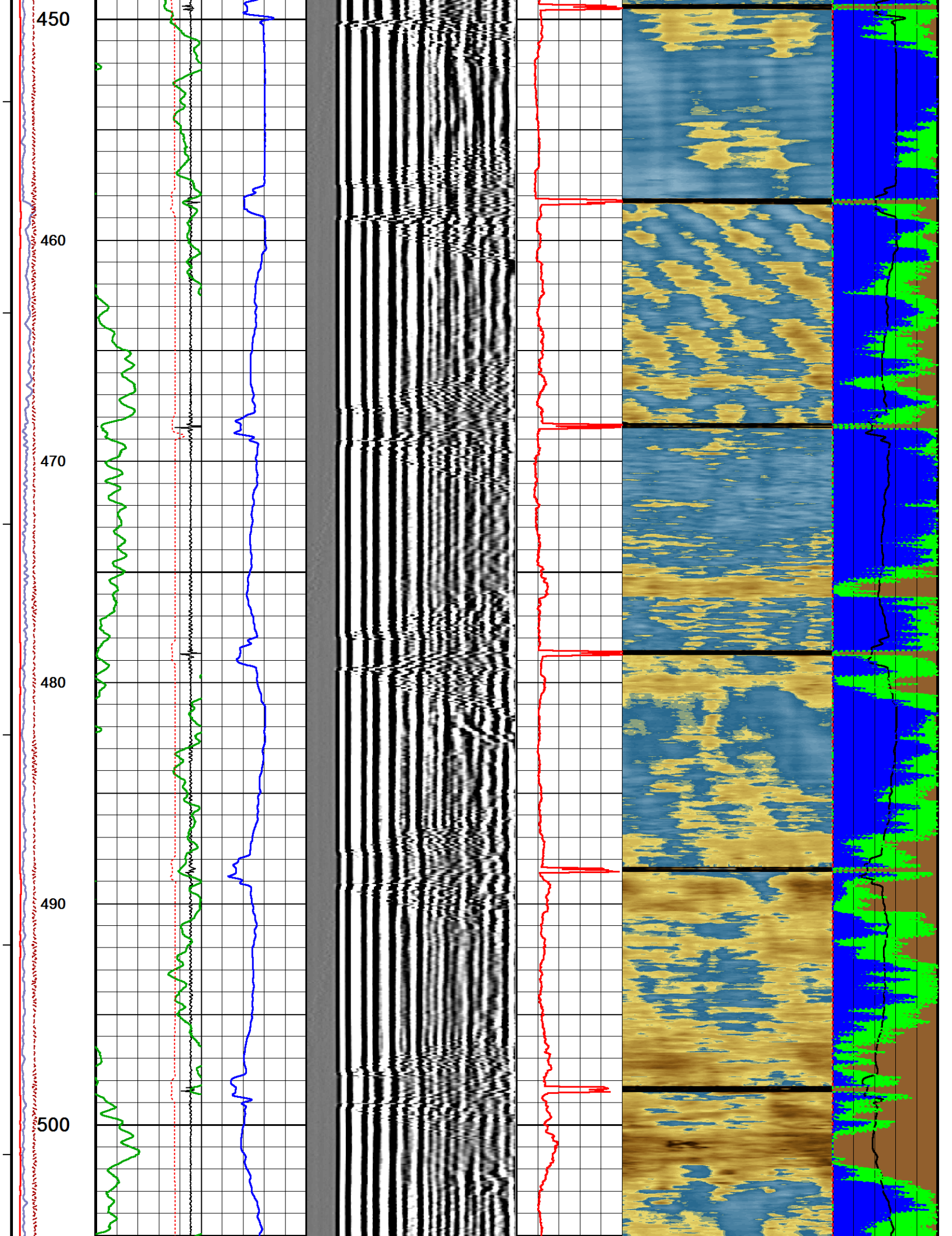
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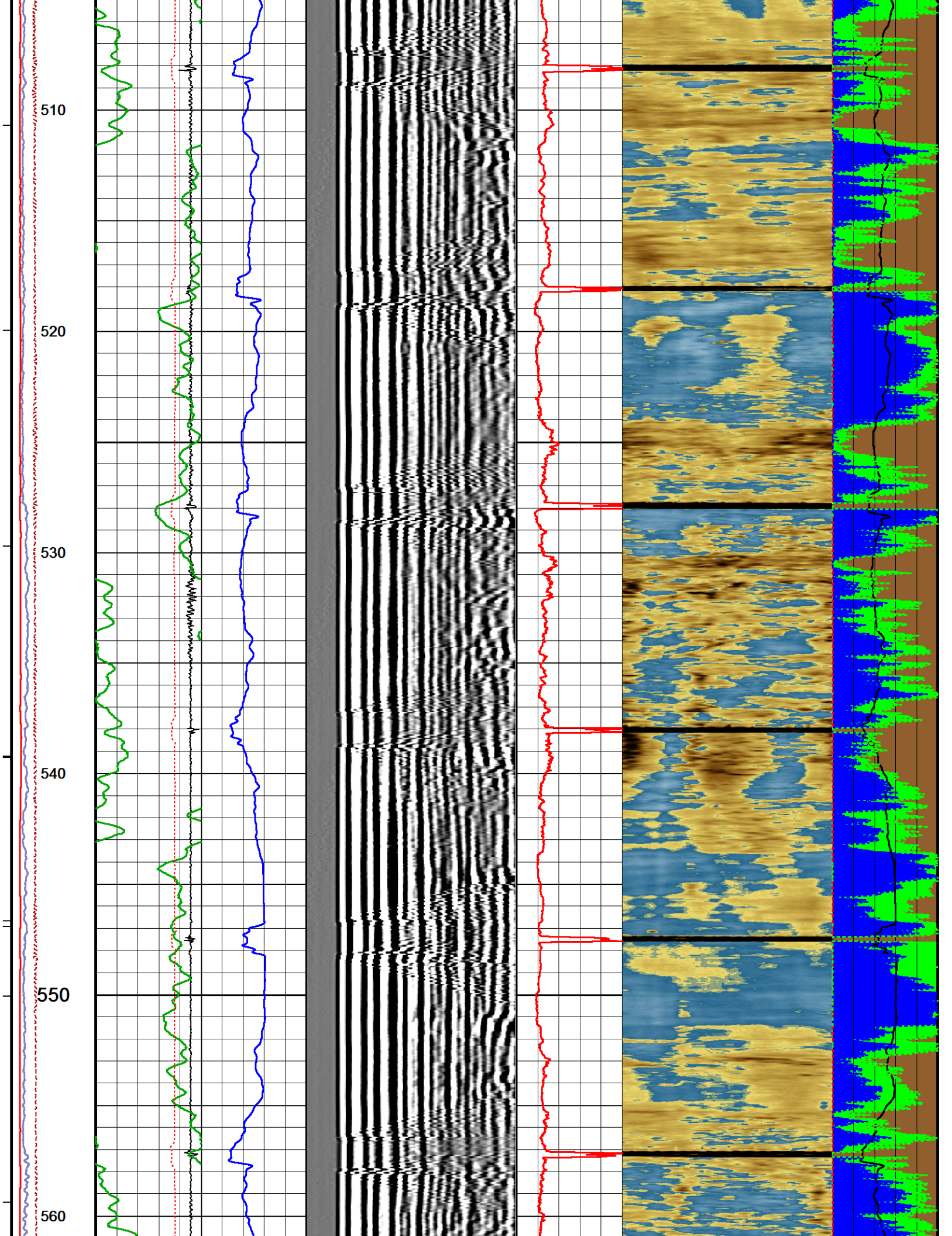
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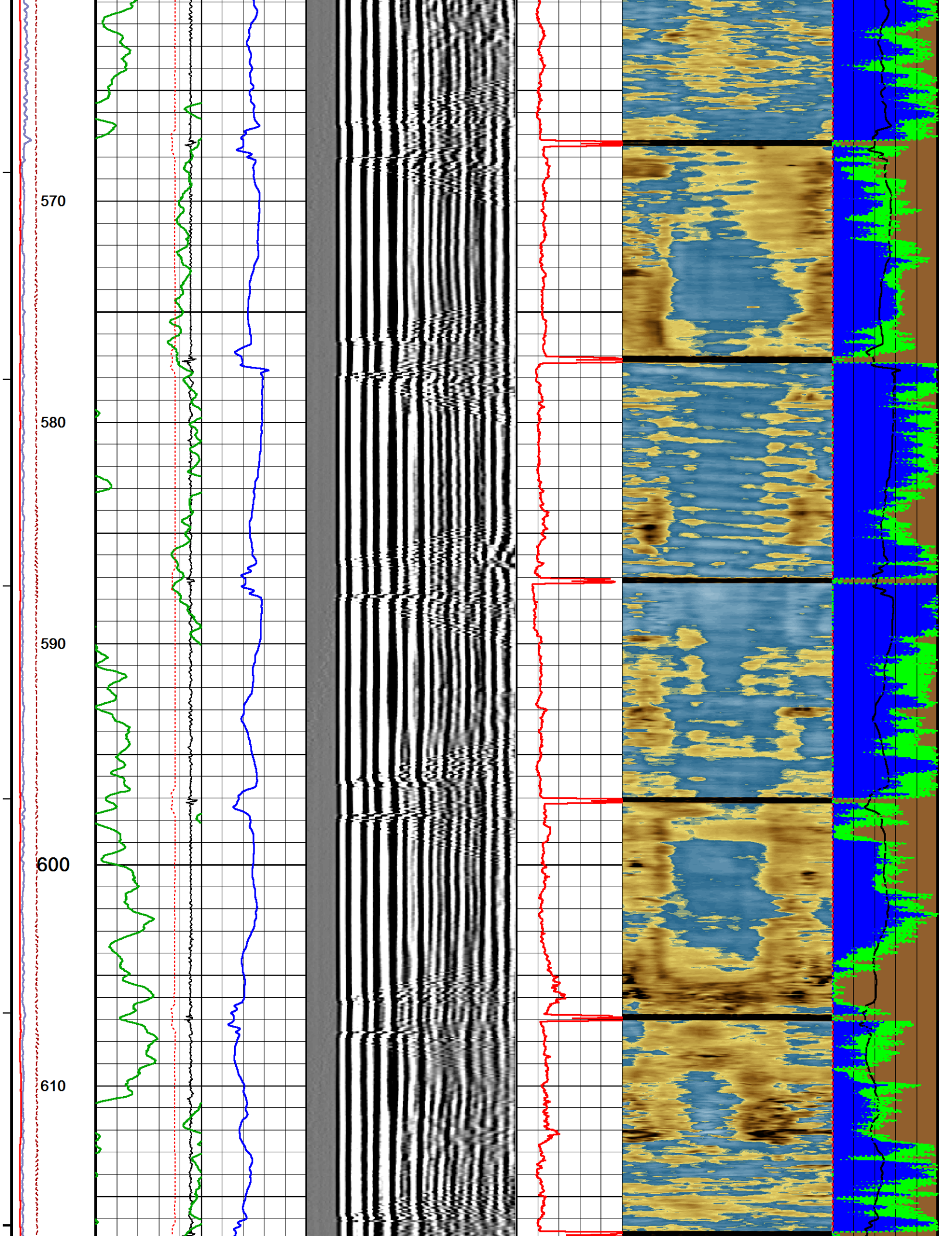
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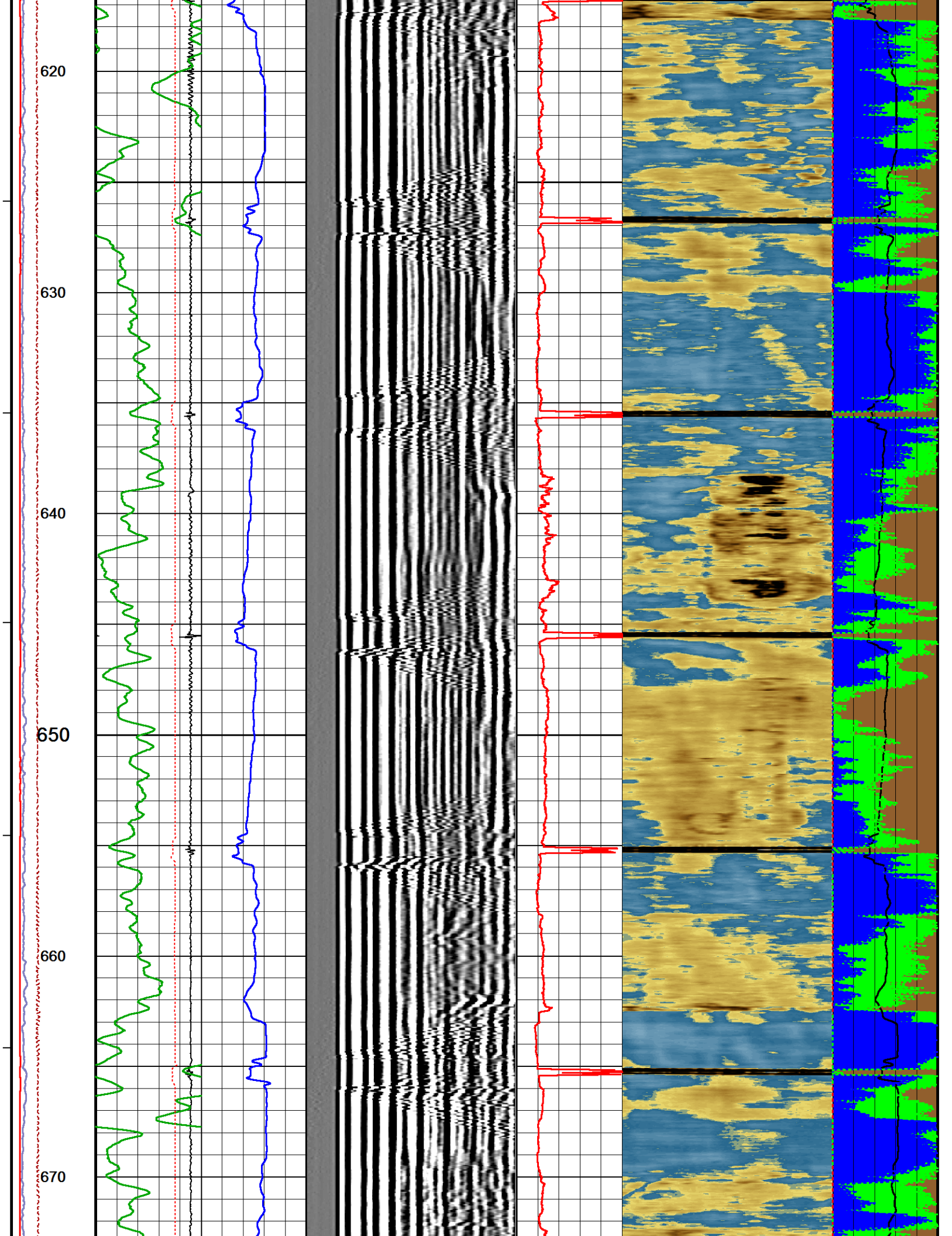
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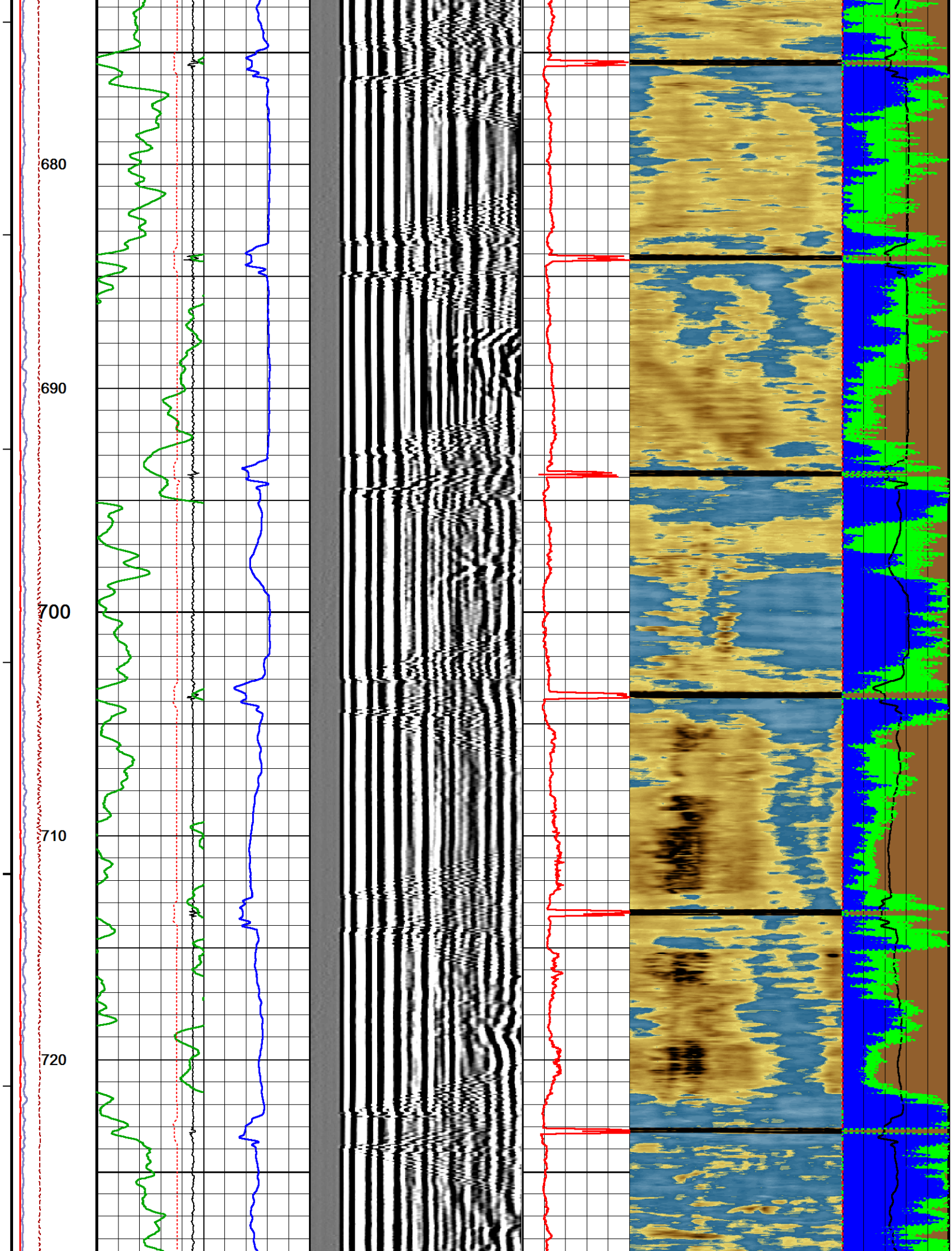
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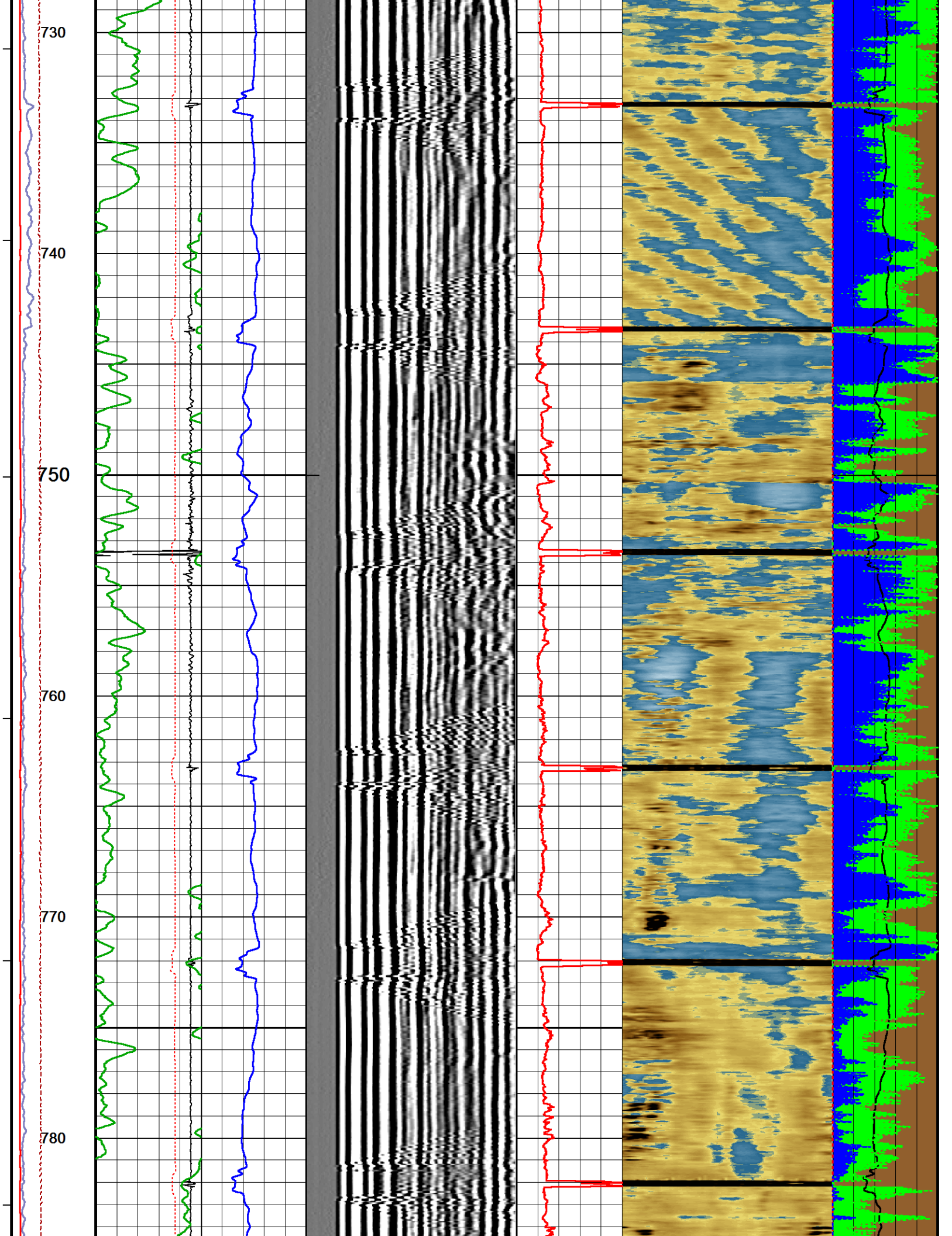
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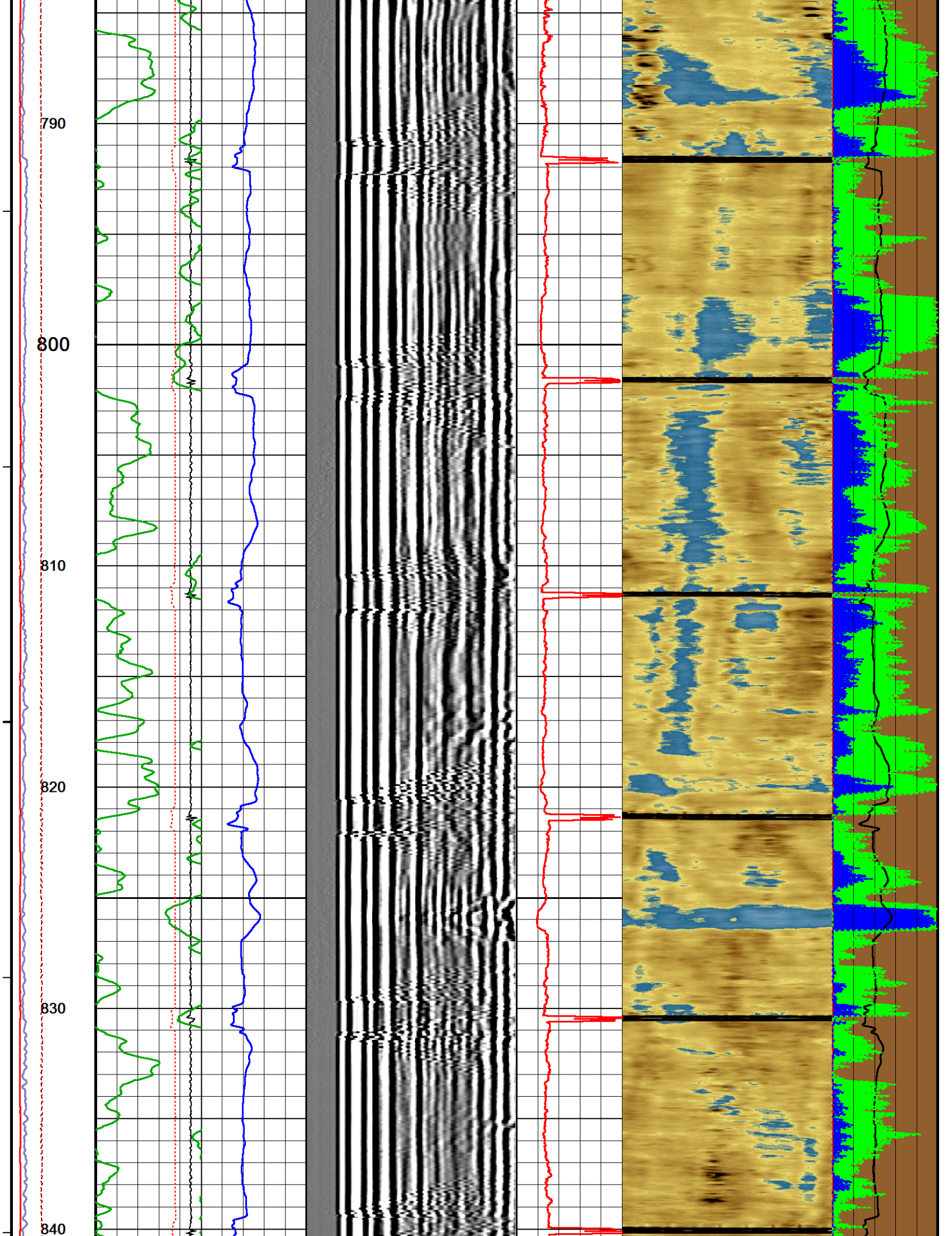
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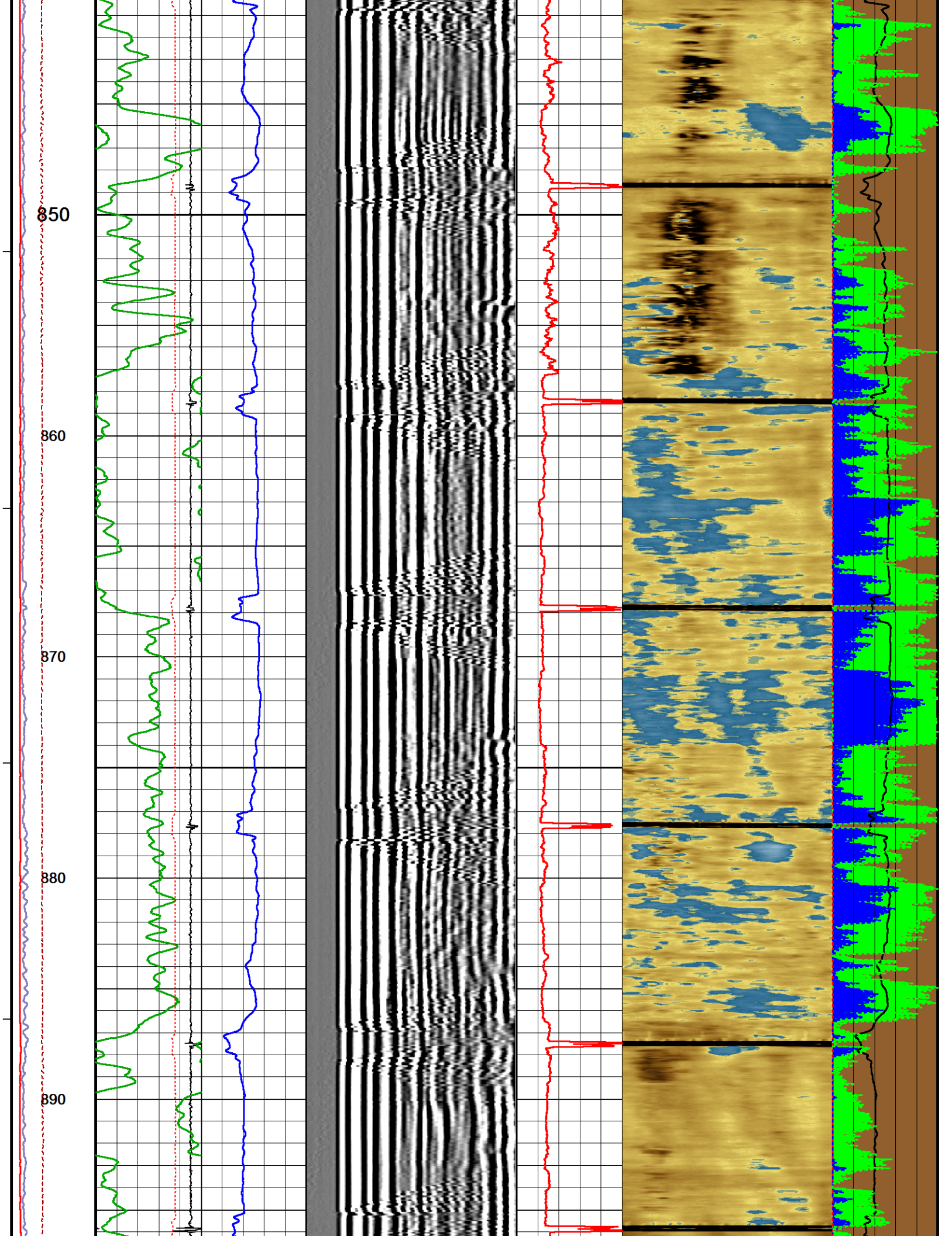
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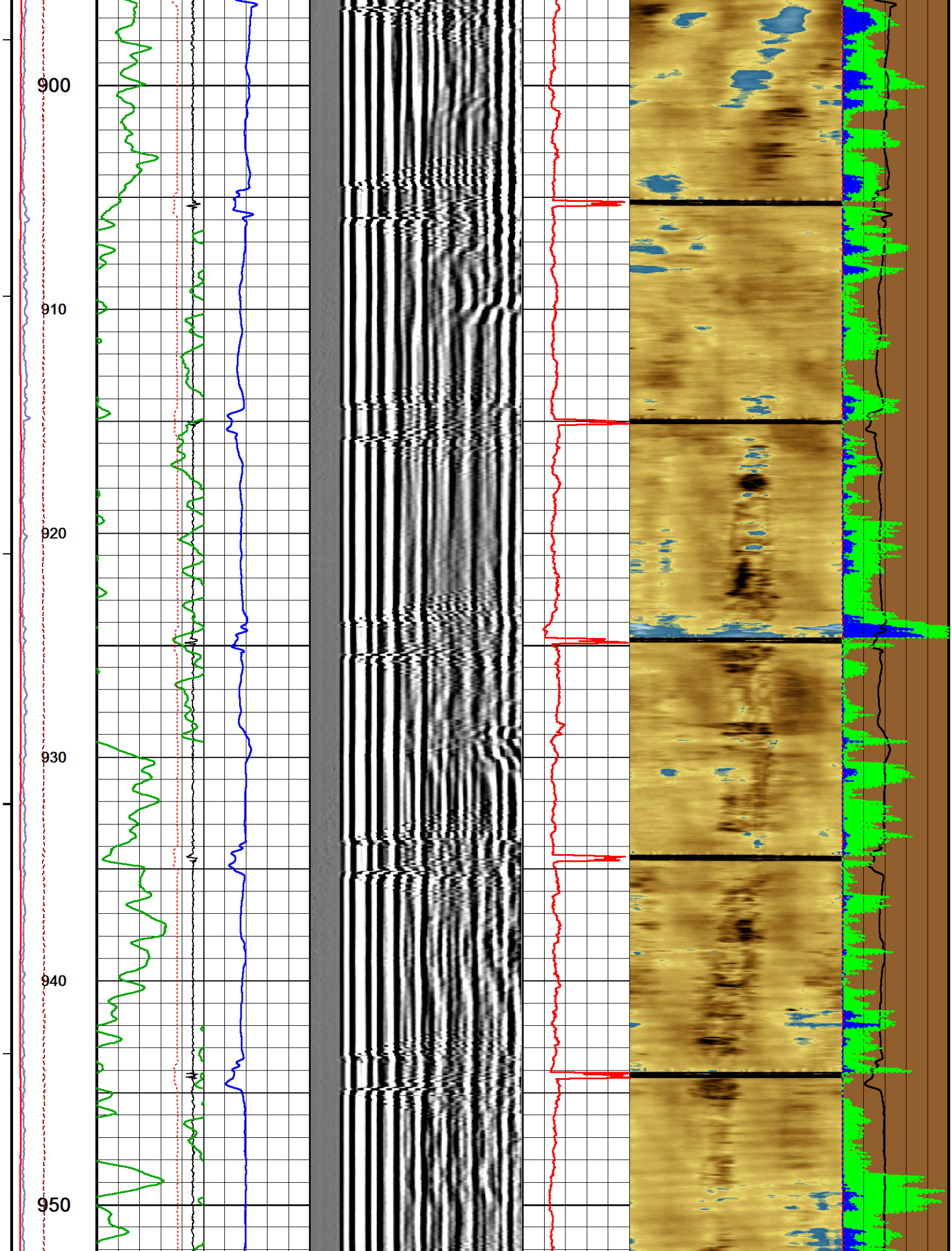
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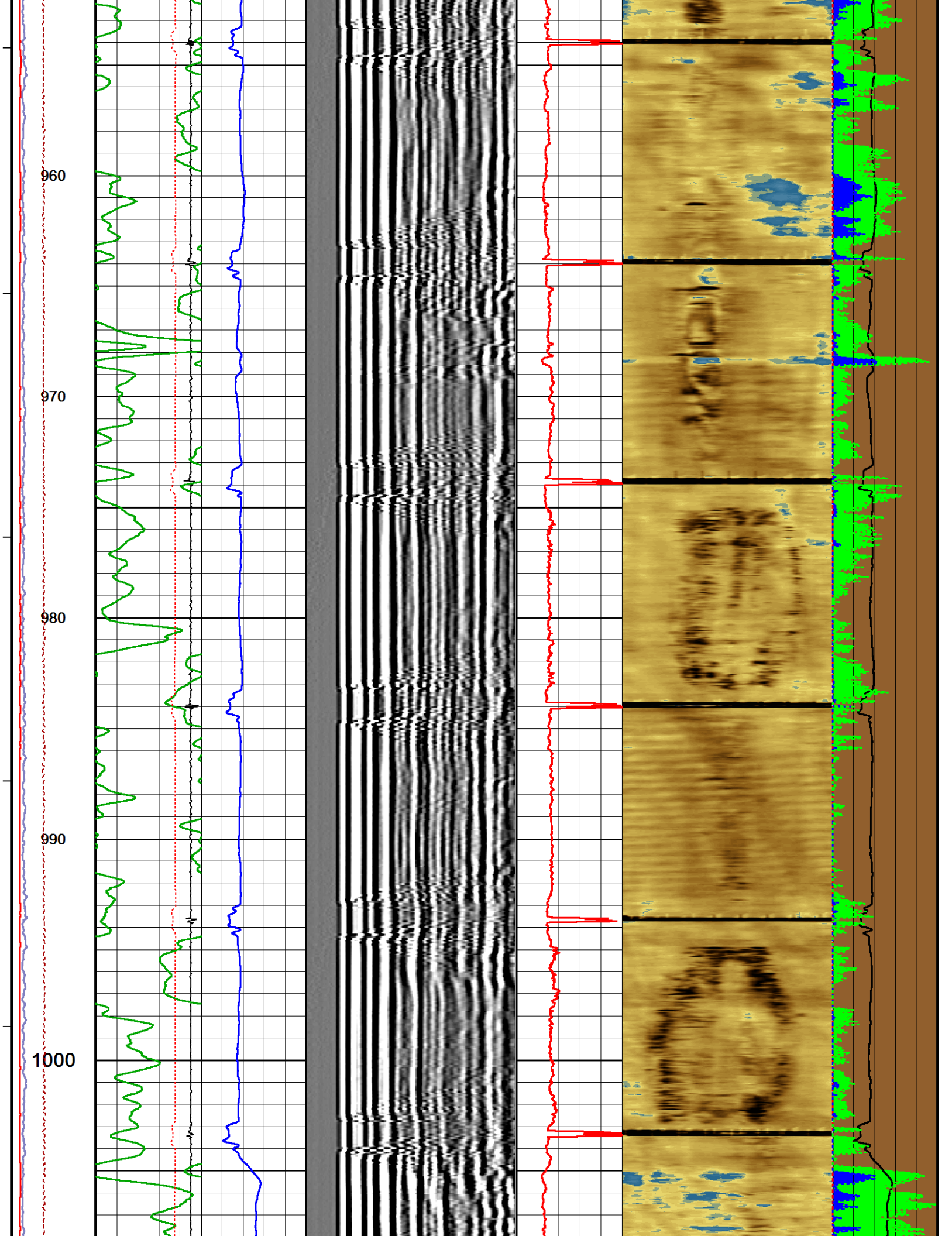
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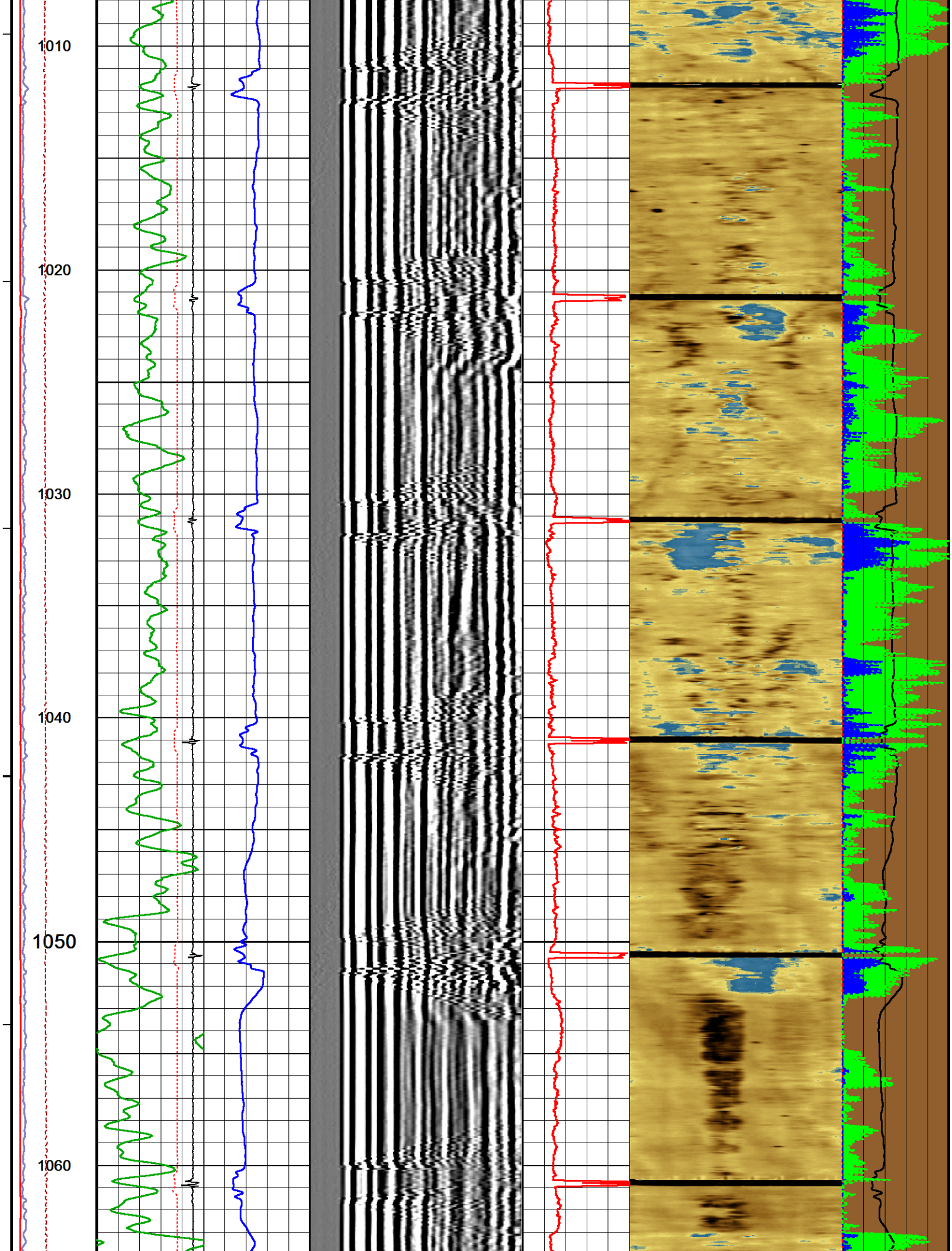
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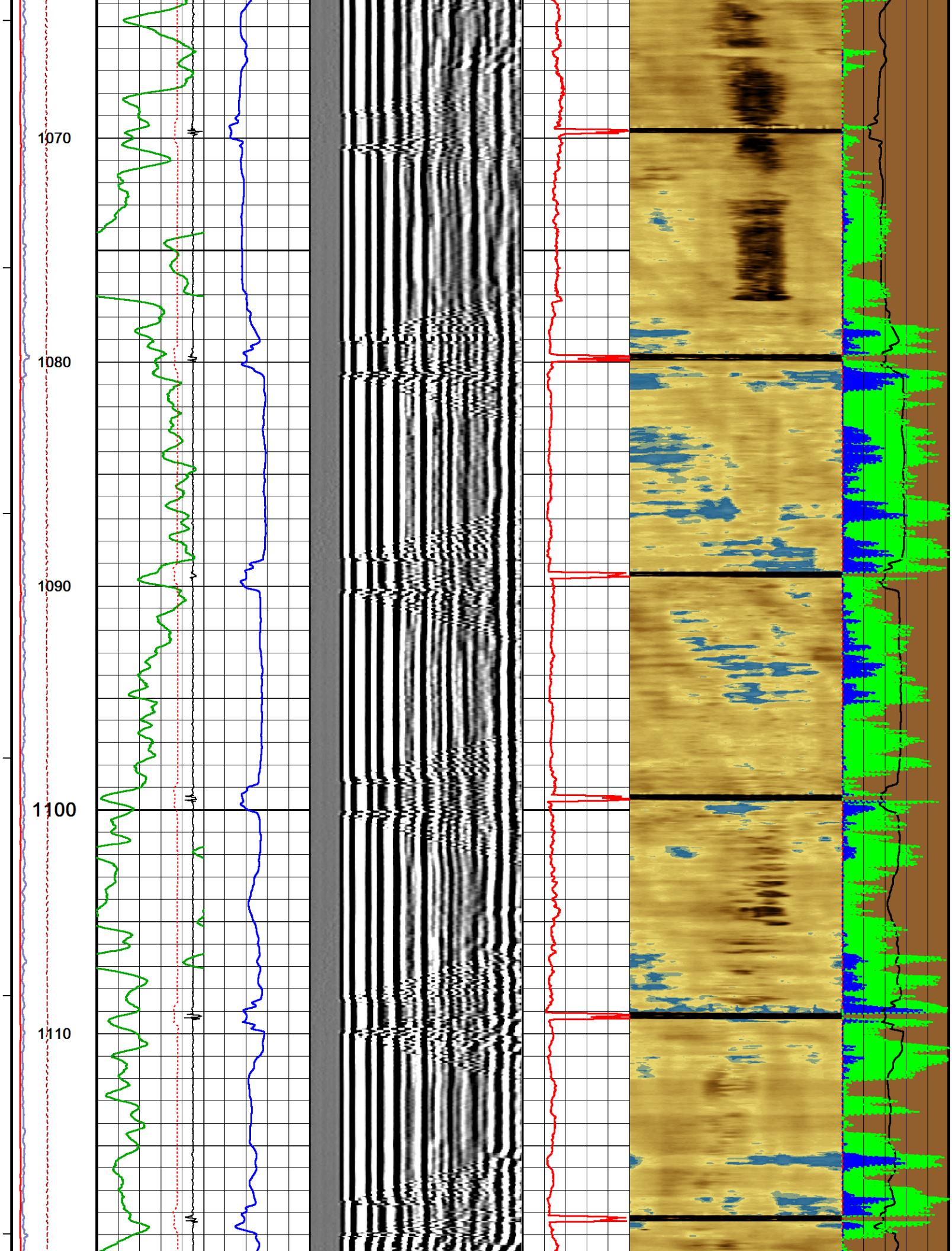
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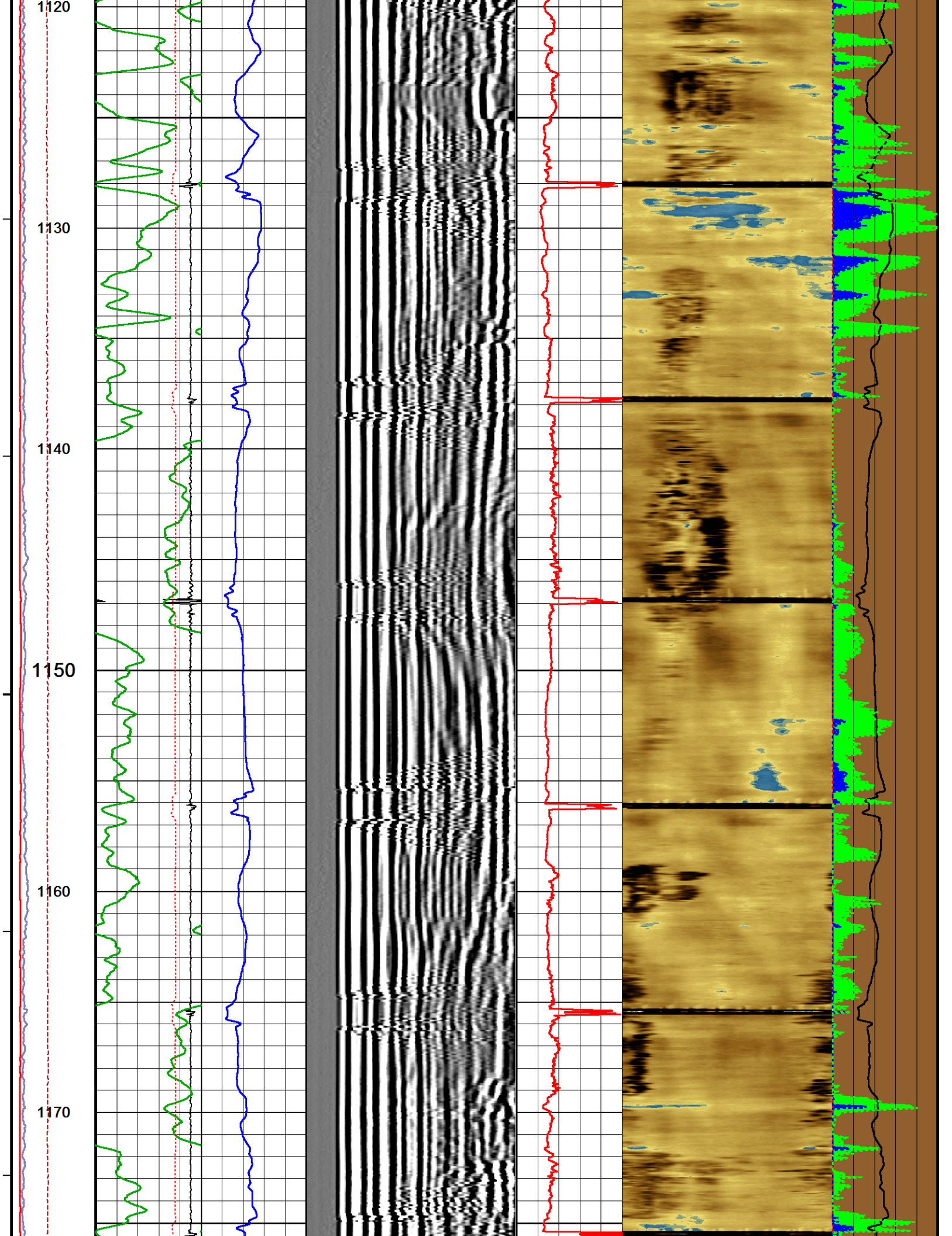
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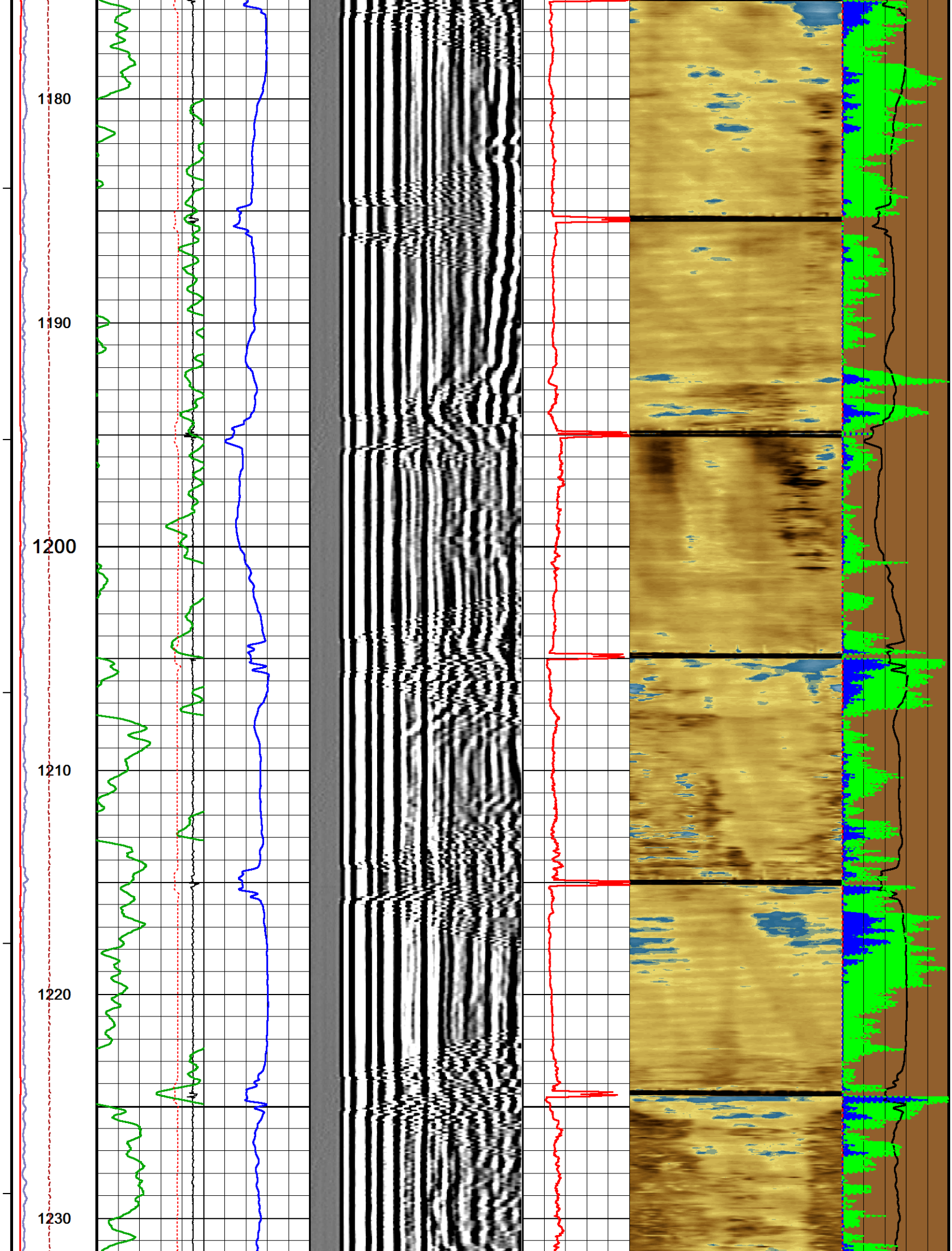
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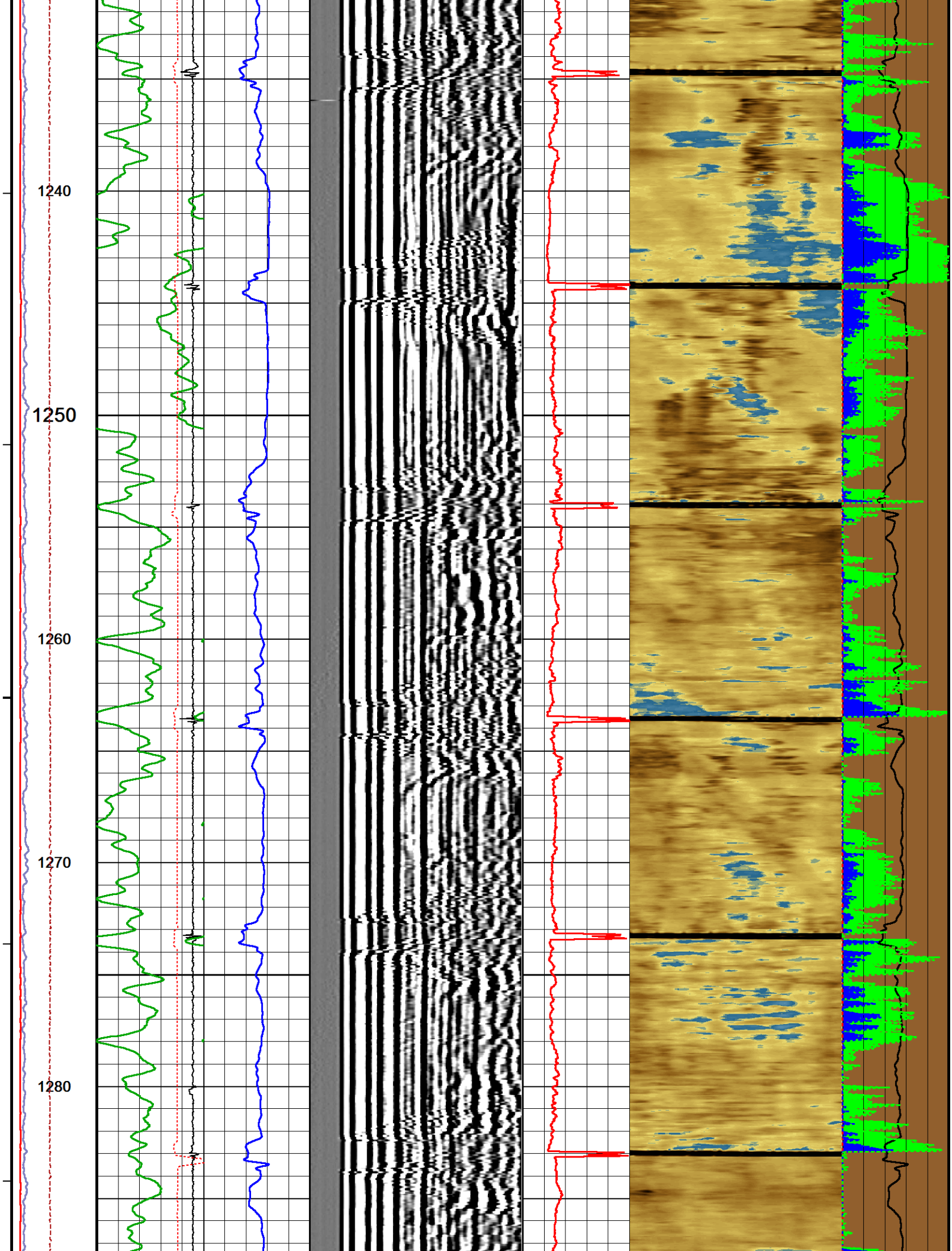
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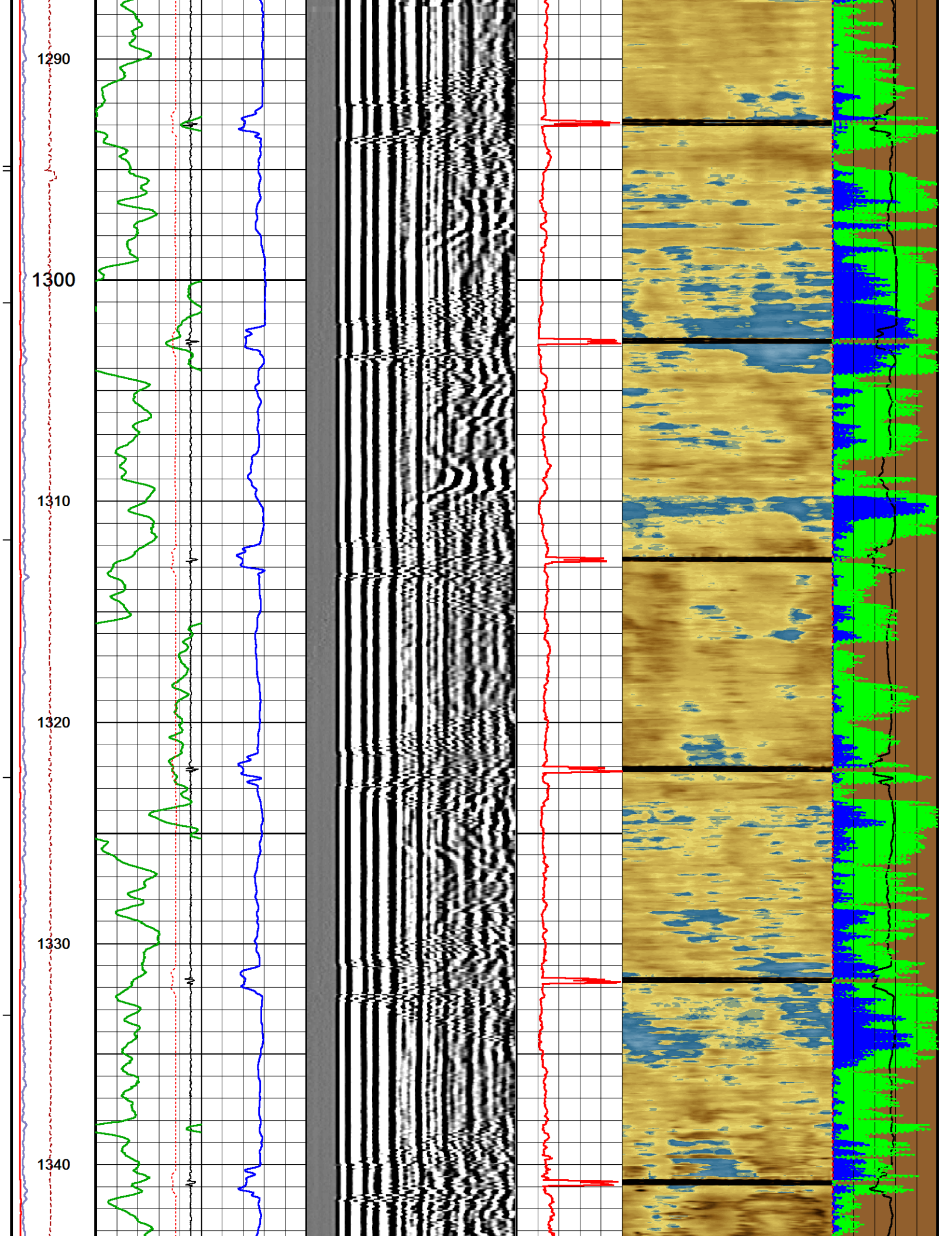
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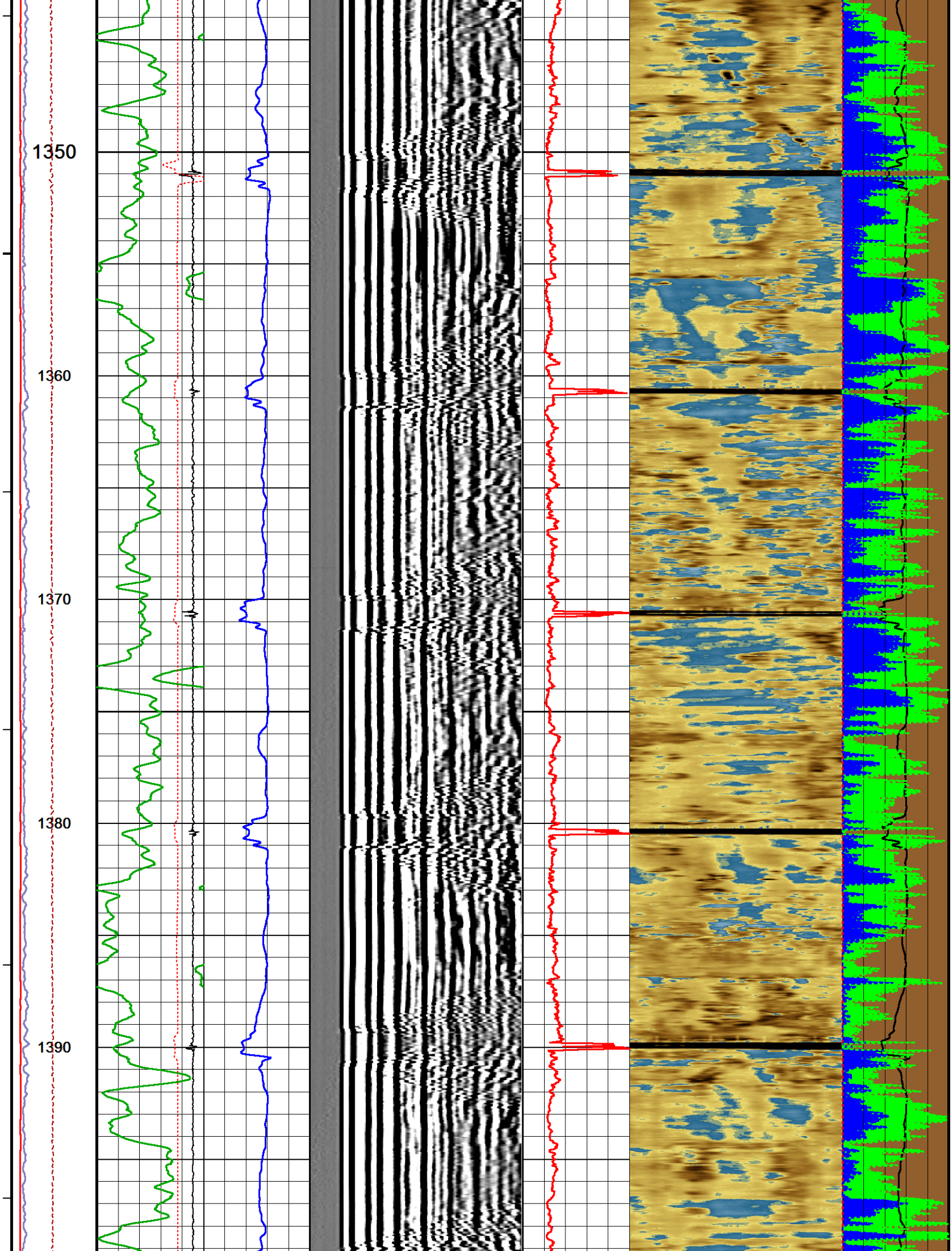
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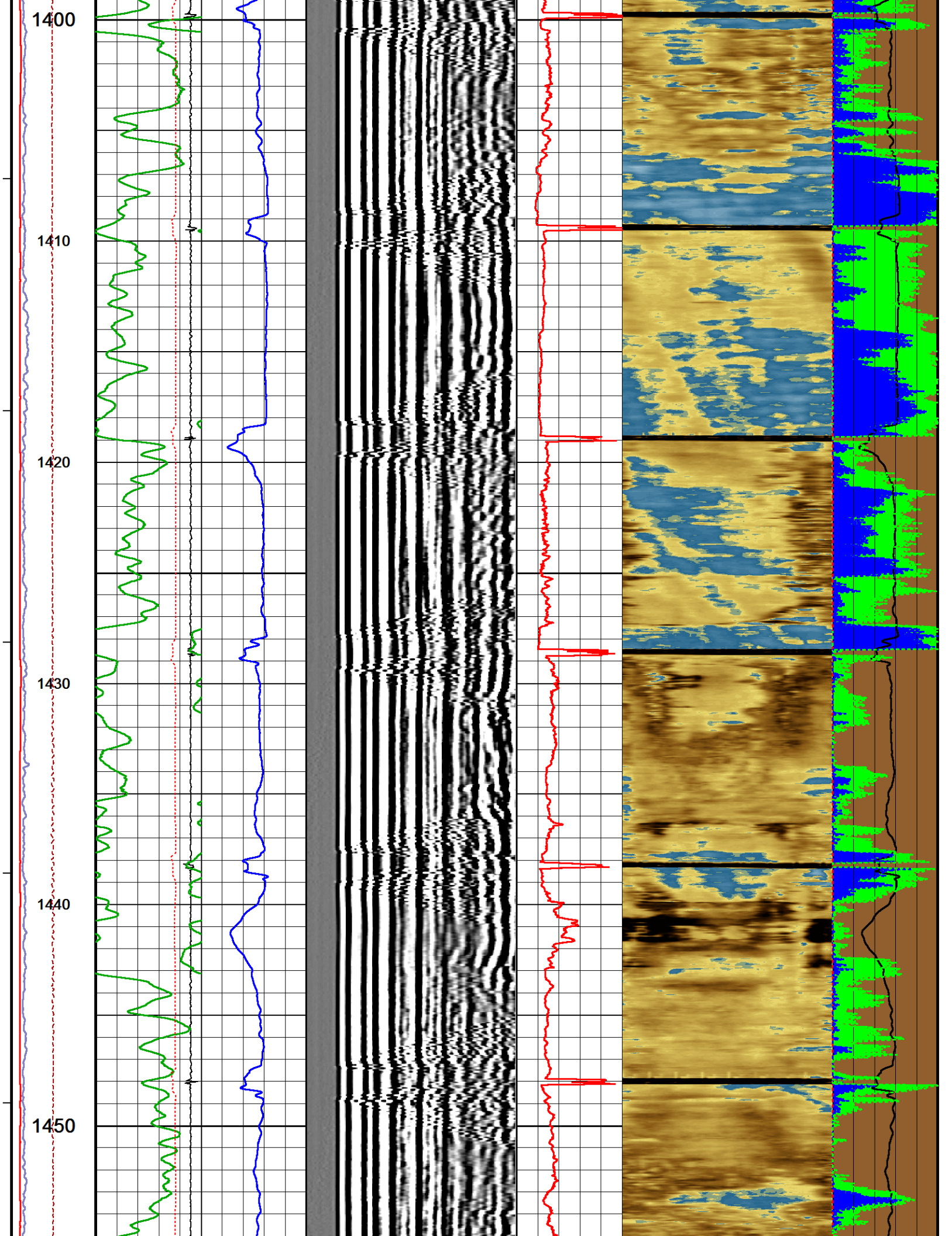
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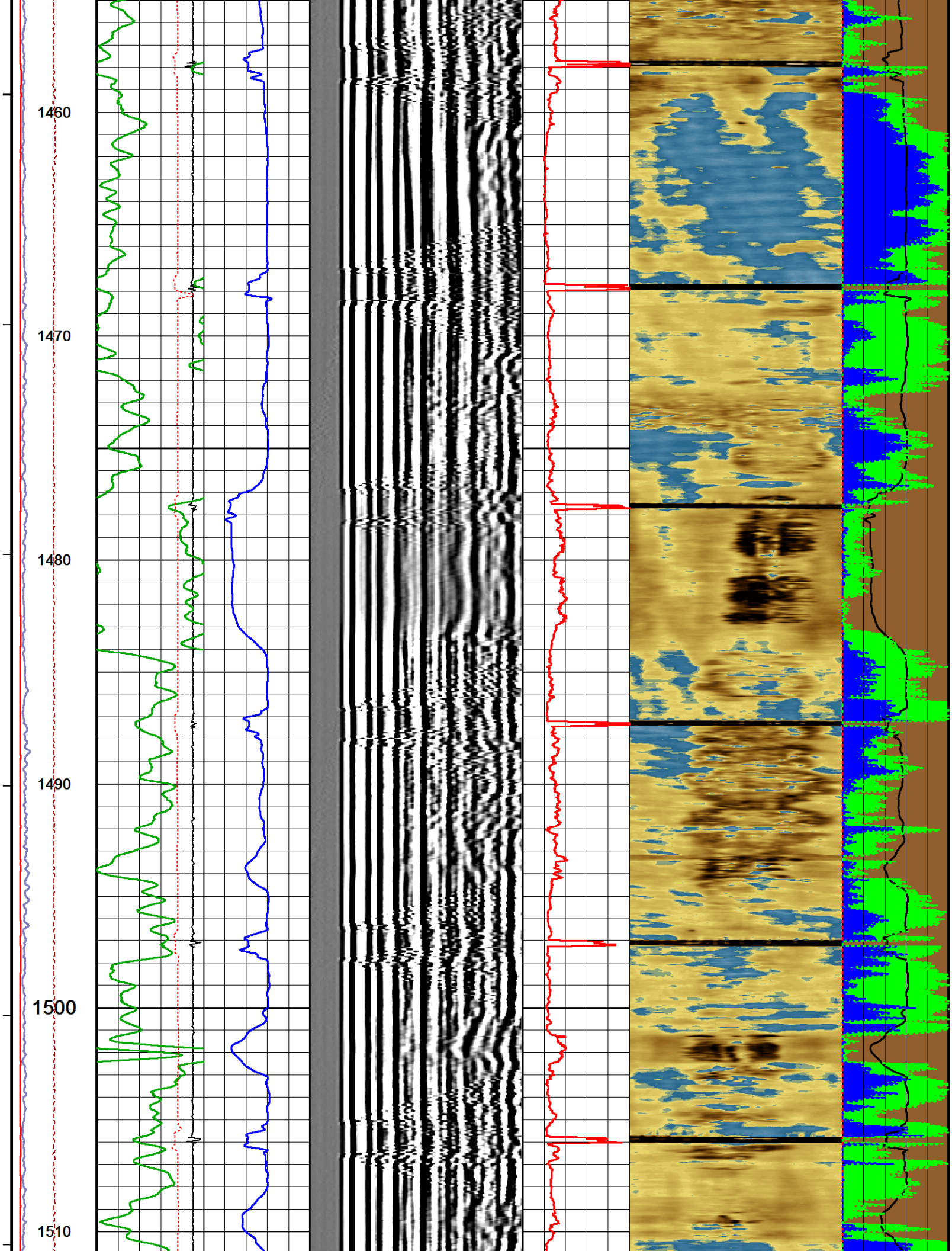
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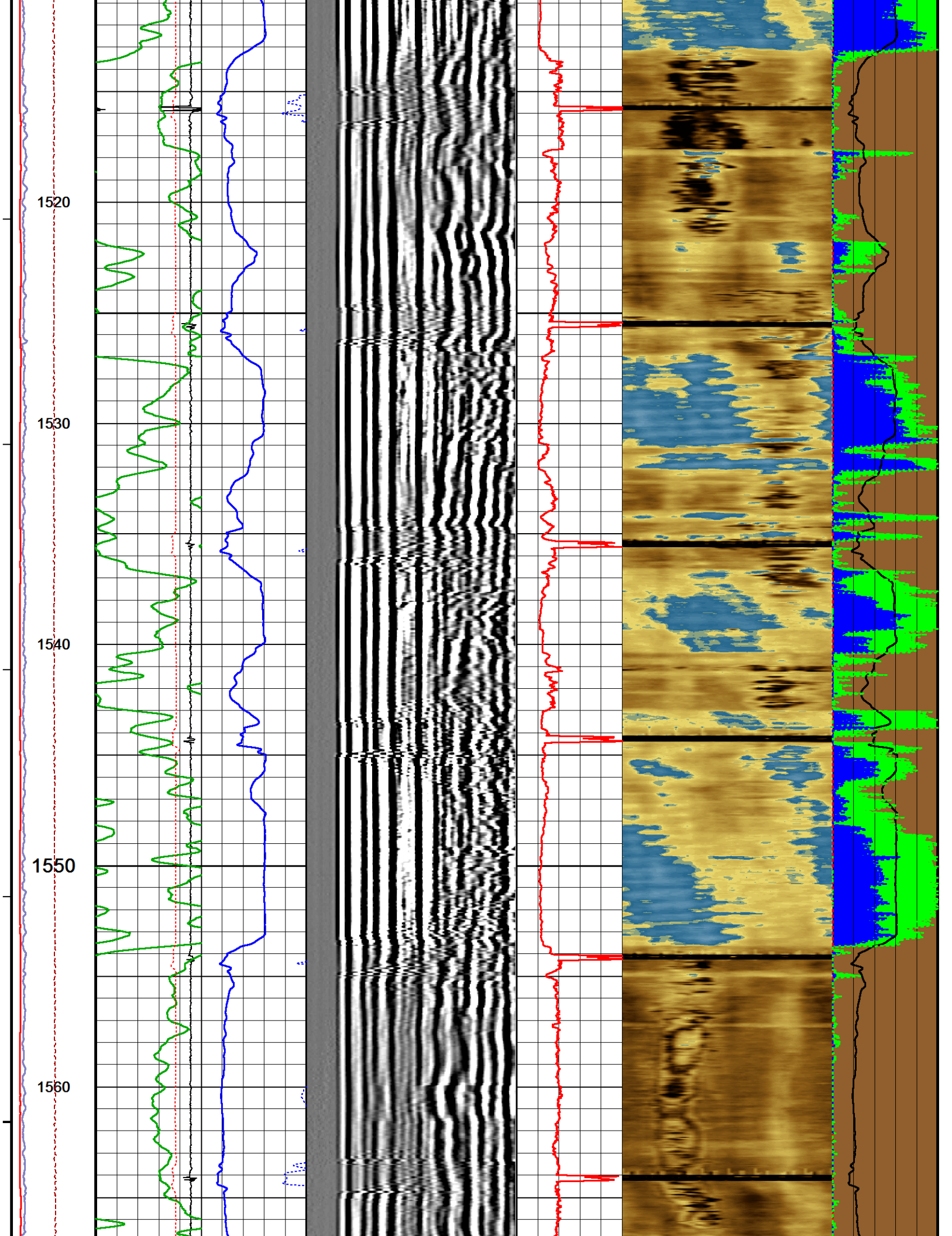
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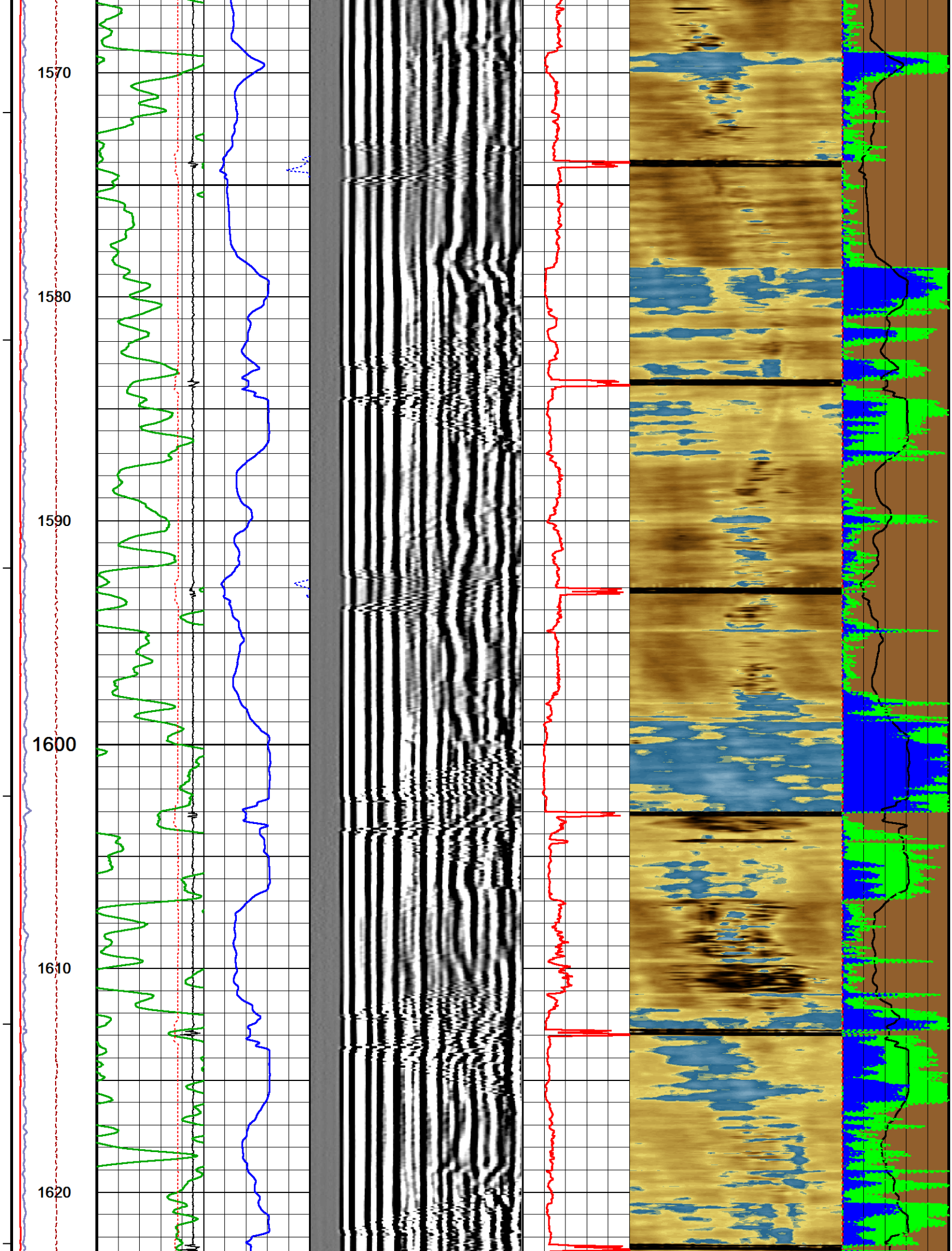
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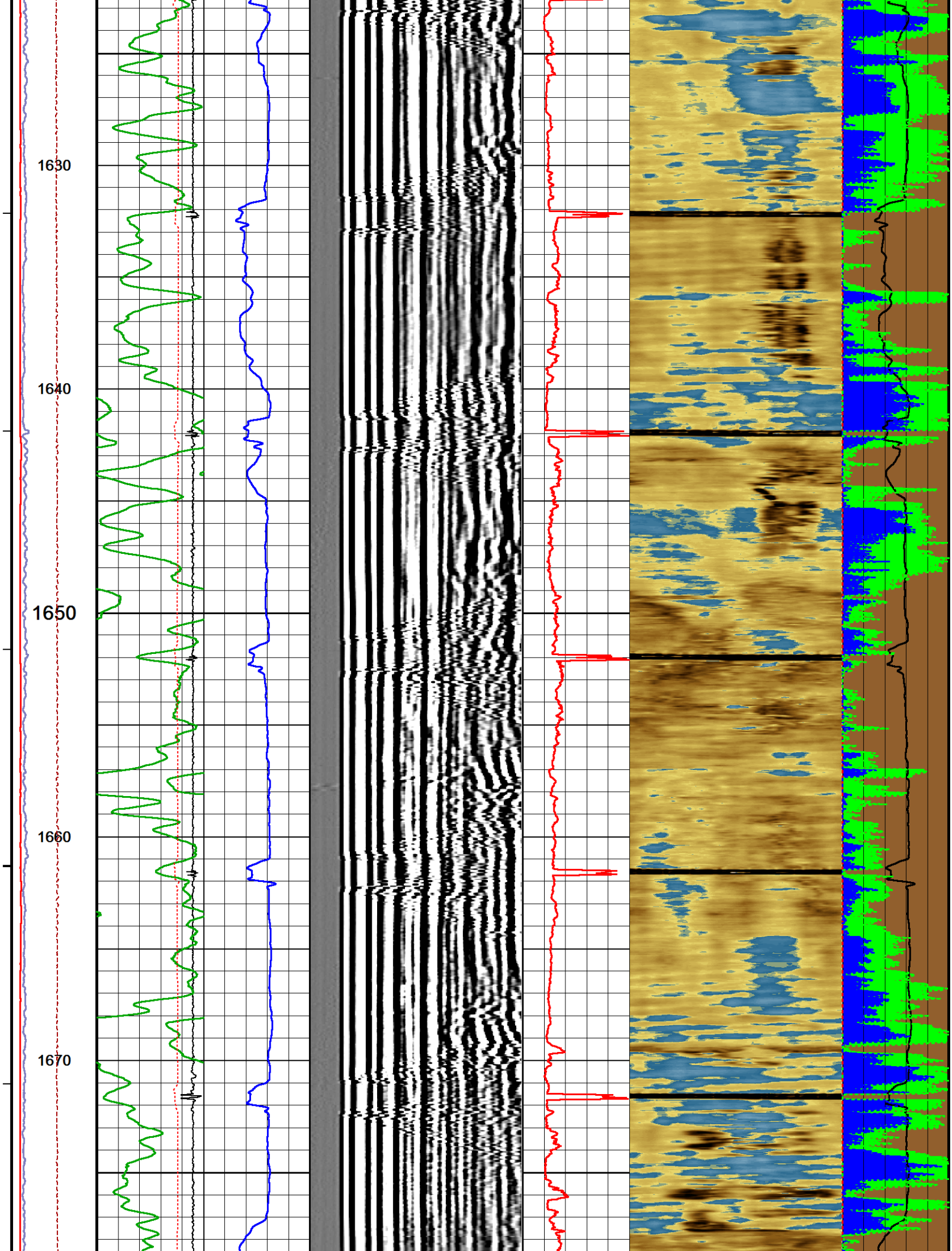
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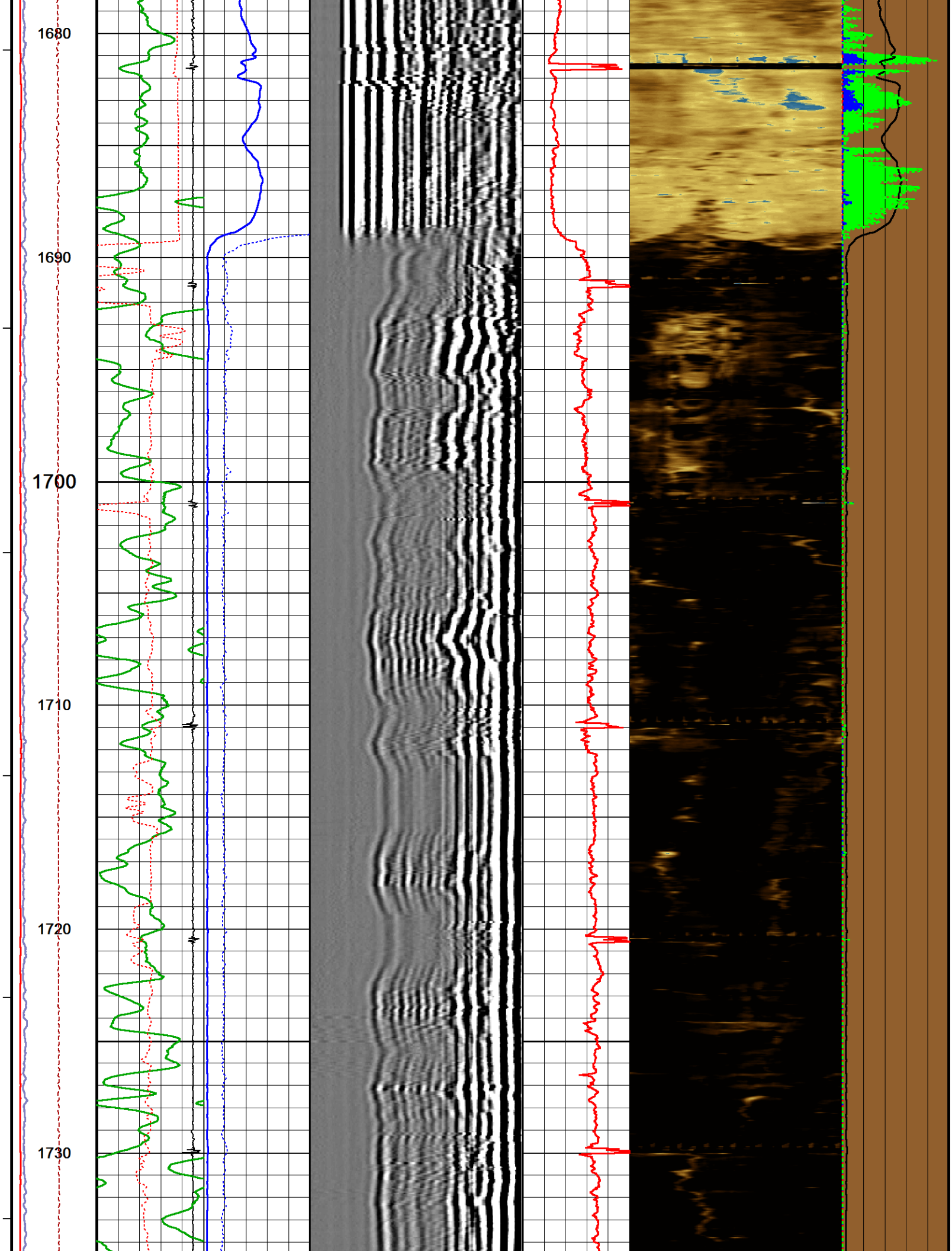
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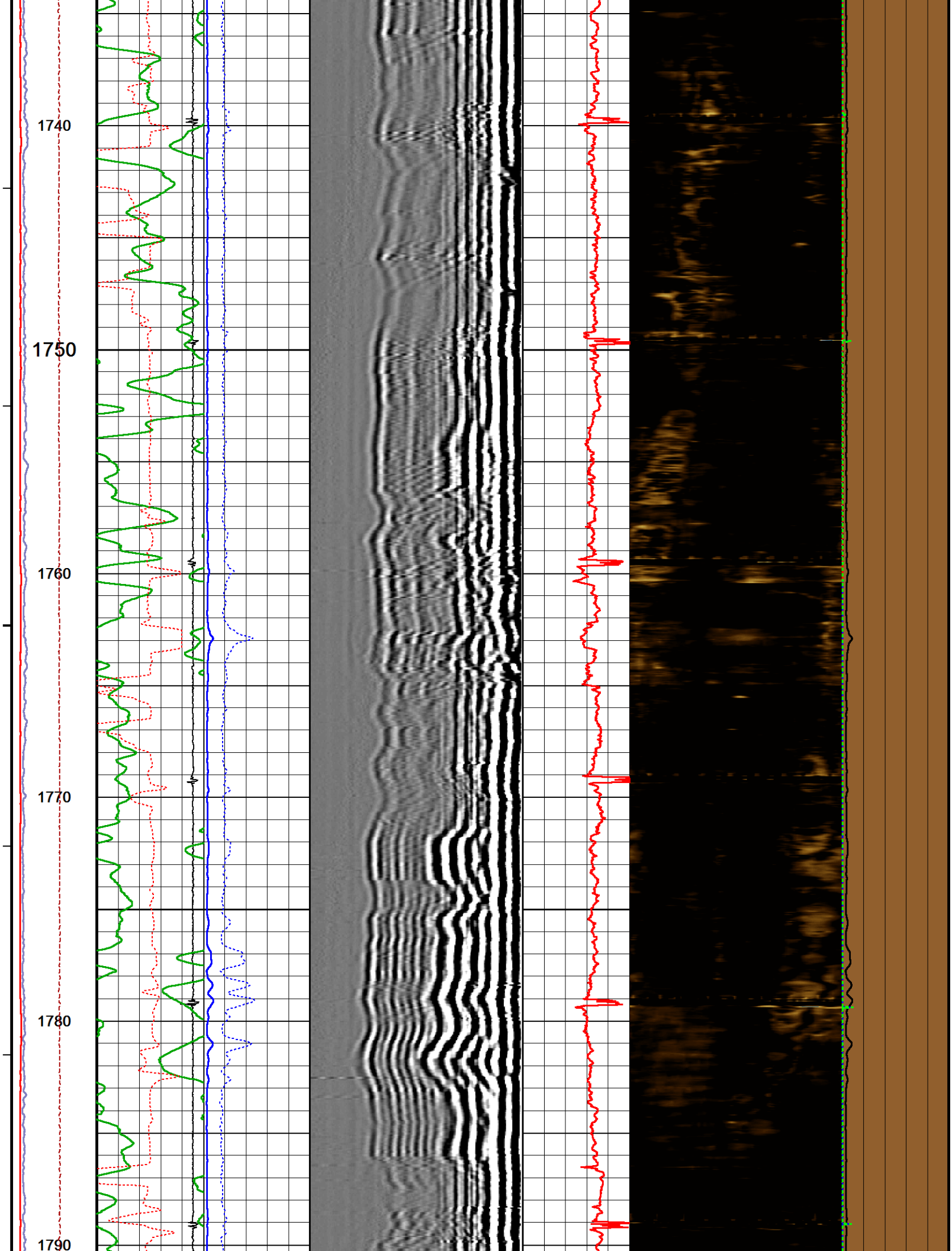
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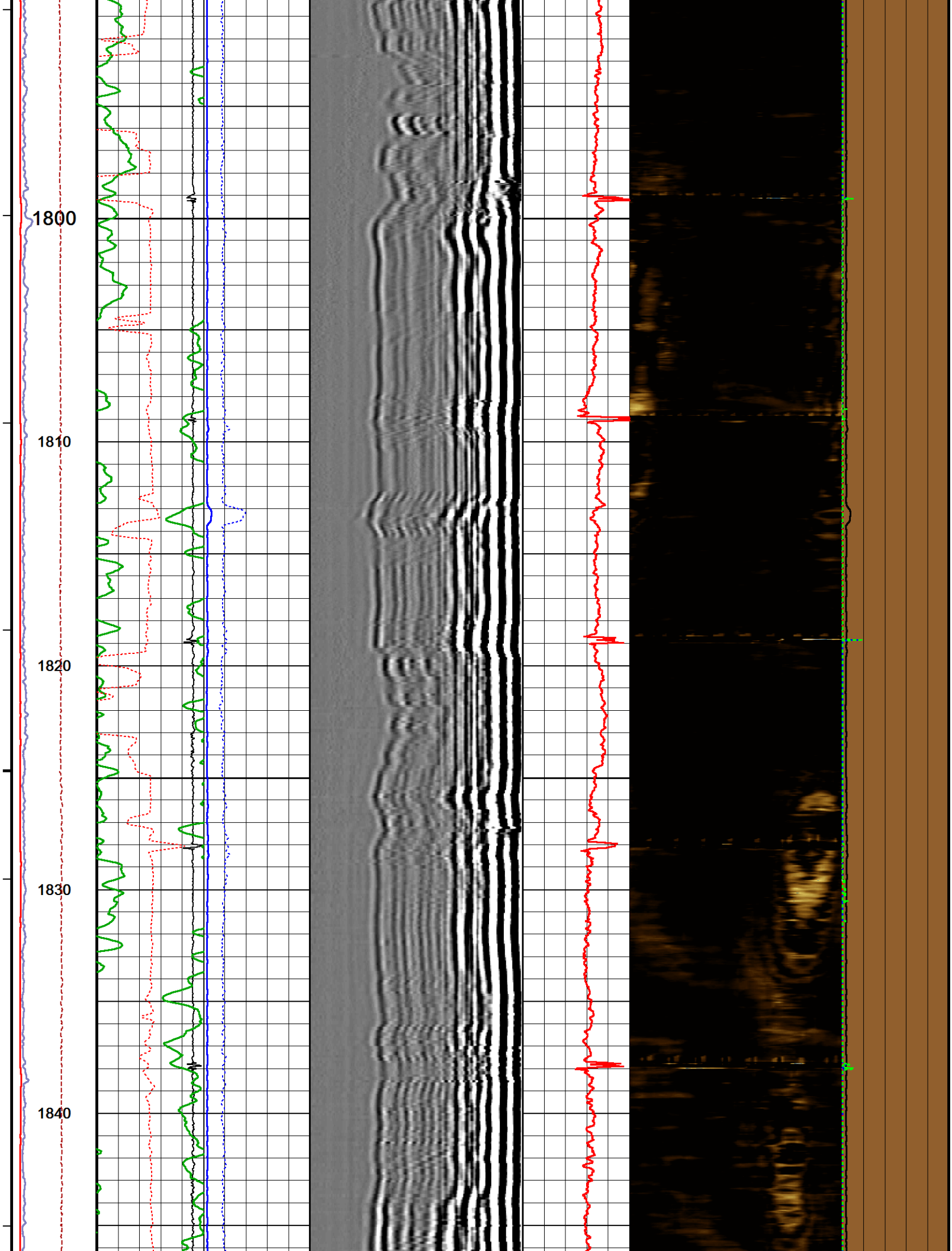
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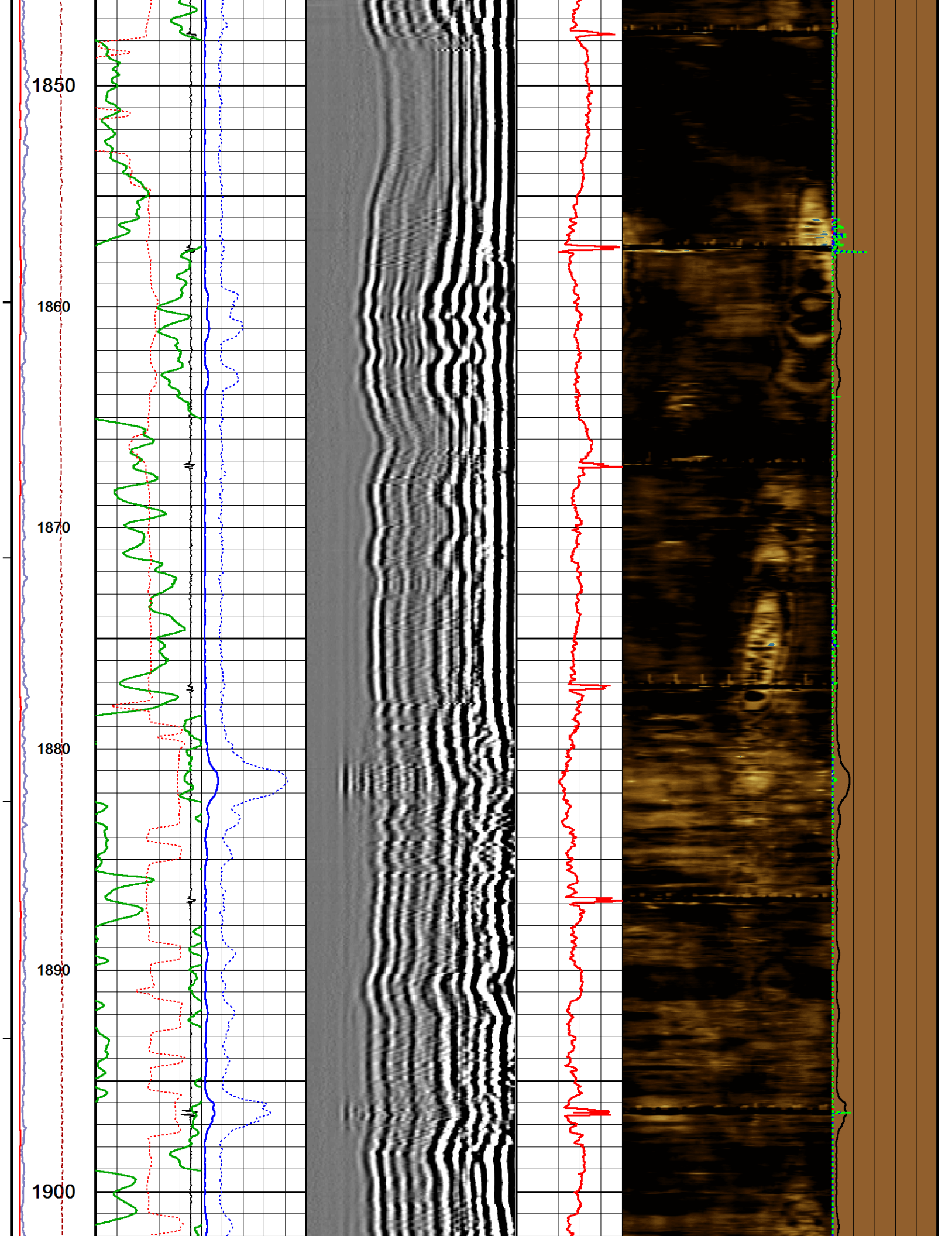
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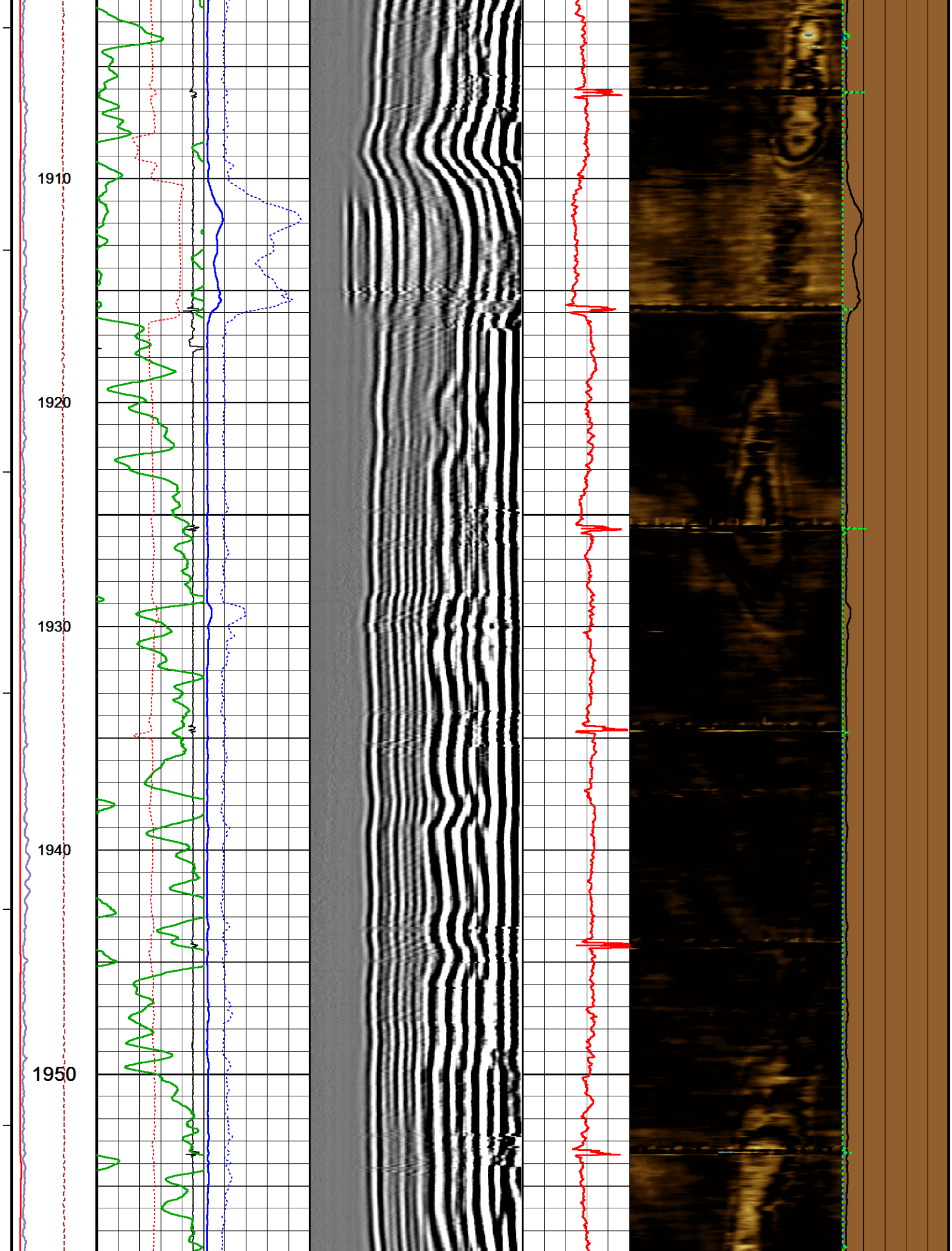
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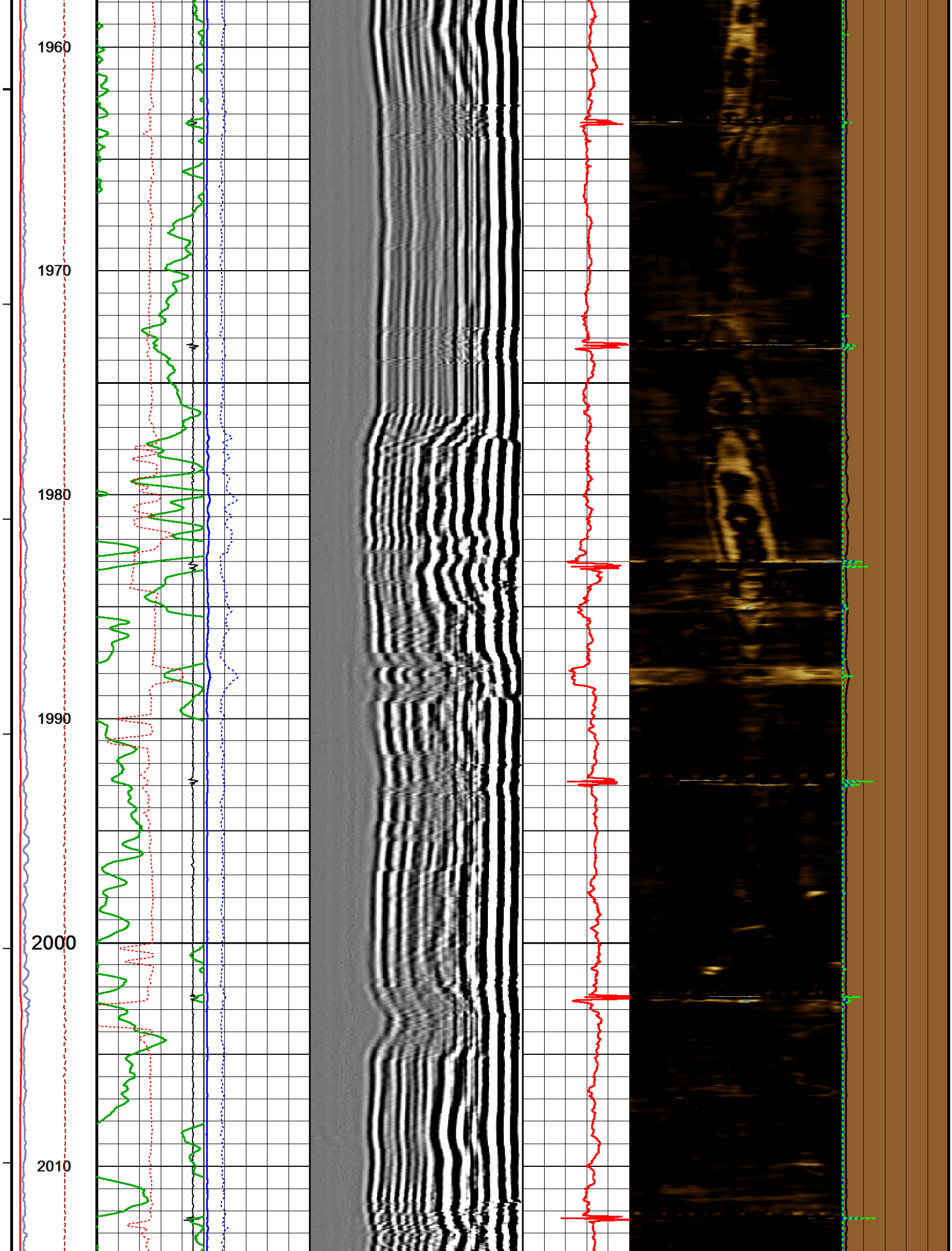
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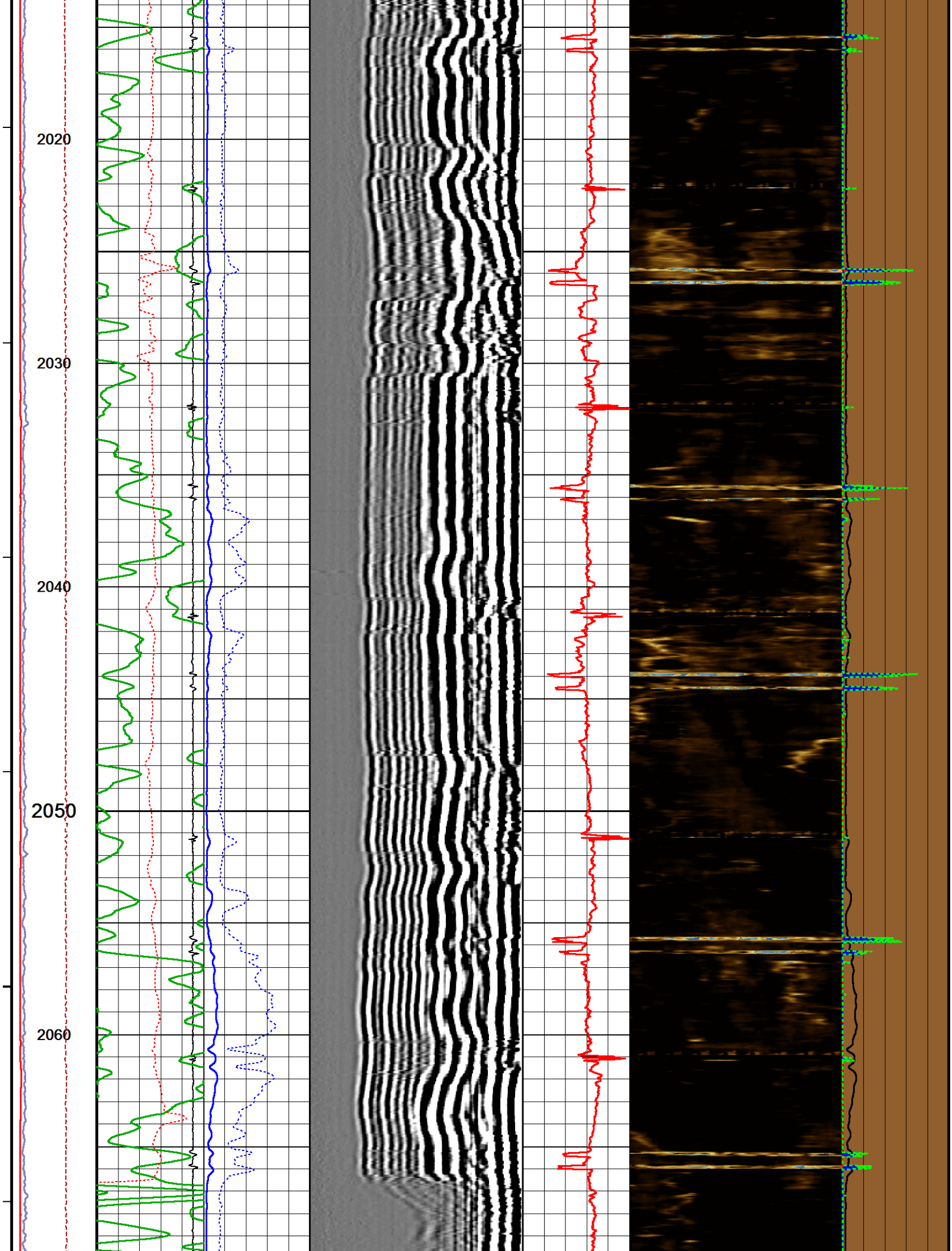
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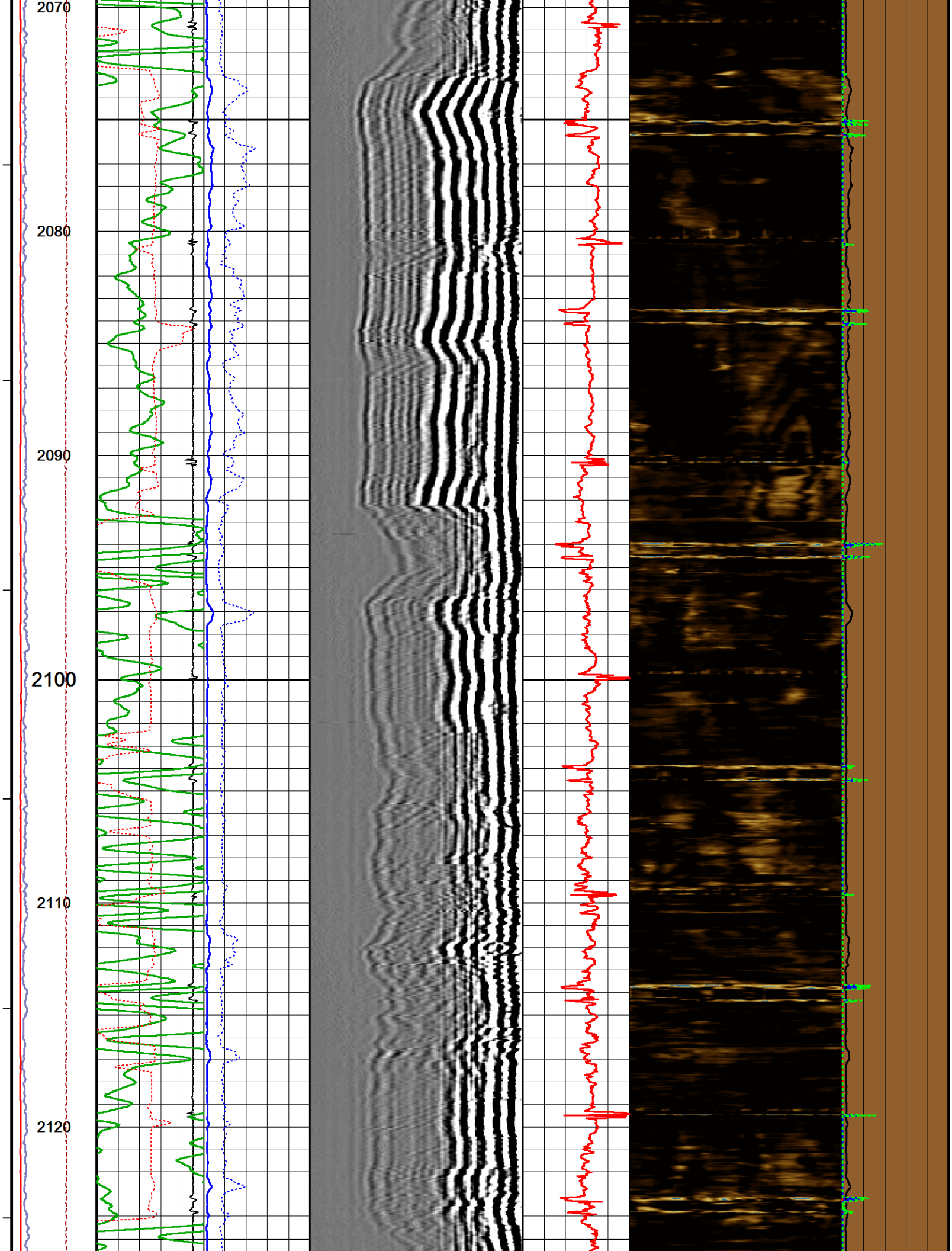
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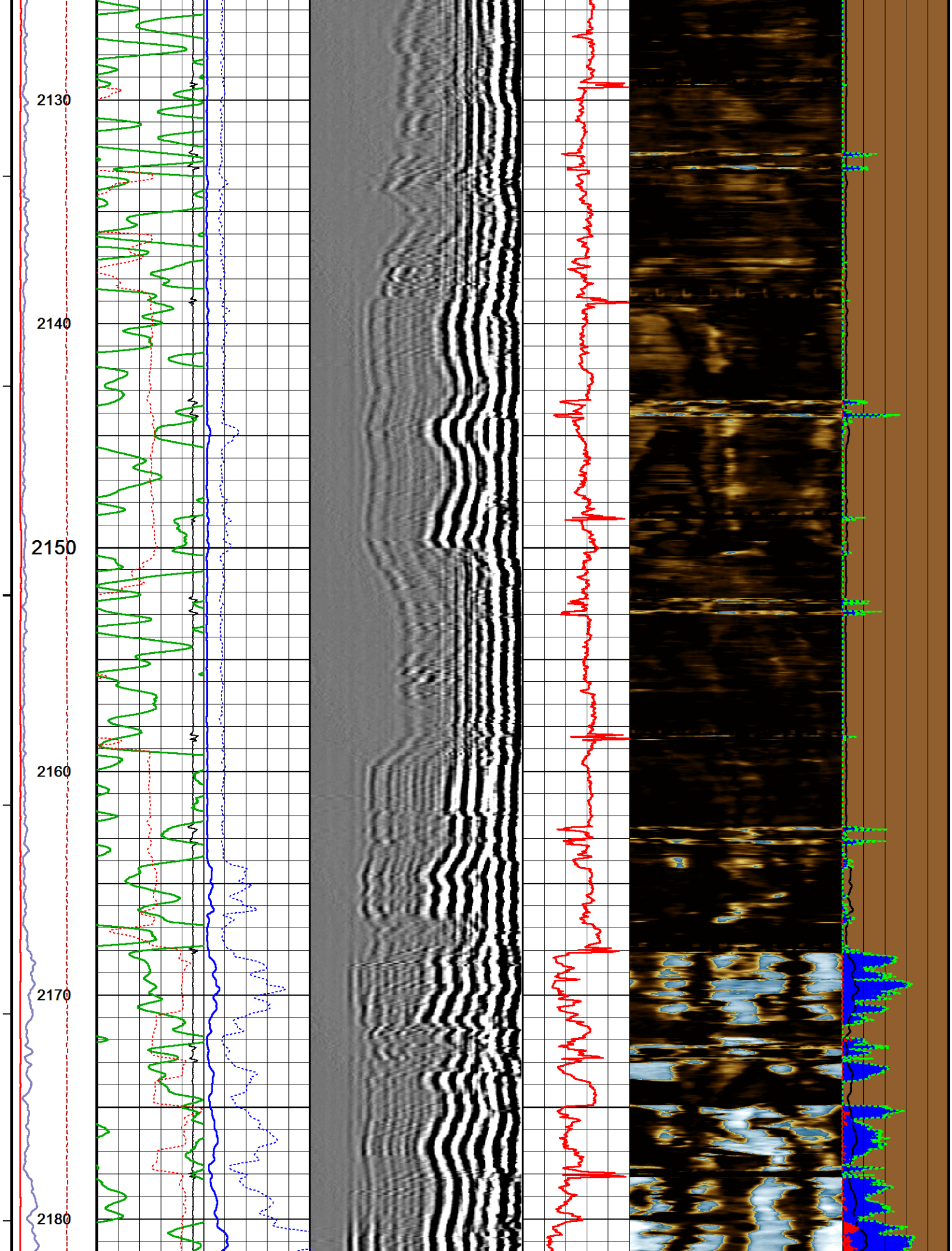
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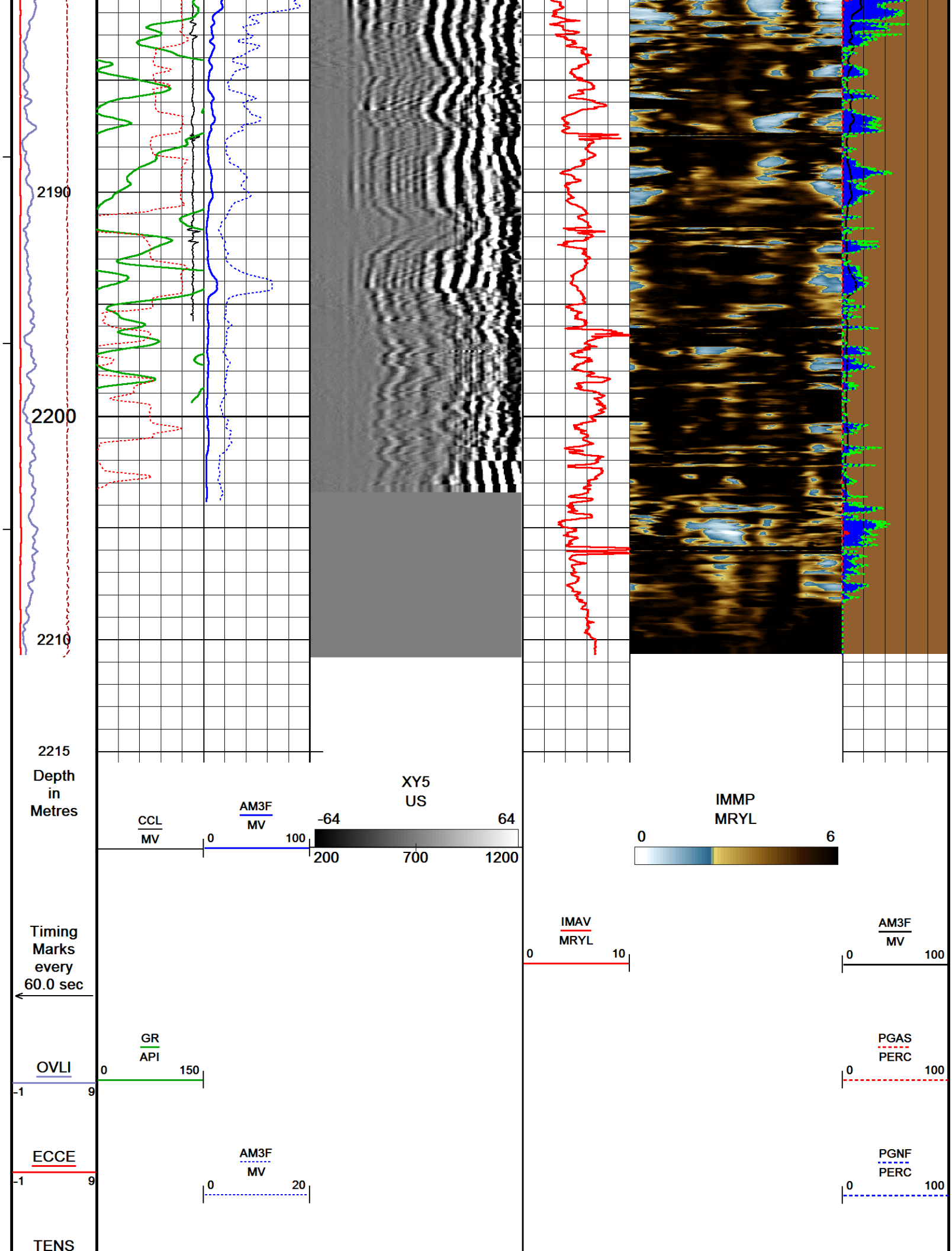
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2200
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2215
Depth
in
Metres
XY5
US
CCL
MV
AM3F
MV
0
100
-64
64
200
700
1200
IMMP
MRYL
0
6
Timing
Marks
every
60.0 sec
IMAV
MRYL
0
10
AM3F
MV
0
100
GR
API
0
150
OVLI
-1
9
PGAS
PERC
0
100
ECCE
-1
9
AM3F
MV
0
20
PGNF
PERC
0
100
TENS

0 5000

TM3
US
400 200

PCON
PERC
0 100

Replay
Scale
1:200

Depth Based Data - Maximum Sampling Increment 2.5cm
Plotted on 03-OCT-2018 17:46
Filename: C:\Users\ADMINI~2\AppData...\NOORINDOO 1_RUN 1_URS-CBL-CCL-GR_MAINPASS.dta
Recorded on 03-OCT-2018 13:18
System Versions: Logged with 18.03.9328 Plotted with 17.03.9215

MAINPASS 1:200

DOWNHOLE EQUIPMENT

C:\Users\ADMINI~2\AppData\Local\Temp\Weatherford PreView27\0\NOORINDOO 1_RUN 1_URS-CBL-CCL-GR_MAINPASS.dta

CBH-A, Cablehead, 55 pin
CBH-AA 120 LG: 0.93 m WT: 39.7 lb OD: 86.0 mm

Crossover 11-pin to 55-pin
XOV-KB 224 LG: 0.45 m WT: 13.2 lb OD: 86.0 mm

Casing Collar Locator, 55 pin
CCL-WA 153 LG: 0.92 m WT: 19.8 lb OD: 70.0 mm

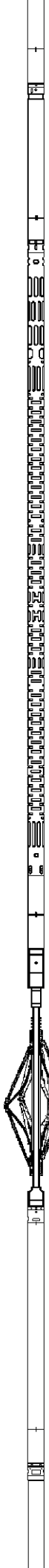
15.00 m CCL - Collar Locator

CommSub, OH, 86mm
WCC-BC 235 LG: 2.31 m WT: 125.7 lb OD: 86.0 mm

Gamma Ray
UGR-JD 316 LG: 1.40 m WT: 81.6 lb OD: 86.0 mm

11.62 m GR - Gamma Ray

Compensated Sonic
HBB-AB 172 LG: 4.62 m WT: 229.3 lb OD: 86.0 mm



7.37 m XY5 - XY Signature 5FT

7.07 m AM3F - Amplitude 3FT

7.07 m TM3 - Travel Time 3FT

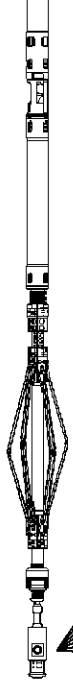
55 pin Centralizer
CEN-XA 167 LG: 1.37 m WT: 86.0 lb OD: 86.0 mm

URS Electronics Cartridge
UCC-AA 163 LG: 1.38 m WT: 79.4 lb OD: 86.0 mm

URS Sonde Section
USS-AB 163 LG: 2.94 m WT: 167.6 lb OD: 86.0 mm

Ultrasonic Radial Scanner Head B
USH-BA 108 LG: 0.31 m WT: 13.2 lb OD: 80.0 mm

Total Length: 16.62 m Weight: 855.4 lb



0.11 m	IMMP - Impd Map
0.11 m	IMAV - Avg Impedance
0.11 m	ECCE - Eccentering
0.11 m	OVLI - ID Ovality
0.11 m	PGNF - Fluid Percent
0.11 m	PGAS - Gas Percent
0.11 m	PCON - Contaminated Percent
0.00 m	TENS - Tension
Tool Zero	(0.00m from bottom)

All measurements relative to tool zero.

SHOP AND FIELD CALIBRATIONS

C:\Users\ADMINI~2\AppData\Local\Temp\Weatherford PreView27\0\NOORINDOO 1_RUN 1_URS-CBL-CCL-GR_MAINPASS.dta

HBB Field Calibration HBB-AB 172

Field Calibration on 00-JAN-1988 00:00

High Resolution Borehole Sonic Amplitude Field Calibration

Tool Type HBB-AB Serial No 172

Free Pipe Depth

Sensor	Description	Standard(mV)	Measured(mV)
AMP 3 FT	100 % Bond	1.70	4.14
	Free Pipe	62.00	346.92
AMP 5 FT	100 % Bond	0.10	9.09
	Free Pipe	41.00	293.34

HBB Constants HBB-AB 172

Last Edited on 03-OCT-2018 12:07

Min Ampl 100% Bond	1.08 MV
Max Ampl 0% Bond	62.03 MV
Cement Cmpr Strength	2500 PSI
Casing Size	7.00 IN
Casing Weight	34.2 KG/M
Casing Velocity	57.00 US/F
DT Fluid	200.0 US/F
Maximum Attenuation	12.00 DB/F
3' TT Correction	-999.3 US
Cement Weight	12.90 LB/G

Ultrasonic Radial Scanner Before Cal USH-BA 108

Field Calibration on 00-JAN-1988 00:00

Ultrasonic Radial Scanner Before Calibration

Tool Type USH-BA Serial No 108

	Measured	Minimum	Maximum	
Free Pipe	-999.250	0.000	0.000	MRYL
Mud Impedance	1.500	0.000	0.000	MRYL

URS Constants USH-BA 108

Last Edited on 03-OCT-2018 12:07

*** Well Information ***

** NOTE **

If `Use General Settings` is set to `OFF`, the `ZHead Cal` and `ZMud Cal` values Will be obtained from `Depth Specific Settings` entry

** General Settings **

Use General Settings	ON
ZHead Cal Area Ratio	3.60
ZMud Cal Area Ratio	3.90

** Depth Specific Settings **

Dpth Intvl Min(M)	Dpth Intvl Max(M)	Cs Sz (IN)	Cs WT (LB/G)	ZHd Cal ARatio	ZMd Cal ARatio	Thk (IN)	Harmnc K Factor
0.000	235.610	7.00	53.57	1.50	1.50	0.32	1.00
0.000	2215.000	7.00	34.23	1.50	1.50	0.32	1.00

** Constants **

Thickness Calculated from	ADA
Radius Offset	0.00
Mud Slowness Offset	0.00 US/F
Mud Chamber Equation	Titanium Air Backed
Z_mud at Calibration	1.50 MRYL
Z_mud Outside	1.70 MRYL
Gas Impedance Cutoff	0.38 MRYL
Fluid Impedance Cutoff	2.30 MRYL
Contam Impedance Cutoff	2.70 MRYL
Relative Bearing Rotate	OFF
RB Offset Angle	0.00 DEG
Cement Density	15.20 LB/G

COMPANY	AGL

WELL	NOORINDOO 1
FIELD	SURAT BASIN
PROVINCE/COUNTY	QUEENSLAND
COUNTRY/STATE	AUSTRALIA

Elevation Kelly Bushing		metres	Bottom Log Interval	2210.50	metres
Elevation Drill Floor	280.72	metres	Depth Driller	2215.00	metres
Elevation Ground Level	277.06	metres	Depth Logger	2210.50	metres

Weatherford®

SECUREVIEW

ULTRAVIEW

1:200

Bore Report

From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
22782	Artesian - Controlled Flow	Existing	17/05/1971	Roma	4860 - MARANOA REGIONAL

Details

Description	P35V		
Parish	3593 - NOORINDOO		
Original Name	UOD NOORINDOO 3		
Driller Name			
Drill Company			
Const Method	ROTARY RIG		
Bore Line			
D/O File No		**Polygon**	
R/O File No		**Equipment**	NE
H/O File No	04522	**RN of Bore Replaced**	
Log Received Date		**Data Owner**	
Roles			

Location

Latitude	27-07-41	**Basin**	4222
Longitude	149-12-37	**Sub-area**	
GIS Latitude	-27.128150179	**Lot**	
GIS Longitude	149.210291013	**Plan**	
Easting	719081		
Northing	6997446	**Map Scale**	104 - 1: 100 000
Zone	55	**Map Series**	M - Metric Series
Accuracy		**Map No**	8743
GPS Accuracy		**Map Name**	SURAT
Checked	No	**Prog Section**	

Casing

0 ***records for RN*** **22782**

Strata Logs

1 ***records for RN*** **22782**

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	2139.60	NO STRATA RECORDS AVAILABLE

Stratigraphies

0 ***records for RN*** **22782**

Aquifers

0 ***records for RN*** **22782**

Bore Report

From Year:

Pump Tests Part 1

1 *records for RN* 22782

Pipe	Date	Rec	RN of Pumped Bore	Top (m)	Bottom (m)	Dist (m)	Meth	Test Types	Pump Type	Suction Set (m)	Q Prior to Test (l/s)	Dur of Q PR (mins)	Pres on Arriv (m)	Q on Arriv (l/s/)
A	01/01/1971	1												

Pump Tests Part 2

1 *records for RN* 22782

Pipe	Date	Rec	Test Dur (mins)	SWL(m)	Recov Time (mins)	Resid DD (m)	Max DD or P RED (m)	Q at Max DD (l/s)	Time to Max DD (mins)	Max Q (l/s)	Calc Stat HD (m)	Design Yield (l/s)	Design BP (m)	Suct. Set (m)	Tmsy (m2/Day)	Stor
A	01/01/1971	1														

Bore Conditions

0 *records for RN* 22782

Elevations

1 *records for RN* 22782

Pipe	Date	Elevation (m)	Precision		Datum	Meas	Point	Survey Source
A	17/05/1971	259.80	BAR	Aneroid Barometer	STD - State Datum	N	Natural Surface	

Water Analysis Part 1

0 *records for RN* 22782

Water Analysis Part 2

0 *records for RN* 22782

Water Levels

0 *records for RN* 22782

Wire Line Logs

0 *records for RN* 22782

Field Measurements

0 *records for RN* 22782

Special Water Analysis

0 *records for RN* 22782

Bore Report

From Year:

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APPENDIX B SAFETY DATA SHEETS

Material safety data sheet

SECTION 1-COMPANY IDENTIFICATION

Trade name:	Wanli® ceramic proppant(All Mesh Sizes)
Synonym(s):	Ceramic Proppant
Uses:	Oil&Gas Reservoir
Manufacturer:	Xinmi Wanli Industry Development Co., Ltd No.4 Wenhua Road, Xinmi city, Henan, China 452370
Tel./Fax:	+ 86 371 60126628/+ 86 371 60126629
Issuing Date:	7th, February, 2019

SECTION 2-COMPONENT INFORMATION

INGREDIENTS	CAS NUMBER	CONCENTRATION	CLASSIFICATION	R-PHRASES
Corundum	1302-74-5	55%~65%	Not Classified	Not assigned
Mullite	1302-93-8	35%~45%	Not Classified	Not assigned

SECTION 3-PHYSICAL AND CHEMICAL PROPERTIES

Boling point:	N/A F	Specific gravity:	≤3.00 g/cm^3 (H2O=1)	pH: N/A
Melting point:	4000 F (estimated)	Bulk density:	≤1.65 g/cm^3	
Vapor pressure:	N/A mm Hg	% volatile by weight:	N/A	
Vapor density:	N/A (Air=1)	evaporation rate:	N/A (Butyl Acetate=1)	
Appearance/odor:	Brown to dark green to black spheres with possible light sweet odor.	Solubility in water:	Insoluble	

Volatile organic compounds (VOC): 0 lbs/gal (EPA Reference Methods 24)

SECTION 4-FIRE AND EXPLOSION HAZARD DATE

Flash point:	non flammable
Estimated explosive limits (% by volume in air):	LEL: N/A UEL: N/A
Special firefighting procedures:	N/K
Extinguishing media:	Use extinguishing agent suitable for type of surrounding fire.
Unusual fire and explosion hazards:	inorganic, non-hazardous.

SECTION 5-HAZARD IDENTIFICATION

GHS Classification:
Flammable liquids : No
Skin corrosion/irritation : No
Serious eye damage/eye : Airborne dust may cause irritation to eyes
Irritation: No
Skin sensitization : Prolonged contact with a skin may cause irritation

GHS Label element
Hazard pictograms :

Inhalation: Inhalation of dusts may cause respiratory tract irritation. Repeated or prolonged breathing of particles of respirable size may cause severe respiratory disease. However, this product contains few particles of respirable size. The amount of dust due to breakdown during shipment and intended use and handling is not expected to exceed applicable exposure limits.

Signal Word : Non-Hazardous

Hazard Statements : Airborne dust may cause irritation to eyes. Prolonged contact with a skin may cause irritation.

Precautionary Statements : Prevention: Avoid breathing dust. Wear protective gloves/ protective clothing/ eye protection/ face protection.
Response: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

SECTION 6-EMERGENCY AND FIRST AID MEASURES

Inhalation:	Remove affected person from source of exposure. Get medical attention if irritation occurs.
Ingestion:	No treatment is necessary unless large quantities.Seek medical attention if large quantities are ingested.
Eye contact:	Immediately flush eyes with large amounts of water,lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention.
Skin contact:	Wash the affected area with soap and water. Get medical attention if irritation occurs.

SECTION 7-PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in case material is released or spilled: No Special procedures are required for clean-up of spills or leaks of this material. Surfaces should become slippery due to the round sand particles. Sweep up the spilled material to prevent falls. Persons should take care so as not to slip

SECTION 8-HANDLING AND STORAGE

Handling:	Avoid skin and eye contact. Do not create dust. Use personal protective equipment. Refer to section 8 for personal protective equipment.
Storage:	Store under cool dry conditions in closed container to reduce dust. Avoid high temperature and moisture to reduce tendency to create lumps.

SECTION 9-STABILITY AND REACTIVITY

Reactivity:	Minimal
Stability:	Stable
Incompatible materials:	Strong oxidizing agents, strong bases, strong acids, alkalis, calcium hypochlorite.

SECTION 10-TOXICOLOGICAL INFORMATION

Acute effects	Coughing and throat irritation are early symptoms of excessive exposure. May be irritating to the respiratory system, lungs and skin. May also cause irritation to eyes.
Chronic effects:	Chronic exposure in excess of established human exposure levels can cause severe respiratory diseas

SECTION 11-ECOLOGICAL INFORMATION

This product poses no significant environmental contamination impact during expected use, handling, and proper disposal.

SECTION 12-DISPOSAL CONSIDERATIONS

Waste disposal: Disposal must be at an approved waste disposal facility and in accordance with applicable Federal, State and Local laws and regulations. Contact the district Director of the Environmental Protection Agency and/or state regulatory agency for appropriate requirements.

SECTION 13-TRANSPORT INFORMATION

UN NO.	N/A
ICAO/IATA	Not Restricted
RID/ADR	Not Restricted
DOT SHIPPING DESCRIPTION	Not Restricted
CAN	Not Restricted
IMO	Not Restricted

SECTION 14-EXPOSURE CONTROLS/PROTECTION DURING USE

EXPOSURE LIMITS:

INGREDIENTS	OSHA PEL-TWA	ACGIH-TWA TLV
Corundum	15 mg/m3 (total)	10 mg/m3 (total)
	5 mg/m3 (respirable)	3 mg/m3 (respirable)
Mullite	15 mg/m3 (total)	10 mg/m3 (total)
	5 mg/m3 (respirable)	3 mg/m3 (respirable)

RESPIRATORS:

An applicable NIOSH/MSHA or equivalent approved respirator should be worn where airborne exposures may exceed OSHA/ACGIH permissible air concentrations. Follow the OSHArespirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

VENTILATION:

Provide sufficient (general and/or local exhaust) ventilation to maintain exposure below permissible air concentrations.

ENGINEERING CONTROL MEASURES:

Exposure to this material may be controlled in a number of ways. The measures appropriate for a particular worksite depend on how the material is used and the potential for exposure. Use of the basic principles of industrial hygiene will enable safe handling of the material.

EYE PROTECTION:

Wear safety glasses or chemical goggles to prevent eye contact. Do not wear contact lenses when working with this substance unless protected under full coverage goggles.

CLOTHING/GLOVES:

Gloves are optional to reduce abrasion.

WORK HYGIENE PRACTICES:

Handle in accordance with good personal hygiene and safety practices.

SECTION 15-REGULATORY INFORMATION

TOXIC SUBSTANCE CONTROL ACT (TSCA) STATUS: All chemicals in this product arelisted, automatically included, or are exempt from listing on the TSCA Inventory.

SARA TITLE III: Section 302: None
Section 312: None
Section 313: None

CERCLA REPORTABLE QUANTITY: None

CLEAN AIR AMENDMENTS-HAZARDOUS AIR POLLUTANTS (HAPS): None

CALIFORNIA STATE PROPOSITION 65: N/A

SECTION 16-CONTACT INFORMATION

Xinmi Wanli Industry Development Co., Ltd.
Xinmi City, Henan, China
Tel: +86 (371) 6012-6628 Fax: +86 (371) 6012-6629
www.wlproppant.com wl@wlproppant.com

Holcim

SAFETY DATA SHEET

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

1.1 Product identifier

Product name **HOLCIM GRADED SAND & GRAVEL PRODUCTS**

Synonyms 16/30, 20/40, 40/70, 45/200 - PRODUCT CODES ● 3/2, 5/2, 6/3 - PRODUCT CODES ● 6, 8/16, 12/20, 18/40, 20/40, 30/60, 40/70, 45/200, 8/16FG, 16/30FG, 18/40FG, 30/60FG - PRODUCT CODES ● FILTERSIL SERIES ● GRAVEL SERIES ● HOLCIM GRADED SAND AND GRAVEL PRODUCTS ● HOLFRAC SERIES

1.2 Uses and uses advised against

Uses DRILLING APPLICATIONS ● FILTRATION

Uses advised against This product is not to be used for abrasive blasting applications.

1.3 Details of the supplier of the product

Supplier name **HOLCIM (AUSTRALIA) PTY LTD**

Address Level 8, Tower B, 799 Pacific Hwy, Chatswood, NSW, 2067, AUSTRALIA

Telephone (02) 9412 6600

Fax (02) 9412 6601

Website http://www.holcim.com.au

1.4 Emergency telephone numbers

Emergency (02) 9412 6600; 13 11 26 (Poisons Information Centre)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

NOT CLASSIFIED AS HAZARDOUS ACCORDING TO SAFE WORK AUSTRALIA CRITERIA

2.2 GHS Label elements

No signal word, pictograms, hazard or precautionary statements have been allocated.

2.3 Other hazards

No information provided.

3. COMPOSITION/ INFORMATION ON INGREDIENTS

3.1 Substances / Mixtures

Ingredient	CAS Number	EC Number	Content
QUARTZ (CRYSTALLINE SILICA) (IE. SAND)	14808-60-7	238-878-4	99%
NON HAZARDOUS INGREDIENTS	Not Available	Not Available	Remainder

Ingredient Notes Contains <0.1% respirable crystalline silica in the form of quartz.

4. FIRST AID MEASURES

4.1 Description of first aid measures

Eye If in eyes, hold eyelids apart and flush continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre, a doctor, or for at least 15 minutes.

Inhalation If inhaled, remove from contaminated area. Apply artificial respiration if not breathing.

Skin If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water. Continue flushing with water until advised to stop by a Poisons Information Centre or a doctor.

Ingestion For advice, contact a Poisons Information Centre on 13 11 26 (Australia Wide) or a doctor (at once). Due to

product form and application, ingestion is considered unlikely.

First aid facilities None allocated.

4.2 Most important symptoms and effects, both acute and delayed
Contact with dust / powder may result in mechanical irritation.

4.3 Immediate medical attention and special treatment needed
Treat symptomatically.

5. FIRE FIGHTING MEASURES

5.1 Extinguishing media
Use an extinguishing agent suitable for the surrounding fire.

5.2 Special hazards arising from the substance or mixture
Non flammable. May evolve toxic gases if strongly heated.

5.3 Advice for firefighters
No fire or explosion hazard exists.

5.4 Hazchem code
None allocated.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear Personal Protective Equipment (PPE) as detailed in section 8 of the SDS.

6.2 Environmental precautions
Prevent product from entering drains and waterways.

6.3 Methods of cleaning up
Contain spillage, then collect and place in suitable containers for disposal. Avoid generating dust.

6.4 Reference to other sections
See Sections 8 and 13 for exposure controls and disposal.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Before use carefully read the product label. Use of safe work practices are recommended to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating. Prohibit eating, drinking and smoking in contaminated areas.

7.2 Conditions for safe storage, including any incompatibilities
Store in a cool, dry, well ventilated area, removed from incompatible substances and foodstuffs. Ensure containers are adequately labelled, protected from physical damage and sealed when not in use.

7.3 Specific end uses
No information provided.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters
Exposure standards

Ingredient	Reference	TWA		STEL	
		ppm	mg/m³	ppm	mg/m³
Quartz (respirable dust)	SWA [AUS]	--	0.05	--	--
Quartz (respirable dust)	WorkSafe VIC	--	0.02	--	--

Biological limits
No biological limit values have been entered for this product.

8.2 Exposure controls

Engineering controls Avoid inhalation. Use in well ventilated areas. Where an inhalation risk exists, mechanical extraction ventilation is recommended. Wet where possible. Maintain dust levels below the recommended exposure standard.

PPE

Eye / Face	When using large quantities or where heavy contamination is likely, wear dust-proof goggles.
Hands	When using large quantities or where heavy contamination is likely, wear PVC or rubber or cotton gloves.
Body	Not required under normal conditions of use.
Respiratory	Where an inhalation risk exists, wear a Class P1 (Particulate) respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance	OFF WHITE TO LIGHT BROWN CRYSTALS
Odour	ODOURLESS
Flammability	NON FLAMMABLE
Flash point	NOT RELEVANT
Boiling point	NOT AVAILABLE
Melting point	NOT AVAILABLE
Evaporation rate	NOT AVAILABLE
pH	NOT AVAILABLE
Vapour density	NOT AVAILABLE
Relative density	2.65
Solubility (water)	INSOLUBLE
Vapour pressure	NOT AVAILABLE
Upper explosion limit	NOT RELEVANT
Lower explosion limit	NOT RELEVANT
Partition coefficient	NOT AVAILABLE
Autoignition temperature	NOT AVAILABLE
Decomposition temperature	NOT AVAILABLE
Viscosity	NOT AVAILABLE
Explosive properties	NOT AVAILABLE
Oxidising properties	NOT AVAILABLE
Odour threshold	NOT AVAILABLE

10. STABILITY AND REACTIVITY

10.1 Reactivity

Carefully review all information provided in sections 10.2 to 10.6.

10.2 Chemical stability

Stable under recommended conditions of storage. At 825°C calcium carbonate (calcite) decomposes and emits carbon dioxide and corrosive fumes of calcium oxide.

10.3 Possibility of hazardous reactions

Polymerization will not occur.

10.4 Conditions to avoid

Avoid contact with incompatible substances.

10.5 Incompatible materials

Incompatible with strong acids (e.g. hydrochloric acid).

10.6 Hazardous decomposition products

May evolve toxic gases if heated to decomposition.

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity Based on available data, the classification criteria are not met.

Skin	Contact may result in mechanical irritation, redness, rash and dermatitis.
Eye	Contact may result in mechanical irritation, lacrimation and redness.
Sensitisation	Not classified as causing skin or respiratory sensitisation.
Mutagenicity	Insufficient data available to classify as a mutagen.
Carcinogenicity	Not classified as a carcinogen. Crystalline silica is classified as carcinogenic to humans (IARC Group 1). However, adverse health effects are not anticipated given the non respirable nature of the silica quartz in this product (as supplied).
Reproductive	Insufficient data available to classify as a reproductive toxin.
STOT - single exposure	Not classified as causing organ damage from single exposure. However, over exposure may result in irritation of the nose and throat, with coughing.
STOT - repeated exposure	Not classified as causing organ damage from repeated exposure. Adverse health effects, usually associated with long term exposure to high crystalline silica dust levels are not anticipated due to the product form. This product may only present a hazard if respirable quartz dust is generated. Chronic exposure to dust may cause lung fibrosis (silicosis).
Aspiration	This product is a solid and aspiration hazards are not expected to occur.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
The substance is inert and there is no evidence of significant toxicity.

12.2 Persistence and degradability
Being inorganic, the substance will not biodegrade.

12.3 Bioaccumulative potential
The substance is inert and will not be absorbed and accumulate in tissues.

12.4 Mobility in soil
No information provided.

12.5 Other adverse effects
The main component/s of this product are not anticipated to cause any adverse effects to plants or animals.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Waste disposal	Reuse where possible. No special precautions are normally required when handling this product.
Legislation	Dispose of in accordance with relevant local legislation.

14. TRANSPORT INFORMATION

NOT CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE, IMDG OR IATA

	LAND TRANSPORT (ADG)	SEA TRANSPORT (IMDG / IMO)	AIR TRANSPORT (IATA / ICAO)
14.1 UN Number	None allocated.	None allocated.	None allocated.
14.2 Proper Shipping Name	None allocated.	None allocated.	None allocated.
14.3 Transport hazard class	None allocated.	None allocated.	None allocated.
14.4 Packing Group	None allocated.	None allocated.	None allocated.

14.5 Environmental hazards
Not a Marine Pollutant.

14.6 Special precautions for user
Hazchem code None allocated.

15. REGULATORY INFORMATION

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

Poison schedule A poison schedule number has not been allocated to this product using the criteria in the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).

Classifications Safe Work Australia criteria is based on the Globally Harmonised System (GHS) of Classification and Labelling of Chemicals (GHS Revision 7).

Inventory listings **AUSTRALIA: AIIC (Australian Inventory of Industrial Chemicals)**
All components are listed on AIIC, or are exempt.

16. OTHER INFORMATION

Additional information

SILICA - MEDICAL CONSIDERATIONS: Medical testing for those with frequent or potentially high exposure to silica (half the Exposure Standard or more) is recommended before beginning work and at regular intervals thereafter. This should include; Lung function tests - chest x-rays every 1-3 years. If abnormal chest x-ray develops, skin test for tuberculosis should be done. Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

EXPOSURE STANDARDS - TIME WEIGHTED AVERAGES: Exposure standards are established on the premise of an 8 hour work period of normal intensity, under normal climatic conditions and where a 16 hour break between shifts exists to enable the body to eliminate absorbed contaminants. In the following circumstances, exposure standards must be reduced: Strenuous work conditions; hot, humid climates; high altitude conditions; extended shifts (which increase the exposure period and shorten the period of recuperation).

IARC GROUP 1 - CONFIRMED HUMAN CARCINOGEN. This product contains an ingredient for which there is sufficient evidence to have been classified by the International Agency for Research into Cancer as a human carcinogen. The use of products known to be human carcinogens should be strictly monitored and controlled.

PERSONAL PROTECTIVE EQUIPMENT GUIDELINES:
The recommendation for protective equipment contained within this report is provided as a guide only. Factors such as form of product, method of application, working environment, quantity used, product concentration and the availability of engineering controls should be considered before final selection of personal protective equipment is made.

HEALTH EFFECTS FROM EXPOSURE:
It should be noted that the effects from exposure to this product will depend on several factors including: form of product; frequency and duration of use; quantity used; effectiveness of control measures; protective equipment used and method of application. Given that it is impractical to prepare a report which would encompass all possible scenarios, it is anticipated that users will assess the risks and apply control methods where appropriate.

Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
CAS #	Chemical Abstract Service number - used to uniquely identify chemical compounds
CNS	Central Nervous System
EC No.	EC No - European Community Number
EMS	Emergency Schedules (Emergency Procedures for Ships Carrying Dangerous Goods)
GHS	Globally Harmonized System
GTEPG	Group Text Emergency Procedure Guide
IARC	International Agency for Research on Cancer
LC50	Lethal Concentration, 50% / Median Lethal Concentration
LD50	Lethal Dose, 50% / Median Lethal Dose
mg/m³	Milligrams per Cubic Metre
OEL	Occupational Exposure Limit
pH	relates to hydrogen ion concentration using a scale of 0 (high acidic) to 14 (highly alkaline).
ppm	Parts Per Million
STEL	Short-Term Exposure Limit
STOT-RE	Specific target organ toxicity (repeated exposure)
STOT-SE	Specific target organ toxicity (single exposure)
SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
SWA	Safe Work Australia
TLV	Threshold Limit Value
TWA	Time Weighted Average

Report status

This document has been compiled by RMT on behalf of the manufacturer, importer or supplier of the product and serves as their Safety Data Sheet ('SDS').

It is based on information concerning the product which has been provided to RMT by the manufacturer, importer or supplier or obtained from third party sources and is believed to represent the current state of knowledge as to the appropriate safety and handling precautions for the product at the time of issue. Further clarification regarding any aspect of the product should be obtained directly from the manufacturer, importer or supplier.

While RMT has taken all due care to include accurate and up-to-date information in this SDS, it does not provide any warranty as to accuracy or completeness. As far as lawfully possible, RMT accepts no liability for any loss, injury or damage (including consequential loss) which may be suffered or incurred by any person as a consequence of their reliance on the information contained in this SDS.

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[End of SDS]

HALLIBURTON

SAFETY DATA SHEET

DCA-19002

Revision Date: 05-Jul-2016 **Revision Number:** 19

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

1.1. Product Identifier

Product Name DCA-19002

Other means of Identification

Synonyms None

Hazardous Material Number: HM007663

Recommended use of the chemical and restrictions on use

Recommended Use Crosslinker

Uses advised against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road
Jandakot
WA 6164
Australia

ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300

E-mail Address fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951

Australian Poisons Information Centre
24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

Classification of the hazardous chemical

Serious Eye Damage/Irritation	Category 2 - H319
Reproductive Toxicity	Category 1B - H360
Specific Target Organ Toxicity - (Repeated Exposure)	Category 1 - H372

Label elements, including precautionary statements

Hazard pictograms

Signal Word Danger

Hazard Statements:
H319 - Causes serious eye irritation
H360 - May damage fertility or the unborn child
H372 - Causes damage to organs through prolonged or repeated exposure

Precautionary Statements

Prevention
P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P260 - Do not breathe dust/fume/gas/mist/vapors/spray
P264 - Wash face, hands and any exposed skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P280 - Wear eye protection/face protection
P281 - Use personal protective equipment as required

Response
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P337 + P313 - If eye irritation persists: Get medical advice/attention
P308 + P313 - IF exposed or concerned: Get medical advice/attention
P314 - Get medical attention/advice if you feel unwell

Storage
P405 - Store locked up

Disposal
P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

Contains

Substances	**CAS Number**
Ulexite	1319-33-1
Ethylene glycol	107-21-1
Crystalline silica, quartz	14808-60-7

Other hazards which do not result in classification
This mixture contains no substance considered to be persistent, bioaccumulating nor toxic (PBT).
This mixture contains no substance considered to be very persistent nor very bioaccumulating (vPvB).

For the full text of the H-phrases mentioned in this Section, see Section 16

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Ulexite	1319-33-1	30 - 60%	Eye Irrit. 2A (H319) Repr. 1 (H360)
Ethylene glycol	107-21-1	10 - 30%	Acute Tox. 4 (H302) STOT RE 1 (H372)
Crystalline silica, quartz	14808-60-7	1 - 5%	Carc. 2 (H351) STOT RE 1 (H372)

4. First aid measures

Description of necessary first aid measures

Inhalation If inhaled, move victim to fresh air and seek medical attention.

Eyes	Immediately flush eyes with large amounts of water for at least 15 minutes. Get immediate medical attention.
Skin	Wash off immediately with soap and plenty of water for at least 15 minutes while removing all contaminated clothing and shoes.
Ingestion	Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Symptoms caused by exposure

Causes eye irritation Potential reproductive hazard. May cause birth defects. Prolonged or repeated exposure may cause damage to organs. Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

Suitable Extinguishing Media

Water fog, carbon dioxide, foam, dry chemical.

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical

Special exposure hazards in a fire

Decomposition in fire may produce harmful gases.

Special protective equipment and precautions for fire fighters

Special protective equipment for firefighters

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment. Avoid contact with skin, eyes and clothing. Avoid breathing vapors. Ensure adequate ventilation. Evacuate all persons from the area.

6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas. Consult local authorities.

6.3. Methods and material for containment and cleaning up

Contain spill with sand or other inert materials. Scoop up and remove. Isolate spill and stop leak where safe.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions

Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Avoid breathing mist. This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud if this product becomes dry. Avoid breathing or creating dust. Use only with adequate ventilation to keep exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, or equivalent respirator when using dried product. Ensure adequate ventilation. Material is slippery underfoot. Use appropriate protective equipment.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Information

Store away from oxidizers. Store in a cool well ventilated area. Keep container closed when not in use.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Ulexite	1319-33-1	Not applicable	Not applicable
Ethylene glycol	107-21-1	TWA: 10 mg/m³ TWA: 20 ppm TWA: 52 mg/m³ STEL: 40 ppm STEL: 104 mg/m³	Ceiling: 100 mg/m³ (aerosol only)
Crystalline silica, quartz	14808-60-7	TWA: 0.1 mg/m³	TWA: 0.025 mg/m³

Appropriate engineering controls

Engineering Controls Use in a well ventilated area.

Personal protective equipment (PPE)

Personal Protective Equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Respiratory Protection If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional.
Organic vapor respirator.

Hand Protection Rubber gloves.
Skin Protection Rubber apron.
Eye Protection Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions None known.
Environmental Exposure Controls Do not allow material to contaminate ground water system

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Liquid
Odor: Odorless
Color Milky white
Odor Threshold: No information available

Property Remarks/ - Method	Values
pH:	6.5 - 7.5
Freezing Point / Range	-34 °C
Melting Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	1.45
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%) No data available

10. Stability and Reactivity

10.1. Reactivity

Not expected to be reactive.

10.2. Chemical stability

Stable

10.3. Possibility of hazardous reactions

Will Not Occur

10.4. Conditions to avoid

None anticipated

10.5. Incompatible materials

Strong oxidizers.

10.6. Hazardous decomposition products

Carbon monoxide and carbon dioxide.

11. Toxicological Information

Information on routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Most Important Symptoms/Effects

Causes eye irritation Potential reproductive hazard. May cause birth defects. Prolonged or repeated exposure may cause damage to organs. Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

Numerical measures of toxicity

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ulexite	1319-33-1	3493-6080 mg/kg (Rat) (similar substance) 3450 mg/kg (Male Rat) (similar substance)	> 2000 mg/kg (Rabbit) (similar substance)	> 2 mg/L (Rat) 4h (similar substance) > 2.12 mg/L (Rat) 4h (similar substance) > 2.04 mg/L (Rat) 4h (similar substance)
Ethylene glycol	107-21-1	4000 mg/kg (Rat) 7712 mg/kg (Rat) > 10000 mg/kg (Rat) 1670 mg/kg (Cat) 1400 – 1600 mg/kg (Human)	9530 µL/kg (Rabbit) > 3500 mg/kg (Mouse)	> 2.5 mg/L (Rat) 6h (saturated concentration)
Crystalline silica, quartz	14808-60-7	> 15000 mg/kg (human)	No information available	No data available

Immediate, delayed and chronic health effects from exposure

Inhalation May cause respiratory irritation. In high air concentrations: May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness. Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).

Eye Contact Causes eye irritation.

Skin Contact May cause mild skin irritation.

Ingestion May be harmful if swallowed. In large amounts: May cause abdominal pain, vomiting,

nausea, and diarrhea. May cause heart, kidney and brain disorders.

Chronic Effects/Carcinogenicity Prolonged or repeated exposure may cause embryo and fetus toxicity. Prolonged or repeated exposure may cause reproductive system damage. Repeated overexposure may cause liver and kidney effects. Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

See "Inhalation" subsection above with respect to silicosis, cancer status and other data with possible relevance to human health. There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

Exposure Levels
No data available

Interactive effects
Eye ailments. Skin disorders. Liver and kidney disorders. Individuals with respiratory disease, including but not limited to asthma and bronchitis, or subject to eye irritation, should not be exposed to quartz dust.

Data limitations
No data available

Substances	CAS Number	Skin corrosion/irritation
Ulexite	1319-33-1	Non-irritating to the skin (Rabbit) (similar substances)
Ethylene glycol	107-21-1	Non-irritating to the skin (Rabbit)
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin

Substances	CAS Number	Serious eye damage/irritation
Ulexite	1319-33-1	Causes moderate eye irritation (Rabbit) (similar substances)
Ethylene glycol	107-21-1	Non-irritating to the eye (Rabbit)
Crystalline silica, quartz	14808-60-7	Mechanical irritation of the eyes is possible. No information available

Substances	CAS Number	Skin Sensitization
Ulexite	1319-33-1	Did not cause sensitization on laboratory animals (guinea pig) (similar substances)
Ethylene glycol	107-21-1	Did not cause sensitization on laboratory animals (guinea pig) Patch test on human volunteers did not demonstrate sensitization properties
Crystalline silica, quartz	14808-60-7	No information available.

Substances	CAS Number	Respiratory Sensitization
Ulexite	1319-33-1	No information available
Ethylene glycol	107-21-1	No information available
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	Mutagenic Effects
Ulexite	1319-33-1	In vitro tests did not show mutagenic effects (similar substances)
Ethylene glycol	107-21-1	In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects.
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
Ulexite	1319-33-1	Did not show carcinogenic effects in animal experiments (similar substances)
Ethylene glycol	107-21-1	Did not show carcinogenic effects in animal experiments
Crystalline silica, quartz	14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this

		substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.

Substances	CAS Number	Reproductive toxicity
Ulexite	1319-33-1	Experiments have shown reproductive toxicity effects on laboratory animals (similar substances)
Ethylene glycol	107-21-1	Fetotoxic and teratogenic effects observed in experimental animals at concentrations that did not produce maternal toxicity.
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	STOT - single exposure
Ulexite	1319-33-1	None under normal use conditions
Ethylene glycol	107-21-1	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Ulexite	1319-33-1	None under normal use conditions
Ethylene glycol	107-21-1	Causes damage to organs through prolonged or repeated exposure: (Kidney)
Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Ulexite	1319-33-1	Not applicable
Ethylene glycol	107-21-1	No information available
Crystalline silica, quartz	14808-60-7	Not applicable

12. Ecological Information

Ecotoxicity

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Ulexite	1319-33-1	EC50 (72h) 1398.64 mg/L (Skeletonema costatum)	LC50 (96h) > 320 mg/L (Scophthalmus maximus) LC50 (96h) > 1100 mg/L (Oncorhynchus mykiss) LC50 (96h) > 1021 mg/L (Lepomis macrochirus) LD50 (28d) 65 mg/L (Oncorhynchus mykiss)	No information available	EC50 (48h) 7341.67 mg/L (Acartia tonsa) EC50 (48h) 133 mg/L (Daphnia magna)
Ethylene glycol	107-21-1	EC50 6500 - 13000 mg/L (Pseudokirchneriella subcapitata) TGK (8d) > 10000 mg/L (Scenedesmus quadricauda)	LC50 41000 mg/L (Oncorhynchus mykiss) LC50 (96h) 72860 mg/L (Pimephales promelas) NOEC (7d) 15380 mg/L (mortality) (Pimephales promelas)	TTC (16h) > 10000 mg/L (Pseudomonas putida) EC20 (30 m) > 1995 mg/L (activated sludge, domestic) (similar substance)	EC50 46300 mg/L (Daphnia magna) EC50 (48h) >100 mg/L (Daphnia magna) NOEC (7d) 8590 mg/L (reproduction) (Ceriodaphnia dubia)
Crystalline silica, quartz	14808-60-7	EC50 (72 h) =440 mg/L (Selenastrum capricornutum)	LL0 (96 h) =10000 mg/L (Danio rerio)	No information available	LL50 (24 h) >10000 mg/L (Daphnia magna)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Ulexite	1319-33-1	The methods for determining biodegradability are not applicable to inorganic substances.
Ethylene glycol	107-21-1	Readily biodegradable (100% @ 10d)
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow

Ulexite	1319-33-1	0.175
Ethylene glycol	107-21-1	-1.36
Crystalline silica, quartz	14808-60-7	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Ulexite	1319-33-1	No information available
Ethylene glycol	107-21-1	No information available
Crystalline silica, quartz	14808-60-7	No information available

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Disposal should be made in accordance with federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

14. Transport Information

Transportation Information

Australia ADG

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

IMDG/IMO

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

IATA/ICAO

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product

International Inventories

Australian AICS Inventory	All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.
New Zealand Inventory of Chemicals	All components are listed on the NZIoC or are subject to a relevant exemption, permit, or assessment certificate.
EINECS (European Inventory of Existing Chemical Substances)	This product, and all its components, complies with EINECS
US TSCA Inventory	All components listed on inventory or are exempt.
Canadian Domestic Substances List (DSL)	All components listed on inventory or are exempt.

Poisons Schedule number

None Allocated

International Agreements

Montreal Protocol - Ozone Depleting Substances:	Does not apply
Stolkhom Convention - Persistent Organic Pollutants:	Does not apply
Rotterdam Convention - Prior Informed Consent:	Does not apply
Basel Convention - Hazardous Waste:	Does not apply

16. Other information

Date of preparation or review

Revision Date: 05-Jul-2016

Revision Note

SDS sections updated: 2

Full text of H-Statements referred to under sections 2 and 3

H302 - Harmful if swallowed
H319 - Causes serious eye irritation
H351 - Suspected of causing cancer if inhaled
H360 - May damage fertility or the unborn child
H372 - Causes damage to organs through prolonged or repeated exposure if swallowed
H372 - Causes damage to organs through prolonged or repeated exposure if inhaled

Additional information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

Key abreviations or acronyms used

bw – body weight
CAS – Chemical Abstracts Service
EC50 – Effective Concentration 50%
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
NOEC – No Observed Effect Concentration
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
vPvB – very Persistent and very Bioaccumulative
h - hour
mg/m^3 - milligram/cubic meter
mm - millimeter

mmHg - millimeter mercury
w/w - weight/weight
d - day

Key literature references and sources for data
www.ChemADVISOR.com/
OSHA
ECHA C&L

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End of Safety Data Sheet

SAFETY DATA SHEET

Revision date: 30-Nov-2021

Revision Number 1

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product identifier

Product Name CF150FBS

Product Code(s) 000000069041

Other means of identification

Synonyms Manufactured exclusively for Condor Energy Services by Fusion Technologies (Australia) Pty Ltd

Recommended use of the chemical and restrictions on use

Recommended use Hydraulic fracturing additive.

Uses advised against No information available.

Supplier
Fusion Technologies Australia Pty Ltd
ABN: 50 636 538 960
Street Address: 7 Noble Street
Bridgeman Downs QLD 4035
Australia

Telephone number: +61 (0)460 047 656
Website: www.fusiontechinc.net

Emergency telephone number

Emergency telephone number **1800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

2. HAZARDS IDENTIFICATION

GHS Classification

Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG)

Acute toxicity - Oral	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Specific target organ toxicity (repeated exposure)	Category 2
Acute aquatic toxicity	Category 2
Chronic aquatic toxicity	Category 3

SIGNAL WORD
Warning

Label elements

Corrosion
Health hazard
Exclamation mark

Hazard statements
H302 - Harmful if swallowed
H315 - Causes skin irritation
H318 - Causes serious eye damage
H371 - May cause damage to kidneys if swallowed
H373 - May cause damage to organs through prolonged or repeated exposure if swallowed
H401 - Toxic to aquatic life
H412 - Harmful to aquatic life with long lasting effects

Precautionary Statements - Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Wear protective gloves/eye protection/face protection
Do not breathe mist, vapours, spray.
Avoid release to the environment
Precautionary Statements - Response
IF exposed or concerned: Call a POISON CENTER or doctor if you feel unwell
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Immediately call a POISON CENTER or doctor
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash it before reuse
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Precautionary Statements - Storage
No storage statements
Precautionary Statements - Disposal
Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable

Other hazards which do not result in classification
Poisons Schedule (SUSMP) 6

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS No.	Weight-%
Ethylene glycol	107-21-1	10-30%

Nonionic surfactant	-	10-30%
Anionic surfactant	-	10-30%
Non-hazardous ingredients	Proprietary	Balance

4. FIRST AID MEASURES

Description of first aid measures

General advice If swallowed, seek medical advice immediately and show this container or label.

Emergency telephone number Poisons Information Center, Australia: 13 11 26
Poisons Information Center, New Zealand: 0800 764 766

Inhalation Remove to fresh air and keep at rest in a position comfortable for breathing. Call a physician if symptoms occur.

Eye contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Keep eye wide open while rinsing. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical advice/attention.

Skin contact Wash off immediately with soap and plenty of water. Get medical attention if irritation develops and persists. Take off contaminated clothing and wash before reuse.

Ingestion Rinse mouth immediately and drink plenty of water. Get medical attention. Do NOT induce vomiting.

Self-protection of the first aider Avoid breathing vapors or mists. Avoid contact with skin, eyes, and clothing. See section 8 for more information.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Suitable Extinguishing Media Dry chemical, CO2, alcohol-resistant foam or water spray.

Unsuitable extinguishing media Do not use a solid water stream as it may scatter and spread fire.

Specific hazards arising from the chemical

Specific hazards arising from the chemical No information available.

Hazardous combustion products Carbon oxides. Oxides of sulfur.

Special protective actions for fire-fighters

Special protective equipment for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation. Avoid breathing vapors or mists. Avoid contact with skin, eyes, and clothing. Do not touch or walk through spilled material. Extremely slippery when spilled.

For emergency responders Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions Keep out of drains, sewers, ditches and waterways. Local authorities should be advised if significant spillages cannot be contained.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so. Dike to collect large liquid spills. Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see Section 13).

Methods for cleaning up Avoid breathing dust or spray mist. Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Collect in properly labelled drums or other suitable containers, with loose fitting lids. After cleaning, flush away traces with water and detergent.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Solutions extremely slippery when spilled.

General hygiene considerations Avoid breathing vapors or mists. Avoid contact with skin, eyes, and clothing. Do not eat, drink or smoke when using this product. Wear suitable gloves and eye/face protection. Remove and wash contaminated clothing and gloves, including the inside, before re-use.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible materials Strong oxidizing agents.

Poisons Schedule (SUSMP) 6

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Limits No value assigned for this specific material by Safe Work Australia. However, Workplace Exposure Standard(s) for constituent(s):

Ethylene glycol (vapour): 8hr TWA = 52 mg/m^3 (20 ppm), 15 min STEL = 104 mg/m^3 (40 ppm), Sk

As published by Safe Work Australia Workplace Exposure Standards for Airborne Contaminants.

TWA - The time-weighted average airborne concentration of a particular substance when calculated over an eight-hour working day, for a five-day working week.

STEL (Short Term Exposure Limit) - the airborne concentration of a particular substance calculated as a time-weighted average over 15 minutes, which should not be exceeded at any time during a normal eight hour work day. According to current knowledge this concentration should neither impair the health of, nor cause undue discomfort to, nearly all workers.

`Sk' (skin) Notice - absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.

These Workplace Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These workplace exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Appropriate engineering controls

Engineering controls Apply technical measures to comply with the occupational exposure limits.

If in the handling and application of this material, safe exposure levels could be exceeded, the use of engineering controls such as local exhaust ventilation must be considered and the results documented. If achieving safe exposure levels does not require engineering controls, then a detailed and documented risk assessment using the relevant Personal Protective Equipment (PPE) (refer to PPE section below) as a basis must be carried out to determine the minimum PPE requirements.

Individual protection measures, such as personal protective equipment

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, SAFETY GLASSES, GLOVES.

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing. Long sleeved clothing. Protective shoes or boots.

Hand protection Wear suitable gloves.

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required. If determined by a risk assessment an inhalation risk exists, wear a suitable mist respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716.

Environmental exposure controls Do not allow into any sewer, on the ground or into any body of water. Local authorities should be advised if significant spillages cannot be contained.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state Liquid

Appearance	Clear
Color	Pale Yellow
Odor	Slight Ester
Odor threshold	No information available.

Property	Values	Remarks • Method
pH	7.0 - 8.5	None known
pH (as aqueous solution)	No data available	None known
Melting point / freezing point	-10°C	None known
Boiling point / boiling range	>100°C	None known
Flash point	No data available	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Relative density	0.99 - 1.01	None known
Water solubility	Soluble in water	None known
Solubility(ies)	Soluble in ethanol	None known
Partition coefficient	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known

Other information

10. STABILITY AND REACTIVITY

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid Keep away from open flames, hot surfaces and sources of ignition.

Incompatible materials

Incompatible materials Strong oxidizing agents.

Hazardous decomposition products

Hazardous decomposition products Carbon oxides. Oxides of sulfur.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Information on likely routes of exposure

Product Information No adverse health effects expected if the chemical is handled in accordance with this Safety Data Sheet and the chemical label. Symptoms or effects that may arise if the chemical is mishandled and overexposure occurs are:

Inhalation Inhalation of vapors in high concentration may cause irritation of respiratory system.

Eye contact Causes serious eye damage.

Skin contact Causes skin irritation.

Ingestion Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea. Harmful if swallowed. May cause adverse kidney effects.

Symptoms No information available.

Numerical measures of toxicity - Product Information
No information available.

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Ethylene glycol	= 1700 mg/kg (Rat)	= 10600 mg/kg (Rat) = 9530 µL/kg (Rabbit)	-

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Causes skin irritation. Classification based on data available for ingredients.

Serious eye damage/eye irritation Causes serious eye damage. Classification based on data available for ingredients.

Respiratory or skin sensitization No information available.

Germ cell mutagenicity No information available.

Carcinogenicity No information available.

Reproductive toxicity No information available.

STOT - single exposure Causes damage to organs if swallowed.

STOT - repeated exposure Causes damage to organs through prolonged or repeated exposure if swallowed.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Ethylene glycol	EC50: 6500 - 13000mg/L (96h, Pseudokirchneriella subcapitata)	LC50: =41000mg/L (96h, Oncorhynchus mykiss) LC50: 14 - 18mL/L (96h, Oncorhynchus mykiss) LC50: =27540mg/L (96h, Lepomis macrochirus) LC50: =40761mg/L (96h, Oncorhynchus mykiss) LC50: 40000 - 60000mg/L (96h, Pimephales promelas) LC50: =16000mg/L (96h, Poecilia reticulata)	-	EC50: =46300mg/L (48h, Daphnia magna)

Persistence and degradability

Persistence and degradability Expected to be biodegradable.

Bioaccumulative potential

Bioaccumulation Bioaccumulation is not expected.

Chemical name	Partition coefficient
Ethylene glycol	-1.93

Mobility

Mobility in soil No information available.

Other adverse effects

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Dispose of in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

ADG
Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail; NON-DANGEROUS GOODS.

IATA
Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; NON-DANGEROUS GOODS.

IMDG
Not regulated Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; NON-DANGEROUS GOODS.

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia
Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG)

See section 8 for national exposure control parameters

Poisons Schedule (SUSMP) 6

Chemical name	National pollutant inventory
Ethylene glycol - 107-21-1	10 tonne/yr Threshold category 1

International Inventories

AIIC	All the constituents of this material are listed on the Australian Inventory of Industrial Chemicals.
NZIoC	All the constituents of this material are listed on the New Zealand Inventory of Chemicals.

Legend:
- Australian Inventory of Industrial Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

16. OTHER INFORMATION

Supplier Safety Data Sheet 08/ 2016

Reason(s) For Issue: First Issue Primary SDS

Issuing Date: 30-Nov-2021

This Safety Data Sheet has been prepared by Ixom Operations Pty Ltd (Toxicology and SDS Services).

Revision Note:
The symbol (*) in the margin of this SDS indicates that this line has been revised.

Key or legend to abbreviations and acronyms used in the safety data sheet
Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation
C	Carcinogen		

Key literature references and sources for data used to compile the SDS

EPA (Environmental Protection Agency)
Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australian Industrial Chemicals Introduction Scheme (AICIS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
RTECS (Registry of Toxic Effects of Chemical Substances)
World Health Organization

Disclaimer

This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since The Supplier cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Supplier representative or The Supplier at the contact details on page 1.

The Supplier's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

End of Safety Data Sheet

SAFETY DATA SHEET

Revision date: 16-Jul-2021

Revision Number 1

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product identifier

Product Name CFBE5

Product Code(s) 000000069016

Other means of identification

UN number 2922

Synonyms Manufactured exclusively for Condor Energy Services by Fusion Technologies (Australia) Pty Ltd

Recommended use of the chemical and restrictions on use

Recommended use Biocidal product.

Uses advised against No information available.

Supplier
Fusion Technologies Australia Pty Ltd
ABN: 50 636 538 960
Street Address: 7 Noble Street
Bridgeman Downs QLD 4035
Australia

Telephone number: +61 (0)460 047 656
Website: www.fusiontechinc.net

Emergency telephone number

Emergency telephone number **1800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

2. HAZARDS IDENTIFICATION

GHS Classification

Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG).

Acute toxicity - Oral	Category 4
Acute toxicity - Inhalation (Vapors)	Category 3
Skin corrosion/irritation	Category 1 Sub-category B
Respiratory sensitization	Category 1
Skin sensitization	Category 1A
Specific target organ toxicity (single exposure)	Category 3
Acute aquatic toxicity	Category 1
Chronic aquatic toxicity	Category 2

SIGNAL WORD
Danger

Label elements

Skull and crossbones
Corrosion
Health hazard
Environment

Hazard statements
H331 - Toxic if inhaled
H302 - Harmful if swallowed
H335 - May cause respiratory irritation
H314 - Causes severe skin burns and eye damage
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
H317 - May cause an allergic skin reaction
H400 - Very toxic to aquatic life
H411 - Toxic to aquatic life with long lasting effects

Precautionary Statements - Prevention
Do not breathe mist, vapours, spray.
Use only outdoors or in a well-ventilated area
In case of inadequate ventilation wear respiratory protection
Wear protective gloves / protective clothing / eye protection / face protection
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not eat, drink or smoke when using this product
Avoid release to the environment
Precautionary Statements - Response

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
If skin irritation or rash occurs: Get medical advice/attention
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Immediately call a POISON CENTER or doctor/physician
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Collect spillage
Precautionary Statements - Storage
Store in a well-ventilated place. Keep container tightly closed

Store locked up

Precautionary Statements - Disposal

Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable

Other hazards which do not result in classification

Poisons Schedule (SUSMP) 6

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS No.	Weight-%
Glutaraldehyde	111-30-8	20-50%
Methanol (methyl alcohol)	67-56-1	1-5%
Non-hazardous ingredients	Proprietary	Balance

4. FIRST AID MEASURES

Description of first aid measures

General advice Take a copy of the Safety Data Sheet when going for medical treatment.

Emergency telephone number Poisons Information Center, Australia: 13 11 26
Poisons Information Center, New Zealand: 0800 764 766

Inhalation Move to fresh air in case of accidental inhalation of vapors. Seek immediate medical attention/advice. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.

Eye contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get immediate medical advice/attention.

Skin contact Wash off immediately with soap and plenty of water for at least 15 minutes. Remove and isolate contaminated clothing and shoes. Get immediate medical advice/attention. Wash contaminated clothing before reuse.

Ingestion Rinse mouth thoroughly with water. Never give anything by mouth to an unconscious person. Do NOT induce vomiting. Immediate medical attention is required.

Self-protection of the first aider Do not breathe vapor or mist. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Avoid contact with skin, eyes, and clothing.

Most important symptoms and effects, both acute and delayed

Symptoms Asthma-like and/ or skin allergy-like symptoms. May cause redness and tearing of the eyes. Burning sensation.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Suitable Extinguishing Media Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media High volume water jet.

Specific hazards arising from the chemical

Specific hazards arising from the chemical Non-combustible. Environmentally hazardous.

Hazardous combustion products Carbon oxides.

Special protective actions for fire-fighters

Special protective equipment for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Hazchem code 2X

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation. Keep people away from and upwind of spill/leak. Avoid contact with skin, eyes and inhalation of vapors.

For emergency responders Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions Do not allow to enter into soil/subsoil. Keep out of waterways. See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment Stop leak if you can do it without risk. Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see Section 13). Dike to collect large liquid spills.

Methods for cleaning up Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Sweep up and shovel into suitable containers for disposal. Avoid breathing dust or spray mist. Clean contaminated surface thoroughly.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Do not breathe vapor or mist. Do not get in eyes. Avoid contact with skin. Wash thoroughly after handling. Ensure adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment.

General hygiene considerations Remove and wash contaminated clothing and gloves, including the inside, before re-use. Take off contaminated clothing and wash it before reuse. When using do not eat, drink or smoke.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep container tightly closed in a dry and well-ventilated place. Store locked up. Keep in properly labelled containers.

This material is a Scheduled Poison and must be stored, maintained and used in accordance with the relevant regulations.

Incompatible materials None known based on information supplied.

Poisons Schedule (SUSMP) 6

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Limits No value assigned for this specific material by Safe Work Australia. However, Workplace Exposure Standard(s) for constituent(s):

Chemical name	Australia	ACGIH TLV
Glutaraldehyde 111-30-8	0.1 ppm Peak 0.41 mg/m³ Peak	Ceiling: 0.05 ppm activated and inactivated

Glutaraldehyde: Peak Limitation = 0.41 mg/m³ (0.1 ppm), Sen
Methyl alcohol (Methanol): 8hr TWA = 262 mg/m³ (200 ppm), 15 min STEL = 328 mg/m³ (250 ppm), Sk

As published by Safe Work Australia Workplace Exposure Standards for Airborne Contaminants.

TWA - The time-weighted average airborne concentration of a particular substance when calculated over an eight-hour working day, for a five-day working week.

STEL (Short Term Exposure Limit) - the airborne concentration of a particular substance calculated as a time-weighted average over 15 minutes, which should not be exceeded at any time during a normal eight hour work day. According to current knowledge this concentration should neither impair the health of, nor cause undue discomfort to, nearly all workers.

`Sen' Notice - sensitiser. The substance can cause a specific immune response in some people. An affected individual may subsequently react to exposure to minute levels of that substance and should not be further exposed to the substance.

`Sk' (skin) Notice - absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.

These Workplace Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These workplace exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Appropriate engineering controls

Engineering controls Apply technical measures to comply with the occupational exposure limits.

If in the handling and application of this material, safe exposure levels could be exceeded, the use of engineering controls such as local exhaust ventilation must be considered and the results documented. If achieving safe exposure levels does not require engineering controls, then a detailed and documented risk assessment using the relevant Personal Protective Equipment (PPE) (refer to PPE section below) as a basis must be carried out to determine the minimum PPE requirements.

Individual protection measures, such as personal protective equipment

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, SAFETY GLASSES, GLOVES, RESPIRATOR.

Eye/face protection	Wear safety glasses with side shields (or goggles). If splashes are likely to occur:. Face protection shield.
Skin and body protection	Wear suitable protective clothing. Long sleeved clothing.
Hand protection	Wear suitable gloves. Nitrile rubber. Neoprene gloves. Impervious gloves.
Respiratory protection	No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required. If determined by a risk assessment an inhalation risk exists, wear an organic vapour respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716.
Environmental exposure controls	Do not allow into any sewer, on the ground or into any body of water. Local authorities should be advised if significant spillages cannot be contained.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	Clear
Color	Colourless
Odor	Pungent
Odor threshold	No information available.

Property	**Values**	**Remarks • Method**
pH	3 - 5	
pH (as aqueous solution)	No data available	None known
Melting point / freezing point	No data available	None known
Boiling point / boiling range	No data available	None known
Flash point	> 100°C	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Relative density	1.063	
Water solubility	Miscible in water	
Solubility(ies)	No data available	None known
Partition coefficient	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known

Other information

10. STABILITY AND REACTIVITY

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials None known based on information supplied.

Hazardous decomposition products

Hazardous decomposition products Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Information on likely routes of exposure

Product Information No adverse health effects expected if the chemical is handled in accordance with this Safety Data Sheet and the chemical label. Symptoms or effects that may arise if the chemical is mishandled and overexposure occurs are:

Inhalation Toxic by inhalation. Vapors may be irritating to eyes, nose, throat, and lungs. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause sensitization by inhalation.

Eye contact Causes serious eye irritation.

Skin contact Harmful in contact with skin. Causes severe burns. Repeated or prolonged skin contact may cause allergic reactions with susceptible persons.

Ingestion Harmful if swallowed. Can burn mouth, throat, and stomach. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Symptoms Asthma-like and/ or skin allergy-like symptoms. May cause sensitization by inhalation and skin contact. Irritation/Corrosion. May cause redness and tearing of the eyes. Rashes. Coughing and/ or wheezing.

Numerical measures of toxicity - Product Information
No information available.

Numerical measures of toxicity - Component Information

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Glutaraldehyde	= 252 mg/kg (Rat)	= 1800 mg/kg (Rabbit) = 560 µL/kg (Rabbit)	= 40.1 ppm (Rat) 4 h = 23.5 ppm (Rat) 4 h
Methanol (methyl alcohol)	= 6200 mg/kg (Rat)	= 15840 mg/kg (Rabbit) = 15800 mg/kg (Rabbit)	= 64000 ppm (Rat) 4 h = 22500 ppm (Rat) 8 h

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Causes burns.

Serious eye damage/eye irritation Causes serious eye irritation.

Respiratory or skin sensitization May cause sensitization by inhalation and skin contact.

Germ cell mutagenicity No information available.

Carcinogenicity No information available.

Reproductive toxicity No information available.

STOT - single exposure May cause respiratory irritation.

STOT - repeated exposure No information available.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Glutaraldehyde	EC50: =0.61mg/L (72h, Desmodesmus subspicatus) EC50: =0.84mg/L (96h, Desmodesmus subspicatus)	LC50: 7.8 - 22mg/L (96h, Lepomis macrochirus) LC50: 2.6 - 4.8mg/L (96h, Oncorhynchus mykiss) LC50: 7.8 - 13mg/L (96h, Oncorhynchus mykiss) LC50: =5.4mg/L (96h, Pimephales promelas)	-	EC50: =14mg/L (48h, Daphnia magna) EC50: 0.56 - 1.0mg/L (48h, Daphnia magna)
Methanol (methyl alcohol)	-	LC50: =28200mg/L (96h, Pimephales promelas) LC50: >100mg/L (96h, Pimephales promelas) LC50: 19500 - 20700mg/L (96h, Oncorhynchus mykiss) LC50: 18 - 20mL/L (96h,	-	-

		Oncorhynchus mykiss) LC50: 13500 - 17600mg/L (96h, Lepomis macrochirus)		

Persistence and degradability

Persistence and degradability No information available.

Bioaccumulative potential

Bioaccumulation There is no data for this product.

Component Information

Chemical name	Partition coefficient
Glutaraldehyde	0.22
Methanol (methyl alcohol)	-0.77

Mobility

Mobility in soil No information available.

Other adverse effects

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Dispose of contents/containers in accordance with local regulations.

14. TRANSPORT INFORMATION

ADG
Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail; DANGEROUS GOODS.

UN number 2922
Proper shipping name CORROSIVE LIQUID, TOXIC, N.O.S. (CONTAINS GLUTARALDEHYDE)
Hazard class 8
Subsidiary hazard class 6.1
Packing group II
Hazchem code 2X

IATA
Classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; DANGEROUS GOODS.

UN number 2922
UN proper shipping name CORROSIVE LIQUID, TOXIC, N.O.S. (CONTAINS GLUTARALDEHYDE)
Transport hazard class(es) 8
Subsidiary hazard class 6.1
Packing group II

IMDG
Classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; DANGEROUS GOODS.

UN number	2922
UN proper shipping name	CORROSIVE LIQUID, TOXIC, N.O.S. (CONTAINS GLUTARALDEHYDE)
Transport hazard class(es)	8
Subsidiary hazard class	6.1
Packing group	II

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia
Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG).

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Classified as a scheduled poison according to the Standard for Uniform Scheduling of Medicines and Poisons (SUSMP)
Poisons Schedule (SUSMP) 6

National pollutant inventory
Subject to reporting requirement

Chemical name	National pollutant inventory
Glutaraldehyde - 111-30-8	10 tonne/yr Threshold category 1
Methanol (methyl alcohol) - 67-56-1	10 tonne/yr Threshold category 1

Banned and/or restricted
This product contains one or more substance(s) subject to prohibition, authorization or restriction. Verify that requirements related to using, handling, and storing substances subject to prohibition, authorization or restriction are met.

Chemical name	Carcinogen	Restricted substance
Methanol (methyl alcohol) - 67-56-1		For spray painting at a concentration of >1% by volume

International Inventories

AICS	All the constituents of this material are listed on the Australian Inventory of Industrial Chemicals.

Legend:
- Australian Inventory of Industrial Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

16. OTHER INFORMATION

Supplier Safety Data Sheet 05/ 2020

Reason(s) For Issue: First Issue Primary SDS

Issuing Date: 16-Jul-2021

This Safety Data Sheet has been prepared by Ixom Operations Pty Ltd (Toxicology and SDS Services).

Revision Note:
The symbol (*) in the margin of this SDS indicates that this line has been revised.

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation
C	Carcinogen		

Key literature references and sources for data used to compile the SDS

EPA (Environmental Protection Agency)
Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australian Industrial Chemicals Introduction Scheme (AICIS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
RTECS (Registry of Toxic Effects of Chemical Substances)
World Health Organization

Disclaimer

This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since The Supplier cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Supplier representative or The Supplier at the contact details on page 1.

The Supplier's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

End of Safety Data Sheet

CF380DXL	

SAFETY DATA SHEET

EMERGENCY TELEPHONE NUMBER: + 1 - 587 - 353 - 2940 (24 Hrs)

Product Name: CF380DXL
Date Issued: April 29, 2021

Prepared by: HSE Dept
& Version: A7-1.0

1. PRODUCT IDENTIFICATION AND COMPANY IDENTIFICATION

Product Name:	CF380DXL
Product Purpose:	Fracturing Additive
Supplier Identification:	Fusion Technologies (Australia) Pty Ltd. 7 Noble Street Bridgeman Downs QLD, 4035 Australia

PREPARER'S TELEPHONE NUMBER: + 1 - 587 - 353 - 2940

2. HAZARDS IDENTIFICATION

HSNO Hazard classification
Respiratory sensitization : Category 1

Hazard Pictograms:

Signal word: Danger

Primary Routes of Exposure: Inhalation and skin

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute Toxicity Oral (Category 4), H302
Skin Corrosion /Irritation (Category 1), H314
Reproductive Toxicity (Category 1), H360

Hazard statements:

H302 - Harmful if swallowed
H314 - Causes severe skin burns and eye damage
H360 - May damage fertility or the unborn child

Precautionary statements:

P260 - Do not breathe mist, vapours, spray
P264 - Wash exposed skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P280 - Wear protective gloves, protective clothing, eye protection, face protection
P301 + P330 + P331 - If Swallowed: rinse mouth. Do NOT induce vomiting
P303 + P361 + P353 – If on skin (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower P304 + P340 – In inhaled: remove victim to fresh air and keep at rest in a position comfortable for breathing
P305 + P351 + P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P310 - Immediately call a POISON CENTER or doctor/physician
P363 - Wash contaminated clothing before reuse
P405 - Store locked up
P501 - Dispose of contents/container to comply with local, state and federal regulations

Human health effects:

Eye: Corrosive. May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness.
Skin: Corrosive. Initial contact may result in itching with increasing irritation if not removed. Causes severe skin irritation with tissue destruction. Prolonged contact and badly damaged skin may result in absorption causing redness and peeling of skin.
Ingestion: Maybe fatal if swallowed. Causes burns to the mouth, throat and stomach. Symptoms may include nausea, headache, and vomiting. Cardiac failure, pulmonary edema, and severe kidney

damage may develop. Potassium carbonate is high caustic, and ingestion of either the granular or liquid forms will cause severe burning and pain in lips, mouth, tongue, throat and stomach.
Inhalation: Inhalation of mist may cause damage to nasal and respiratory passages. Inhalation of large amounts may cause nausea, vomiting and diarrhea. Irritation may lead to chemical pneumonitis and pulmonary edema.
Chronic: May cause asthma, lung diseases and skin diseases.

3. PRODUCT COMPOSITION/INGREDIENTS

Chemical Name	CAS #	% by Weight
Sodium Gluconate	527-07-1	15 to 40
Boric Acid	10043-35-3	7 to 13
Potassium Hydroxide	1310-58-3	15 to 40

4. FIRST AID MEASURES

Eye Contact: Rinse eyes immediately with copious amounts of water and under the eyelids for at least 30 minutes. If symptoms persist seek medical advice.

Skin Contact: Remove contaminated clothing. Immediately wash off all material with soap and copious amounts of water. Remove all contaminated clothing and footwear. Discard contaminated leather articles such as shoes and belt.

Ingestion: Do not induce vomiting without medical advice. Seek medical advice. If the victim is not breathing, perform resuscitation using an approved respiratory barrier.

Inhalation: Remove to fresh air, treat symptomatically. If symptoms persist, seek medical advice. If person is not breathing and heart has stopped, begin performing cardiopulmonary resuscitation immediately.

5. FIRE FIGHTING MEASURES

Flashpoint: Not determined
Auto-Ignition Temperature: Not determined

Lower Explosion Limit: Not determined
Upper Explosion Limit: Not determined

Extinguishing Media: Water fog or fine spray, carbon dioxide or dry chemical foam. Water spray or fog for larger fires is acceptable.

Special Fire Fighting Procedures: Cool tanks and containers with water spray. Do not flush into surface water or sanitary sewer system. Keep product and empty containers away from heat and ignition sources.

Unusual Fire & Explosion Hazard: Heating can release hazardous gases

Hazardous Combustion Products: May evolve oxides of nitrogen, potassium and carbon under fire conditions.

Protective Equipment for Firefighters: Self contained breathing apparatus

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Avoid contact with skin, eyes and clothing. Evacuate personnel to safe areas. Keep people away from and upwind of spill or leak. PPE: see section 8.

Environmental Precautions: Do not contaminate surface water. Do not release into the environment. Prevent product from entering any drains. Do not flush product into surface water or sanitary sewer systems.

Methods For Cleaning Up: Sweep up and shovel and then place into an appropriate waste container. Remove soiled refuse and place in a suitable disposal container.

Disposal: Dispose of material in compliance with local, provincial and Federal regulations. See Section 13.

7. HANDLING AND STORAGE

Handling Precautions: Handle wearing appropriate PPE as per section 8. Ensure adequate ventilation is available to avoid breathing vapors. Avoid contact with

	eyes, skin and clothing. Do not ingest. Empty containers may contain product residues. Keep the containers closed when not in use. Protect against physical damage. Do not consume food, drink or smoke when handling this material. When mixing, slowly add to water to minimize heat generation and spattering.
Storage Precautions:	Store according to State and Federal regulations. Store in a cool, dry, well-ventilated area. Place away from incompatible materials. Keep containers tightly closed. Store at ambient temperatures. Tanks must be diked.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters:

Ingredient	Exposure Limits
Boric Acid	6 mg/m³ STEL 2 mg/m³ TLV-TWA
Sodium Hydroxide	2 mg/m³ Ceiling

Personal protective equipment:

Eye protection	Wear safety glasses with side shields or chemical goggles. Wear a face shield if splashing hazard exists.
Hand protection	Wear PVC, rubber or nitrile gloves.
Skin protection	Wear standard protective clothing – consider selecting type of protective clothing depending on quantity of chemical to be handled.
Respiratory protection	If exposure exceeds occupational exposure limits, use an appropriate NIOSH-approved respirator. For most conditions, no respirator protection is needed; however, if handling at elevated temperatures without sufficient ventilation, use an approved air-purifying respirator. Organic vapor cartridge with a particulate pre-filter.
Hygiene measures	Keep an eye wash fountain and safety shower available

9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Liquid
Color:	Colourless
Odor:	Characteristic
pH:	> 14
Density:	1.44
Solubility:	Soluble
Freezing Point:	-20°C

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions.
Conditions to Avoid:	Avoid excessive heat, open flames and all ignition sources. Incompatible materials.
Materials to Avoid:	Strong oxidizing agents, strong acids and bases. Contact with reactive metals may produce flammable hydrogen gas.
Hazardous Polymerization:	Will not occur
Hazardous Decomposition Products:	Oxides of nitrogen, potassium and carbon.
Under Fire Conditions:	Heating can release hazardous gases

11. TOXICOLOGICAL INFORMATION

Ingredients	Acute Oral Toxicity	LD50/oral/rat	LC50/inhalation/rat	LD50/dermal/4hr/rabbit
Sodium Gluconate	No data available	No data available	No data available	No data available
Boric Acid	No data available	2,660 mg/kg	>0.16 mg/L in 4 hr	>2,000 mg/kg
Sodium Hydroxide	No data available	No data available	No data available	1350 mg/kg

Sensitization: Possible and may cause allergic reaction

Mutagenic Effects: Possible

Reproductive Toxicity: Boric acid studies in rat, mouse and dog at high doses, have demonstrated effects on fertility and testes. Boric acid studies in rat, mouse, and rabbit demonstrate developmental effects on the fetus, including fetal weight loss and minor skeletal variations. The doses administered were many times in excess of those to which humans would normally be exposed

Carcinogenic Effects: Boric acid is listed as A4 Carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

Teratogenicity and Embryo Toxicity: See information listed above in reproductive category.

Human Experience: High

Other Toxicity Information: Toxicological Synergistic products: none known.

12. ECOLOGICAL INFORMATION

Ingredients	Ecotoxicity – Fish Species Data	Acute Crustaceans Toxicity	Ecotoxicity – Fresh water Algae
Sodium Gluconate	Not available	Not available	Not available
Boric Acid	1,020 mg/L LC50 (Carassius auratus) 72 h flow through	Not available	Not available
Sodium Hydroxide	Not available	Not available	Not available

Persistence and Degradability: Material is not readily biodegradable
Mobility: Product is liquid and therefore readily mobile.

13. DISPOSAL INFORMATION

Waste Residues/Unused Product and Package Dispose of waste in an approved incinerator or waste treatment site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage. Empty containers should be recycled locally or taken away for waste disposal.

14. TRANSPORT INFORMATION

The shipper/consignor/sender is responsible to ensure that the packaging, labeling, and markings are in compliance with the selected mode of transport.

Typical proper shipping name for this product are as follows:

SODIUM HYDROXIDE, SOLUTION	CLASS 8	UN 1824	PKG GRP: II

Important Note: This information does not take the place of shipping paper (Bill of Lading or BOL)

15. REGULATORY INFORMATION

None available.

16. OTHER INFORMATION

NFPA 704M RATING

Health: 3	Flammability: 0	Instability: 1	Other: n/a

HMIS

Health: 3	Flammability: 0	Instability: 1	Other: n/a

0= insignificant 1= slight 2= moderate 3= high 4= Extreme * = Chronic Hazard

Label Hazard Warning: Corrosive

Label Precautions: Inhalation of mist may cause damage to nasal and respiratory passages. Inhalation of large amounts may cause nausea, vomiting and diarrhea. Irritation may lead to chemical pneumonitis and pulmonary edema.
Corrosive. May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness.
Corrosive. Initial contact may result in itching with increasing irritation if not removed. Causes severe skin irritation with tissue destruction. Prolonged contact and badly damaged skin may result in absorption causing redness and peeling of skin.

Label First Aid: Wash product off of skin or out of eyes. If swallowed, do not induce vomiting without medical advice. If irritation develops, seek medical attention.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so

that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Fusion Technologies for any additional information.

This material safety data sheet provides health and safety information for the safe use of this product provided it is used as recommended per the associated product literature. Users of this product should be aware of the recommended safety precautions. For any other use, exposures must be evaluated so that appropriate handling and training programs can be created and implemented to insure safe workplace operations. Consult with Fusion Technologies for any additional information.

SAFETY DATA SHEET

Revision date: 20-Apr-2022

Revision Number 1

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product identifier

Product Name CF8200E

Product Code(s) 000000069059

Other means of identification

Recommended use of the chemical and restrictions on use

Recommended use Hydraulic fracturing fluid.

Uses advised against No information available.

Supplier
Condor Energy Services Ltd
ABN: 35 153 250 670
Brisbane Head Office: Level 11, 333 Ann Street
Brisbane QLD 4000
Australia

Telephone number: 07 3999 9044
Website: www.CondorEnergy.com.au

Emergency telephone number

Emergency telephone number **1800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

2. HAZARDS IDENTIFICATION

GHS Classification

Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG)

Respiratory sensitization	Category 1

SIGNAL WORD

Danger

Label elements

Health hazard

Hazard statements
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled

Precautionary Statements - Prevention
Avoid breathing dust / fume / gas / mist / vapours / spray
In case of inadequate ventilation wear respiratory protection
Precautionary Statements - Response
IF exposed or concerned
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician
Precautionary Statements - Storage
No storage statements
Precautionary Statements - Disposal
Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable

Other hazards which do not result in classification
Poisons Schedule (SUSMP) 5

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS No.	Weight-%
Mannanase (Mannan endo-1,4-beta-mannosidase)	37288-54-3	<5
Non-hazardous ingredients	Proprietary	Balance

4. FIRST AID MEASURES

Description of first aid measures

Emergency telephone number Poisons Information Center, Australia: 13 11 26

Inhalation Move victim to fresh air. Treatment should be symptomatic and supportive. Get immediate medical advice/attention. If breathing is difficult, (trained personnel should) give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.

Eye contact In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if symptoms occur.

Skin contact Wash off immediately with soap and plenty of water. Get medical attention if symptoms occur.

Ingestion Rinse mouth thoroughly with water. Get medical attention if symptoms occur.

Self-protection of the first aider Do not breathe fume, gas, mist, vapours, spray. Use personal protective equipment as

required.

Most important symptoms and effects, both acute and delayed

Symptoms May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Suitable Extinguishing Media Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media None known.

Specific hazards arising from the chemical

Specific hazards arising from the chemical Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.

Hazardous combustion products Carbon oxides.

Special protective actions for fire-fighters

Special protective equipment for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Avoid breathing vapors or mists. Ensure adequate ventilation. Use personal protective equipment as required.

For emergency responders Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions Do not allow to enter into soil/subsoil. Keep out of waterways.

Methods and material for containment and cleaning up

Methods for containment Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see Section 13).

Methods for cleaning up Take up with sand or other non-combustible absorbent material and place into containers for later disposal. Dike to collect large liquid spills. Prevent product from entering drains.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Avoid breathing dust / fume / gas / mist / vapours / spray. Ensure adequate ventilation.

General hygiene considerations Do not eat, drink or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep out of the reach of children. Keep container closed when not in use. Store in accordance with local regulations.

Incompatible materials None known.

Poisons Schedule (SUSMP) 5

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Limits No value assigned for this specific material by Safe Work Australia.

Appropriate engineering controls

Engineering controls Apply technical measures to comply with the occupational exposure limits.

If in the handling and application of this material, safe exposure levels could be exceeded, the use of engineering controls such as local exhaust ventilation must be considered and the results documented. If achieving safe exposure levels does not require engineering controls, then a detailed and documented risk assessment using the relevant Personal Protective Equipment (PPE) (refer to PPE section below) as a basis must be carried out to determine the minimum PPE requirements.

Individual protection measures, such as personal protective equipment

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, SAFETY GLASSES, GLOVES.

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing.

Hand protection Protective gloves. Nitrile rubber.

Respiratory protection If determined by a risk assessment an inhalation risk exists, wear a suitable mist respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716.

Environmental exposure controls No information available.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	Clear
Color	Amber
Odor	Slight Fermentation
Odor threshold	No information available.

Property	**Values**	**Remarks • Method**
pH	4.8 - 6.5	None known
pH (as aqueous solution)	No data available	None known
Melting point / freezing point	0 °C	Pour Point
Boiling point / boiling range	100 °C	None known
Flash point	No data available	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Relative density	1.000 - 1.050	None known
Water solubility	No data available	None known
Solubility(ies)	No data available	None known
Partition coefficient	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	1 mPa s	None known

Other information

10. STABILITY AND REACTIVITY

Reactivity

Reactivity Non-reactive under normal conditions of use, storage and transport.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials None known.

Hazardous decomposition products

Hazardous decomposition products Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Information on likely routes of exposure

Product Information No adverse health effects expected if the chemical is handled in accordance with this Safety Data Sheet and the chemical label. Symptoms or effects that may arise if the chemical is mishandled and overexposure occurs are:

Inhalation May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Eye contact May cause slight irritation.

Skin contact May cause irritation.

Ingestion Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Symptoms May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Numerical measures of toxicity - Product Information
No information available.

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation No information available.

Serious eye damage/eye irritation No information available.

Respiratory or skin sensitization May cause sensitization by inhalation. Classification based on individual ingredients of the mixture.

Germ cell mutagenicity No information available.

Carcinogenicity No information available.

Reproductive toxicity No information available.

Developmental toxicity None known

STOT - single exposure No information available.

STOT - repeated exposure No information available.

Aspiration hazard No information available.

Chronic effects: No long term risks to humans are associated with this material when handled and used as directed on the label.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity Not considered to be harmful to aquatic life.

Persistence and degradability

Persistence and degradability Readily biodegradable.

Bioaccumulative potential

Bioaccumulation Bioaccumulation is not expected.

Mobility

Mobility in soil Expected to be mobile in soil.

Mobility Soluble in water.

Other adverse effects

Other adverse effects No information available.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products Dispose of in accordance with local regulations.

Contaminated packaging Dispose of in accordance with federal, state and local regulations. Dispose of wastes in an approved waste disposal facility. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. TRANSPORT INFORMATION

ADG
Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail; NON-DANGEROUS GOODS.

IATA
Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; NON-DANGEROUS GOODS.

IMDG
Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; NON-DANGEROUS GOODS.

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia
Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG)

See section 8 for national exposure control parameters

Poisons Schedule (SUSMP) 5

International Inventories

AIIC	All the constituents of this material are listed on the Australian Inventory of Industrial Chemicals.
NZIoC	All the constituents of this material are listed on the New Zealand Inventory of Chemicals.

Legend:
- Australian Inventory of Industrial Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

16. OTHER INFORMATION

Supplier Safety Data Sheet 06/ 2020

Reason(s) For Issue: First Issue Primary SDS

Issuing Date: 20-Apr-2022

This Safety Data Sheet has been prepared by Ixom Operations Pty Ltd (Toxicology and SDS Services).

Revision Note:
1.

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation
C	Carcinogen		

Key literature references and sources for data used to compile the SDS

EPA (Environmental Protection Agency)

Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australian Industrial Chemicals Introduction Scheme (AICIS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
RTECS (Registry of Toxic Effects of Chemical Substances)
World Health Organization

Disclaimer

This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since The Supplier cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Supplier representative or The Supplier at the contact details on page 1.

The Supplier's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

End of Safety Data Sheet

SAFETY DATA SHEET

Revision date: 24-Jan-2022

Revision Number 1

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product identifier

Product Name CF8550EA

Product Code(s) 000000069052

Other means of identification

UN number 1444

Synonyms Manufactured exclusively for Condor Energy Services by Fusion Technologies (Australia) Pty Ltd

Recommended use of the chemical and restrictions on use

Recommended use Hydraulic fracturing additive.

Uses advised against No information available.

Supplier
Fusion Technologies Australia Pty Ltd
ABN: 50 636 538 960
Street Address: 7 Noble Street
Bridgeman Downs QLD 4035
Australia

Telephone number: +61 (0)460 047 656
Website: www.fusiontechinc.net

Emergency telephone number

Emergency telephone number **1800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

2. HAZARDS IDENTIFICATION

GHS Classification

Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG).

Oxidizing solids	Category 3
Acute toxicity - Oral	Category 4
Respiratory sensitization	Category 1
Skin sensitization	Category 1
Specific target organ toxicity (single exposure)	Category 3

SIGNAL WORD
Danger

Label elements

Flame over circle
Exclamation mark
Health hazard

Hazard statements
H302 - Harmful if swallowed
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
H317 - May cause an allergic skin reaction
H335 - May cause respiratory irritation
H272 - May intensify fire; oxidizer

Precautionary Statements - Prevention
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking
Keep/Store away from clothing/ combustible materials
Do not eat, drink or smoke when using this product
Wear protective gloves / protective clothing / eye protection / face protection
Avoid breathing dust / fume / gas / mist / vapours / spray
Use only outdoors or in a well-ventilated area
In case of inadequate ventilation wear respiratory protection
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Precautionary Statements - Response
IF exposed:
IF IN EYES If eye irritation persists: Get medical advice/attention
IF ON SKIN: Gently wash with plenty of soap and water If skin irritation or rash occurs: Get medical advice/attention Take off contaminated clothing and wash before reuse
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
If experiencing respiratory symptoms: Call a POISON CENTER or doctor
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
In case of fire: Use extinguishing media as outlined in Section 5 of this Safety Data Sheet to extinguish.
Precautionary Statements - Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Precautionary Statements - Disposal
Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable

Other hazards which do not result in classification
Poisons Schedule (SUSMP) 6

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS No.	Weight-%
Ammonium persulfate	7727-54-0	60-90%
Talc	14807-96-6	<5%
Non-hazardous ingredients	Proprietary	Balance

4. FIRST AID MEASURES

Description of first aid measures

General advice Take a copy of the Safety Data Sheet when going for medical treatment.

Inhalation Remove to fresh air and keep at rest in a position comfortable for breathing. If breathing is difficult, (trained personnel should) give oxygen. Give artificial respiration if victim is not breathing. Get immediate medical advice/attention.

Eye contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Do not rub affected area. Seek immediate medical attention/advice.

Skin contact Remove and isolate contaminated clothing and shoes. Wash off immediately with plenty of water. Get medical attention if symptoms occur. Allergic symptoms may be delayed.

Ingestion Rinse mouth thoroughly with water. Do NOT induce vomiting. Drink 1 or 2 glasses of water. Get immediate medical advice/attention.

Most important symptoms and effects, both acute and delayed

Symptoms May cause allergic skin reaction. May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Suitable Extinguishing Media Water spray or fog is preferred; if water not available use dry chemical, CO2 or regular foam.

Unsuitable extinguishing media No information available.

Specific hazards arising from the chemical

Specific hazards arising from the chemical Oxidizer. Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. Promotes the combustion (oxidizer). Can cause fire and explosion when in contact with flammable substances. Any material contaminated with the product (e.g. clothes) ignites easily and burns vigorously - increased fire hazard. Containers may explode when heated.

Hazardous combustion products Carbon oxides.

Special protective actions for fire-fighters

Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Cool containers with flooding quantities of water until well after fire is out.
Hazchem code	1Z

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation. Evacuate personnel to safe areas. Stop leak if you can do it without risk. Avoid breathing dust / fume / gas / mist / vapours / spray. Avoid generation of dust.
Other information	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Cover powder spill with plastic sheet or tarp to minimize spreading. Prevent dust cloud.
Methods for cleaning up	Take up with inert, damp, non-combustible material using clean non-sparking tools and place into loosely covered plastic containers for later disposal. Do not dry sweep dust. Wet dust with water before sweeping or use a vacuum to collect dust. Keep in suitable, closed containers for disposal. Prevent product from entering drains.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes, and clothing. Avoid breathing dust or spray mist. Take precautionary measures against static discharges.
General hygiene considerations	Take off contaminated clothing and wash it before reuse. Wash hands and face before breaks and immediately after handling the product. Wear suitable gloves and eye/face protection. When using do not eat, drink or smoke.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Keep containers tightly closed in a dry, cool and well-ventilated place.
Incompatible materials	Acids. Alkalis. Combustible material. Halogenated compounds. Organic compounds.
Poisons Schedule (SUSMP)	6

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Limits	No value assigned for this specific material by Safe Work Australia. However, Workplace Exposure Standard(s) for constituent(s):

Chemical name	Australia	ACGIH TLV
Ammonium persulfate 7727-54-0	0.1 mg/m³ Peak	TWA: 0.1 mg/m³ persulfate

Talc (containing no asbestos fibres): 8hr TWA = 2.5 mg/m³

As published by Safe Work Australia Workplace Exposure Standards for Airborne Contaminants.

Peak Limitation - a maximum or peak airborne concentration of a particular substance determined over the shortest analytically practicable period of time which does not exceed 15 minutes.

TWA - The time-weighted average airborne concentration of a particular substance when calculated over an eight-hour working day, for a five-day working week.

These Workplace Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These workplace exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Appropriate engineering controls

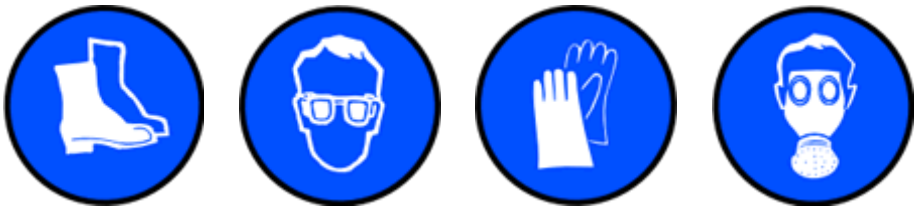
Engineering controls Apply technical measures to comply with the occupational exposure limits.

If in the handling and application of this material, safe exposure levels could be exceeded, the use of engineering controls such as local exhaust ventilation must be considered and the results documented. If achieving safe exposure levels does not require engineering controls, then a detailed and documented risk assessment using the relevant Personal Protective Equipment (PPE) (refer to PPE section below) as a basis must be carried out to determine the minimum PPE requirements.

Individual protection measures, such as personal protective equipment

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, SAFETY GLASSES, GLOVES, DUST MASK.



Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing. Long sleeved clothing.

Hand protection Wear suitable gloves.

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required. If determined by a risk assessment an inhalation risk exists, wear a dust mask/respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716.

Environmental exposure controls Avoid creating dust.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Solid
Appearance	Crystalline Powder
Color	Beige
Odor	Faint Organic
Odor threshold	No information available.

Property	**Values**	**Remarks • Method**
pH	7.2	
pH (as aqueous solution)	No data available	None known
Melting point / freezing point	121°C (Decomposes on heating)	
Boiling point / boiling range	No data available	None known
Flash point	121°C	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Relative density	1.8	
Water solubility	Insoluble in water	
Solubility(ies)	No data available	None known
Partition coefficient	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	>120°C	
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known

Other information

10. STABILITY AND REACTIVITY

Reactivity

Reactivity Oxidizer.

Chemical stability

Stability Stable under normal conditions. Unstable if heated.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions Can react violently with reducing agents. Contact with combustible material may cause fire.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid

Conditions to avoid Dust formation. Extremes of temperature and direct sunlight.

Incompatible materials

Incompatible materials Acids. Alkalis. Combustible material. Halogenated compounds. Organic compounds.

Hazardous decomposition products

Hazardous decomposition products Carbon oxides. Nitrogen oxides. Oxides of sulfur.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Information on likely routes of exposure

Product Information No adverse health effects expected if the chemical is handled in accordance with this Safety Data Sheet and the chemical label. Symptoms or effects that may arise if the chemical is mishandled and overexposure occurs are:

Inhalation Irritating to respiratory system. May cause sensitization by inhalation. May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Eye contact May cause irritation.

Skin contact May cause irritation. May cause sensitization by skin contact. Repeated or prolonged skin contact may cause allergic reactions with susceptible persons.

Ingestion Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Symptoms Irritating. Asthma-like and/ or skin allergy-like symptoms. May cause sensitization by inhalation and skin contact.

Numerical measures of toxicity - Product Information
No information available.

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Ammonium persulfate	= 495 mg/kg (Rat)	> 10000 mg/kg (Rabbit)	= 520 mg/L (Rat) 1 h

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation May cause skin irritation. Classification based on data available for ingredients.

Serious eye damage/eye irritation Mild eye irritation. Classification based on data available for ingredients.

Respiratory or skin sensitization May cause sensitization by inhalation and skin contact.

Germ cell mutagenicity No information available.

Carcinogenicity No information available.

Reproductive toxicity No information available.

STOT - single exposure May cause respiratory irritation.

STOT - repeated exposure No information available.

Aspiration hazard Not applicable.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity Keep out of waterways.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Ammonium persulfate	-	LC50: =103mg/L (96h, Lepomis macrochirus) LC50: =76.3mg/L (96h, Oncorhynchus mykiss) LC50: =323mg/L (96h, Poecilia reticulata)	-	EC50: =120mg/L (48h, Daphnia magna)
Talc	-	LC50: >100g/L (96h, Brachydanio rerio)	-	-

Persistence and degradability

Persistence and degradability Not readily biodegradable.

Bioaccumulative potential

Bioaccumulation Bioaccumulation is not expected.

Mobility

Mobility in soil No information available.

Other adverse effects

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Dispose of contents/containers in accordance with local regulations.

14. TRANSPORT INFORMATION

ADG
Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail; DANGEROUS GOODS.

UN number 1444
Proper shipping name AMMONIUM PERSULPHATE
Hazard class 5.1
Packing group III
Hazchem code 1Z

IATA
Classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations

for transport by air; DANGEROUS GOODS.

UN number	1444
UN proper shipping name	AMMONIUM PERSULPHATE
Transport hazard class(es)	5.1
Packing group	III

IMDG
Classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; DANGEROUS GOODS.

UN number	1444
UN proper shipping name	AMMONIUM PERSULPHATE
Transport hazard class(es)	5.1
Packing group	III
IMDG EMS Fire	F-A
IMDG EMS Spill	S-Q

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia
Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG).

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Classified as a scheduled poison according to the Standard for Uniform Scheduling of Medicines and Poisons (SUSMP)
Poisons Schedule (SUSMP) 6

International Inventories

AIIC	This material is listed on the Australian Inventory of Industrial Chemicals.
NZIoC	All the constituents of this material are listed on the New Zealand Inventory of Chemicals.

Legend:
- Australian Inventory of Industrial Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

16. OTHER INFORMATION

Supplier Safety Data Sheet 06/ 2020

Reason(s) For Issue: First Issue Primary SDS

Issuing Date: 24-Jan-2022

This Safety Data Sheet has been prepared by Ixom Operations Pty Ltd (Toxicology and SDS Services).

Revision Note:
The symbol (*) in the margin of this SDS indicates that this line has been revised.

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation
C	Carcinogen		

Key literature references and sources for data used to compile the SDS

EPA (Environmental Protection Agency)
Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australian Industrial Chemicals Introduction Scheme (AICIS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
RTECS (Registry of Toxic Effects of Chemical Substances)
World Health Organization

Disclaimer

This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since The Supplier cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Supplier representative or The Supplier at the contact details on page 1.

The Supplier's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

End of Safety Data Sheet

SAFETY DATA SHEET

Revision date: 12-Nov-2021

Revision Number 1

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product identifier

Product Name CF10GGC

Product Code(s) 000000069033

Other means of identification

Synonyms Manufactured by Condor Energy Services Ltd

Recommended use of the chemical and restrictions on use

Recommended use Completion fluid.

Uses advised against No information available.

Supplier
Condor Energy Services Ltd
ABN: 35 153 250 670
Brisbane Head Office: Level 11, 333 Ann Street
Brisbane QLD 4000
Australia

Telephone number: 07 3999 9044
Website: www.CondorEnergy.com.au

Emergency telephone number

Emergency telephone number **1800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

2. HAZARDS IDENTIFICATION

GHS Classification

Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG)

Flammable liquids	Category 4

Acute toxicity - Oral	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2A

SIGNAL WORD
Warning

Label elements

Exclamation mark

Hazard statements
H227 - Combustible liquid
H302 - Harmful if swallowed
H315 - Causes skin irritation
H319 - Causes serious eye irritation

Precautionary Statements - Prevention
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking
Wear protective gloves / protective clothing / eye protection / face protection
Wash hands and face thoroughly after handling
Do not eat, drink or smoke when using this product
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off immediately all contaminated clothing and wash it before reuse
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
In case of fire: Use extinguishing media as outlined in Section 5 of this Safety Data Sheet to extinguish.
Precautionary Statements - Storage
Store in a well-ventilated place
Precautionary Statements - Disposal
Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable

Other hazards which do not result in classification
May be harmful in contact with skin
May be harmful if swallowed and enters airways
Combustible liquid

Poisons Schedule (SUSMP) 5

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS No.	Weight-%
Guar gum	9000-30-0	30-60%
Aliphatic hydrocarbons	-	30-60%
Glycol ether derivative	-	< 10%
Organophillic silicate	-	< 5%

4. FIRST AID MEASURES

Description of first aid measures

Emergency telephone number	Poisons Information Center, Australia: 13 11 26 Poisons Information Center, New Zealand: 0800 764 766
Inhalation	Remove to fresh air and keep at rest in a position comfortable for breathing. If exposed or concerned: Get medical advice/attention.
Eye contact	In case of eye contact, remove contact lens and rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If symptoms persist, call a physician.
Skin contact	Wash off immediately with soap and plenty of water. If skin irritation persists, call a physician. Take off contaminated clothing and wash before reuse.
Ingestion	Rinse mouth. Drink 1 or 2 glasses of water. Get medical attention.

Most important symptoms and effects, both acute and delayed

Symptoms	No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians	Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Dry chemical, CO2, sand, earth, water spray or regular foam.
Unsuitable extinguishing media	High volume water jet.

Specific hazards arising from the chemical

Specific hazards arising from the chemical	Extremely slippery when spilled. Combustible liquid.
Hazardous combustion products	Carbon oxides.

Special protective actions for fire-fighters

Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation. Remove all sources of ignition. Special danger of slipping by leaking/spilling product.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see Section 13).

Methods for cleaning up After cleaning, flush away traces with water and detergent. Collect in properly labelled drums or other suitable containers, with loose fitting lids. Use clean non-sparking tools to collect absorbed material.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes, and clothing. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use grounding and bonding connection when transferring this material to prevent static discharge, fire or explosion.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible materials Strong oxidizing agents.

Poisons Schedule (SUSMP) 5

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Limits No value assigned for this specific material by Safe Work Australia. However, supplier recommended Workplace Exposure Standard(s) for constituent(s):

Chemical name	Australia	ACGIH TLV
Aliphatic hydrocarbons		TWA: 200 mg/m³, Sk (as total hydrocarbon vapour)

As published by Safe Work Australia Workplace Exposure Standards for Airborne Contaminants.

TWA - The time-weighted average airborne concentration of a particular substance when calculated over an eight-hour working day, for a five-day working week.

`Sk' (skin) Notice - absorption through the skin may be a significant source of exposure. The exposure standard is invalidated if such contact should occur.

These Workplace Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These workplace exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Appropriate engineering controls

Engineering controls Apply technical measures to comply with the occupational exposure limits.

If in the handling and application of this material, safe exposure levels could be exceeded, the use of engineering controls such as local exhaust ventilation must be considered and the results documented. If achieving safe exposure levels does not require engineering controls, then a detailed and documented risk assessment using the relevant Personal Protective Equipment (PPE) (refer to PPE section below) as a basis must be carried out to determine the minimum PPE requirements.

Individual protection measures, such as personal protective equipment

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, CHEMICAL GOGGLES, GLOVES.

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing.

Hand protection Impervious gloves.

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required. If determined by a risk assessment an inhalation risk exists, wear an organic vapour respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716.

Environmental exposure controls Local authorities should be advised if significant spillages cannot be contained.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	Slurry
Color	Light brown
Odor	Mild Hydrocarbon
Odor threshold	No information available.

Property	**Values**	**Remarks • Method**
pH	No data available	None known
pH (as aqueous solution)	No data available	None known
Melting point / freezing point	No data available	None known
Boiling point / boiling range	No data available	None known
Flash point	76.7°C	Pensky-Martens Closed Cup (PMCC)
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	No data available	
Lower flammability or explosive	No data available	

limits		
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Relative density	1.02 - 1.09	
Water solubility	Emulsifiable	
Solubility(ies)	No data available	None known
Partition coefficient	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	28 mm2/s	
Dynamic viscosity	No data available	None known

Other information

10. STABILITY AND REACTIVITY

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid Heat, flames and sparks.

Incompatible materials

Incompatible materials Strong oxidizing agents.

Hazardous decomposition products

Hazardous decomposition products None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Information on likely routes of exposure

Product Information No adverse health effects expected if the chemical is handled in accordance with this Safety Data Sheet and the chemical label. Symptoms or effects that may arise if the chemical is mishandled and overexposure occurs are:

Inhalation May cause central nervous system depression with nausea, headache, dizziness, vomiting, and incoordination.

Eye contact Causes serious eye irritation.

Skin contact Causes skin irritation. Repeated exposure may cause skin dryness or cracking. Repeated or prolonged skin contact may cause allergic reactions with susceptible persons.

Ingestion Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Symptoms No information available.

Numerical measures of toxicity - Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral) 4,967.20
ATEmix (dermal) 4,448.90

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Guar gum	= 6770 mg/kg (Rat)	-	-
Aliphatic hydrocarbons	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	-
Glycol ether derivative	= 1310 mg/kg (Rat)	-	-

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Irritating to skin. Classification based on data available for ingredients.

Serious eye damage/eye irritation Causes serious eye irritation. Classification based on data available for ingredients.

Respiratory or skin sensitization No information available.

Germ cell mutagenicity No information available.

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical name	Australia
Organophillic silicate -	Carc. 1A

Reproductive toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity The environmental impact of this product has not been fully investigated.

Persistence and degradability

Persistence and degradability For the major component: Biodegradable.

Bioaccumulative potential

Bioaccumulation No information available.

Mobility

Mobility in soil No information available.

Other adverse effects

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Dispose of contents/containers in accordance with local regulations.

14. TRANSPORT INFORMATION

ADG
Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail; NON-DANGEROUS GOODS.

IATA
Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; NON-DANGEROUS GOODS. Not regulated

IMDG
Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; NON-DANGEROUS GOODS. Not regulated

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia
Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG)

See section 8 for national exposure control parameters

Poisons Schedule (SUSMP) 5

International Inventories

AIIC	All the constituents of this material are listed on the Australian Inventory of Industrial Chemicals.
NZIoC	All the constituents of this material are listed on the New Zealand Inventory of Chemicals.

Legend:
- Australian Inventory of Industrial Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

16. OTHER INFORMATION

Supplier Safety Data Sheet

Reason(s) For Issue: First Issue Primary SDS

Issuing Date: 11-Nov-2021

This Safety Data Sheet has been prepared by Ixom Operations Pty Ltd (Toxicology and SDS Services).

Revision Note:
The symbol (*) in the margin of this SDS indicates that this line has been revised.

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation
C	Carcinogen		

Key literature references and sources for data used to compile the SDS

EPA (Environmental Protection Agency)
Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australian Industrial Chemicals Introduction Scheme (AICIS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
RTECS (Registry of Toxic Effects of Chemical Substances)
World Health Organization

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the

date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of Safety Data Sheet

HYDROCHLORIC ACID SOLUTION

Norkem Limited - Australia

Part Number: **H27**
Version No: **1.3**
Safety Data Sheet according to WHS Regulations (Hazardous Chemicals) Amendment 2020 and ADG requirements

Issue Date: **17/02/2023**
Print Date: **17/02/2023**
S.GHS.AUS.EN

SECTION 1 Identification of the substance / mixture and of the company / undertaking

Product Identifier

Product name	HYDROCHLORIC ACID SOLUTION
Synonyms	Muriatic Acid. Spirits of salt. Hydrogen chloride.
Proper shipping name	HYDROCHLORIC ACID
Other means of identification	H27 | UFI:D200-U0CW-500V-QPEC

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Acidifier. Chemical intermediate. Laboratory reagent. Pickling and anodising metals, scale remover. Precursor for generation of chlorine dioxide gas used in water treatment.

Details of the manufacturer or supplier of the safety data sheet

Registered company name	**Norkem Limited - Australia**
Address	G19, Wheelers Hill Business Centre, 202 Jells Road, Wheelers Hill. Victoria. Vic 3150. Australia
Telephone	+61 (3) 9560 0158
Fax	Not Available
Website	www.norkem.com
Email	datasheet@norkem.com

Emergency telephone number

Association / Organisation	**Norkem Limited - Australia**
Emergency telephone numbers	Australian Contact Number: +61 (0) 2801 44558 or 18000 74234 (toll-free). National Poison Information Number: 131126
Other emergency telephone numbers	Not Available

SECTION 2 Hazards identification

Classification of the substance or mixture

Poisons Schedule	Not Applicable
Classification [1]	Skin Corrosion/Irritation Category 1B, Corrosive to Metals Category 1, Serious Eye Damage/Eye Irritation Category 1, Specific Target Organ Toxicity - Single Exposure (Respiratory Tract Irritation) Category 3
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI*

Label elements

Hazard pictogram(s)	
Signal word	**Danger**

Hazard statement(s)

H314	Causes severe skin burns and eye damage.
H290	May be corrosive to metals.
H335	May cause respiratory irritation.

Page 1 continued...

Precautionary statement(s) Prevention

P260	Do not breathe mist/vapours/spray.
P264	Wash all exposed external body areas thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves, protective clothing, eye protection and face protection.
P234	Keep only in original packaging.

Precautionary statement(s) Response

P301+P330+P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower].
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER/doctor/physician/first aider.
P363	Wash contaminated clothing before reuse.
P390	Absorb spillage to prevent material damage.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.

Precautionary statement(s) Storage

P405	Store locked up.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.

Precautionary statement(s) Disposal

P501	Dispose of contents/container to authorised hazardous or special waste collection point in accordance with any local regulation.

SECTION 3 Composition / information on ingredients

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
7647-01-0	>25	Hydrochloric Acid
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI; 4. Classification drawn from C&L; * EU IOELVs available*	

SECTION 4 First aid measures

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: ▸ Immediately hold eyelids apart and flush the eye continuously with running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. ▸ Transport to hospital or doctor without delay. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ▸ Immediately flush body and clothes with large amounts of water, using safety shower if available. ▸ Quickly remove all contaminated clothing, including footwear. ▸ Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre. ▸ Transport to hospital, or doctor.
Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor, without delay. ▸ Inhalation of vapours or aerosols (mists, fumes) may cause lung oedema. ▸ Corrosive substances may cause lung damage (e.g. lung oedema, fluid in the lungs). ▸ As this reaction may be delayed up to 24 hours after exposure, affected individuals need complete rest (preferably in semi-recumbent posture) and must be kept under medical observation even if no symptoms are (yet) manifested. ▸ Before any such manifestation, the administration of a spray containing a dexamethasone derivative or beclomethasone derivative may be considered. **This must definitely be left to a doctor or person authorised by him/her.** (ICSC13719)
Ingestion	▸ For advice, contact a Poisons Information Centre or a doctor at once. ▸ Urgent hospital treatment is likely to be needed. ▸ If swallowed do **NOT** induce vomiting. ▸ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ▸ Observe the patient carefully. ▸ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

Continued...

	▸ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ▸ Transport to hospital or doctor without delay.

Indication of any immediate medical attention and special treatment needed

for corrosives:

BASIC TREATMENT

- Establish a patent airway with suction where necessary.
- Watch for signs of respiratory insufficiency and assist ventilation as necessary.
- Administer oxygen by non-rebreather mask at 10 to 15 l/min.
- Monitor and treat, where necessary, for pulmonary oedema .
- Monitor and treat, where necessary, for shock.
- Anticipate seizures.
- Where eyes have been exposed, flush immediately with water and continue to irrigate with normal saline during transport to hospital.
- **DO NOT** use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.
- Skin burns should be covered with dry, sterile bandages, following decontamination.
- **DO NOT** attempt neutralisation as exothermic reaction may occur.

ADVANCED TREATMENT

- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use.
- Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolaemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary oedema.
- Hypotension with signs of hypovolaemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.

EMERGENCY DEPARTMENT

- Laboratory analysis of complete blood count, serum electrolytes, BUN, creatinine, glucose, urinalysis, baseline for serum aminotransferases (ALT and AST), calcium, phosphorus and magnesium, may assist in establishing a treatment regime.
- Positive end-expiratory pressure (PEEP)-assisted ventilation may be required for acute parenchymal injury or adult respiratory distress syndrome.
- Consider endoscopy to evaluate oral injury.
- Consult a toxicologist as necessary.

BRONSTEIN, A.C. and CURRANCE, P.L. EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994

SECTION 5 Firefighting measures

Extinguishing media

- Water spray or fog.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.

Advice for firefighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear full body protective clothing with breathing apparatus. ▸ Prevent, by any means available, spillage from entering drains or water course. ▸ Use fire fighting procedures suitable for surrounding area. ▸ **Do not** approach containers suspected to be hot. ▸ Cool fire exposed containers with water spray from a protected location. ▸ If safe to do so, remove containers from path of fire. ▸ Equipment should be thoroughly decontaminated after use.
Fire/Explosion Hazard	▸ Non combustible. ▸ Not considered a significant fire risk, however containers may burn. The product reacts with metals with evolution of highly flammable hydrogen. May emit corrosive fumes. Hydrogen chloride (gas)
HAZCHEM	2R

SECTION 6 Accidental release measures

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Continued...

Minor Spills	▸ Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material. ▸ Check regularly for spills and leaks. ▸ Clean up all spills immediately. ▸ Avoid breathing vapours and contact with skin and eyes. ▸ Control personal contact with the substance, by using protective equipment. ▸ Contain and absorb spill with sand, earth, inert material or vermiculite. ▸ Wipe up. ▸ Place in a suitable, labelled container for waste disposal.
Major Spills	▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear full body protective clothing with breathing apparatus. ▸ Prevent, by any means available, spillage from entering drains or water course. ▸ Stop leak if safe to do so. ▸ Contain spill with sand, earth or vermiculite. ▸ Collect recoverable product into labelled containers for recycling. ▸ Neutralise/decontaminate residue (see Section 13 for specific agent). ▸ Collect solid residues and seal in labelled drums for disposal. ▸ Wash area and prevent runoff into drains. ▸ After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using. ▸ If contamination of drains or waterways occurs, advise emergency services.

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 Handling and storage

Precautions for safe handling

Safe handling	▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs. ▸ Use in a well-ventilated area. ▸ **WARNING:** To avoid violent reaction, **ALWAYS** add material to water and **NEVER** water to material. ▸ Avoid smoking, naked lights or ignition sources. ▸ Avoid contact with incompatible materials. ▸ When handling, **DO NOT** eat, drink or smoke. ▸ Keep containers securely sealed when not in use. ▸ Avoid physical damage to containers. ▸ Always wash hands with soap and water after handling. ▸ Work clothes should be laundered separately. Launder contaminated clothing before re-use. ▸ Use good occupational work practice. ▸ Observe manufacturer's storage and handling recommendations contained within this SDS. ▸ Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained. ▸ **DO NOT** allow clothing wet with material to stay in contact with skin
Other information	▸ Store in original containers. ▸ Keep containers securely sealed. ▸ Store in a cool, dry, well-ventilated area. ▸ Store away from incompatible materials and foodstuff containers. ▸ Protect containers against physical damage and check regularly for leaks. ▸ Observe manufacturer's storage and handling recommendations contained within this SDS.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ Lined metal can, lined metal pail/ can. ▸ Plastic pail. ▸ Polyliner drum. ▸ Packing as recommended by manufacturer. ▸ Check all containers are clearly labelled and free from leaks. For low viscosity materials ▸ Drums and jerricans must be of the non-removable head type. ▸ Where a can is to be used as an inner package, the can must have a screwed enclosure. For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.): ▸ Removable head packaging; ▸ Cans with friction closures and ▸ low pressure tubes and cartridges may be used. - Where combination packages are used, and the inner packages are of glass, porcelain or stoneware, there must be sufficient inert cushioning material in contact with inner and outer packages unless the outer packaging is a close fitting moulded plastic box and the substances are not incompatible with the plastic.
Storage incompatibility	▸ Dangerous goods of other classes.

SECTION 8 Exposure controls / personal protection

Control parameters

Occupational Exposure Limits (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	Hydrochloric Acid	Hydrogen chloride	Not Available	Not Available	5 ppm / 7.5 mg/m3	Not Available

Continued...

Emergency Limits

Ingredient	TEEL-1	TEEL-2	TEEL-3
Hydrochloric Acid	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
Hydrochloric Acid	50 ppm	Not Available

Exposure controls

Appropriate engineering controls

Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
The basic types of engineering controls are:
Process controls which involve changing the way a job activity or process is done to reduce the risk.
Enclosure and/or isolation of emission source which keeps a selected hazard 'physically' away from the worker and ventilation that strategically 'adds' and 'removes' air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use.
Employers may need to use multiple types of controls to prevent employee overexposure.

Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Correct fit is essential to obtain adequate protection. Supplied-air type respirator may be required in special circumstances. Correct fit is essential to ensure adequate protection.
An approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area. Air contaminants generated in the workplace possess varying 'escape' velocities which, in turn, determine the 'capture velocities' of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:
solvent, vapours, degreasing etc., evaporating from tank (in still air).	0.25-0.5 m/s (50-100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5-1 m/s (100-200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5-10 m/s (500-2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favourable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Individual protection measures, such as personal protective equipment

Eye and face protection

- Safety glasses with unperforated side shields may be used where continuous eye protection is desirable, as in laboratories; spectacles are not sufficient where complete eye protection is needed such as when handling bulk-quantities, where there is a danger of splashing, or if the material may be under pressure.
- Chemical goggles.whenever there is a danger of the material coming in contact with the eyes; goggles must be properly fitted.
- Full face shield (20 cm, 8 in minimum) may be required for supplementary but never for primary protection of eyes; these afford face protection.
- Alternatively a gas mask may replace splash goggles and face shields.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent]

Skin protection

See Hand protection below

Hands/feet protection

- Elbow length PVC gloves
- When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.

The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.
Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:

Continued...

	· frequency and duration of contact, · chemical resistance of glove material, · glove thickness and · dexterity Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent). · When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended. · When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended. · Some glove polymer types are less affected by movement and this should be taken into account when considering gloves for long-term use. · Contaminated gloves should be replaced. As defined in ASTM F-739-96 in any application, gloves are rated as: · Excellent when breakthrough time > 480 min · Good when breakthrough time > 20 min · Fair when breakthrough time < 20 min · Poor when glove material degrades For general applications, gloves with a thickness typically greater than 0.35 mm, are recommended. It should be emphasised that glove thickness is not necessarily a good predictor of glove resistance to a specific chemical, as the permeation efficiency of the glove will be dependent on the exact composition of the glove material. Therefore, glove selection should also be based on consideration of the task requirements and knowledge of breakthrough times. Glove thickness may also vary depending on the glove manufacturer, the glove type and the glove model. Therefore, the manufacturers technical data should always be taken into account to ensure selection of the most appropriate glove for the task. Note: Depending on the activity being conducted, gloves of varying thickness may be required for specific tasks. For example: · Thinner gloves (down to 0.1 mm or less) may be required where a high degree of manual dexterity is needed. However, these gloves are only likely to give short duration protection and would normally be just for single use applications, then disposed of. · Thicker gloves (up to 3 mm or more) may be required where there is a mechanical (as well as a chemical) risk i.e. where there is abrasion or puncture potential Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
Respiratory and body protection	▸ Respiratory: If ventilation is inadequate, suitable respiratory protection must be worn. Wear a respirator fitted with the following cartridge: Combination filter, type B+E/P3. Gas and combination filter cartridges should comply with European Standard EN14387. ▸ Body: See Other protection below
Other protection	▸ Overalls. ▸ PVC Apron. ▸ PVC protective suit may be required if exposure severe. ▸ Eyewash unit. ▸ Ensure there is ready access to a safety shower.

SECTION 9 Physical and chemical properties

Information on basic physical and chemical properties

Appearance	Colourless to slightly yellow.

Physical state	Liquid	**Relative density (Water = 1)**	1.16
Odour	Pungent acidic odour.	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Applicable
pH (as supplied)	<1	**Decomposition temperature (°C)**	Not Available
Melting point / freezing point (°C)	<-20	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	109	**Molecular weight (g/mol)**	Not Available
Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	Not Available	**Explosive properties**	There are no chemical groups present in the product that are associated with explosive properties.
Flammability	Not Applicable	**Oxidising properties**	There are no chemical groups present in the product that are associated with oxidising properties.
Upper Explosive Limit (%)	Not Applicable	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	Not Applicable	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	Not Available	**Gas group**	Not Available
Solubility in water	Miscible	**pH as a solution (Not Available%) (1%)**	Not Available
Vapour density (Air = 1)	Not Available	**VOC g/L**	Not Available

SECTION 10 Stability and reactivity

Reactivity	The following materials may react violently with the product:

Continued...

	Alkalis.
Chemical stability	▸ Unstable in the presence of incompatible materials. ▸ Product is considered stable. ▸ Hazardous polymerisation will not occur.
Possibility of hazardous reactions	In contact with some metals can generate hydrogen gas, which can form explosive mixtures with air. Reacts with alkalis and generates heat.
Conditions to avoid	Avoid excessive heat for prolonged periods of time.
Incompatible materials	Alkalis. Oxidising agents. Metals.
Hazardous decomposition products	Hydrogen chloride (HCl). Hydrogen. Chlorine.

SECTION 11 Toxicological information

Information on toxicological effects

Inhaled	The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage. The material has **NOT** been classified by EC Directives or other classification systems as 'harmful by inhalation'. This is because of the lack of corroborating animal or human evidence.
Ingestion	The material can produce severe chemical burns within the oral cavity and gastrointestinal tract following ingestion. The material has **NOT** been classified by EC Directives or other classification systems as 'harmful by ingestion'. This is because of the lack of corroborating animal or human evidence.
Skin Contact	The material can produce severe chemical burns following direct contact with the skin. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
Eye	The material can produce severe chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating. If applied to the eyes, this material causes severe eye damage.
Chronic	Repeated or prolonged exposure to corrosives may result in the erosion of teeth, inflammatory and ulcerative changes in the mouth and necrosis (rarely) of the jaw. Bronchial irritation, with cough, and frequent attacks of bronchial pneumonia may ensue. Long-term exposure to respiratory irritants may result in airways disease, involving difficulty breathing and related whole-body problems. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.

HYDROCHLORIC ACID SOLUTION	**TOXICITY**	**IRRITATION**
	Dermal: study scientifically unjustified[1]	Eye: adverse effect observed (irritating)[1]
	Oral: study scientifically unjustified [1]	Skin: adverse effect observed (corrosive)[1]
		Skin: adverse effect observed (irritating)[1]

Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

HYDROCHLORIC ACID SOLUTION	Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. Other criteria for diagnosis of RADS include a reversible airflow pattern on lung function tests, moderate to severe bronchial hyperreactivity on methacholine challenge testing, and the lack of minimal lymphocytic inflammation, without eosinophilia. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. On the other hand, industrial bronchitis is a disorder that occurs as a result of exposure due to high concentrations of irritating substance (often particles) and is completely reversible after exposure ceases. The disorder is characterized by difficulty breathing, cough and mucus production.

Acute Toxicity	✗	**Carcinogenicity**	✗
Skin Irritation/Corrosion	✓	**Reproductivity**	✗
Serious Eye Damage/Irritation	✓	**STOT - Single Exposure**	✓
Respiratory or Skin sensitisation	✗	**STOT - Repeated Exposure**	✗
Mutagenicity	✗	**Aspiration Hazard**	✗

Legend: ✗ *– Data either not available or does not fill the criteria for classification*
✓ *– Data available to make classification*

SECTION 12 Ecological information

Toxicity

Continued...

HYDROCHLORIC ACID SOLUTION	**Endpoint**	**Test Duration (hr)**	**Species**	**Value**	**Source**
	Not Available	Not Available	Not Available	Not Available	Not Available
Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*				

Not regarded as dangerous for the environment.
Prevent, by any means available, spillage from entering drains or water courses.
DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
Hydrochloric Acid	LOW	LOW

Bioaccumulative potential

Ingredient	Bioaccumulation
Hydrochloric Acid	LOW (LogKOW = 0.5392)

Mobility in soil

Ingredient	Mobility
Hydrochloric Acid	LOW (KOC = 14.3)

SECTION 13 Disposal considerations

Waste treatment methods

Product / Packaging disposal	Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked. A Hierarchy of Controls seems to be common - the user should investigate: ▸ Reduction ▸ Reuse ▸ Recycling ▸ Disposal (if all else fails) This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate. ▸ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ▸ It may be necessary to collect all wash water for treatment before disposal. ▸ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ▸ Where in doubt contact the responsible authority. ▸ Recycle wherever possible. ▸ Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified. ▸ Treat and neutralise at an approved treatment plant. Treatment should involve: Neutralisation followed by: burial in a land-fill specifically licensed to accept chemical and / or pharmaceutical wastes or Incineration in a licensed apparatus (after admixture with suitable combustible material) ▸ Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

SECTION 14 Transport information

Labels Required

	
Marine Pollutant	NO
HAZCHEM	2R

Land transport (ADG)

UN number or ID number	1789
UN proper shipping name	HYDROCHLORIC ACID
Transport hazard class(es)	Class: 8 Subrisk: Not Applicable
Packing group	II
Environmental hazard	Not Applicable

Continued...

Special precautions for user	Special provisions	Not Applicable
	Limited quantity	1 L

Air transport (ICAO-IATA / DGR)

UN number	1789	
UN proper shipping name	Hydrochloric acid	
Transport hazard class(es)	ICAO/IATA Class	8
	ICAO / IATA Subrisk	Not Applicable
	ERG Code	8L
Packing group	II	
Environmental hazard	Not Applicable	
Special precautions for user	Special provisions	A3 A803
	Cargo Only Packing Instructions	855
	Cargo Only Maximum Qty / Pack	30 L
	Passenger and Cargo Packing Instructions	851
	Passenger and Cargo Maximum Qty / Pack	1 L
	Passenger and Cargo Limited Quantity Packing Instructions	Y840
	Passenger and Cargo Limited Maximum Qty / Pack	0.5 L

Sea transport (IMDG-Code / GGVSee)

UN number	1789	
UN proper shipping name	HYDROCHLORIC ACID	
Transport hazard class(es)	IMDG Class	8
	IMDG Subrisk	Not Applicable
Packing group	II	
Environmental hazard	Not Applicable	
Special precautions for user	EMS Number	F-A, S-B
	Special provisions	Not Applicable
	Limited Quantities	1 L

Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

Transport in bulk in accordance with MARPOL Annex V and the IMSBC Code

Product name	Group
Hydrochloric Acid	Not Available

Transport in bulk in accordance with the IGC Code

Product name	Ship Type
Hydrochloric Acid	Not Available

SECTION 15 Regulatory information

Safety, health and environmental regulations / legislation specific for the substance or mixture

Hydrochloric Acid is found on the following regulatory lists

Australia Hazardous Chemical Information System (HCIS) - Hazardous Chemicals
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 5
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 6
Australian Inventory of Industrial Chemicals (AIIC)
International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs - Not Classified as Carcinogenic

National Inventory Status

National Inventory	Status
Australia - AIIC / Australia Non-Industrial Use	Yes
Canada - DSL	Yes
Canada - NDSL	No (Hydrochloric Acid)
China - IECSC	Yes
Europe - EINEC / ELINCS / NLP	Yes

Continued...

National Inventory	Status
Japan - ENCS	Yes
Korea - KECI	Yes
New Zealand - NZIoC	Yes
Philippines - PICCS	Yes
USA - TSCA	Yes
Taiwan - TCSI	Yes
Mexico - INSQ	Yes
Vietnam - NCI	Yes
Russia - FBEPH	Yes
Legend:	*Yes = All CAS declared ingredients are on the inventory* *No = One or more of the CAS listed ingredients are not on the inventory. These ingredients may be exempt or will require registration.*

SECTION 16 Other information

Revision Date	17/02/2023
Initial Date	21/07/2022

SDS Version Summary

Version	Date of Update	Sections Updated
0.3	17/02/2023	Composition / information on ingredients - Ingredients, Physical and chemical properties - Physical Properties

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.
The following information is provided to conform with article 13 of the EC Directive on Packaging and Packaging Waste 94/62/EC:- Wherever possible we use returnable packaging and pallets. Details of these are on our sales contracts.- For any non-returnable packaging the cost of disposal is at your expense, but we do have a list of reprocessers available.- In most cases, but not all, we are able to supply products in returnable packaging but the additional cost of this will be for the customer's expense. Please ask for details with your specific requirements.- Any product supplied in returnable packaging is clearly marked to this effect.
For detailed advice on Personal Protective Equipment, refer to the following EU CEN Standards:
EN 166 Personal eye-protection
EN 340 Protective clothing
EN 374 Protective gloves against chemicals and micro-organisms
EN 13832 Footwear protecting against chemicals
EN 133 Respiratory protective devices

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations
ES: Exposure Standard
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index
AIIC: Australian Inventory of Industrial Chemicals
DSL: Domestic Substances List
NDSL: Non-Domestic Substances List
IECSC: Inventory of Existing Chemical Substance in China
EINECS: European INventory of Existing Commercial chemical Substances
ELINCS: European List of Notified Chemical Substances
NLP: No-Longer Polymers
ENCS: Existing and New Chemical Substances Inventory
KECI: Korea Existing Chemicals Inventory
NZIoC: New Zealand Inventory of Chemicals
PICCS: Philippine Inventory of Chemicals and Chemical Substances
TSCA: Toxic Substances Control Act
TCSI: Taiwan Chemical Substance Inventory
INSQ: Inventario Nacional de Sustancias Químicas
NCI: National Chemical Inventory
FBEPH: Russian Register of Potentially Hazardous Chemical and Biological Substances

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end of SDS

SAFETY DATA SHEET

Revision date: 19-Jul-2021

Revision Number 1

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product identifier

Product Name CA370FE

Product Code(s) 000000069021

Other means of identification

Synonyms Manufactured exclusively for Condor Energy Services by Fusion Technologies (Australia) Pty Ltd

Recommended use of the chemical and restrictions on use

Recommended use Iron control additive.

Uses advised against No information available.

Supplier
Fusion Technologies Australia Pty Ltd
ABN: 50 636 538 960
Street Address: 7 Noble Street
Bridgeman Downs QLD 4035
Australia

Telephone number: +61 (0)460 047 656
Website: www.fusiontechinc.net

Emergency telephone number

Emergency telephone number **1800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

2. HAZARDS IDENTIFICATION

GHS Classification

Not classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS)

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG)

SIGNAL WORD
Not Hazardous

Label elements

Hazard statements
None

Other hazards which do not result in classification
Poisons Schedule (SUSMP) None allocated

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS No.	Weight-%
Sodium salt of organic acid	-	70-100%
Non-hazardous ingredients	Proprietary	Balance

4. FIRST AID MEASURES

Description of first aid measures

Emergency telephone number Poisons Information Center, Australia: 13 11 26
Poisons Information Center, New Zealand: 0800 764 766

Inhalation Remove to fresh air and keep at rest in a position comfortable for breathing. If symptoms persist, call a physician.

Eye contact Rinse thoroughly with plenty of water, also under the eyelids. If symptoms persist, call a physician.

Skin contact Take off contaminated clothing. Wash skin with soap and water. Get medical attention if irritation develops and persists.

Ingestion Rinse mouth. Do NOT induce vomiting. Drink 1 or 2 glasses of water. Get medical attention.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Suitable Extinguishing Media Water spray or fog is preferred; if water not available use dry chemical, CO2 or regular foam.

Unsuitable extinguishing media No information available.

Specific hazards arising from the chemical

Specific hazards arising from the chemical	Fine dust dispersed in air may ignite.

Special protective actions for fire-fighters

Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation. Remove all sources of ignition.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Stop leak if you can do it without risk. Cover powder spill with plastic sheet or tarp to minimize spreading. Keep out of drains, sewers, ditches and waterways.
Methods for cleaning up	Take up with inert, damp, non-combustible material using clean non-sparking tools and place into loosely covered plastic containers for later disposal. Avoid generation of dust. Vacuum or sweep material and place in a disposal container. Do not dry sweep dust. Wet dust with water before sweeping or use a vacuum to collect dust.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid breathing dust or spray mist. Avoid generation of dust.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Keep in a dry, cool and well-ventilated place. Store away from sources of heat or ignition.
Incompatible materials	Strong oxidizing agents.
Poisons Schedule (SUSMP)	None allocated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Limits	No value assigned for this specific material by Safe Work Australia. However, Workplace Exposure Standard(s) for particulates:

Dusts not otherwise classified: 8hr TWA = 10 mg/m^3

As published by Safe Work Australia Workplace Exposure Standards for Airborne Contaminants.

TWA - The time-weighted average airborne concentration of a particular substance when calculated over an eight-hour working day, for a five-day working week.

These Workplace Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These workplace exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Appropriate engineering controls

Engineering controls Apply technical measures to comply with the occupational exposure limits.

If in the handling and application of this material, safe exposure levels could be exceeded, the use of engineering controls such as local exhaust ventilation must be considered and the results documented. If achieving safe exposure levels does not require engineering controls, then a detailed and documented risk assessment using the relevant Personal Protective Equipment (PPE) (refer to PPE section below) as a basis must be carried out to determine the minimum PPE requirements.

Individual protection measures, such as personal protective equipment

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, CHEMICAL GOGGLES, GLOVES, DUST MASK.

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing.

Hand protection Wear suitable gloves.

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required. If determined by a risk assessment an inhalation risk exists, wear a dust mask/respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716.

Environmental exposure controls No information available.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Solid
Appearance	Crystalline Powder
Color	White
Odor	Odourless
Odor threshold	No information available.

Property	Values	Remarks • Method
pH	5.5 - 8.0	None known
pH (as aqueous solution)	No data available	None known
Melting point / freezing point	169 - 172°C	None known
Boiling point / boiling range	No data available	None known
Flash point	No data available	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Relative density	No data available	None known
Water solubility	Soluble in water 160 g/L at 20°C	None known
Solubility(ies)	No data available	None known
Partition coefficient	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known

Other information

10. STABILITY AND REACTIVITY

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid

Conditions to avoid Heat, flames and sparks. Dust formation.

Incompatible materials

Incompatible materials Strong oxidizing agents.

Hazardous decomposition products

Hazardous decomposition products Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Information on likely routes of exposure

Product Information No adverse health effects expected if the chemical is handled in accordance with this Safety Data Sheet and the chemical label. Symptoms or effects that may arise if the chemical is mishandled and overexposure occurs are:

Inhalation Inhalation of dust in high concentration may cause irritation of respiratory system.

Eye contact Mild eye irritation. Dust contact with the eyes can lead to mechanical irritation.

Skin contact May cause irritation.

Ingestion May cause gastrointestinal discomfort if consumed in large amounts.

Symptoms No information available.

Numerical measures of toxicity - Product Information

Numerical measures of toxicity - Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Sodium salt of organic acid	> 5 g/kg (Rat)	-	-

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation No information available.

Serious eye damage/eye irritation No information available.

Respiratory or skin sensitization No information available.

Germ cell mutagenicity No information available.

Carcinogenicity No information available.

Reproductive toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity The environmental impact of this product has not been fully investigated. Keep out of waterways.

Persistence and degradability

Persistence and degradability No information available.

Bioaccumulative potential

Bioaccumulation No information available.

Mobility

Mobility in soil No information available.

Other adverse effects

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Dispose of contents/containers in accordance with local regulations.

14. TRANSPORT INFORMATION

ADG
Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail; NON-DANGEROUS GOODS.

IATA
Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; NON-DANGEROUS GOODS.

IMDG
Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; NON-DANGEROUS GOODS.

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia
Not classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS)

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG)

See section 8 for national exposure control parameters

Poisons Schedule (SUSMP) None allocated

International Inventories
AICS Complies.

Legend:
- Australian Inventory of Industrial Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

16. OTHER INFORMATION

Reason(s) For Issue: First Issue Primary SDS

Issuing Date: 19-Jul-2021

This Safety Data Sheet has been prepared by Ixom Operations Pty Ltd (Toxicology and SDS Services).

Revision Note:
The symbol (*) in the margin of this SDS indicates that this line has been revised.

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation
C	Carcinogen		

Key literature references and sources for data used to compile the SDS

EPA (Environmental Protection Agency)
Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australian Industrial Chemicals Introduction Scheme (AICIS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
RTECS (Registry of Toxic Effects of Chemical Substances)
World Health Organization

Disclaimer

This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since The Supplier cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Supplier representative or The Supplier at the contact details on page 1.

The Supplier's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

End of Safety Data Sheet

SAFETY DATA SHEET

Revision date: 22-Jul-2021

Revision Number 1

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product identifier

Product Name CF210PH

Product Code(s) 000000069031

Other means of identification

Recommended use of the chemical and restrictions on use

Recommended use Buffer solution.

Uses advised against No information available.

Supplier
Fusion Technologies Australia Pty Ltd
ABN: 50 636 538 960
Street Address: 7 Noble Street
Bridgeman Downs QLD 4035
Australia

Telephone number: +61 (0)460 047 656
Website: www.fusiontechinc.net

Emergency telephone number

Emergency telephone number **1800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

2. HAZARDS IDENTIFICATION

GHS Classification

Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG)

Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2
Specific target organ toxicity (single exposure)	Category 3

SIGNAL WORD
Warning

Label elements

Exclamation mark

Hazard statements
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H335 - May cause respiratory irritation

Precautionary Statements - Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves / protective clothing / eye protection / face protection
Avoid breathing dust / fume / gas / mist / vapours / spray
Use only outdoors or in a well-ventilated area
Precautionary Statements - Response
IF exposed or concerned
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Precautionary Statements - Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Precautionary Statements - Disposal
Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable

Other hazards which do not result in classification
May be harmful if swallowed

Poisons Schedule (SUSMP) None allocated

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS No.	Weight-%
Citric acid	77-92-9	30-60%
Non-hazardous ingredients	Proprietary	Balance

4. FIRST AID MEASURES

Description of first aid measures

General advice Show this safety data sheet to the doctor in attendance.

Emergency telephone number Poisons Information Center, Australia: 13 11 26
Poisons Information Center, New Zealand: 0800 764 766

Inhalation	Remove to fresh air. Call a physician if symptoms occur.
Eye contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Keep eye wide open while rinsing. Do not rub affected area. Get medical attention if irritation develops and persists.
Skin contact	Wash with soap and water. Take off contaminated clothing and wash before reuse. Call a physician if symptoms occur.
Ingestion	Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. Do NOT induce vomiting. Call a physician.
Self-protection of the first aider	Avoid contact with skin, eyes, and clothing. Wear personal protective clothing (see section 8).

Most important symptoms and effects, both acute and delayed

Symptoms	Burning sensation. Prolonged contact may cause redness and irritation.

Indication of any immediate medical attention and special treatment needed

Note to physicians	Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Suitable Extinguishing Media	Dry chemical, CO2, sand, earth, water spray or regular foam.
Unsuitable extinguishing media	No information available.

Specific hazards arising from the chemical

Specific hazards arising from the chemical	No information available.

Special protective actions for fire-fighters

Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions	Avoid contact with skin, eyes, and clothing. Use personal protective equipment as required.
Other information	Refer to protective measures listed in Sections 7 and 8.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so. Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see Section 13).

Methods for cleaning up Cover liquid spill with sand, earth or other non-combustible absorbent material. Sweep up and shovel into suitable containers for disposal. Use personal protective equipment as required. Prevent product from entering drains. Neutralise residues with lime or soda ash. After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

General hygiene considerations Avoid contact with skin, eyes, and clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible materials Alkalis. Strong oxidizing agents. Metals.

Poisons Schedule (SUSMP) None allocated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Limits No value assigned for this specific material by Safe Work Australia.

Appropriate engineering controls

Engineering controls Apply technical measures to comply with the occupational exposure limits.

If in the handling and application of this material, safe exposure levels could be exceeded, the use of engineering controls such as local exhaust ventilation must be considered and the results documented. If achieving safe exposure levels does not require engineering controls, then a detailed and documented risk assessment using the relevant Personal Protective Equipment (PPE) (refer to PPE section below) as a basis must be carried out to determine the minimum PPE requirements.

Individual protection measures, such as personal protective equipment

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, SAFETY GLASSES, GLOVES.

Eye/face protection	If splashes are likely to occur, wear safety glasses with side-shields. Wear safety glasses with side shields (or goggles).
Skin and body protection	Wear suitable protective clothing.
Hand protection	Wear suitable gloves.
Respiratory protection	No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required. If determined by a risk assessment an inhalation risk exists, wear a suitable mist respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716.
Environmental exposure controls	No information available.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	Clear
Color	Light yellow
Odor	None
Odor threshold	No information available.

Property	**Values**	**Remarks • Method**
pH	1.3	None known
pH (as aqueous solution)	No data available	None known
Melting point / freezing point	No data available	None known
Boiling point / boiling range	No data available	None known
Flash point	No data available	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Relative density	1.2	None known
Water solubility	Miscible in water	None known
Solubility(ies)	No data available	None known
Partition coefficient	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known

Other information

10. STABILITY AND REACTIVITY

Reactivity

Reactivity Reacts with alkalis. Reacts with unlined mild steel or galvanised steel to produce hydrogen.

Chemical stability

Stability Stable under normal conditions.

Explosion data
Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Alkalis. Strong oxidizing agents. Metals.

Hazardous decomposition products

Hazardous decomposition products Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Information on likely routes of exposure

Product Information No adverse health effects expected if the chemical is handled in accordance with this Safety Data Sheet and the chemical label. Symptoms or effects that may arise if the chemical is mishandled and overexposure occurs are:

Inhalation May cause irritation of respiratory tract.

Eye contact Causes serious eye irritation. May cause redness, itching, and pain.

Skin contact Causes mild skin irritation. Prolonged contact may cause redness and irritation.

Ingestion Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Symptoms May cause redness and tearing of the eyes. Prolonged contact may cause redness and irritation.

Numerical measures of toxicity - Product Information
No information available.

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Citric acid	= 3000 mg/kg (Rat)	> 2000 mg/kg (Rat)	-

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation May cause skin irritation. Classification based on data available for ingredients.

Serious eye damage/eye irritation Causes serious eye irritation. Classification based on data available for ingredients.

Respiratory or skin sensitization No information available.

Germ cell mutagenicity No information available.

Carcinogenicity No information available.

Reproductive toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity The environmental impact of this product has not been fully investigated.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Citric acid	-	LC50: =1516mg/L (96h, Lepomis macrochirus)	-	EC50: =120mg/L (72h, Daphnia magna)

Persistence and degradability

Persistence and degradability Biodegradable.

Bioaccumulative potential

Bioaccumulation Bioaccumulation is not expected.

Component Information

Chemical name	Partition coefficient
Citric acid	-1.72

Mobility

Mobility in soil No information available.

Other adverse effects

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Dispose of contents/containers in accordance with local regulations.

14. TRANSPORT INFORMATION

ADG
Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail; NON-DANGEROUS GOODS.

IATA
Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; NON-DANGEROUS GOODS.

IMDG
Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; NON-DANGEROUS GOODS.

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia
Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Not classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG)

See section 8 for national exposure control parameters

Poisons Schedule (SUSMP) None allocated

International Inventories
AICS This material is listed on the Australian Inventory of Chemical Substances (AICS) or has been assessed under the National Industrial Chemicals (Notification and Assessment) Act 1989 as amended.

Legend:
- Australian Inventory of Industrial Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

16. OTHER INFORMATION

Reason(s) For Issue: First Issue Primary SDS

This Safety Data Sheet has been prepared by Ixom Operations Pty Ltd (Toxicology and SDS Services).

Revision Note:
The symbol (*) in the margin of this SDS indicates that this line has been revised.

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation
C	Carcinogen		

Key literature references and sources for data used to compile the SDS

EPA (Environmental Protection Agency)
Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australian Industrial Chemicals Introduction Scheme (AICIS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
RTECS (Registry of Toxic Effects of Chemical Substances)
World Health Organization

Disclaimer

This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since The Supplier cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Supplier representative or The Supplier at the contact details on page 1.

The Supplier's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

End of Safety Data Sheet

NALCO Champion
An Ecolab Company

SAFETY DATA SHEET

Condor Energy Services CAI500LT

Section: 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Condor Energy Services CAI500LT
Other means of identification	:	Manufactured exclusively for Condor Energy Services by NALCO Champion
Recommended use	:	CORROSION INHIBITOR
Restrictions on use	:	Refer to available product literature or ask your local Sales Representative for restrictions on use and dose limits.
Company	:	ECOLAB PTY LTD 2 Drake Avenue Macquarie Park NSW 2113 Australia A.B.N. 59 000 449 990 TEL: 1300 654 224 FAX: +61 2 8870 8680
Emergency telephone number	:	1800 205 506 International: +64 7 958 2372
Issuing date	:	04.06.2019

Section: 2. HAZARDS IDENTIFICATION

GHS Classification

Flammable liquids	:	Category 2
Skin corrosion/irritation	:	Category 2
Serious eye damage/eye irritation	:	Category 1
Skin sensitization	:	Category 1
Specific target organ toxicity - single exposure	:	Category 3 (Central Nervous System)

GHS Label element

Hazard pictograms :

Signal Word : Danger

Hazard Statements :
Highly flammable liquid and vapour.
Causes skin irritation.
May cause an allergic skin reaction.
Causes serious eye damage.
May cause drowsiness or dizziness.

Precautionary Statements :
Prevention:
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray. Wear protective gloves/ eye protection/ face protection.
Response:
IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell. IF IN EYES: Rinse cautiously with water for

several minutes. Remove contact lenses, if present and easy to do so. Continue rinsing.
Storage:
Store in a well-ventilated place.
Disposal:
Dispose of contents/ container to an approved waste disposal plant.

Other hazards : None known.

Section: 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance/mixture : Mixture

Chemical Name	CAS-No.	Concentration: (%)
Isopropanol	67-63-0	30 - 60
Ethoxylated C12-C16 Alcohol	68551-12-2	10 - 30
Ethoxylated Decanol	26183-52-8	5 - 10
Cinnamaldehyde	104-55-2	5 - 10
Ethoxylated Tallow Alkyl Amine	61791-26-2	1 - 5
Methanol	67-56-1	0.1 - 1

Section: 4. FIRST AID MEASURES

In case of eye contact : Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention immediately.

In case of skin contact : Wash off immediately with plenty of water for at least 15 minutes. Use a mild soap if available. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

If swallowed : Rinse mouth with water. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Aspiration hazard if swallowed - can enter lungs and cause damage. Get medical attention immediately.

Contact the Poison's Information Centre (eg Australia 13 1126; New Zealand 0800 764 766).

If inhaled : Remove to fresh air. Treat symptomatically. Get medical attention if symptoms occur.

Protection of first-aiders : In event of emergency assess the danger before taking action. Do not put yourself at risk of injury. If in doubt, contact emergency responders. Use personal protective equipment as required.

Notes to physician : Treat symptomatically.

Most important symptoms and effects, both acute and delayed : See Section 11 for more detailed information on health effects and symptoms.

Section: 5. FIREFIGHTING MEASURES

Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media : High volume water jet

Specific hazards during firefighting	:	Fire Hazard Keep away from heat and sources of ignition. Flash back possible over considerable distance. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
Hazardous combustion products	:	Carbon oxides nitrogen oxides (NOx) Sulphur oxides Hydrogen chloride
Special protective equipment for firefighters	:	Use personal protective equipment.
Specific extinguishing methods	:	Use water spray to cool unopened containers. Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. In the event of fire and/or explosion do not breathe fumes.
Hazchem Code	:	•3YE

Section: 6. ACCIDENTAL RELEASE MEASURES

Initial Emergency Response Guide No	:	14
Personal precautions, protective equipment and emergency procedures	:	Ensure adequate ventilation. Remove all sources of ignition. Keep people away from and upwind of spill/leak. Avoid inhalation, ingestion and contact with skin and eyes. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. Ensure clean-up is conducted by trained personnel only. Refer to protective measures listed in sections 7 and 8.
Environmental precautions	:	Do not allow contact with soil, surface or ground water.

Section: 7. HANDLING AND STORAGE

Advice on safe handling	:	Avoid contact with skin and eyes. Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapours). Do not ingest. Keep away from fire, sparks and heated surfaces. Do not breathe dust/fume/gas/mist/vapours/spray. Do not get in eyes, on skin, or on clothing. Wash hands thoroughly after handling. Use only with adequate ventilation.
Conditions for safe storage	:	Keep away from heat and sources of ignition. Keep in a cool, well-ventilated place. Keep away from oxidizing agents. Keep out of reach of children. Keep container tightly closed. Store in suitable labelled containers.
Suitable material	:	Keep in properly labelled containers.
Unsuitable material	:	not determined

Section: 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Form of exposure	Permissible concentration	Basis
Isopropanol	67-63-0	TWA	400 ppm 983 mg/m3	AU OEL

		VLE	500 ppm 1,230 mg/m3	AU OEL
Isopropanol	67-63-0	WES-TWA	400 ppm 983 mg/m3	NZ OEL
		WES-STEL	500 ppm 1,230 mg/m3	NZ OEL
Isopropanol	67-63-0	TWA	200 ppm	ACGIH
		STEL	400 ppm	ACGIH
		TWA	400 ppm 980 mg/m3	NIOSH REL
		STEL	500 ppm 1,225 mg/m3	NIOSH REL
		TWA	400 ppm 980 mg/m3	OSHA Z1
Methanol	67-56-1	TWA	200 ppm 262 mg/m3	AU OEL
		VLE	250 ppm 328 mg/m3	AU OEL
Methanol	67-56-1	WES-TWA	200 ppm 262 mg/m3	NZ OEL
		WES-STEL	250 ppm 328 mg/m3	NZ OEL
Methanol	67-56-1	TWA	200 ppm	ACGIH
		STEL	250 ppm	ACGIH
		TWA	200 ppm 260 mg/m3	NIOSH REL
		STEL	250 ppm 325 mg/m3	NIOSH REL
		TWA	200 ppm 260 mg/m3	OSHA Z1

Engineering measures : Effective exhaust ventilation system. Maintain air concentrations below occupational exposure standards.

Personal protective equipment

Eye protection : Safety goggles
Face-shield

Hand protection : Wear the following personal protective equipment:
Nitrile rubber
butyl-rubber
Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.

Skin protection : Personal protective equipment comprising: suitable protective gloves, safety goggles and protective clothing

Respiratory protection : When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Hygiene measures : Handle in accordance with good industrial hygiene and safety practice. Remove and wash contaminated clothing before re-use. Wash face, hands and any exposed skin thoroughly after handling. Provide suitable facilities for quick drenching or flushing of the eyes and body in case of contact or splash hazard.

Section: 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	liquid
Colour	:	clear amber
Odour	:	solvent-like, cinnamon-like
Flash point	:	22.2 °C, Method: Pensky-Martens closed cup
pH	:	4.0 - 6.0,(10 %), (25 °C), 75/25:IPA/H2O
Odour Threshold	:	no data available
Melting point/freezing point	:	Pour point: -34.4 °C
Initial boiling point and boiling range	:	79.5 °C, Method: ASTM D 86
Evaporation rate	:	no data available
Flammability (solid, gas)	:	no data available
Upper explosion limit	:	no data available
Lower explosion limit	:	no data available
Vapour pressure	:	23.4 hPa, (24 °C), ASTM D 5191, 135.8 hPa, (37.8 °C), ASTM D 5191,
Relative vapour density	:	no data available
Relative density	:	0.8856 - 0.9447, (20 °C),
Density	:	no data available
Water solubility	:	dispersible
Solubility in other solvents	:	no data available
Partition coefficient: n-octanol/water	:	no data available
Auto-ignition temperature	:	no data available
Thermal decomposition	:	no data available
Viscosity, dynamic	:	11.4 mPa.s (22 °C)
Viscosity, kinematic	:	no data available
Molecular weight	:	no data available
VOC	:	no data available

Section: 10. STABILITY AND REACTIVITY

Reactivity	:	No dangerous reaction known under conditions of normal use.
Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	No dangerous reaction known under conditions of normal use.
Conditions to avoid	:	Heat, flames and sparks.
Incompatible materials	:	Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.
Hazardous decomposition products	:	In case of fire, hazardous decomposition products may be produced such as: Carbon oxides

nitrogen oxides (NOx)
Sulphur oxides
Hydrogen chloride

Section: 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure : Inhalation, Eye contact, Skin contact

Potential Health Effects

Eyes : Causes serious eye damage.

Skin : Causes skin irritation. May cause allergic skin reaction.

Ingestion : Health injuries are not known or expected under normal use.

Inhalation : May cause drowsiness or dizziness.

Experience with human exposure

Eye contact : Redness, Pain, Corrosion

Skin contact : Redness, Pain, Irritation, Corrosion, Allergic reactions

Ingestion : Corrosion, Vomiting, Abdominal pain

Inhalation : Respiratory irritation, Cough, Dizziness, Drowsiness

Toxicity

Product

Acute oral toxicity	:	Acute toxicity estimate: > 2,000 mg/kg
Acute inhalation toxicity	:	Acute toxicity estimate: > 20 mg/l Exposure time: 4 h Test atmosphere: vapour
Acute dermal toxicity	:	Acute toxicity estimate: > 2,000 mg/kg
Skin corrosion/irritation	:	Result: Skin irritation
Serious eye damage/eye irritation	:	Result: Causes serious eye damage.
Respiratory or skin sensitization	:	no data available
Carcinogenicity	:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
Reproductive effects	:	No toxicity to reproduction
Germ cell mutagenicity	:	Based on available data, the classification criteria are not met.
Teratogenicity	:	no data available
STOT - single exposure	:	May cause drowsiness or dizziness.
STOT - repeated exposure	:	no data available
Aspiration toxicity	:	No aspiration toxicity classification

Human Hazard Characterization

Based on our hazard characterization, the potential human hazard is: High

Section: 12. ECOLOGICAL INFORMATION

Ecotoxicity

Environmental Effects : Harmful to aquatic life.

Product

Toxicity to fish : no data available

Toxicity to daphnia and other aquatic invertebrates : no data available

Toxicity to algae : no data available

Components

Toxicity to fish :

Isopropanol
LC50 Pimephales promelas (fathead minnow): 9,640 mg/l
Exposure time: 96 h

Ethoxylated C12-C16 Alcohol
LC50 : 1.5 mg/l
Exposure time: 96 h

Cinnamaldehyde
LC50 : 103.085 mg/l
Exposure time: 96 h

Ethoxylated Tallow Alkyl Amine
LC50 Fish: 1.1 mg/l
Exposure time: 96 h

Methanol
LC50 : 15,400 mg/l
Exposure time: 96 h

Components

Toxicity to daphnia and other aquatic invertebrates :

Isopropanol
LC50 Daphnia magna (Water flea): > 10,000 mg/l

Cinnamaldehyde
EC50 Daphnia magna (Water flea): 119.56 mg/l
Exposure time: 48 h

Methanol
EC50 : > 10,000 mg/l
Exposure time: 48 h

Components

Toxicity to algae :

Cinnamaldehyde
NOEC : 37.2314 mg/l
Exposure time: 72 h

Methanol
EC50 : 22,000 mg/l
Exposure time: 72 h

Components

Toxicity to bacteria	:	Isopropanol 1,050 mg/l Cinnamaldehyde 8.612 mg/l Methanol > 1,000 mg/l

Components

Toxicity to fish (Chronic toxicity)	:	Methanol NOEC: 7,900 mg/l Exposure time: 8.3 d

Persistence and degradability

no data available

Mobility

no data available

Bioaccumulative potential

no data available

Other information

no data available

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Low

Section: 13. DISPOSAL CONSIDERATIONS

Disposal methods	:	The product should not be allowed to enter drains, water courses or the soil. Where possible recycling is preferred to disposal or incineration. If recycling is not practicable, dispose of in compliance with local regulations. Dispose of wastes in an approved waste disposal facility.
Disposal considerations	:	Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers.

Section: 14. TRANSPORT INFORMATION

The shipper/consignor/sender is responsible to ensure that the packaging, labeling, and markings are in compliance with the selected mode of transport.

Land transport

Proper shipping name	:	FLAMMABLE LIQUID, N.O.S.
Technical name(s):	:	Isopropanol
UN/ID No.	:	UN 1993
Transport hazard class(es)	:	3

Packing group	:	II
IERG No	:	14
Hazchem Code	:	•3YE

Air transport (IATA)

UN/ID No.	:	UN 1993
Proper shipping name	:	FLAMMABLE LIQUID, N.O.S.
Technical name(s)	:	Isopropanol
Transport hazard class(es)	:	3
Packing group	:	II

Sea transport (IMDG/IMO)

UN/ID No.	:	UN 1993
Proper shipping name	:	FLAMMABLE LIQUID, N.O.S.
Technical name(s)	:	Isopropanol
Transport hazard class(es)	:	3
Packing group	:	II

Section: 15. REGULATORY INFORMATION

Standard for the Uniform Scheduling of Medicines and Poisons : Schedule 5

INTERNATIONAL CHEMICAL CONTROL LAWS :

Australia. Industrial Chemical (Notification and Assessment) Act
not determined

Section: 16. OTHER INFORMATION

REFERENCES

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS™ CD-ROM Version),
Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH,
(TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Revision Date	:	04.06.2019
Version Number	:	1.0
Prepared By	:	Regulatory Affairs

REVISED INFORMATION: Significant changes to regulatory or health information for this revision is indicated by a bar in the left-hand margin of the SDS.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
For additional copies of an SDS visit www.nalco.com and request access.

SAFETY DATA SHEET
POTASSIUM CHLORIDE

SECTION 1: Identification: Product identifier and chemical identity

Product identifier

Product name POTASSIUM CHLORIDE

Product No. P16

Synonyms; trade names SYLVINE, SYLVITE, MURIATE OF POTASH

CAS number 7447-40-7

Relevant identified uses of the substance or mixture and uses advised against

Application Industrial use. Fertilisers. Catalysts. Chemical additive.
Some grades of this substance are available for feed/food use. Feed material. (# 11.5.1) Food additive (E 508).

Uses advised against No specific uses advised against are identified.

Details of the supplier of the safety data sheet

Supplier

Norkem Limited Australia
G19, Wheelers Hill Business Centre,
202 Jells Road, Wheelers Hill,
Vic 3150, Australia
T: +61 (0) 3 9560 0158
F: +61 (0) 3 9561 3935
datasheet@norkem.com

Emergency telephone number

Emergency telephone Australian Contact Number: +61 (0) 2801 44558 / 18000 74234 (toll-free)
New Zealand Contact Number: +64 (0) 9929 1483 / 0800 446 881 (toll-free)
National Poison Information Number: 131126

SECTION 2: Hazard(s) identification

Classification of the substance or mixture

Physical hazards Not Classified

Health hazards Not Classified

Environmental hazards Not Classified

Label elements

Hazard statements NC Not Classified

Other hazards

This substance is not classified as PBT (persistent, bioaccumulative and toxic) or vPvB (very persistent and very bioaccumulative).

SECTION 3: Composition and information on ingredients

Substances

POTASSIUM CHLORIDE

Product name POTASSIUM CHLORIDE

CAS number 7447-40-7

SECTION 4: First aid measures

Description of first aid measures

Inhalation Move affected person to fresh air at once. Rinse nose and mouth with water. Get medical attention if any discomfort continues.

Ingestion Rinse mouth thoroughly with water. Get medical attention if any discomfort continues. Do not induce vomiting.

Skin Contact Remove affected person from source of contamination. Remove contaminated clothing. Wash skin thoroughly with soap and water. Get medical attention if any discomfort continues.

Eye contact Rinse with water. Remove any contact lenses and open eyelids wide apart. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

Most important symptoms and effects, both acute and delayed

General information No information available.

Indication of any immediate medical attention and special treatment needed

Notes for the doctor No specific recommendations. Treat symptomatically.

SECTION 5: Firefighting measures

Extinguishing media

Suitable extinguishing media Use fire-extinguishing media suitable for the surrounding fire. The product is not flammable.

Special hazards arising from the substance or mixture

Hazardous combustion products Thermal decomposition or combustion products may include the following substances: Hydrogen chloride (HCl). Oxides of the following substances: Potassium.

Advice for firefighters

Special protective equipment for firefighters Wear positive-pressure self-contained breathing apparatus (SCBA) and appropriate protective clothing. Firefighter's clothing conforming to Australia/New Zealand Standards AS/NZS 4967 (for clothing) AS/NZS 1801 (for helmets), AS/NZS 4821 (for protective boots), AS/NZS 1801 (for protective gloves) will provide a basic level of protection for chemical incidents.

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions Avoid inhalation of dust. Provide adequate ventilation.
Wear protective clothing as described in Section 8 of this safety data sheet.

Environmental precautions

Environmental precautions Avoid the spillage or runoff entering drains, sewers or watercourses.

Methods and material for containment and cleaning up

Methods for cleaning up Avoid generation and spreading of dust.
Collect and place in suitable waste disposal containers and seal securely. Label the containers containing waste and contaminated materials and remove from the area as soon as possible.
Flush contaminated area with plenty of water.

Reference to other sections

POTASSIUM CHLORIDE

Reference to other sections Wear protective clothing as described in Section 8 of this safety data sheet. For waste disposal, see section 13.

SECTION 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Usage precautions Avoid spilling. Avoid contact with skin and eyes. Provide adequate ventilation. Avoid handling which leads to dust formation.

Advice on general occupational hygiene Do not eat, drink or smoke when using this product. Wash at the end of each work shift and before eating, smoking and using the toilet. Take off contaminated clothing and wash it before reuse.

Conditions for safe storage, including any incompatibilities

Storage precautions Store in tightly-closed, original container in a dry, cool and well-ventilated place. Protect from sunlight.
Protect from moisture. The substance is hygroscopic and will absorb water by contact with the moisture in the air.

Specific end use(s)

Specific end use(s) The identified uses for this product are detailed in Section 1.

SECTION 8: Exposure controls and personal protection

Ingredient comments No exposure limits known for ingredient(s).

Exposure controls

Protective equipment

Appropriate engineering controls Provide adequate ventilation. Avoid inhalation of dust.
Observe any occupational exposure limits for the product or ingredients.

Eye/face protection Eyewear complying with an approved standard should be worn if a risk assessment indicates eye contact is possible. Personal protective equipment for eye and face protection should comply with Australia/New Zealand Standard AS/NZS 1337.

Hand protection Wear protective gloves. To protect hands from chemicals, gloves should comply with Australia/New Zealand Standard AS/NZS 2161. Chemical-resistant, impervious gloves complying with an approved standard should be worn if a risk assessment indicates skin contact is possible.

Other skin and body protection Provide eyewash station and safety shower. Wear appropriate clothing to prevent any possibility of skin contact.

Respiratory protection Protection against nuisance dust must be used when the airborne concentration exceeds 10 mg/m3. Wear a suitable dust mask. Particulate filter, type P2. Disposable filtering half mask respirators should comply with Australia/New Zealand Standard AS/NZS 1716.

Environmental exposure controls Avoid releasing into the environment. Do not discharge into drains or watercourses or onto the ground.

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Appearance Powder. Crystals.

POTASSIUM CHLORIDE

Colour	White.
Odour	Odourless.
Melting point	770 - 773°C
Initial boiling point and range	Scientifically unjustified.
Flash point	Not applicable. Substance is inorganic. Solid.
Flammability (solid, gas)	The product is not flammable.
Flammability Limit - Lower(%)	Not applicable.
Vapour pressure	Scientifically unjustified.
Relative density	1.984
Solubility(ies)	Soluble in water. 355 g/l water @ 20°C
Partition coefficient	Not relevant. Substance is inorganic.
Auto-ignition temperature	Not applicable.
Explosive properties	Not considered to be explosive. There are no chemical groups present in the product that are associated with explosive properties.
Oxidising properties	Does not meet the criteria for classification as oxidising. There are no chemical groups present in the product that are associated with oxidising properties.
Other information	Not available.

SECTION 10: Stability and reactivity

Reactivity	The following materials may react violently with the product: Strong oxidising agents.
Stability	Stable at normal ambient temperatures and when used as recommended.
Possibility of hazardous reactions	The following materials may react violently with the product: Strong oxidising agents.
Conditions to avoid	Avoid excessive heat for prolonged periods of time. Water, moisture.
Materials to avoid	Strong oxidising agents. Potassium Permanganate (CAS: 7722-64-7) . Sulphuric Acid (CAS: 7664-93-9) . Bromine Trifluoride (BrF3) (CAS: 7787-71-5).
Hazardous decomposition products	Chlorine. Potassium. Hydrogen chloride (HCl).

SECTION 11: Toxicological information

Information on toxicological effects

Acute toxicity - oral

Notes (oral LD_{50})	OECD: Organisation for Economic Co-operation and Development. LD_{50} 3020 mg/kg, Oral, Rat (OECD SIDS, 2001) Based on available data the classification criteria are not met.

Acute toxicity - dermal

POTASSIUM CHLORIDE

Notes (dermal LD_{50}) Data lacking.

Acute toxicity - inhalation

Notes (inhalation LC_{50}) Data lacking.

Skin corrosion/irritation

Animal data Not irritating.
Weight of evidence.
Based on available data the classification criteria are not met.

Serious eye damage/irritation

Serious eye damage/irritation Not irritating.
Weight of evidence.
Based on available data the classification criteria are not met.

Skin sensitisation

Skin sensitisation Data lacking.

Germ cell mutagenicity

Genotoxicity - in vitro Gene mutation: Negative.
(OECD SIDS, 2001)
Based on available data the classification criteria are not met.

Carcinogenicity

Carcinogenicity No evidence of carcinogenicity in animal studies.
(OECD SIDS, 2001)
Based on available data the classification criteria are not met.

IARC carcinogenicity Not listed.

Reproductive toxicity

Reproductive toxicity - development Developmental toxicity: - NOAEL: ca. 310 mg/kg/day, Oral, Rat
No evidence of reproductive toxicity in animal studies.
(OECD SIDS, 2001)
Based on available data the classification criteria are not met.

Specific target organ toxicity - repeated exposure

STOT - repeated exposure NOAEL 1820 mg/kg/day, Oral, Rat
(OECD SIDS, 2001)
Based on available data the classification criteria are not met.

Aspiration hazard

Aspiration hazard Not relevant.

General information :

Inhalation Dust in high concentrations may irritate the respiratory system.

Ingestion May cause discomfort if swallowed.

Skin Contact Powder may irritate skin.

Eye contact Particles in the eyes may cause irritation and smarting.

SECTION 12: Ecological information

Toxicity Based on available data the classification criteria are not met.

Acute aquatic toxicity

POTASSIUM CHLORIDE

Acute toxicity - fish	LC_{80}, 96 hours: 880 mg/l, Pimephales promelas (Fat-head Minnow) (OECD SIDS, 2001)
Acute toxicity - aquatic invertebrates	EC_{50}, 48 hours: 660 mg/l, Daphnia magna (OECD SIDS, 2001)
Acute toxicity - aquatic plants	EC_{50}, 120 hours: 1337 mg/l, Nitzchia linearis (OECD SIDS, 2001)

Chronic aquatic toxicity

Chronic toxicity - aquatic invertebrates	LOEC, 21 day: 101 mg/l, Daphnia magna (OECD SIDS, 2001)

Persistence and degradability

Persistence and degradability	There are no data on the degradability of this product. The product contains only inorganic substances which are not biodegradable.

Bioaccumulative potential

Bioaccumulative Potential	No data available on bioaccumulation.
Partition coefficient	Not relevant. Substance is inorganic.

Mobility in soil

Mobility	Not known.

Other adverse effects

Other adverse effects	None known.

SECTION 13: Disposal considerations

Waste treatment methods

Disposal methods	Dispose of waste to licensed waste disposal site in accordance with the requirements of the local Waste Disposal Authority.

SECTION 14: Transport information

General	The product is not covered by international regulations on the transport of dangerous goods (IMDG, IATA, ADG).

UN number

Not applicable.

UN proper shipping name

Not applicable.

Transport hazard class(es)

Not applicable.

Packing group

Not applicable.

Environmental hazards

Environmentally hazardous substance/marine pollutant

No.

Special precautions for user

Not applicable.

POTASSIUM CHLORIDE

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

SECTION 15: Regulatory information

Inventories

EU - EINECS/ELINCS
Yes

Canada - DSL/NDSL
Yes

US - TSCA
Yes

Korea - KECI
Yes

China - IECSC
Yes

Philippines - PICCS
Yes

New Zealand - NZIOC
Yes

SECTION 16: Any other relevant information

POTASSIUM CHLORIDE

Abbreviations and acronyms used in the safety data sheet

ADG: Australian dangerous goods code
ATE: Acute toxicity estimate.
BCF: Bioconcentration factor.
CAS: Chemical abstracts service.

EC_{50}: 50% of maximal effective concentration.
IATA: International air transport association.
ICAO: Technical instructions for the safe transport of dangerous goods by air.
IMDG: International maritime dangerous goods.
LC_{50}: Lethal concentration to 50 % of a test population.
LD_{50}: Lethal dose to 50% of a test population (median lethal dose).
LOAEC: Lowest observed adverse effect concentration.
LOAEL: Lowest observed adverse effect level.
LOEC: Lowest observed effect concentration.
MARPOL 73/78: International convention for the prevention of pollution from ships, 1973 as modified by the protocol of 1978.
IBC: International code for the construction and equipment of ships carrying dangerous chemicals in bulk (International bulk chemical code).
NOAEC: No observed adverse effect concentration.
NOAEL: No observed adverse effect level.
NOEC: No observed effect concentration.
OECD: Organisation for Economic Co-operation and Development.
PBT: Persistent, bioaccumulative and toxic substance.

UN: United Nations.
vPvB: Very persistent and very bioaccumulative.

Key literature references and sources for data

European Chemicals Agency, http://echa.europa.eu/ - REACH disseminated dossier. OECD SIDS Initial Assessment Report for Potassium Chloride, 2001.

Revision comments

NOTE: Lines within the margin indicate significant changes from the previous revision.

Revision date

30/04/2019

Revision

4

Supersedes date

20/06/2017

SAFETY DATA SHEET

Revision date: 19-Jul-2021

Revision Number 1

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product identifier

Product Name CF8500

Product Code(s) 000000069018

Other means of identification

UN number 1444

Synonyms Manufactured exclusively for Condor Energy Services by Fusion Technologies (Australia) Pty Ltd

Recommended use of the chemical and restrictions on use

Recommended use Hydraulic fracturing additive.

Uses advised against No information available.

Supplier
Fusion Technologies Australia Pty Ltd
ABN: 50 636 538 960
Street Address: 7 Noble Street
Bridgeman Downs QLD 4035
Australia

Telephone number: +61 (0)460 047 656
Website: www.fusiontechinc.net

Emergency telephone number

Emergency telephone number **1800 033 111 (ALL HOURS)**

Please ensure you refer to the limitations of this Safety Data Sheet as set out in the "Other Information" section at the end of this Data Sheet.

2. HAZARDS IDENTIFICATION

GHS Classification

Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG).

Oxidizing solids	Category 3
Acute toxicity - Oral	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2A
Respiratory sensitization	Category 1
Skin sensitization	Category 1
Specific target organ toxicity (single exposure)	Category 3

SIGNAL WORD
Danger

Label elements

Flame over circle
Exclamation mark
Health hazard

Hazard statements
H302 - Harmful if swallowed
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
H317 - May cause an allergic skin reaction
H335 - May cause respiratory irritation
H272 - May intensify fire; oxidizer

Precautionary Statements - Prevention
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking
Keep/Store away from clothing/ combustible materials
Do not eat, drink or smoke when using this product
Wear protective gloves / protective clothing / eye protection / face protection
Avoid breathing dust / fume / gas / mist / vapours / spray
Use only outdoors or in a well-ventilated area
In case of inadequate ventilation wear respiratory protection
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Precautionary Statements - Response
IF exposed:
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
IF ON SKIN: Gently wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
If experiencing respiratory symptoms: Call a POISON CENTER or doctor
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
In case of fire: Use extinguishing media as outlined in Section 5 of this Safety Data Sheet for extinction.
Precautionary Statements - Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up

Precautionary Statements - Disposal
Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable

Other hazards which do not result in classification
Poisons Schedule (SUSMP) 6

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS No.	Weight-%
Ammonium persulfate	7727-54-0	60-100%
Non-hazardous ingredients	Proprietary	Balance

4. FIRST AID MEASURES

Description of first aid measures

General advice Take a copy of the Safety Data Sheet when going for medical treatment.

Emergency telephone number Poisons Information Center, Australia: 13 11 26
Poisons Information Center, New Zealand: 0800 764 766

Inhalation Remove to fresh air and keep at rest in a position comfortable for breathing. If breathing is difficult, (trained personnel should) give oxygen. Give artificial respiration if victim is not breathing. Get immediate medical advice/attention.

Eye contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Do not rub affected area. Seek immediate medical attention/advice.

Skin contact Remove and isolate contaminated clothing and shoes. Wash off immediately with plenty of water. Get medical attention if symptoms occur. Allergic symptoms may be delayed.

Ingestion Rinse mouth thoroughly with water. Do NOT induce vomiting. Drink 1 or 2 glasses of water. Get immediate medical advice/attention.

Most important symptoms and effects, both acute and delayed

Symptoms May cause allergic skin reaction. May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Indication of any immediate medical attention and special treatment needed

Note to physicians Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Suitable Extinguishing Media Water spray or fog is preferred; if water not available use dry chemical, CO2 or regular foam.

Unsuitable extinguishing media No information available.

Specific hazards arising from the chemical

Specific hazards arising from the Oxidizer. Non-combustible, substance itself does not burn but may decompose upon

chemical	heating to produce corrosive and/or toxic fumes. Promotes the combustion (oxidizer). Can cause fire and explosion when in contact with flammable substances. Any material contaminated with the product (e.g. clothes) ignites easily and burns vigorously - increased fire hazard. Containers may explode when heated.
Hazardous combustion products	Carbon oxides.

Special protective actions for fire-fighters

Special protective equipment for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Cool containers with flooding quantities of water until well after fire is out.
Hazchem code	1Z

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation. Evacuate personnel to safe areas. Stop leak if you can do it without risk. Avoid breathing dust / fume / gas / mist / vapours / spray. Avoid generation of dust.
Other information	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Cover powder spill with plastic sheet or tarp to minimize spreading. Prevent dust cloud.
Methods for cleaning up	Take up with inert, damp, non-combustible material using clean non-sparking tools and place into loosely covered plastic containers for later disposal. Do not dry sweep dust. Wet dust with water before sweeping or use a vacuum to collect dust. Keep in suitable, closed containers for disposal. Prevent product from entering drains.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes, and clothing. Avoid breathing dust or spray mist. Take precautionary measures against static discharges.
General hygiene considerations	Take off contaminated clothing and wash it before reuse. Wash hands and face before breaks and immediately after handling the product. Wear suitable gloves and eye/face protection. When using do not eat, drink or smoke.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Keep containers tightly closed in a dry, cool and well-ventilated place.
Incompatible materials	Acids. Alkalis. Combustible material. Halogenated compounds. Organic compounds.
Poisons Schedule (SUSMP)	6

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Limits

Chemical name	Australia	ACGIH TLV
Ammonium persulfate 7727-54-0	0.1 mg/m³ Peak	TWA: 0.1 mg/m³ persulfate

As published by Safe Work Australia Workplace Exposure Standards for Airborne Contaminants.

Peak Limitation - a maximum or peak airborne concentration of a particular substance determined over the shortest analytically practicable period of time which does not exceed 15 minutes.

These Workplace Exposure Standards are guides to be used in the control of occupational health hazards. All atmospheric contamination should be kept to as low a level as is workable. These workplace exposure standards should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity.

Appropriate engineering controls

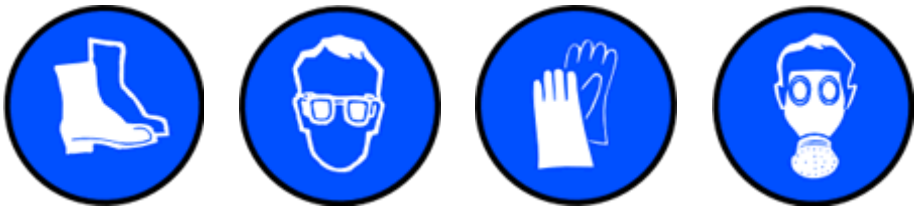
Engineering controls Apply technical measures to comply with the occupational exposure limits.

If in the handling and application of this material, safe exposure levels could be exceeded, the use of engineering controls such as local exhaust ventilation must be considered and the results documented. If achieving safe exposure levels does not require engineering controls, then a detailed and documented risk assessment using the relevant Personal Protective Equipment (PPE) (refer to PPE section below) as a basis must be carried out to determine the minimum PPE requirements.

Individual protection measures, such as personal protective equipment

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors.

OVERALLS, SAFETY SHOES, SAFETY GLASSES, GLOVES, DUST MASK.



Eye/face protection Wear safety glasses with side shields (or goggles).

Skin and body protection Wear suitable protective clothing. Long sleeved clothing.

Hand protection Wear suitable gloves.

Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required. If determined by a risk assessment an inhalation risk exists, wear a dust mask/respirator meeting the requirements of AS/NZS 1715 and AS/NZS 1716.

Environmental exposure controls Avoid creating dust.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Solid
Appearance	Crystalline Powder
Color	White
Odor	Faint Organic
Odor threshold	No information available.

Property	**Values**	**Remarks • Method**
pH	4.0 - 3.2 (1% - 10% solution)	
pH (as aqueous solution)	No data available	None known
Melting point / freezing point	120°C	
Boiling point / boiling range	No data available	None known
Flash point	No data available	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		None known
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Relative density	1.980 (bulk density)	
Water solubility	Sparingly soluble 80 g/L at 20°C	
Solubility(ies)	No data available	None known
Partition coefficient	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	>120°C	
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known

Other information

10. STABILITY AND REACTIVITY

Reactivity

Reactivity Oxidizer.

Chemical stability

Stability Stable under normal conditions. Unstable if heated.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions Can react vigorously with acids or alkalis (lyes) - danger of explosion. Can react violently with reducing agents.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid

Conditions to avoid Dust formation. Extremes of temperature and direct sunlight.

Incompatible materials

Incompatible materials Acids. Alkalis. Combustible material. Halogenated compounds. Organic compounds.

Hazardous decomposition products

Hazardous decomposition products Carbon oxides. Nitrogen oxides. Oxides of sulfur.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Information on likely routes of exposure

Product Information No adverse health effects expected if the chemical is handled in accordance with this Safety Data Sheet and the chemical label. Symptoms or effects that may arise if the chemical is mishandled and overexposure occurs are:

Inhalation Irritating to respiratory system. May cause sensitization by inhalation. May cause allergy or asthma symptoms or breathing difficulties if inhaled.

Eye contact Causes serious eye irritation.

Skin contact Causes skin irritation. May cause sensitization by skin contact. Repeated or prolonged skin contact may cause allergic reactions with susceptible persons.

Ingestion Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Symptoms Irritating. Asthma-like and/ or skin allergy-like symptoms. May cause sensitization by inhalation and skin contact.

Numerical measures of toxicity - Product Information
No information available.

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Ammonium persulfate	= 495 mg/kg (Rat)	> 10000 mg/kg (Rabbit)	= 520 mg/L (Rat) 1 h

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Causes skin irritation.

Serious eye damage/eye irritation Causes serious eye irritation.

Respiratory or skin sensitization May cause sensitization by inhalation and skin contact.

Germ cell mutagenicity No information available.

Carcinogenicity No information available.

Reproductive toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity Keep out of waterways.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Ammonium persulfate	-	LC50: =103mg/L (96h, Lepomis macrochirus) LC50: =76.3mg/L (96h, Oncorhynchus mykiss) LC50: =323mg/L (96h, Poecilia reticulata)	-	EC50: =120mg/L (48h, Daphnia magna)

Persistence and degradability

Persistence and degradability No information available.

Bioaccumulative potential

Bioaccumulation No information available.

Mobility

Mobility in soil No information available.

Other adverse effects

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Dispose of contents/containers in accordance with local regulations.

14. TRANSPORT INFORMATION

ADG

Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for Transport by Road and Rail; DANGEROUS GOODS.

UN number 1444
Proper shipping name AMMONIUM PERSULPHATE
Hazard class 5.1
Packing group III
Hazchem code 1Z

IATA

Classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air; DANGEROUS GOODS.

UN number	1444
UN proper shipping name	AMMONIUM PERSULPHATE
Transport hazard class(es)	5.1
Packing group	III

IMDG
Classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea; DANGEROUS GOODS.

UN number	1444
UN proper shipping name	AMMONIUM PERSULPHATE
Transport hazard class(es)	5.1
Packing group	III
IMDG EMS Fire	F-A
IMDG EMS Spill	S-Q

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia
Classified as a hazardous chemical in accordance with the criteria of Safe Work Australia - Globally Harmonized System (GHS).

Classified as dangerous goods in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG).

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Classified as a scheduled poison according to the Standard for Uniform Scheduling of Medicines and Poisons (SUSMP)
Poisons Schedule (SUSMP) 6

International Inventories
AICS This material is listed on the Australian Inventory of Industrial Chemicals.

Legend:
- Australian Inventory of Industrial Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

16. OTHER INFORMATION

Supplier Safety Data Sheet 01/ 2018

Reason(s) For Issue: First Issue Primary SDS

Issuing Date: 19-Jul-2021

This Safety Data Sheet has been prepared by Ixom Operations Pty Ltd (Toxicology and SDS Services).

Revision Note:
The symbol (*) in the margin of this SDS indicates that this line has been revised.

Key or legend to abbreviations and acronyms used in the safety data sheet

Legend Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	*	Skin designation
C	Carcinogen		

Key literature references and sources for data used to compile the SDS

EPA (Environmental Protection Agency)
Acute Exposure Guideline Level(s) (AEGL(s))
U.S. Environmental Protection Agency Federal Insecticide, Fungicide, and Rodenticide Act
U.S. Environmental Protection Agency High Production Volume Chemicals
Food Research Journal
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
Japan GHS Classification
Australian Industrial Chemicals Introduction Scheme (AICIS)
NIOSH (National Institute for Occupational Safety and Health)
National Library of Medicine's ChemID Plus (NLM CIP)
National Library of Medicine's PubMed database (NLM PUBMED)
National Toxicology Program (NTP)
New Zealand's Chemical Classification and Information Database (CCID)
Organization for Economic Co-operation and Development Environment, Health, and Safety Publications
Organization for Economic Co-operation and Development High Production Volume Chemicals Program
Organization for Economic Co-operation and Development Screening Information Data Set
RTECS (Registry of Toxic Effects of Chemical Substances)
World Health Organization

Disclaimer

This SDS summarises to our best knowledge at the date of issue, the chemical health and safety hazards of the material and general guidance on how to safely handle the material in the workplace. Since The Supplier cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact their Supplier representative or The Supplier at the contact details on page 1.

The Supplier's responsibility for the material as sold is subject to the terms and conditions of sale, a copy of which is available upon request.

End of Safety Data Sheet

APPENDIX C HUMAN HEALTH AND ENVIRONMENTAL HAZARD ASSESSMENT

Table C-1: Human Health and Environmental Hazard Assessment Summary

CAS RN	Chemical Constituent	Approx. Concentration (mg/L)	Read-across? Name (CAS RN)	Persistence	P	Bioaccumulation	B	Toxicity	T	Ecological Hazard	Human Health Effects	Human Hazard	ECHA Registered Dossiers	AICIS IMAP Reports	Other Sources
1302-74-5	Light Weight Proppant – 20/40 size - Corundum (55-65% neat product)	139322	Refer crystalline silica below due to similar inert properties and potential for silicosis.	-	-	-	-	-	-	L	-	H Additional measured to mitigate inhalation or excessive generation of dust from this component of the fluid is suggested.	-	-	-
1302-93-8	Light Weight Proppant – 20/40 size - Mullite (35-45% neat product)	92881	Refer crystalline silica below due to similar inert properties and potential for silicosis.	-	-	-	-	-	-	L	-	H Additional measured to mitigate inhalation or excessive generation of dust from this component of the fluid is suggested.	-	-	-
14808-60-7a	Quartz crystalline silica	8089	Refer crystalline silica below.	-	-	-	-	-	-	L	-	H Additional measured to mitigate inhalation or excessive generation of dust from this component of the fluid is suggested.	-	-	-
78330-21-9	Ethoxylated branched C13 alcohol	163	Isotridecanol, ethoxylated (69011-36-5) & isotridecanol, ethoxylated, 3 EO (24938-91-8) (as noted where required)	Readily biodegradable (based on tests available for the structural analogue isotridecanol, ethoxylated, 3 EO (CAS 24938-91-8))	-	Log Pow 4.73 (experimentally determined with OECD 117); BCF up to 387 (ECHA citing Tolls et al., 2000 study for alcohol ethoxylate constituents >C13). Ready biodegradability results plus reported low literature BCFs for a wide range of alcohol ethoxylates (C12-C16) indicate a low potential to bioaccumulate. ECHA also reported rapid biotransformation and excretion potential for this group of chemicals.	-	**Acute:** Isotridecanol, ethoxylated (69011-36-5) -Fish 96h LC50 1.1 mg/L (geomean measured, OECD 203, Danio rerio) -Invertebrate 48h EC50 0.544 mg/L (geomean measured, OECD 202, Daphnia magna) - Aq Plants 72h ErC50 3.4 mg/L (meas. arith. Mean, OECD 201, Desmodesmus subspicatus) **Chronic:** Isotridecanol, ethoxylated (69011-36-5) - Fish 30d EC10 0.236 mg/L (QSAR estimation) - Invertebrates 21d NOEC 0.218 mg/L (TWA, OECD 211, Daphnia magna) - Aq Plants 72h ErC10 1.33 mg/L (meas. arith. Mean, OECD 201, Desmodesmus subspicatus)	vT	H	Low to moderate acute oral toxicity. Potentially correlated to ethoxylation (highest for EO5-EO14). Moderate acute oral toxicity cannot be ruled out. Oral LD50 600 mg/kg bw/day (rats for C15-16, C14-C1EO11) to 10,000 mg/kg bw/day (rats, CxEO1-3, CxEO>15). Study design discrepancies were noted by NICNAS (2020). Low acute dermal toxicity. Dermal LD50 2,000-5,000 mg/kg bw/day (rabbits) and LD50 >800 mg/kg bw/day (C13-15EO10, C13-C15EO11) to >5,000 mg/kg bw/day. Low acute inhalation toxicity. LC50 >0.22 mg/L (C9-11EO5 4h mist, rats). Mists/droplets may cause respiratory irritation and consequent damage to lungs. Compounds with EO3 were severely irritating while those with EO7 were mildly to severely irritating. Dilutions at 1% were slightly irritating and at 0.1% were minimally to non-irritating. These chemicals (CAS No. 68439-46-3, 66455-14-9, 68131-39-5 (group members) and 68951-67-7 were severely to extremely irritating when tested undiluted and without rinsing, slightly to moderately irritating at 10 %, and non-irritating to mildly irritating at 0.1-1% Not expected to cause serious damage through repeated dose exposure (oral, dermal - except for local effects). No data available for repeated inhalation dose exposure. Not considered to be genotoxic nor carcinogenic & do not cause reproductive or developmental toxicity (NICNAS, 2020). Harmful if swallowed Cat 4 (H302) Causes serious eye damage Cat 1 (H318) Causes skin irritation Cat 2 (H315)	M Oral exposure can be mitigated by standard safety protocols.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/13803	https://www.industrialchemicals.gov.au/sites/default/files/Ethoxylates of aliphatic alcohols %28Greater ThanC8%29 Human health tier II assessment.pdf	-
68439-57-6	Sulfonic acids, C14-16-alkane hydroxy and C14-16-alkene, sodium salts	143	Grouped by AICIS (IMAP Tier II HHRA Report) with sulfuric acid, mono-C12-18-alkyl esters, sodium salts (68955-19-1)	Readily biodegradable (based on tests with alpha olefin sulfonates in freshwater and marine water, OECD 301B)	-	Log Pow -1.3 (experimentally determined with EU Method A.8). Estimated BCF 70.8 L/kg. Both BCF and depuration time (the latter at least for 12 and 14 carbons in the alkyl chain) indicate that the substances are not bioaccumulative up to 16 carbons in the alkyl chain (SIDS, 2007).	-	**Acute:** -Fish 96h LC50 4.2 mg/L (GLP, OECD 203, Danio rerio) -Invertebrate 48h EC50 4.53 mg/L (OECD 202, Ceriodaphnia dubia) - Aq Plants 72h ErC50 1.97 mg/L (converted to 100% test substance but unreliable study, Skeletonema costatum) **Chronic:** - Fish - no tests available due to low persistence, low potential for bioaccumulation, and similar acute toxicity between invertebrates and fish. - Invertebrates 21d NOEC 2.42 mg/L (100 % active ingredient, Daphnia magna, OECD 211) - Aq Plants 72h ErC10 1.2 mg/L (converted to 100% test substance but unreliable study, Skeletonema costatum)	T	M	Low to moderate acute oral toxicity. Oral LD50 1,400-7,800 mg/kg (rats), 2,600->8,000 mg/kg (mice). Low acute dermal toxicity. LD50 >6,000 mg/kg bw (rabbits). Low acute inhalation toxicity. Inhalation LC50 >229 mg/L (equiv. >52 mg/L 4h undiluted). Irritating to skin and severely irritating to eyes. Not sensitising to skin. Not considered to cause serious damage following repeated exposure (oral, dermal). No data available for repeated inhalation exposures. Not genotoxic and not carcinogenic (NICNAS, 2020). Does not show specific reproductive or developmental toxicity (observed effects are secondary to maternal toxicity). Developmental NOAEL 300 mg/kg bw/day (rats). Causes serious eye damage Cat 1 (H318) Causes skin irritation Cat 2 (H315)	M Oral, eye and skin exposure can be mitigated by standard safety protocols.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/16004	https://www.industrialchemicals.gov.au/sites/default/files/Selected anionic surfactants_Human health tier II assessment.pdf	-
71195-64-7	Diisobutyl glutarate	19	Results for combined mixture diisobutyl esters (EC No. 907-870-9) comprising diisobutyl glutarate (71195-64-7), diisobutyl succinate (925-06-4), and diisobutyl adipate (141-04-8) are available for hazard reviews. For repeated dose studies (human health), ECHA used dimethyl esters (read-across). For genotoxicity reviews (human health), ECHA read across to data available on the methyl esters and also the hydroysis products, isobutanol, and the constituent acids (adipic, succinic, glutaric). For reproductive effects (human health), ECHA read across to data for the methyl esters of these acids, isobutanol and dibutyl adipate (a structurally similar analogue to one of the components).	Readily biodegradable (OECD 301D, OECD 306 seawater)	-	Log Pow ranged 3.7-4.5 (test type not identified) BCFs <13 L/kg (QSAR estimated using BCFBAF, Arnot-Gobas model)	-	**Acute:** -Fish 96h LC50 1.6 mg/L (GLP, OECD 203, Scophthalmus maximus (juvenile turbot)) -Invertebrate 48h LL50 25 mg/L (ISO TC147/SC5/WG2), marine copepod (Acartia tonsa)) - Aq Plants 72h ErC50 7.9 mg/L (GLP, ISO 10253 growth, marine algal toxicity test with Skeletonema costatum) **Chronic:** - Fish & invertebrates - no tests available due to low persistence, low potential for bioaccumulation, and low acute toxicity. - Aq Plants 72h ErC10 0.32 mg/L (GLP, ISO 10253 growth, marine algal toxicity test with Skeletonema costatum)	T	M	Lack of acute toxic effects identified for diisobutyl ester mixture (EC No. 907-870-9) Non-irritating to skin and eyes. No evidence of adverse effects reported from repeated dose studies (read-across by ECHA: dimethyl esters), for genotixicity, for reproduction.	L	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/12513	-	-

Table C-1: Human Health and Environmental Hazard Assessment Summary

CAS RN	Chemical Constituent	Approx. Concentration (mg/L)	Read-across? Name (CAS RN)	Persistence	P	Bioaccumulation	B	Toxicity	T	Ecological Hazard	Human Health Effects	Human Hazard	ECHA Registered Dossiers	AICIS IMAP Reports	Other Sources
925-06-4	Diisobutyl succinate	6.4	See diisobutyl glutarate (71195-64-7)	See diisobutyl glutarate (71195-64-7)	-	See diisobutyl glutarate (71195-64-7)	-	See diisobutyl glutarate (71195-64-7)	T	M	See diisobutyl glutarate (71195-64-7)	L	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/12513	-	-
141-04-8	Diisobutyl adipate	5.2	See diisobutyl glutarate (71195-64-7)	See diisobutyl glutarate (71195-64-7)	-	See diisobutyl glutarate (71195-64-7)	-	See diisobutyl glutarate (71195-64-7)	T	M	See diisobutyl glutarate (71195-64-7)	L	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/12513	-	-
7757-82-6	Sodium sulphate	9.8	-	Inorganic - not biodegradable	-	LogPow is has been calculated at -4.38 and predicted BCF is 0.5 L/kg. Sodium sulfate is therefore not expected to bioaccumulate	-	Sodium sulfate is not considered hazardous to aquatic organisms. Acute aquatic toxicity endpoints reported by ECHA are as follows: LC50 Fish 7960 mg/L; LC50 invertebrates Daphnia magna 1766 mg/L.	-	L	A Tier I IMAP assessment reported by AICIS (formerly NICNAS) indicates this chemical is of low concern to human health and is not considered to pose a risk to workers or public health. Sodium sulfate is not an eye or skin irritant. Genotoxic and reproductive effects have not been reported; Toxicological endpoints reported by ECHA are as follows: NOEL Oral >1000 mg/kg/day (rat); LOEL Dermal (subchronic) 320 mg/kg-bw/day (rat); LC50 (4h) Inhalation >2400 mg/m3 (rat).	L (Table 2.1 NICNAS, 2017)	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/15539	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.dcceew.gov.au%2Fsites%2Fdefault%2Ffiles%2Fdocuments%2Ftechnical-report-number-11-chemicals-low-concern.docx&wdOrigin=BROWSELINK	-
107-21-1	Ethylene glycol	151	-	Readily biodegradable in water and not expected to persist in the environment. 100% of the product is reported to degrade after 10 days (OECD 301A)	-	While no bioaccumulation studies have been reported for aquatic or terrestrial organisms, based on the calculated log Pow of -1.36, bioaccumulation is not expected	-	**From SDS:** H401 - Toxic to aquatic life H412 - Harmful to aquatic life with long lasting effects Fish: LC50 41000mg/L (96h, Oncorhynchus mykiss) LC50 14 - 18mL/L (96h, Oncorhynchus mykiss) LC50 27540mg/L (96h, Lepomis macrochirus) LC50 40761mg/L (96h, Oncorhynchus mykiss) LC50 40000 - 60000mg/L (96h, Pimephales promelas) LC50 16000mg/L (96h, Poecilia reticulata) Invertebrates: EC50 46300mg/L (48h, Daphnia magna) Aq plants: EC50 6500 - 13000mg/L (96h, Pseudokirchneriella subcapitata)	H	L	**From SDS:** H302 - Harmful if swallowed H315 - Causes skin irritation H318 - Causes serious eye damage H371 - May cause damage to kidneys if swallowed H373 - May cause damage to organs through prolonged or repeated exposure if swallowed Oral LD50 (rat) 1,700 mg/kg Dermal LD50 (rat) 10,600 mg/kg Dermal LD50 9,530 uL/kg (rabbit) No inhalation reported in SDS	M Oral and dermal exposures can be mitigated by standard safety protocols.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/15973	https://www.industrialchemicals.gov.au/sites/default/files/1%2C2-Ethanediol_Human health tier II assessment.pdf	-
111-30-8	Glutaraldehyde	489	-	Readily biodegradable in water. 90-100% is degraded in water in 28 days (ECHA), indicating it is not persistent in the environment.	-	Log Pow range -.41 at pH 5 to -.8 at pH 9. Bioaccumulation is not expected. This conclusion is confirmed by the result of the calculated BCF (3.16 L/kg wet-wt) using EpiWin v4.00 BCFBAF v3.00.	-	Glutaraldehyde is considered hazardous to aquatic organisms. ECHA report aquatic toxicity values as follows: LC50 (96hr) 10 mg/L (fish Salmo gairdneri); NOEC (97 d) 1.6 mg/L (fish Oncorhynchus mykiss); EC50 (48 h) 14.87 mg/L (invertebrate Daphnia magna); NOAEL (21 d) 10mg/L (invertebrate Daphnia magna)	T	M	Glutaraldehyde is fatal if inhaled, toxic if swallowed. It causes severe burns and eye damage. It is a skin sensitiser may cause allergy or asthma symptoms or breathing difficulties if inhaled and may cause respiratory irritation. **From SDS:** H331 - Toxic if inhaled H302 - Harmful if swallowed H335 - May cause respiratory irritation H314 - Causes severe skin burns and eye damage H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled H317 - May cause an allergic skin reaction	M Oral, eye and dermal exposures can be mitigated by standard safety protocols. Additional ihalation protection suggested.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/1930/5/4/1	-	-
527-07-1	Sodium gluconate	1426	Gluconic acid (526-95-4) which also references intended substance sodium gluconate (ECHA)	Readily biodegradable (OECD 301D, GLP)	-	Read-across: Log Pow -3.17 to -1.86 (more hydrophillic). No BCFs calculated due to low log Pow values. However, based on log Pow values, there is low potential for bioaccumulation.	-	**Acute:** sodium gluconate -Fish 96h LC50 >100 mg/L (GLP, OECD 203, Oryzias latipes) -Invertebrate 48h EC50 >1,000 mg/L (GLP. OECD 202, Daphnia magna) - Aq Plants 72h ErC50 100 mg/L (freshwater algae species Desmodesmus subspicatus (Stiene, 2001), OECD Guideline 201 with some deviations) **Chronic:** sodium gluconate - Fish & invertebrates - no tests available due to low persistence, low potential for bioaccumulation, and low acute toxicity. - Aq Plants 72h ErC10 - not available.	-	L	Not acutely toxic via oral, dermal and inhalation pathways (read across: potassium gluconate). Potassium gluconate is associated with a low acute toxicity in rats following oral administration. The reported oral LD50 of potassium gluconate was 6060 mg/kg body weight in male and female Wistar rats. The dermal LD50 value for gluconic acid was determined to be greater than 2000 mg/kg body weight in rats in a study performed according to test guidelines and good laboratory practice (Mortier, 2009). In accordance with column 2 of REACH Annex VIII, the acute toxicity by inhalation study (required in section 8.5.2) does not need to be conducted as acute toxicity studies are available for the oral and dermal routes of exposure. Not a skin or eye irritant and not sensitising. Repeated dose toxicity: LOAEL was determined to be 250 mg/kg body weight in rats; however, results are not considered to be relevant to humans by ECHA reviewers. Not genotoxic and expected to be non-carcinogenic (ECHA).	L	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/1957/11	-	-
10043-35-3	Boric acid	713	-	From ECHA: Boric acid is an inorganic compound and not degradable. It is not subject to hydrolysis, photodegradation or biodegradation. Other borates yield boric acid upon dissolution in water (or borate anion in higher pH conditions). Over 200 minerals contain boron, mostly present as the sodium or calcium borate salt. Boron and its inorganic compounds are subject to chemical transformation precipitation, and fixation) once released to the environment.	-	Log Pow -1.09 (GLP, EU Method A.8) BCF >0.1 to 10.5 L/kg reported from experimental data with fish and oysters (ECHA citing Hamilton & Wiedemeyer, 1990 and Thompson et al., 1976) Low potential for bioaccumulation.	-	**Acute:** -Fish 4d LC50 74.0 mg/L (test not identified, L. limanda) -Invertebrate LC50 130 mg/L (marine shrimp L. vannamei, no test duration or method stipulated) - Aq Plants 10d ErC50 11.7 mg/L (Spirodella polyrrhiza, EPA OPPTS 850.4400 (Aquatic Plant Toxicity Test using Lemna spp. Tiers I & II)) **Chronic:** - Fish 32d NOEC 11.2 mg/L (measured geomean; mortality), fathead minnow) - Invertebrates 28d NOEC 18.6 mg/L (meas. geomean, reproduction, added boron, Americamysis bahia, EPA OPPTS 850.1350 (Mysid Chronic Toxicity Test)) - Aq Plants 10d ErC50 6.5 mg/L (Spirodella polyrrhiza, EPA OPPTS 850.4400 (Aquatic Plant Toxicity Test using Lemna spp. Tiers I & II))	H	L	**Per NICNAS (2020) IMAP Group Assessment Report:** The critical health effects for risk characterisation include reproductive and developmental toxicity. Although the available animal data show clear evidence of reproductive and developmental toxicity, epidemiological studies of workers and general populations exposed to boron show no reproductive or developmental effects. However, there are limitations in the human studies. The available human data are not sufficient to invalidate the animal data.	M Paucity of data in relation to potential reproductive or developmental effects.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/15472	https://www.industrialchemicals.gov.au/sites/default/files/Boric_acid_Human health tier II assessment.pdf	-
1310-58-3	Potassium hydroxide	1426	-	Inorganic - not biodegradable	-	Potassium hydroxide is a strong alkaline substance that dissociates completely in water to K+ and OH-. Considering its high water solubility, potassium hydroxide is not expected to bioconcentrate in organisms (ECHA)	-	From ECHA's review: Potassium hydroxide is a strong alkaline substance that dissociates completely in water to K+ and OH- (OECD SIDS potassium hydroxide, 2002). Therefore, the only posssible effect would result from the pH effect. However pH is likely to remain between environmentally expected ranges.	-	L	**From NICNAS Technical Report 11 - Identification of low concern chemicals used in the coal seam gas industry (2017):** The hazard profiles of binary inorganics and salts of organic acids were characterised taking into consideration the separate toxicities of the anion and the cation components. The following anions, cations and organic acids were identified for potential inclusion in the list of chemicals generally considered of low concern: · Na+, K+, Mg+, Ca+2, Cl-, CO3-2, PO4-3, NO3-1, OH-1, O-2 and SO4-2, and simple salts of acetate, citrates, lactates, tartrates, malates and di- and tri- phosphates.	L (Table 2.1 NICNAS, 2017)	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/15804	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.dcceew.gov.au%2Fsites%2Fdefault%2Ffiles%2Fdocuments%2Ftechnical-report-number-11-chemicals-low-concern.docx&wdOrigin=BROWSELINK	-

Table C-1: Human Health and Environmental Hazard Assessment Summary

CAS RN	Chemical Constituent	Approx. Concentration (mg/L)	Read-across? Name (CAS RN)	Persistence	P	Bioaccumulation	B	Toxicity	T	Ecological Hazard	Human Health Effects	Human Hazard	ECHA Registered Dossiers	AICIS IMAP Reports	Other Sources
37288-54-3	Mannanase	0.5	ECHA read-across to several other enzymes for the bioaccumulation review.	Readily biodegradable (OECD 301B, GLP)	-	Log Pow range -3.1 to -2.95 (literature) for many other enzymes (most enzymes should be able to be read across as indicated by ECHA). Very low potential for bioaccumulation of this enzyme.	-	**Acute: mannanase** -Fish 96h LC50 >105.8 mg/L (OECD 203, GLP, Oncorhynchus mykiss) -Invertebrates 48h EC50 >105.8 mg/L (OECD 202, Daphnia sp., GLP) -Aq plants 72h EC50 55.5 mgL (growth, OECD 201, GLP, Raphidocelis subcapitata) **Chronic: mannanase** -Fish & invertebrate chronic study waived due to very low acute toxicity results. -Aq plants 72h NOEC 13.9 mg/L (growth, OECD 201, GLP, Raphidocelis subcapitata)	H	L	Does not exert any acute oral or inhalation toxicity for workers or consumers. No acute dermal toxicity data was available. Oral LD50 >3.320 mg/kg bw (rat). Inhalation LC50 >0.45 mg/L (rat, 4h aerosol). Mannanase is neither a skin nor an eye irritant. Enzymes are well documented not to be skin sensitisers in humans. Not considered to cause serious toxic effects through repeated oral dose exposure. Oral NOAEL 1,277 mg/kg bw/day (rat). No data available for repeated dermal, inhalation repeated dose exposures (systemic or local). No mutagenic activity of mannanase could be detected in the Ames Assay. Mannanase is not a reproductive toxicant. Due to the high biodegradability of enzymes, it is highly unlikely that they could reach target organs or sites to any significant amount or of any significant period of time (ECHA). Toxicokinetic data, together with the enzymatic structure, the weight of evidence from animal studies, and human exposure provide no evidence for reproductive toxicity of enzymes (ECHA). Safe Work Australia: Respiratory sensitisation - category 1 H334 (May cause allergy or asthma symptoms or breathing difficulties if inhaled)	L	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/10278	https://hcis.safeworkaustralia.gov.au/HazardousChemical/Details?chemicalID=4850	-
7727-54-0	Ammonium persulphate	267	Persistence considerations based on chemical oxygen demand testing with diammonium persulfate.	Negligible chemical oxygen demand (GLP, EU Method C.6 (Degradation: Chemical Oxygen Demand). Chemical will hydrolyse into cation and persulfate anion. Decomposition rates depend on pH and temperate. Persulfate further decomposes to sulphate and hydrogen ions by readily oxidising water to oxygen.	-	Log Pow -1 at 20C (default selected by ECHA due to the fact that is it an inorganic salt). From ECHA: Substances of the Persulfate Category are inorganic salts sharing the same anionic persulfate moiety. Persulfates are very soluble in water and are not expected to bioaccumulate in soil or aqueous solutions. They will decompose into organic sulfate or bisulfate.	-	**Acute:** -Fish 96h LC50 76.3 mg/L (FIFRA Guideline 72-1 of the Pesticide Assessment Guidelines, no deviations, freshwater Oncorhynchus mykiss) -Invertebrates 48h EC50 120 mg/L (FIFRA Guideline 72-2 of the Pesticide Assessment Guidelines, no deviations, Daphnia magna) -Aq plants 72h EC50 136 mg/L (OECD 201, marine modification, Phaeodactylum tricornutum) **Chronic:** -Fish chronic toxicity testing not available. -Invertebrates 21d EC10 25.9 mg/L (OECD 211, no deviations, Daphnia magna) -Aq plants 72h NOEC 32 mg/L (OECD 201, marine modification, Phaeodactylum tricornutum)	H	L	Persulfate salts are considered to have moderate acute toxicity by the oral route. Oral LD50 495-820 mg/kg bw (rats). Persulfate salts have low acute dermal toxicity. Dermal LD50 >2,000 mg/kg bw (rats). All three persulfates have low acute inhalation toxicity. Inhalation LC50 2.95 mg/L (rats). The persulfates have low repeat dose oral toxicity. Oral NOAEL 41 mg/kg bw/day (rats). The persulfates have low repeat dose inhalation toxicity. Inhalation NOAEC 10.3 mg/m3 (rats). No repeat dose dermal data were available for review. Based on the limited available data, ammonium, sodium and potassium persulfates were not mutagenic nor carcinogenic (NICNAS, 2020). Based on the limited data available for ammonium persulfate, the three chemicals are not toxic to reproduction or development (NICNAS, 2020). Irritating to eyes and respiratory system, but not skin. The main critical effects to human health are skin and respiratory sensitisation and irritation. Harmful if swallowed - Cat. 4 (H302) Causes serious eye irritation - Cat. 2A (H319) Causes skin irritation - Cat. 2 (H315) May cause respiratory irritation - Specific target organ tox, single exp Cat. 3 (H335) May cause an allergic skin reaction - Cat. 1 (H317) May cause allergy or asthma symptoms or breathing difficulties if inhaled - Cat. 1 (H334)	M Oral, eye and inhalation exposure can be mitigated by standard safety protocols.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/14389	https://www.industrialchemicals.gov.au/sites/default/files/Persulfates_Human health tier II assessment.pdf	-
14807-96-6	Talc	9.2	-	Inorganic substance - not biodegradable.	-	Log Pow -9.4 (QSAR KOWWIN v1.68) BCF 3.16 k/kg ww (QSAR EPI Suite Arnot-Gobas (upper trophic)). Not expected to be bioaccumulative.	-	**Acute: QSAR** -Fish studies are not required to be conducted because the substance is highly insoluble in water, hence indicating that aquatic toxicity is unlikely to occur (ECHA). -Invertebrates 48h LC50 36,812 mg/L (QSAR EPI Suite / ECOSAR, Daphnia spp.) **Chronic: QSAR** -Fish studies are not required to be conducted because the substance is highly insoluble in water, hence indicating that aquatic toxicity is unlikely to occur (ECHA). -Invertebrates 30d NOEC ChV 1460 mg/L (QSAR EPI Suite / ECOSAR, Daphnia spp.)	-	L	Talc listed with 'Chemicals identified as of low concern for human health'	L (Table 2.1 NICNAS, 2017)	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/18727	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.dcceew.gov.au%2Fsites%2Fdefault%2Ffiles%2Fdocuments%2Ftechnical-report-number-11-chemicals-low-concern.docx&wdOrigin=BROWSELINK	-
64742-47-8	Hydrotreated light petroleum distillates	2302	PBT assessment considered findings from hydrocarbon components of the broader 'kerosine' group, which share structural and behavioural similarities. These are noted in discussions at the right.	Kerosines are readily to inherently biodegradable (ECHA). Naptha solvents were readily biodegradable (ECHA citing one OECD 301 study by Shell, 1997). Kerosine mid-blend was not readily biodegradable (ECHA citing one OECD 301F study by Mobil, 1999). However, the results found by Mobil indicated that kerosine mid-blend was inherently biodegradable in accordance with US EPA guidance on biodegradability. In a report by CONCAWE (2001), on the basis of known properties of hydrocarbons in the C9-C16 range, kerosines are not readily biodegradable but are inherently biodegradable also due to the fact hat these hydrocarbons can be degraded by micro-organisms. On the basis of the above, hydrotreated light petroleum distillates are not expected to persist in the environment.	-	Calculated log Pow for constituents of this substance range between 1.99 and 18.02 (QSAR due to substance being 'UVCB') From ECHA: Calculated BCF for constituents of this substance range between 0.4 and 19200 L/kg. It should be borne in mind that this is the full range of predicted values, and that this may be misleading or unrepresentative of the properties of the UVCB substance as a whole. ECHA does not consider the composition to be bioaccumulative.	-	The provided SDS did not indicate where hydrotreated light petroleum distillates may arise from. From ECHA using studies from Exxon and Shell: **Acute:** -Fish 96h LL50 2-5 mg/L (OECD 203, KS=1, Shell, 1994) -Invertebrates 48h EL50 1.4 mg/L (OECD 202, KS=1, Exxon, 1995) -Aq plants 72h EL50 1-3 mg/L (OECD 201, KS=1, freshwater plant Raphidocelis subcapitata, Shell, 1994) **Chronic:** -Fish NOEL 0.098 mg/L (QSAR PETROTOX model, ECHA citing Redman et al., 2010) -Invertebrates 21d NOEL 0.48 mg/L (OECD 211, KS=1, Daphnia magna, ExxonMobil, 2010) -Aq plants 72h NOEL 1 mg/L (OECD 201, KS=1, freshwater plant Raphidocelis subcapitata, Shell, 1994)	T	M	These chemicals have the potential to cause chemical pneumonitis if aspirated and can cause severe skin irritation and cracking following repeated exposure. The chemicals are considered unlikely to cause skin tumours in the absence of prolonged skin irritation. May be fatal if swallowed and enters airways - Aspi. Cat. 1 (H304) Repeated exposure may cause skin dryness and cracking (AUH066) PAH levels are very low (<0.01%) (NICNAS, 2020, API, 2010) From SDS listed as 'aliphatic hydrocarbons' with no corresponding CAS RN (assumed that it relates to hydrotreated light petroleum distillates): Oral LD50 >5,000 mg/kg (rat), dermal LD50 >2,000 mg/kg (rabbit)	M Oral, dermal and inhalation exposures can be mitigated by standard safety protocols.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/15375	https://www.industrialchemicals.gov.au/sites/default/files/Kerosines_Human health tier II assessment.pdf	American Petroleum Institute (API) (2010) Kerosene/Jet Fuel Category Assessment Document submitted to the US EPA 21 September 2010
9000-30-0	Guar gum	1951	Guar gum is a UVCB. Read across to representative constituents were made. These are noted to the right.	Benzoin resin is not readily biodegradable (48% at 28d) (ECHA). Other considerations: Guar gum is a naturally occurring polysaccharide from the guar plant or cluster bean; it is expected to be biodegradable although with lower solubility in water. On the basis of these two lines of evidence, guar gum is not able to be classified as P.	-	The partition coefficient of benzoin resin has been determined as log P = 1.3-3.9 at 25°C in a study equivalent to OECD Guideline 117 (HPLC Method). Average was 2.6. Low potential for bioaccumulation.	-	**Acute:** -Invertebrates 48h EL50 >100 mg/L (OECD 202, GLP, Daphnia magna) -Aq plants 72h ErL50 >100 mg/L (OECD 201, GLP, Pseudokirchneriella subcapitata) **Chronic:** -Aq plants 72h ErL10 >100 mg/L (OECD 201, GLP, Pseudokirchneriella subcapitata)	-	L	A Tier I IMAP assessment reported by NICNAS indicates this chemical is of low concern to human health and is not considered to pose a risk to workers or public health.	L (Table 2.1 NICNAS, 2017)	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/26789	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.dcceew.gov.au%2Fsites%2Fdefault%2Ffiles%2Fdocuments%2Ftechnical-report-number-11-chemicals-low-concern.docx&wdOrigin=BROWSELINK	-

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CAS RN	Chemical Constituent	Approx. Concentration (mg/L)	Read-across? Name (CAS RN)	Persistence	P	Bioaccumulation	B	Toxicity	T	Ecological Hazard	Human Health Effects	Human Hazard	ECHA Registered Dossiers	AICIS IMAP Reports	Other Sources
9016-45-9	Nonylphenol ethoxylates	533	4-nonylphenol, branched, ethoxylated (127087-87-0). This CAS No. applies to many constituents containing 1–120 EO units (NICNAS, 2020).	Nonylphenol ethoxylates: Readily biodegradable (ECHA citing studies with unspecified testing protocols) 4-nonylphenol, branched, ethoxylated: Readily biodegradable (OECD 301C)	-	**Nonylphenol ethoxylates:** Log Pow 3.7 (OECD Guideline 117 (Partition Coefficient (n-octanol / water), HPLC Method)). No BCF is available; however, log Pow is indicating a low potential for bioaccumulation. **4-nonylphenol, branched, ethoxylated:** BCF using nonylphenol ethoxylates (constituents of interest in this project) was calculated with QSAR (EPI Suite BCFBAF) methods. BCF = 7.86 L/kg.	-	**Acute:** -Invertebrates 48h LC50 1.821 mg/L (estimated QSAR EPI Suite, ECOSAR, Daphnia magna) -Invertebrates 48h LC50 20.9 mg/L (4-nonylphenol, ethoxylated, Daphnia magna, ECHA citing Ecotox Database, 2017) -Aq plants 48h EC50 20 mg/L (EU Method C.3, reliable study with restrictions, ECHA citing Yamane et al., 1984, Pseudokirchneriella subcapitata, inhibition). Chronic toxicity data not available for review.	T	M	From NICNAS (2020): nonylphenol ethoxylates Low to moderate acute toxicity: Oral LD50 was reported to be 1310 mg/kg bw in rats (HSDB). Low dermal toxicity: Dermal LD50 for the chemical with CAS No. 9016-45-9 was reported to be 2000 mg/kg bw in rabbits (HSDB) Listed in the EC Endocrine Disruptors Priority List, listed under Category 2, indicating at least some in vitro evidence of biological activity related to endocrine activity (NICNAS, 2020 citing EC, 2015). Harmful if swallowed - Cat. 4 (H302) Causes serious eye irritation - Cat. 2A (H319) Causes skin irritation - Cat. 2 (H315)	H, reproductive & developmental effects	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/8196	https://www.industrialchemicals.gov.au/sites/default/files/Nonylphenol and octylphenol ethoxylates and related compounds_Human health tier II assessment.pdf	-
68953-58-2	Bis(hydrogenated tallow alkyl)dimethyl ammonium bentonite salts	575	Assessed as a category: organoclays category of 14 CAS RNs (OECD, 2007)	From OECD (2007): In three separate OECD TG 306 biodegradation tests using B(2Alk)M bentonite (68153-30-0), biodegradation ranged from 4.7 to 33.4% in 28 days, depending on the test. It is noted that biodegradation relates only to the organic component (i.e. the alkyl quaternary ammonium salts).	-	Since organoclays are essentially insoluble in both water and lipids, the partition coefficient cannot be accurately determined (OECD, 2007)	-	**Acute:** -Fish 96h LC50 >500 mg/L (nominal) (Oncorhynchus mykiss, B(Alk)2M Bentonite (68153-30-0), study quality and protocol not specified) -Invertebrate 48h EC50 >100 mg/L (Daphnia magna, 2M(2Alk) bentonite (68953-58-2; this constituent), study quality and protocol not specified) -Aq plants 72h ErC50 >1,000 mg/L (nominal) (2M(2Alk) bentonite (Skeletonema costatum, 68953-58-2; this constituent), study quality and protocol not specified) **Chronic:** -Invertebrates 21d NOEC 3.2 mg/L (Daphnia magna, study quality and protocol not specified).	-	L	From OECD (2007): Based on the toxicokinetic data with B(Alk)2M bentonite, organoclay compounds are not expected to be absorbed following oral (gavage) exposure and will be excreted directly and rapidly in feces with negligible elimination via urine and bile. There is no evidence of any tissue retention or systemic uptake of these substances. Based on reported particle size distribution data for consumer and industrial products, these materials are not expected to be respirable. These materials are also not expected to be absorbed through the skin based on the physical chemical properties as well as these reported particle sizes. Organoclay materials are not expected to cause developmental toxicity or to demonstrate reproductive toxicity at doses up to 1,000 mg/kg bw/day.	L	-	-	https://hpvchemicals.oecd.org/ui/handler.axd?id=b8b51b84-081c-444c-bb95-fb7f41c859c1
629-11-8	1,6-Hexanediol	53	-	Hexane-1,6-diol is readily biodegradable (according to OECD criteria).	-	Log Pow 0 (ECHA, measured). Low potential for bioaccumulation.	-	**Acute:** -Fish 96h LC50 4,640 mg/L (German Industrial Standard DIN 38412 part 15 using Leuciscus idus) -Invertebrates 48h EC50 500 mg/L (non-GLP static test according to EU method C.2 using Daphnia magna) -Aq plants 72h EC50 5,940 mg/L (green alga Scenedesmus subspicatus (new name: Desmodesmus subspicatus) according to German Industrial Standard DIN 38412 part 9) **Chronic:** -Fish & invertebrates - not required due to low acute toxicity to these organisms. -Aq plants 72h EC10 1,180 mg/L (green alga Scenedesmus subspicatus (new name: Desmodesmus subspicatus) according to German Industrial Standard DIN 38412 part 9)	-	L	A Tier I IMAP assessment reported by NICNAS indicates this chemical is of low concern to human health and is not considered to pose a risk to workers or public health.	L (NICNAS, 2013)	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/15109	https://www.yumpu.com/en/document/view/15458609/tier-i-human-health-nicnas	-
14808-60-7	Crystalline silica	14	-	Inorganic chemical - not biodegradable	-	Inorganic and relatively inert compound. Low bioaccumulation potential.	-	Provided SDS does not contain ecotoxicity data. Secondary sources also indicate a paucity of data available for review. Based on ecological toxicity data reported in an SDS from Halliburton for a chemical mixture (DCA-19002) that contains crystalline silica: crystalline silica is not hazardous to aquatic organisms, as follows: -EC50 (72hr) Algae Skeletonema costatum 440mg/L -LL0 (96hr) Fish Danio rerio 10,000 mg/L -LL50 (24hr) Invertebrate Daphnia magna >10,000 mg/L.	-	L	Crystalline silica is not irritating to the skin, but may be irritating to the eye. It is not considered to be mutagenic, and no information is available for reproductive toxicity effects. Exposure to silica via oral and dermal routes are not considered to pose a health risk. Oral LD50 >15000 mg/kg (humans). Respirable Crystalline silica is considered carcinogenic, and repeated long term inhalation exposure to silica dust may cause the lung disease - silicosis.	H Additional measured to mitigate inhalation or excessive generation of dust from this component of the fluid is suggested.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/25239	https://www.industrialchemicals.gov.au/sites/default/files/Microcrystalline Silica_Human health tier II assessment.pdf	-
7647-01-0	Hydrochloric acid	2689	-	Inorganic - not biodegradable	-	Based on a LogKow -2.65, this chemical is not considered bioaccumulative. In the aquatic environment, the effects of HCl are clearly related to the pH effect, as HCl will dissociate fully in H3O+ & Cl- ions, of which the latter is not a harmful substance. The substance cannot be measured accurately in the body since chlorine ions are already very abundant, and excretion of chlorine via the urine/faeces is high (ECHA).	-	**Acute:** -Freshwater fish (unspecified): 20.5 mg/L (normalised from pH 3.25) -Invertebrate Daphnia sp. 0.45 mg/L (normalised from pH 4.9) -Freshwater algae (unspecified): EC50 0.73 mg/L (normalised from pH 4.7; growth rate) **Chronic:** -Not relevant to determine toxicity in terms of mg/L due to the varying buffering capacity of different test systems and different aquatic ecosystems. Maintaining exact pH values over time in chronic studies could be problematic. It is accepted that the aquatic toxicity of hydrochloric acid results if sufficient acid is present to produce a very low pH (i.e. pH 3-5) (ECHA). -Freshwater algae (unspecified): NOEC 0.364 mg/L (normalised from pH 5; growth rate) (ECHA) Although data indicate that hydrochloric acid is hazardous to aquatic organism, this primarily due the lowering of the pH, thus hydrochloric acid is not considered hazardous to aquatic organism (ECHA) **From SDS:** - 96h LC50, Fish (Gambusia affinis): 282 mg/L - 72h EC50, Daphnia (Water flea): 56 mg/L	-	L	Causes severe eye irritation which may damage tissue. Causes severe skin irritation with tissue destruction. May cause respiratory irritation. Harmful if inhaled. Not considered to be genotoxic nor carcinogenic (NICNAS, 2020). Critical health effects relate to local effects (corrosivity) and systemic acute effects (acute toxicity via the inhalation route). Toxicological endpoints were not reported in the SDS. Adverse effects are likely due to the low pH on contact rather than the presence of chloride ions, and sufficient data is available such that long-term exposure to humans and animals are not expected to cause adverse effects (NICNAS). Acute toxicity data presented by NICNAS are as follows: LD50 Oral 238-277 mg/L (rats); LC50 (30 min) Inhalation of aerosol 3.2 mg/L (mice).	M Oral, eye, dermal, and inhalation exposures can be mitigated by standard safety protocols.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/15859	https://www.industrialchemicals.gov.au/sites/default/files/Hydrochloric acid_Human health tier II assessment.pdf	-

Table C-1: Human Health and Environmental Hazard Assessment Summary

CAS RN	Chemical Constituent	Approx. Concentration (mg/L)	Read-across? Name (CAS RN)	Persistence	P	Bioaccumulation	B	Toxicity	T	Ecological Hazard	Human Health Effects	Human Hazard	ECHA Registered Dossiers	AICIS IMAP Reports	Other Sources
6381-77-7	Sodium erythorbate	22	-	Not readily biodegradable (OECD 301E, 56% by 28d).	P	Log Pow -3.29 (calculated)	-	Provided SDS does not contain ecotoxicity information ('not been fully investigated'). From ECHA, as follows: **Acute:** -Fish 96h LC50 >100 mg/L (no study details provided, Oncorhynchus mykiss) -Invertebrates 48h EC50 >100 mg/L (no study details provided, Daphnia magna) -Aq plants 72h ErC50 >160 mg/L(no study details provided, no algal species indicated) **Chronic:** -Aq plants 72h NOEC 20 mg/L(no study details provided, no algal species indicated) -Fish & invertebrates - studies waived due to low acute toxicity.	-	L	Sodium erythorbate listed with 'Chemicals identified as of low concern for human health'	L (Table 2.1 NICNAS, 2017)	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/11622	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.dcceew.gov.au%2Fsites%2Fdefault%2Ffiles%2Fdocuments%2Ftechnical-report-number-11-chemicals-low-concern.docx&wdOrigin=BROWSELINK	-
77-92-9	Citric acid	553	-	Readily biodegradable (97% in 28d, OECD301B); and not expected to persist in the environment	-	Based on a log Pow of -1.72 from the SDS, bioaccumulation is not expected	-	**Based on SDS:** -Fish 96h LC50 1,516 mg/L (Lepomis macrochirus) -Invertebrates 72h EC50 120 mg/L (Daphnia magna) No aq plant data were available for review.	-	L	Citric acid listed with 'Chemicals identified as of low concern for human health'. Citric acid does not show mutagenic, carcinogenic or reproductive toxicity. Citric acid causes eye, skin, and respiratory tract irritation. Based on the SDS: oral LD50 3,000 mg/kg (rat) and dermal LD50 >2000 mg/kg (rat)	L (Table 2.1 NICNAS, 2017)	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/15451	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.dcceew.gov.au%2Fsites%2Fdefault%2Ffiles%2Fdocuments%2Ftechnical-report-number-11-chemicals-low-concern.docx&wdOrigin=BROWSELINK	-
67-63-0	Isopropanol	4.3	-	Readily biodegradable	-	Log Pow 0.04 (primary source: peer-reviewed handbook of values) (ECHA) A supporting aquatic BCF value of 1.015 L/kg wet weight was generated using a QSAR model (ECHA)	-	**Acute:** -Fish 96h LC50 9,640 mg/L (OECD 203, not GLP, Pimephales promelas) -Invertebrates 24h LC50 10,000 mg/L (OECD 202, not GLP, Daphnia magna) **Chronic:** -Fish 28d NOELR >1,000 mg/L (QSAR, Target Lipid Model, PETROTOX, Danio rerio) -Invertebrates 21d NOELR >1,000 mg/L (QSAR, Target Lipid Model, PETROTOX, Daphnia magna) -Aq plants 7d LC3 1,800 mg/L (no guideline, Scenedesmus quadricauda)	-	L	Low acute oral toxicity. Oral LD50 >2,000 mg/kg bw (rats). Low acute dermal toxicity. Dermal LD50 >2,000 mg/kg bw (rats). Low acute inhalation toxicity. Inhalation LD50 >20 mg/L (rats). Acute intoxication has been reported in humans (children and elderly during medical care using 70% concentrations). Isopropanol is twicce as toxic as ethanol (NICNAS, 2020 citing HSDB). Not a skin irritant. Mild irritant to eyes and respiratory system (human reports). No structural alerts for potential sensitisation. Not considered to cause serious damage to health from repeated oral exposure. Oral LOAEL 1,390 mg/kg bw/day (rats). No dermal and limited inhalation data were available for review by NICNAS (2020). Not considered to be genotoxic nor carcinogenic (NICNAS, 2020). The critical health effects for risk characterisation include the potential for eye irritation and intoxication symptoms following inhalation of high vapour concentrations.	L	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/15339	https://www.industrialchemicals.gov.au/sites/default/files/2-Propanol_Human health tier II assessment.pdf	-
68551-12-2	Ethoxylated C12-C16 Alcohol	2.9	Alcohol ethoxylates C12-C15 (68131-39-5)	Rates are structurally dependent. Rapidly biodegradable for the majority of C12-C15. C16 noted to undergo notably slower biodegradation rates. Overall readily biodegradable: >=60 – 100% in 28 days (ECHA)	-	Range 5.36 (C12 AE) to 6.65 (C16 AE) (HERA, 2009) Fathead minnow range 12.7-387.5 (flow through whole-body) Alcohol ethoxylates are not expected to bioaccumulate due to a rapid biotransformation and excretion (ECHA)	-	Provided SDS does not contain ecotoxicity data. From ECHA, as follows: **Acute:** -Fish 96h LC50 0.628 mg/L (C/EO QSAR mass based toxic unit additivity, Pimephales promelas) -Invertebrates 48h EC50 0.143 mg/L (C/EO QSAR mass based toxic unit additivity model, Daphnia magna) -Aq plants 72h ErC50 0.0311 mg/L (OECD 201, Raphidocelis subcapitata) **Chronic:** -Fish 28d EC10 0.265 mg/L (C/EO QSAR mass based toxic unit additivity, Pimephales promelas) -Invertebrates 21d NOEC 0.0356 mg/L (OECD 211, Daphnia magna) -Aq plants 72h ErC10 0.0255 mg/L (OECD 201, Raphidocelis subcapitata)	vT	H	From HERA (2009): -Oral and dermal toxicity the use of these compounds is of low concern. Oral LD50 range from 0.6 g/kg to more than 10 g/kg bodyweight (rats). The acute oral toxicity of AEs to rats appears to be related to ethoxylation degree. -Alcohol ethoxylates (AEs) are of low acute inhalation toxicity to rats with LC50 values exceeding the saturated vapour concentration in air. Most data refer to C9-C11 (less than current constituent of interest comprising C12-C16). -Dermal lethal doses in rats were in most cases above the maximum dose levels tested (i.e. larger than 0.7 g/kg to 5 g/kg, with most values in the >2 to >5 g/kg range). In rabbits dermal LD50 values were determined to be in the range of 2 g/kg to 5.2 g/kg. Therefore, alcohol ethoxylates can be considered to be slightly to practically non-toxic by the dermal route of application (HERA, 2009 citing Weiss, 1980). -Mildly irritating to skin and eyes at diluted concentrations. Exposure to undiluted concentrations were slightly to severely irritating to the skin and eyes of rabbits and rats. -Not skin sensitising (based on a review of 25 studies). -Oral and dermal toxicity studies on alcohol ethoxylates provide a coherent picture of their systemic toxicity profile. In two chronic long-term toxicity studies which also investigated the carcinogenic potential of AEs, no adverse effects were observed up to a dose level of 50 mg/kg/day. In several dermal and oral subchronic studies over 90 days the NOELs/NOAELs ranged from 50 to 700 mg/kg/day. No data was available for review on the effects from repeated inhalation exposures. -In all available in vitro and in vivo genotoxicity assays, there was no indication of genetic toxicity of broad range of structurally different alcohol ethoxylates. Most of the studies were performed in accordance with GLP and following OECD guideline methodologies. The remaining in vitro and in vivo studies were well documented and conducted. The structure of alcohol ethoxylates are not of concern for potential genotoxicity. -No evidence of carcinogenicity was observed in reviewed studies (oral and dermal long-term toxicity/carcinogenicity).	L	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/12510/4/2	https://www.heraproject.com/files/34-f-09 hera ae report version 2 - 3 sept 09.pdf	-

Table C-1: Human Health and Environmental Hazard Assessment Summary

CAS RN	Chemical Constituent	Approx. Concentration (mg/L)	Read-across? Name (CAS RN)	Persistence	P	Bioaccumulation	B	Toxicity	T	Ecological Hazard	Human Health Effects	Human Hazard	ECHA Registered Dossiers	AICIS IMAP Reports	Other Sources
26183-52-8	Ethoxylated decanol	1.0	Results based on combined group assessment for ethoxylates of aliphatic alcohols (>C6) (NICNAS, 2020). Specific read-across compounds indicated at the right, where necessary.	Readily biodegradable (based on decan-1-ol, ethoxylated (1-2.5 moles EO) (26183 -52-8), OECD 301B, reliability 1).	-	Log Pow 3.51 averaged (QSAR EPI Suite KOWWIN, based on experimental log Pow from decan-1-ol, ethoxylated, 1-2.5 moles EO tested with OECD Guideline 117 (Partition Coefficient (n-octanol / water), HPLC Method). Based on a study by Tolls et al. (2000), reported BCF-values ranged from <5 to 387.5 L/kg, whereas uptake rates varied from 330 to 1660 (L x kg/d) and elimination rates varied from 3.3 to 59 per day. Bioaccumulation is likely to be negligible due to biotransformation and excretion of alcohol ethoxylates.	-	**Acute toxicity based on read across study data** -Fish: 96h LC50 1.2 mg/L (Cyprinus carpio and Danio rerio, based on similar alcohol ethoxylates (C12, 4 EO; CAS 9002-92-0, and C12-14, 2EO; CAS 68439-50-9), GLP and EU Method C.1) -Invertebrates: 48h EC50 0.39 mg/L (three similar alcohol ethoxylates (C9-11, 2.5EO; CAS 68439-46-3, C12, 4 EO; CAS 9002-92-0 and C12-14, 2 EO; CAS 68439-50-9), EG-Guideline 92/69/EWG and GLP) -Algae: 72h ErC50 0.43 mg/L (hree similar alcohol ethoxylates (C12, 2EO; CAS 3055-93-4, C12, 4 EO; CAS 9002-92-0 and C12, 4 EO; CAS 5274-68-0), Scenedesmus subspicatus, EG-Guideline 92/69/EWG) **Chronic toxicity based on alcohol ethoxylate specific QSARs** -Fish: 30d EC20 >= 2.92 - <= 5.14 mg/L (Pimephales promelas) -Invertebrates: 21d EC20 >= 3.72 - <= 6.55 mg/L (Daphnia magna reproduction) -Algae: 72h ErC20 >=3.23 - <= 5.67 mg/L (Desmodesmus subspicatus)	vT	H	From NICNAS (2020): The AEs in this group contain two defining substructures, the hydrophobic alcohol derived alkyl chain moiety and the hydrophilic ethoxylate chain moiety. Chemicals with the same generic CAS number may include a range of ethoxylation degrees and properties, which may affect the toxicological properties. Overall, AEs are not expected to be systemically toxic. Low to moderate acute oral toxicity. Potentially correlated to ethoxylation (highest for EO5-EO14). Moderate acute oral toxicity cannot be ruled out. Oral LD50 600 mg/kg bw/day (rats for C15-16, C14-C1EO11) to 10,000 mg/kg bw/day (rats, CxEO1-3, CxEO>15). Study design discrepancies were noted by NICNAS (2020). Low acute dermal toxicity. Dermal LD50 2,000-5,000 mg/kg bw/day (rabbits) and LD50 >800 mg/kg bw/day (C13-15EO10, C13-C15EO11) to >5,000 mg/kg bw/day. Low acute inhalation toxicity. LC50 >0.22 mg/L (C9-11EO5 4h mist, rats). Mists/droplets may cause respiratory irritation and consequent damage to lungs. Compounds with EO3 were severely irritating while those with EO7 were mildly to severely irritating. Dilutions at 1% were slightly irritating and at 0.1% were minimally to non-irritating. These chemicals (CAS No. 68439-46-3, 66455-14-9, 68131-39-5 (group members) and 68951-67-7 were severely to extremely irritating when tested undiluted and without rinsing, slightly to moderately irritating at 10 %, and non-irritating to mildly irritating at 0.1-1% Not expected to cause serious damage through repeated dose exposure (oral, dermal - except for local effects). No data available for repeated inhalation dose exposure. Not considered to be genotoxic nor carcinogenic & do not cause reproductive or developmental toxicity (NICNAS, 2020). Harmful if swallowed Cat 4 (H302) Causes serious eye damage Cat 1 (H318) Causes skin irritation Cat 2 (H315)	M Oral exposure can be mitigated by standard safety protocols.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/30070	https://www.industrialchemicals.gov.au/sites/default/files/Ethoxylates of aliphatic alcohols %28Greater ThanC6%29_Human health tier II assessment.pdf	
104-55-2	Cinnamaldehyde	1.0	-	61.44% at 14 days (OECD 301 D Closed Bottle Test) (ECHA)	-	log Pow 2.107 (ECHA). Low bioaccumulative potential.	-	**From SDS:** -Fish 96h LC50 103 mg/L -Invertebrates 38h EC50 120 mg/L -Algae 72h NOEC 37 mg/L	H	L	From NICNAS (2020): -Low acute oral toxicity. Oral LD50 >2,000 mg/kg bw (rats). -Moderate acute dermal toxicity. Dermal LC50 620-1,260 mg/kg bw (rabbits). -No acute inhalation toxicity data was available for review. -Irritating to respiratory system, skin and eyes. -Low concentrations cause sensitisation to the skin. A well-reported contact allergen to humans. -'Generally regarded as safe' (GRAS) for use as a flavour ingredient by US FDA (NICNAS, 2020 citing US FDA, 2015). Low concern for long-term toxicity via oral route. Oral NOAEL 68-200 mg/kg bw/day (read across, rats). -Not considered to cause serious damage to health by repeated dermal exposure. -No inhalation data was available for review. -The chemical cinnamaldehyde contains an a,b-unsaturated aldehyde group, a common structural alert for genotoxicity due to the ability of the chemical to form DNA adducts. However, based on the available data, the chemical is not considered to be genotoxic. -Based on limited data, not expected to be carcinogenic. -Based on the limited data available, the chemical is not expected to have the potential for reproductive or developmental toxicity. Any developmental effects were only observed secondary to maternal toxicity. -The critical health effect for risk characterisation is skin sensitisation. Other observed health effects include systemic acute effects (acute toxicity from dermal exposure) and local effects (eye/skin/respiratory irritation).	M Dermal and inhalation exposures can be mitigated by standard safety protocols.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/14462	https://www.industrialchemicals.gov.au/sites/default/files/2-Propenal%2C 3-phenyl-_Human health tier II assessment.pdf	-
61791-26-2	Ethoxylated tallow alkyl amine	0.5	Fatty acids, tall-oil, ethoxylated (61791-00-2) & fatty acids, tall oil, ethoxylated (EO 5) (9004-96-0) ethoxylated (EO 5) (9004-96-0) (ECHA)	Readily biodegradable: 90 -100% in 28 days (OECD 301B; read across to fatty acids, tall oil, ethoxylated (ECHA)	-	Components with log Kow >10 but rapid environmental biodegradation, metabolism, and sterical hindrance of cross biological membranes in aquatic organisms is not expected (read across to fatty acids, tall-oil, ethoxylated (ECHA)	-	Acute: -Fish 96h LL50 > 100 mg/L (nominal, loading rate for mortality of Danio rerio, OECD 203)` -Invertebrates 48h EL50 12.41 mg/L (nominal, loading rate for immobilisation of Daphnia magna, OECD 202) -Aq plants 72h EL50 39.7 mg/L (loading rate, nominal for growth rate inhibition of Pseudokirchneriella subcapitata, OECD 201) Chronic: -Aq plants 72h EL10 7.08 mg/L (loading rate, nominal for growth rate inhibition of Pseudokirchneriella subcapitata, OECD 201)	H	L	Acute oral LD50 of the test substance was determined to be > 10000 mg/kg bw Limited and unreliable data in relation to acute inhalation exposures. Not an irritant or corrosive to the skin in a GLP-compliant OECD 431 and 439 study. Not an irritant to the eyes in a GLP-compliant OECD 492 study. Did not show an indication of skin sensitising potential in an OECD 429 (LLNA) study. No adverse signs of toxicity in male and female animals at a dose level of 1000 mg/kg bw/d. NOAEL for general systemic toxicity was determined to be 1,000 mg/kg bw/d (male and female rats). Subacute NOAEL for fertility 1,000 mg/kg bw/d (rats). Not mutagenic in bacteria, as determined in an OECD 471 study. Not chromosome damaging, as determined in an OECD 487 study.	L (Table 2.1 NICNAS, 2017)	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/25307	-	-
67-56-1	Methanol	0.1	-	Readily biodegradable (95%; 20d) and therefore not considered to be persistent	-	Not bioaccumulative based on a BCF of <10 (experimental fish species Cyprinus carpio and Leuciscus idus) Log Pow -0.82 to 0.64	-	From SDS: Only fish data provided LC50: =28200mg/L (96h, Pimephales promelas) LC50: >100mg/L (96h, Pimephales promelas) LC50: 19500 - 20700mg/L (96h, Oncorhynchus mykiss) LC50: 18 - 20mL/L (96h, Oncorhynchus mykiss) LC50: 13500 - 17600mg/L (96h, Lepomis macrochirus) Calculated geomean of above fish studies from SDS: 1,800 mg/L and used for T considerations. ECHA: Freshwater algae, 96h EC50 growth 22 000 mg/L	-	L	Methanol does not cause skin or eye irritation, or skin sensitisation. It does not cause mutagenic effects, however insufficient data is available to determine carcinogenic effect. Reproductive toxicity effects have been reported for laboratory animals. It is not considered a cause reproductive or developmental toxicity in humans (NICNAS) Methanol is considered toxic via oral, dermal and inhalation exposure routes (NICNAS). It may cause damage to the central nervous system. The main critical effects to human health are acute toxicity from inhalation, in contact with skin and if swallowed, and possible irreversible effects from acute exposure. Toxic if swallowed - Cat. 3 (H301) Toxic in contact with skin- Cat. 3 (H311) Causes damageto organs - Specific target organ tox, single exp Cat. 1 (H370) Toxic if inhaled - Cat. 3 (H331) **From the SDS:** Oral LD50 6,200 mg/kg (rat) Dermal LD50 15,800 mg/kg (rabbit) Inhalation LC50 22,500 ppm (rat)	M Oral, dermal and inhalation exposures can be mitigated by standard safety protocols.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/15569/5/4/2	https://www.industrialchemicals.gov.au/sites/default/files/Methanol_Human health tier II assessment.pdf	-
7447-40-7	Potassium chloride	18188	-	Inorganic - not biodegradable	-	Inorganic salt, thus low potential for bioaccumulation.	-	From SDS: **Acute:** -Fish 96h LC50 880 mg/L (citing OECD SIDS, 2001, Pimephales promelas) -Invertebrates 48h 660 mg/L (citing OECD SIDS, 2001, Daphnia magna) -Aq plants 120h EC50 1,337 mg/L (citing OECD SIDS, 2001, Nitzchia linearis) **Chronic:** -Invertebrates 21d LOEC 101 mg/L (citing OECD SIDS, 2001, Daphnia magna)	-	L	Potassium chloride has low acute toxicity, it neither a skin nor an eye irritant. It is not a skin sensitier. In a repeated dose study a NOAEL of 1820 mg/kgbw/day was set this was the highest dose tested. Potassium chloride is not genotoxic. It does not cause reproductive or developmental toxicity. Potassium chloride listed with 'Chemicals identified as of low concern for human health' **From NICNAS Technical Report 11 - Identification of low concern chemicals used in the coal seam gas industry (2017):** The hazard profiles of binary inorganics and salts of organic acids were characterised taking into consideration the separate toxicities of the anion and the cation components. The following anions, cations and organic acids were identified for potential inclusion in the list of chemicals generally considered of low concern: · Na+, K+, Mg+, Ca+2, Cl-, CO3-2, PO4-3, NO3-1, OH-1, O-2 and SO4-2, and simple salts of acetate, citrates, lactates, tartrates, malates and di- and tri- phosphates.	L (Table 2.1 NICNAS, 2017)	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/14341	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.dcceew.gov.au%2Fsites%2Fdefault%2Ffiles%2Fdocuments%2Ftechnical-report-number-11-chemicals-low-concern.docx&wdOrigin=BROWSELINK	-
7732-18-5	Water in additive	717	-	Not applicable. Water is not required to be assessed.	-	Not applicable. Water is not required to be assessed.	-	Not applicable. Water is not required to be assessed.	-	L	Water listed with 'Chemicals identified as of low concern for human health'	L (Table 2.1 NICNAS, 2017)	-	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.dcceew.gov.au%2Fsites%2Fdefault%2Ffiles%2Fdocuments%2Ftechnical-report-number-11-chemicals-low-concern.docx&wdOrigin=BROWSELINK	-

Table C-1: Human Health and Environmental Hazard Assessment Summary

CAS RN	Chemical Constituent	Approx. Concentration (mg/L)	Read-across? Name (CAS RN)	Persistence	P	Bioaccumulation	B	Toxicity	T	Ecological Hazard	Human Health Effects	Human Hazard	ECHA Registered Dossiers	AICIS IMAP Reports	Other Sources
24634-61-5	Potassium sorbate	3.6	Sorbic acid (110-44-1) From ECHA: The extrapolation from sorbic acid to potassium sorbate is considered not to be restricted in anyway, since the determination of potential toxicity is the "sorbate" anion.	Readily biodegradable (sorbic acid)	-	Log Pow -1.72 (sorbic acid, EU method A.8 and OECD guideline 117, HPLC method) BCF 0.007 (calculated, sorbic acid, EU TGD with sorbic acid log Pow)	-	No provided SDS could be matched to potassium sorbate. After ECHA: **Acute: sorbic acid** -Fish 96h LC50 >500 mg/L (unknown test procotol, zebra fish) -Invertebrates 48h EC50 982 mg/L (unknown test protocol, Daphnia magna) -Aq plants 48h ErC50 480 mg/L (unspecified test protocol, Scenedesmus subspicatus) **Chronic: sorbic acid** -Invertebrates 48h NOEC 50 mg/L (GLP, OECD 211, Daphnia magna) -Aq plants 48h ErC50 97 mg/L (unspecified test protocol, Scenedesmus subspicatus, assumed sorbic acid)	-	L	**Sorbic acid:** Very low acute toxicity in rats and mice in acute oral toxicity studies. Acute oral LD50 10,500 mg/kg bw (rat) Acute dermal LD50 2,000 mg/kg bw (mice) Acute inhalation LD50 7,360 mg/kg bw (rabbits) **Sorbic acid:** Repeated oral dose for systemic toxicity effects - practically non-toxic to rats and dogs. Subchronic NOAEL 6,792 mg/kg bw/day (rat) **Potassium sorbate:** Moderately irritating to eyes. Not irritating to skin. Not sensitising. **Sorbic acid and its salts** are non-mutagenic and non-clastogenic in vitro and in vivo. **Sorbic acid:** No adverse effect on fertility observed. NOAEL 1,000 mg/kg bw/day (rat). **Sorbic acid:** No adverse effect on developmental toxicity. NOAEL 300 mg/kg bw/day (rabbit).	L	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/11008	-	http://disseminationn.echa.europa.eu/Biocides/ActiveSubstances/1350-08/1350-08_Assessment_Report.pdf
532-32-1	Sodium benzoate	0.1	Benzoic acid (65-85-0). From ECHA: Data is not available for partition coefficient of sodium benzoate itself. Given the dissociation constant of benzoic acid (pKa is 4.03) it is anticipated that in solution sodium benzoate will be largely dissociated into benzoic acid. Hence read-across of the partition coefficient study from benzoic acid (ECHA citing Berthod, 1988) is justified.	Readily biodegradable (OECD 301 aerobic and OECD 311 anaerobic)	-	Log Pow 1.88 (benzoic acid). Low potential for bioaccumulation.	-	**Acute:** -Fish 96h LC50 484 mg/L (EPA OPP 72-1, Pimephales promelas, unknown quality study, but flow-through vs static) -Invertebrates 96h LC50 >100 mg/L (amended OECD 202, no analytics included for review) -Aq plants 72h EC50 30.5 mg/L (OECD 201, GLP, Pseudokirchnerella subcapitata) **Chronic:** -Fish NOEC 10 mg/L (unknown study quality, duration and protocol, ECHA citing Tsay, 2007) -Invertebrates 21d NOEC 5.81 mg/L (OECD 211, reliability 1, Daphnia magna reproduction, sodium benzoate) -Aq plants 72h EC10 6.5 mg/L (OECD 201, GLP, Pseudokirchnerella subcapitata)	H	L	**For benzoic acid (NICNAS, 2020):** Low acute oral toxicity in animal tests (rats and mice). LD50 >2,000 mg/kg bw/day. Low acute dermal toxicity in animal tests (rats). LD50 >2,000 mg/kg bw/day. Low acute inhalation toxicity in animal tests (rats and mice). LC50 >12.2 mg/L/4h. Irritating to respiratory system. Irritatiing to skin. Positive skin irritant reactions (erythema and oedema). Risk of serious eye damage. Not considered to cause serious damage through repeated dose exposure (oral, dermal, inhalation). Oral NOAEL 825 mg/kg bw/day. Dermal NOAEL 2,500 mg/kg bw/day. Inhalation NOAEC >0.25 mg/L 6h/d (systemic effects in rats). Not genotoxic or carcinogenic (based on weight of evidence reviewed by NICNAS, 2020) Causes serious eye damage - Cat. 1 (H318) Causes skin irritation - Cat. 2 (H315) May cause respiratory irritation - Specific target organ tox, single exp Cat. 3 (H335)	M Oral, eye, dermal, and inhalation exposures can be mitigated by standard safety protocols.	https://echa.europa.eu/it/registration-dossier/-/registered-dossier/14966/1/1	https://www.industrialchemicals.gov.au/sites/default/files/Benzoic acid_Human health tier II assessment.pdf	-

APPENDIX D ANALYTICAL RESULTS

Table D-1: BTEX and PAH Results of Stimulation Fluid Products (provided by AGL)

Additive Type	Manufacturer	Manufacturer Product Name	Purpose Of Chemical	BTEX/PAH Testing					Application(s)
				Benzene	Toluene	Ethylbenzene	Tot. Xylene	Tot. PAH	
				Government Regulatory Requirements					
				1 µg/L	180 µg/L	80 µg/L	75 µg/L	0.02 µg/L	
Primary fluid system									
Clay Inhibitor	Norkem	KCl	Clay Inhibitor						
Biocide	Fusion	CFBE5	Biocide	<1	<2	<2	<2	<0.005	Stimulation Fluids
Liquid Guar	Fusion	CF10GGC	Guar	<1	<2	<2	<2	<0.012	Stimulation Fluids
Surfactant	Fusion	CF150FBS	Flowback Surfactant	<1	<2	<2	<2	<0.005	Stimulation Fluids
Delayed Crosslinker	Fusion	CF380DXL	Delayed Crosslinker	<1	<2	<2	<2	<0.005	Stimulation Fluids
Enzyme Breaker	Fusion	CF8200E	Enzyme Breaker	<1	<2	<2	<2	<0.005	Stimulation Fluids
Encapsulated Oxidising Breaker	Fusion	CF8550EA	Encapsulated Oxidising Breaker	<1	<2	<2	<2	<0.006	Stimulation Fluids
Acid and inhibition package									
Hydrochloric Acid	Norkem	HCl	Reduces near wellbore tortuosity issues	<1	<2	<2	<5	<0.005	Stimulation Fluids
Iron Control	Fusion	CA370FE	Prevents precipitation of of metal oxides	<1	<2	<2	<2	<0.005	Stimulation Fluids
Corrosion Inhibitor	Champion X	CAI500LT	Corrosion Inhibitor	<1	<2	<2	<2	<0.012	Stimulation Fluids
Contingency fluid system									
Citric Acid if required	Fusion	CF210PH	Lowers pH	<1	<2	<2	<2	<0.005	Stimulation Fluids
Oxidising Breaker if required	Fusion	CF8500	Oxidising Breaker	<1	<2	<2	<2	<0.09	Stimulation Fluids

CERTIFICATE OF ANALYSIS

Work Order	: **EB2318245**	Page	: 1 of 8
Client	: **AGL ENERGY**	Laboratory	: Environmental Division Brisbane
Contact	: MR JOHN MORAITIS	Contact	: Customer Services EB
Address	: GPO BOX 1048 BRISBANE QLD, AUSTRALIA 4001	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3243 7222
Project	: Surat Bore Water (Council)	Date Samples Received	: 20-Jun-2023 09:00
Order number	: 4500104105	Date Analysis Commenced	: 20-Jun-2023
C-O-C number	: ----	Issue Date	: 26-Jun-2023 14:21
Sampler	: RICHARD LEE		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Keegan Mullane	Senior Chemist - Organics	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Sarah Ashworth	Laboratory Manager - Brisbane	Brisbane Organics, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

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

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- It is recognised that EG020T (Total Metals by ICP-MS) is less than EG020F (Dissolved Metals by ICP-MS). However, the difference is within experimental variation of the methods.
- EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	SURAT BORE	----	----	----	----
			Sampling date / time	16-Jun-2023 10:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2318245-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**8.84**	----	----	----	----
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Adsorption Ratio	----	0.01	-	**119**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1920**	----	----	----	----
EA016: Calculated TDS (from Electrical Conductivity)								
Total Dissolved Solids (Calc.)	----	10	mg/L	**1250**	----	----	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	<1	----	----	----	----
EA161: Residual Alkali								
Residual Alkali	----	0.1	meq/L	**19.0**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	**129**	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**821**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**950**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**72**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	**498**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**2**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.003**	----	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.013**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SURAT BORE	----	----	----	----
				Sampling date / time	16-Jun-2023 10:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2318245-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.006**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.003**	----	----	----	----
Silver	7440-22-4	0.001	mg/L		<0.001	----	----	----	----
Boron	7440-42-8	0.05	mg/L		**2.95**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.19**	----	----	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.01**	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.003**	----	----	----	----
Barium	7440-39-3	0.001	mg/L		**0.030**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.005**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.023**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.007**	----	----	----	----
Silver	7440-22-4	0.001	mg/L		<0.001	----	----	----	----
Boron	7440-42-8	0.05	mg/L		**2.85**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.26**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG052F: Dissolved Silica by ICPAES									
Silicon as SiO2	14464-46-1	0.1	mg/L		**16.0**	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**2.4**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.81**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	SURAT BORE	----	----	----	----
			Sampling date / time	16-Jun-2023 10:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2318245-001	--------	--------	--------	--------
				Result	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser - Continued								
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.04**	----	----	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**21.0**	----	----	----	----
ø Total Cations	----	0.01	meq/L	**21.7**	----	----	----	----
ø Ionic Balance	----	0.01	%	**1.64**	----	----	----	----
EP025: Oxygen - Dissolved (DO)								
Dissolved Oxygen	----	0.1	mg/L	**4.5**	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	----	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SURAT BORE	----	----	----	----
				Sampling date / time	16-Jun-2023 10:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2318245-001	--------	--------	--------	--------
					Result	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons - Continued									
C10 - C14 Fraction	----	50	µg/L		**210**	----	----	----	----
C15 - C28 Fraction	----	100	µg/L		**120**	----	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		**330**	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L		**300**	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		**300**	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		**300**	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	----	----	----	----
Toluene	108-88-3	2	µg/L		<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	----	----	----	----
^ Total Xylenes	----	2	µg/L		<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**22.5**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**66.6**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**67.5**	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**99.1**	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%		**92.0**	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		**105**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**101**	----	----	----	----
Toluene-D8	2037-26-5	2	%		**99.0**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	SURAT BORE	----	----	----	----
				Sampling date / time	16-Jun-2023 10:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2318245-001	--------	--------	--------	--------
					Result	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates - Continued									
4-Bromofluorobenzene	460-00-4	2	%		**95.1**	**----**	**----**	**----**	**----**

Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	72
2-Chlorophenol-D4	93951-73-6	27	130
2.4.6-Tribromophenol	118-79-6	19	181
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	14	146
Anthracene-d10	1719-06-8	35	137
4-Terphenyl-d14	1718-51-0	36	154
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	66	138
Toluene-D8	2037-26-5	79	120
4-Bromofluorobenzene	460-00-4	74	118

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APPENDIX C ENVIRONMENTAL MANAGEMENT PLAN (OPERATIONS PHASE)

Silver Springs Project

ENVIRONMENTAL MANAGEMENT PLAN (OPERATIONS PHASE)

Version 2.1 – June 2022

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Document revision history

Date	Version	Author	Comments
June 2020	2.0	J Moraitis	Updated to incorporate AGL HSEMS
June 2022	2.1	J Moraitis	Updated to incorporate de-amalgamation of an EA, sandblasting activities, and trenching activities.

1. Introduction

1.1. Description of activity

The Silver Springs Project includes the following major assets and areas:

- Renlim underground gas storage reservoir
- AGL Silver Springs Facility: comprised of a gas processing plant that receives gas from the surrounding gas fields and from the underground storage reservoir.
- Silver Springs to Wallumbilla pipeline: a high pressure gas pipeline approximately 100km long that is used to transfer gas from the Silver Springs facility to the Wallumbilla facility. AGLs Churchie gas fields also feeds directly into the pipeline via the Churchie compressor station.
- Wallumbilla LPG Facility: comprised of a gas processing plant for producing sales quality gas for export into the Roma to Brisbane pipeline
- Gas fields: the gas fields cover an extensive area with a network of producing wells feeding into the Silver Springs and Churchie Plant for delivery to Wallumbilla. AGL also owns the Taylor Plant which connects some wells to the Silver Springs facility.

In 2011, AGL began injecting and storing gas underground at the depleted Silver Springs/Renlim reservoir in the Bowen Surat Basin in central Queensland. AGL provides the storage for balancing gas supply in its domestic portfolio.

The Silver Springs/Renlim gas field produced gas from 1978 to 1999 for the Brisbane market. Gas production finished in 2000 when the reservoir was fully depleted. Since then, the shale-capped reservoir – which naturally prevents gas from escaping – has proved to be ideal for underground gas storage. The Silver Springs/Renlim underground gas reservoir sits about 1.9 km below the surface and about 500 m below the deepest known aquifer bearing sandstones in the Great Artesian Basin. Above it, a thick layer of impermeable cap rock has acted as a gas-tight seal for millions of years. The impermeable cap rock also prevents the injected gas from migrating into the Great Artesian Basin.

All gas wells drilled into these fields are isolated from aquifers with steel casing and cement grouting to prevent any connectivity between the gas reservoir and the Great Artesian Basin. Water quality, reservoir pressures and gas-water contact movements are monitored as part of a comprehensive reservoir management plan. Gas from the Silver Springs storage facility and other natural gas fields in the region are sent to the Wallumbilla LPG Plant via an underground high pressure steel pipeline approximately 100km long.

AGL acquired the existing Wallumbilla Liquefied Petroleum Gas (LPG) facility from Santos QNT Pty Ltd in April 2011. The facility is about 13 km south of Wallumbilla and 42 km east-southeast of Roma in the Maranoa region of Queensland. AGL extensively refurbished the LPG facility between 2011 and 2015 and it was recommissioned in May 2016. The facility produces sales quality natural gas for delivery to residential and commercial customers, and has byproducts of propane, butane, oil condensate and electricity.

A new Environmental Authority (EA) in accordance with Chapter 5A of the Environmental Protection Act was required to operate the facility. The EA was granted in 2013 and was subsequently amended in 2016 and 2017.

1.2. Objective of EMP

This objective of this Environmental Management Plan (EMP) is to assist AGL in adhering to appropriate environmental management practices during the operational phase of the project.

More specifically, this EMP assists AGL to:

- Comply with environmental approvals and the requirements of overarching environmental legislation, codes of practice and other guidelines including the 'general environmental duty'
- Comply with AGLs Health and Safety Environmental Management System (HSEMS)
- Consistently manage and mitigate environmental risks through the application of industry standard control measures across the project, while striving for best practice where practicable

1.3. Environmental policy

All activities will be undertaken in accordance with the AGL Environment Policy that outlines AGLs commitment to ongoing management of HSE aspects and performance. The latest version of AGLs Environment Policy can be found on the AGL Intranet (GRID).

2. Statutory requirements

2.1. Commonwealth legislation

2.1.1. Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the EPBC Act as 'matters of national environmental significance' (MNES).

The nine MNES are:

- world heritage properties
- national heritage places
- wetlands of international importance (often called 'Ramsar' wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

2.1.2. National Greenhouse and Energy Reporting Act 2007

The National Greenhouse and Energy Reporting (NGER) Scheme was introduced in 2007 to provide data and accounting in relation to greenhouse gas emissions and energy consumption and production. The NGER Scheme operates under the National Greenhouse and Energy Reporting Act 2007 (NGER Act).

The Act reports the following monitoring and measurement tools:

- National Greenhouse and Energy Reporting (Audit) Determination 2009
- National Greenhouse and Energy Reporting (Measurement) Determination 2008
- National Greenhouse and Energy Reporting Regulations 2008
- National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015

2.1.3. Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act 1984

This Act provides for the preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters, being areas and objects of particular significance.

2.1.4. Commonwealth Aboriginal and Torres Strait Islander Act 2005

The objects of this Act are, in recognition of the past dispossession and dispersal of the Aboriginal and Torres Strait Islander peoples and their present disadvantaged position in Australian society (a) to ensure maximum participation of Aboriginal persons and Torres Strait Islanders in the formulation and implementation of government policies that affect them; (b) to promote the development of self-management and self-sufficiency among Aboriginal persons and Torres Strait Islanders; (c) to further the economic, social and cultural development of Aboriginal persons and Torres Strait Islanders; and (d) to ensure co-ordination in the formulation and implementation of policies affecting Aboriginal persons and Torres Strait Islanders by the Commonwealth, State, Territory and local governments, without detracting from the responsibilities of State, Territory and local governments to provide services to their Aboriginal and Torres Strait Islander residents.

2.2. Queensland legislation

2.2.1. Environmental Protection Act 1994

The object of the Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends ('ecologically sustainable development').

AGL currently holds eight environmental authorities (licences) issued under the Act by the regulatory authority, the Department of Environment and Science (DES). AGL is required to submit annual returns and pay licence fees to DES on an annual basis.

All persons in Queensland have important obligations under the Act, including the requirement to take all reasonable and practicable measures to prevent/minimise environmental harm (s. 319 - the 'general environmental duty') and the duty to notify environmental harm (s.320 – Duty to Notify).

The following subordinate legislation exist under the Act:

- **Environmental Protection (Air) Policy 2019**. The purpose of this policy is to achieve the object of the EP Act in relation to the air environment by a) identifying environmental values to be enhanced or protected, b) stating indicators and air quality objectives for enhancing or protecting the environmental values, c) providing a framework for making consistent, equitable and informed decisions about the air environment.
- **Environmental Protection (Noise) Policy 2019**. The purpose of this policy is to achieve the object of the EP Act in relation to the acoustic environment by a) identifying environmental values to be enhanced or protected, b) stating acoustic quality objectives for enhancing or protecting the environmental values, c) providing a framework for making consistent, equitable and informed decisions about the acoustic environment.
- **Environmental Protection (Water and Wetland Biodiversity) Policy 2019**. The purpose of this policy is to achieve the object of the EP Act in relation to waters and wetlands by: a) identifying environmental values for waters and wetlands, b) identifying management goals for waters, c) stating water quality guidelines and water quality objectives to enhance or protect the environmental values, d) providing a framework for making consistent, equitable and informed decisions about waters, e) monitoring and reporting on the condition of waters.

2.2.2. Environmental Protection Regulation 2008

The *Environmental Protection Regulation 2008* sets out fees in relation to Environment Protection Licences and notices. The regulation also includes requirements to report to the National Pollution Inventory (NPI) annually when a facility reaches a certain threshold for a substance.

AGL Queensland Gas Operations are required to submit air emission data annually as part of the NPI reporting requirements.

2.2.3. Petroleum and Gas (Production and Safety) Act 2004

The *Petroleum and Gas (Production and Safety) Act 2004* sets out the approved activities, safety requirements and overall instrument of approval for petroleum exploration and productions.

AGL Queensland Gas Operations are required to submit work programs/later development plans based on project requirements. AGL Queensland Gas Operations are also required to submit Annual safety reports.

2.2.4. Nature Conservation Act 1992

The *Nature Conservation Act 1992* sets forth management requirements for flora and fauna management. It is the overarching legislative tool for the protection of nature as defined in the Act.

AGL Queensland Gas Operations are required to monitor activities and ensure no impact to nature occurs as part of the project.

The following subordinate legislation exists under the Act:

- **Nature Conservation (Administration) Regulation 2017**. The objective of the Nature Conservation (Administration) Regulation 2017 is to provide for the ongoing management of protected areas declared under the Nature Conservation Act 1992, and in particular, to provide for a system of permits and other authorities for the use of protected areas and provide a system of licences, permits and other authorities for the use of wildlife outside of protected areas
- **Nature Conservation (Koala) Conservation Plan 2017**. The main purposes of this plan are (a) to promote the continued existence of viable koala populations in the wild; and (b) to prevent the decline of koala habitats.
- **Nature Conservation (Wildlife Management) Regulation 2006**. The purpose of this regulation is to prescribe native wildlife into classes and state the declared management intent for each of the classes of wildlife. This regulation applies only to wildlife that is not in a protected area.

2.2.5. Fisheries Act 1994

The purpose of the Act is to provide for the use, conservation and enhancement of community fisheries resources and habitats. This also includes the Fisheries (General) Regulation 2019, which provides for the use and management of Queensland's fisheries resources and fish habitats in accordance with the objectives of the Fisheries Act 1994.

2.2.6. Biosecurity Act 2014

The objects of this Act are to provide for managing biosecurity risks, the risk of contagion of a listed human disease, the risk of listed human diseases entering Australian territory or a part of Australian territory, or emerging, establishing themselves or spreading in Australian territory or a part of Australian territory, risks related to ballast water, biosecurity emergencies and human biosecurity emergencies and to give effect to Australia's international rights and obligations, including under the International Health Regulations, the SPS Agreement and the Biodiversity Convention.

The Act is supported by the Biosecurity Regulation 2016, which prescribes ways in which a person's general biosecurity obligation can be met to prevent or minimise a biosecurity risk, and includes measures to prevent or control the spread of biosecurity matter, sets maximum acceptable levels of contaminants in carriers, and sets fees.

2.2.7. Queensland Aboriginal Cultural Heritage Act 2003

The *Cultural Heritage Act 2003* sets forth the recognition of Aboriginal ownership of key matters associated with cultural heritage and provides guideance and regulation on how to manage these affairs. AGLs Cultural Heritage Management Plan has been prepared with Mandandanji People. This outlines the requirements for all cultural heritage matters relating to Aboriginal Cultural Heritage.

2.2.8. Native Title (Queensland) Act 1994

The main objects of this Act are (a) in accordance with the Commonwealth Native Title Act, to validate past acts, and intermediate period acts, invalidated because of the existence of native title and to confirm certain rights; and (b) to ensure that Queensland law is consistent with standards set by the Commonwealth Native Title Act for future dealings affecting native title.

2.2.9. Queensland Heritage Act 1992

The object of this Act is to provide for the conservation of Queensland's cultural heritage for the benefit of the community and future generations.

2.2.10. Torres Strait Islander Cultural Heritage Act 2003

The purpose of this Act is to provide effective recognition, protection and conservation of Torres Strait Islander cultural heritage.

2.2.11. Vegetation Management Act 1999

The Vegetation Management Act establishes the vegetation management framework for Queensland which applies to all vegetation other than state forests, national parks, forest reserves and certain other tenures defined under the Forestry Act 1959 and the Nature Conservation Act.

The Act is supported by the Vegetation Management Regulation 2012, which provides the framework for accepted development vegetation clearing codes and matters relating to regional ecosystem.

2.2.12. Water Act 2000

The Water Act 2000 provides a framework for the planning, allocation and use of surface water and groundwater in Queensland, including regulating major water impoundments (such as dams and weirs) and extraction through pumping for irrigation and other uses.

The Act is supported by the following subordinate legislation:

- **Water Regulation 2016**, which provides the legal framework for the management of water resources under the Act, including resource management and fees
- **Water Plan (Condamine and Balonne) 2019**, The purposes of this plan are to (a) define the availability of water to which this plan, applies; and (b) provide a framework for sustainably managing water to which this plan applies; and (c) identify priorities and mechanisms for dealing with the future water requirements in the plan area; and (d) provide a framework for managing water allocations; and (e) provide a framework for reversing, where practicable, the degradation of natural ecosystems caused by the taking of, or interference with, water to which this plan applies.
- **Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017**, the purpose of which is to (a) define the availability of water in the plan area; and (b) to provide a framework for sustainably managing water and the taking of water in the plan area; and (c) to identify priorities and mechanisms for dealing with future water requirements; and (d) to provide a framework for reversing, if practicable, the degradation of groundwater-dependent ecosystems.

2.2.13. Environmental Offset Act

The Environmental Offsets Act 2014 coordinates the delivery of environmental offsets across jurisdictions and provides a single point-of-truth for offsets in Queensland.

The Act is supported by the Environmental Offset Regulation 2014, which provides details of the prescribed activities regulated under existing legislation and prescribed environmental matters to which the Act applies.

2.2.14. Waste Reduction and Recycling Act 2011

The purpose of the Waste Reduction and Recycling Act 2011 is to promote waste avoidance and reduction, and resource recovery and efficiency actions; to reduce the consumption of natural resources and minimise the disposal of waste by encouraging waste avoidance and the recovery, re-use and recycling of waste; to minimise the overall impact of waste generation and disposal.

The Act is supported by the Waste Reduction and Recycling Regulation 2011, which sits under the Waste Reduction and Recycling Act 2011 and provides details about the new legislative framework. The key provisions of the Regulation include, fees for applications under the Waste Reduction and Recycling Act 2011, management of used packaging materials, details about who is required to plan and report about waste management.

2.2.15. Plumbing and Drainage Act 2018

The main purpose of this Act is to regulate the carrying out of plumbing or drainage work in a way that reduces risks to public health and safety and the environment.

2.2.16. Agricultural Chemicals Distribution Control Act 1966

The Act regulates the distribution of agricultural chemicals from aircraft and from ground equipment, and for other purposes.

The Act is supported by the Agricultural Chemicals Distribution Control Regulation 1998. The Regulation consists of 4 Parts completed by two schedules, contains provisions on licences under the Agricultural Chemicals Distribution Control Act and on safety requirements for the aerial and ground distribution of agricultural chemicals.

2.3. Codes of practice, policies and guidelines

2.3.1. PFAS National Environmental Management Plan

The PFAS NEMP provides governments with a consistent, practical, risk-based framework for the environmental regulation of PFAS-contaminated materials and sites. The PFAS NEMP has been developed as an adaptive plan, able to respond to emerging research and knowledge.

2.3.2. Codes of practice

Code of Practice - For the construction and abandonment of petroleum wells and associated bores in Queensland

The purpose of this Code is to ensure that all petroleum wells and associated bores are constructed, maintained and abandoned to a minimum acceptable standard resulting in long-term well integrity, containment of petroleum and the protection of groundwater resources. This Code identifies industry standards and good oilfield practice for oil and gas well design.

Code of Practice – for leak management, detection and reporting for petroleum operating plant

This Code standardises the detection, remediation and reporting of petroleum leaks from well site facilities, gathering systems, processing plants and emphasises on community safety.

2.4. Summary of approvals

The following table summarises the environmental approvals currently held by AGL under the *Environmental Protection Act 1994*, as the key environmental legislation that applies to AGL's operations. All approvals were issued by the Queensland Department of Environment and Science as the current administering authority.

Name / No.	Primary holder	Description	Date of effect	Date of Expiry/ Renewal
Silver Springs Project EPPG00784013 (PL 446)	AGL Gas Storage Pty Ltd	Environmental Authority for Level 1 Environmental Authority as defined in EP Act 1994. Issued under Section 309X of the EP Act 1994.	29 Sep 2016	Annual return due 24 May
Wallumbilla Project EPPG01233113 (PFL27)	AGL Gas Storage Pty Ltd	Environmental Authority issued under Chapter 5 of the EP Act 1994.	22 December 2017	Anniversary date 22 December 2017
Silver Springs Project EPPG00770313 (PL192)	AGL Upstream Gas (Mos) Pty Ltd	Environmental Authority for petroleum activities conducted on PL192, issued under Chapter 5 of the EP Act 1994.	23 July 2014	Anniversary date 10 August
Silver Springs Project EPG00304213 (PL213)	AGL Upstream Gas (Mos) Pty Ltd	Environmental Authority for Petroleum Lease 213, issued under Chapter 5 of the EP Act 1994.	7 July 2016	Anniversary date 23 January
Silver Springs (Boxleigh field) P-EA-100227919	AGL Gas Storage Pty Ltd	Environmental Authority for Petroleum Lease 15, issued under Chapter 5 of the EP Act 1994,	1 April 2022	Anniversary date 15 August.
Silver Springs / Taylor Project (PLs 48, 49, 66, 202)	AGL Gas Storage Pty Ltd	Environmental Authority issued under Section 310M of the EP Act 1994, to cover Petroleum Leases 15, 48, 49, 66, 202.	1 April 2022	Anniversary date 15 August
Silver Springs Project PEN202330511 (PPL4)	AGL Gas Storage Pty Ltd	Environmental Authority for Level 2 Environmental Authority as defined in EP Act 1994. Issued under Section 309X of the EP Act 1994.	22 June 2011	Anniversary date 22 June
Silver Springs Project EPG00370113 (PPL 87, PPL 93)	AGL Gas Storage Pty Ltd	Environmental Authority issued under Chapter 5 of the EP Act 1994.	3 Feb 2015	Anniversary date 29 April
Silver Springs Project EPSX02909615 (ATP1190)	AGL Gas Storage Pty Ltd	Environmental Authority issued under Chapter 5 of the EP Act 1994, for petroleum activities covering ATP1190.	16 February 2015	Anniversary date 16 February

2.5. Management policies

AGL's health, safety and environmental management system (HSEMS) contains AGL's environment policy, environmental standards, and environmental methodologies. The following environmental standards apply to the operational phase of the project:

- AGL-HSE-STD-009.1 Land Standard
- AGL-HSE-STD-009.2 Groundwater Standard
- AGL-HSE-STD-009.3 Surface Water Standard
- AGL-HSE-STD-009.4 Air Emissions Standard
- AGL-HSE-STD-009.5 Noise Emissions Standard
- AGL-HSE-STD-009.6 Biodiversity Standard
- AGL-HSE-STD-009.7 Waste Standard
- AGL-HSE-STD-009.8 Cultural Heritage Standard
- AGL-HSE-STD-009.9 Greenhouse Gas Emissions Standard

3. Environmental management

3.1. Environmental risk assessment

AGL has a risk management system that utilises the Fully Integrated Risk Management and Assessment Matrix (FIRM) and is aligned with the risk management standards and methodologies recommended by the Australian and New Zealand Risk Management Standard AS/NZS 31000:2009. Environmental risk assessment at the project is undertaken in accordance with the AGL FIRM and HSEMS HSE Risk Management Standard (AGL-HSE-STD-004.1).

3.2. Risk registers

The Queensland Gas Operations risk register incorporates environmental risks and is developed, updated and reviewed annually by key personnel in the Queensland Gas Operations team. The Environment Business Partner is responsible for the identification and management of risks recorded in the AGL Queensland Gas Operations risk register and the Site Leadership Team will approve the risk register at each annual review. Risk workshops are held for new projects across the assets, which further aids in the identification of any new risks.

3.2.1. EMP sub-plans

The EMP is the primary environment management document for the project. Within the EMP, there are nine separate sub-plans for each aspect (as listed below), consistent with AGLs HSEMS:

- Land (incl. biodiversity)
- Groundwater
- Surface water
- Air emissions
- Noise emissions
- Waste
- Cultural heritage
- Greenhouse gas emissions.

Each sub-plan provides specific information on the existing environmental values, activities, impacts and control measures for that particular aspect.

3.3. AGLs activities

The following list serves as a master list of all activities undertaken by AGL at the Silver Springs Gas Project.

Location	Activities
General construction, maintenance and operation	Construction, maintenance and operation of above ground infrastructure • Access roads, table drains, culverts, crossings • Well pads, main line valves
	Construction and/or repairs of above and below ground infrastructure • Facilities and plants • Pipelines
Renlim underground storage reservoir	Injection of natural gas into storage reservoir
	Extraction of natural gas for processing at Silver Springs Plant
	Operation of monitoring wells to measure reservoir pressure
Silver Springs facility	Hydrocarbon gas refining (gas sourced from reservoir and gas fields)
	Chemical storage including dangerous goods
	Operation of fuel burning equipment (compressors and generators)
	Operation of a fuel farm for refuelling light and heavy vehicles
	Operation of a produced water management system (including separators, condensate and water tanks, interceptor ponds, and a lined 60ML dam supplemented by 159ML unlined storage dams)
	Regulated waste treatment (land farm)
	Operation of a wash bay for vehicles and equipment
	Monitoring of seepage monitoring bores
	Management of two legacy oil ponds
	Operation of a sewage treatment plant (21 to 100 EP) and wastewater irrigation area
	Operation of a water treatment plant (reverse osmosis) fed by a camp water bore
	Operation of an accommodation camp (35 rooms) including kitchen, laundry, gymnasium and administration buildings
	Operation of a mechanical workshop (light and heavy vehicles)
	Operation of a laydown area and boneyard for disused equipment
	Operation of a vertical and horizontal flare
	Pig launching and receival into pipelines
	Isolation and blowdown of equipment
	Temporary waste storage (e.g. drums, IBCs)
Wallumbilla facility	Hydrocarbon gas refining
	Hydrocarbon gas production (natural gas)
	Operation of a weighbridge for tanker loadout of LPGs (butane and propane)
	Operation of fuel burning equipment (compressors, microturbines, heaters)
	Operation of a low emissions butane fuelled 1MW microturbine for export of power (Australia's first) with 98% efficiency and 800kW output
	Operation of two domestic sized sewage treatment plants and a wastewater irrigation area
	Chemical storage including dangerous goods
	Operation of a water treatment plant (ultra-filtration) fed by a camp water bore
	Operation of a small mechanical workshop (light and heavy vehicles)
	Operation of a boneyard for disused equipment
	Operation of a vertical flare including a vegetation free area
	Monitoring of seepage monitoring bores

	Management of a legacy landfarm
	Stockpiling of topsoil resources
	Management of on-site weeds
	Management of a disused firewater dam
	Pig launching and receival
	Isolation and blowdown of equipment and pipelines
	Temporary waste storage (drums, IBCs)
Churchie compressor station	Operation of a small administration building and goods store
	Operation of a switch room with small diesel tank storage
	Monitoring of seepage bores
	Drainage and erosion works
	Management of two 0.5ML lined dams
	Vegetation management (weed spraying)
	Operation of a compressor (future)
	Glycol injection? Biocide?
	Pig launching and receiver station
Taylor compressor station	Operation of a small administration building and goods store
	Monitoring of seepage bores
	Biocide injection to pipeline
	Drainage and erosion works
	Management of disused produced water dams
	Operation of a compressor (future)
	Pig launching and receival
Pipelines	Above ground integrity surveys
	Pigging (incl. intelligent pig runs)
	Subterranean repairs (dig-ups)
	Operation of a cathodic protection system
Pipeline ROWs	Vegetation management (slashing, weed spraying)
	Erosion repairs
Well pads	Erosion repairs
	Weed spraying
	Install and maintain cattle fencing
	Workovers and strata stimulation
	Rehabilitation (reinstatement and revegetation) to required standards
Gas fields	Seismic surveys
	Drainage and erosion works
	Management of water bores
Access roads	Drainage management and erosion repairs
Off-lease areas	Management of communications towers
	Stakeholder relations and community projects

4. Implementation

4.1. Responsibilities

AGL has overall responsibility for environmental management during operation of the AGL Queensland Gas Operations. All AGL personnel and contractors are responsible for ensuring that their work complies with the requirements of this EMP.

Key roles and responsibilities for environmental management during operation of the AGL Queensland Gas Projects are included in the table below.

Position Title	Accountability
General Manager, HSE	The General Manager HSE is responsible for: • Delegating authority to ensure adequate implementation of AGLs HSEMS Standards; and • Ensuring adequate resources are available for the implementation and enforcement of the Standards.
Head of Function	The Head of Function is responsible for: • Ensuring the implementation and adherence to AGLs HSEMS Standards by the Business Unit; • Ensuring adequate resources are available for the implementation and enforcement of the Standards; and • Ensuring AGL procedures and processes for reporting of required data are followed.
Senior Manager, Environment Operations	The Senior Manager, Environment Operations is responsible for: • Managing the development, implementation and maintenance of the HSEMS Standards; • Ensuring consultation in the development, review and approval of the Standards; and • Overseeing audits and assurance activities to ensure compliance with the Standards and applicable regulatory requirements.
Environment Business Partner	The Environment Business Partner and/or Health, Safety and Environment (HSE) Business Partner are responsible for: • Reviewing contracts to provide HSE and site specific input; • Monitoring and providing support in the implementation of reporting procedures and processes at site level; and • Undertaking audit and assurance activities, to ensure compliance with AGLs HSEMS Standards and applicable regulatory requirements and developing and tracking corrective action management plans.
AGL Economic Policy and Sustainability Team	The AGL Economic Policy and Sustainability Team is responsible for: • maintaining the AGL Energy and GHG Manual, which documents the process for complying with the NGER legislative framework, including the process for collecting relevant information from sites.
Engineering Team	Responsible for adhering to environmental requirements through maintaining communications with Site Leaders and the Environment Business Partner.

Position Title	Accountability
Land and Approvals Manager	Responsible for landowner consultation and notification, and communication with the Site Leaders, Environment BP and Subsurface Manager to meet environmental compliance requirements.
Subsurface Manager	Directly responsible for the overseeing and fulfilment of commitments contained in this EMP, cf relating to drilling activities.
Field Superintendent	AGL's representative on work sites, providing guidance and operational support to all contractors. Responsible for guiding field works (e.g. civils, earthmoving, site preparation) and assisting in the implementation of the EMP including reporting, monitoring and auditing as required.
Company Man	AGL's representative on work sites providing guidance and operational support to contractors for subsurface projects. Responsible for assisting in the implementation of the EMP including reporting, monitoring and auditing as required.
Civil and Drilling Contractors	Responsible for ensuring that works comply with the Contract, EMP and regulatory requirements. Reports to the AGL Subsurface Manager or delegate.
Cultural Heritage Monitors	Elders and members of the Mandandanji people as defined in the Cultural Heritage Management Plan.

4.2. Training

4.2.1. Inductions

All personnel, including contractors, must attend an HSE induction. All personnel will be made aware during the induction of relevant environmental obligations and the need to perform all activities in an environmentally responsible manner.

Inductions and training will aim to outline a range of HSE issues including:

- The 'general environmental duty' in accordance with section 319 of the *Environmental Protection Act 1994*;
- The 'duty to notify of environmental harm' in accordance with section 320 of the *Environmental Protection Act 1994*;
- AGL's Environmental Policy and regulatory requirements;
- The significance and potential environmental effects associated with their work requirements;
- Personnel roles and responsibilities for environmental performance;
- The relevant objectives and requirements of the Environmental Management Plan; and
- Emergency response system and incident reporting protocols.

4.2.2. Job specific training

Job specific training will also be undertaken where applicable and will cover general environmental management issues such as:

- Land and vegetation management;
- Fauna management;

- Watercourse management;
- Erosion prevention and control;
- Spill containment and equipment;
- Corrective actions;
- Environmental monitoring;
- Landowner management; and
- Management of hazardous substances.

It is the responsibility of each main sub-contractor to prepare and implement an induction (where appropriate) and job specific training program appropriate to their methods of work. Approval from AGL shall be obtained prior to implementation as per the EMP and all training will be recorded in a register to ensure that all personnel are trained prior to commencing work

4.3. Communications

4.3.1. Internal communications

AGL communicates internally through the following forums:

- Toolbox meetings: daily site meetings to discuss current field work and resourcing requirements and to share HSE knowledge or findings
- Planner/Scheduler meetings: weekly meetings to discuss field work resourcing and upcoming project scheduling
- Leadership meetings: weekly meetings attended by Gas Operations Manager, Site Leaders, Engineering Manager, Subsurface Manager, Finance Manager, Environment Business Partner, Health and Safety Business Partner
- Corporate Environment Team Meetings: weekly meetings led by the Senior Manager, Environment Operations, and attended by all AGL Environment Business Partners
- Surat Asset meetings: monthly meetings attended by all disciplines to discuss current projects and challenges/requirements
- Shutdown meetings: as required meetings to discuss annual shutdown work and findings
- Risk workshops: as required meetings to discuss upcoming projects and inherent and residual risks across all disciplines.

4.3.2. External communications

External communication between AGL and relevant stakeholders is crucial to the success of the project. The following protocols are to be followed on the project at the preconstruction phase:

- Site Access - During all phases of the project, access to the project site will be approved through the relevant AGL Project Manager and/or delegate;
- Works Program - Prior to any works commencing in the field, a work method statement and job safety and environmental analysis, which includes a targeted environmental risk assessment of the specific work activities, must be undertaken and submitted to the AGL Project Manager for review and approval;

- Inductions - AGL on site inductions must be completed for all people involved in the field work activities prior to the commencement of any works;
- Inspections and Monitoring - Inspections and monitoring of field activities must be undertaken during the work and provided to AGL in writing if required.

4.3.3. Community enquiries and complaints

Any public enquiries and/or complaints are recorded by site personnel and entered into AGLs myHSE system as an environmental event. This ensures that appropriate actions are taken by AGL to consider and action the complaint, to maintain compliance with environmental approvals.

4.4. Reporting

Environmental reporting requirements are included in the EMP sub-plans, as there are several environmental approvals relating to the entire Silver Springs Gas Project. Therefore each sub-plan contains details of the specific reporting requirements under each lease.

4.5. Document control

Document control for the EMP is undertaken in accordance with AGL's Gas Operations Document Control Procedure (DCS_GN_SOP_AD_010). Under this procedure, documents must be authorised and include current issue number.

5. Monitoring and compliance

5.1. Environmental monitoring

Details of specific environmental monitoring undertaken for each lease is included in the EMP sub-plans, as there are numerous requirements under the environmental approvals.

The following key personnel are responsible for undertaking monitoring:

- Site personnel – field inspections including the completion of weekly and/or fortnightly checklists, daily meter reads to track consumption and production, aerial and ground surveys of assets including ROWs
- Environment Business Partner – monthly site visits to carry out specific monitoring required under the environmental approvals held for each lease (e.g. groundwater monitoring, stack testing)
- Field Superintendent – collation of work site environmental data (e.g. subsurface projects) including waste tracking documentation, weed washdown certificates
- Third party technical specialists – collection of data across a range of activities including for example: stack testing, ambient air monitoring, waste tracking, weed washdown certificates
- Project managers – during project construction specific monitoring may be carried out in terms of visual inspections and reporting to other key personnel.

5.2. Auditing and assurance activities

AGL undertakes a variety of auditing and assurance activities to manage environmental compliance. These include:

- Routine inspections - undertaken by site and corporate personnel across the asset. Checklists are completed and stored in hardcopy form on-site
- Environment walks – undertaken by site and corporate personnel across the asset as per AGLs guidelines. Records are entered and stored in AGLs myHSE system in SAP Fiori
- Critical control checks - undertaken by site and corporate personnel across the asset as per AGLs guidelines. Records are entered and stored in AGLs myHSE system in SAP Fiori
- Critical control verifications – undertaken by site and corporate personnel across the asset as per AGLs guidelines. Records are entered and stored into AGLs Audit and Action Tracker Register on AGLs Grid page (intranet)
- First party (internal) audits – undertaken by AGL corporate personnel (e.g. Group Audit) in company with the Environment Business Partner on particular aspects of the operation/asset. Records are entered and stored into AGLs Audit and Action Tracker Register on AGLs Grid page (intranet)
- Second party (supplier) audits – undertaken by AGL corporate personnel to determine whether suppliers/contractors are meeting their contractual requirements. Records are entered and stored into AGLs Audit and Action Tracker Register on AGLs Grid page (intranet)

- Third party (external) audits – undertaken by technical specialists engaged by AGL to determine compliance against environmental approvals or other requirements. Records are entered and stored into AGLs Audit and Action Tracker Register on AGLs Grid page (intranet).

5.3. Compliance management

Environmental compliance obligations relating to Project were formerly managed in a database known as 'Compliance Management Obligations' (CMO), which is now superseded by SAP Fiori (myHSE). Each compliance obligation and resulting action is stored within the system for compliance tracking purposes. It is the responsibility of the Environment Business Partner or delegate to track and manage all compliance requirements. This involves documenting a response to each action and attaching proof of compliance, at pre-determined intervals. New obligations and actions are added into the system as required, to ensure that AGL has a robust tracking system covering all environmental requirements.

5.4. Environmental events

All environmental events (incidents, near misses, hazards) are managed in accordance with the HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1). The Procedure contains detailed information on the classification and management of events, to ensure a consistent approach across AGL.

5.5. Statutory enforcement notices

AGL commits to fully complying with any statutory enforcement notices, information requests or specific directions issued by the administering authority. These may include:

- Environmental protection orders
- Direction notices
- Clean-up notices
- Cost recovery notices
- Regulator investigations.

5.6. Change management

Change is an integral part of AGL's business. However, change can introduce new hazards into the workplace if not managed correctly or can even invalidate previous risk assessments and control strategies. Changes must be managed to ensure that environmental risks arising from such changes remain at acceptable levels.

Company personnel, contractors, management or external sources may identify the need to implement a change and as such all contractors and external sources should raise any proposed or suggested changes with an appropriate person and the proposed change should be entered into a Change Request Form.

AGL's Management of Change procedure ensures:

- All modifications to equipment, systems and procedures are carried out in a manner so as not to produce a hazard to safety, environment, production or plant operability, generally completed by use of Engineering Change Request (ECR) or similar documentation; and

- All modifications to equipment, systems and procedures are reviewed by authorized personnel and approved prior to implementation through the appropriate MOC process (i.e. ECR).

6. Document review

AGL commits to reviewing the EMP and all associated sub-plans at least annually or:

- Following a major incident
- Upon receipt of new environmental requirements (approvals, permits, codes)
- When directed to do so by the administering authority.

Reviews are managed by the Environment Business Partner and if material changes are made, the EMP must be submitted to the regulatory authority.

A hardcopy of the EMP is maintained at the Silver Springs and Wallumbilla facilities, and new copies are installed at these locations following annual reviews if changes are made.

7. EMP sub-plans

The following sub-plans were prepared to provide information on potential impacts and control measures for specific environmental aspects. These sub plans form part of the EMP.

- Land Disturbance
- Groundwater
- Surface water
- Air emissions
- Noise emissions
- Biodiversity
- Waste
- Cultural heritage
- Greenhouse gas emissions.

Silver Springs Project

LAND MANAGEMENT SUB-PLAN

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Document revision history

Date	Version	Author	Comments
May 2020	R0	John Moraitis	Updated for AGL HSEMS
June 2022	R1	John Moraitis	Review and update

1. Introduction

This Land Management Sub Plan was prepared as part of the Environment Management Plan (EMP) for AGL's Silver Springs Gas Project ("the project").

This Plan was developed to specifically address and manage potential land management issues for the project and is based on the previously prepared and approved Environment Health and Safety Management Plans. This Plan conforms with AGLs Land Standard (ALG-HSE-STD-009.1) and Land Methodology (AGL-HSE-SDM-009.1) as stipulated in the AGL Health, Safety and Environment Management System (HSEMS).

This Plan applies to land owned, covered by a land access agreement, leased, and managed by AGL. It covers all activities carried out by AGL employees and contractors, at AGL controlled sites, that disturb land or have the potential to contaminate land, and emergency events that result in the need for land remediation or rehabilitation

1.1. Objectives

The intent of this Sub-Plan is to assist AGL controlled sites ensuring that:

- Land disturbance impacts are minimised, to as low as reasonably practicable;
- Releases, leaks and spills of hazardous chemicals/wastes to land are, as far as practicable, prevented and control measures are in place at all times;
- Both human health and the environment are protected in the event of significant land contamination, and land remediation is promptly carried out to agreed standards; and
- Regulatory licence conditions and other compliance obligations (e.g. general environmental duty) with respect to the management of land are met.

1.2. Responsibilities

The roles and responsibilities for the development, implementation and review of this Plan are summarised below.

1.2.1. General Manager, HSE

The General Manager, HSE is responsible for:

- Delegating authority to ensure adequate implementation, monitoring and review of the Land Standard, and associated Methodology, occurs; and
- Ensuring adequate resources are available for the development, implementation, monitoring and review of the Land Standard.

1.2.2. Head of Function

The Head of Function is responsible for:

- Ensuring the implementation and adherence to the Land Standard throughout the Business Unit; and
- Ensuring adequate resources are available for the implementation, monitoring and review of the Land Standard.

1.2.3. Senior Manager, Environment Operations

The Senior Manager, Environment Operations is responsible for:

- Managing the development, implementation, and maintenance of the Land Standard;
- Ensuring consultation in the development, review and approval of the Land Standard, and associated Methodology;
- Providing guidance for the development of objectives, goals, targets, and/or Key Performance Indicators (KPIs) associated with the Land Standard, as applicable;
- Ensuring processes and/or procedures related to the Land Standard are developed, implemented, followed, and meet obligations and/or requirements under applicable environmental legislation;
- Ensuring that applicable environmental objectives, goals, and targets associated with the Land Standard are introduced, adhered to, and measured while meeting AGL-wide policies, objectives, goals, and targets; and
- Overseeing audits and assurance activities to ensure compliance with the Land Standard and applicable regulatory requirements.

1.2.4. Environment Business Partner

The Environment Business Partner is responsible for:

- Overseeing and monitoring the implementation of the Land Standard within their Business Unit, and communicating Land Standard requirements to relevant personnel and/or contractors, as applicable;
- Developing processes and/or procedures related to management of land to ensure consistency with the Land Standard, and with applicable environmental legislation;
- Providing support and guidance in the implementation of land related processes and/or procedures at Business Unit level;
- Undertaking or providing guidance and assistance to Leaders in the completion and review of environmental risk assessments and control processes;
- Undertaking audit and assurance activities, to ensure compliance with the Land Standard and applicable regulatory requirements, and developing tracking and corrective action management plans; and

- Assisting with the delivery and tracking of environmental management projects, or the integration of environmental considerations into projects, to ensure Business Unit and site-specific targets are met.

1.2.5. Environment Advisor

The Environment Advisor is responsible for supporting the Environment Manager and/or Environment Business Partner(s) with tasks associated with:

- Implementation of the Land Standard; and/or
- Management of the processes and/or procedures related to Land Standard, at Business Unit level.

2. Legal obligations

2.1. Key legislative requirements

The key regulatory requirements relating to land management are detailed below.

2.1.1. Environmental Protection Act 1994

- Section 22: Act binds all persons
- Section 125: Requirements to apply for an environmental authority
- Section 319: General environmental duty
- Section 320DA: Duty of owner, occupier or auditor to notify administering authority
- Section 437: Offences of causing serious environmental harm
- Section 438: Offences of causing material environmental harm
- Section 440: Offence of causing environmental nuisance
- Section 442: Offence of releasing prescribed contaminant
- Section 443: Offence to place contaminant where serious or material environmental harm may be caused
- Section 443A: Offence to place contaminant where environmental nuisance may be caused

2.1.2. Environmental Protection Regulation 2019

- Division 4: Environmental management and environmental offences.

2.1.3. Environmental Protection and Biodiversity Conservation Act 1999

- Section 18: Actions with significant impact on listed threatened species or endangered community prohibited without approval
- Part 4: Referral of proposals to take action

2.1.4. Nature Conservation Act 1992

- Part 5: Wildlife and habitat conservation
  - Division 4: Particular restrictions relating to protected wildlife
    - Subdivision 1: Particular restrictions relating to protected animals
    - Subdivision 2: Particular restrictions relating to protected plants

2.1.5. Nature Conservation (Wildlife Management) Regulation 2006

- Chapter 3, Part 1: Taking, keeping, using, moving or dealing with protected animals other than under a wildlife authority

- Chapter 4, Part 2: Requirements for and restrictions about taking and using protected plants
- Chapter 4, Part 3: Exemptions for taking or using protected plants
- Chapter 4, Part 4A: Protected plant clearing permits
- Chapter 4, Division 5: Exemptions for taking protected plants when clearing.

2.1.6. Vegetation Management Act 1999

- Section 19O: Accepted development vegetation clearing code
- Part 2, Division 5AA: Vegetation management maps
- Part 2, Division 6: Relationship with Planning Act

2.1.7. Environmental Offsets Act 2014

- Section 14: Imposing offset conditions

2.1.8. Environmental Offsets Regulation 2014

- Schedule 2: Prescribed environmental matters – Matters of State Environmental Significance (MSES)

2.2. Key licence requirements

The environmental licences held for each lease contain general and specific conditions for managing land. The table below shows the current environmental approvals (licences) held for each petroleum lease, issued by the Queensland Department of Environment and Science.

Petroleum lease	Environmental licence no.	Issue date	Anniversary date (each year)
PL446	EPPG00784013	29 September 2016	24 May
PFL27	EPPG01233113	22 December 2017	Not listed on EA
PL192	EPPG00770313	23 July 2014	10 August
PL213	EPPG00304213	7 July 2016	23 January
PL 15	EPPG00770613	1 April 2022	15 August
PLs 48, 49, 66, 202	P-EA-100227919	1 April 2022	15 August
PPL 4	PEN202330511	22 June 2011	22 June
PPL 87, 93	EPPG00370113	3 February 2015	29 April
ATP1190	EPSX02909615	16 February 2015	Not listed on EA

2.3. Approval conditions

The approval conditions for each environmental approval (licence) including AGLs actions and comments are displayed in Section 4 of this document. This provides a useful reference for auditing and assurance activities as it demonstrates how AGL is specifically managing compliance against each condition.

3. Impacts and control measures

3.1. Potential impacts

The following specific activities are identified as having the potential to cause impacts on land if not appropriately managed:

- Land disturbances (clearing, trenching, excavations)
- Vegetation management (e.g. herbicide applications)
- Land contamination from:
    - Storage of hazardous substances (e.g. aboveground and underground storage tanks)
    - Handling of hazardous substances (e.g. movement, transport, vessel recharge)
    - Operation of stationary plant and equipment (e.g. compressors, generators, wells)
    - Operation of mobile plant and equipment (e.g. vehicles, machinery, pumps)
    - Operation of impoundment structures (e.g. dams) that contain produced water
    - Tanker loadout operations (e.g. condensate, LPG)
    - Operation of fire water systems (e.g. deluge systems) if fitted with chemicals
    - Washdown and surface preparation activities (e.g. detergents, sandblasting)
    - Maintenance activities (e.g. motor vehicle workshop, annual shutdown tasks).

3.2. Control measures

3.2.1. HSEMS minimum controls

The following minimum controls are specified by AGLs Land Standard (ALG-HSE-STD-009.1) and Land Methodology (AGL-HSE-SDM-009.1).

Land disturbance

RCM Ref	Minimum Control
9.1.1.1	Prior to any land disturbance, the relevant Leader must: • Consult with the Environment representative to determine if the area to be disturbed is covered under an existing regulatory approval held by the AGL controlled site; and • Confirm if the activities/works are permissible without approval or are the subject of an exemption. If approval is required by the AGL controlled site, it must be obtained from the relevant regulatory authority(ies).
9.1.1.2	AGL controlled sites must develop and implement control measures to manage land disturbance.

9.1.1.3	Employees and contractors must be informed of the areas that cannot be disturbed via site inductions, toolbox talks and contractual documentation (where relevant).
9.1.1.4	If the risk of disturbing Acid Sulfate Soils has been identified, guidelines and/or protocols established by the regulatory authority must be followed. When these are not available, comparable, or international recognised Acid Sulfate Soils management protocols must be used.

Land disturbance procedures should be developed and implemented at AGL controlled sites. These procedures should align with legislative requirements (e.g. permits or approvals may be required from the regulatory authority) and guidelines, relevant HSE Management System Standards and any commitments associated with management of land.

Where applicable, the legislative definition of land disturbance should be identified by the relevant Leader and Environment representative so that it is complied with at the AGL controlled site. Furthermore, the relevant Leader should verify if the specific works requires a permit to work; if that is the case, the permitting system as defined in the Permit To Work Standard (AGL-HSE-STD-004.2) should be followed.

Work that involves disturbance of land should be carried out in a way that prevents or minimises impacts on soil structure and stability, and other potential environmental impacts. Appropriate control measures should be in place to prevent erosion, landslides, loss of topsoil, generation of dust, surface water and groundwater contamination, and impacts to flora, fauna or matters of cultural heritage significance. Care must be taken when constructing trenches to install buried pipelines due to the potential for fauna injury/impacts such as cattle. Care must be taken to install adequate fencing to exclude cattle and effective landholder communication is necessary to manage the situation – particularly when delays occur. Leaders must ensure that the applicable minimum controls within the relevant AGL Environment Standard(s) are adhered to.

Leaders should ensure that personnel undertaking land disturbance works are fully aware of the HSE risks associated with the activity and the required control measures to minimise potential environmental impacts. Prior to undertaking land disturbance works, personnel should be provided with the relevant area map, which clearly demarcates the approved area for land disturbance.

Land contamination - general

RCM Ref	Minimum Control
9.1.1.5	Notices or orders, issued by the regulatory authority, for contaminated land must be complied with and all requirements adhered to.

If an AGL controlled site receives an order or notice to conduct a contaminated land assessment, all requirements need to be adhered to within the allocated timeframe. Requirements can include, but not limited to:

- Determining the nature and extent of land contamination (in and/or in the vicinity of contaminated land) and report results to the regulatory authority;
- Appointing or engaging a person with specified qualifications to carry out the assessment or prepare the assessment report;

- Undertaking an audit, in accordance with the guidelines established by the regulatory authority; and
- Consulting with stakeholders (i.e. owners or occupiers of the land in the vicinity of the AGL controlled site).

If an AGL controlled site receives an order or notice to remediate contaminated land, all requirements should be adhered to within the allocated timeframe. Requirements can include, but are not limited to:

- Remediating the contaminated land area within a specified period;
- Preparing a Remediation Action Plan, according to requirements and satisfaction of the regulatory authority;
- Reporting to the regulatory authority on remediation, in a specified form and within a specified period;
- Appointing or engaging a person with specified qualifications to carry out the remediation works, to prepare the Remediation Action Plan or to prepare the remediation validation report;
- Undertaking an audit, in accordance with the guidelines established by the regulatory authority, and submitting an audit report to the regulatory authority; and
- Consulting with stakeholders (i.e. owners or occupiers of the land in the vicinity of the site).

If an AGL controlled site receives an ongoing prevention notice for contaminated land, all requirements should be adhere to within the allocated timeframe. Requirements can include, but are not limited to:

- Preventing an activity that has been or is carried out in an environmentally unsatisfactory manner;
- Installing or repairing controls to prevent water pollution impacting land; and
- Not operating a plant or equipment until the regulatory authority is satisfied that appropriate controls are in place.

If an AGL controlled site receives an ongoing maintenance order for contaminated land, all requirements should be adhere to within the allocated timeframe. Requirements can include, but are not limited to:

- Maintaining the integrity of a capping system; and
- Monitoring of groundwater to ensure the effectiveness of the remediation.

Prevention

RCM Ref	Minimum Control
9.1.1.6	To prevent and minimise releases, spills, leaks of hazardous chemicals/wastes to land, procedures must be developed and implemented for managing: • Plant and equipment that use and/or store hazardous chemicals/wastes; and • Areas where hazardous chemicals/wastes are located, handled, used, and disposed.
9.1.1.7	Leaders must ensure that plant and equipment that store hazardous chemicals/wastes (e.g. pipelines, storage tanks) are: • Fitted with appropriate engineering controls;

	• Located and placed correctly, considering any risks of these being impacted by site activities, third party activities and extreme weather events (e.g. flooding); and • Operated and maintained according to manufacturer guidelines, and inspected so that any deficiencies are rectified.

Procedures developed for land contamination prevention need to align with the Hazardous Chemicals and Substances Standard (AGL-HSE-STD-007.10), Plant and Equipment Management Standard (AGL-HSE-STD-007.6) and Waste Standard (AGL-HSE-STD-009.7). Areas where hazardous chemicals/wastes are used, stored, and handled are required to have appropriate secondary containment (e.g. bunding, trays).

As land contamination may result in groundwater contamination, Leaders should ensure that the applicable Groundwater Standard (AGL-HSE-STD-009.2) minimum controls are adhered to.

Identification

RCM Ref	Minimum Control
9.1.1.8	Potential sources of land contamination must be identified, assessed, and documented.
9.1.1.9	Land areas suspected or identified as being contaminated must be documented in the AGL controlled site Contaminated Land Register.

Potential sources of land contamination are generally associated with hazardous chemicals/wastes and their transport, storage, handling, use and disposal. Naturally generated land contamination can occur via exposure or disturbance of Acid Sulfate Soils (if present in the area). In order to prevent or minimise land contamination at AGL controlled sites, contamination sources should be identified and their potential to contaminate land assessed and documented in a database or risk register maintained by the AGL controlled site.

Contaminated land, caused by previous activities/operations, may exist within the boundaries of the AGL controlled site, and these should be identified and documented in a Contaminated Land Register. Information on legacy contaminated land areas should be retrieved from Contaminated Land Registers held by the regulatory authority(ies), and other sources of local history information.

Assessment

RCM Ref	Minimum Control
9.1.1.10	Assessments of suspected and known contaminated land areas must be carried out and documented, as per protocols, methods and guidelines prescribed by the regulatory authority.
9.1.1.11	AGL controlled sites must engage a suitably qualified contaminated land professional to assist and/or undertake assessments of suspected and known contaminated land.
9.1.1.12	Land area believed to be contaminated within the AGL controlled site must be reported to the regulatory authority, where required under applicable legislation.

The applicable legislative definition of land contamination should be identified by the relevant Leader and Environment representative, so that it is considered in all assessments carried out at the AGL controlled site.

Assessments should be carried out on all known or suspected contaminated land areas in order to ascertain if the contamination poses an actual or potential risk of harm to the environment and human health, and what actions should be taken. The contaminated land assessments should take into consideration:

- Type of substance(s);
- Extent and degree of contamination (including exposure pathways for the substance(s) to spread);
- Location and physical characteristics of the contaminated land area;
- Current land use; and
- Significance of the land and any adjoining land.

The initial assessment may include a desktop study, an inspection of the area and, where appropriate, limited sampling (conducted by a qualified contaminated land professional) to determine whether contamination is present or likely to be present. Subsequently, the information attained from the initial assessment could be used to assess if:

- A more detailed assessment is required. This may include collection of comprehensive data on the issues identified in the initial assessment, and sampling, analysis and conducting a risk assessment to determine whether contamination constitutes 'material harm to the environment'; and
- Remediation is required, to return the land to a suitable condition for the current or another agreed land use.

Contaminated Land Management Plan

RCM Ref	Minimum Control
9.1.1.13	A Contaminated Land Management Plan must be developed, implemented, and documented for contaminated land areas that have been: • Assessed, and contamination is to be managed onsite; and • Remediated, and residual contamination is to be managed onsite.
9.1.1.14	AGL controlled sites must engage a suitably qualified contaminated land professional to develop the Contaminated Land Management Plan.
9.1.1.15	A Contaminated Land Management Plan must: • State the purpose of the Plan; • State the objectives to be achieved and maintained under the plan; • State how the objectives are to be achieved and maintained; and • Make provision for monitoring and reporting compliance with the Plan.
9.1.1.16	Accredited environmental laboratory services (i.e. certified by National Association of Testing Authorities (NATA) or equivalent accreditation bodies) must be used for chemical analysis of contaminated land samples.
9.1.1.17	The Contaminated Land Management Plan must be submitted for approval by the regulatory authority, where required under applicable legislation.

When developing the Contaminated Land Management Plan, Leaders should ensure that its objectives, are achievable, measurable and can be reported against. The Contaminated Land Management Plan should address the following:

- Elimination of any source of discharges to land;

- Onsite containment of hazardous chemicals/wastes;
- Security of the area (i.e. limiting access by people and animals); and
- Awareness of HSE hazards and risks associated with the contamination.

Activities conducted (e.g. monitoring of contaminated land) as part of the Contaminated Land Management Plan should be documented and records kept. AGL controlled sites should develop and implement data quality assurance (QA) and quality control (QC) procedures for sampling and chemical analysis of contaminated land. If chemical analysis is to be conducted onsite, standard analytical methods should apply and work carried out by competent and qualified professionals.

Incidents and Emergencies

RCM Ref	Minimum Control
9.1.1.18	Releases, spills, leaks or loss of containment incidents must be cleaned-up, as per AGL controlled site procedures.
9.1.1.19	The site Emergency Response Plan must include management of significant environmental incidents resulting in land contamination (i.e. major releases, spills, leaks or loss of containment).
9.1.1.20	Hazards, near misses and incidents resulting in potential or actual land contamination must be reported and investigated using the AGL Incident Management System.
9.1.1.21	Incidents that result in land contamination must be reported to the regulatory authority, in accordance with the notification requirements established by applicable legislation.

Clean-up procedures for incidents resulting in land contamination should include the following key elements, but not limited to:

- Spill control equipment;
- Personal Protective Equipment (PPE);
- Suitable methods of disposal of contaminated materials; and
- Internal and external communications, as required.

Significant releases, spills, leaks or loss of containment (e.g. failure of hazardous substance tanks and/or pipelines, rupture of bund wall) should be managed through the site Emergency Response Plan, and the Pollution Incident Response Management Plan (only applicable to NSW Environment Protection Licence holders). The site Emergency Response Plan should be aligned with the Emergency Preparedness and Response Standard (AGL-HSE-STD-010).

Releases, spills, leaks and/or loss of containment to land should be reported as per the HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1).

Land Remediation

RCM Ref	Minimum Control
9.1.1.22	Whenever remediation of contaminated land is required, it must be carried out as per protocols, methods and guidelines prescribed or agreed by the regulatory authority. When these are not available, comparable, or internationally recognised protocols, methods and guidelines must be used.

9.1.1.23	In the event that land contamination extends offsite, remediation must be carried out to a level acceptable by the regulatory authority.

AGL controlled sites are responsible for remediation of contaminated land to the extent that is required, to avoid or minimise the risk to human health and the environment.

1.1.1 Remediation Action Plan

RCM Ref	Minimum Control
9.1.1.24	A Remediation Action Plan must be developed, implemented, and documented for contaminated land areas requiring remediation.
9.1.1.25	AGL controlled sites must engage a suitably qualified contaminated land professional to develop the Remediation Plan.
9.1.1.26	A Remediation Action Plan must include the following: • Remediation goals, set to ensure that, on completion of the remediation and validation, the land be suitable for the proposed use and poses no unacceptable risk to human health and the environment; • Remediation option(s), to adequately deal with the nature and extent of land contamination; • Processes and procedures, to reduce any HSE risks to acceptable levels; • Environmental safeguards, to complete the remediation works in an environmentally acceptable manner; and • Approvals, licences and/or permits, to comply with any legislative requirements imposed by the regulatory authority(ies).

When selecting the most suitable remediation option(s), the preferred management hierarchy should be considered:

1. Onsite treatment, so that land contamination is remediated or the associated risk is reduced to an acceptable level;
2. Offsite treatment of excavated land, so that contamination is remediated or the associated risk is reduced to an acceptable level, after which land is returned to the site;
3. Onsite consolidation and isolation of contaminated land, by containment with a suitably designed barrier;
4. Removal of contaminated land to an approved site or facility, followed by replacement with appropriate material, if required; and
5. Implementation of an appropriate management strategy, if the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect.

When deciding on which option or mix of remediation options, Leaders should evaluate the environmental, social, and economic aspects of each option. If the appropriate remediation option(s) is not economically feasible, or not readily available, regulatory controls or other forms of remediation should be investigated.

The relevant Leader, in consultation with the Environment representative and the contaminated land professional, should prepare a Remediation Action Plan for all contaminated land that requires remediation. The Plan should reflect the planning of the remediation works and how its success will be evaluated (i.e. validated).

Remediation Works

RCM Ref	Minimum Control
9.1.1.27	AGL controlled sites must develop and implement control measures to manage land remediation works, and to ensure the health and safety of personnel involved in contaminated land remediation works.
9.1.1.28	Remediation works must be carried out in accordance with the Remediation Action Plan.

AGL controlled sites should develop and implement control measures to manage all aspects of land remediation works, taking into account compliance with relevant legislation and site-specific requirements and procedures related to contaminated land.

Remediation works are to be undertaken as per the Remediation Action Plan, considering assessed HSE risks and resources availability. Remediation works are to be documented and records kept at the relevant AGL controlled site.

Post-Remediation Validation

RCM Ref	Minimum Control
9.1.1.29	Post-Remediation validation must be carried out for each Remediation Action Plan, and a validation report must be produced by a qualified contaminated land professional.
9.1.1.30	A validation report must include details on the following: • Remediation works (including contaminated soil transport and disposal); • Assessment of post-remediation against the remediation goals, as set in the Remediation Action Plan; and • How regulatory authority(ies) approval, licence or permit conditions have been met (e.g. may require documentary evidence).
9.1.1.31	Post-remediation audits, requested by the regulatory authority, must be conducted, and complied with, as per legislative and other specified requirements. Audit findings must be reviewed by Leaders; and if required, corrective action plans must be developed and implemented.
9.1.1.32	Post-remediation validation must be carried out before any land disturbance occurs in an area that has been remediated.

Post-Remediation validation should be conducted to demonstrate that contaminated land has been remediated in accordance with the Remediation Action Plan, and to confirm whether the remediation goals have been achieved. This involves assessing the success of remediation, by conducting a validation sampling program.

If remediation goals were not achieved, the reasons should be identified and additional remediation works should be proposed to achieve those, where feasible. In addition, if full remediation cannot be achieved (i.e. area with residual contamination), Leaders should manage the area under a Contaminated Land Management Plan.

Land Rehabilitation

RCM Ref	Minimum Control
9.1.1.33	Rehabilitation of disturbed land areas must be carried out as soon as practicable after the completion of works or activity ends.
9.1.1.34	Rehabilitation of significantly disturbed land areas must be carried out in accordance with the Rehabilitation Plan.
9.1.1.35	*Rehabilitation conditions prescribed in regulatory approval(s) held by the AGL controlled site must be adhered to.*

Land rehabilitation at AGL controlled sites should aim to return disturbed lands to a safe, stable, and non-polluting condition, and to the agreed land use(s).

Land Rehabilitation Plan

RCM Ref	Minimum Control
9.1.1.36	A Rehabilitation Plan must be developed, implemented, and documented, for a land area(s) requiring rehabilitation.
9.1.1.37	A Rehabilitation Plan must include: • Rehabilitation objectives; • Rehabilitation planning, and associated rehabilitation works; • Rehabilitation evaluation, including development of appropriate rehabilitation criteria and indicators; and • Rehabilitation monitoring.

AGL controlled sites should develop a Rehabilitation Plan based on a set of site-specific rehabilitation objectives, which clearly defines the proposed rehabilitation outcomes. When developing rehabilitation objectives, the following should be taken into account:

- The degree the land should be rehabilitated, addressing potential environmental impacts;
- The requirements of the landholder, as expressed in the Access and Compensation Agreement (where applicable);
- The agreed land use(s); and
- The desired long-term outcome (i.e. land able to self-sustain or sustained by on-going management and maintenance).

Rehabilitation criteria and indicators should be developed for the established rehabilitation objectives. In order to measure progress towards achieving the objectives, rehabilitated areas should start to be monitored as soon as possible. Rehabilitation monitoring should be conducted as per the defined monitoring program and protocols, and results recorded. Any significant rehabilitation deficiencies detected during monitoring are required to be reported and corrective action taken.

If an AGL controlled site is required to continuously manage rehabilitation of a particular land area, ongoing monitoring and maintenance requirements should be planned and implemented to ensure that potential human health and/or environmental harm is limited to acceptable levels.

A Rehabilitation Plan should be reviewed if there are changes that directly impact its implementation (e.g. legislation, permit requirements, local land planning) or when new knowledge on land rehabilitation is likely to further enhance land management performance at the AGL controlled site.

Rehabilitation Works

RCM Ref	Minimum Control
9.1.1.38	AGL controlled sites must develop and implement control measures to manage land rehabilitation.
9.1.1.39	Rehabilitation works (e.g. landform shaping and stabilisation, erosion control and drainage) must be carried out in accordance with the Rehabilitation Plan.

AGL controlled sites should develop and implement control measures to manage all aspects of land rehabilitation works, taking into account compliance with relevant legislation, site specific requirements and procedures related to management of land, and the landholder's requirements (if required).

The relevant Leader, in consultation with the Environment representative, should assess soil and area characteristics (including surrounding environment), prior to rehabilitation works being undertaken, to determine which rehabilitation actions and techniques are suitable to achieve the rehabilitation objectives. Rehabilitation works are to be documented and records kept at AGL controlled site.

3.2.2. Training and Competency

RCM Ref	Minimum Control
9.1.1.40	Works carried out to investigate and remediate contaminated land, and rehabilitate land, must be carried out by suitably qualified and experienced professionals.

The Leaders responsible for land-related should verify that professionals appointed to carry out the activities have the appropriate qualifications or training, and are experienced and competent to conduct the work safely. Contaminated land professionals should have competencies consistent with the requirements of Schedule B (9) of the National Environment Protection (Assessment of Site Contamination) Measure 1999.

Personnel whose work could cause significant impacts to land, as identified by the AGL controlled site, should be competent to perform the tasks to which they are assigned. Specific training needs for individuals and teams should be determined through the implemented training and competency system, developed in alignment with the Training and Competency Methodology (AGL-HSE-SDM-013).

3.2.3. Definitions

Term	Definition
Acid Sulfate Soils	Acid Sulfate Soils are naturally occurring soils that contain iron-sulfides, which when exposed to air oxidise and produce acids. The acids can then leach, and release other substances (e.g. heavy metals), causing serious harm to the environment (e.g. can have severe impacts on flora and/or fauna).

Term	Definition
AGL Controlled Site	An AGL owned operated or controlled site, including a field operational site or an office site.
Agreed Land Use	Agreed land use refers to the selected land use for an area that has been remediated and/or rehabilitated. Agreement is reached in consultation with key stakeholders (e.g. land owner and regulatory authority) and considering legislation and regulatory requirements, land use of surrounding areas and conservation, ecological and heritage values of the area.
Appropriate Secondary Containment	Secondary containment (e.g. bunding) is a method of safeguarding used to contain any hazardous chemicals/wastes spillage in the event of loss of integrity or storage failure. "Appropriate secondary containment" is designed to ensure that the *most likely* quantity released from the primary containment (e.g. tank, container) does not escape secondary containment before clean-up occurs.
Contaminated Land	Contaminated land refers to land where chemical substance(s) or physical substance(s) (e.g. asbestos) are present in concentration(s) above the background or acceptable levels, that result or have the potential to result in real or potential harm to human health and/or the environment. Heavy metals (e.g. arsenic, cadmium, chromium, copper, mercury, nickel, zinc, and lead), petroleum fuels and oils, tars, and chemicals (e.g. solvents) are examples of substances often associated with contaminated land.
Hazardous Chemicals/Wastes	Hazardous chemicals/wastes pose a significant threat to human health and/or the environment, if people or the environment are exposed to them. Typically, these have toxic, corrosive, flammable, explosive, or radioactive characteristics.
HSE	Health, Safety, and Environment.
Land	The surface of the Earth that is not covered by water. Land includes soils, rocks, and minerals.
Land Contamination	Land contamination occurs when there is a noticeable (i.e. identified visually and/or by smell) or measurable change in the land characteristics, due to the presence of chemical/physical substance(s) at levels that pose a risk of harm to human health and/or the environment. Refer also to the 'Contaminated Land' definition.
Land Disturbance	Land disturbance refers to a change in the land surface, as a result of clearing, grading or excavation works. These works can be carried out manually and/or by use of machinery.
Land Rehabilitation	Land rehabilitation is the process of returning land to a suitable and safe state, for both people and the environment, after land use activities and/or natural disaster has resulted in its damage. Rehabilitation may be constrained not only by physical attributes of the area (i.e. climate, soil/rock types and size) but also by regulatory requirements such as land use planning and specific approval conditions.
Land Remediation	Actions taken to respond to land contamination, including: • Removal, dispersion, destruction, reduction, mitigation, or containment of land contamination, or

Term	Definition
	• Elimination or reduction of any hazard arising from land contamination (e.g. preventing people or animals of entering the land).
Land Use	Land use refers to how land resources are used by humans. Land uses include the modification and/or management of land for industrial, residential, agriculture, mining, forestry, and other uses (e.g. conservation areas).
Leader	Any employee who has others reporting to him or her, or who has the authority to allocate resources.
Material Harm to the Environment	Material harm to the environment means environmental harm that: • Comprises an environmental nuisance of a high impact or on a wide scale; and/or • Involves actual or potential harm to the health or safety of human beings that is not trivial or other actual or potential environmental harm that is not trivial nor negligible; and/or • Results in incurring reasonable costs and expenses to take all reasonable and practicable measures to prevent, mitigate or make good harm to the environment.
Significantly Disturbed Land Areas	Significantly disturbed land areas refers to areas that have undergone significant land disturbance and human intervention is needed to rehabilitate them. Significantly disturbed land includes for example: • Areas where vegetation has been removed or destroyed to an extent where the land has been made susceptible to erosion; and • Areas under temporary infrastructure. Temporary infrastructure includes any infrastructure (e.g. roads, tracks, bridges, culverts, dams, bores, buildings, and hardstand areas) which is to be removed after the activity/project has ceased.

4. Approval conditions and comments

4.1. PL446

Condition ID	Requirement	Actions and comments
Schedule E - Land		
E1	Contaminants must not be directly or indirectly released to land except as permitted under this environmental authority.	All personnel receive inductions and training to ensure that contaminants are not released to land. AGL has a range of controls to ensure that contaminants are not released to land.
E2	Prior to conducting petroleum activities that involve significant disturbance to land, an assessment must be undertaken of the condition, type and ecological value of any vegetation in such areas where the activity is proposed to take place.	AGL has an established Management of Change Process in place, that captures environmental risks through an assessment by the Environment Business Partner. Third party technical specialists are engaged to carry out environmental assessments if required.
E3	The assessment required by condition (E2) must be undertaken by a suitably qualified person and include an assessment of the bio-condition of the vegetation to be disturbed, the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas and the presence of species classed as endangered, vulnerable, rare or near threatened under the Nature Conservation Act 1992.	Third party technical specialists are engaged to carry out environmental assessments if required.
E4	If the assessment required by conditions (E2) and (E3) indicates that a Regional Ecosystem mapped as Endangered or Of Concern by the Queensland Herbarium should be in a different conservation value classification, the holder of this environmental authority must advise the administering authority in writing before any significant disturbance to land takes place.	Third party technical specialists are engaged to carry out environmental assessments if required, and to determine if notification to the administering authority is required.
E5	If, within the 20 business days following the lodgement of the notification under condition (E4) the administering authority notifies the holder of this environmental authority, in writing, that the Regional Ecosystem mapping requires further validation, then significant disturbance to land in the mapped Regional Ecosystem is prohibited until the administering authority provides written advice that significant disturbance to land may proceed.	Third party technical specialists are engaged to carry out environmental assessments if required, and to determine if notification to the administering authority is required.

E6	The holder of this environmental authority, when carrying out the petroleum activity(ies) must: a) avoid, minimise or mitigate (in order of preference) any impacts on areas of vegetation or other areas of ecological value b) minimise disturbance to land that may otherwise result in land degradation c) ensure that for land that is to be significantly disturbed by the petroleum activity(ies): i. the top layer of the soil profile is removed ii. soils are stockpiled in a manner that will preserve its biological and chemical properties; and iii. soils are used for rehabilitation purposes. d) avoid clearing mature trees; and e) prior to carrying out field-based petroleum activities, make all relevant staff, contractors or agents carrying out those petroleum activities, aware of the location of any Category A, B or C Environmentally Sensitive Areas and the requirements of this environmental authority.	AGL has an established Management of Change Process in place, that captures environmental risks through a desktop and field assessment by the Environment Business Partner. Third party technical specialists are engaged to carry out environmental assessments if required.
E7	Despite condition (E6), significant disturbance to land caused by the carrying out of the petroleum activities must not involve clearing vegetation or placing fill: a) in a way which significantly isolates, fragments or dissects tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional / local corridor networks) and/or results in an increase in threatening processes (e.g. potential impacts associated with edge effects or introduced species) b) on slopes greater than 10% for the petroleum activity(ies) other than for pipelines and wells; or c) in discharge areas.	See comment for condition E6.
E8	Clearing of remnant vegetation shall not exceed 10m in width for the purpose of establishing tracks or 20m in width for dual carriageway roads.	See comment for condition E6.
E9	Cleared vegetation must be stockpiled in a manner that facilitates respreading or salvaging and does not impede vehicle, stock or wildlife movements.	See comment for condition E6.
E10	The holder of this environmental authority must ensure that the petroleum activity(ies) is only conducted in accordance with Schedule E: Table 1 - Environmentally Sensitive Areas (ESAs) below for each of the ESA categories and associated primary and secondary protection zones.	See comment for condition E6.

<table>
<tr><td></td><td>
Schedule E: Table 1 – Environmentally Sensitive Areas (ESAs)
<table>
<tr><th>ESA Category</th><th>Within the ESA</th><th>Primary protection zone of the ESA</th><th>Secondary protection zone of the ESA</th></tr>
<tr><td>All Category A ESAs</td><td>No petroleum activities permitted</td><td>No petroleum activities permitted</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category B ESAs excluding 'Endangered' regional ecosystems</td><td>No petroleum activities permitted</td><td>No petroleum activities permitted</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category B ESAs: 'Endangered' regional ecosystems</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category C ESAs excluding 'Of Concern' regional ecosystems, State Forests and Timber Reserves</td><td>No petroleum activities permitted</td><td>No petroleum activities permitted</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category C ESAs: State Forests, Timber Reserves and 'Of Concern' regional ecosystems</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
</table>
</td><td></td></tr>
<tr><td>E11</td><td>Limited petroleum activities carried out in the secondary protection zone in accordance with condition (E 10) must be preferentially located in pre-existing areas of clearing or significant disturbance to the greatest practicable extent and avoid the clearing of mature trees.</td><td>See comment for condition E6.</td></tr>
<tr><td>E12</td><td>Limited petroleum activities carried out in the secondary protection zone in accordance with condition (E10) must be preferentially located in pre-existing areas of clearing or significant disturbance to the greatest practicable extent and avoid the clearing of mature trees.</td><td>See comment for condition E6.</td></tr>
<tr><td>E13</td><td>Where limited petroleum activities are proposed to be undertaken within the primary protection zone of, or in the Category B and C Environmentally Sensitive Area as authorised in Condition (E10), the holder of this environmental authority must be able to demonstrate that no reasonable or practicable alternative exists and that disturbance to land only be located and carried out in areas according to the following order of preference:
a) pre-existing cleared areas or significantly disturbed land within the primary protection zone of a Category C Environmentally Sensitive Area
b) pre-existing cleared areas or significantly disturbed land within the primary protection zone of a Category B Environmentally Sensitive Area
c) undisturbed areas within the primary protection zone of a Category C Environmentally Sensitive Area</td><td>See comment for condition E6.</td></tr>
</table>

	d) undisturbed areas within the primary protection zone of a Category B Environmentally Sensitive Area e) pre-existing areas of significant disturbance within a Category C Environmentally Sensitive Area (e.g. areas where significant clearing or thinning has been undertaken within a Regional Ecosystem, and/or areas containing high densities of weed or pest species which has inhibited re-colonisation of native regrowth) f) pre-existing areas of significant disturbance within a Category B Environmentally Sensitive Area (e.g. areas where significant clearing or thinning has been undertaken within a Regional Ecosystem and/or areas containing high densities of weed or pest species which has inhibited recolonisation of native regrowth) g) areas where clearing of a Category C Environmentally Sensitive Area is unavoidable; and h) areas where clearing of a Category B Environmentally Sensitive Area is unavoidable.	
E14	Notwithstanding Conditions (E10) and (E13), where limited petroleum activities are proposed to be undertaken within the primary protection zone of, or in a Category B or C Environmentally Sensitive Area, any vegetation clearing must not exceed any of the following areas: a) for the life of the project and before any activity commences, if the disturbance relates to an Endangered or Of Concern Regional Ecosystem, 10% of the remnant unit of Endangered or Of Concern Regional Ecosystem as ground truthed and mapped as per Conditions (E2) and (E3) of this environmental authority; and b) more than 30m2 for the construction of a sump; or c) more than 6m in width for tracks; or d) more than 12m in width for flow pipeline construction purposes.	See comment for condition E6.
E15	For each well site within the primary protection zone of, or in a Category B or C Environmentally Sensitive Area specified in condition (E10), all reasonable and practical measures must be taken to minimize the area cleared which must include but not be limited to, for each well site, ranked constraints mapping and a risk assessment which considers safety and environmental impacts.	See comment for condition E6.
E16	Details of any significant disturbance to land undertaken within the primary protection zone of, or in a Category B or C Environmentally Sensitive Area, along with a record of the assessment required by conditions (E2) and (E3) must be kept and submitted to the administering authority with each annual return.	The Annual Return form submitted to the administering authority requires AGL to consider whether any records must be attached to the submission. The draft submission is reviewed by Site Leaders and AGL Senior Leaders, including Group Counsel.
E17	A Soil Management Plan which has been certified by a suitably qualified person must be developed within 6 months of the date of issue of this approval.	The Silver Springs Soil Management Plan was developed in October 2011. A copy is maintained on the AGL network.

E18	The Soil Management Plan must include, but not necessarily be limited to: a) establishing baseline soils information for areas to be disturbed including soil depth, pH, electrical conductivity (EC), chloride, cations (aluminium, calcium, magnesium, potassium and sodium), exchangeable sodium percentage (ESP), particle size and soil fertility (including carbon, nitrogen, phosphorous, potassium, sulphur and micronutrients) b) a soils monitoring program outlining parameters to be monitored, frequency of monitoring and acceptable ranges for each parameter c) identification of soil units within areas to be disturbed by the petroleum activity(ies) at a scale of 1 :50,000, in accordance with the "Guidelines for Surveying Soil and Land Resources, 2nd Edition" (McKenzie et al. 2008), "Australian Soil and Land Survey Handbook, 3rd Edition" (National Committee on Soil and Terrain 2009) and "The Australian Soil Classification" (Isbell 2002), as amended from time time d) development of soil descriptions that are relevant to assessment for agricultural suitability, topsoil assessment, erodibility and rehabilitation, for example: i. black earths ii. shallow cracking clay soils iii. deep cracking clay soils iv. deep saline and/or sodic cracking clay soils with melon holes v. thin surface, sodic duplex soils vi. medium to thick surface (i.e > 15cm), sodic duplex soils; and vii. non-sodic duplex soils. e) detailed horizon and soils compaction management procedures, including top soil and top soil stockpile management procedures to minimise the impacts of soil disturbance and promote successful rehabilitation f) detailed mitigation measures and procedures to manage the risk of adverse soil disturbance in the carrying out of the petroleum activity(ies) g) for pipelines, methods of keeping soil horizons separate on excavation, storage and backfilling; and h) for areas of good quality agricultural land, detailed methods to be undertaken to minimise potential impacts to soil productivity.	See comment for condition E17.
E19	The holder of this environmental authority must implement the Soil Management Plan.	AGL implements the Soil Management Plan as part of its Management of Change process for new projects. The Environment Business Partner carries out an environmental assessment, which includes consideration of soils and land quality.

E20	A copy of the Soil Management Procedures must be submitted to any potentially affected landholder upon request by that landholder.	A copy of the Plan is kept on AGLs servers. To date, there has been no such requests from landholders.
E21	Fauna management procedures must be developed within 6 months from the date of issue of this approval.	AGL developed an EMP which included Fauna Management Procedures at the commencement of operations.
E22	The fauna management procedures must be certified by a suitably quality person	See comment for condition E21.
E23	The fauna management procedures must ensure that the petroleum activity(ies) (including, but not necessarily limited to: pipeline construction, dam construction and operation) are carried out in a manner that minimises the risk of injury, harm, or entrapment to wildlife and stock.	See comment for condition E21.
E24	Well lease infrastructure and dams must be securely fenced and/or screened after construction is completed to: a) exclude and prevent the entrapment of livestock and terrestrial wildlife; and b) limit habitats for the introduction or spread of pests.	See comment for condition E21.
E25	The fauna management procedures must include training and awareness of staff and contractors.	AGLs inductions and contractor icebreaker sessions include training and awareness on fauna management procedures.
E26	Planned fauna handling must be undertaken by a suitably qualified person.	AGL has a licensed spotter/catcher in place at Silver Springs, being the Asset Manager (James Dean).
E27	The holder of this environmental authority must implement the fauna management procedures. *Note: The procedures required by conditions (E21) and (E27) should consider the "Australian Pipeline Industry Association Code of Environmental Practice - Onshore Pipelines" March 2009, as amended from time to time.*	This EMP is used to implement the fauna management procedures, along with AGLs Management of Change process.
Schedule I - Rehabilitation		
I1	Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than 3 months after completion.	There have not been any recent pipeline installations on PL446.
I2	During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.	See comment for condition I1.
I3	Backfilled and rehabilitated pipeline trenches must: a) be a stable landform b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and c) be re-profiled to a level consistent with surrounding soils d) be re-profiled to original contours and established drainage lines e) be visually consistent with the surround land features; and	See comment for condition I1.

	f) (f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	
I4	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must commence as soon as practicable, but not longer than 9 months following the completion of any construction or operational works associated with the petroleum activity(ies).	AGL has plans to commence rehabilitation of disused dams in FY21, provided that the budget request is approved. This includes dams at the SSP facility (oily water dams) and dams located on landholder properties within PL446. AGL is currently running a Land Contamination Program across all of its national assets to identify and remediate contaminated land risks.
I5	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must: a) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt) b) reshape all significantly disturbed land to a stable landform c) reprofile all significantly disturbed land to original contours d) on all significantly disturbed land: i. re-establish surface drainage lines ii. reinstate the top layer of the soil profile iii. establish groundcover to ensure that erosion is minimised; or iv. establish vegetation based upon the floristic species composition found in analogue sites (using stock of local provenance where possible) to achieve the benchmark parameters outlined in condition (A7). e) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and/or minimise environmental harm.	See comment for Condition I4.
I6	All significantly disturbed land caused by the carrying out of the petroleum activity(ies) must be rehabilitated to meet the following final acceptance criteria: a) all significantly disturbed land is reinstated to the pre-disturbed land use unless otherwise agreed to between the holder of this environmental authority, the landholder and the administering authority and is provided for in the Operational Plan b) all significantly disturbed land is reinstated to the pre-disturbed soil suitability class c) the landform is safe for humans and fauna d) the landform is stable with no subsidence or erosion gullies for at least 5 years e) a minimum of 80% foliage cover of analogue sites is maintained in the rehabilitated sites for at least 3 years	See comment for Condition I4.

	f) a minimum of 80% of the flora species diversity in analogue sites is maintained in the rehabilitated sites for at least 3 years g) a minimum equal density of habitat structures, including but not limited to litter cover, fallen woody material and hollow logs, as that in analogue sites h) erosion is minimised with appropriate sediment traps and erosion control measures installed as determined by a suitably qualified person i) the water quality of any residual void or water bodies constructed by the petroleum activity(ies) meets criteria for subsequent uses and does not have potential to cause environmental harm; j) there is no ongoing contamination to waters k) there is no ongoing contamination to groundwater from dams or monocells (demonstrated via groundwater monitoring and leak detection monitoring systems); and l) (l) the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance caused by carrying out the petroleum activities.	
I7	Notwithstanding condition (16), all buried pipelines must be decommissioned in accordance with the requirements of Australian Standard 2885.	There are currently no plans to rehabilitate any buried pipelines.
I8	Notwithstanding condition (16), any dam may be decommissioned for a beneficial use provided that it is approved or authorised by the administering authority and the landowner.	This is a future requirement; see comments for Condition I4.

4.2. PFL27

Condition ID	Requirement	Actions and comments
Schedule G - Land		
C1	Contaminants must not be directly or indirectly released to land, except as permitted by conditions (C2) and (C3).	AGL has dedicated above ground storage tanks for waste oil and coolant. Contaminated soil from minor spills is temporarily stored in a dedicated intermediate bulk container (IBC) within a pallet bin.
C2	Measures to minimise stormwater entry onto significantly disturbed land must be implemented and maintained. (PESCC14)	The Wallumbilla facility is located on an elevated part of the landscape. Concentrated stormwater flow does not enter the site.
C3	Sediment and erosion control measures to prevent soil loss and deposition beyond significantly disturbed land must be implemented and maintained. (PESCC15)	There is a variety of drainage and erosion controls on-site to minimise erosion and subsequent sedimentation. Drainage controls consist of flow diversion berms located in strategic areas, and erosion controls consist of groundcover including blue metal aggregate and grassed areas. The Environment Business Partner is a Certified Professional in Erosion and Sediment Control and frequent inspections are carried out.
C4	Chemicals and fuels on the relevant tenures must be stored in, or serviced by, an effective containment system that meets Australian Standards, where such a standard is relevant. (PESCC16)	Chemicals are stored in intermediate bulk containers within bunded areas. Diesel is stored in double skinned steel tanks, which are subject to integrity tests and inspections.
Schedule G - Rehabilitation		
G1	All buried pipelines must be decommissioned in accordance with the requirements of Australian Standard 2885, as amended from time to time.	This a future requirement at the end of the asset life.
G2	When no longer required all low hazard dams must be decommissioned to no longer accept inflow from the petroleum activities and be either: a) rehabilitated; or b) agreed to in writing by the administering authority and the landholder to remain in situ following the cessation of the petroleum activities associated with the dam, with the contained water of a quality suitable for the intended ongoing uses by that landholder. (PESCC20)	There is a small (disused) firewater dam on-site that was replaced in 2019 with a large steel firewater tank.
G3	Significantly disturbed areas must be rehabilitated so that: a) the areas are reshaped to a stable landform	This is a future requirement. The entire site (7ha) is a significantly disturbed area, however there are decades of asset life remaining.

	b) the areas are re-profiled to contours consistent with the surrounding landform c) surface drainage lines are re-established d) top soil is reinstated.	
G4	All significantly disturbed land caused by the carrying out of the petroleum activities must be rehabilitated to meet condition (G3) and the following final acceptance criteria: a) any contaminated land (e.g. contaminated soils, decommissioned dams containing salt) is remediated and rehabilitated b) rehabilitation is undertaken in a manner such that any actual or potential acid sulfate soils on the area of significant disturbance are treated to prevent or minimise environmental harm in accordance with the Instructions for the treatment and management of acid sulfate soils c) (2001), published by the Queensland Government and amended from time to time. d) for land that is not being cultivated by the landholder: i. groundcover, that is not a declared pest species is established and self-sustaining ii. vegetation of similar species richness and species diversity to pre-selected analogue sites is established and self-sustaining e) for land that is to be cultivated by the landholder, cover crop is reinstated, unless the landholder will be preparing the site for cropping within 3 months of petroleum activities being completed.	See comments for condition G3.
G5	Monitoring of performance indicators must be carried out on rehabilitation activities until final acceptance criteria in condition (G4) have been met for the rehabilitated area	See comments for condition G3.

4.3. PL192

Condition ID	Requirement	Actions and comments
Schedule F- Land		
F1	Contaminants must not be directly or indirectly released to land except as authorised by condition (C5).	The Churchie facility is located on PL192. The facility has a dedicated bunded area for the storage of raw materials. Chemicals are stored in intermediate bulk containers (IBCs). There is also two lined produced water dams (0.5ML each) in place.
F2	Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.	The pipelines were installed several years ago. Future pipe laying will be subject to AGLs Management of Change process and the Environment Business Partner is responsible for ensuring all licence conditions have been complied with.
F3	During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.	Future pipe laying will be subject to AGLs Management of Change process and the Environment Business Partner is responsible for ensuring all licence conditions have been complied with.
F4	Backfilled and rehabilitated pipeline trenches must: a) be a stable landform; b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and c) be re-profiled to a level consistent with surrounding soils; and d) be re-profiled to original contours and established drainage lines; and e) be visually consistent with the surround land features; and. f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	Future pipe laying will be subject to AGLs Management of Change process and the Environment Business Partner is responsible for ensuring all licence conditions have been complied with.

F5	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity(ies).	AGL's operations are confined to specific areas of land disturbance that are necessary to operate the project. As such, there are no current opportunities to progressively rehabilitate the land to reduce significantly disturbed areas.
F6	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must: a) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt); b) reshape all significantly disturbed land to a stable landform; c) reprofile all significantly disturbed land to original contours; d) on all significantly disturbed land: i. re-establish surface drainage lines; ii. reinstate the top layer of the soil profile; iii. establish groundcover to ensure that erosion is minimised; iv. establish vegetation of floristic species composition found in analogue sites; e) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and I or minimise environmental harm.	See comments for condition F5.
Schedule G – Disturbance to Land		
G1	Prior to undertaking activities that result in significant disturbance to land in areas of native vegetation, confirmation of on-the-ground biodiversity values of the native vegetation communities at that location must be undertaken by a suitably qualified person.	AGL has implemented a Management of Change process that involves the Environment Business Partner undertaking an initial assessment of land disturbance activities to ascertain the likely impacts. Third party consultants are engaged if advice from technical specialists is required.
G2	A suitably qualified person must develop and certify a methodology so that condition (G1) can be complied with and which is appropriate to confirm on-the-ground biodiversity values.	See comments for condition G2.

G3	Where mapped biodiversity values differ from those confirmed under conditions (G1) and (G2), petroleum activities may proceed in accordance with the conditions of the environmental authority based on the confirmed on-the-ground biodiversity value.	See comments for condition G2.
G4	The location of the petroleum activity(ies) must be selected in accordance with the following site planning principles: a) maximise the use of areas of pre-existing disturbance b) in order of preference, avoid, minimise or mitigate any impacts, including cumulative impacts, on areas of native vegetation or other areas of ecological value c) minimise disturbance to land that may otherwise result in land degradation d) in order of preference, avoid then minimise isolation, fragmentation, edge effects or dissection of tracts of native vegetation; and e) in order of preference, avoid then minimise clearing of native mature trees.	See comments for condition G2.
G5	Linear infrastructure construction corridors must: a) maximise co-location b) be minimised in width to the greatest practicable extent; and c) for linear infrastructure that is an essential petroleum activity authorised in an environmentally sensitive area or its protection zone, be no greater than 40m in total width.	See comments for condition G2.
G6	Where petroleum activities are to be carried out in environmentally sensitive areas or their protection zones, the petroleum activities must be carried out in accordance with Protection of Biodiversity Values, Table 1 - Authorised Petroleum Activities in Environmentally Sensitive Areas and their protection zones (see environmental authority).	See comments for condition G2.

Protection of Biodiversity Values, Table 1 – Authorised petroleum activities in Environmentally Sensitive Areas and their protection zones

Environmentally sensitive area	Within the environmentally sensitive area	Primary protection zone of the environmentally sensitive area	Secondary protection zone of the environmentally sensitive area
Category A environmentally sensitive areas	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are other than 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.
Category C environmentally sensitive areas that are 'nature refuges' or 'koala habitat'	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	
Category C environmentally sensitive areas that are 'essential habitat', 'essential regrowth habitat', or 'of concern' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'regional parks' (previously known as 'resources reserves')	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'state forests' or 'timber reserves'	Only essential petroleum activities permitted.	Petroleum activities permitted.	
Areas of vegetation that are 'critically limited'	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	

<table>
<tr><td>G7</td><td>Despite condition (G6) of this environmental authority, the infrastructure (and associated activities necessary for construction, operational and maintenance purposes) within Schedule G: Table 2 - Authorised Petroleum Activity(ies) Disturbance are permitted within a Category B ESA that is an Endangered Regional Ecosystem at the location specified.

Schedule G: Table 2 – Authorised Petroleum Activity(ies) Disturbance
<table><tr><th>Tenure</th><th>Description of Infrastructure</th><th>Number</th><th>Location</th></tr><tr><td rowspan="4">PL192</td><td>Churchie 1 Well Site</td><td>1</td><td>Lat – 27^0 05' 53.448" S
Long – 149^0 12' 55.3357" E</td></tr><tr><td>Churchie 1A Well Site</td><td>1</td><td>Lat – 27^0 05' 40.1407" S
Long – 149^0 12' 53.7600" E</td></tr><tr><td>Churchie 2 Well Site</td><td>1</td><td>Lat – 27^0 06' 07.7582" S
Long – 149^0 12' 12.2389" E</td></tr><tr><td>Churchie 4 Well Site</td><td>1</td><td>Lat – 27^0 05' 15.1476" S
Long – 149^0 12' 32.3397" E</td></tr></table></td><td>See comments for condition G2.</td></tr>
<tr><td>G8</td><td>A report must be prepared for each annual return period for all petroleum activities that involved clearing of any environmentally sensitive area or protection zone which includes:
a) Records able to demonstrate compliance with condition (G4), (G5) and (G6)
b) a description of the works
c) a description of the area and its pre-disturbance values (which may include maps or photographs, but must include GPS coordinates for the works); and
d) (d) based on the extent of environmentally sensitive areas and primary protection zones on the relevant resource authority(ies), the proportion of native vegetation cleared per environmentally sensitive area and primary protection zone, including regional ecosystem type, over the annual return period.</td><td>The Environment Business Partner prepares the Annual Return for each lease. The draft Annual Report and all supporting information is reviewed by Site Leaders, Senior Managers and Group Counsel before lodgement with the administering authority.</td></tr>
<tr><td>G9</td><td>Impacts to State significant biodiversity values are not authorised, except as permitted by condition (G7).</td><td>See comments for condition G2.</td></tr>
</table>

4.4. PL213

Condition ID	Requirement	Actions and comments
4	The holder of the environmental authority must ensure that petroleum activities: a) are not conducted within a category A or B environmentally sensitive area; and b) do not cause a significant disturbance within 1 km of a category A environmentally sensitive area or within 500m of a category B environmentally sensitive area; c) are not conducted in a category C environmentally sensitive area unless there is a written agreement to enter the area from the relevant administering authority. d) Notwithstanding, condition 4(a) and 4(b), the proposed well within graticular block CHAR2727F and petroleum activities carried out within the 500m buffer zone to any Endangered Regional Ecosystem (ERE), but not within 50m of any ERE, must be in accordance with the scale and intensity of activities outlined below: i. the drill site must not disturb an area greater than 10,000 m2; ii. the flare pit size must not be greater than 10 m2; iii. the mud pit size must not be greater than 600 m2; iv. topsoil stripping must be limited to the sump and flare pit area; v. clearing of mature trees must be prevented or minimised during drill site construction; vi. existing access and fence line tracks must be used where possible and any new tracks must be constructed by linking natural clearings where possible; and vii. track construction involving blade clearing of established ground cover vegetation and/or clearing of mature trees must be prevented or minimised.	AGL has implemented a Management of Change process that involves the Environment Business Partner undertaking an initial assessment of land disturbance activities to ascertain the likely impacts. Third party consultants are engaged if advice from technical specialists is required.
5	The holder of the environmental authority must: a) take all reasonable and practicable measures to minimise disturbance to land in order to prevent land degradation; and b) ensure that for land that is to be significantly disturbed by petroleum activities, the top layer of the soil profile is removed and	See comments for Condition 4.

	i. stockpiled in a manner that will preserve its biological and chemical properties; and ii. used for rehabilitation purposes (refer Condition 18).	
6	The holder of this environmental authority must: a) take all reasonable and practicable measures to prevent or minimise disturbance to vegetation by petroleum activities and manage the effects of clearing to prevent the loss of biodiversity, maintain ecological processes and prevent land degradation. b) The holder of the environmental authority must not clear: i. in, or within 50 metres of, the high bank of a watercourse; ii. in, or within 50 metres of, the static high water mark of wetlands, lakes or springs; iii. in a way that isolates clumps or dissects corridors of vegetation; iv. on slopes greater than 5%; v. on dispersible soils vi. in existing or potential discharge areas; and vii. in areas subject to waterlogging or at risk of waterlogging as a result of clearing; viii. except for necessary construction and maintenance of roads, tracks and pipelines where there is no suitable alternative site for the road, track or pipeline. c) the holder of the environmental authority must not clear in areas with a high probability of acid sulfate soils unless the clearing is conducted in accordance with an acid sulfate soil environmental management plan prepared in accordance with the State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils and Guideline.	See comments for Condition 4.
13	The holder of the environmental authority must ensure that the storage of all flammable and combustible liquids: a) is contained within an on-site containment system; and b) is controlled in a manner that prevents environmental harm; and c) is maintained in accordance with Section 2.4 for minor storages and Section 5.8 for storages above 10,000L of Australian Standard AS 1940-2004 The Storage and Handling of Flammable and Combustible Liquids.	AGL does not store any flammable and combustible liquids on PL213.

<table>
<tr>
<td>14</td>
<td>Notwithstanding the other conditions of this environmental authority, if a hazardous contaminant is released to waters or land, the holder of the environmental authority must:
a) take immediate action to stop any further release;
b) take immediate action to contain the hazardous contaminant to the affected area, taking particular care to protect environmentally sensitive areas;
c) restore or rehabilitate the environment to its condition before the release occurred; and
d) prevent a recurrence of the release.</td>
<td>AGLs HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1) is used by personnel to respond to situations involving contamination of land or waters.</td>
</tr>
<tr>
<td>18</td>
<td>As soon as practicable and within 6 months (or longer period agreed in writing with the administering authority) of the completion of petroleum activities causing significant disturbance to land, the holder of the environmental authority must:
a) remediate contaminated land (e.g. evaporation ponds containing hazardous waste) in accordance with Environmental Protection Act 1994 requirements;
b) reshape all significantly disturbed land to a stable landform similar to that of surrounding undisturbed areas; and
c) on all significantly disturbed land, take all reasonable and practicable measures to:
i. re-establish surface drainage lines; and
ii. reinstate the top layer of the soil profile.
d) revegetate the areas identified as Endangered Regional Ecosystems with plant species from the same ecosystem type. Consult with the Environmental Protection Agency prior to commencing rehabilitation to determine the most appropriate techniques and seed mixture for the specific area.
e) Rehabilitation of all areas disturbed within the Endangered Regional Ecosystem will be completed as soon as practical but no longer than three months after completion of the disturbance activity.
f) Environmentally Sensitive areas identified within and adjacent to PL213 are listed in the table below.

<table><tr><td>Category</td><td>Land Classification</td></tr><tr><td>B</td><td>Endangered Regional Ecosystem (including but not limited to): 11.3.17</td></tr></table></td>
<td>This is a future requirement.</td>
</tr>
<tr>
<td>19</td>
<td>All infrastructure, constructed by or for the holder of the environmental authority, including water storage structures, must be removed by the holder from the site and the sites rehabilitated according to Condition 18, prior to surrender of the petroleum</td>
<td>This is a future requirement.</td>
</tr>
</table>

	authority, except where it is to remain with the written agreement of the administering authority and post petroleum authority landowner/holder.	

4.5. PL 15

Condition ID	Requirement	Actions and comments
Schedule F - Land		
F1	Contaminants must not be directly or indirectly released to land.	AGL does not store contaminants on these leases.
F2	Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.	The underground pipelines that traverse the leases are PPL93 (Waggamba to Taylor) and also PPL4 (Silver Springs to Wallumbilla). These pipelines are operated under separate environmental licences.
F3	During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.	The pipelines were installed several years ago, prior to AGL acquiring the assets.
F4	Backfilled and rehabilitated pipeline trenches must: a) be a stable landform; b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and c) be re-profiled to a level consistent with surrounding soils; and d) be re-profiled to original contours and established drainage lines; and e) be visually consistent with the surround land features; and. f) (f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	See comments for Condition F3.
F5	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity(ies).	This is a future requirement at end of asset life.
F6	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must:	AGL has not undertaken any formal progressive rehabilitation of significantly disturbed areas as this is a future requirement at

	a) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt); b) reshape all significantly disturbed land to a stable landform; c) reprofile all significantly disturbed land to original contours; d) on all significantly disturbed land: i. re-establish surface drainage lines; ii. reinstate the top layer of the soil profile; iii. establish groundcover to ensure that erosion is minimised; iv. establish vegetation of floristic species composition found in analogue sites; e) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and / or minimise environmental harm.	the end of asset life. AGL undertakes periodic inspections to determine whether any contamination or drainage issues are present.

4.6. PLs 48, 49, 66, 202

Condition ID	Requirement	Actions and comments
Schedule F - Land		
F1	Contaminants must not be directly or indirectly released to land.	AGL does not store contaminants on PLs 15, 48, 49, 66, 202.
F2	Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.	The underground pipelines that traverse the leases are PPL93 (Waggamba to Taylor) and also PPL4 (Silver Springs to Wallumbilla). These pipelines are operated under separate environmental licences.
F3	During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.	The pipelines were installed several years ago, prior to AGL acquiring the assets.
F4	Backfilled and rehabilitated pipeline trenches must: g) be a stable landform; h) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and i) be re-profiled to a level consistent with surrounding soils; and	See comments for Condition F3.

	j) be re-profiled to original contours and established drainage lines; and k) be visually consistent with the surround land features; and. l) (f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	
F5	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity(ies).	This is a future requirement at end of asset life.
F6	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must: f) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt); g) reshape all significantly disturbed land to a stable landform; h) reprofile all significantly disturbed land to original contours; i) on all significantly disturbed land: v. re-establish surface drainage lines; vi. reinstate the top layer of the soil profile; vii. establish groundcover to ensure that erosion is minimised; viii. establish vegetation of floristic species composition found in analogue sites; j) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and / or minimise environmental harm.	AGL has not undertaken any formal progressive rehabilitation of significantly disturbed areas as this is a future requirement at the end of asset life. AGL undertakes periodic inspections to determine whether any contamination or drainage issues are present.

4.7. PPL 4

Condition ID	Requirement	Actions and comments
Schedule D - Land		
D1	Contaminants must not be directly or indirectly released to land except as permitted under this environmental authority.	AGL does not store contaminants on PPL4, being the pipeline between Silver Springs and Wallumbilla. A breach of the pipeline would result in high pressure gas escaping to atmosphere. Many control measures are in place to prevent pipeline breaches.
D2	Prior to conducting petroleum activities that involve significant disturbance to land, an assessment must be undertaken of the condition, type and ecological value of soils and vegetation in such areas where the activity is proposed to take place.	The pipeline was installed several years ago (approx. mid 1980s). Activities now include inspecting and maintaining the right of way. If new disturbances are required, AGLs management of change process is used to determine potential impacts and control measures.
D3	The assessment required by condition (D2) must be undertaken by a suitably qualified person and include the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas, wetlands and the presence of species classed as endangered, vulnerable, rare or near threatened under the Nature Conservation Act 1992.	AGLs Environment Business Partner carries out the initial assessment as part of the risk management process. If specialist advice is required, third party technical specialists are engaged.
D4	The assessment required by condition (D2) must include, but not necessarily be limited to: a) identification of the vegetation communities present (including species composition and regional ecosystem type2 for native vegetation communities) within each area(s) to be disturbed; b) data representing each vegetation community present within each area(s) to be rehabilitated including: i. flora species richness and diversity; ii. structural data including woody stem count densities for dominant species within each stratum; and iii. percent foliage cover (accounting for seasonal variation and excluding pests); c) data regarding habitat features, including but not necessarily limited to: i. organic litter cover (%); and ii. trees with hollows ;;:10cm diameter (count and number per hectare); iii. hollow bearing logs (count and number per hectare); and	AGLs Environment Business Partner carries out the initial assessment as part of the risk management process. If specialist advice is required, third party technical specialists are engaged.

	iv. a map or series of maps of suitable scale displaying the distributing of vegetation communities.	
D5	Notwithstanding conditions (D2) - (D4), the as-constructed pipeline right of way is authorised.	This condition is for information purposes.
D6	Pest management procedures must be developed by 22 September 2011.	AGL developed and implemented an Environmental Management Plan upon acquisition of the project. The Plan included a section on fauna management and it was prepared by a suitably qualified person. The Plan is implemented through business as usual activities, including raising matters at daily toolbox meetings and/or through direct communication with the Environment Business Partner.
D7	The pest management procedures must be certified by a suitably qualified person.	See comment for Condition D6.
D8	The pest management procedures must include, but not necessarily be limited to: a) identification of pest species and infestation areas; b) prevention and/or minimisation of the introduction and/or spread of pests; c) control and management of pest outbreaks as a result of the petroleum activity(ies); d) details of community consultation ln developing the pest management procedures.	See comment for Condition D6.
D9	A copy of the pest management procedures must be made available to any potentially affected landholder upon request by that landholder.	AGL has not received any such requests from landholders.
D10	The holder of this environmental authority must implement the pest management procedures.	See comment for Condition D6.
D11	All explosives, hazardous chemicals, corrosive substances, toxic substances, gases, dangerous goods, flammable and combustible liquids (Including petroleum products and associated piping and infrastructure) must be stored and handled in accordance with the relevant Australian Standard where such is available.	AGL does not store any of these materials on PPL4.
D12	Notwithstanding the requirements of any Australian Standard, any liquids stored on site that have the potential to cause environmental harm must be stored in, or serviced by, an effective containment system that is impervious to the materials stored and managed to prevent the release of liquids to waters or land.	AGL does not store any of these materials on PPL4.
D13	Where no relevant Australian Standard is available for the chemical and / or fuel storage activity, the following requirements apply: a) storage tanks must be bunded so that the capacity and construction of the bund is sufficient to contain at least 110% of a single storage tank or 100% of the largest storage tank plus 10% of the second largest storage tank in multiple storage areas; and	AGL does not store any of these materials on PPL4.

	b) drum storages must be bunded so that the capacity and construction of the bund is sufficient to contain at least 25% of the maximum design storage volume within the bund.	
D14	All containment systems must be designed to minimise rainfall collection within the system.	AGL does not store any of these materials on PPL4.
Schedule H – Pipelines		
H1	The holder of this authority must ensure that the pipeline is operated and maintained in accordance with AS2885 or any subsequent versions thereof, and accepted engineering standards.	AGL has a multidisciplinary team of personnel in place to meet compliance with this condition. The team consists of a variety of engineering disciplines (process, electrical, instruments, pipeline integrity) who are responsible for managing compliance of the pipeline.
H2	The condition of the relevant pipelines must be assessed by a suitably qualified and experienced person on an annual basis.	AGL engages a third party technical specialist to perform an annual pipeline survey, which involves a leak detection program.
H3	The condition of pipelines must be monitored for early signs of loss of structural or hydraulic integrity based on the advice of a suitably qualified and experienced person.	AGLs Pipeline and Integrity Engineer oversees an inspection program to ensure that the pipeline is subject to an appropriate monitoring system. This includes surveys to assess coating integrity, and intelligent pigging programs.
H4	In the event of early signs of loss of structural or hydraulic integrity, the holder of this authority must take action to prevent or minimize any actual or potential environmental harm, and report any findings and actions taken to the administering authority.	AGLs Hazard, Near Miss and Incident Reporting Procedure is used to manage environmental events including notification to the administering authority.
H5	The holder of this authority must decommission the pipeline in accordance with AS2885 and to a situation where ongoing environmental harm is prevented. As a minimum, pipelines must be decommissioned such that: a) pipelines no longer contain hazardous contaminants; b) pipelines are left in stable condition; c) all the above ground Infrastructure Is removed, and d) all areas disturbed by above ground Infrastructure are rehabilitated in accordance with the requirements of this authority.	This is a future requirement for AGL.
H6	Prior to the commencement of decommissioning or abandonment activities, the scope of work for decommissioning or abandonment shall be developed and agreed to with the administering authority.	See comment for Condition H5.

H7	The holder of this environmental authority must ensure that activities conducted in accordance with this authority do not compromise the integrity of another pipeline, whether or not that pipeline is under the control of the holder.	AGL is not aware of any other pipelines being affected by the activities relating to the operation of PPL4 or the maintenance of the right of way.
Schedule I - Rehabilitation		
I1	A Rehabilitation Plan which has been certified by a suitably qualified person must be developed by 22 December 2011.	The current Rehabilitation Plan for PPL4 is dated 15 November 2013. It was prepared by Nigel Goulding of M.S Environmental Science and Engineering.
I2	The Rehabilitation Plan must include strategies for the determination of final land use(s) and rehabilitation goals and details of how rehabilitation objectives will be achieved. The Rehabilitation Plan must include: a) a rehabilitation hierarchy for: i. reinstating a native ecosystem as similar as possible to the original ecosystem as the preferred option; then ii. establishing an alternative outcome with a higher environmental value than the previous land use; then iii. reinstating the previous land use (e.g. grazing or cropping); and b) methods to achieve rehabilitation goals Including, but not necessarily being limited to: i. establishing final land use(s) in consultation with affected landholder(s) and the administering authority; ii. identifying suitable analogue sites to measure rehabilitation success that may either be the pre-disturbed area or another area that has equivalent values and characteristics as the intended final land use(s); and iii. for sites that are being reinstated to a land use other than a native ecosystem, the Rehabilitation Plan must identify any additional and relevant indicators to be measured at both the analogue and rehabilitation site(s) so as to assess progressive and final rehabilitation success for that land use; iv. for sites that are being reinstated to native ecosystems and the analogue site is the pre-disturbed site, the Rehabilitation Plan must Include indicators that, as a minimum include those in condition (D3)(a) - (03)(d) and will be able to measure success against the progressive and final rehabilitation criteria in this environmental authority; v. identification of any land use constraints which have resulted from the petroleum activity(ies); vi. residual pollution risks with strategies for managing and mitigating them; vii. landscape planning and landform design principles to achieve stable landforms including slope designs, erosion controls and drainage lines;	The Plan was prepared against the requirements of this condition.

	viii. integrating rehabilitated areas so they are compatible with the surrounding landscape, including linking rehabilitated areas of native vegetation with undisturbed native vegetation to provide larger areas and wildlife corridors where feasible; ix. ensuring that significantly disturbed areas are rehabilitated progressively and that the progressive rehabilitation criteria are routinely measured; x. site preparation such as re-profiling, re-instating surface drainage systems; xi. top soil management such as top soil handling and stockpiling to preserve soil fertility and biota, respreading techniques, planned thickness, ripping, top soil treatments I amendments and mulching in consideration of analogue data; xii. flora to be established, Including required species diversity, abundance and composition and projective cover in consideration of analogue data; xiii. plant propagation and / or supply methods including using seeds/ spores of local provenance where feasible; xiv. establishment methods to maximise rehabilitation success such as seed treatments, seed spreading, timing of seeding to suit best local climatic conditions, hydroseeding, transplanting; xv. weed control; xvi. sourcing habitat structures for native fauna and installation .methods in consideration of matching analogue data; xvii. on going maintenance program for rehabilitated areas; and xviii. rehabilitation monitoring program as required by conditions (111) and (112) of this environmental authority; and c) timeframes for commencing rehabilitation of significantly disturbed areas not required for the ongoing conduct of the petroleum activity(les), not greater than three (3) months for the rehabilitation of buried pipelines and not greater than nine (9) months for any other disturbed area.	
I3	The holder of this environmental authority must implement the Rehabilitation Plan.	This is a future requirement.
I4	Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.	The pipeline was installed decades ago (approximately mid-1980s), and no new pipelines have been installed on PPL4 by AGL.
I5	During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.	See comment for Condition I4.
I6	Backfilled and rehabilitated pipeline trenches must: a) be a stable landform;	See comment for Condition I4.

	b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and c) be re-profiled to a level consistent with surrounding soils; and d) be re-profiled to original contours and established drainage lines; and e) be visually consistent with the surround land features; and f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	
I7	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity(ies).	See comment for Condition I4. AGL has not undertaken any certified progressive rehabilitation. This will be a future requirement.
I8	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must: a) remediate any contaminated land (e.g. contaminated soils); b) reshape alt significantly disturbed land to a stable landform; c) re-profile all significantly disturbed land to original contours; d) on all significantly disturbed land: i. re-establish surface drainage lines; ii. reinstate the top layer of the soil profile; iii. establish groundcover to ensure that erosion is minimised; iv. establish vegetation of floristic species composition found in analogue sites; e) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and / or minimise environmental harm.	See comment for Condition I4.
I9	All significantly disturbed land caused by the carrying out of the petroleum activity(ies) must be rehabilitated to meet the following final acceptance criteria: a) all significantly disturbed land is reinstated to the pre-disturbed soil suitability class; b) the landform is safe for humans and fauna; c) the landform Is stable with no subsidence or erosion gullies for at least three (3) years; d) all significantly disturbed land is reinstated so that the distribution of vegetation communities represents the analogue site; e) each vegetation community must be re-established so that each of the following rehabilitation parameters are maintained for at least three {3) years: i. the rehabilitated site shows distinct and progressive re-establishment of the various strata which characterise the vegetation community In the analogue site;	See comment for Condition I4.

	ii. all dominant species within each strata are re-established at densities equivalent to that of the analogue site; iii. notwithstanding (i} and (ii) above, a minimum of 70% floral species richness and diversity is observed when compared to the relevant analogue site; iv. a minimum of 50% foliage cover is observed when compared to the relevant analogue site. f) each vegetation community must be rehabilitated and maintained until it can be demonstrated that it is resilient and self-sustaining g) percent organic litter cover, count and density of hollow bearing logs and nest boxes (as replacement for trees with hollows ≥ 10cm diameter) and fallen woody material (total length of logs ≥ 10 cm diameter per hectare and number of logs ≥ 10cm per hectare) have been installed at numbers and densities no lower than the analogue site; h) the water quality of any residual void or water bodies constructed by the petroleum activity(ies) meets criteria for subsequent uses and does not have potential to cause environmental harm; i) there Is no ongoing contamination to waters; and j) the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance caused by carrying out the petroleum activity(ies).	
I10	Notwithstanding condition (19), all buried pipelines must be decommissioned in accordance with the requirements of Australian Standard 2885, as amended from time to time.	This is a future requirement.
I11	A Rehabilitation Monitoring Program which has been certified by a suitably qualified person must be developed by 22 December 2011.	The current Rehabilitation Plan for PPL4 is dated 15 November 2013. It was prepared by Nigel Goulding of M.S Environmental Science and Engineering. The Plan includes a section on Rehabilitation Monitoring.
I12	A Rehabilitation Monitoring Program which has been certified by a suitably qualified person must be developed by 22 December 2011. a) methods to measure subsidence and erosion rates at rehabilitated buried transmissions pipeline corridors and buried flow lines. b) monitoring of indicators identified in the Rehabilitation Plan at analogue sites to measure progressive and final rehabilitation success relevant to the final land use(s}; and c) frequency and seasonality of monitoring analogue sites and rehabilitated areas to assess rehabilitation success; and d) identification of the experimental design for analysing analogue and rehabilitated site data including statistical methods of analyses.	See comment for Condition I11. AGL has not carried out any formal certified progressive rehabilitation. The area is accessed to carry out inspections and maintenance of the right of way.

I13	The holder of this environmental authority must implement the Rehabilitation Monitoring Program.	This is a future requirement.
I14	At least yearly monitoring of rehabilitated areas must be undertaken to demonstrate compliance with the requirements of condition (I9) for a minimum of five (5) years after rehabilitation is completed.	This is a future requirement.

4.8. PPL 87 and 93

Condition ID	Requirement	Actions and comments
Schedule F – Land Management		
F1	The holder of this authority must: a) minimise disturbance to land in order to prevent land degradation; and b) ensure that for land that is to be significantly disturbed by petroleum activities (except in area of highly erosive soils), the top layer of the soil profile is removed; and i. stockpiled in a manner that will preserve its biological and chemical properties; and ii. used for rehabilitation purposes in accordance with condition (F14).	The pipeline was installed several years ago by a previous asset owner. AGLs activities include inspecting and maintaining the right of way, and carrying out pipeline surveys and repairs. If new disturbances are required, AGLs Management of Change process is used to determine potential impacts and control measures (e.g. dig-ups to repair pipeline coatings).
F2	The holder of this authority must: a) prevent or minimise disturbance to vegetation by petroleum activities; and b) manage the effects of clearing to prevent the loss of biodiversity, reduction of ecological processes and land degradation.	See comment for Condition F1.
F3	The holder of this authority must consider whether it is feasible to avoid clearing, and where viable alternatives exist, must not clear vegetation: a) in, or within 50 metres of, the high bank of a watercourse; b) in, or within 50 metres of, the static high water mark of wetlands, lakes or springs; c) in a way that isolates clumps or dissects corridors of vegetation; d) on slopes greater than 5%; e) on dispersible soils; and f) in existing or potential discharge areas.	See comment for Condition F1. The Environment Business Partner is able to carry out desktop searches as part of the risk management process.
F4	During construction, pipe must be strung with gaps to allow for fauna movement across the line of the pipe.	The pipeline was constructed several years ago by a prior asset owner.
F5	Measures must be employed to prevent fauna entrapment in pipe section or within the pipeline trench.	See comment for Condition F4.

F6	Open trenches and pipes must be checked for fauna prior to backfill and any trapped animals removed.	See comment for Condition F4.
F11	Progressive rehabilitation of disturbed areas must commence as soon as practicable following the completion of any construction or operational works associated with the authorised petroleum activities on the relevant petroleum authority.	AGL has not carried out any certified progressive rehabilitation. The pipeline was constructed several years ago by a prior asset owner, and the vegetative groundcover percentages fluctuate in accordance with climatic conditions. As AGL accesses the right of way areas as part of operations, it is unlikely that any certified progressive rehabilitation will take place until the end of asset life.
F12	The holder of the authority must: a) remediate contaminated land caused by petroleum activities in accordance with EP Act requirements and this environmental authority; and b) undertake works to establish a safe, stable, non-polluting landform similar to that of surrounding undisturbed areas, including where relevant excavate or place fill in a way that does not interfere with the flow of water in a watercourse, wetland, or spring, including: i. backfilling any voids and trenches; ii. neutralising and/or encapsulating any acid producing or potentially acid producing material; iii. re-establishing surface drainage lines; iv. minimising the potential for slumping, subsidence or erosion; v. reinstating the top layer of the soil profile; vi. respreading any cleared vegetation; and vii. promoting establishment of vegetation of similar species composition and density of cover to the surrounding undisturbed land; unless the holder of this authority has the written consent of the landowner/holder and the administering authority.	See comment for Condition F11.
F13	As soon as practicable and within three (3) months from the date of cessation of petroleum activities that cause any significant disturbance to land, the holder of this authority must: a) investigate contaminated land status in accordance with *Environmental Protection Act 1994* requirements and the *National Environment Protection (Site Assessment) Measure 1999 (NEPM)* where land has been subject to contamination caused by petroleum activities authorised under this authority.	This is a future requirement for AGL.
F14	All land significantly disturbed by petroleum activities must be rehabilitated to:	This is a future requirement for AGL.

	a) a stable landform with a self-sustaining vegetation cover with the same species and density of cover to that of the surrounding undisturbed areas; b) ensure that all land is reinstated to the pre-disturbed land use and suitability class; c) ensure that the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities; and d) ensure that the water quality of any residual void or water bodies constructed by petroleum activities meets criteria for subsequent uses and does not have potential to cause environmental harm.	
F15	Maintenance of rehabilitated areas must take place to ensure and demonstrate: a) stability of landforms; b) erosion control measures remain effective; c) stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters; d) plants show healthy growth and recruitment is occurring; and e) rehabilitated areas are free of any declared pest plants.	Aerial inspections (helicopter) are undertaken every three (3) months for PPL87 and 93. Ground inspections are undertaken annually. The inspections are carried out to assist AGL in determining whether any maintenance is required. Maintenance requirements are scheduled via AGLs work order system, following site leader approval.
F16	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 (3) years.	AGL has not undertaken any formal certified progressive rehabilitation on PPL87 and 93. This is expected to be undertaken at end of project life.
F17	All explosives, hazardous chemicals, corrosive substances, toxic substances, gases and dangerous goods must be stored and handled in accordance with the relevant Australian Standard where such is available.	AGL does not store these types of substances on the leases. AGLs routine activities are limited to vegetation management (possibly including the use of herbicides) and also periodic inspections undertaken at ground level (annually).
F18	Flammable and combustible liquids (including petroleum products and associated piping and infrastructure), must be stored, handled and maintained in accordance with the latest edition of Australian Standard 1940 – The Storage and Handling of Flammable and Combustible Liquids.	See comment for Condition F17.
F19	Any liquids stored on site that have the potential to cause environmental harm must be stored in or serviced by an effective containment system that is impervious to the materials stored and managed to prevent the release of liquids to waters or land.	See comment for Condition F17.
F20	Drum storages must be bunded so that the capacity and construction of the bund is sufficient to contain at least 25% of the maximum design storage volume within the bund.	See comment for Condition F17.
F21	All containment systems must be designed to minimise rainfall collection within the system.	See comment for Condition F17.
Schedule G – Cultural Heritage		

G1	The holder of the environmental authority must take all reasonable and practicable measures to avoid impacting upon places of known or potential cultural heritage significance whilst carrying out petroleum activities.	From a cultural heritage perspective, the pipeline right of ways are previously disturbed areas. Ground disturbance works are subject to an assessment by the Environment Business Partner as part of the management of change process. This includes the Environment Business Partner determining the control measures required to manage cultural heritage if items or areas of significance are discovered (e.g. stop work).
Schedule H – Nature Conservation		
H1	Notwithstanding any other condition of this authority, the holder of this authority must ensure that: a) petroleum activities are not conducted within a Category A or Category B environmentally sensitive area; b) petroleum activities do not cause a significant disturbance within 1km of a Category A environmentally sensitive area or within 500m of a Category B environmentally sensitive area; and c) petroleum activities are not conducted in a Category C environmentally sensitive area	The Environment Business Partner is responsible for determining the potential impacts of any petroleum activities that are proposed to be carried out on the leases. AGLs Management of Change Process is used as part of the risk management process for proposed activities. This would include the Environment Business Partner carrying out a desktop search to determine if any activities were proposed in environmentally sensitive areas. Third party technical specialists (e.g. environmental planners and ecologists) would be engaged if ground-truthing of the desktop assessment was required.
Schedule J – Pipeline		
J1	All petroleum infrastructure (including buildings, structures, plant and equipment erected and/or used for the petroleum activities) authorised under this authority must be located within the PPL87 and PPL93 licence areas as defined by the coordinates in Schedule J, Table 1 – Table 2.	AGL has limited aboveground infrastructure along the pipeline leases, that are located within the coordinates. AGL uses an internal mapping system (ArcGIS) and survey data to ensure any new infrastructure is situated within the coordinate areas. Any new project or installation is subject to AGLs Management of Change Process, which will involve a risk assessment with input from a variety if disciplines.

<table>
<tr><td></td><td>

Schedule J Table 1 – Location of the PPL87 pipeline corridor

Location	Longitude	Latitude
Start	E 149°11'23.7"	S 27°06'16"
Finish	E 149°08'29.3"	S 27°07'0.7"

Schedule J Table 2 – Location of the PPL93 pipeline corridor

Location	Longitude	Latitude
Start	E 149°27'31.07"	S 27°39'40.8"
Finish	E 149°13'31.4"	S 27°35'44.6"

</td><td></td></tr>
<tr><td>J2</td><td>

The gas pipeline authorised under this authority is constructed in accordance with the design specifications and operating parameters as described in Schedule J, Table 4 – Table 5.

Schedule J Table 4 – Pipeline Design Specifications for PPL87 and PPL93

Pipeline Component	PPL87	PPL93
Length (km)	5.0	24.0
Material	Steel	Steel
Nominal diameter	150mm	200mm
Design Standards and Codes	AS 2885	AS 2885
MAOP	Not specified	Not specified
Coating	Not specified	Not specified
Cathodic protection	Not specified	Not specified

Schedule J Table 5 – Pipeline Operating Parameters for PPL87 and PPL93

Operating Parameters	PPL 87	PPL 93
Coating	HDPE	HDPE
Minimum depth of burial	750mm	750mm
Width of easement, where applicable	15m	15m

</td><td>This condition is now for information purposes only.</td></tr>
<tr><td>J3</td><td>Prior to the commencement of decommissioning or abandonment activities the scope of work for decommissioning or abandonment of project infrastructure shall be developed and agreed to by the administering authority.</td><td>This is a future requirement for AGL.</td></tr>
<tr><td>J4</td><td>All petroleum infrastructure must be removed from the relevant petroleum authority prior to surrender of this authority, except where agreed in writing by the administering authority and the current landowner.</td><td>This is a future requirement for AGL.</td></tr>
</table>

J5	The holder of this authority must implement an Emergency Response Plan from the date of grant of this authority and submit to the Administering Authority a copy of the original or subsequently amended Emergency Response Plan for the operating of the pipelines and associated facilities to aid in the effective response to an emergency situation that may result in environmental harm. The plan shall include: a) means by which an emergency response is initiated; b) defined key roles and responsibilities required to respond to an emergency; c) facilities required to coordinate the emergency response; d) key contact list; e) criteria for escalation of an emergency f) likely emergency scenarios and guidelines for responding to such scenarios; g) communication and documentation requirements; and h) evacuation protocols and muster points.	AGL has an Emergency Response Plan for the Surat assets, that covers the facilities and pipelines. A copy of the Plan is kept on AGLs network.
J6	The Emergency Response Plan shall be reviewed annually to validate the adequacy of the scope of emergency scenarios and adequacy of the content.	The Plan is reviewed annually by AGL to ensure the scope is valid and adequate, and all contact details are correct. AGL uses a SAP Application to manage reminders for the annual review that is led by the Safety Team.
J7	In accordance with Condition (J6), the holder of this authority must ensure that relevant personnel shall be trained and competent to effectively fulfil their roles required as detailed in the Emergency Response Plan to deal with pipeline incidents that could potentially result in environmental harm. Training records are to be kept for five (5) years.	See comment for Condition J6. AGL keeps records for an indefinite period.
J8	The holder of this authority must undertake emergency exercises to: a) test the effectiveness of the emergency response plan; b) validate the competency of key emergency response personnel; c) assess capability to respond to an emergency; d) reinforce prior training; and e) identify opportunities for improvement. Emergency response exercises may be in the form of simulated emergencies, practical drills, desktop exercises, resources and equipment checks, or other exercises designed to systematically include all personnel likely to be involved.	AGL uses a SAP Application to provide reminders for undertaking emergency exercises. The exercises are organised by the Environment Business Partner, and records are kept on AGLs servers.

4.9. ATP1190

Condition ID	Requirement	Actions and comments
Schedule A – Authorised activities		
PESCA 2	The following types of petroleum activities are not authorised: a) processing or storing petroleum or petroleum by-products that are not necessarily associated with well operations b) extracting earthen materials (other than drilling waste rock) of more than 100,000t/year c) extracting by dredging of more than 1 000t/year of material from the bed of naturally occurring surface waters d) drilling wells with fluids that are oil-based or synthetic oil-based e) carrying out stimulation activities using stimulation fluid that contains chemical additives where polycyclic aromatic hydrocarbons are in concentrations above the reporting limit.	AGL has undertaken limited activities on ATP1190 since acquiring the asset. Any new activities/projects are captured through AGLs Management of Change process that includes risk workshops with input from all disciplines. The Environment Business Partner is responsible for assessing the projects against the licence conditions and overarching legislation.
PESCA 3	Only low impact petroleum activities can be undertaken within Category B Environmentally Sensitive Areas (ESAs) or Category C ESAs other than state forests or timber reserves, or within the primary protection zone of Category A ESAs. *Explanatory note: Category A ESAs are excised from DAA, WMA and ATP tenure types and therefore petroleum activities cannot occur in these areas.*	Any new activities/projects proposed for the lease areas is subject to a full risk assessment in accordance with AGLs Management of Change process. The Environment Business Partner is responsible for undertaking desktop assessments of environmentally sensitive areas (ESAs) to provide advice on likely impacts and required mitigation measures. Third party experts are commissioned by AGL if specialist advice is required (e.g. environmental planners and ecologists).
PESCA 4	Only essential petroleum activities can be undertaken in: a) the primary protection zone of Category B ESAs or Category C ESAs other than state forests or timber reserves b) the secondary protection zone of Category A ESAs or Category B ESAs c) Category C ESAs that are state forests or timber reserves.	See comment for Condition PESCA 3.
PESCA 5	Essential petroleum activities carried out in a primary protection zone must: a) be located in areas of pre-existing disturbance; and b) not negatively impact the ESA.	See comment for Condition PESCA 3.
PESCB 1	Petroleum activities that cause significant disturbance to land must not be carried out until financial assurance has been given to the administering authority as security for compliance with the environmental authority and	See comment for Condition PESCA 3.

	any costs or expenses, or likely costs or expenses, mentioned in Section 298 of the *Environmental Protection Act 1994*.	
PESCB 2	Petroleum activities must not cause environmental nuisance from dust, odour, light, smoke or noise at a sensitive place, other than where an alternative arrangement is in place.	There is potential for AGL to cause temporary environmental nuisances due to the activities conducted on the pipeline. These would mainly include dust and noise associated with vehicles and machinery accessing the easement to conduct inspections.
PESCB 3	Contaminants must not be directly or indirectly released to land or air except for those releases authorised by standard conditions (PESCC 11), (PESCC 15), (PESCC 22), (PESCC 23), (PESCC 25), (PESCC26), (PESCC 27), (PESCC 28), (PESCC 29), (PESCC 30), (PESCC 31), (PESCC 32), (PESCC 34) or (PESCC 35).	See comments for Condition PESCB 2.
PESCB 4	For petroleum activities to be carried out in a wild river area, the activities must comply with the conditions stated for relevant petroleum activities in the wild river declaration for that area.	AGL does not propose to carry out further petroleum activities in any wild river areas.
PESCB 5	Prior to carrying out petroleum activities, the location of petroleum activities must be selected to: a) firstly avoid, then minimise, then mitigate any negative impacts on areas of vegetation or other areas of ecological value b) minimise disturbance to land that may otherwise result in land degradation c) minimise isolation, fragmentation or dissection of tracts of vegetation that would lead to a reduction in the current level of ecosystem functioning or ecological connectivity d) minimise clearing of mature or hollow bearing trees.	Any new proposed activities would be subject to AGLs Management of Change process that involves a full risk assessment with multi-disciplinary input. The Environment Business Partner is responsible for ensuring that all legislative requirements are considered when selecting new project areas.
PESCB 6	Records must be kept to demonstrate compliance with standard condition (PESCB 5).	AGL keeps records of risk assessments conducted, including Management of Change documents such as Engineering Change Requests.
PESCB 7	Prior to any significant disturbance to land: a) an ecological assessment of areas with native vegetation that are to be significantly disturbed, must be conducted in accordance with the Queensland Government's Biocondition, a Condition Assessment Framework for Terrestrial Biodiversity in Queensland, Assessment Manual; and b) an assessment of the impacts that will occur as a result of significant disturbance to land must be undertaken.	Any new activities/projects proposed for the lease areas is subject to a full risk assessment in accordance with AGLs Management of Change process. The Environment Business Partner is responsible for undertaking desktop assessments of environmentally sensitive areas (ESAs) to provide advice on likely impacts and required mitigation measures. Third party experts are commissioned by AGL if specialist advice is required (e.g. environmental planners and ecologists).

PESCC 9	Petroleum activities that require earthworks, vegetation clearing and/or placing fill, other than that associated with the construction of linear infrastructure, are not permitted in or within: a) 200 metres of any wetland, lake or spring; or b) 100 metres of the outer bank of any other watercourse.	Any new proposed activities would be subject to AGLs Management of Change process that involves a full risk assessment with multi-disciplinary input. The Environment Business Partner is responsible for ensuring that all legislative requirements are considered when selecting new project areas.
PESCC 14	Measures to minimise stormwater entry onto significantly disturbed land must be implemented and maintained.	Aerial inspections are carried out every three months to check for drainage issues. Measures to prevent issues include the construction and maintenance of flow diversion bunds to direct water around or through the easement in a controlled manner.
PESCC 15	Sediment and erosion control measures to prevent soil loss and deposition beyond significantly disturbed land must be implemented and maintained.	The leases are approximately 20m wide and AGLs focus is on maintaining drainage controls to prevent erosion and subsequent sedimentation. Aerial inspections are conducted every three months to check for drainage and erosion issues, and ground level inspections are carried out annually.
PESCC 16	Chemicals and fuels on the relevant tenures must be stored in, or serviced by, an effective containment system that meets Australian Standards, where such a standard is relevant.	No chemicals or fuels are stored on the leases, however herbicide spraying may be undertaken at times. The herbicides are stored in a purpose built trailer mounted tank.
PESCC 17	Other than for flare pits and sumps used to store residual drilling material and drilling fluids, the hazard category of any dam or levee to be used in carrying out petroleum activities must be assessed in accordance with the Queensland Government Manual for Assessing Hazard Categories and Hydraulic Performance of Dams.	There are no dams located on the leases.
PESCC 38	Significantly disturbed areas that are no longer required for the ongoing conduct of the petroleum activities must be progressively rehabilitated within 6 months (unless an exceptional circumstance in the area to be rehabilitated (e.g. a flood event) prevents this timeframe being met) so that: a) the areas are reshaped to a stable landform b) the areas are re-profiled to contours consistent with the surrounding landform c) surface drainage lines are re-established d) top soil is reinstated.	AGL does not plan on undertaking any certified progressive rehabilitation because the easements are needed until end of project life.
PESCC 39	All significantly disturbed land caused by the carrying out of the petroleum activity(ies) must be rehabilitated to meet standard condition (PESCC 38) and the following final acceptance criteria:	This is a future requirement for AGL.

	a) any contaminated land (e.g. contaminated soils, decommissioned dams containing salt) is remediated and rehabilitated b) rehabilitation is undertaken in a manner such that any actual or potential acid sulfate soils on the area of significant disturbance are treated to prevent or minimise environmental harm in accordance with the Instructions for the treatment and management of acid sulfate soils (2001) c) for land that is not being cultivated by the landholder: i. groundcover, that is not a declared pest species is established and self-sustaining ii. vegetation of similar species richness and species diversity to pre-selected analogue sites is established and self-sustaining d) for land that is to be cultivated by the landholder, cover crop is reinstated, unless the landholder will be preparing the site for cropping within 3 months of petroleum activities being completed.	
PESCC 40	Monitoring of performance indicators must be carried out on rehabilitation activities until final acceptance criteria in standard condition (PESCC 39) have been met for the rehabilitated area.	This is a future requirement for AGL.
PESCC 41	Prior to any changes in petroleum activities which would result in an increase to the maximum disturbance since the last financial assurance calculation was submitted, the holder of the environmental authority must submit, and the administering authority must have approved, an application to amend the financial assurance.	No changes are proposed to the petroleum activities carried out on the leases at this stage.

Silver Springs Project

GROUND WATER MANAGEMENT SUB-PLAN

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Document revision history

Date	Version	Author	Comments
May 2020	R0	John Moraitis	Updated for AGL HSEMS
June 2022	R1	John Moraitis	Review and update

1. Introduction

This Ground Water Management Sub Plan was prepared as part of the Environment Management Plan (EMP) for AGL's Silver Springs Gas Project ("the project").

This Plan was developed to specifically address and manage potential ground water quality issues for the project and is based on the previously prepared and approved Environment Health and Safety Management Plans. This Plan conforms with the Ground Water Standard (ALG-HSE-STD-009.2) as stipulated in the AGL Health, Safety and Environment Management System (HSEMS).

This Sub Plan applies to all activities carried out by AGL employees and contractors, at AGL controlled sites that:

- Extract and/or use groundwater as a water supply source;
- Pump groundwater to the surface, and subsequently require this by-product to be managed;
- Directly discharge, via a bore, into an aquifer;
- Directly or indirectly may result in groundwater contamination; and
- Directly or indirectly may result in impacts to groundwater levels/pressures.

1.1. Objectives

The intent of this Sub-Plan is to assist AGL controlled sites in ensuring that:

- Risks to groundwater quality, groundwater levels/pressures and groundwater dependent ecosystems are minimised to as low as reasonably practicable;
- Groundwater pumped to the surface is stored and handled in accordance with regulatory requirements, and managed effectively prior to treatment and disposal, reuse and/or recycling;
- Releases, leaks and spills of hazardous chemicals/wastes or other materials that negatively impact on groundwater quality are prevented and control measures are in place; and
- Compliance obligations with respect to protection of groundwater resources are met. This condition excludes activities (e.g. fracture stimulation, drilling, maintenance and/or operation of gas wells and water bores) that are approved by the relevant regulatory authority(ies).

In accordance with the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*, AGL seeks to protect and enhance the quality of waters and wetlands through the implementation of suitable control measures.

The environmental values of waters to be protected under this Plan are:

- for waters that may be used for agricultural purposes—the suitability of the water for agricultural purposes; or
- for waters that may be used for recreation or aesthetic purposes—the suitability of the water for—
    - primary recreational use; or

- secondary recreational use; or
- visual recreational use; or

- for waters that may be used for drinking water—the suitability of the water for supply as drinking water having regard to the level of treatment of the water; or
- for waters that may be used for industrial purposes—the suitability of the water for industrial use; or
- the cultural and spiritual values of the water.

(Please refer to the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* for definitions of the specific terms).

1.2. Existing environment

AGLs operations are located within an extensive area of the Surat Basin in Queensland. The topography is gently undulating, with grazing and agriculture dominating the land uses. The area is highly prone to drought conditions, with a mean annual rainfall of approximately 490mm. The warmer months are dominated by high intensity storms that can be localised and fast moving.

The Surat Cumulative Management Area Underground Water Impact Report (QWC, 2012) provides a thorough summary of the geology and hydrogeology of the region. Within PL 446, the Jurassic to Cretaceous aged sedimentary sequence of the Surat Basin is overlain by younger, unconsolidated sediments and alluvium.

The 1:250,000 QLD geological Mapping Sheet SG 55-16 for Surat identifies the underlying geology surrounding the site to be Quaternary unconsolidated sands, as well as a Lower Cretaceous lithic sandstone, siltstone, minor mudstone, commonly glauconitic and calcareous with shelly fossils and plant remains, of the Surat Basin (QWC, 2012). Although the DNRM groundwater bore database (2013) indicates that the top of the Cretaceous (Griman Creek Formation of the Surat Basin) sequence is logged between around 4 – 6 m bgl, within the Silver Springs and Taylor region; geotechnical reports for the Silver Springs Processing Plant did not log the Griman Formation at depths less than 10 m bgl (Coffey, 2013). The unconsolidated material overlying the Griman Formation is soil comprised of sand, clay and gravel and about 0.4m of topsoil (Coffey, 2013).

The water table within the area is expected to be at least 15 m bgl, and likely to be much deeper (around 50 m bgl), given the local and regional geology. This assertion is supported by geotechnical reports conducted at Silver Springs that show no groundwater was encountered during installation of geotechnical bores penetrating at least 10 m bgl (Coffey, 2013). There are 57 bores identified within PL 446 in the DNRM database. No water bore identified within PL 446 in the DNRM database has information on water quality (field or laboratory analysis).

Within the deeper, regional groundwater systems of the Great Artesian Basin, groundwater movement is dominated by sub-horizontal flow, with very little contribution via vertical leakage (QWC, 2012). Recharge occurs predominately by rainfall directly

infiltrating into the outcrop areas to the north and northwest, with only minor recharge occurring via indirect leakage from streams or overlying aquifers. Interrogation of the DEHP's 2010 Queensland Wetland Database (Version 3.0) informs that there are no springs or groundwater discharge areas within the vicinity of PL 446. The groundwater flow direction of the regional aquifers within PL 446 is to the south southwest (QWC, 2012).

Given the thin nature of the colluvial/alluvial soils and the low permeability weathered rock, local groundwater recharge is unlikely. It is more likely that occasional perched water may accumulate in the soil and weathered rock profile after heavy rains and this water is likely to be ephemeral, be transpired by plants and evaporated from the shallow profile.

1.3. Responsibilities

The roles and responsibilities for the development, implementation and review of this Plan are summarised below.

1.3.1. Executive General Manager

The Executive General Manager is responsible for:

- Delegating authority to ensure adequate implementation, monitoring and review of the Groundwater Standard, and associated Standard Methodology, occurs; and
- Ensuring adequate resources are available for the development, implementation, monitoring and review of the Groundwater Standard.

1.3.2. Head of Function

The Head of Function is responsible for:

- Ensuring the implementation and adherence to the Groundwater Standard throughout the Business Unit; and
- Ensuring adequate resources are available for the implementation, monitoring and review of the Groundwater Standard.

1.3.3. Head of Environment, Health, Audit, and Training

The Head of Environment, Health, Audit, and Training is responsible for:

- Managing the development, implementation, and maintenance of the Groundwater Standard;
- Ensuring consultation in the development, review and approval of the Groundwater Standard, and associated Standard Methodology; and
- Providing guidance for the development of objectives, goals, targets, and/or Key Performance Indicators (KPIs) associated with the Groundwater Standard, as applicable.

1.3.4. Environment Manager

The Environment Manager is responsible for:

- Assisting with the implementation and maintenance of the Groundwater Standard;
- Ensuring consultation for the review and approval of the Groundwater Standard, and associated Standard Methodology;
- Ensuring processes and/or procedures related to the Groundwater Standard are developed, implemented, followed, and meet obligations and/or requirements under applicable environmental legislation;
- Ensuring that applicable environmental objectives, goals, and targets associated with the Groundwater Standard are introduced, adhered to, and measured while meeting AGL-wide policies, objectives, goals, and targets; and
- Overseeing audits and assurance activities to ensure compliance with the Groundwater Standard and applicable regulatory requirements.

1.3.5. Business Unit Environment / Lead Environment Business Partner

The Business Unit Environment / Lead Environment Business Partner is responsible for:

- Overseeing and monitoring the implementation of the Groundwater Standard within their Business Unit, and communicating Groundwater Standard requirements to relevant personnel and/or contractors, as applicable;
- Developing processes and/or procedures related to management of groundwater to ensure consistency with the Groundwater Standard, and with applicable environmental legislation;
- Providing support and guidance in the implementation of groundwater related processes and/or procedures at Business Unit level;
- Undertaking or providing guidance and assistance to Leaders in the completion and review of environmental risk assessments and control processes;
- Undertaking audit and assurance activities, to ensure compliance with the Groundwater Standard and applicable regulatory requirements, and developing tracking and corrective action management plans; and
- Assisting with the delivery and tracking of environmental management projects, or the integration of environmental considerations into projects, to ensure Business Unit and site-specific targets are met.

1.3.6. Environment Advisor

The Environment Advisor is responsible for supporting the Environment Manager and/or Environment Business Partner(s) with tasks associated with:

- Implementation of the Groundwater Standard; and/or
- Management of the processes and/or procedures related to Groundwater Standard, at Business Unit level.

2. Legal obligations

2.1. Key legislative requirements

The key regulatory requirements relating to ground water quality are detailed below.

2.1.1. Environmental Protection Act 1994

- Section 22: Act binds all persons
- Section 125: Requirements to apply for an environmental authority
- Section 319: General environmental duty
- Section 320DA: Duty of owner, occupier or auditor to notify administering authority
- Section 437: Offences of causing serious environmental harm
- Section 438: Offences of causing material environmental harm
- Section 440ZF: Prescribed water contaminants
- Section 440ZG: Depositing prescribed water contaminants in waters and related matters
- Section 442: Offence of releasing prescribed contaminant
- Section 443: Offence to place contaminant where serious or material environmental harm may be caused

2.1.2. Environmental Protection (Water and Wetland Biodiversity) Policy 2019

- Section 8: Indicators and water quality guidelines for environmental values for waters
- Section 9: When environmental values of water are protected
- Section 11: Water quality objectives for waters
- Section 12: Identifying environmental values etc. for waters.

2.2. Key licence requirements

The environmental licences held for each lease contain general and specific conditions for managing ground water quality. The table below shows the current environmental approvals (licences) held for each petroleum lease, issued by the Queensland Department of Environment and Science.

Petroleum lease	Environmental licence no.	Issue date	Anniversary date (each year)
PL446	EPPG00784013	29 September 2016	24 May
PFL27	EPPG01233113	22 December 2017	Not listed on EA
PL192	EPPG00770313	23 July 2014	10 August
PL213	EPPG00304213	7 July 2016	23 January
PL 15	EPPG00770613	1 April 2022	15 August
PLs 48, 49, 66, 202	P-EA-100227919	1 April 2022	15 August
PPL 4	PEN202330511	22 June 2011	22 June
PPL 87, 93	EPPG00370113	3 February 2015	29 April
ATP1190	EPSX02909615	16 February 2015	Not listed on EA

2.3. Approval conditions

The approval conditions for each environmental approval (licence) including AGLs actions and comments are displayed in Section 4 of this document. This provides a useful reference for auditing and assurance activities as it demonstrates how AGL is specifically managing compliance against each condition.

3. Impacts and control measures

3.1. Potential impacts

AGLs activities have the potential to cause impacts on land and waters if not managed appropriately:

- Petroleum production and exploration – subsurface leaks
- Flowlines from gas/oil fields – condensate oil leakage
- Stationary plant and equipment (e.g. compressors, generators) – leakage of oil, fuel, coolant
- Mobile plant and equipment (e.g. machinery, vehicles, pumps) – leakage of oil, fuel, coolant in transit or on location
- Chemical storage areas – loss of containment leading to release of hazardous substances
- Above ground storage vessels– contaminant leakage (e.g. oil, fuel, coolant, chemicals)
- Underground storage vessels – contaminant leakage or overflow (e.g. sumps, tanks, triple interceptors)
- Produced water dams – loss of containment resulting in contaminant release (e.g. high conductivity and nutrients, blue green algae)
- Landfarms and waste storage areas – release of contaminated water
- Treated sewage irrigation area – release of contaminated water (e.g. high nutrients)
- Vegetation management – percolation of herbicides to groundwater
- Refuelling activities – fuel spillage during transfer that may percolate to groundwater
- Release of water from impoundments (e.g. bunds, ponds, dams) leading to percolation to groundwater
- Washdown of plant and equipment outside of dedicated washdown bay – resulting in contaminants percolating to groundwater
- Hydrotesting of pipelines or other equipment – potentially generating contaminated water that can percolate to groundwater

3.2. Control measures

3.2.1. Management hierarchy

AGL manages ground water quality in accordance with the management hierarchy contained within the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019:*

- **Firstly** – reduce the production of wastewater or contaminants by reducing the use of water;
- **Secondly** – prevent waste and implement appropriate waste prevention measures;
- **Thirdly** – evaluate treatment and recycling options and implement appropriate treatment and recycling

- **Fourthly** – evaluate the following options for wastewater or contaminants in the order in which they are listed—
    - appropriate treatment and release to a waste facility or sewer;
    - appropriate treatment and release to land;
    - appropriate treatment and release to surface waters or groundwaters.

Definitions

***appropriate treatment**, of waste water or contaminants, means—*

- *for release to a sewerage service provider's waste facility or sewer—treatment that meets the service provider's requirements for the release to the waste facility or sewer; or*
- *for release to land—treatment that ensures the release to land is ecologically sustainable; or*
- *for release to surface waters or groundwaters—treatment that ensures, or the taking of other steps to ensure, that the release—*
    - *will not affect the environmental values for the waters; or*
    - *is offset by undertaking an activity to counterbalance the impacts of releasing waste water or contaminants to waters, other than an offset to which the Environmental Offsets Act 2014 applies.*

***sewerage service provider** see the Water Supply (Safety and Reliability) Act 2008, schedule 3.*

***waste facility** means a facility for the recycling, reprocessing, treatment, storage, incineration, conversion to energy or disposal of waste.*

***waste prevention** means the adoption of practices or processes that avoid generating waste or reduce the quantity of waste requiring subsequent treatment, recycling or disposal.*

3.2.2. HSEMS minimum controls

The following minimum controls are specified by AGLs Groundwater Standard (AGL-HSE-STD-009.2) and AGLs Groundwater Methodology (AGL-HSE-SDM-009.2).

Groundwater extracted for supply and use

RCM Ref	Minimum Control
9.2.1.1	Prior to extracting groundwater, AGL controlled sites must obtain the relevant approvals, licences, permits or authorisations as required by the regulatory authority(ies).
9.2.1.2	Conditions prescribed in the groundwater and bore construction licences, permits or authorisations must be adhered to.
9.2.1.3	Bore construction at an AGL controlled sites must be carried out by a bore driller with a valid drillers licence. The drillers licence must: • Be issued by the relevant regulatory authority; and • Applicable to the class of work (as defined by applicable legislation) and the drilling method to be used.

9.2.1.4	Bore information (e.g. bore location, bore depth and water quality), as prescribed by licence conditions and applicable legislative requirements, must be provided to the relevant regulatory authority(ies).
9.2.1.5	Notices or orders prohibiting or restricting groundwater extraction, and specifying permissible consumptive volumes for an area or aquifer, must be complied with and all requirements adhered to.
9.2.1.6	AGL controlled sites must comply with the water use minimum controls stated in the Surface Water Standard (AGL-HSE-STD-009.3), as these apply to groundwater use.
9.2.1.7	Notices or orders, issued by the regulatory authority, for total or partial closure of a bore, or to discontinue the use of a bore, must be complied with and all requirements adhered to.

The applicable legislative drillers licence classification, and associated requirements, need to be identified by the relevant Leader. This information will need to be considered when engaging a bore driller to carry out drilling operations at the AGL controlled site.

A bore construction licence, permit or authorisation needs to be obtained, by the relevant Leader, prior to works being undertaken. The relevant Leader should provide a copy of the groundwater licence to the driller, so that the driller is informed and complies with any bore construction conditions. Furthermore, the groundwater licence may prescribe conditions for (but not limited to):

- The maximum annual volume of water that may be taken, and the rate at which it may be taken;
- The location where the water can be taken and usage purpose; and
- The installation and use of metering or measuring devices.

Bore construction should follow the guidelines developed by the National Groundwater Committee (i.e. '*Minimum Construction Requirements for Water Bores in Australia*').

The Environment representative, and Leaders whose activities use groundwater, need to have an understanding of groundwater-surface water interactions, groundwater levels/pressures and ecosystems dependent on the groundwater resource, to ensure groundwater extraction does not pose an environmental risk to surface water beneficial uses (e.g. disturbing surface water flows and reducing surface water quality).

In addition, groundwater extraction should not be contrary to a (including but not limited to):

- Water Management Plan (established under State legislation);
- Water restriction;
- Groundwater area order;
- Restricted groundwater area order; and
- Groundwater protection zone/area.

AGL controlled sites should not take groundwater in excess of that endorsed or required in a groundwater licence or permit, and should implement measures to prevent it from being improperly used or wasted (e.g. leakage as a result of poor bore maintenance).

Groundwater extracted for other purposes than supply

RCM Ref	Minimum Control
9.2.1.8	AGL controlled sites must notify the relevant regulatory authority(ies) prior commencing to pump produced water, naturally poor quality or contaminated groundwater to the surface, where required under applicable legislation.
9.2.1.9	Produced water, naturally poor quality or contaminated groundwater pumped to the surface must be managed in accordance with the wastewater management minimum controls stated in the Surface Water Standard (AGL-HSE-STD-009.3).
9.2.1.10	If produced water, naturally poor quality or contaminated groundwater require disposal to a body of water (after appropriate treatment), the wastewater discharge minimum controls stated in the Surface Water Standard (AGL-HSE-STD-009.3) must be complied with.

AGL controlled sites should avoid discharging of produced water, naturally poor quality or contaminated groundwater to a body of water (after appropriate treatment), wherever possible. Procedures for managing produced water, naturally poor quality or contaminated groundwater, at AGL controlled sites need to be developed and implemented. This needs to align with legislative requirements (including licences and regulatory approval(s)) and guidelines, relevant HSE Management System Standards and any other commitments made with regard to groundwater and surface water management.

If an AGL controlled site needs to discharge produced water, naturally poor quality or contaminated groundwater to a body of water then the wastewater management hierarchy (as discussed in section 6.1 of the Surface Water Standard Methodology (AGL-HSE-SDM-009.3)) needs to be applied, as follows as follows (in order of preference):

- Reuse and/or recycling produced water, naturally poor quality or contaminated groundwater within operations, to minimise discharge to the surface; and
- Treatment of produced water, naturally poor quality or contaminated groundwater, to reduce the concentration and/or load of contaminants prior to discharge.

Produced water, naturally poor quality or contaminated groundwater reuse and/or recycling options to be implemented at AGL controlled sites should not pose an environmental risk, and in particular protect:

- The beneficial uses of surface water, if produced water, naturally poor quality or contaminated groundwater is discharged into a body of water;
- The beneficial uses of groundwater, if produced water, naturally poor quality or contaminated groundwater is applied to land; and
- The land use and soil characteristics, if produced water, naturally poor quality or contaminated groundwater is applied to land.

Where produced water, naturally poor quality or contaminated groundwater treatment is necessary prior to discharge, then the required level of treatment should take into consideration:

- Aspects associated with the receiving environment, including nature, beneficial use(s), assimilative capacity and presence of sensitive receptors or habitats;

- The surface water discharge licence conditions; and
- Available best/leading practices in place within industry.

Discharge to groundwater

RCM Ref	Minimum Control
9.2.1.11	AGL controlled sites must avoid discharges to groundwater, wherever possible. If discharge to groundwater is to be considered as a disposal option, a risk assessment must be carried out in accordance with the HSE Risk Management Standard (AGL-HSE-STD-004.1).
9.2.1.12	Prior discharging to groundwater, the AGL controlled site must obtain a licence, permit or authorisation from the relevant regulatory authority(ies). If a licence, permit or authorisation is granted, all conditions must be adhered to.
9.2.1.13	Water quality objectives for groundwater must not be exceeded at or beyond the boundaries of the attenuation zone, designated by the relevant regulatory authority.
9.2.1.14	AGL controlled sites must engage with a suitably qualified groundwater professional to assist with the development of a monitoring program.
9.2.1.15	AGL controlled sites must comply with the monitoring minimum controls as stated in the Surface Water Standard (AGL-HSE-STD-009.3), as these apply to discharge to groundwater.
9.2.1.16	Monitoring program information must be reported to the regulatory authority, in accordance with licence, permit or authorisation conditions and/or other regulatory reporting requirements.
9.2.1.17	Any notices or orders, issued by the regulatory authority, related to environmental harm caused by a discharge to groundwater must be complied with, and all requirements adhered to.

Regulatory authority approval for a discharge to groundwater should only be sought if it can be demonstrated that:

- This option is the lowest environmental risk, in comparison with other options such as reuse, recycling and discharge;
- There is no adverse impacts to any beneficial use(s) of groundwater, surface water or land;
- The water quality objectives for the groundwater are not exceeded at or beyond the boundaries of the designated attenuation zone; or
- Where treated wastewater/stormwater is used to recharge an aquifer, the discharge water presents equal or better quality than the water in the aquifer.

Licences, permits or authorisations for discharge to groundwater may set conditions on (but not limited to):

- Discharge limits;
- Location and boundaries of the attenuation zone;
- Monitoring program, and assessment of the monitoring results; and
- Actions to be taken in accordance with a contingency plan (to be approved by the regulatory authority), in case the water quality objectives for the groundwater are exceeded at or beyond the boundaries of the attenuation zone.

All practicable measures need to be taken at AGL controlled sites to prevent pollution of groundwater, i.e. to protect the beneficial use(s) of groundwater (or of particular groundwater bodies, if applicable). Discharge design criteria and operational procedures need to be complied with, so that the discharge does not prejudice the achievement of water quality objectives at or beyond the boundaries of the attenuation zone.

A suitably qualified groundwater professional needs to be engaged to develop a monitoring program, which takes into consideration the identified risks and the licence, permit or authorisation conditions (e.g. monitoring discharge quality and groundwater quality, including baseline monitoring).

Groundwater contamination and/or changes to groundwater levels/pressures

RCM Ref	Minimum Control
9.2.1.18	AGL controlled sites must comply with the contamination prevention and identification minimum controls stated in the Land Standard (AGL-HSE-STD-009.1), as these apply to groundwater contamination.
9.2.1.19	Guidelines, protocols, and codes of practice related to groundwater protection must be complied with, as prescribed by the regulatory authority(ies).
9.2.1.20	AGL controlled sites must verify if they are located within or in the vicinity of a groundwater protection area, as designated by the regulatory authority. If a groundwater protection area is identified, the AGL controlled site must comply with conditions prescribed by legislation and/or specific requirements issued by the regulatory authority.
9.2.1.21	Notices or orders, issued by the regulatory authority, for taking specific actions to prevent groundwater contamination and/or changes in groundwater levels/pressures, must be complied with and all requirements adhered to.

Activities that have the potential to cause groundwater contamination need to be managed, which includes (but not limited to):

- Land disturbance works (e.g. soil or other materials used for construction works);
- Use, storage and transport of hazardous chemicals and substances (e.g. underground storage tanks and pipelines for chemicals and other hazardous substances);
- Storage and disposal of hazardous and organic wastes (e.g. landfills and waste rock (coal) dumps);
- Storage, treatment, transport, and discharge of effluents (e.g. septic tanks), wastewaters (e.g. treatment ponds and ash dumps) and stormwater; and
- Petroleum production and exploration activities.

The relevant Leader, in consultation with key technical personnel and the Environment representative, should identify the applicable codes of practice and environmental management guidelines (prescribed by relevant regulatory authority(ies) and industry bodies) prior carrying out activities that impact or have the potential to adversely impact on groundwater quality and/or groundwater levels/pressures.

Assessment

RCM Ref	Minimum Control
9.2.1.22	AGL controlled sites must comply with the assessment minimum controls as stated in the Land Standard (AGL-HSE-STD-009.1), as these apply to groundwater contamination.
9.2.1.23	Contaminated groundwater and/or groundwater levels/pressures assessments must be undertaken by suitably qualified and experienced groundwater professionals.

The main situations, at an AGL controlled site, that may trigger a groundwater contamination assessment are:

- Current or previous activities at site, suggesting the potential for groundwater contamination;
- Assessment of land contamination suggesting the potential for groundwater contamination; and
- Results from groundwater monitoring indicate contamination.

Assessments should be carried out on all known and/or suspected contaminated groundwater to ascertain if the contamination poses an actual or potential risk of harm to the environment and human health, and what actions (and urgency of those actions) should be taken to protect groundwater quality. The applicable legislative definition of groundwater contamination needs to be identified by the relevant Leader and Environment representative, so that it is considered in all assessments carried out at the AGL controlled site.

The initial groundwater contamination assessment may include a desktop study of the geology and hydrology of the contaminated area, and an intrusive sampling program to identify the presence of contaminants (conducted by a suitably qualified groundwater professional, together with a suitably qualified contaminated land professional if required). Subsequently, the information attained from the initial assessment could be used to assess if a more detailed assessment is required (i.e. where there is a risk of harm to any current or realistic future uses of groundwater, or where groundwater could create a potential exposure pathway that could result in a risk to human health and/or the environment).

The detailed groundwater contamination assessment may consist in the development, and continual improvement (via further sampling), of a conceptual site model for groundwater contamination. This model should take into consideration:

- Contamination sources and release mechanisms;
- Nature and extent of contamination;
- Dominant fate and transport characteristics of contaminants (e.g. using analytical and numerical mathematical modelling); and
- Potential receptors and exposure pathways.

The detailed groundwater contamination assessment should provide enough information on the nature and severity of the risks associated with the contamination so that it can be controlled, and management and/or remediation options can be developed.

Management and remediation

RCM Ref	Minimum Control
9.2.1.24	AGL controlled sites must comply with the management and remediation minimum controls stated in the Land Standard (AGL-HSE-STD-009.1), as these apply to groundwater contamination.
9.2.1.25	Contaminated groundwater remediation must be undertaken by suitably qualified and experienced groundwater professionals.
9.2.1.26	Where required, if a Non-Aqueous Phase Liquid (NAPL) is present in an aquifer, it must be removed unless exempted by the regulatory authority.
9.2.1.27	Notices or orders, issued by the regulatory authority, defining a contaminated groundwater zone, must be complied with and all requirements adhered to.

At a minimum, groundwater contamination management and/or remediation options to be implemented at an AGL controlled site should ensure that groundwater quality, and/or groundwater levels/pressures, do not compromise relevant beneficial uses and human health and the environment are protected. Measures taken to address groundwater contamination may include (but not limited to):

- Plume containment;
- Active or passive remediation of contaminated groundwater;
- Ongoing monitoring of groundwater and contingency plans;
- Implementing groundwater management plans to mitigate risks; and
- Restricting groundwater use, in, and down-gradient of, the contaminant plume.

When assessing the most suitable option(s) for remediation of contaminated groundwater, the following hierarchy should be considered (in preferential order):

- Natural background groundwater water quality is restored;
- Protection of relevant beneficial uses of groundwater and protection of human health and the environment; and
- Remediation to the extent practicable (i.e. only to a point of necessity), as remediation of groundwater back to the original beneficial use is not always possible or feasible.

The benefits from carrying out remediation of contaminated groundwater should surpass potential negative impacts to human health and/or the environment that could arise from the remediation.

Incidents and emergencies

RCM Ref	Minimum Control
9.2.1.28	Incidents and emergencies associated with land contamination that result, or have the potential to result, in groundwater contamination must comply with the minimum controls stated in the Land Standard (AGL-HSE-STD-009.1).
9.2.1.29	Hazards, near misses and incidents resulting in potential or actual contamination of groundwater must be reported and investigated using the AGL Incident Management System.
9.2.1.30	Incidents that result in the contamination of groundwater must be reported to the regulatory authority, in accordance with the notification requirements established by applicable legislation.
9.2.1.31	Notices or orders issued, by the regulatory authority, for management of contaminated groundwater must be complied with, and all requirements adhered to.

If the relevant Leader, and/or Environment representative, has to notify the regulatory authority in regard to potential or real contamination to groundwater, the notification should provide details on:

- The site contamination location, with sufficient information to be easily identified; and
- The nature and extent of site contamination, including all known relevant information.

Training and competency

RCM Ref	Minimum Control
9.2.1.32	Assessment, clean-up, or remediation of contaminated groundwater must be carried out by qualified and experienced professionals.

Professionals appointed to assess, clean-up or remediate contaminated groundwater (e.g. groundwater professionals and contaminated land professionals – refer to section 7, Land Standard Methodology(AGL-HSE-SDM-009.1)) need to have the appropriate qualifications or training, and are experienced and competent to conduct the work safely.

Personnel whose work could cause significant impacts to groundwater, as identified by the AGL controlled site, should be competent to perform the tasks to which they are assigned. Specific training needs for individuals and teams should be determined through the implemented training and competency system, developed in alignment with the Training and Competency Standard (AGL-HSE-STD-013).

Definitions

Term	Definition
AGL Controlled Site	An AGL owned operated or controlled site, including a field operational site or an office site.
Attenuation zone	An attenuation zone is a designated area within which some or all of the groundwater water quality objectives are not required to be achieved. It permits exceedance of specified groundwater water quality objectives within designated boundaries, provided that strict prerequisites are met. This is allowed on the condition that the contaminants present in the groundwater are attenuated, such that the groundwater quality objectives are complied with at the boundaries of the attenuation zone. Attenuation zone must not: • Occupy a significant proportion of an aquifer; and • Extend beyond the boundaries of the land in which the discharge is made, unless there is consent from the affected landowners.
Aquifer	An aquifer is a geological structure or formation that is capable of transmitting water, when it is sufficiently permeable to allow water to move within it and yield productive volumes of groundwater.
Beneficial Use	Beneficial use (also known as environmental value or protected environmental value), in relation to groundwater, means a value or use of groundwater which must be protected from the effects of pollution in general. A beneficial use does not prohibit or permit the use of groundwater for any particular purpose, but requires groundwater to be of a suitable quality and quantity to support that use or value. Beneficial uses can include: aquatic ecosystem, recreational water use and aesthetics, potable use, agriculture use, aquaculture use and industrial use. There can be more than one beneficial use for a given area.
Body of Water	Body of water refers to the parts of the Earth surface that are covered with water. It includes still, contained, and moving waters (e.g. oceans, seas, lakes, rivers, streams, and wetlands).
Bore	Bore refers to a structure drilled below the surface for the purpose of: • Accessing groundwater, either by natural flows, pumping or other means; • Monitoring groundwater (e.g. groundwater quality and/or groundwater levels/pressures); • Draining poor quality or contaminated groundwater; and • Recharging an aquifer.
Contaminated Groundwater	Contaminated groundwater refers to groundwater where chemical substance(s) or physical substance(s) are present in

Term	Definition
	concentration(s) above the background or acceptable levels, that result or have the potential to result in real or potential harm to human health and/or the environment. Substances present within the aquifer may migrate over time from the source site, and potentially impact surrounding areas beyond AGL controlled sites boundaries.
Effluent	Effluent refers to the treated wastewater generated by a sewage treatment plant or septic tank, which is generally discharged to the environment.
Exposure Pathway	Exposure pathway refers to the path followed by contaminants from their source - via air, soil, water, and food - to people and/or the environment.
Groundwater	Groundwater is the water located beneath the Earth's surface contained in or occurring in a geological structure or formation. Groundwater is recharged from rainfall that percolates down through soil or fractures in rock, filling up the pores between sand grains or the fissures in rocks.
Groundwater Contamination	Groundwater contamination occurs when there is a noticeable (i.e. identified visually and/or by smell) or measurable change in the groundwater characteristics, due to the presence of chemical/physical substance(s) at levels that pose a risk of harm to human health and/or the environment. Refer also to the 'Contaminated Groundwater' definition.
Groundwater-Surface Water Interactions	Groundwater-surface water interactions refer to the hydraulic connections between shallow groundwater and surface water. A body of water may gain water from shallow groundwater, when the groundwater level is higher than the surface water level. Conversely, an aquifer may be recharged by surface water, when the surface water level is higher than the groundwater level. Furthermore, these interactions can affect both the quantity and/or quality of surface water and groundwater (e.g. water extraction from streams can deplete groundwater, and conversely pumping groundwater can deplete water in streams; surface water contamination can cause degradation of groundwater quality and conversely groundwater contamination can negatively impact in surface water quality).
Hazardous Chemicals/Wastes	Hazardous chemicals/wastes pose a significant threat to human health and/or the environment, if people or the environment are exposed to them. Typically, these have toxic, corrosive, flammable, explosive, or radioactive characteristics.
HSE	Health, Safety, and Environment.
Land Disturbance	Land disturbance refers to a change in the land surface, as a result of clearing, grading or excavation works. These works can be carried out manually and/or by use of machinery.

Term	Definition
Leader	Any employee who has others reporting to him or her, or who has the authority to allocate resources.
Non-Aqueous Phase Liquid (NAPL)	A Non-Aqueous Phase Liquid (NAPL) means a liquid (e.g. petroleum products) which has low solubility in water that is in sufficient quantity to form a discrete layer or separate phase in the aquifer. A NAPL in an aquifer is an uncontrolled source of contamination, and a detailed groundwater contamination assessment is always required if present in or on groundwater.
Naturally Poor Quality Groundwater	Naturally poor quality groundwater refers to groundwater that is naturally high in mineral content (i.e. salts, metals, hydrocarbons, nutrients and/or pH), or are highly turbid, making it unsuitable for specific uses.
Produced Water	Produced water refers to the groundwater extracted as a by-product from petroleum production and exploration activities.
Stormwater	Stormwater includes any surface runoff and flows resulting from rainfall, drainage, or other sources (e.g. overflow from bunded areas and wastewater/water ponds). Typically, stormwater runoff contains suspended sediments, metals, oil, nutrients (i.e. phosphorous and nitrogen), pathogens (e.g. bacteria) and litter – becoming a source of pollution to the environment if not managed appropriately.
Surface Water	Surface water means all waters on the Earth's surface, including fresh, estuarine, and marine waters (whether permanent, temporary, ephemeral, or seasonal), other than groundwater. It includes for example: natural rivers, creeks, lagoons, wetlands, lakes, and coastal waters.
Underground Storage Tank	Any storage tank with more than 50% of its height buried below the surrounding ground gradient and mounded without any surrounding pit or chamber.
Water Quality Objectives	Water quality objectives are numerical concentration limits or narrative statements for indicators, that has been established to support and protect the designated beneficial uses for groundwater at a specified site. Water Quality Objectives are developed based on scientific criteria or water quality guidelines, but are locally relevant - reflecting site specific requirements such as social or political constraints.
Wastewater	Wastewater refers to a water that has been used in an activity (e.g. washing, flushing, manufacturing or processing), and therefore mixed with different substances/materials or exposed to a source of heat. It is a liquid waste, mainly consisting of water (e.g. wash down water, cooling water, produced water and effluent).

4. Approval conditions and comments

4.1. PL446

Condition ID	Requirement	Actions and comments
Schedule A – General		
A1	The environmental authority holder must not exceed the number and maximum size for each of the specified petroleum activities listed in Schedule A: Table 1 – Authorised Petroleum Activities for each petroleum tenure.	AGL has not exceeded the number and size of the existing activities and dam structures. This is monitored on a regular basis and captured through AGLs Management of Change Process.
Schedule C - Water		
C1	Contaminants must not be directly or indirectly released to any waters.	The region is generally heavily drought affected, however contaminants are managed to prevent/minimise the possibility of release to waters.
C2	An Erosion and Sediment Control Plan which has been certified by a suitably qualified person must be developed within 3 months from the date of issue of this authority.	An Erosion and Sediment Control Plan was produced as is stored on AGLs network.
C3	The Erosion and Sediment Control Plan must include but not necessarily be limited to: (a) managing and/or diverting uncontaminated stormwater run-off around areas disturbed by the petroleum activity(ies) or where contaminants or wastes are stored or handled that may contribute to contamination of waters (b) ensuring that contaminated stormwater runoff and incident rainfall is collected, treated, reused, or released in accordance with the conditions of this environmental authority (c) roofing or minimising the size of areas where contaminants or wastes are stored or handled; (d) revegetating disturbed areas as soon as practicable after the completion of works (e) using materials and or processes (e.g. dry absorbents) to clean up spills that will minimise contamination of waters (f) placing erosion and sediment control structures to minimise erosion of disturbed areas and prevent the contamination of waters (g) an inspection and maintenance program for the erosion and sediment control measures; (h) provision for adequate access to maintain all erosion and sediment control measures especially during the wet season months from November to April	See above.

	(i) additional erosion and sediment control measures for construction of wells and pipelines on slopes >10% j) a surface water monitoring program designed to detect impacts from sediment runoff into waters where erosion and sediment control measures occur within 1 00m of the high bank of a watercourse (k) identification of remedial actions required to ensure compliance with the conditions of this environmental authority; and (I) details of landholder consultation strategies and processes to be used in further developing and implementing the Erosion and Sediment Control Plan.	
C4	The holder of this environmental authority must implement the Erosion and Sediment Control Plan.	AGL implements the Plan as part of its normal operations. AGL personnel carry out frequent environmental inspections to check for erosion, and projects are managed on a case by case basis where required.
C5	A copy of the Erosion and Sediment Control Plan must be submitted to any potentially affected landholders upon request by that landholder.	A copy is maintained on AGLs network for distribution to landholders on request.
C6	The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas from where the resultant contaminants cannot be released into any waters.	AGLs machinery is maintained and cleaned at either the Silver Springs or Wallumbilla facility, where dedicated washdown bays are in place. The resultant washdown water flows to a lined pond system.
C7	Where the petroleum activity(ies) is carried out on floodplain areas, the holder of this environmental authority must ensure that the petroleum activity(ies) does not: (a) concentrate flood flows in a way that will or may cause or threaten an adverse environmental impact (b) divert flood flows from natural drainage paths and alter flow distribution (c) increase the local duration of floods (d) increase the risk of detaining flood flows (e) pose an unacceptable risk to the safety of persons from flooding; or (f) pose an unacceptable risk of damage to property from flooding.	Regular inspections of the assets and drainage systems on PL446 are carried out as part of normal operations. Remediation projects are carried out on a case by case basis, through the creation of maintenance notifications.
Schedule D – Dams		
D1	The **consequence category** of any structure must be **assessed** by a **suitably qualified and experienced person** in accordance with *the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)* at the following times: a) prior to the design and **construction** of the **structure,** if it is not an **existing structure;** or b) prior to any change in its purpose or the nature of its stored contents.	The dams were assessed and signed off by certified personnel prior to construction. There has been no change in purpose or nature of stored contents, nor any new dams constructed.

D2	A consequence assessment report and **certification** must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.	AGL commissioned suitably qualified persons to assess the structures and maintains electronic copies of the certifications.
D3	Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).*	See above.
D4	The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.	The requirements of this condition have not been triggered.
D5	All low consequence dams must be designed and constructed, operated and maintained in accordance with accepted engineering standards currently appropriate for the purpose for which they are intended.	AGL carries out annual dam assessments to maintain compliance with this condition.
D6	The consequence category of each low consequence dam must be determined by a suitably qualified and experienced person: (a) prior to its construction; or (b) within 120 business days of the date of grant of this environmental authority for existing low consequence dams; and (c) prior to any change in its purpose or stored contents.	See above.
D7	Where the consequence category of a low consequence dam is for the first time assessed as significant or high, the holder of this environmental authority must ensure that the dam meets the hydraulic performance required of the assessed consequence category within 12 months of that assessment.	There are no significant or high hazard dams on PL446. A review of the 13 legacy dams was conducted by a third party technical specialist in 2015 (see report titled "PL446 Legacy Dam Consequence Assessment – IH046200-N-HY-RP-02 Rev1). The report concluded that all legacy dams identified on PL446 are low consequence category dams.
D8	In the event of early signs of loss of structural or hydraulic integrity of a low consequence dam, the holder of this environmental authority must immediately take action to prevent or minimise any actual or potential environmental harm.	The stormwater pond walls are constructed of dispersive material and therefore regular inspections are undertaken by site personnel. Following rainfall events, it is possible that erosion of the dam walls can occur, and these are managed on a case by case basis through entering maintenance notifications. Produced water is managed in lined dams that have a low erosion risk.
D9	Low consequence dams must be designed with a floor and sides made of material to contain the	Produced water is contained in lined dams. The other dams onsite capture stormwater only, which readily evaporates.

	wetting front and any entrained contaminants within the bounds of the containment system during its operational life, including any period of decommissioning and rehabilitation.	
Schedule J – Monitoring Programs		
J29	The condition of all low consequence dams must be monitored for early signs of loss of structural or hydraulic integrity, based on the advice of a suitably qualified and experienced person. The methods of monitoring and frequency of monitoring shall be as assessed by the person who conducts the consequence assessment based on the particular circumstances of each dam.	Site personnel carry out regular inspections of the dam walls. The Environment BP also carries out inspections of the dam walls when on-site for routine environment visits (approx. every 3 weeks).

4.2. PFL27

Condition ID	Requirement	Actions and comments
Schedule B - Water		
B1	Prescribed contaminants must not be directly or indirectly released to water.	Contaminants are managed in a closed drain system, and are not directly or indirectly released to waters.
B2	The hazard category of any dam to be used in carrying out petroleum activities must be assessed in accordance with the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams*, published by the Queensland Government, and amended from time to time.	A small firewater dam is located on-site that contains stormwater only. As such the dam is low risk and is not used to carry out petroleum related activities.
B3	Regulated dams are not permitted under this environmental authority.	There are no regulated dams on-site.
B4	Low hazard dams must be: a) constructed, operated and maintained in accordance with accepted engineering standards currently appropriate for the purpose for which the dam is intended to be used; and b) designed with a floor and sides made of material that will contain the wetting front and any entrained contaminants within the bounds of the containment system during both its operational life and including any period of decommissioning and rehabilitation. (PESCC18)	See above.
B5	All low hazard dams must be monitored for early signs of loss of structural or hydraulic integrity as specified in the initial hazard assessment. (PESCC19)	See above.
Schedule G - Rehabilitation		
G2	When no longer required all low hazard dams must be decommissioned to no longer accept inflow from the petroleum activities and be either: a) rehabilitated; or	The requirements of this condition have not yet been triggered.

	b) agreed to in writing by the administering authority and the landholder to remain in situ following the cessation of the petroleum activities associated with the dam, with the contained water of a quality suitable for the intended ongoing uses by that landholder.	

4.3. PL192

Condition ID	Requirement	Actions and comments
Schedule A - General		
A1	In the carrying out of the petroleum activities, 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 – Authorised Petroleum Activities for each petroleum tenure.	There has been no change to the number and size of petroleum activities. This is tracked by the Environment Business Partner, with any new projects captured by the management of change process.
Schedule C - Water		
C1	Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority.	Contaminants are only generated when workover activities (or strata stimulation) are occurring. Risk workshops and icebreaker sessions are held during the planning phase and routine inspections are carried out during workover activities. Contaminants are captured on-site and transferred to appropriate facilities.
C2	Produced water is not authorised to be released into the environment.	AGL is not currently generating produced water from PL192, except as part of strata stimulation activities (i.e. Churchie 12). The produced water is captured in purpose-built tanks and transferred to an appropriate facility.
C4	Petroleum activities must not occur in or within 200m of a: (a) wetland of high ecological significance (b) Great Artesian Basin Spring (c) subterranean cave GDE.	The Environment Business Partner is responsible for verifying that petroleum activities do not fall within 200m of these areas. These checks occur during the planning phase of the projects, to ensure the online mapping info is current and correct.

C5	Only construction or maintenance of linear infrastructure is permitted in or within any wetland or other environmental value or in a watercourse.	The Environment Business Partner is responsible for conducing searches of online mapping databases during the planning phase of projects.
C6	The construction or maintenance of linear infrastructure in a wetland of other environmental value must not result in the: (a) clearing of riparian vegetation outside of the minimum area practicable to carry out the works; or (b) ingress of saline water into freshwater aquifers; or (c) draining or filling of the wetland beyond the minimum area practicable to carry out the works.	AGL has not constructed any new wells, and the Environment Business Partner is responsible for confirming that the requirement of this condition is complied with in full.
C7	After the construction or maintenance works for linear infrastructure in a wetland of other environmental value are completed, the linear infrastructure must not: (a) drain or fill the wetland (b) prohibit the flow of surface water in or out of the wetland (c) lower or raise the water table and hydrostatic pressure outside the bounds of natural variability that existed before the activities commenced (d) result in ongoing negative impacts to water quality (e) result in bank instability; or (f) result in fauna ceasing to use adjacent areas for habitat, feeding, roosting or nesting.	AGL has not constructed any new linear infrastructure. Any proposed works would be subject to a detailed planning phase including risk workshops to account for impacts.
C8	The construction or maintenance of linear infrastructure activities in a watercourse must be conducted in the following preferential order: (a) firstly, in times where there is no water present (b) secondly, in times of no flow (c) thirdly, in times of flow, providing a bankfull situation is not expected and that flow is maintained.	See above.
C9	The construction or maintenance of linear infrastructure authorised under condition (C5) must comply with the water quality limits as specified in **Protecting Water Values, Table 1- Release limits for construction or maintenance of linear infrastructure.**	See above.
C10	Monitoring must be undertaken at a frequency that enables compliance with condition (C9).	See above.
C11	A register must be kept of all linear infrastructure construction and maintenance activities in a wetland of other environmental value and watercourses, which must include: (a) location of the activity (e.g. GPS coordinates (GDA94) and watercourse name) (b) estimated flow rate of surface water at the time of the activity (c) duration of works, and (d) results of impact monitoring carried out under condition (C10).	See above.
C12	Measures must be taken to minimise negative impacts to, or reversal of, any river improvement works carried out in River Improvement Areas by Queensland's River Improvement Trusts.	See above.

C13	Petroleum activity(ies) on floodplains must be carried out in a way that does not: (a) concentrate flood flows in a way that will or may cause or threaten a negative environmental impact; or (b) divert flood flows from natural drainage paths and alter flow distribution; or (c) increase the local duration of floods; or (d) increase the risk of detaining flood flows.	See above.
C19	For activities involving significant disturbance to land, control measures that are commensurate to the site specific risk of erosion, and risk of sediment release to waters must be implemented to: (a) allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities (b) minimise soil erosion resulting from wind, rain, and flowing water (c) minimise the duration that disturbed soils are exposed to the erosive forces of wind, rain, and flowing water (d) minimise work-related soil erosion and sediment runoff; and (e) minimise negative impacts to land or properties adjacent to the activities (including roads).	See above. This would form part of a detailed risk assessment that would be carried out during the planning phase. In addition, routine inspections are carried out by site personnel and the Environmental Business Partner.
Schedule D – Stormwater		
D1	The holder must implement and maintain measures to minimise the likelihood of the release of contaminated stormwater from the place where the activities are carried out to any stormwater drain or any waters.	PL192 is in a care and maintenance phase at present, with the exception of a strata stimulation activity that occurred at Churchie 12 in mid-2019. The main contaminants that could impact on stormwater include: sediment from cleared areas and access tracks, and hydrocarbons from spills to land. Drought conditions have existed in the area for several years, and large areas of land are devoid of vegetation at present. Sedimentation is therefore occurring on a regional wide scale. Hydrocarbon spills are generally very minor in nature and are either contained within purpose built bunds or excavated from the soil and placed in the landfarm at Silver Springs.
D2	The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas from where the resultant contaminants are unlikely to be released into any waters, roadside gutter or stormwater drainage system.	The maintenance and cleaning of vehicles and machinery is carried out at the Silver Springs and Wallumbilla facilities. Dedicated washdown bays

		are in place at both facilities, along with maintenance workshops.
D3	Any spillage of wastes or contaminants that may cause environmental harm must be effectively contained and/or cleaned up as quickly as practicable.	Wastes are not currently stored on PL192 on a permanent basis. Waste is stored temporarily at locations where projects are carried out from time to time, however a full risk assessment is carried out during the planning phase to determine waste management requirements.
D4	Any spillage of wastes or contaminants must not be cleaned up by hosing, or otherwise releasing such waste or contaminants to any stormwater drainage system, roadside gutter or waters.	If minor spillages of wastes occur to land, the material is recovered and placed into a suitable containment system (steel tank, IBC or lined bag) for disposal to an appropriate facility.
Schedule E - Dams		
E1	The dams used for the storage of contaminants must be maintained: (a) so as to prevent any release of contaminants through the bed or banks of the pond to any waters (including groundwater); (b) so that a freeboard of not less than 0.5 metres is maintained at all times; and (c) so as to ensure the stability of the dams' construction.	There are two lined dams (0.5ML each) located within the Churchie gas facility, that are currently empty but may be used in future as evaporation dams for produced water. Seepage monitoring bores are located around the dams, to detect any contaminant leakage from the dams. For the past two years, the dams have been empty as produced water is not being generated from the Churchie gas fields, and the area has been in a prolonged drought.
E2	Darns must be securely fenced and / or screened to: (a) exclude and prevent the entrapment of livestock and wildlife; and (b) limit habitats for the introduction or spread of pests.	The entire Churchie Plant is securely fenced, plus there are egress ladders in place. The dams have been dry since at least January 2018 as drought conditions have prevailed and no produced water is being received by the Plant.
E3	The hazard category of any dam must be assessed by a suitably qualified and experienced person in accordance with the "Manual for Assessing Hazard Categories and Hydraulic Performance of Darns", as amended from time to time.	AGL maintains records of the original assessment (certification) of the dams.
E4	The hazard assessment required under condition (E2) must occur in any of the following situations: (a) prior to the design and construction of the darn; (b) prior to any change in its purpose or its stored contents;	See above. There has been no changes to the purpose or stored contents of the dam.

	(c) for an existing low hazard dam, within 120 business days of **16 August 2011.**	
E5	All certifications must be in the form set out in the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.	See above.
E6	Only low hazard dams are permitted under this authority.	See above. The two dams are 0.5ML and were constructed as lined dams for the evaporation of produced water in future.
E7	The holder of this environmental authority must not abandon any dam but must decommission each dam such that ongoing environmental harm is prevented.	This is a future requirement.

4.4. PL 213

Condition ID	Requirement	Actions and comments
7	The holder of the environmental authority must: a) Ensure that there is no significant disturbance in riverine areas containing permanent water, except for the necessary construction and/or maintenance of roads, tracks and pipelines; and b) Minimise disturbance of all other riverine areas.	PL213 is in a care and maintenance phase at present. No activities have taken place recently, and any proposed activities would be subject to a full risk assessment process.
8	The holder of the environmental authority must take all reasonable and practicable measures to prevent or minimise: a) Erosion of areas disturbed by petroleum activities; and b) Sedimentation of any waters as a result of petroleum activities.	See above.

4.5. PL15

Condition ID	Requirement	Actions and comments
Schedule C – Water		
C1	Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority.	Raw materials and waste products are stored at PL446 (Silver Springs) and PFL27 (Wallumbilla Plant). Any projects conducted on these leases would be subject to a full risk assessment as part of the planning process.
C2	**No** produced water shall be released into the environment	Produced water is received by the lined dams at Silver Springs (PL446). One of the dams adjacent to the Taylor Plant is located partially on PL49, however this dam does not receive produced water.
C3	The method of water sampling required by this environmental authority must comply with that set out in the most recent version of the Department of Environment and Resource Management's "Monitoring and Sampling Manual 2009 - Environmental Protection (Water) Policy 2009 Version 2 September 2010".	This requirement is taken into account during the risk assessment process that applies for proposed new projects.
C4	All laboratory analyses and tests required to be conducted under this environmental authority must be carried out by a laboratory that has NATA accreditation for such analyses and tests, except as otherwise authorised by the administering authority.	This requirement is taken into account during the risk assessment process that applies for proposed new projects.
C5	Erosion protection measures and sediment control measures must be implemented and maintained to minimise erosion and the release of sediment from all disturbed areas.	Routine erosion inspections are carried out by site personnel and any issues are managed on a case by case basis through a maintenance notification raised in SAP Fiori.
C6	Prevent any build-up of sediment in any stormwater drain.	See above.
Schedule D - Stormwater		
D1	The holder must implement and maintain measures to minimise the likelihood of the release of contaminated stormwater from the place where the activities are carried out to any stormwater drain or any waters.	The entire region is currently subject to drought conditions, with large areas of land devoid of vegetation. Wastes and raw materials are not stored at these leases, as dedicated storage areas exist at PL446 (Silver Springs) and PFL27 (Wallumbilla).
D2	The maintenance and cleaning of vehicles and any other equipment or plant must be carried out	The maintenance and cleaning of vehicles and machinery is carried out in dedicated washdown

	in areas from where the resultant contaminants are unlikely to be released into any waters, roadside gutter or stormwater drainage system.	bays and workshops at PL446 (Silver Springs) and PFL27 (Wallumbilla). Washdown water flows to triple interceptors at both sites, and the resultant water flows to evaporation dams. Oil is recovered into closed drain tanks for transport offsite to licensed facilities.
D3	Any spillage of wastes or contaminants that may cause environmental harm must be effectively contained and/or cleaned up as quickly as practicable. Such spillage must not be cleaned up by hosing, or otherwise releasing such waste or contaminants to any stormwater drainage system, roadside gutter or waters.	Wastes and raw materials are stored at PL446 (Silver Springs) and PFL27 (Wallumbilla) in dedicated bunded areas or on bunded pallets.
Schedule E - Dams		
E1	The dams used for the storage of contaminants must be maintained: (a) so as to prevent any release of contaminants through the bed or banks of the pond to any waters (including groundwater); (b) so that a freeboard of not less than 0.5 metres is maintained at all times; and (c) so as to ensure the stability of the dams' construction.	There is one dam that is partially located on PL49, which is associated with the Taylor Plant. AGL does not use this dam for the storage of contaminants. The dams can receive incident rainfall, however the region is currently experiencing prolonged drought conditions and the dams have been empty for several months or years.
E2	The hazard category of any dam must be assessed by a suitably qualified and experienced person in accordance with the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.	AGL keeps records of dam certifications on its servers. All assessments are conducted by suitably qualified and experienced engineers.
E3	The hazard assessment required under condition (E2) must occur in any of the following situations: (a) prior to the design.and construction of the dam; (b) prior to any change in its purpose or its stored contents; (c) for an existing low hazard dam, within 120 business days of 16 August 2011.	See above. AGL purchased the assets in 2011, and there have been no changes to the purpose or stored contents of the dams partially located on PL49.
E4	All certifications must be in the form set out in the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.	See above.
E5	Only low hazard dams are permitted under this authority.	The dams are classified as low hazard dams.
E6	The holder of this environmental authority must not abandon any dam but must decommission each dam such that ongoing environmental harm is prevented.	This is a future requirement.
E7	Well infrastructure and dams must be securely fenced and *I* or screened to: (a) exclude and prevent the entrapment of livestock and wildlife; and (b) limit habitats for the introduction or spread of pests.	The dam that is partially located on PL49 is not fenced, but the dams are empty and are not being used.

4.6. PLs 48, 49, 66, 202

Condition ID	Requirement	Actions and comments
Schedule C – Water		
C1	Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority.	Raw materials and waste products are stored at PL446 (Silver Springs) and PFL27 (Wallumbilla Plant). Any projects conducted on these leases would be subject to a full risk assessment as part of the planning process.
C2	**No** produced water shall be released into the environment	Produced water is received by the lined dams at Silver Springs (PL446). One of the dams adjacent to the Taylor Plant is located partially on PL49, however this dam does not receive produced water.
C3	The method of water sampling required by this environmental authority must comply with that set out in the most recent version of the Department of Environment and Resource Management's "Monitoring and Sampling Manual 2009 - Environmental Protection (Water) Policy 2009 Version 2 September 2010".	This requirement is taken into account during the risk assessment process that applies for proposed new projects.
C4	All laboratory analyses and tests required to be conducted under this environmental authority must be carried out by a laboratory that has NATA accreditation for such analyses and tests, except as otherwise authorised by the administering authority.	This requirement is taken into account during the risk assessment process that applies for proposed new projects.
C5	Erosion protection measures and sediment control measures must be implemented and maintained to minimise erosion and the release of sediment from all disturbed areas.	Routine erosion inspections are carried out by site personnel and any issues are managed on a case by case basis through a maintenance notification raised in SAP Fiori.
C6	Prevent any build-up of sediment in any stormwater drain.	See above.
Schedule D - Stormwater		
D1	The holder must implement and maintain measures to minimise the likelihood of the release of contaminated stormwater from the place where the activities are carried out to any stormwater drain or any waters.	The entire region is currently subject to drought conditions, with large areas of land devoid of vegetation. Wastes and raw materials are not stored at these leases, as dedicated storage areas exist at PL446 (Silver Springs) and PFL27 (Wallumbilla).
D2	The maintenance and cleaning of vehicles and any other equipment or plant must be carried out	The maintenance and cleaning of vehicles and machinery is carried out in dedicated washdown

	in areas from where the resultant contaminants are unlikely to be released into any waters, roadside gutter or stormwater drainage system.	bays and workshops at PL446 (Silver Springs) and PFL27 (Wallumbilla). Washdown water flows to triple interceptors at both sites, and the resultant water flows to evaporation dams. Oil is recovered into closed drain tanks for transport offsite to licensed facilities.
D3	Any spillage of wastes or contaminants that may cause environmental harm must be effectively contained and/or cleaned up as quickly as practicable. Such spillage must not be cleaned up by hosing, or otherwise releasing such waste or contaminants to any stormwater drainage system, roadside gutter or waters.	Wastes and raw materials are stored at PL446 (Silver Springs) and PFL27 (Wallumbilla) in dedicated bunded areas or on bunded pallets.
Schedule E - Dams		
E1	The dams used for the storage of contaminants must be maintained: (a) so as to prevent any release of contaminants through the bed or banks of the pond to any waters (including groundwater); (b) so that a freeboard of not less than 0.5 metres is maintained at all times; and (c) so as to ensure the stability of the dams' construction.	There is one dam that is partially located on PL49, which is associated with the Taylor Plant. AGL does not use this dam for the storage of contaminants. The dams can receive incident rainfall, however the region is currently experiencing prolonged drought conditions and the dams have been empty for several months or years.
E2	The hazard category of any dam must be assessed by a suitably qualified and experienced person in accordance with the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.	AGL keeps records of dam certifications on its servers. All assessments are conducted by suitably qualified and experienced engineers.
E3	The hazard assessment required under condition (E2) must occur in any of the following situations: (a) prior to the design.and construction of the dam; (b) prior to any change in its purpose or its stored contents; (c) for an existing low hazard dam, within 120 business days of 16 August 2011.	See above. AGL purchased the assets in 2011, and there have been no changes to the purpose or stored contents of the dams partially located on PL49.
E4	All certifications must be in the form set out in the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.	See above.
E5	Only low hazard dams are permitted under this authority.	The dams are classified as low hazard dams.
E6	The holder of this environmental authority must not abandon any dam but must decommission each dam such that ongoing environmental harm is prevented.	This is a future requirement.
E7	Well infrastructure and dams must be securely fenced and *I* or screened to: (a) exclude and prevent the entrapment of livestock and wildlife; and (b) limit habitats for the introduction or spread of pests.	The dam that is partially located on PL49 is not fenced, but the dams are empty and are not being used.

4.7. PPL4

Condition ID	Requirement	Actions and comments
Schedule B – Water		
B1	Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority	No contaminants (i.e. hazardous substances) are stored on PPL4, which is a pipeline easement. The generation of contaminants is possible within the easement, due to maintenance or decommissioning activities (e.g. pipeline repairs, hydrotesting). However, risk assessments are carried out during the planning phase of these activities. Sediment is also classified as a contaminant, and inspections of the pipeline easement are carried out routinely to check for drainage and erosion issues.
B2	Erosion protection measures and sediment control measures must be implemented and maintained to minimise erosion and the release of sediment and contaminated stormwater to waters.	Routine inspections are carried out along the pipeline easement. This includes frequent inspections by site personnel and periodic inspections by an independent third party.
B3	An Erosion and Sediment Control Plan must be developed and implemented for all stages of the petroleum activities and which has been certified by a Certified Professional in Sediment and Erosion Control, or a professional with appropriate experience and or qualifications accepted by the administering authority and must include but not be limited to: (a) diverting uncontaminated stormwater run-off around areas disturbed by petroleum activities or where contaminants or wastes are stored or handled that may contribute to stormwater; (b) contaminated stormwater runoff and incident rainfall ls collected; and treated, reused, or released in accordance with the conditions of this environmental authority; (c) roofing or minimising the size of areas where contaminants or wastes are stored or handled; (d) using alternate materials and or processes (such as dry absorbents) to clean up spills that will minimise the generation of contaminated waters; (e) erosion and sediment control structures are placed to minimise erosion of disturbed areas and prevent contamination of any waters; (f) an inspection and maintenance program for the erosion and sediment control features;	AGL maintains a copy of the Plan on its servers. However, the project is now in an operational phase and erosion issues are dealt with on a case by case basis. Site personnel are experienced with carrying out remedial works and the Environment Business Partner is a Certified Professional in Erosion and Sediment Control.

	(g) provision for adequate access to maintain all erosion and sediment control measures especially during the wet season months from December to March; and (h) identification of remedial actions that would be required to ensure compliance with the conditions of this environmental authority.	
B4	A copy of the Erosion and Sediment Control Plan must be submitted to the administering authority upon request.	This condition is yet to be triggered.
B5	There must be no release of stormwater runoff that has been in contact with any contaminants at the site to any waters, roadside gutter or stormwater drain.	Contaminants (e.g. hazardous substances) are not stored on PPL4. Hazardous substances are stored in dedicated storage areas at PL446 (Silver Springs) and PFL27 (Wallumbilla).
B6	The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas from where the resultant contaminants cannot be released into any waters.	The maintenance and cleaning of vehicles and machinery is carried out in dedicated washdown bays and workshops at PL446 (Silver Springs) and PFL27 (Wallumbilla). Washdown water flows to triple interceptors at both sites, and the resultant water flows to evaporation dams. Oil is recovered into closed drain tanks for transport offsite to licensed facilities.
B7	Contaminants must not be directly or indirectly released to any groundwaters except as permitted under this environmental authority.	The pipeline is subject to a strict integrity management program. The coatings on the pipeline date back to the mid-seventies, and surveys are undertaken annually to check the condition of the external coatings. Every five years, and intelligent pig survey is carried out to check the internal and external condition of the pipeline. Sections of coating are repaired as required. To date, no known groundwater contamination incidents have occurred on PPL4.
Schedule C - Dams		
C1	Dams are not authorised under this environmental authority.	AGL does not operate dams on PPL4.

4.8. PPL 87 and 93

Condition ID	Requirement	Actions and comments
Schedule C – Water management		
C1	The holder of this authority must ensure that the petroleum activities do not result in the release of contaminants to waters, unless specifically authorised under this authority.	No contaminants (i.e. hazardous substances) are stored on PPLs 87 and 93, which are pipeline easements. The generation of contaminants is possible within the easement, due to maintenance or decommissioning activities (e.g. pipeline repairs, hydrotesting). However, risk assessments are carried out during the planning phase of these activities. Sediment is also classified as a contaminant, and inspections of the pipeline easement are carried out routinely to check for drainage and erosion issues.
C2	The holder of this authority may allow pipeline trench water to be released to land for disposal provided that the water does not have any properties nor contain any organisms or other contaminants in concentrations that are capable of causing environmental harm.	During pipeline dig-ups, there is a possibility that stormwater could fill the trench for disposal to land the following morning. The volume of water would be very small, and any contaminants would be derived from overland flow. The region is typically subject to widespread drought conditions.
C3	Subject to Condition (C2), the holder of this authority must ensure that the release of trench water to land must be carried out in a manner that ensures that: a) vegetation is not damaged; b) soil erosion and soil structure damage is avoided; c) there is no surface ponding of trench water; d) the quality of groundwater is not adversely affected; and e) there are no releases of trench water to any surface waters.	See above.
C4	Hydrostatic test water must be contained in existing dams on site, tested and either: a) directly reused where appropriate for petroleum activities; b) treated so that it meets water quality criteria for the intended reuse; or c) disposed of via evaporation in a suitably lined pond.	There is no current need to hydrostatically test the pipelines. This may occur at end of project life as part of decommissioning activities.
C5	Except as otherwise provided by the conditions of this authority, petroleum activities must be carried out by such reasonable and practicable means necessary to prevent the contact of incident rainfall and stormwater runoff with waste or other contaminants.	Wastes and other contaminants are not stored on PPLs 87 and 93. Wastes and raw materials are stored at PL446 (Silver Springs) and PFL27 (Wallumbilla) in dedicated storage areas.
C6	All stormwater treatment devices used to treat stormwater from the authorised activities must be maintained in proper and efficient working condition.	There are no stormwater treatment devices installed on PPLs87 and 93.

C7	The maintenance and cleaning of vehicles and other equipment or plant must be carried out in areas where the resultant contaminants are not to be released to any waters.	The maintenance and cleaning of vehicles and machinery is carried out in dedicated washdown bays and workshops at PL446 (Silver Springs) and PFL27 (Wallumbilla). Washdown water flows to triple interceptors at both sites, and the resultant water flows to evaporation dams. Oil is recovered into closed drain tanks for transport offsite to licensed facilities.
C8	All determinations of the quality of contaminants released must be made in accordance with methods prescribed in the latest edition of the Department of Environment and Resource Management Water Quality Sampling Manual, and carried out on samples that are representative.	This condition is for information purposes. At present, no water monitoring is being carried out on PPLs 87 and 93.
Schedule F – Land Management		
F7	Unless otherwise approved under relevant legislation, the holder of this authority must not: a) excavate or place fill in a way that interferes with the flow of water in a watercourse, wetland, or spring, including; works that divert the course of flow of the water, or works that impound the water; b) undertake activities that take water from a watercourse, wetland or spring; c) undertake activities that take overland flow water using works that are mentioned as assessable development in a water resource plan under the *Water Act 2000*.	The requirements of this condition have not been triggered in the past few years. All proposed projects that involve land disturbance are subject to a risk assessment through AGLs management of change process.
F8	Activities resulting in significant disturbance to the bed or banks of a watercourse or wetland, or a spring must: a) only be undertaken where necessary for the construction and/or maintenance of roads, tracks and pipelines that are essential for carrying out the authorised petroleum activities and no reasonable alternative location is feasible; and b) be no greater than the minimum area necessary for the purpose of the significant disturbance; and c) be designed and undertaken by an appropriately qualified person; and d) have rehabilitation commence immediately upon cessation of the works.	See above.
F9	Sediment control measures must be implemented to minimise any increase in water turbidity due to carrying out petroleum activities in the bed or banks of a watercourse or wetland, or a spring.	There has not been a requirement to conduct works within the bed or banks of water bodies or a spring.
F10	Routine visual monitoring must be undertaken while carrying out petroleum activities in a watercourse, wetland or spring. If, due to the petroleum activities, water turbidity increases in the watercourse, wetland or spring outside contained areas, works must cease and the sediment control measures must be rectified before activities recommence.	See above.

4.9. ATP1190

Condition ID	Requirement	Actions and comments
Schedule B – Protecting environmental values		
PESCB4	For petroleum activities to be carried out in a wild river area, the activities must comply with the conditions stated for relevant petroleum activities in the wild river declaration for that area.	No petroleum activities were carried out in a wild river area. The Environment Business Partner carries out a search of online mapping databases as part of the risk assessment process for any proposed projects.
Schedule C – Operating standards		
PESCC9	Petroleum activities that require earthworks, vegetation clearing and/or placing fill, other than that associated with the construction of linear infrastructure, are not permitted in or within: (a) 200 metres of any wetland, lake or spring; or (b) 100 metres of the outer bank of any other watercourse.	There are no wells that are located within 200m of any wetland, lake or spring, or 100m from the outer bank of any other watercourse. Merroombil 1 was recently decommissioned, however only minor earthworks (grading) were required to restore localised drainage patterns.
PESCC10	The construction and/or maintenance of linear infrastructure that will result in significant disturbance to a wetland, lake, spring or watercourse must be conducted in accordance with the following order of preference. Conducting works: 1. firstly, in times where there is no water present 2. secondly, in times of no flow 3. thirdly, in times of flow, but in a way that does not impede low flow.	The requirements of this condition have not been triggered. It has not been necessary to construct any linear infrastructure.
PESCC11	Petroleum activities must not result in water turbidity increases of more than 10% in high ecological value waters outside contained construction or maintenance areas.	See above. There has not been any major land disturbances on ATP1190, and the entire region is subject to prolonged drought conditions at present.
PESCC12	The construction and/or maintenance of linear infrastructure that will result in significant disturbance to a lake, spring or watercourse must be designed and undertaken by a suitably qualified person in accordance with the guideline Activities in a watercourse, lake or spring associated with a resource activity or mining operations.	The requirements of this condition have not been triggered. It has not been necessary to construct any linear infrastructure.
PESCC13	The construction and/or maintenance of linear infrastructure that will result in significant disturbance to a wetland must be designed and undertaken by a suitably qualified person taking into	See above.

	consideration sections 5 and 6 of the guideline Activities in a watercourse, lake or spring associated with a resource activity or mining operations.	
PESCC14	Measures to minimise stormwater entry onto significantly disturbed land must be implemented and maintained.	See above.
PESCC17	Other than for flare pits and sumps used to store residual drilling material and drilling fluids, the hazard category of any dam or levee to be used in carrying out petroleum activities must be assessed in accordance with the Queensland Government Manual for Assessing Hazard Categories and Hydraulic Performance of Dams.	The requirements of this condition have not been triggered. It has not been necessary to construct any dams or levees.
PESCC18	Low hazard dams must be: a) constructed, operated and maintained in accordance with accepted engineering standards currently appropriate for the purpose for which the dam is intended to be used; and b) designed with a floor and sides made of material that will contain the wetting front and any entrained contaminants within the bounds of the containment system during both its operational life and including any period of decommissioning and rehabilitation.	See above.
PESCC19	All low hazard dams must be monitored for early signs of loss of structural or hydraulic integrity as specified in the initial hazard assessment.	See above.
PESCC20	When no longer required all low hazard dams must be decommissioned to no longer accept inflow from the petroleum activities and be either: a) rehabilitated; or b) agreed to in writing by the administering authority and the landholder to remain in situ following the cessation of the petroleum activity(ies) associated with the dam, with the contained water of a quality suitable for the intended ongoing uses(s) by that landholder.	See above.

Silver Springs Project

SURFACE WATER QUALITY MANAGEMENT SUB-PLAN

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Document revision history

Date	Version	Author	Comments
May 2020	R0	John Moraitis	Updated for AGL HSEMS
June 2022	R1	John Moraitis	Review and update

1. Introduction

This Surface Water Quality Management Sub Plan was prepared as part of the Environment Management Plan (EMP) for AGL's Silver Springs Gas Project ("the project").

This Plan was developed to specifically address and manage potential surface water quality issues for the project and is based on the previously prepared and approved Environment Health and Safety Management Plans. This Plan conforms with the Surface Water Standard (ALG-HSE-STD-009.3) and Surface Water Methodology (AGL-HSE-STD-009.3) as stipulated in the AGL Health, Safety and Environment Management System (HSEMS).

1.1. Objectives

The intent of this Plan is to assist AGL controlled sites in ensuring that:

- Environmental impacts to surface water resources and associated natural ecosystems are minimised to as low as reasonably practicable;
- Stormwater is managed effectively to prevent and minimise uncontrolled and poor water quality discharges (e.g. discharge of contaminants and sediment present in stormwater);
- Generation of wastewater(s) is managed and minimised (i.e. volume and load) as far as practicable and in accordance with relevant legislation and approvals, and opportunities for reuse and recycling are considered, prior to treatment and discharge to surface water;
- Releases, leaks and spills of hazardous substances/materials to waters are prevented and control measures are in place; and
- Regulatory licence conditions and other compliance obligations with respect to protection of surface water resources and discharges to the receiving waters are met.

In accordance with the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*, AGL seeks to protect and enhance the quality of waters and wetlands through the implementation of suitable control measures.

The environmental values of waters to be protected under this Plan are:

- for high ecological value waters (e.g. drinking water supplies) —the biological integrity of an aquatic ecosystem that is effectively unmodified or highly valued; or
- for slightly disturbed waters—the biological integrity of an aquatic ecosystem that has effectively unmodified biological indicators, but slightly modified physical, chemical or other indicators; or
- for moderately disturbed waters—the biological integrity of an aquatic ecosystem that is adversely affected by human activity to a relatively small but measurable degree; or
- for highly disturbed waters—the biological integrity of an aquatic ecosystem that is measurably degraded and of lower ecological value than waters mentioned in paragraphs (a) to (c); or
- for waters from which aquatic foods intended for human consumption are taken—the suitability of the water for producing the foods for human consumption; or

- for waters that may be used for aquaculture—the suitability of the water for aquacultural use; or
- for waters that may be used for agricultural purposes—the suitability of the water for agricultural purposes; or
- for waters that may be used for recreation or aesthetic purposes—the suitability of the water for—
    - primary recreational use; or
    - secondary recreational use; or
    - visual recreational use; or
- for waters that may be used for drinking water—the suitability of the water for supply as drinking water having regard to the level of treatment of the water; or
- for waters that may be used for industrial purposes—the suitability of the water for industrial use; or
- the cultural and spiritual values of the water.

The environmental values of wetlands to be protected under this Plan are:

- the health of the wetland's ecosystems;
- the wetland's natural state and biological integrity;
- the presence of distinct or unique features, endemic plants or animals and their habitats, including threatened wildlife and near threatened wildlife under the Nature Conservation Act 1992;
- the wetland's natural hydrological cycle;
- the natural interaction of the wetland with other ecosystems, including other wetlands.

(Please refer to the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* for definitions of the specific terms).

1.2. Existing environment

AGLs operations are located within an extensive area of the Surat Basin in Queensland. The topography is gently undulating, with grazing and agriculture dominating the land uses. The area is highly prone to drought conditions, with a mean annual rainfall of approximately 490mm. The warmer months are dominated by high intensity storms that can be localised and fast moving.

AGLs Surat operations lie wholly within the Murray Darling drainage division, which has a total area of 262,522.3 km2 and occupies 15.2% of Queensland's land area. Within the drainage division, AGLs Surat operations occur within the Balonne-Condamine drainage basin, and the Moonie drainage basin.

AGLs lease areas are located within the catchments of the Balonne River and the Moonie River. Noona Creek - a tributary of the Balonne River – is a recognised watercourse located to the north of the Silver Springs Plant and is the closest creek to AGLs operations.

The Queensland Government (Healthy Waterways) has carried out assessments on these river catchments and identified the following threats and classifications:

- Instream pest fauna (e.g. non-native fish) – high priority threat
- Climate change impacts – high priority threat

- Deposited sediment within waterway (from erosion) – high priority threat
- Hydrology/flow regime – medium priority threat
- Riparian disturbance (i.e. vegetation clearing) – medium priority threat

The Department of Natural Resources, Mines and Energy operates gauging stations on these two rivers, to collect information to assist with the management and assessment of Queensland's surface water resources. The two nearest gauging stations to AGLs Surat Operations are:

- 422213A (Balonne River at Weribone);
- 422220A (Balonne River at Surat); and
- 417205A (Moonie River at Flinton).

An analysis of the long-term stream gauge data collected at these three locations indicates that the flow volumes can vary widely depending on the type of rainfall events that occur. Water quality data is collected at the Balonne River locations only, and the data indicates that conductivity, turbidity and pH can also vary widely in response to rainfall events.

The below photographs show the two Balonne River stream gauge locations and provide an indication of the typical turbidity levels of natural waterways in the area.

Stream gauging station 422213A – Balonne River at Weribone (Source: Qld Govt – Water Monitoring Information Portal).

Stream gauging station 422220A - Balonne River at Surat (Source: Qld Govt – Water Monitoring Information Portal).

Stream gauging station 417205A – Moonie River at Flinton (Source: Qld Govt – Water Monitoring Information Portal).

1.3. Responsibilities

The roles and responsibilities for the development, implementation and review of this Plan are summarised below.

1.3.1. Executive General Manager

The Executive General Manager is responsible for:

- Delegating authority to ensure adequate implementation, monitoring and review of the Surface Water Standard, and associated Standard Methodology, occurs; and
- Ensuring adequate resources are available for the development, implementation, monitoring and review of the Surface Water Standard.

1.3.2. Head of Function

The Head of Function is responsible for:

- Ensuring the implementation and adherence to the Surface Water Standard throughout the Business Unit; and

- Ensuring adequate resources are available for the implementation, monitoring and review of the Surface Water Standard.

1.3.3. Head of Environment, Health, Audit, and Training

The Head of Environment, Health, Audit, and Training is responsible for:

- Managing the development, implementation, and maintenance of the Surface Water Standard;
- Ensuring consultation in the development, review and approval of the Surface Water Standard, and associated Standard Methodology; and
- Providing guidance for the development of objectives, goals, targets, and/or Key Performance Indicators (KPIs) associated with the Surface Water Standard, as applicable.

1.3.4. Environment Manager

The Environment Manager is responsible for:

- Assisting with the implementation and maintenance of the Surface Water Standard;
- Ensuring consultation for the review and approval of the Surface Water Standard, and associated Standard Methodology;
- Ensuring processes and/or procedures related to the Surface Water Standard are developed, implemented, followed, and meet obligations and/or requirements under applicable environmental legislation;
- Ensuring that applicable environmental objectives, goals, and targets associated with the Surface Water Standard are introduced, adhered to, and measured while meeting AGL-wide policies, objectives, goals, and targets; and
- Overseeing audits and assurance activities to ensure compliance with the Surface Water Standard and applicable regulatory requirements.

1.3.5. Business Unit Environment / Lead Environment Business Partner

The Business Unit Environment / Lead Environment Business Partner is responsible for:

- Overseeing and monitoring the implementation of the Surface Water Standard within their Business Unit, and communicating Surface Water Standard requirements to relevant personnel and/or contractors, as applicable;
- Developing processes and/or procedures related to management of surface water to ensure consistency with the Surface Water Standard, and with applicable environmental legislation;
- Providing support and guidance in the implementation of surface water related processes and/or procedures at Business Unit level;
- Undertaking or providing guidance and assistance to Leaders in the completion and review of environmental risk assessments and control processes;
- Undertaking audit and assurance activities, to ensure compliance with the Surface Water Standard and applicable regulatory requirements, and developing tracking and corrective action management plans; and

- Assisting with the delivery and tracking of environmental management projects, or the integration of environmental considerations into projects, to ensure Business Unit and site-specific targets are met.

1.3.6. Environment Advisor

The Environment Advisor is responsible for supporting the Environment Manager and/or Environment Business Partner(s) with tasks associated with:

- Implementation of the Surface Water Standard; and
- Management of the processes and/or procedures related to Surface Water Standard, at Business Unit level.

2. Legal obligations

2.1. Key legislative requirements

The key regulatory requirements relating to surface water quality are detailed below. Note there are many other sets of environmental legislation that are concerned with directly and indirectly protecting natural surface waters.

2.1.1. Environmental Protection Act 1994

- Section 22: Act binds all persons
- Section 125: Requirements to apply for an environmental authority
- Section 319: General environmental duty
- Section 320DA: Duty of owner, occupier or auditor to notify administering authority
- Section 357B: Who may apply for a temporary emissions licence
- Section 437: Offences of causing serious environmental harm
- Section 438: Offences of causing material environmental harm
- Section 440ZF: Prescribed water contaminants
- Section 440ZG: Depositing prescribed water contaminants in waters and related matters
- Section 442: Offence of releasing prescribed contaminant
- Section 443: Offence to place contaminant where serious or material environmental harm may be caused

2.1.2. Environmental Protection (Water and Wetland Biodiversity) Policy 2019

- Section 8: Indicators and water quality guidelines for environmental values for waters
- Section 9: When environmental values of water are protected
- Section 11: Water quality objectives for waters
- Section 12: Identifying environmental values etc. for waters

2.2. Key licence requirements

The environmental licences held for each lease contain general and specific conditions for managing water quality. The table below shows the current environmental approvals (licences) held for each petroleum lease, issued by the Queensland Department of Environment and Science.

Petroleum lease	Environmental licence no.	Issue date	Anniversary date (each year)
PL446	EPPG00784013	29 September 2016	24 May
PFL27	EPPG01233113	22 December 2017	Not listed on EA
PL192	EPPG00770313	23 July 2014	10 August
PL213	EPPG00304213	7 July 2016	23 January
PL 15	EPPG00770613	1 April 2022	15 August
PLs 48, 49, 66, 202	P-EA-100227919	1 April 2022	15 August
PPL 4	PEN202330511	22 June 2011	22 June
PPL 87, 93	EPPG00370113	3 February 2015	29 April
ATP1190	EPSX02909615	16 February 2015	Not listed on EA

2.3. Approval conditions

The approval conditions for each environmental approval (licence) including AGLs actions and comments are displayed in Section 4 of this document. This provides a useful reference for auditing and assurance activities as it demonstrates how AGL is specifically managing compliance against each condition.

2.4. Environmental values of waters

In accordance with the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*, the environmental values of water are considered protected when all indicators comply with the water quality guidelines stated for the indicators.

An **indicator** for an environmental value for water is a physical, chemical, biological or other property that can be measured or decided in a quantitative way.

Examples include:

- Chemical – the concentration of nutrients and pH value
- Physical – water clarity and temperature
- Biological – species density and richness

Water quality guidelines are quantitative measures or statements for **indicators,** including for example, the concentration or load of a contaminant of water, that protect a stated environmental value.

For particular water, the indicators and water quality guidelines for an environmental value are:

1. Decided using the following documents –

a. Site specific documents for the water, being a document that contains specific information about the water (or part of the water), and that is recognised by the chief executive as having appropriate scientific authority

b. The document called the "*Queensland Water Quality Guidelines 2009*" published on the Department's website

c. The document called the "*Australian and New Zealand Guidelines for Fresh and Marine Water Quality*", published in October 2018

d. The document called the "Australian Drinking Water Guidelines, Paper 6, National Water Quality Management Strategy" dated 2011 and published on the National Health and Medical Research Council's website;

e. The document called "Guidelines for Managing Risks in Recreational Waters" dated 2008, and published on the National Health and Medical Research Council's website;

f. Other relevant documents published by a recognised entity; or

2. For water mentioned in Schedule 1, Column 1 – the indicators stated in the document opposite the water in Schedule 1, Column 2.

3. To the extent of any inconsistency between the documents mentioned above for a particular water quality guideline, the documents are to be used in the order in which they are listed.

3. Potential impacts and control measures

3.1. Potential impacts

AGLs activities have the potential to cause impacts on land and waters if not managed appropriately:

- Flowlines from gas/oil fields – condensate oil leakage
- Stationary plant and equipment (e.g. compressors, generators) – leakage of oil, fuel, coolant
- Mobile plant and equipment (e.g. machinery, vehicles, pumps) – leakage of oil, fuel, coolant in transit or on location
- Chemical storage areas – loss of containment leading to release of hazardous substances
- Above ground storage vessels– contaminant leakage (e.g. oil, fuel, coolant, chemicals)
- Underground storage vessels – contaminant leakage or overflow (e.g. sumps, tanks, triple interceptors)
- Produced water dams – loss of containment resulting in contaminant release (e.g. high conductivity and nutrients, blue green algae)
- Landfarms and waste storage areas – release of contaminated surface water
- Treated sewage irrigation area – release of contaminated water (e.g. high nutrients)
- Disturbed land areas – erosion causing the generation of sediment laden and/or turbid waters to impact on natural water bodies (e.g. access tracks, cleared land, pipeline dig-ups)
- Stockpiling of materials (e.g. topsoil, subsoil, sand) – resulting in sedimentation of natural water bodies
- Work in watercourses – changes to flow patterns due to placement or removal of fill in drainage lines or waterways, including siltation
- Vegetation management – release of herbicides to natural waterbodies and/or eutrophication of waterbodies
- Refuelling activities – fuel spillage during transfer
- Release of water from impoundments (e.g. bunds, ponds, dams)
- Washdown of plant and equipment outside of dedicated washdown bay – resulting in contaminants and/or weed material being released to the environment
- Hydrotesting of pipelines or other equipment – potentially generating contaminated water
- Flooding of plant and pond areas leading to contaminant release.

3.2. Control measures

3.2.1. Management hierarchy

AGL manages surface water quality in accordance with the management hierarchy contained within the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019:*

- **Firstly** – reduce the production of wastewater or contaminants by reducing the use of water;
- **Secondly** – prevent waste and implement appropriate waste prevention measures;
- **Thirdly** – evaluate treatment and recycling options and implement appropriate treatment and recycling
- **Fourthly** – evaluate the following options for wastewater or contaminants in the order in which they are listed—
    - appropriate treatment and release to a waste facility or sewer;
    - appropriate treatment and release to land;
    - appropriate treatment and release to surface waters or groundwaters.

Definitions

appropriate treatment*, of waste water or contaminants, means—*

- *for release to a sewerage service provider's waste facility or sewer—treatment that meets the service provider's requirements for the release to the waste facility or sewer; or*
- *for release to land—treatment that ensures the release to land is ecologically sustainable; or*
- *for release to surface waters or groundwaters—treatment that ensures, or the taking of other steps to ensure, that the release—*
    - *will not affect the environmental values for the waters; or*
    - *is offset by undertaking an activity to counterbalance the impacts of releasing waste water or contaminants to waters, other than an offset to which the Environmental Offsets Act 2014 applies.*

sewerage service provider *see the Water Supply (Safety and Reliability) Act 2008, schedule 3.*

waste facility *means a facility for the recycling, reprocessing, treatment, storage, incineration, conversion to energy or disposal of waste.*

waste prevention *means the adoption of practices or processes that avoid generating waste or reduce the quantity of waste requiring subsequent treatment, recycling or disposal.*

3.2.2. HSEMS minimum controls

The following minimum controls are sourced from AGLs Surface Water Standard (ALG-HSE-STD-009.3) and Surface Water Methodology (AGL-HSE-STD-009.3) as stipulated in the AGL Health, Safety and Environment Management System (HSEMS).

RCM Ref	Minimum Control
9.3.1.1	Prior to extracting surface water from a body of water, AGL controlled sites must obtain the relevant approvals, licences, permits or authorisations as required by the regulatory authority(ies).
9.3.1.2	Surface water extraction and use conditions prescribed in the water licence, permit or authorisation must be adhered to.
9.3.1.3	Surface water usage at AGL controlled sites must be monitored and documented, as required.
9.3.1.4	Notices or orders, prohibiting or restricting surface water extraction (e.g. mandatory water restrictions, water contamination incident) must be complied with and all requirements adhered to.

Water licence or permit conditions that relate to surface water extraction and use need to be complied with, as per requirements established by the regulatory authority(ies). These may include, but not limited to:

- The maximum amounts of water which may be taken in particular periods or circumstances;
- The purposes for which the water may be used;
- The efficient use of water resources;
- The protection of the environment, including riparian environment; and
- The installation and use of measuring devices or pumps.

AGL controlled sites should not take surface water in excess of that endorsed or required in a water licence or permit. In addition, surface water extraction should not be contrary to the following (including but not limited to):

- Water Management Plan (established under state legislation);
- Temporary water allocation permission and/or short term water allocation;
- Water restriction;
- Temporary transfer authorisation;
- Watercourse authority; and
- Water supply emergency declaration.

Key water usage streams, including their purpose and volume, should be documented by AGL controlled sites. This information should be captured in a register or database – to monitor water usage onsite, so that opportunities for continuous improvement in water usage can be identified.

Water Efficiency and Conservation

RCM Ref	Minimum Control
9.3.1.5	Notices or orders, issued by the regulatory authority, to prepare a Water Efficiency Management Plan must be complied with, and all requirements adhered to.
9.3.1.6	Water restrictions notices, water shortages notices or water supply emergencies declarations, issued by the regulatory authority, must be complied with and all requirements adhered to.

Reasonable steps should be taken at AGL controlled sites to prevent wastage of water. Wherever feasible, AGL controlled sites should review their water usage practices, identify, and assess water efficiency opportunities, and plan for implementation. Water efficiency opportunities include but not limited to the following:

- Changes to equipment and/or plant (e.g. water efficient appliances and equipment, automatic shut-off mechanisms);
- Changes to operational processes (e.g. prompt water leak detection and repair, reuse and recycling of water, collection and use of rain water, reuse of treated wastewater, adjustment of water flow to the minimum required); and
- Administrative measures (e.g. in-house water use awareness programs, employee's involvement in water efficiency programs).

Water efficiency measures should also be considered and incorporated into the design of new projects, wherever feasible.

Where a Water Efficiency Management Plan is required, it should include information on:

- Water efficiency measures in place;
- Quantity of water used, including identifying increases or reductions in water consumption and estimating the percentage of water used in each major area;
- Selected indicators and targets, including benchmarking; and
- Proposed action plan, including short-term, long-term, and ongoing actions.

Water conservation measures, restrictions or prohibitions affecting an AGL controlled site should be communicated to all employees and contractors, via site inductions, toolbox talks or other communication methods.

Stormwater Management

RCM Ref	Minimum Control
9.3.1.7	Stormwater must be managed in accordance with relevant codes of practice and guidelines, where prescribed by the regulatory authority.
9.3.1.8	Control measures must be implemented at AGL controlled sites to prevent stormwater from: • Becoming contaminated with hazardous substances/materials; • Becoming loaded with sediments and other materials; • Entering the sewer, unless authorised under a trade waste agreement; and • Entering bores and/or being discharged to groundwater, unless authorised by the regulatory authority.
9.3.1.9	Contaminated stormwater must be captured and treated prior to being reused and/or discharged, as required.

AGL controlled sites should take the following principles into consideration when managing stormwater:

- Divert clean stormwater from site work areas;
- Preserve existing elements of the natural stormwater system, such as natural channels, wetlands, and riparian vegetation;
- Keep stormwater separate from other wastewater streams generated onsite;
- Minimise stormwater from work areas with potential sources of contamination (e.g. minimise area of impermeable surfaces to reduce stormwater runoff volume);
- Prevent and minimise stormwater from work areas and contact with potential sources of contamination (including soil or other materials used for construction works, sediments and acid sulfate soils/materials);
- Segregate stormwaters generated in different work areas (i.e. consider level of contamination); and
- Modify stormwater flow by using stabilisation and/or erosion controls.

Since stormwater contamination directly relates to land contamination, Leaders should ensure that the Land Standard (AGL-HSE-STD-009.1) minimum controls associated to the identification of potential sources of contamination (AGL-HSE-SDM-009.1, Section 5.2) and operational controls for preventing land contamination (AGL-HSE-SDM-009.1, Section 5.1) have been adhered to.

Where stormwater treatment is required, Leaders should assess available treatment techniques (e.g. sediment basins), to improve stormwater quality and control flow. Treatment priority should be given to stormwater generated after the first rainfall event. Leaders should also consider stormwater reuse opportunities for meeting non-potable water needs at the AGL controlled site (e.g. dust control and land irrigation), whenever water quality of stormwater is appropriate for the receiving environment.

Sludge and/or other solid waste captured in stormwater engineering controls and treatment plants should be managed in accordance with the AGL controlled site waste procedures, and in alignment with the Waste Standard (AGL-HSE-STD-009.7) and any regulatory requirements.

AGL controlled sites should develop a Stormwater Management procedure(s), to capture stormwater management strategies implemented onsite.

Stormwater discharge Points

RCM Ref	Minimum Control
9.3.1.10	Stormwater discharge points must be licensed by the relevant regulatory authority(ies), where required.

Discharge Quality

RCM Ref	Minimum Control
9.3.1.11	Stormwater discharges must not cause any of the water quality objectives applicable to the receiving waters to be exceeded (or further exceeded) and/or must comply with other regulatory authority(ies) requirements.
9.3.1.12	Notices or orders, issued by the regulatory authority, related to environmental nuisance and/or harm caused by stormwater discharges must be complied with, and all requirements adhered to.

Land disturbance works carried out at AGL controlled sites should have effective controls measures in place to manage soil erosion and use of construction materials (e.g. soil and sand), in order to minimise contact with stormwater and prevent discharge of sediments, sand, and mud to waters. Furthermore, where there is the potential for the presence and/or disturbance of Acid Sulfate Soils, acid drainage generation should be prevented, captured, and diverted away from stormwater, as it may become an environmental risk to receiving waters.

Monitoring and Reporting

RCM Ref	Minimum Control
9.3.1.13	Stormwater discharges must comply with monitoring and reporting requirements, as per licence conditions or other regulatory requirements, where required.

A monitoring program for stormwater discharges should be developed and implemented, where required, to assess if the receiving waters beneficial use(s) are being protected. This program can be developed separately or as part of the overall water/wastewater monitoring program for the AGL controlled site (refer to sections 6.2.3 and 6.2.4).

Wastewater Management

RCM Ref	Minimum Control
9.3.1.14	AGL controlled sites must develop and implement control measures to manage wastewaters generated by its activities.
9.3.1.15	Wastewaters generated at AGL controlled sites must be managed in accordance with the Waste Management Hierarchy.
9.3.1.16	Wastewater reuse and/or recycling, and its use at AGL controlled sites, must be in accordance with relevant guidelines, as prescribed by the regulatory authority.

Procedures for managing wastewaters generated, and minimising discharges to waters, at AGL controlled sites need to be developed and implemented. These needs to align with legislative requirements (including licences and regulatory approval(s)) and guidelines, relevant HSE Management System Standards, and any other commitments made with regard to wastewater management.

Wastewater generation at AGL controlled sites should be avoided, as far as practicable. Where wastewater generation is unavoidable, opportunities for maximising the implementation of the waste management hierarchy need to be identified, as follows (in order of preference):

- Reuse and/or recycling wastewaters within operations, to minimise discharge to waters; and
- Wastewater treatment, to reduce the concentration and/or load of contaminants prior to discharge.

Wastewater reuse and/or recycling options to be implemented at AGL controlled sites should not pose an environmental risk, and in particular protect:

- The beneficial uses of surface water, if wastewater is discharged into a body of water;
- The beneficial uses of groundwater, if wastewater is applied to land and/or injected underground; and
- The land use and soil characteristics, if wastewater is applied to land.

Where wastewater treatment is necessary prior to discharge, then the required level of treatment should take into consideration:

- Aspects associated with the receiving waters, including nature, beneficial use(s), assimilative capacity and presence of sensitive receptors or habitats;
- The discharge licence conditions; and
- Available best/leading practices in place within industry.

Wastewater Discharge

RCM Ref	Minimum Control
9.3.1.17	A licence, permit or consent must be obtained from the relevant regulatory authority, prior to discharging any wastewater to a body of water.

Discharge licences issued by the regulatory authority commonly set conditions (but not limited to) for:

- The location(s) and timing of discharge(s);
- The nature, composition, temperature, volume, and rate of discharge(s);
- Monitoring requirements, including maintenance and testing of measurement and/or sampling equipment; and
- Documenting wastewater discharge characteristics and monitoring results.

Discharge Points

RCM Ref	Minimum Control
9.3.1.18	Point source discharges (e.g. pipe or outfall) to the receiving waters must be licensed by the relevant regulatory authority. Any changes to licensed discharge points must be approved by the regulatory authority.

AGL controlled sites should avoid the creation of new point source discharges. If an AGL controlled site requires a new discharge point, or the relocation of an existing discharge point, approval needs to be obtained from the relevant regulatory authority(ies).

Discharge Quality

RCM Ref	Minimum Control
9.3.1.19	Wastewater discharges must not put at risk any beneficial use(s) of the receiving waters. In particular, AGL controlled sites must not discharge, unless authorised by the regulatory authority, to: • Any water supply or a catchment area of a water supply; • A Water reserve; and • Water in special or controlled areas.
9.3.1.20	Wastewater discharges must comply with the discharge limits (i.e. quantity, quality, or timing), as per the licence conditions.
9.3.1.21	Wastewater discharges must not cause any of the water quality objectives applicable to the receiving waters to be exceeded (or further exceeded), unless a mixing zone has been approved or discharge has been authorised by the relevant regulatory authority.
9.3.1.22	Notices or orders, issued by the regulatory authority, related to environmental nuisance and/or harm caused by wastewater discharges must be complied with, and all requirements adhered to.

In order to comply with discharge licence and other regulatory requirements, AGL controlled sites need to conform with discharge design criteria(s) and operational procedure(s).

The Environment representative needs to identify the beneficial use(s) to be protected for the receiving waters, and determine if the water quality objectives (i.e. specific values for water quality indicators) have been defined in relevant legislation. If these have not been defined, the Environment representative should either default to the relevant water quality guidelines (e.g. ANZECC guidelines) or derive site-specific water quality objectives, in accordance with the methodology proposed by the national and/or state water quality guidelines. However, if water quality objectives have been defined for most indicators but some key indicators are not available, then the relevant water quality guidelines for the missing indicators should be used for guidance.

Where a mixing zone has been granted by the regulatory authority, water quality objectives at or beyond the edge of the mixing zone should not be exceeded.

Wastewater monitoring

RCM Ref	Minimum Control
9.3.1.23	Wastewater discharges must comply with monitoring requirements, as per discharge licence conditions.
9.3.1.24	Monitoring must be conducted using methods and protocols approved by the regulatory authority.
9.3.1.25	Sampling and measurement equipment must be calibrated, inspected, tested, and maintained, in accordance with discharge licence conditions and other relevant regulatory requirements.
9.3.1.26	Accredited environmental laboratory services (i.e. certified by National Association of Testing Authorities (NATA) or equivalent accreditation bodies) must be used for analysis of wastewater discharge and receiving water samples.
9.3.1.27	Monitoring data must be reviewed and assessed against discharge licence limits and water quality objectives for the receiving waters. All non-compliances must be investigated and, if required, notified to the regulatory authority. Subsequently, corrective actions must be implemented and monitored.

AGL controlled sites need to develop and implement a monitoring program, in proportion to the identified level of environmental risk, in order to:

- Meet discharge licence conditions; and
- Assess the impact of the wastewater discharge(s) on the beneficial use(s) set for the receiving waters.

The Environment representative should consider the following elements when developing the monitoring program:

- Monitoring indicators, as per discharge licence requirements and any substances of concern (e.g. related to community perception);
- Monitoring type and frequency, taking into account discharge characteristics from the process over time, and significant changes to operations or the receiving waters characteristics;
- Monitoring locations, selected with the objective of providing representative monitoring data (for both wastewater discharge and the receiving waters) and in accordance with discharge licence conditions and other regulatory requirements; and
- Methods for sampling and analysis, approved by the regulatory authority.

Monitoring activities should be carried out by competent and qualified professionals, following monitoring and record-keeping procedures, and using properly calibrated and maintained equipment. AGL controlled sites should develop and implement data Quality Assurance (QA) and Quality Control (QC) procedures for conducting sampling and analysis of wastewater discharges and the receiving waters samples.

The Environment representative needs to review and analyse monitoring data, and compare with discharge limits set by the discharge licence and water quality objectives for the receiving waters. If a non-compliance is verified, the Environment representative needs to assess the environmental risks to beneficial uses of the receiving waters, and identify and implement mitigation actions to address those risks. If non-compliance results in material/serious harm to the receiving waters, then the regulatory authority needs to be notified having regard to the notification procedures under relevant legislation and AGL policies.

Reporting

RCM Ref	Minimum Control
9.3.1.28	Monitoring program information must be reported as per requirements of the regulatory authority, in accordance with discharge licence conditions.
9.3.1.29	AGL controlled sites that exceed National Pollutant Inventory (NPI) reporting threshold(s) must report relevant NPI emissions to waters, and associated transfers to waste.

NPI reporting for AGL controlled sites is managed by the AGL Environment Team. A consultant has been engaged to conduct NPI reporting for all AGL sites that trigger NPI Reporting. The AGL NPI reporting process is described in the NPI Reporting Guideline (AGL-HSE-GUI-015.3.1).

The Environment Business Partners are responsible for project managing the NPI reporting process at site level, with assistance from relevant data owners and other key stakeholders. The final NPI results are approved by the site's Head of Function, and if required by other AGL Leaders, prior to submitting the report to the relevant regulatory authority

Surface Water Contamination Incidents

RCM Ref	Minimum Control
9.3.1.30	Releases, spills, leaks or loss of containment incidents must be cleaned-up as per requirements prescribed by the regulatory authority, whenever required.
9.3.1.31	Hazards, near misses and incidents resulting in potential or actual contamination of surface water must be reported and investigated using the AGL Incident Management System.
9.3.1.32	Incidents that result in the contamination of waters must be reported to the regulatory authority, in accordance with the notification requirements established by applicable legislation.
9.3.1.33	Notices or orders issued, by the regulatory authority, for management of contaminated waters must be complied with, and all requirements adhered to.

AGL controlled sites need to identify diffuse source discharges and manage the risk to the receiving waters to as low as reasonably practicable.

Clean-up procedures for incidents resulting in surface water contamination should include the following key elements:

- Spill control equipment;
- Reference to the relevant Safety Data Sheets;
- Use of dispersants, where required;
- Personal protective equipment (PPE);
- Suitable methods of disposal of contaminated materials; and
- Internal and external communications, as required.

Releases, spills, leaks and/or loss of containment to surface water need to be reported as per the HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1).

Training and Competency

RCM Ref	Minimum Control
9.3.1.34	Assessment, clean-up, or remediation of contaminated surface water must be carried out by qualified and experienced professionals.

Professionals appointed to assess, clean-up or remediate contaminated waters need to have the appropriate qualifications or training, and are experienced and competent to conduct the work safely. Professionals assigned to respond to oil and/or chemical spills in marine waters should have competencies in accordance with the Australian Maritime Safety Authority training curriculum.

Personnel whose work could cause significant impacts to surface water, as identified by the AGL controlled site, should be competent to perform the tasks to which they are assigned. Specific training needs for individuals and teams should be determined through the implemented training and competency system, developed in alignment with the Training and Competency Standard (AGL-HSE-STD-013).

Definitions

Term	Definition
Acid Sulfate Soils	Acid Sulfate Soils are naturally occurring soils that contain iron-sulphides, which when exposed to air oxidise and produce acids. The acids can then leach, and release other substances (e.g. heavy metals), causing serious harm to the environment (e.g. killing vegetation and/or animals).
AGL Controlled Site	An AGL owned operated or controlled site, including a field operational site or an office site.
Beneficial Use	Beneficial use (also known as environmental value or protected environmental value), in relation to waters or a particular body of water, means a value or use of water which must be protected from the effects of wastewater discharges and pollution in general. A beneficial use does not prohibit or permit the use of surface waters for any particular purpose, but requires surface waters to be of a suitable quality and quantity to support that use or value. Beneficial uses can include: aquatic ecosystem, recreational water use and aesthetics, potable use, agriculture use, aquaculture use and industrial use. There can be more than one beneficial use for a given area.
Body of Water	Body of water refers to the parts of the Earth surface that are covered with water. It includes still, contained, and moving waters (e.g. oceans, seas, lakes, rivers, streams, and wetlands).
Bore	Bore refers to a structure drilled below the surface for the purpose of: • Accessing groundwater, either by natural flows, pumping or other means; • Monitoring groundwater (e.g. groundwater quality and/or groundwater levels/pressures); • Draining poor quality or contaminated groundwater; and • Recharging an aquifer.
Diffuse Source Discharge	Diffuse source discharge is typically an indirect discharge that occurs following a rainfall event or as a result of poor operational practices (e.g. contaminated stormwater run-off from site discharging to council stormwater system, discharge/over-topping from sedimentation basins or wastewater treatment ponds and sewer overflow). These do not always have an obvious discharge point.
Dispersant	Dispersant is a chemical product that improves the separation of particles. When applied to oil spills, it breaks up the oil in the water surface into particles that can be dispersed into the water column. This practice is typically used to minimise serious harm to coastal areas and marine life.
Groundwater	Groundwater is the water located beneath the Earth's surface contained in or occurring in a geological structure or formation. Groundwater is recharged from rainfall that percolates down through soil or fractures in rock, filling up the pores between sand grains or the fissures in rocks.

Term	Definition
Hazardous Substances/ Materials	Hazardous substances/materials pose a significant threat to people and/or the environment. Typically, these have toxic, corrosive, flammable, explosive or radioactive characteristics.
HSE	Health, Safety, and Environment.
Leader	Any employee who has others reporting to him or her, or who has the authority to allocate resources.
Material Environmental Harm	Material environmental harm means environmental harm that: • Comprises an environmental nuisance of a high impact or on a wide scale; and/or • Involves actual or potential harm to the health or safety of human beings that is not trivial or other actual or potential environmental harm that is not trivial nor negligible; and/or • Results in incurring reasonable costs and expenses to take all reasonable and practicable measures to prevent, mitigate or make good harm to the environment.
Mixing Zone	Mixing zone means a three-dimensional area of the receiving waters around a wastewater discharge point, within which it is recognised that the water quality objectives for the receiving waters may not be achieved (i.e. concentrations for some indicators may exceed the guideline values). This means that some or all beneficial uses may not be protected in the mixing zone. The mixing zone is site specific and specified in the wastewater discharge licence.
National Pollutant Inventory	The National Pollutant Inventory (NPI) is an online, publicly available database that contains data on key substances being emitted to air, land, and water across Australia. These key substances have been identified as potentially having a negative impact on human health and the environment.
Point Source Discharge	Point source discharge means a discrete, identifiable location, usually a discharge pipe or outfall, via which wastewater is discharged. This allows for the wastewater discharge to be readily measured.
Receiving Waters	Receiving waters means a body of water into which wastewater or stormwater is discharged.
Riparian Environment	Riparian environment refers to the area that is the interface between land and a river or stream – usually, narrow strips of land that line the borders of a body of fresh water.
Serious Environmental Harm	Serious environmental harm includes environmental harm that: • Is irreversible, high impact or wide-spread; and/or • Occurs in an area of high conservation value or an area of special significance (e.g. world heritage areas); and/or • Results in costs of more than the threshold amount being incurred in taking appropriate action to prevent or minimise the harm, and rehabilitate or remediate the environment to its condition before the harm.
Stormwater	Stormwater includes any surface runoff and flows resulting from rainfall, drainage, or other sources (e.g. overflow from bunded areas

Term	Definition
	and wastewater/water ponds). Typically, stormwater runoff could contain suspended sediments, metals, oil, nutrients (i.e. phosphorous and nitrogen), pathogens (e.g. bacteria) and litter – becoming a source of pollution to the environment if not managed appropriately.
Surface Water	Surface water means all waters on the Earth's surface, including fresh, estuarine, and marine waters (whether permanent, temporary, ephemeral, or seasonal), other than groundwater. It includes for example: natural rivers, creeks, lagoons, wetlands, lakes, and coastal waters.
Trade Waste	Trade waste refers to any liquid waste generated from industrial/commercial activities and processes, which is discharged into the sewerage system, other than domestic sewage.
Water Quality Indicators	Water quality indicators are physical (e.g. clarity), chemical (e.g. nutrients and pH), biological (e.g. seagrass depth range) or other properties of water that can be measured and be used to provide an indication of water quality.
Water Quality Guidelines	Water quality guidelines are numerical concentration limits or narrative statements for indicators, recommended to support and maintain designated beneficial water use(s) (including human uses). The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* – known as the *Australian and New Zealand Environment and Conservation Council (ANZECC) 2000 Guidelines* - provide an agreed framework to assess water quality in Australia. Australian states have developed water quality guidelines tailored to the states regions and water types.
Water Quality Objectives	Water quality objectives are numerical concentration limits or narrative statements for indicators, that have been established to support and protect the designated beneficial water uses at a specified site. Water quality objectives are developed based on scientific criteria or water quality guidelines, but are locally relevant - reflecting site specific requirements such as social or political constraints.
Wastewater	Wastewater means water used in an activity (e.g. washing, flushing, manufacturing or processing), and therefore mixed with different substances/materials or exposed to a source of heat. It is a liquid waste, mainly consisting of water (e.g. wash down water, cooling water, produced water and effluent).
Waste Management Hierarchy	The waste management hierarchy is a framework that prioritises waste management practices. Typically represented by an inverted pyramid, ranking from the most to the least environmentally sound option, it includes: • Waste avoidance; • Waste reduction; • Waste reuse; • Waste recycling; • Waste treatment; and • Waste disposal.

Term	Definition
Water Conservation	Water conservation encompasses policies, strategies, and activities to manage water as a sustainable resource, in order to meet current and future human demand. Typically enforced during a water shortage (e.g. drought), by restricting the volume of water that can be used.
Water Reserve	Water reserve refers to a proclaimed public drinking water source area. This means that surface and/or groundwater sources from that area are used for water supply and need to be protected accordingly.
Water Efficiency	**Water efficiency** means using improved practices (e.g. leak detection programs, taking showers rather than baths) and products/technologies (e.g. water efficient appliances and fixtures) that deliver equal or better service with less water, therefore reducing water wastage.

4. Approval conditions and comments

4.1. PL446

Condition ID	Requirement	Actions and comments
Schedule A – General		
A1	The environmental authority holder must not exceed the number and maximum size for each of the specified petroleum activities listed in Schedule A: Table 1 – Authorised Petroleum Activities for each petroleum tenure.	AGL has not exceeded the number and size of the existing activities and dam structures. This is monitored on a regular basis and captured through AGLs Management of Change Process.
Schedule C - Water		
C1	Contaminants must not be directly or indirectly released to any waters.	The region is generally heavily drought affected, however contaminants are managed to prevent/minimise the possibility of release to waters.
C2	An Erosion and Sediment Control Plan which has been certified by a suitably qualified person must be developed within 3 months from the date of issue of this authority.	An Erosion and Sediment Control Plan was produced as is stored on AGLs network.
C3	The Erosion and Sediment Control Plan must include but not necessarily be limited to: (a) managing and/or diverting uncontaminated stormwater run-off around areas disturbed by the petroleum activity(ies) or where contaminants or wastes are stored or handled that may contribute to contamination of waters (b) ensuring that contaminated stormwater runoff and incident rainfall is collected, treated, reused, or released in accordance with the conditions of this environmental authority (c) roofing or minimising the size of areas where contaminants or wastes are stored or handled; (d) revegetating disturbed areas as soon as practicable after the completion of works (e) using materials and or processes (e.g. dry absorbents) to clean up spills that will minimise contamination of waters (f) placing erosion and sediment control structures to minimise erosion of disturbed areas and prevent the contamination of waters (g) an inspection and maintenance program for the erosion and sediment control measures; (h) provision for adequate access to maintain all erosion and sediment control measures especially during the wet season months from November to April	See above.

	(i) additional erosion and sediment control measures for construction of wells and pipelines on slopes >10% j) a surface water monitoring program designed to detect impacts from sediment runoff into waters where erosion and sediment control measures occur within 1 00m of the high bank of a watercourse (k) identification of remedial actions required to ensure compliance with the conditions of this environmental authority; and (I) details of landholder consultation strategies and processes to be used in further developing and implementing the Erosion and Sediment Control Plan.	
C4	The holder of this environmental authority must implement the Erosion and Sediment Control Plan.	AGL implements the Plan as part of its normal operations. AGL personnel carry out frequent environmental inspections to check for erosion, and projects are managed on a case by case basis where required.
C5	A copy of the Erosion and Sediment Control Plan must be submitted to any potentially affected landholders upon request by that landholder.	A copy is maintained on AGLs network for distribution to landholders on request.
C6	The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas from where the resultant contaminants cannot be released into any waters.	AGLs machinery is maintained and cleaned at either the Silver Springs or Wallumbilla facility, where dedicated washdown bays are in place. The resultant washdown water flows to a lined pond system.
C7	Where the petroleum activity(ies) is carried out on floodplain areas, the holder of this environmental authority must ensure that the petroleum activity(ies) does not: (a) concentrate flood flows in a way that will or may cause or threaten an adverse environmental impact (b) divert flood flows from natural drainage paths and alter flow distribution (c) increase the local duration of floods (d) increase the risk of detaining flood flows (e) pose an unacceptable risk to the safety of persons from flooding; or (f) pose an unacceptable risk of damage to property from flooding.	Regular inspections of the assets and drainage systems on PL446 are carried out as part of normal operations. Remediation projects are carried out on a case by case basis, through the creation of maintenance notifications.
Schedule D – Dams		
D1	The **consequence category** of any structure must be **assessed** by a **suitably qualified and experienced person** in accordance with *the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933)* at the following times: a) prior to the design and **construction** of the **structure,** if it is not an **existing structure;** or b) prior to any change in its purpose or the nature of its stored contents.	The dams were assessed and signed off by certified personnel prior to construction. There has been no change in purpose or nature of stored contents, nor any new dams constructed.

D2	A consequence assessment report and **certification** must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.	AGL commissioned suitably qualified persons to assess the structures and maintains electronic copies of the certifications.
D3	Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933).*	See above.
D4	The holder must provide a copy of any reports, documentation and certifications prepared under this authority, including but not limited to any Register of Regulated Structures, consequence assessment, design plan and other supporting documentation, to a new holder on transfer of this authority.	The requirements of this condition have not been triggered.
D5	All low consequence dams must be designed and constructed, operated and maintained in accordance with accepted engineering standards currently appropriate for the purpose for which they are intended.	AGL carries out annual dam assessments to maintain compliance with this condition.
D6	The consequence category of each low consequence dam must be determined by a suitably qualified and experienced person: (a) prior to its construction; or (b) within 120 business days of the date of grant of this environmental authority for existing low consequence dams; and (c) prior to any change in its purpose or stored contents.	See above.
D7	Where the consequence category of a low consequence dam is for the first time assessed as significant or high, the holder of this environmental authority must ensure that the dam meets the hydraulic performance required of the assessed consequence category within 12 months of that assessment.	There are no significant or high hazard dams on PL446. A review of the 13 legacy dams was conducted by a third party technical specialist in 2015 (see report titled "PL446 Legacy Dam Consequence Assessment – IH046200-N-HY-RP-02 Rev1). The report concluded that all legacy dams identified on PL446 are low consequence category dams.
D8	In the event of early signs of loss of structural or hydraulic integrity of a low consequence dam, the holder of this environmental authority must immediately take action to prevent or minimise any actual or potential environmental harm.	The stormwater pond walls are constructed of dispersive material and therefore regular inspections are undertaken by site personnel. Following rainfall events, it is possible that erosion of the dam walls can occur, and these are managed on a case by case basis through entering maintenance notifications. Produced water is managed in lined dams that have a low erosion risk.
D9	Low consequence dams must be designed with a floor and sides made of material to contain the wetting front and any entrained contaminants within the bounds of the containment system during its operational life, including any period of decommissioning and rehabilitation.	Produced water is contained in lined dams. The other dams onsite capture stormwater only, which readily evaporates.

Schedule J – Monitoring Programs		
J29	The condition of all low consequence dams must be monitored for early signs of loss of structural or hydraulic integrity, based on the advice of a suitably qualified and experienced person. The methods of monitoring and frequency of monitoring shall be as assessed by the person who conducts the consequence assessment based on the particular circumstances of each dam.	Site personnel carry out regular inspections of the dam walls. The Environment BP also carries out inspections of the dam walls when on-site for routine environment visits (approx. every 3 weeks).

4.2. PFL27

Condition ID	Requirement	Actions and comments
Schedule B - Water		
B1	Prescribed contaminants must not be directly or indirectly released to water.	Contaminants are managed in a closed drain system, and are not directly or indirectly released to waters.
B2	The hazard category of any dam to be used in carrying out petroleum activities must be assessed in accordance with the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams*, published by the Queensland Government, and amended from time to time.	A small firewater dam is located on-site that contains stormwater only. As such the dam is low risk and is not used to carry out petroleum related activities.
B3	Regulated dams are not permitted under this environmental authority.	There are no regulated dams on-site.
B4	Low hazard dams must be: a) constructed, operated and maintained in accordance with accepted engineering standards currently appropriate for the purpose for which the dam is intended to be used; and b) designed with a floor and sides made of material that will contain the wetting front and any entrained contaminants within the bounds of the containment system during both its operational life and including any period of decommissioning and rehabilitation. (PESCC18)	See above.
B5	All low hazard dams must be monitored for early signs of loss of structural or hydraulic integrity as specified in the initial hazard assessment. (PESCC19)	See above.
Schedule G - Rehabilitation		
G2	When no longer required all low hazard dams must be decommissioned to no longer accept inflow from the petroleum activities and be either: a) rehabilitated; or b) agreed to in writing by the administering authority and the landholder to remain in situ following the cessation of the petroleum activities associated with the dam, with the contained water of a quality suitable for the intended ongoing uses by that landholder.	The requirements of this condition have not yet been triggered.

4.3. PL192

Condition ID	Requirement	Actions and comments
Schedule A - General		
A1	In the carrying out of the petroleum activities, 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 – Authorised Petroleum Activities for each petroleum tenure.	There has been no change to the number and size of petroleum activities. This is tracked by the Environment Business Partner, with any new projects captured by the management of change process.
Schedule C - Water		
C1	Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority.	Contaminants are only generated when workover activities (or strata stimulation) are occurring. Risk workshops and icebreaker sessions are held during the planning phase and routine inspections are carried out during workover activities. Contaminants are captured on-site and transferred to appropriate facilities.
C2	Produced water is not authorised to be released into the environment.	AGL is not currently generating produced water from PL192, except as part of strata stimulation activities (i.e. Churchie 12). The produced water is captured in purpose-built tanks and transferred to an appropriate facility.
C4	Petroleum activities must not occur in or within 200m of a: (a) wetland of high ecological significance (b) Great Artesian Basin Spring (c) subterranean cave GDE.	The Environment Business Partner is responsible for verifying that petroleum activities do not fall within 200m of these areas. These checks occur during the planning phase of the projects, to ensure the online mapping info is current and correct.
C5	Only construction or maintenance of linear infrastructure is permitted in or within any wetland or other environmental value or in a watercourse.	The Environment Business Partner is responsible for conducing searches of online mapping databases during the planning phase of projects.
C6	The construction or maintenance of linear infrastructure in a wetland of other environmental value must not result in the: (a) clearing of riparian vegetation outside of the minimum area practicable to carry out the works; or (b) ingress of saline water into freshwater aquifers; or (c) draining or filling of the wetland beyond the minimum area practicable to carry out the works.	AGL has not constructed any new wells, and the Environment Business Partner is responsible for confirming that the requirement of this condition is complied with in full.

C7	After the construction or maintenance works for linear infrastructure in a wetland of other environmental value are completed, the linear infrastructure must not: (a) drain or fill the wetland (b) prohibit the flow of surface water in or out of the wetland (c) lower or raise the water table and hydrostatic pressure outside the bounds of natural variability that existed before the activities commenced (d) result in ongoing negative impacts to water quality (e) result in bank instability; or (f) result in fauna ceasing to use adjacent areas for habitat, feeding, roosting or nesting.	AGL has not constructed any new linear infrastructure. Any proposed works would be subject to a detailed planning phase including risk workshops to account for impacts.
C8	The construction or maintenance of linear infrastructure activities in a watercourse must be conducted in the following preferential order: (a) firstly, in times where there is no water present (b) secondly, in times of no flow (c) thirdly, in times of flow, providing a bankfull situation is not expected and that flow is maintained.	See above.
C9	The construction or maintenance of linear infrastructure authorised under condition (C5) must comply with the water quality limits as specified in **Protecting Water Values, Table 1- Release limits for construction or maintenance of linear infrastructure.**	See above.
C10	Monitoring must be undertaken at a frequency that enables compliance with condition (C9).	See above.
C11	A register must be kept of all linear infrastructure construction and maintenance activities in a wetland of other environmental value and watercourses, which must include: (a) location of the activity (e.g. GPS coordinates (GDA94) and watercourse name) (b) estimated flow rate of surface water at the time of the activity (c) duration of works, and (d) results of impact monitoring carried out under condition (C10).	See above.
C12	Measures must be taken to minimise negative impacts to, or reversal of, any river improvement works carried out in River Improvement Areas by Queensland's River Improvement Trusts.	See above.
C13	Petroleum activity(ies) on floodplains must be carried out in a way that does not: (a) concentrate flood flows in a way that will or may cause or threaten a negative environmental impact; or (b) divert flood flows from natural drainage paths and alter flow distribution; or (c) increase the local duration of floods; or (d) increase the risk of detaining flood flows.	See above.
C19	For activities involving significant disturbance to land, control measures that are commensurate to the site specific risk of erosion, and risk of sediment release to waters must be implemented to: (a) allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities (b) minimise soil erosion resulting from wind, rain, and flowing water	See above. This would form part of a detailed risk assessment that would be carried out during the planning phase. In addition, routine inspections are carried out by site personnel and the Environmental Business Partner.

	(c) minimise the duration that disturbed soils are exposed to the erosive forces of wind, rain, and flowing water (d) minimise work-related soil erosion and sediment runoff; and (e) minimise negative impacts to land or properties adjacent to the activities (including roads).	
Schedule D – Stormwater		
D1	The holder must implement and maintain measures to minimise the likelihood of the release of contaminated stormwater from the place where the activities are carried out to any stormwater drain or any waters.	PL192 is in a care and maintenance phase at present, with the exception of a strata stimulation activity that occurred at Churchie 12 in mid-2019. The main contaminants that could impact on stormwater include: sediment from cleared areas and access tracks, and hydrocarbons from spills to land. Drought conditions have existed in the area for several years, and large areas of land are devoid of vegetation at present. Sedimentation is therefore occurring on a regional wide scale. Hydrocarbon spills are generally very minor in nature and are either contained within purpose built bunds or excavated from the soil and placed in the landfarm at Silver Springs.
D2	The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas from where the resultant contaminants are unlikely to be released into any waters, roadside gutter or stormwater drainage system.	The maintenance and cleaning of vehicles and machinery is carried out at the Silver Springs and Wallumbilla facilities. Dedicated washdown bays are in place at both facilities, along with maintenance workshops.
D3	Any spillage of wastes or contaminants that may cause environmental harm must be effectively contained and/or cleaned up as quickly as practicable.	Wastes are not currently stored on PL192 on a permanent basis. Waste is stored temporarily at locations where projects are carried out from time to time, however a full risk assessment is carried out during the planning phase to determine waste management requirements.
D4	Any spillage of wastes or contaminants must not be cleaned up by hosing, or otherwise releasing such waste or contaminants to any stormwater drainage system, roadside gutter or waters.	If minor spillages of wastes occur to land, the material is recovered and placed into a suitable containment system (steel tank, IBC or lined bag) for disposal to an appropriate facility.
Schedule E - Dams		
E1	The dams used for the storage of contaminants must be maintained: (a) so as to prevent any release of contaminants through the bed or banks of the pond to any waters	There are two lined dams (0.5ML each) located within the Churchie gas facility, that are currently

	(including groundwater); (b) so that a freeboard of not less than 0.5 metres is maintained at all times; and (c) so as to ensure the stability of the dams' construction.	empty but may be used in future as evaporation dams for produced water. Seepage monitoring bores are located around the dams, to detect any contaminant leakage from the dams. For the past two years, the dams have been empty as produced water is not being generated from the Churchie gas fields, and the area has been in a prolonged drought.
E2	Darns must be securely fenced and / or screened to: (a) exclude and prevent the entrapment of livestock and wildlife; and (b) limit habitats for the introduction or spread of pests.	The entire Churchie Plant is securely fenced, plus there are egress ladders in place. The dams have been dry since at least January 2018 as drought conditions have prevailed and no produced water is being received by the Plant.
E3	The hazard category of any dam must be assessed by a suitably qualified and experienced person in accordance with the "Manual for Assessing Hazard Categories and Hydraulic Performance of Darns", as amended from time to time.	AGL maintains records of the original assessment (certification) of the dams.
E4	The hazard assessment required under condition (E2) must occur in any of the following situations: (a) prior to the design and construction of the darn; (b) prior to any change in its purpose or its stored contents; (c) for an existing low hazard dam, within 120 business days of **16 August 2011.**	See above. There has been no changes to the purpose or stored contents of the dam.
E5	All certifications must be in the form set out in the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.	See above.
E6	Only low hazard dams are permitted under this authority.	See above. The two dams are 0.5ML and were constructed as lined dams for the evaporation of produced water in future.
E7	The holder of this environmental authority must not abandon any dam but must decommission each dam such that ongoing environmental harm is prevented.	This is a future requirement.

4.4. PL 213

Condition ID	Requirement	Actions and comments
7	The holder of the environmental authority must: a) Ensure that there is no significant disturbance in riverine areas containing permanent water, except for the necessary construction and/or maintenance of roads, tracks and pipelines; and b) Minimise disturbance of all other riverine areas.	PL213 is in a care and maintenance phase at present. No activities have taken place recently, and any proposed activities would be subject to a full risk assessment process.
8	The holder of the environmental authority must take all reasonable and practicable measures to prevent or minimise: a) Erosion of areas disturbed by petroleum activities; and b) Sedimentation of any waters as a result of petroleum activities.	See above.

4.5. PL15

Condition ID	Requirement	Actions and comments
Schedule C – Water		
C1	Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority.	Raw materials and waste products are stored at PL446 (Silver Springs) and PFL27 (Wallumbilla Plant). Any projects conducted on these leases would be subject to a full risk assessment as part of the planning process.
C2	**No** produced water shall be released into the environment	Produced water is received by the lined dams at Silver Springs (PL446). One of the dams adjacent to the Taylor Plant is located partially on PL49, however this dam does not receive produced water.
C3	The method of water sampling required by this environmental authority must comply with that set out in the most recent version of the Department of Environment and Resource Management's "Monitoring and Sampling Manual 2009 - Environmental Protection (Water) Policy 2009 Version 2 September 2010".	This requirement is taken into account during the risk assessment process that applies for proposed new projects.
C4	All laboratory analyses and tests required to be conducted under this environmental authority must be carried out by a laboratory that has NATA accreditation for such analyses and tests, except as otherwise authorised by the administering authority.	This requirement is taken into account during the risk assessment process that applies for proposed new projects.

C5	Erosion protection measures and sediment control measures must be implemented and maintained to minimise erosion and the release of sediment from all disturbed areas.	Routine erosion inspections are carried out by site personnel and any issues are managed on a case by case basis through a maintenance notification raised in SAP Fiori.
C6	Prevent any build-up of sediment in any stormwater drain.	See above.
Schedule D - Stormwater		
D1	The holder must implement and maintain measures to minimise the likelihood of the release of contaminated stormwater from the place where the activities are carried out to any stormwater drain or any waters.	The entire region is currently subject to drought conditions, with large areas of land devoid of vegetation. Wastes and raw materials are not stored at these leases, as dedicated storage areas exist at PL446 (Silver Springs) and PFL27 (Wallumbilla).
D2	The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas from where the resultant contaminants are unlikely to be released into any waters, roadside gutter or stormwater drainage system.	The maintenance and cleaning of vehicles and machinery is carried out in dedicated washdown bays and workshops at PL446 (Silver Springs) and PFL27 (Wallumbilla). Washdown water flows to triple interceptors at both sites, and the resultant water flows to evaporation dams. Oil is recovered into closed drain tanks for transport offsite to licensed facilities.
D3	Any spillage of wastes or contaminants that may cause environmental harm must be effectively contained and/or cleaned up as quickly as practicable. Such spillage must not be cleaned up by hosing, or otherwise releasing such waste or contaminants to any stormwater drainage system, roadside gutter or waters.	Wastes and raw materials are stored at PL446 (Silver Springs) and PFL27 (Wallumbilla) in dedicated bunded areas or on bunded pallets.
Schedule E - Dams		
E1	The dams used for the storage of contaminants must be maintained: (a) so as to prevent any release of contaminants through the bed or banks of the pond to any waters (including groundwater); (b) so that a freeboard of not less than 0.5 metres is maintained at all times; and (c) so as to ensure the stability of the dams' construction.	There is one dam that is partially located on PL49, which is associated with the Taylor Plant. AGL does not use this dam for the storage of contaminants. The dams can receive incident rainfall, however the region is currently experiencing prolonged drought conditions and the dams have been empty for several months or years.
E2	The hazard category of any dam must be assessed by a suitably qualified and experienced person in accordance with the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.	AGL keeps records of dam certifications on its servers. All assessments are conducted by suitably qualified and experienced engineers.
E3	The hazard assessment required under condition (E2) must occur in any of the following situations:	See above. AGL purchased the assets in 2011, and there have been no changes to the purpose

	(a) prior to the design.and construction of the dam; (b) prior to any change in its purpose or its stored contents; (c) for an existing low hazard dam, within 120 business days of 16 August 2011.	or stored contents of the dams partially located on PL49.
E4	All certifications must be in the form set out in the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.	See above.
E5	Only low hazard dams are permitted under this authority.	The dams are classified as low hazard dams.
E6	The holder of this environmental authority must not abandon any dam but must decommission each dam such that ongoing environmental harm is prevented.	This is a future requirement.
E7	Well infrastructure and dams must be securely fenced and / or screened to: (a) exclude and prevent the entrapment of livestock and wildlife; and (b) limit habitats for the introduction or spread of pests.	The dam that is partially located on PL49 is not fenced, but the dams are empty and are not being used.

4.6. PL2 48, 49, 66, 202

Condition ID	Requirement	Actions and comments
Schedule C – Water		
C1	Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority.	Raw materials and waste products are stored at PL446 (Silver Springs) and PFL27 (Wallumbilla Plant). Any projects conducted on these leases would be subject to a full risk assessment as part of the planning process.
C2	**No** produced water shall be released into the environment	Produced water is received by the lined dams at Silver Springs (PL446). One of the dams adjacent to the Taylor Plant is located partially on PL49, however this dam does not receive produced water.
C3	The method of water sampling required by this environmental authority must comply with that set out in the most recent version of the Department of Environment and Resource Management's "Monitoring and Sampling Manual 2009 - Environmental Protection (Water) Policy 2009 Version 2 September 2010".	This requirement is taken into account during the risk assessment process that applies for proposed new projects.
C4	All laboratory analyses and tests required to be conducted under this environmental authority must be carried out by a laboratory that has NATA accreditation for such analyses and tests, except as otherwise authorised by the administering authority.	This requirement is taken into account during the risk assessment process that applies for proposed new projects.
C5	Erosion protection measures and sediment control measures must be implemented and maintained to minimise erosion and the release of sediment from all disturbed areas.	Routine erosion inspections are carried out by site personnel and any issues are managed on a case by case basis through a maintenance notification raised in SAP Fiori.

C6	Prevent any build-up of sediment in any stormwater drain.	See above.
Schedule D - Stormwater		
D1	The holder must implement and maintain measures to minimise the likelihood of the release of contaminated stormwater from the place where the activities are carried out to any stormwater drain or any waters.	The entire region is currently subject to drought conditions, with large areas of land devoid of vegetation. Wastes and raw materials are not stored at these leases, as dedicated storage areas exist at PL446 (Silver Springs) and PFL27 (Wallumbilla).
D2	The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas from where the resultant contaminants are unlikely to be released into any waters, roadside gutter or stormwater drainage system.	The maintenance and cleaning of vehicles and machinery is carried out in dedicated washdown bays and workshops at PL446 (Silver Springs) and PFL27 (Wallumbilla). Washdown water flows to triple interceptors at both sites, and the resultant water flows to evaporation dams. Oil is recovered into closed drain tanks for transport offsite to licensed facilities.
D3	Any spillage of wastes or contaminants that may cause environmental harm must be effectively contained and/or cleaned up as quickly as practicable. Such spillage must not be cleaned up by hosing, or otherwise releasing such waste or contaminants to any stormwater drainage system, roadside gutter or waters.	Wastes and raw materials are stored at PL446 (Silver Springs) and PFL27 (Wallumbilla) in dedicated bunded areas or on bunded pallets.
Schedule E - Dams		
E1	The dams used for the storage of contaminants must be maintained: (a) so as to prevent any release of contaminants through the bed or banks of the pond to any waters (including groundwater); (b) so that a freeboard of not less than 0.5 metres is maintained at all times; and (c) so as to ensure the stability of the dams' construction.	There is one dam that is partially located on PL49, which is associated with the Taylor Plant. AGL does not use this dam for the storage of contaminants. The dams can receive incident rainfall, however the region is currently experiencing prolonged drought conditions and the dams have been empty for several months or years.
E2	The hazard category of any dam must be assessed by a suitably qualified and experienced person in accordance with the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.	AGL keeps records of dam certifications on its servers. All assessments are conducted by suitably qualified and experienced engineers.
E3	The hazard assessment required under condition (E2) must occur in any of the following situations: (a) prior to the design.and construction of the dam; (b) prior to any change in its purpose or its stored contents; (c) for an existing low hazard dam, within 120 business days of 16 August 2011.	See above. AGL purchased the assets in 2011, and there have been no changes to the purpose or stored contents of the dams partially located on PL49.
E4	All certifications must be in the form set out in the "Manual for Assessing Hazard Categories and	See above.

	Hydraulic Performance of Dams", as amended from time to time.	
E5	Only low hazard dams are permitted under this authority.	The dams are classified as low hazard dams.
E6	The holder of this environmental authority must not abandon any dam but must decommission each dam such that ongoing environmental harm is prevented.	This is a future requirement.
E7	Well infrastructure and dams must be securely fenced and *I* or screened to: (a) exclude and prevent the entrapment of livestock and wildlife; and (b) limit habitats for the introduction or spread of pests.	The dam that is partially located on PL49 is not fenced, but the dams are empty and are not being used.

4.7. PPL4

Condition ID	Requirement	Actions and comments
Schedule B – Water		
B1	Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority	No contaminants (i.e. hazardous substances) are stored on PPL4, which is a pipeline easement. The generation of contaminants is possible within the easement, due to maintenance or decommissioning activities (e.g. pipeline repairs, hydrotesting). However, risk assessments are carried out during the planning phase of these activities. Sediment is also classified as a contaminant, and inspections of the pipeline easement are carried out routinely to check for drainage and erosion issues.
B2	Erosion protection measures and sediment control measures must be implemented and maintained to minimise erosion and the release of sediment and contaminated stormwater to waters.	Routine inspections are carried out along the pipeline easement. This includes frequent inspections by site personnel and periodic inspections by an independent third party.
B3	An Erosion and Sediment Control Plan must be developed and implemented for all stages of the petroleum activities and which has been certified by a Certified Professional in Sediment and Erosion Control, or a professional with appropriate experience and or qualifications accepted by the administering authority and must include but not be limited to: (a) diverting uncontaminated stormwater run-off around areas disturbed by petroleum activities or where contaminants or wastes are stored or handled that may contribute to stormwater; (b) contaminated stormwater runoff and incident rainfall ls collected; and treated, reused, or released in accordance with the conditions of this environmental authority;	AGL maintains a copy of the Plan on its servers. However, the project is now in an operational phase and erosion issues are dealt with on a case by case basis. Site personnel are experienced with carrying out remedial works and the Environment Business Partner is a Certified Professional in Erosion and Sediment Control.

	(c) roofing or minimising the size of areas where contaminants or wastes are stored or handled; (d) using alternate materials and or processes (such as dry absorbents) to clean up spills that will minimise the generation of contaminated waters; (e) erosion and sediment control structures are placed to minimise erosion of disturbed areas and prevent contamination of any waters; (f) an inspection and maintenance program for the erosion and sediment control features; (g) provision for adequate access to maintain all erosion and sediment control measures especially during the wet season months from December to March; and (h) identification of remedial actions that would be required to ensure compliance with the conditions of this environmental authority.	
B4	A copy of the Erosion and Sediment Control Plan must be submitted to the administering authority upon request.	This condition is yet to be triggered.
B5	There must be no release of stormwater runoff that has been in contact with any contaminants at the site to any waters, roadside gutter or stormwater drain.	Contaminants (e.g. hazardous substances) are not stored on PPL4. Hazardous substances are stored in dedicated storage areas at PL446 (Silver Springs) and PFL27 (Wallumbilla).
B6	The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas from where the resultant contaminants cannot be released into any waters.	The maintenance and cleaning of vehicles and machinery is carried out in dedicated washdown bays and workshops at PL446 (Silver Springs) and PFL27 (Wallumbilla). Washdown water flows to triple interceptors at both sites, and the resultant water flows to evaporation dams. Oil is recovered into closed drain tanks for transport offsite to licensed facilities.
B7	Contaminants must not be directly or indirectly released to any groundwaters except as permitted under this environmental authority.	The pipeline is subject to a strict integrity management program. The coatings on the pipeline date back to the mid-seventies, and surveys are undertaken annually to check the condition of the external coatings. Every five years, and intelligent pig survey is carried out to check the internal and external condition of the pipeline. Sections of coating are repaired as required. To date, no known groundwater contamination incidents have occurred on PPL4.
Schedule C - Dams		
C1	Dams are not authorised under this environmental authority.	AGL does not operate dams on PPL4.

4.8. PPL 87 and 93

Condition ID	Requirement	Actions and comments
Schedule C – Water management		
C1	The holder of this authority must ensure that the petroleum activities do not result in the release of contaminants to waters, unless specifically authorised under this authority.	No contaminants (i.e. hazardous substances) are stored on PPLs 87 and 93, which are pipeline easements. The generation of contaminants is possible within the easement, due to maintenance or decommissioning activities (e.g. pipeline repairs, hydrotesting). However, risk assessments are carried out during the planning phase of these activities. Sediment is also classified as a contaminant, and inspections of the pipeline easement are carried out routinely to check for drainage and erosion issues.
C2	The holder of this authority may allow pipeline trench water to be released to land for disposal provided that the water does not have any properties nor contain any organisms or other contaminants in concentrations that are capable of causing environmental harm.	During pipeline dig-ups, there is a possibility that stormwater could fill the trench for disposal to land the following morning. The volume of water would be very small, and any contaminants would be derived from overland flow. The region is typically subject to widespread drought conditions.
C3	Subject to Condition (C2), the holder of this authority must ensure that the release of trench water to land must be carried out in a manner that ensures that: a) vegetation is not damaged; b) soil erosion and soil structure damage is avoided; c) there is no surface ponding of trench water; d) the quality of groundwater is not adversely affected; and e) there are no releases of trench water to any surface waters.	See above.
C4	Hydrostatic test water must be contained in existing dams on site, tested and either: a) directly reused where appropriate for petroleum activities; b) treated so that it meets water quality criteria for the intended reuse; or c) disposed of via evaporation in a suitably lined pond.	There is no current need to hydrostatically test the pipelines. This may occur at end of project life as part of decommissioning activities.

C5	Except as otherwise provided by the conditions of this authority, petroleum activities must be carried out by such reasonable and practicable means necessary to prevent the contact of incident rainfall and stormwater runoff with waste or other contaminants.	Wastes and other contaminants are not stored on PPLs 87 and 93. Wastes and raw materials are stored at PL446 (Silver Springs) and PFL27 (Wallumbilla) in dedicated storage areas.
C6	All stormwater treatment devices used to treat stormwater from the authorised activities must be maintained in proper and efficient working condition.	There are no stormwater treatment devices installed on PPLs87 and 93.
C7	The maintenance and cleaning of vehicles and other equipment or plant must be carried out in areas where the resultant contaminants are not to be released to any waters.	The maintenance and cleaning of vehicles and machinery is carried out in dedicated washdown bays and workshops at PL446 (Silver Springs) and PFL27 (Wallumbilla). Washdown water flows to triple interceptors at both sites, and the resultant water flows to evaporation dams. Oil is recovered into closed drain tanks for transport offsite to licensed facilities.
C8	All determinations of the quality of contaminants released must be made in accordance with methods prescribed in the latest edition of the Department of Environment and Resource Management Water Quality Sampling Manual, and carried out on samples that are representative.	This condition is for information purposes. At present, no water monitoring is being carried out on PPLs 87 and 93.
Schedule F – Land Management		
F7	Unless otherwise approved under relevant legislation, the holder of this authority must not: a) excavate or place fill in a way that interferes with the flow of water in a watercourse, wetland, or spring, including; works that divert the course of flow of the water, or works that impound the water; b) undertake activities that take water from a watercourse, wetland or spring; c) undertake activities that take overland flow water using works that are mentioned as assessable development in a water resource plan under the *Water Act 2000*.	The requirements of this condition have not been triggered in the past few years. All proposed projects that involve land disturbance are subject to a risk assessment through AGLs management of change process.
F8	Activities resulting in significant disturbance to the bed or banks of a watercourse or wetland, or a spring must: a) only be undertaken where necessary for the construction and/or maintenance of roads, tracks and pipelines that are essential for carrying out the authorised petroleum activities and no reasonable alternative location is feasible; and b) be no greater than the minimum area necessary for the purpose of the significant disturbance; and c) be designed and undertaken by an appropriately qualified person; and d) have rehabilitation commence immediately upon cessation of the works.	See above.
F9	Sediment control measures must be implemented to minimise any increase in water turbidity due to carrying out petroleum activities in the bed or banks of a watercourse or wetland, or a spring.	There has not been a requirement to conduct works within the bed or banks of water bodies or a spring.
F10	Routine visual monitoring must be undertaken while carrying out petroleum activities in a watercourse, wetland or spring. If, due to the petroleum activities, water turbidity increases in the	See above.

	watercourse, wetland or spring outside contained areas, works must cease and the sediment control measures must be rectified before activities recommence.	

4.9. ATP1190

Condition ID	Requirement	Actions and comments
Schedule B – Protecting environmental values		
PESCB4	For petroleum activities to be carried out in a wild river area, the activities must comply with the conditions stated for relevant petroleum activities in the wild river declaration for that area.	No petroleum activities were carried out in a wild river area. The Environment Business Partner carries out a search of online mapping databases as part of the risk assessment process for any proposed projects.
Schedule C – Operating standards		
PESCC9	Petroleum activities that require earthworks, vegetation clearing and/or placing fill, other than that associated with the construction of linear infrastructure, are not permitted in or within: (a) 200 metres of any wetland, lake or spring; or (b) 100 metres of the outer bank of any other watercourse.	There are no wells that are located within 200m of any wetland, lake or spring, or 100m from the outer bank of any other watercourse. Merroombil 1 was recently decommissioned, however only minor earthworks (grading) were required to restore localised drainage patterns.
PESCC10	The construction and/or maintenance of linear infrastructure that will result in significant disturbance to a wetland, lake, spring or watercourse must be conducted in accordance with the following order of preference. Conducting works: 1. firstly, in times where there is no water present 2. secondly, in times of no flow 3. thirdly, in times of flow, but in a way that does not impede low flow.	The requirements of this condition have not been triggered. It has not been necessary to construct any linear infrastructure.
PESCC11	Petroleum activities must not result in water turbidity increases of more than 10% in high ecological value waters outside contained construction or maintenance areas.	See above. There has not been any major land disturbances on ATP1190, and the entire region is subject to prolonged drought conditions at present.
PESCC12	The construction and/or maintenance of linear infrastructure that will result in significant disturbance to a lake, spring or watercourse must be designed and undertaken by a suitably qualified person in accordance with the guideline Activities in a watercourse, lake or spring associated with a resource activity or mining operations.	The requirements of this condition have not been triggered. It has not been necessary to construct any linear infrastructure.

PESCC13	The construction and/or maintenance of linear infrastructure that will result in significant disturbance to a wetland must be designed and undertaken by a suitably qualified person taking into consideration sections 5 and 6 of the guideline Activities in a watercourse, lake or spring associated with a resource activity or mining operations.	See above.
PESCC14	Measures to minimise stormwater entry onto significantly disturbed land must be implemented and maintained.	See above.
PESCC17	Other than for flare pits and sumps used to store residual drilling material and drilling fluids, the hazard category of any dam or levee to be used in carrying out petroleum activities must be assessed in accordance with the Queensland Government Manual for Assessing Hazard Categories and Hydraulic Performance of Dams.	The requirements of this condition have not been triggered. It has not been necessary to construct any dams or levees.
PESCC18	Low hazard dams must be: a) constructed, operated and maintained in accordance with accepted engineering standards currently appropriate for the purpose for which the dam is intended to be used; and b) designed with a floor and sides made of material that will contain the wetting front and any entrained contaminants within the bounds of the containment system during both its operational life and including any period of decommissioning and rehabilitation.	See above.
PESCC19	All low hazard dams must be monitored for early signs of loss of structural or hydraulic integrity as specified in the initial hazard assessment.	See above.
PESCC20	When no longer required all low hazard dams must be decommissioned to no longer accept inflow from the petroleum activities and be either: a) rehabilitated; or b) agreed to in writing by the administering authority and the landholder to remain in situ following the cessation of the petroleum activity(ies) associated with the dam, with the contained water of a quality suitable for the intended ongoing uses(s) by that landholder.	See above.

Silver Springs Project

AIR QUALITY MANAGEMENT SUB-PLAN

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Document revision history

Date	Version	Author	Comments
May 2020	R0	John Moraitis	Updated for AGL HSEMS
June 2022	R1	John Moraitis	Updated for sandblasting

1. Introduction

This Air Quality Management Sub Plan was prepared as part of the Environment Management Plan (EMP) for AGL's Silver Springs Gas Project ("the project").

This Plan was developed to specifically address and manage potential air quality issues for the project and is based on the previously prepared and approved Environment Health and Safety Management Plans. This Plan conforms with the Air Emissions Standard (ALG-HSE-STD-009.4) as stipulated in the AGL Health, Safety and Environment Management System (HSEMS).

This Plan applies to AGL controlled sites where sources of point source and/or fugitive emissions are operated or managed. It covers all activities, carried out by AGL employees and contractors, in AGL controlled sites, that:

- Generate and/or result in the generation of air emissions; and
- Result or potentially result in air pollution incidents.

1.1. Objectives

The intent of this Plan is to assist AGL controlled sites in ensuring that:

- Impacts from air emissions to the environment, human health and safety, and amenity are minimised to as low as reasonably practicable;
- Generation of air emissions is managed effectively and minimised as far as practicable, and in accordance with relevant legislation and approvals;
- Accidental/unplanned air emissions that impact on ambient air quality are prevented and control measures are in place; and
- Regulatory licence conditions and other compliance obligations with respect to protection of ambient air quality are met.

In accordance with the *Environmental Protection (Air) Policy 2019*, AGL seeks to protect and enhance the qualities of the air environment that are conducive to:

- Protecting the health and biodiversity of ecosystems; and
- Human health and wellbeing; and
- Protecting the aesthetics of the environment, including the appearance of buildings, structures and other property; and
- Protecting agricultural use of the environment.

1.2. Ambient air quality

The Department of Environment and Science has established a monitoring network within the Western Downs region to assess air quality in an area of intensive coal seam gas (CSG) production. Air monitoring stations are currently active at Hopeland (2015), Miles Airport (2015) and Upper Humbug (2019). Historical stations include Burncluith (2016 – 2018), Condamine (2016 – 2017) and Tara (2016 – 2019). The closest air monitoring station to AGLs Surat assets is the Upper Humbug station which is located near the township of Condamine.

These monitoring stations are situated on properties near CSG infrastructure such as gas processing facilities and active gas wells. The air monitoring stations that were located at Condamine and Burncluith ceased operation in February 2018. Up until February 2018, this monitoring network was managed by the CSIRO's Gas Industry Social and Environmental Research Alliance (GISERA) as part of the Surat Basin Air Quality study. Environmental consultants operated the monitoring network on behalf of CSIRO/GISERA during the study period. Method and data validation for the network was overseen by CSIRO. The monitoring network is now operated by the gas industry and the data is available at the Department of Environment and Science website, along with further information on the monitoring network.

1.3. Responsibilities

The roles and responsibilities for the development, implementation and review of this Plan are summarised below, consistent with AGLs HSEMS.

1.3.1. General Manager, HSE

The General Manager, HSE is responsible for:

- Delegating authority to ensure adequate implementation, monitoring and review of the Air Emissions Standard, and associated Methodology, occurs; and
- Ensuring adequate resources are available for the development, implementation, monitoring and review of the Air Emissions Standard.

1.3.2. Head of Function

The Head of Function is responsible for:

- Ensuring the implementation and adherence to the Air Emissions Standard throughout the Business Unit; and
- Ensuring adequate resources are available for the implementation, monitoring and review of the Air Emissions Standard.

1.3.3. Senior Manager, Environment Operations

The Senior Manager, Environment Operations is responsible for:

- Managing the development, implementation and maintenance of the Air Emissions Standard;
- Ensuring consultation in the development, review and approval of the Air Emissions Standard, and associated Methodology;

- Ensuring processes and/or procedures related to the Air Emissions Standard are developed, implemented, followed and meet obligations and/or requirements under applicable environmental legislation;
- Providing guidance for the development of objectives, goals, targets and/or Key Performance Indicators (KPIs) associated with the Air Emissions Standard, as applicable.
- Ensuring that applicable environmental objectives, goals and targets associated with the Air Emissions Standard are introduced, adhered to and measured while meeting AGL-wide policies, objectives, goals and targets; and
- Overseeing audits and assurance activities to ensure compliance with the Air Emissions Standard and applicable regulatory requirements.

1.3.4. Environment Business Partner

The Environment Business Partner is responsible for:

- Overseeing and monitoring the implementation of the Air Emissions Standard within their Business Unit, and communicating Air Emissions Standard requirements to relevant personnel and/or contractors, as applicable;
- Developing processes and/or procedures related to management of air emissions to ensure consistency with the Air Emissions Standard, and with applicable environmental legislation;
- Providing support and guidance in the implementation of air emissions related processes and/or procedures at Business Unit level;
- Undertaking or providing guidance and assistance to Leaders in the completion and review of environmental risk assessments and control processes;
- Undertaking audit and assurance activities, to ensure compliance with the Air Emissions Standard and applicable regulatory requirements, and developing tracking and corrective action management plans; and
- Assisting with the delivery and tracking of environmental management projects, or the integration of environmental considerations into projects, to ensure Business Unit and site-specific targets are met.

1.3.5. Environment Advisor

The Environment Advisor is responsible for supporting the Senior Manager, Environment Operations and/or Environment Business Partner(s) with tasks associated with:

- Implementation of the Air Emissions Standard; and/or
- Management of the processes and/or procedures related to Air Emissions Standard, at Business Unit level.

2. Legal obligations

2.1. Key legislative requirements

The key regulatory requirements relating to air quality are detailed below.

2.1.1. Environmental Protection Act 1994

- Section 22: Act binds all persons
- Section 125: Requirements to apply for an environmental authority
- Section 319: General environmental duty
- Section 320DA: Duty of owner, occupier or auditor to notify administering authority
- Section 357B: Who may apply for a temporary emissions licence
- Section 437: Offences of causing serious environmental harm
- Section 438: Offences of causing material environmental harm
- Section 440: Offence of causing environmental nuisance
- Section 442: Offence of releasing prescribed contaminant
- Section 443: Offence to place contaminant where serious or material environmental harm may be caused
- Section 443A: Offence to place contaminant where environmental nuisance may be caused

2.1.2. Environmental Protection Regulation 2019

- Chapter 7 and Chapter 10: National Pollutant Inventory
- Division 4: Environmental management and environmental offences .

2.1.3. Environmental Protection (Air) Policy 2019

- Section 8: Management hierarchy for air emissions
- Schedule 1: Air quality objectives

2.2. Key licence requirements

The environmental licences held for each lease contain general and specific conditions for managing air quality. The table below shows the current environmental approvals (licences) held for each petroleum lease, issued by the Queensland Department of Environment and Science.

Petroleum lease	Environmental licence no.	Issue date	Anniversary date (each year)
PL446	EPPG00784013	29 September 2016	24 May
PFL27	EPPG01233113	22 December 2017	Not listed on EA
PL192	EPPG00770313	23 July 2014	10 August
PL213	EPPG00304213	7 July 2016	23 January
PL 15	EPPG00770613	1 April 2022	15 August
PLs 48, 49, 66, 202	P-EA-100227919	1 April 2022	15 August
PPL 4	PEN202330511	22 June 2011	22 June
PPL 87, 93	EPPG00370113	3 February 2015	29 April
ATP1190	EPSX02909615	16 February 2015	Not listed on EA

2.3. Approval conditions

The approval conditions for each environmental approval (licence) including AGLs actions and comments are displayed in Section 4 of this document. This provides a useful reference for auditing and assurance activities as it demonstrates how AGL is specifically managing compliance against each condition.

3. Impacts and control measures

3.1. Potential impacts

The following sources of emissions are identified as being caused by AGLs activities:

- Pipeline and plant purging and blowdown for maintenance purposes
- Flaring for operational and safety purposes
- Uncontrolled leakage from pipelines and other assets (e.g. wells, plant)
- Stationary machinery exhausts (e.g. compressors, generators, heaters)
- Mobile machinery (e.g. earthmoving equipment, elevated work platforms)
- Temporary and intermittent sandblasting activities (i.e. de-ethaniser stacks, buried pipelines)
- Vehicle exhausts (e.g. light and heavy vehicles)
- Unsealed roads creating windblown dust
- Cleared areas (e.g. laydown yards) creating windblown dust
- Minor emissions (e.g. fuel storage, herbicide spraying, the use of small engines, welding and the use of chemicals and paints).

3.2. Control measures

3.2.1. Management hierarchy

In accordance with the *Environmental Protection (Air) Policy 2019*, the management hierarchy for activities that involve air emissions are listed below. The legislation states that these are expected to be implemented to the extent that it is reasonable to do so:

- **Firstly** – avoid air emissions (e.g. use cleaner technologies, schedule activities)
- **Secondly** – recycle air emissions (e.g. re-use emissions in another industrial process)
- **Thirdly** – minimise air emissions (e.g. use technology, materials or industrial processes that minimise emissions)
- **Fourthly** – manage air emissions (e.g. locating or orientating plant or equipment that releases emissions in a suitable area to minimise the impact of the air emissions, treating air emissions before release, dispersing air emissions to minimise the impact of the air emissions).

3.2.2. HSEMS minimum controls

The following minimum controls are specified in AGLs Air Emissions Standard (AGL-HSE-STD-009.4) and Air Emissions Methodology (AGL-HSE-SDM-009.4).

Management of point source emissions

RCM Ref	Minimum Controls
9.4.1.1	Licences, permits or authorisations for point source emissions (e.g. stack) management, and monitoring must be obtained and adhered to.
9.4.1.2	Notices or orders, issued by the regulatory authority, related to point source emissions must be complied with, and all requirements adhered to.
9.4.1.3	AGL controlled sites must develop and implement control measures to minimise and manage air emissions from point sources.
9.4.1.4	Air emissions from point sources must be managed in accordance with relevant protocols and guidelines prescribed by the regulatory authority, wherever applicable.
9.4.1.5	Air emissions from point sources must be managed in accordance with the following management hierarchy: • Avoid; • Recycle; • Minimise; and • Manage.

Application requirements (e.g. air pollution reduction programs and controls) should be identified and met prior to submitting a licence application to the regulatory authority. Any variation of the licence may require approval from the regulatory authority.

Licences, permits or authorisations for point source emissions may include emissions limits (i.e. concentration or emissions rate) of air contaminants and may include other authorisations for discharge such as but not limited to:

- Start-up of plant/equipment;
- Shutdown of plant/equipment; and
- Commissioning of plant/equipment.

Monitoring and reporting of point source emissions may be required by the regulatory authority through a licence, permit or authorisation. If required, the Environment representative should review and analyse monitoring data, and compare with air emissions limits set by the licence, permit or authorisation. If a non-compliance is verified, the Environment representative should promptly inform the relevant internal stakeholders and identify and implement mitigation actions to prevent ongoing non-compliance. Notification of the non-compliance to the regulatory authority should consider the notification procedures under relevant legislation and AGL policies.

A monitoring program report to be provided to the regulatory authority could include, but not be limited to:

- A summary of the monitoring results and comparison with previous results, if available;
- An evaluation of the monitoring program data;
- Description of non-conformances, including the influence of natural events and fire management, if applicable; and

- Proposed and taken actions to mitigate environmental risks associated to the air quality non-compliance(s).

AGL controlled sites may be requested by the regulatory authority to have the monitoring program and data independently checked and verified. If this is the case, the subsequent audit report needs to be submitted to the regulatory authority.

Procedures for managing air emissions generated from point sources, at AGL controlled sites, should be developed and implemented. These should align with legislative requirements (including licences and regulatory approval(s)) and guidelines, relevant HSE Management System Standards, and any other commitments made with regard to the management of air emissions.

Air emissions generation from point sources at AGL controlled sites should be avoided, as far as practicable (e.g. using technology that does not generate air emissions). Where generation of air emissions is unavoidable, opportunities for implementing management hierarchy options for dealing with air emissions should be identified, as follows (in order of preference):

- Recycling air emissions (e.g. reuse of air emissions in another industrial process); and
- Treatment of air emissions prior to discharge (e.g. air emissions control equipment to reduce concentration of contaminant(s) to the greatest extent practicable).

When considering control measures to minimise air emissions, the following should be taken into account:

- Aspects associated with the receiving air environment and other airshed characteristics (e.g. location of sensitive receptors or protected habitats);
- Aspects associated with the air emissions, including concentration and volume of air contaminant(s), significance of the source, and location of the source relative to other point source and/or fugitive emissions;
- Discharge licence conditions and other applicable regulatory requirements; and
- Available best/leading practice.

Waste(s) streams resulting from air emissions control equipment should be managed in accordance with the AGL controlled site waste procedures, and in alignment with the Waste Standard (AGH-HSE-STD-009.7) and any regulatory requirements.

Discharge of point source emissions

Discharge quality

RCM Ref	Minimum Controls
9.4.1.6	If an AGL controlled site is located within an Air Quality Control Region or Area of Special Significance, additional measures prescribed by the regulatory authority in order to maintain or improve ambient air quality must be adhered to.

Monitoring

RCM Ref	Minimum Controls
9.4.1.7	Monitoring must be conducted using methods and protocols approved by the regulatory authority.

	When these are not available, comparable or internationally recognised monitoring methods/protocols must be used.
9.4.1.8	Sampling and measurement equipment must be calibrated, inspected, tested and maintained, in accordance with licence conditions, other relevant regulatory requirements and manufacturer requirements.
9.4.1.9	Accredited environmental laboratory services (i.e. certified by National Association of Testing Authorities (NATA) or equivalent accreditation bodies) must be used for analysis of air emissions and local ambient air samples.

AGL controlled sites should develop and implement a monitoring program, in proportion to the identified level of environmental risk, in order to:

- Meet licence conditions;
- Assess the potential impacts of air emissions discharged to ambient air; and
- Determine whether improvements are required to reduce air emissions.

The Environment representative should consider the following elements when developing the monitoring program:

- Monitoring air contaminants as per licence requirements, and any contaminants of concern (e.g. related to community perception);
- Monitoring scope and frequency, taking into account air emissions characteristics (including normal and abnormal operational conditions), and significant changes to operations or receiving air environment characteristics;
- Monitoring locations, selected with the objective of providing representative monitoring data (for both air emissions and receiving air environment) and in accordance with local conditions (e.g. prevailing winds and potentially affected communities and ecosystems), dispersion modelling results, licence conditions and other regulatory requirements; and
- Methods for sampling and analysis, approved by the regulatory authority.

Monitoring activities should be carried out by competent and qualified professionals, following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. AGL controlled sites should develop and implement data quality assurance (QA) and quality control (QC) procedures for conducting sampling and analysis of air emissions and local ambient air samples. If monitoring is to be conducted by external suitably qualified professionals, and subject to the terms of the relevant contract between AGL and the external suitably qualified professionals, AGL controlled sites should request and review their QA and QC arrangements.

Reporting

RCM Ref	Minimum Controls
9.4.1.10	AGL controlled sites that exceed National Pollutant Inventory (NPI) reporting threshold(s) must report relevant substances emitted to ambient air, and the transfer of those substances into waste.

NPI reporting for AGL controlled sites is managed by the AGL Environment Team. A consultant has been engaged to conduct NPI reporting for all AGL sites that trigger NPI Reporting. The AGL NPI reporting process is described in the NPI Reporting Guideline (AGL-HSE-GUI-015.3.1).

The Environment Business Partners are responsible for project managing the NPI reporting process at site level, with assistance from relevant data owners and other key stakeholders. The final NPI results are approved by the site's Head of Function, and if required by other AGL Leaders, prior report submission to the relevant regulatory authority.

Dispersion modelling

RCM Ref	Minimum Control
9.4.1.11	If requested by the regulatory authority(ies) or if required under a licence, AGL controlled sites must undertake dispersion modelling for existing or proposed air emissions.
9.4.1.12	Dispersion modelling must be conducted in accordance with the methods, protocols and/or guidelines prescribed or agreed by the regulatory authority. When these are not available, comparable or internationally recognised protocols, methods and guidelines must be used.
9.4.1.13	AGL controlled sites must engage with a suitably qualified professional to develop the air dispersion model(s).

Dispersion modelling can assist AGL controlled sites with the following:

- Assessing ambient air quality against the concentrations set by the regulatory authority(ies) and/or licence requirements;
- Investigating opportunities for reducing the impact(s) associated to the existing or proposed emissions to ambient air;
- Evaluating the potential cumulative effect of existing or proposed emissions on ambient air;
- Defining the appropriate dimensions and/or location of an air emission source or point source from which it is proposed to discharge to the ambient air;
- Evaluating air emissions control strategies; and
- Achieving any outcomes consistent with objective(s) set by legislation (e.g. regional air quality monitoring) and meeting community expectations.

If required, a suitably qualified professional with expertise in dispersion modelling should be engaged to develop the air emissions model and undertake the required simulations/assessments. Depending on the type of assessment required, dispersion modelling should take into account the air emissions source(s), location of sensitive receptors, topography, meteorology and the licence/approval conditions.

Fugitive emissions

RCM Ref	Minimum Control
9.4.1.14	Licences, or authorisations for fugitive emissions management, and monitoring must be obtained and adhered to.
9.4.1.15	Notices or orders, issued by the regulatory authority, related to fugitive emissions must be complied with, and all requirements adhered to.
9.4.1.16	AGL controlled sites must develop and implement control measures to minimise and manage fugitive emissions.
9.4.1.17	Fugitive emissions must be managed in accordance with relevant protocols and guidelines prescribed by the regulatory authority, wherever applicable.

If required, a monitoring program for fugitive emissions from AGL controlled sites should be developed and implemented. This program can be developed separately or as part of the overall air quality/air emissions monitoring program, and associated reporting, for the AGL controlled site (refer to sections 4.2.2 and 4.2.3).

If dispersion modelling for a source of fugitive emissions is required, AGL controlled site should engage a suitably qualified professional, and follow the methods and protocols agreed by the regulatory authority (refer to section 4.2.4).

AGL controlled sites should take reasonable and practicable measures to prevent and/or minimise fugitive emissions, as these emissions have the potential for much greater ground-level impact since they are generally discharged and dispersed closer to the ground. Therefore, sources of fugitive emissions (i.e. plant/equipment, activities and processes) that cause or have the potential to cause material environmental harm or serious environmental harm should be identified, and preventative and control techniques implemented accordingly.

AGL controlled sites should take the following principles into consideration when managing fugitive emissions from:

- Motor vehicles:
    - Implement a motor vehicle maintenance program in accordance with manufacturer recommendations, and using air emissions testing standards prescribed by national regulations;
    - Convert high-use motor vehicles to low emission technology vehicles and/or to cleaner fuels, where feasible;
    - Maintain, or if required install, emission control systems in heavy vehicles; and
    - Educate drivers in driving practices that reduce fuel consumption and lower emissions from motor vehicles.
- Plant and Equipment:
    - Operate and maintain plant and equipment in a proper and efficient manner;
    - Maintain, or if required install, air emissions control equipment (for example the use of shadecloth around scaffolding when carrying out sandblasting); and
    - Liquid fuel used in fuel-burning equipment/plant has a sulfur content (per cent by weight) within the limits prescribed by the relevant legislation, or as specified in the licence or approval held by the AGL controlled site.
- Burning in the open air:
    - Undertake burning in the open air only if approved by the regulatory authority(ies), and in accordance with relevant legislation and fire authorities' requirements.
- Dealing with materials (e.g. construction and mining materials):
    - Process, handle, move, store or dispose materials in a proper and efficient manner;
    - Minimise exposed surfaces (e.g. during clearing) and implement ongoing management of exposed areas; and
    - Use dust mitigation methods (e.g. covers, water suppression).

AGL controlled sites should develop procedures for site-specific fugitive emissions, to capture management strategies implemented onsite.

Air pollution incidents and emergencies

RCM Ref	Minimum Control
9.4.1.18	Hazards, near misses and incidents resulting in potential or actual air pollution must be investigated and reported using the AGL Incident Management System.
9.4.1.19	Air pollution incidents must be reported to the regulatory authority, in accordance with the notification requirements established by applicable legislation.
9.4.1.20	The site Emergency Response Plan must include management of environmental incidents resulting in air pollution.

Air pollution incidents from AGL controlled sites should be reported as per the HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1).

Community complaints related to air pollution are to be recorded and verified by the Environment representative, as per the HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1).

Significant accidental/unplanned emissions to air (e.g. fire) should be managed through the site Emergency Response Plan.

Training and competence

RCM Ref	Minimum Control
9.4.1.21	Monitoring and/or in-situ testing of air emissions, and calibration of continuous emissions monitoring systems, must be carried out by qualified and experienced professionals.

Professionals appointed to monitor and/or conduct in-situ testing of air emissions, and to calibrate continuous emissions monitoring systems, should have the appropriate qualifications or training, are experienced and competent to conduct the work safely.

Personnel whose work could cause significant impacts to ambient air, as identified by the AGL controlled site, should be competent to perform the tasks to which they are assigned. Specific training needs for individuals and teams should be determined through the implemented training and competency system, developed in alignment with the Training and Competency Methodology (AGL-HSE-SDM-013).

Definitions

Term	Definition
AGL Controlled Site	An AGL owned operated or controlled site, including a field operational site or an office site.
Air	Air is a common term for the mixture of gases and small solid and liquid particles that make up the atmosphere.
Air Emissions	Air emissions refers to the emission of gases, vapours, aerosols, mists, fumes, odours, smoke, dust or other particles to ambient air. Air emissions can be released from point source and/or non-point sources (i.e. fugitive emissions).
Air Pollution	Air pollution occurs when:

Term	Definition
	• Prohibited contaminants, as defined by legislation, are released to ambient air; • Air emissions exceed the contaminants levels prescribed or approved by the regulatory authority(ies); or • Air emissions interfere unreasonably with the comfort of people and/or animals.
Air Quality Control Region	Air quality control region is a region, defined by legislation, where the regional effects of air emissions to the ambient air are considered in the formulation of control requirements.
Airshed	Airshed refers to an area in which ambient air quality is subject to common influences from air emissions, meteorology and topography. Airsheds can vary in size from small to regional areas.
Ambient Air	Ambient air refers to the external air environment, and it does not include the air environment inside buildings or structures.
Area of Special Significance	Area of special significance refers to a particular area, defined by legislation, where it is desirable to maintain a very high level of air quality.
Beneficial Use	Beneficial use (also known as environmental value or protected environmental value), in relation to ambient air, means a value or use of ambient air which must be protected from the effects of point source and/or fugitive emissions. Beneficial uses can include: • Life, health and well-being of humans at present and in the future; • Life, health and well-being of other forms of life, including the present and future health, wellbeing and integrity of ecosystems and ecological processes; • Aesthetic enjoyment and local amenity; • Visibility; and • Useful life and aesthetic appearance of buildings, structures, property and materials. There can be more than one beneficial use for a given area.
Class 3 Indicators	Class 3 indicators is a category of air quality indicators defined in Victorian air legislation. These include extremely hazardous substances that are carcinogenic, mutagenic, teratogenic, highly toxic or highly persistent, and which may threaten the beneficial uses of the ambient air.
Fugitive Emissions	Fugitive emissions (also known as non-point sources emissions) refers to emissions that are not confined to a single point of discharge, and are distributed spatially over a wide area. Examples of fugitive emissions include dust from stockpiles and unsealed roads, exhaust fumes from motor vehicles, evaporative emissions from vehicle fuel tanks, volatilisation of vapour from vats or fuel and other volatile organic liquid storage tanks, open vessels and spills.
Dispersion Modelling	Dispersion modelling is the mathematical simulation of air emissions, relating contaminant(s) emission rate to ground-level concentration. Dispersion models replicate atmospheric conditions (including wind speed and direction, air temperature and mixing height), and provide an estimate of contaminant(s) concentration as these travel away from an emission source.

Term	Definition
Emission Control System	Emission control system refers to a device or system fitted to a motor vehicle to limit or reduce air contaminants (e.g. carbon monoxide and particulate matter) emitted from the vehicle.
Heavy Vehicle	Heavy vehicle is: • A motor vehicle that has a Gross Vehicle Mass (GVM) or Aggregate Trailer Mass (ATM) of more than 4.5 tonnes; and • A combination that includes a motor vehicle with a GVM or ATM of more than 4.5 tonnes.
HSE	Health, Safety and Environment.
Leader	Any employee who has others reporting to him or her, or who has the authority to allocate resources.
Liquid Fuel	Liquid fuels include petrol, diesel and other combustible fuels. It can also include blends of one or more of these goods with or without other substances.
Material Environmental Harm	Material environmental harm means environmental harm that: • Comprises an environmental nuisance of a high impact or on a wide scale; and/or • Involves actual or potential harm to the health or safety of human beings that is not trivial or other actual or potential environmental harm that is not trivial nor negligible; and/or • Results in incurring reasonable costs and expenses to take all reasonable and practicable measures to prevent, mitigate or make good harm to the environment. AGL controlled sites should refer to relevant state legislation for applicable definition.
Maximum Extent Achievable (MEA)	Maximum extent achievable means a degree of reduction in the emission of contaminants from a particular source that uses the most effective, practicable means to minimise the risk to human health from those emissions; and is at least equivalent to or greater than that which can be achieved through the application of best practice.
Motor Vehicle	Motor vehicle refers to a road vehicle powered by an internal combustion engine.
National Pollutant Inventory	The National Pollutant Inventory (NPI) is an online, publicly available database that contains data on key substances being emitted to air, land and water across Australia. These key substances have been identified as potentially having a negative impact on human health and the environment.
Point Source	Point source means a large stationary and single point source of air emissions. Examples include coal fired power plants, smelters, industrial boilers, petroleum refineries and manufacturing facilities.
Point Source Emissions	Point source emissions refer to emissions that flow into a vent or stack, and are emitted through the opening to the ambient air.
Sensitive Receptors	Sensitive receptors are locations where people are likely to work or reside. Examples of sensitive receptors are residential dwellings, offices, hospitals, schools, farms and public recreational area.

Term	Definition
Serious Environmental Harm	Serious environmental harm includes environmental harm that: • Is irreversible, high impact or wide-spread; and/or • Occurs in an area of high conservation value or an area of special significance (e.g. world heritage areas); and/or • Results in costs of more than the threshold amount being incurred in taking appropriate action to prevent or minimise the harm, and rehabilitate or remediate the environment to its condition before the harm. AGL controlled sites should refer to relevant state legislation for applicable definition.

4. Approval conditions and comments

4.1. PL446

<table>
<tr><th>Condition ID</th><th>Requirement</th><th>Actions and comments</th></tr>
<tr><td colspan="3">Schedule G – Fuel burning or combustion equipment,</td></tr>
<tr><td>G1</td><td>Contaminants emitted from fuel burning and combustion equipment point sources that are capable of burning at least 500kg in an hour and installed after the date of issue of this approval must be directed vertically upwards</td><td>Compressor 400A is the only equipment that can burn at least 500kg of fuel in an hour. The stacks are directed vertically upwards and are fitted with sampling ports that comply with the Australian Standard.</td></tr>
<tr><td>G2</td><td>Prior to the installation of any new or additional fuel burning and combustion equipment that is capable of burning at least 500kg of fuel in an hour, following the issue of this environmental authority, the holder of this environmental authority must conduct air dispersion modelling to calculate the ground level concentrations of emissions from the fuel burning or combustion equipment under maximum operating conditions within the relevant airshed and identify any potential impacts to air quality within the study area.</td><td>AGL conducts annual stack testing through third party technical specialists, to meet the requirements of this condition. A maintenance notification was created in SAP to ensure the monitoring is organised each year. Copies of the annual monitoring reports are kept on AGLs network.</td></tr>
<tr><td>G3</td><td>The holder of this environmental authority must ensure that calculated ground level concentrations required under condition G2 do not exceed the criteria for each air contaminant in Schedule G: Table 2.

Schedule G: Table 2 - Maximum Ground Level Concentration Criteria
<table><tr><th>Contaminant</th><th>Concentration at 0°C</th><th>Units</th><th>Averaging time</th></tr><tr><td>NOx as Nitrogen Dioxide</td><td>250</td><td>µg/m³</td><td>1 hour</td></tr><tr><td>NOx as Nitrogen Dioxide</td><td>33</td><td>µg/m³</td><td>1 year</td></tr><tr><td>Carbon monoxide</td><td>11</td><td>mg/m³</td><td>8 hour</td></tr></table></td><td>AGLs technical specialists present the findings of the annual stack testing in each report, and provide comments regarding compliance. To date, AGL is not aware of any exceedances of the criteria.</td></tr>
<tr><td>G4</td><td>The holder of this environmental authority must undertake verification monitoring of the air dispersion post commissioning of fuel burning equipment that is capable of burning at least 500kg of fuel in an hour</td><td>AGL commissions third party technical specialists to carry out the verification monitoring annually. The results are included in the reports prepared by the technical specialists.</td></tr>
</table>

G5	Where the verification monitoring required under condition (G4) demonstrates that the air dispersion modelling required under condition (G2) under-predicted actual concentrations, the holder of this environmental authority must: a) provide details to the administering authority within 10 business days b) re-undertake the modelling based on the new information; and c) determine and implement appropriate pollution control measures to bring the emissions into compliance with the limits specified in Schedule G: Table 2 - Maximum Ground Level Concentration Criteria.	To date, AGL is not aware of any exceedances of the (modelled) maximum ground level concentration criteria.
G6	The holder of this environmental authority must maintain a register of fuel burning and combustion equipment that is capable of burning at least 500kg of fuel in an hour that must include, as a minimum, the following information for each piece of equipment: a) fuel burning or combustion equipment name and location b) stack emission height (m) c) minimum efflux velocity (m/s) d) mass emission rates (g/s); and e) contaminant concentrations (mg/Nm3 @x %02 dry gas at 0° C and 1atm).	AGL maintains a Register of Fuel Burning and Combustion Equipment that is updated annually by the Environment Business Partner once the stack testing report is received from third party technical specialists.
G7	The holder of this environmental authority must ensure that the information contained in the register of fuel burning and combustion equipment is always current and complete.	The Environment Business Partner is responsible for maintaining the Register, and an action item is contained in SAP.
G8	All entries in the register of fuel burning and combustion equipment must be certified by the chief executive officer for the tenure holder, or their delegate, as being accurate and correct.	The Environment Business Partner is the nominated delegate.
Schedule J – Monitoring Programs		
J1	The holder of this environmental authority must develop and implement a monitoring program for all monitoring required by the conditions of this environmental authority.	AGLs Environmental Management Plan (this document) serves as the monitoring program..
J2	All monitoring under this environmental authority must be conducted by a suitably qualified person.	AGL uses third party technical specialists to carry out the air quality monitoring (stack testing) and dispersion modelling.
J3	All instruments, equipment and measuring devices used for measuring or monitoring in accordance with any condition of this environmental authority must be calibrated, and operated and maintained effectively in accordance with the manufacturer's specifications.	AGLs scope of work issued to third party technical specialists includes this requirement. The work notification in SAP also includes this requirement.
J4	All laboratory analyses and tests required to be conducted under this environmental authority must be carried out by a laboratory that has NATA accreditation for such analyses and tests, except as otherwise authorised by the administering authority.	AGLs scope of work issued to third party technical specialists includes this requirement. The work notification in SAP also includes this requirement.
J6	Any management or monitoring plans, systems, programs or procedures required to be developed and implemented by a condition of this environmental authority must be reviewed for performance and amended as required but not less than once every 3 years in accordance with the requirements for the particular plans, systems, programs and procedures in the conditions of this environmental authority.	This is the responsibility of the Environment Business Partner. This requirement is included in SAP.

<table>
<tr><td>J7</td><td>If monitoring conducted in accordance with this environmental authority indicates a condition or contaminant level has caused, or has potential to cause, environmental harm, the holder of this environmental authority must, as soon as is practicable, take the necessary actions to rectify the condition or contaminant level so as to avoid or minimise environmental harm.</td><td>This is the responsibility of the Environment Business Partner. Any notification will be carried out in accordance with the licence conditions and AGLs Procedures.</td></tr>
<tr><td>J8</td><td>An annual monitoring report must be prepared each year and submitted to the administering authority upon request. This report must include but not necessarily be limited to:
a) a summary of the previous 12 months monitoring results obtained under all monitoring programs required under this environmental authority and a comparison of the previous 12 months monitoring results to both the limits set in this environmental authority and to relevant prior results
b) the date on which the samples was taken
c) the time at which the samples was taken
d) the monitoring point at which the sample was taken
e) the results of all monitoring and details of any exceedances with the conditions of this environmental authority and the dates and times these exceedances were reported to the administering authority
f) an evaluation/explanation of the data derived from any monitoring programs
g) data analyses and interpretation to assess the nature and extent of any contamination and the level of environmental harm caused as a result of the contamination and the environmentally relevant activity(ies); and
h) an outline of actions taken or proposed to minimise the risk of environmental harm from any condition or elevated contaminant level identified by the monitoring or recording programs.</td><td>AGL prepares the annual monitoring report as part of the annual return process. AGL voluntarily submits the monitoring results to the administering authority with each annual return.</td></tr>
<tr><td>J9</td><td>The evaluation and explanation of data for the purposes of the annual monitoring report must be performed by a suitably qualified person.</td><td>This is the responsibility of the Environment Business Partner, as a suitably qualified and experienced person.</td></tr>
<tr><td>J18</td><td>The holder of this environmental authority must conduct a monitoring program of contaminants released to the atmosphere at each release point recorded in the register of fuel burning and combustion equipment (condition (F6), for the contaminants listed in Schedule F: Table 1 - Maximum Ground Level Concentration Criteria and at the frequencies specified in Schedule J: Table 3 - Monitoring Frequency for Contaminants.

Schedule J: Table 3 – Monitoring Frequency for Contaminants
<table><tr><th>Contaminant</th><th>Monitoring frequency</th></tr><tr><td>NOx as Nitrogen Dioxide</td><td>• During commissioning;
• Annually thereafter</td></tr><tr><td>Carbon monoxide</td><td>• During commissioning
• Annually thereafter</td></tr></table></td><td>AGL uses third party technical specialists to carry out the air quality monitoring (stack testing) and dispersion modelling. The full scope of work is contained with SAP for issue to consultants on an annual basis.</td></tr>
</table>

J19	The monitoring program must include, but not necessarily be limited to: a) monitoring provisions for the release points which complies with the most recent edition of Australian Standard 4323. b) tests for each sample taken at each release point specified in the register of fuel burning or combustion equipment (condition (F6)) including: i. gas velocity, volume and mass flow rate ii. temperature; and iii. water vapour concentration (for non-continuous sampling) c) representative samples of the contaminants discharged when operating under maximum operating conditions d) the collection of production rate and plant status during sampling periods; and e) monitoring of contaminant release carried out in accordance with the latest edition of the administering authority's "Air Quality Sampling Manual 1997", as amended from time to time.	AGL installed sampling ports on the largest compressor (CM400A) that comply with the Australian Standard. The sampling port locations and orientation were designed by third party technical specialists. All sampling is carried out by third party technical specialists.
J24	When the administering authority advises the holder of this environmental authority of a complaint alleging nuisance other than noise, the holder must investigate the complaint as soon as practicable.	AGL will act on this condition when triggered.
J25	The holder of this environmental authority must advise the administering authority in writing of the action proposed or undertaken to resolve the complaint within 3 business days of completing the complaint investigation.	AGL will act on this condition when triggered.
J26	When requested by the administering authority, the holder of this environmental authority must undertake monitoring as specified by the administering authority, within a reasonable and practical timeframe nominated by the administering authority to investigate any complaint of environmental harm at any sensitive place.	AGL will act on this condition when triggered.
J27	The results of the investigation (including an analysis and interpretation of the monitoring results) and he abatement measures implemented must be provided to the administering authority within 5 business days of receiving the advice under condition (J26), unless a longer time is agreed to by the administering authority.	AGL will act on this condition when triggered.
J28	If monitoring in accordance with condition (J26) and (J27), indicates that emissions exceed the limits set in this environmental authority or are causing environmental nuisance, then the holder of this environmental authority must: a) address the complaint including the use of alternative dispute resolution services if required; and/or b) implement abatement or attenuation measures so that the authorised petroleum activity(ies) do not result in further environmental nuisance.	AGL will act on this condition when triggered.

4.2. PFL27

Condition ID	Requirement	Actions and comments
Schedule E – Contaminant release, emergency flare, fuel burning and combustion facilities – ambient air monitoring, air receiving environmental monitoring program		
E1	Contaminants must not be directly or indirectly released to air except as authorised by condition (E5) of this environmental authority.	AGL has 14 point source emissions on-site (3 compressors, 4 generators, 2 heaters, 5 microturbines). The licence condition is erroneous where it refers to condition E5.
E2	Contaminant releases to air emitted from any fuel burning and combustion equipment point sources must be directed vertically upwards without any impedance or hindrance.	The compressor stacks contain 90 degree bends at the top, to exclude rainwater from the engines, which would cause damage. The regulatory authority is aware of this. The generators and heaters have stacks that are directly upwards.
E3	A register of fuel burning and combustion equipment must be developed and maintained, and be accurate and correct.	AGL maintains a Register of Fuel Burning and Combustion Equipment that is updated annually by the Environment Business Partner once the stack testing report is received from third party technical specialists.
E4	The register of fuel burning and combustion equipment must include as a minimum, the following information for each piece of equipment: a) fuel burning or combustion equipment name and location; b) stack emission height (metres); c) minimum efflux velocity (m/s); d) mass emission rates (g/s); and e) contaminant concentrations (mg/Nm3 @ x %O2 dry gas at 0°Celsius and 1 atmosphere).	The Register contains this minimum information and is updated annually.
E5	The emergency flare must be operated in such a way that a flame is present at all times whilst contaminants are being released.	AGL maintains a pilot light on the emergency flare at all times.
E6	The operation of fuel burning or combustion facilities must not result in ground level concentrations of contaminants exceeding the maximum limits specified in Schedule E, Table 1—Maximum ground level concentration of contaminants to air.	AGL commenced ground level monitoring at two off-site locations in August 2018. The first year of

<table>
<tr><td></td><td>Schedule E, Table 1—Maximum ground level concentration of contaminants to air<table><tr><th>Contaminant</th><th>EPP Air Quality Objective/Maximum ground level concentration at 0° Celsius</th><th>Units</th><th>Averaging time</th></tr><tr><td>NOx as Nitrogen Dioxide</td><td>250</td><td>µg/m^3</td><td>1 hour</td></tr><tr><td>NOx as Nitrogen Dioxide</td><td>33</td><td>µg/m^3</td><td>1 year</td></tr><tr><td>Carbon monoxide</td><td>11</td><td>mg/m^3</td><td>8 hour</td></tr></table></td><td>monitoring indicated that no exceedances have occurred.</td></tr>
<tr><td>E7</td><td>An air receiving environment monitoring program (AREMP) must be developed to demonstrate compliance with the limits in Schedule E, Table 1—Maximum ground level Concentration of contaminants to air.</td><td>AGL operates under an approved AREMP.</td></tr>
<tr><td>E8</td><td>The AREMP must include, but not necessarily be limited to:
a) the delineation of the relevant air shed(s)
b) the identification of background reference sites and impact monitoring sites within the relevant air shed(s), including sensitive places
c) a monitoring program to be carried out annually that:
i. includes background reference and impact monitoring sites
ii. includes an assessment of meteorological conditions (wind speed and direction)
iii. is sufficient to determine compliance with the limits listed in Schedule E, Table 1—Maximum ground level concentration of contaminants to air
iv. identifies the effects of the authorised contaminants released to air in the relevant air shed(s)
v. is representative of when the fuel burning or combustion facilities are operating under maximum operating conditions for the annual period
d) an assessment of the condition of each fuel burning or combustion facility; and
e) a description of other significant point sources in the air shed and surrounding land use including sensitive places.</td><td>The AREMP contains this required information and was approved (final version) by the administering authority in January 2019.</td></tr>
<tr><td>E9</td><td>An AREMP report must be written annually which includes the information required by condition (E8) and an assessment of the extent to which monitoring data for ground level concentrations complies with the air contaminant limits listed in Schedule E, Table 1—Maximum ground level concentration of contaminants to air.</td><td>AGL commissioned a third-party technical specialist to prepare the AREMP report. The report is stored on AGLs network.</td></tr>
</table>

<table>
<tr>
<td>E10</td>
<td>Where monitoring data indicates that ground level concentrations listed in Schedule E, Table 1— Maximum ground level concentration of contaminants to air have not been met, the AREMP report required by condition (E9) must also include an assessment of:
a) the extent to which the values of the air environment in the relevant air shed(s) are being protected
b) an assessment of whether contaminant releases to the air environment are consistent with the air management hierarchy in the Environmental Protection (Air) Policy 2008, and
c) any corrective actions that have been implemented or proposed to be implemented to become consistent with the air management hierarchy and achieve compliance with Schedule E, Table 1—Maximum ground level concentration of contaminants to air.

Schedule E, Table 1—Maximum ground level concentration of contaminants to air
<table>
<tr><th>Contaminant</th><th>EPP Air Quality Objective/Maximum ground level concentration at 0° Celsius</th><th>Units</th><th>Averaging time</th></tr>
<tr><td>NOx as Nitrogen Dioxide</td><td>250</td><td>µg/m^3</td><td>1 hour</td></tr>
<tr><td>NOx as Nitrogen Dioxide</td><td>33</td><td>µg/m^3</td><td>1 year</td></tr>
<tr><td>Carbon monoxide</td><td>11</td><td>mg/m^3</td><td>8 hour</td></tr>
</table>
</td>
<td>The first annual AREMP report indicated that no exceedances of contaminant concentrations occurred.</td>
</tr>
<tr>
<td>E11</td>
<td>A statement of compliance prepared by a suitably qualified person must accompany each AREMP report required by condition (E9) and if applicable, condition (E10) stating:
a) whether the AREMP as most recently implemented complies with the requirements of conditions (E7) and (E8)
b) that, to the best of the suitably qualified person’s knowledge, the assessment required by condition (E9) and if applicable, condition (E10) is true, correct and complete, and
c) that, to the best of the suitably qualified person’s knowledge, all information provided as part of the statement of compliance, including attachments, is true, correct and complete.</td>
<td>AGL commissions third party technical specialists to prepare AREMP annual reports. The first AREMP report contains a statement of compliance from a third party technical specialist.</td>
</tr>
<tr>
<td>E12</td>
<td>Where condition (E10) applies, the documents required by conditions (E9), (E10) and (E11) must be given to the administering authority within 5 business days after the AREMP report is written.</td>
<td>The Environmental Business Partner is aware of the requirements of this condition.</td>
</tr>
</table>

4.3. PL192

Condition ID	Requirement	Actions and comments
Schedule B - Air		
B1	The release of any dust, particulate, aerosol or odour resulting from the activity must not cause an environmental nuisance at any sensitive place.	There is a significant buffer distance between AGLs activities and the nearest sensitive place(s). To date, AGL has not received any complaints of environmental nuisance.
Schedule K – Monitoring and reporting		
K1	The holder of this environmental authority must develop and implement a monitoring program for all monitoring required by the conditions of this environmental authority.	AGLs Environmental Management Plan serves as the monitoring program.
K2	All monitoring under this environmental authority must be conducted by a suitably qualified person.	AGL uses third party technical specialists to conduct air monitoring if required.
K3	All instruments, equipment and measuring devices used for measuring or monitoring in accordance with any condition of this environmental authority must be calibrated, and operated and maintained effectively in accordance with the manufacturer's specifications.	AGL uses third party technical specialists to conduct all measuring and monitoring.

4.4. PL 213

Condition ID	Requirement	Actions and comments
9	The holder of the environmental authority must ensure that: a) Dust or particulate matter or both resulting from a petroleum activity must not cause an environmental nuisance at any sensitive place or commercial place. b) When requested by the administering authority, dust and particulate monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (with is neither frivolous or vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive place or commercial place, and the results must be notified within 14 days to the administering authority following completion of the monitoring, analysis and interpretation of results.	PL213 is a relatively small lease (45km2), with no producing wells at present. Therefore, the operations at present are limited to routine inspections of the assets.

4.5. PL15

Condition ID	Requirement	Actions and comments
Schedule B - Air		
B1	The release of any dust, particulate, aerosol or odour resulting from the activity must not cause an environmental nuisance at any sensitive place.	PL213 is a relatively small lease (45km2), with no producing wells at present. Therefore, the operations at present are limited to routine inspections of the assets.

4.6. PLs 48, 49, 66, 202

Condition ID	Requirement	Actions and comments
Schedule B - Air		
B1	The release of any dust, particulate, aerosol or odour resulting from the activity must not cause an environmental nuisance at any sensitive place.	PL213 is a relatively small lease (45km2), with no producing wells at present. Therefore, the operations at present are limited to routine inspections of the assets.

4.7. PPL4

Condition ID	Requirement	Actions and comments
Schedule F - Air		
F1	Fuel burning and combustion equipment that are capable of burning at least 500kg in an hour are not authorised under this environmental authority.	There is no equipment that meets this criteria on PPL4.

4.8. PPL 87 and 93

Condition ID	Requirement	Actions and comments
Schedule B – Dust management, odour management,		
B1	The release of any dust and particulate matter resulting from the petroleum activities must not cause an environmental nuisance at any sensitive or commercial place.	There is a considerable buffer distance between the pipeline easement and the nearest sensitive receptors. To date, no complaints of this nature have been received.

B2	Notwithstanding Condition (B1), dust and particulate matter must not exceed the following levels when measured at any sensitive or commercial place: a) Dust deposition of 120 milligrams per square metre per day, averaged over one (1) month, when monitored in accordance with AS 3580.10.1 Methods for sampling and analysis of ambient air - Determination of particulates - Deposited matter - Gravimetric method of 1991; or b) a concentration of particulate matter with an aerodynamic diameter of less than 10 micrometre (µm) (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24 hour averaging time, at a nuisance sensitive or commercial place downwind of the site, when monitored in accordance with AS3580.9.6 'Ambient air – Particulate matter – Determination of suspended particulate PM10 high-volume sampler with size-selective inlet Gravimetric method'; or c) a concentration of particulate matter with an aerodynamic diameter of less than 2.5 micrometre (µm) (PM2.5) suspended in the atmosphere of 25 micrograms per cubic metre over a 24 hour averaging time, at a nuisance sensitive or commercial place downwind of the site, when monitored in accordance with AS/NZS3580.9.10.2006.	There is a considerable buffer distance between the pipeline easement and the nearest sensitive receptors. To date, no complaints of this nature have been received.
B3	When requested by the administering authority, dust and particulate monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring.	There is a considerable buffer distance between the pipeline easement and the nearest sensitive receptors. To date, no complaints of this nature have been received.
B4	If monitoring, in accordance with B3 indicates exceedance of the relevant limits in Condition (B2), then the holder of this authority must: a) address the complaint including the use of appropriate dispute resolution if required; and/or b) as soon as practicable implement dust abatement measures so that emissions of dust from the activity do not result in further environmental nuisance.	There is a considerable buffer distance between the pipeline easement and the nearest sensitive receptors. To date, no complaints of this nature have been received.
B5	The release of noxious or offensive odour(s) or any other noxious or offensive airborne contaminant(s) resulting from the petroleum activity must not cause an environmental nuisance at any sensitive or commercial place.	There is a considerable buffer distance between the pipeline easement and the nearest sensitive receptors. To date, no complaints of this nature have been received.
B6	When requested by the administering authority, odour monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive place, and the results must be notified within 14 days to the administering authority following completion of monitoring.	There is a considerable buffer distance between the pipeline easement and the nearest sensitive receptors. To date, no complaints of this nature have been received.
B7	If monitoring in accordance with Condition (B6), indicates Condition (B5) is not being met, then the holder of this authority must: a) address the complaint including the use of appropriate dispute resolution if required; and/or	There is a considerable buffer distance between the pipeline easement and the nearest sensitive

	b) as soon as practicable implement odour abatement measures so that emissions of odour from the activity do not result in further environmental nuisance.	receptors. To date, no complaints of this nature have been received.

4.9. ATP1190

Condition ID	Requirement	Actions and comments
PESCB 3	Contaminants must not be directly or indirectly released to land or air except for those releases authorised by standard conditions (PESCC 11), (PESCC 15), (PESCC 22), (PESCC 23), (PESCC 25), (PESCC26), (PESCC 27), (PESCC 28), (PESCC 29), (PESCC 30), (PESCC 31), (PESCC 32), (PESCC 34) or (PESCC 35).	There is a significant buffer distance between AGLs wells located on ATP1190 and the nearest sensitive receptor.
PESCC21	A Blast Management Plan must be developed for each blasting activity in accordance with Australian Standard 2187.	There is no blasting currently being planned or scheduled.
PESCC22	Blasting operations must be designed to not exceed an airblast overpressure level of 120 dB (linear peak) at any time, when measured at or extrapolated to any sensitive place.	There is no blasting currently being planned or scheduled.
PESCC23	Blasting operations must be designed to not exceed a ground-borne vibration peak particle velocity of 10mm/s at any time, when measured at or extrapolated to any sensitive place.	There is no blasting currently being planned or scheduled.
PESCC24	Unless venting is authorised under section 72 of the *Petroleum and Gas (Production and Safety) Act 2004* or section 74M of the Petroleum Act 1923, waste gas from production testing must be flared in a manner such that: a) an automatic ignition system is used; and b) a flame is visible at all times while the waste gas is being flared; and c) there is no visible smoke emissions other than for a total period of no more than 5 minutes in any 2 hours; or d) it uses an enclosed flare. *Explanatory note: If an enclosed flare is used, the requirements in relation to the ignition system, flame and smoke do not apply.*	No venting activities are currently being planned or scheduled.

Silver Springs Project

NOISE MANAGEMENT SUB-PLAN

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Document revision history

Date	Version	Author	Comments
May 2020	R0	John Moraitis	Updated for AGL HSEMS
June 2022	R1	John Moraitis	Review and update

1. Introduction

This Noise Management Sub Plan was prepared as part of the Environment Management Plan (EMP) for AGL's Silver Springs Gas Project ("the project").

This Plan was developed to specifically address and manage potential noise emission issues for the project and is based on the previously prepared and approved Environment Health and Safety Management Plans. This Plan conforms with the Noise Emission Standard (AGL-HSE-STD-009.5) and Noise Emission Methodology (AGL-HSE-SDM-009.5) as stipulated in the AGL Health, Safety and Environment Management System (HSEMS).

In accordance with the *Environmental Protection (Noise) Policy 2019*, AGL seeks to protect and enhance the following environmental values:

- The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and
- 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; and
- The qualities of the acoustic environment that are conducive to protecting the amenity of the community.

1.1. Objectives

The intent of the Plan is to assist AGL controlled sites in ensuring that:

- Noise emitted from AGL controlled sites (e.g. due to activities, works and operation of plant/equipment) is managed and controlled effectively and minimised as far as practicable, and in accordance with relevant legislation and approvals;
- Noise impacts to sensitive receptors are minimised to as low as reasonably practicable; and
- Regulatory licence conditions and other compliance obligations with respect to noise emissions are met.

In accordance with the *Environmental Protection (Noise) Policy 2019*, AGL seeks to protect and enhance the following environmental values:

- The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and
- 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; and

- The qualities of the acoustic environment that are conducive to protecting the amenity of the community.

1.2. Existing acoustic environment

1.2.1. Silver Springs gas facility

The existing background noise environment at Silver Springs (including the gas fields) is typical of rural areas, with low levels of background noise dominated by intermittent mobile noise sources such as livestock, farm machinery and occasional traffic on unsealed roads.

The nearest rural dwelling is located approximately 1.8kms from the Silver Springs plant area, which is the main source of noise emissions. There are no other rural dwellings in the surrounding vicinity, and the closest township is Surat, which is approximately 80kms by road to the north.

To date, AGL has not conducted any background noise modelling or studies, as zero noise complaints have been received from surrounding landholders since AGL took over operations in 2011.

1.2.2. Wallumbilla LPG Plant

The existing background noise environment surrounding the Wallumbilla LPG Plant is also typical of rural areas, with low levels of background noise dominated by intermittent mobile noise sources such as livestock, farm machinery and occasional traffic on unsealed roads.

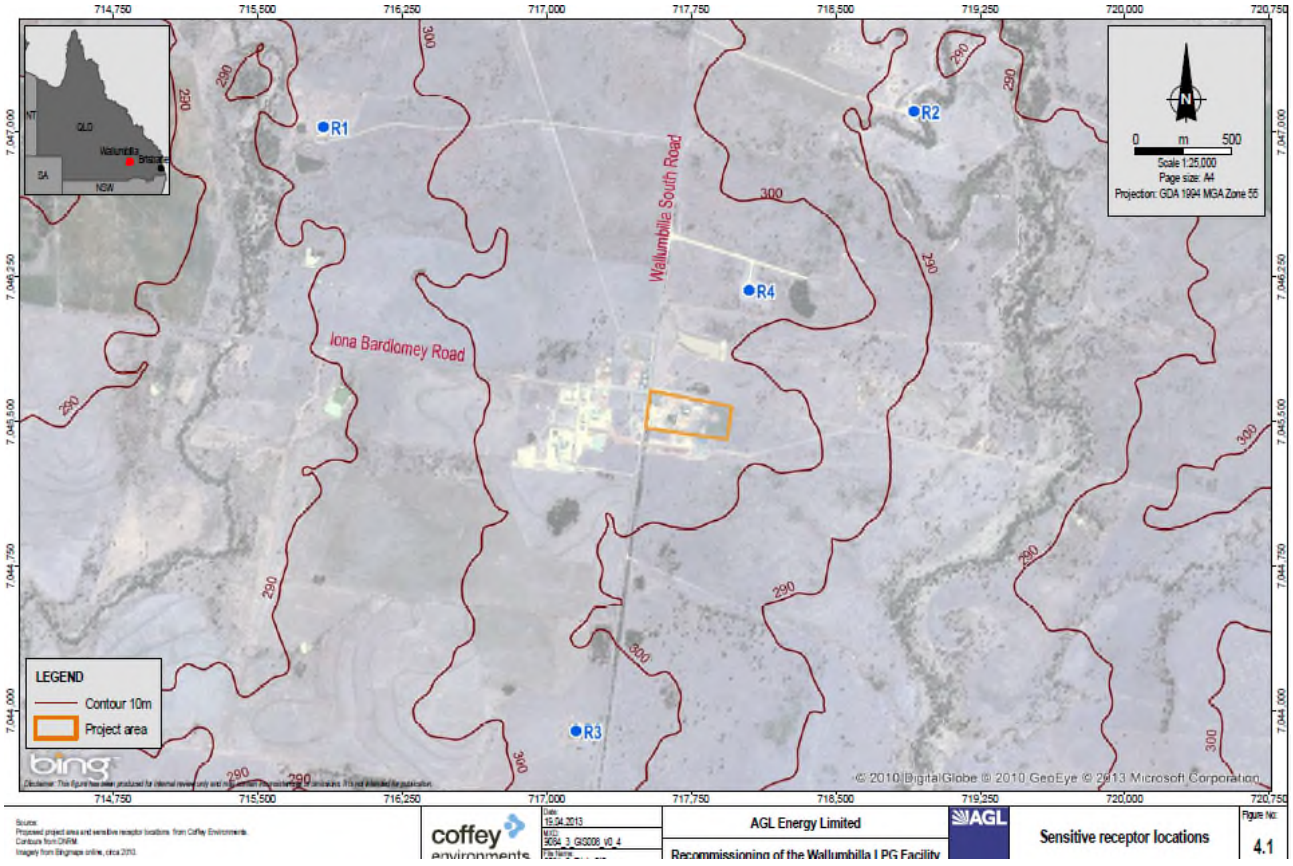
There are currently three rural dwellings surrounding the Wallumbilla LPG Plant, however only two of the dwellings (R2 and R3) are considered sensitive receptors that could be impacted by AGLs facility (see figure below), as R1 is located on the western side of the Santos and APA facilities. R4 was a former Santos accommodation camp, however the camp was removed several years ago (approx. 2014). The closest township is Wallumbilla, which is 13km north of AGLs facility.

At the Wallumbilla hub, there are three neighbouring gas facilities (Jemena, Santos, APA) that contribute to the ambient background noise. In 2013, AGL commissioned Coffey Environments to undertake a noise study at the sensitive receptors surrounding the Plant. Noise monitoring was subsequently conducted over a 9 (nine) day period from 9 January to 13 January 2013. Background noise was recorded at three sensitive receptor locations (R1, R2 and R3) surrounding the plant, and it was noted that noise from the neighbouring gas facilities (which were operational) was not audible at any three of the receptor sites. Note that monitoring was not conducted at R4 (existing Santos camp), on the basis that Santos selected the location of the site knowing the proximity of the existing gas processing facilities. The camp was later decommissioned and removed in approximately 2014/15.

The background noise data from 2013 is presented below as an extract from the document "Environmental Management Plan – Recommissioning and Operation of the Wallumbilla LPG Facility (Coffey, 2013)".

Location	Time of day	Total measurements recorded	Background noise level						
			L_{Aeq} (dB(A))				L_{A90} (dB(A))		
			Number of exceedences*	Min	Max	Avg	Min	Max	Avg
R1	Daytime & evening	535	21	25.7	57.2	39.80	21.1	49.7	32.33
	Night-time	324	118	32.6	59.2	43.06	26.0	51.7	35.57
R2	Daytime & evening	535	165	33.7	64.0	47.02	25.9	47.3	35.06
	Night-time	324	119	34.5	69.6	44.19	32.3	50.8	37.41
R3	Daytime & evening	535	15	31.0	62	41.52	21.5	49.2	34.45
	Night-time	324	104	31.7	57.2	42.86	29.7	52.2	38.74

Background noise data (Coffey, 2013)



Sensitive receivers surrounding the Wallumbilla LPG Plant (Coffey, 2013)

1.3. Responsibilities

The roles and responsibilities for the development, implementation and review of this Plan are summarised below.

1.3.1. General Manager, HSE

The General Manager, HSE is responsible for:

- Delegating authority to ensure adequate implementation, monitoring and review of the Noise Emissions Standard, and associated Methodology, occurs; and
- Ensuring adequate resources are available for the development, implementation, monitoring and review of the Noise Emissions Standard.

1.3.2. Head of Function

The Head of Function is responsible for:

- Ensuring the implementation and adherence to the Noise Emissions Standard throughout the Business Unit; and
- Ensuring adequate resources are available for the implementation, monitoring and review of the Noise Emissions Standard.

1.3.3. Senior Manager, Environment Operations

The Senior Manager, Environment Operations is responsible for:

- Managing the development, implementation and maintenance of the Noise Emissions Standard;
- Ensuring consultation in the development, review and approval of the Noise Emissions Standard, and associated Methodology;
- Ensuring processes and/or procedures related to the Noise Emissions Standard are developed, implemented, followed and meet obligations and/or requirements under applicable environmental legislation;
- Providing guidance for the development of objectives, goals, targets and/or Key Performance Indicators (KPIs) associated with the Noise Emissions Standard, as applicable;
- Ensuring that applicable environmental objectives, goals and targets associated with the Noise Emissions Standard are introduced, adhered to and measured while meeting AGL-wide policies, objectives, goals and targets; and
- Overseeing audits and assurance activities to ensure compliance with the Noise Emissions Standard and applicable regulatory requirements.

1.3.4. Environment Business Partner

The Environment Business Partner is responsible for:

- Overseeing and monitoring the implementation of the Noise Emissions Standard within their Business Unit, and communicating Noise Emissions Standard requirements to relevant personnel and/or contractors, as applicable;
- Developing processes and/or procedures related to management of noise emissions to ensure consistency with the Noise Emissions Standard, and with applicable environmental legislation;
- Providing support and guidance in the implementation of noise emissions related processes and/or procedures at Business Unit level;
- Undertaking or providing guidance and assistance to Leaders in the completion and review of environmental risk assessments and control processes;
- Undertaking audit and assurance activities, to ensure compliance with the Noise Emissions Standard and applicable regulatory requirements, and developing tracking and corrective action management plans; and
- Assisting with the delivery and tracking of environmental management projects, or the integration of environmental considerations into projects, to ensure Business Unit and site-specific targets are met.

1.3.5. Environment Advisor

The Environment Advisor is responsible for supporting the Senior Manager, Environment Operations and/or Environment Business Partner(s) with tasks associated with:

- Implementation of the Noise Emissions Standard; and/or
- Management of the processes and/or procedures related to Noise Emissions Standard, at Business Unit level.

2. Legal obligations

2.1. Key legislative requirements

The key regulatory requirements relating to noise management are detailed below.

2.1.1. Environmental Protection Act 1994

- Section 22: Act binds all persons
- Section 125: Requirements to apply for an environmental authority
- Section 319: General environmental duty
- Section 320DA: Duty of owner, occupier or auditor to notify administering authority
- Section 440: Offence of causing environmental nuisance

2.1.2. Environmental Protection (Noise) Policy 2019

- Section 8: Management hierarchy for noise emissions
- Schedule 1: Acoustic quality objectives

2.2. Key licence requirements

The environmental licences held for each lease contain general and specific conditions for managing air quality. The table below shows the current environmental approvals (licences) held for each petroleum lease, issued by the Queensland Department of Environment and Science.

Petroleum lease	Environmental licence no.	Issue date	Anniversary date (each year)
PL446	EPPG00784013	29 September 2016	24 May
PFL27	EPPG01233113	22 December 2017	Not listed on EA
PL192	EPPG00770313	23 July 2014	10 August
PL213	EPPG00304213	7 July 2016	23 January
PL 15	EPPG00770613	1 April 2022	15 August
PLs 48, 49, 66, 202	P-EA-100227919	1 April 2022	15 August
PPL 4	PEN202330511	22 June 2011	22 June
PPL 87, 93	EPPG00370113	3 February 2015	29 April
ATP1190	EPSX02909615	16 February 2015	Not listed on EA

2.3. Approval conditions

The approval conditions for each environmental approval (licence) including AGLs actions and comments are displayed in Section 4 of this document. This provides a useful reference for auditing and assurance activities as it demonstrates how AGL is specifically managing compliance against each condition.

3. Emissions and control measures

3.1. Emission sources

The following sources of noise emissions are identified as being caused by AGLs activities:

- Pipeline and plant purging and blowdown for maintenance purposes
- Stationary machinery exhausts (e.g. compressors, generators, heaters)
- Mobile machinery (e.g. rigs, earthmoving equipment, telehandlers, elevated work platforms)
- Vehicle exhausts (e.g. light and heavy vehicles accessing the sites)
- Amplified sounds (e.g. alarms, loudspeakers)
- Other intermittent noises associated with operations generally (gates, vehicle horns, gerney's, small engines).

3.2. Control measures

3.2.1. Management hierarchy

In accordance with the *Environmental Protection (Noise) Policy 2019*, the management hierarchy for activities that involve noise emissions are listed below. The legislation states that these are expected to be implemented to the extent that it is reasonable to do so:

- **Firstly** – avoid the noise (e.g. locate the activity in an area that is not near a sensitive receptor)
- **Secondly** – minimise the noise, in the following order:
    1. Orientate an activity to minimise the noise
    2. Use best available technology to minimise the noise
- **Thirdly** – manage the noise (e.g. using heavy machinery only during business hours).

3.2.2. HSEMS minimum controls

The following minimum controls are specified by AGLs Noise Emission Standard (AGL-HSE-STD-009.5) and Noise Emission Methodology (AGL-HSE-SDM-009.5) within AGLs Health, Safety and Environment Management System (HSEMS).

General

RCM Ref	Minimum Controls
9.5.1.1	Licences, permits or authorisations for noise emissions management and monitoring must be obtained and adhered to.
9.5.1.2	Noise monitoring data must be reviewed, assessed against licence/approval limits and reported to the regulatory authority, if required, in accordance with licence, approval conditions and/or other regulatory authority requirements.

RCM Ref	Minimum Controls
9.5.1.3	Notices or orders, issued by the regulatory authority, related to: • Eliminating, controlling or reducing noise emissions; and/or • Carrying-out noise emissions impact studies; must be complied with, and all requirements adhered to.

Licences, permits or authorisations for noise emissions may include requirements for noise monitoring. If applicable, the Environment representative needs to review and analyse monitoring data, and compare with noise limits set by the licence/approval. If a non-compliance is verified, the Environment representative should promptly inform relevant internal stakeholders, and identify and implement mitigation actions to prevent ongoing non-compliance. Notification of the non-compliance to the regulatory authority should have regard to the notification procedures under relevant legislation and AGL policies.

Where required, a noise monitoring report may be requested by the regulatory authority through licence, permit, or authorisation requirements. A noise monitoring report provided to the regulatory authority could include, but not limited to:

- Type of monitoring conducted;
- Description of the affected sensitive receptors;
- Description of complaint(s), if applicable;
- Monitoring location(s), time(s) and duration(s) of monitoring and monitoring equipment used;
- Description of weather conditions and weather instrumentation used;
- An evaluation of the monitoring data;
- Description and reason(s) for non-compliance; and
- Proposed management strategy(ies) and actions taken to mitigate noise non-compliance(s).

AGL controlled sites may be requested by the regulatory authority to submit monitoring data, as a result of community complaints.

Management of Noise

RCM Ref	Minimum Controls
9.5.1.4	AGL controlled sites must develop and implement control measures to minimise and manage noise emissions.
9.5.1.5	Noise-generating activities/works must be managed in accordance with the following management hierarchy: • Avoid; • Minimise; and • Manage.
9.5.1.6	Noise must be managed in accordance with relevant protocols and guidelines prescribed by the regulatory authority, wherever applicable.

AGL controlled sites should take reasonable and practicable measures to prevent or minimise noise emissions from their activities and plant/equipment, so that noise levels do not exceed the noise limits

to be met at sensitive receptors and/or at any point of the AGL controlled site boundaries. Furthermore, noise received at sensitive receptors should be free of the intrusive characteristics of tonality, modulation and impulsiveness.

Noise emissions should be avoided, wherever possible (e.g. by locating a noise source that has the potential to cause nuisance in an area that is not close to, or at a suitable distance from, the sensitive receptor). Where this is not possible, opportunities for implementing management hierarchy options for dealing with noise emissions should be identified, as follows (in order of preference):

- Minimise noise by orientating a noise source away from a sensitive receptor;
- Minimise noise through the use of the best available technology; and
- Manage noise by implementing operational controls on noise emissions (e.g. acoustic barriers, buffers, mufflers, housing noisy equipment in sealed buildings, and restricting the timing for operation of specific plant/equipment).

Sources of noise emissions that cause or have the potential to cause nuisance or material environmental harm should be identified and assessed. Preventative and control techniques or technology, aiming for a significant reduction of noise at sensitive receptors, should be selected and implemented taking into consideration:

- Location/proximity of sensitive receptors;
- Aspects associated with the noise emissions, including significance of the source, location of the source(s) relative to other noise sources, noise type and characteristics, and way in which noise is released into the environment; and
- Licence/approval conditions and other applicable regulatory requirements.

AGL controlled sites should take the following principles into consideration - as a minimum - when managing the following noise sources:

- Motor vehicles:
    - Implement a motor vehicle maintenance program in accordance with manufacturer recommendations, and use noise testing standards prescribed by national regulations;
    - Maintain, or if required install, a silencing device in any motor vehicles (including heavy vehicles) propelled by an internal combustion engine; and
    - Do not allow a motor vehicle to be used if it emits more noise than the prescribed level.
- Plant and Equipment:
    - Operate and maintain plant and equipment in a proper and efficient manner, in compliance with prescribed noise levels, and if possible, switch off when not in use;
    - Only operate specific items within the permissible hours of use, if applicable;
    - Where equipment is to be replaced, select the quietest equipment available, where feasible;
    - Use barriers/structures, or maximise the distance, between noisy equipment/plant and sensitive receptors; and
    - Maintain, or if required install, noise reduction devices.
- Construction activities:
    - Carry out construction activities only within the permissible day(s) of the week and/or hour(s) of the day, if applicable;

    - Implement noise mitigation and prevention measures (e.g. location of noise equipment as far away possible from those who may be affected, use of low-noise equipment or noise reducing devices and utilise natural shielding (e.g. topography) or temporary noise barriers); and
    - Use off-site or alternative construction processes, if feasible.
- Dealing with materials (e.g. construction and mining materials):
    - Process, handle, move, store or dispose materials in a proper and efficient manner.

Procedures for managing noise emissions from different sources and activities, at AGL controlled sites, should be developed and implemented. These should align with legislative requirements (including licenses and regulatory approval(s)) and guidelines, relevant HSE Management System Standards and any other commitments made with regard to the management of noise emissions.

Prior to conducting noise-generating activities/works, AGL controlled sites should identify and engage with potentially noise-affected members of the community. These stakeholders should be informed as early as possible, before the start of the noise-generating activities/works. Where practicable, noise-generating activities/works should be rescheduled to occur at a time that is the least intrusive to the community. External communication processes to be developed and implemented at AGL controlled sites should be in accordance with the HSE Consultation and Communication Methodology (AGL-HSE-SDM-006).

Monitoring of Noise

RCM Ref	Minimum Control
9.5.1.7	Monitoring of noise levels must be conducted using methods and protocols approved by the regulatory authority.
9.5.1.8	Noise monitoring equipment must be calibrated, inspected, tested and maintained, in accordance with licence/approval conditions, other relevant regulatory requirements and manufacturer requirements.

AGL controlled sites should develop and implement a noise monitoring program, in proportion to the identified level of environmental risk, in order to:

- Meet licence/approval conditions, in order to demonstrate compliance with noise limits and no impact to sensitive receptors;
- Assess potential noise impacts to sensitive receptors, particularly in response to community noise complaints; and/or
- Determine whether improvements are required to reduce noise emissions.

The Environment representative should consider the following elements when developing the monitoring program:

- Monitoring scope and frequency, taking into account noise characteristics (i.e. volume, intensity, duration; and time, place and circumstances of the noise emission), significant changes to operations, surrounding land use and/or background noise levels;
- Monitoring locations, selected in accordance with local conditions (e.g. prevailing winds), potentially affected communities and sensitive ecosystems (particularly, where noise levels are likely to be the

highest), noise impacts modelling results, licence conditions and other regulatory requirements; and

- Methods for measuring noise levels, approved by the regulatory authority.

Monitoring activities should be carried out by competent and qualified professionals, following monitoring and record-keeping procedures. The equipment to be used for noise measurement should be properly calibrated and maintained, in alignment with regulatory authority requirements. AGL controlled sites should develop and implement data quality assurance (QA) and quality control (QC) procedures for measuring noise levels (e.g. source noise level, ambient noise level and/or background noise level). If monitoring is to be conducted by external suitably qualified professionals, and subject to the terms of the relevant contract between AGL and the external suitably qualified professionals, AGL controlled sites are to request and review their QA and QC arrangements.

If noise monitoring is to be conducted as a result of a community complaint, then it should be conducted at the complainant's premises under conditions similar (e.g. time of the day and wind conditions) to those as when the noise impacts were reported to occur.

Noise Complaints and Incidents

RCM Ref	Minimum Control
9.5.1.9	Incidents resulting in potential or actual noise limit exceedances, verified community complaints or other noise related non-compliances, must be investigated and reported using the AGL Incident Management System.
9.5.1.10	Noise non-compliances and verified community complaints must be reported to the regulatory authority, in accordance with the notification requirements established by applicable legislation.

Noise incidents from AGL controlled sites need to be reported as per the HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1).

Community complaints related to nuisance noise are to be recorded and verified as per the HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1).

Training and Competence

RCM Ref	Minimum Control
9.5.1.11	Monitoring and/or assessment of noise emissions must be carried out by qualified and experienced professionals.

Professionals appointed to monitor noise levels and/or conduct noise assessments should have the appropriate qualifications or training, and are experienced and competent to conduct the work safely.

Personnel whose work could cause nuisance noise, as identified by the AGL controlled site, should be competent to perform the tasks to which they are assigned. Specific training needs for individuals and teams should be determined through the implemented training and competency system, developed in alignment with the Training and Competency Methodology (AGL-HSE-SDM-013).

1. Definitions

Term	Definition
AGL Controlled Site	An AGL owned operated or controlled site, including a field operational site or an office site.
Heavy Vehicle	Heavy vehicle is: • A motor vehicle that has a Gross Vehicle Mass (GVM) or Aggregate Trailer Mass (ATM) of more than 4.5 tonnes; and • A combination that includes a motor vehicle with a GVM or ATM of more than 4.5 tonnes.
HSE	Health, Safety and Environment.
Leader	Any employee who has others reporting to him or her, or who has the authority to allocate resources.
Material Environmental Harm	Material environmental harm means environmental harm that: • Comprises an environmental nuisance of a high impact or on a wide scale; and/or • Involves actual or potential harm to the health or safety of human beings that is not trivial or other actual or potential environmental harm that is not trivial nor negligible; and/or • Results in incurring reasonable costs and expenses to take all reasonable and practicable measures to prevent, mitigate or make good harm to the environment. AGL controlled sites should refer to relevant state legislation for applicable definition.
Motor Vehicle	Motor vehicle refers to a road vehicle powered by an internal combustion engine.
Noise	Noise includes sound and vibration of any frequency, whether emitted through air or another medium, and is generally unwanted or intrusive. Noise can occur continuously or intermittently. Noise sources and activities can give rise to: • Tonal noise (i.e. containing a prominent frequency and characterised by a definitive pitch, e.g. reverse beepers); or • Impulsive noise (i.e. having a high peak of short duration or sequence of such peaks, e.g. hammering).
Nuisance Noise	Nuisance noise means: • Noise emissions that unreasonably (in regard to its volume, intensity or duration; and/or the time, place and other circumstances in which noise is emitted), interfere with a person's enjoyment of the environment; and/or • Noise emissions that are defined as 'Environmental nuisance' under state legislation, if applicable.
Sensitive Receptors	Sensitive receptors are locations where people are likely to work or reside, or any other location of high amenity that requires the absence of noise at nuisance levels for its proper enjoyment. Examples of sensitive receptors are residential dwellings, offices, hospitals, hotels/motels, schools or other educational establishments, places of worship and public recreational areas.

4. Approval conditions and comments

4.1. PL446

Condition ID	Requirement	Actions and comments
Schedule F – Environmental Nuisance		
F2	A Noise Management Plan which has been certified by a suitably qualified person must be developed within 6 months from the date of issue of this approval.	AGL has developed a Noise Management Plan and keeps a copy on its electronic servers.
F3	The Noise Management Plan must include, but not necessarily be limited to: a) a commitment by the Chief Executive Officer for the holder of this environmental authority, or their delegate, to ensure adequate allocation of staff and resources to the establishment and operation of the Noise Management Plan b) definition of roles, responsibilities and authorities within the staffing of the Noise Management Plan c) delivery of training to staff and contractors and maintenance of competencies d) risk/constraint analysis methods to be undertaken prior to any new operation (e.g. drill site) or installation of new equipment that has the potential to create noise nuisance e) procedures and methods to undertake assessments to determine compliance with the noise limits in Schedule F: Table 1 - Noise limits at Sensitive Receptors in the event of a valid complaint being received and when there are no alternative arrangements in place, taking in to account any tonal or impulsive noise impacts f) procedures for handling noise complaints g) community liaison and consultation procedures including but not limited to consultation for when night time petroleum activities (i.e. between 10:00pm and 6:00am) are likely to exceed 25dBA h) procedures for managing records associated with all aspects of the Noise Management Plan including standardised forms for recording monitoring results and complaints i) details of petroleum activities and measured and/or predicted noise levels of noise sources associated with those activities j) reasonable and practicable control or abatement measures (including relocating the activity, altering the hours of operation, or having an alternate arrangement in place with any potentially affected person) that can be undertaken to ensure compliance with the noise limits in Schedule F: Table 1 - Noise limits at Sensitive Receptors (see below) k) the level of noise at sensitive receptors that would be achieved from implementing the measures detailed under condition F(3)(j); and	See above.

<table>
<tr><td></td><td>l) mediation processes to be used if noise complaints are not able to be resolved.

Schedule F: Table 1 – Noise Limits at Sensitive Receptors
<table><tr><th>Time Period</th><th>Metric</th><th>Short Term Noise Event</th><th>Medium Term Noise Event</th><th>Long Term Noise Event</th></tr><tr><td>7:00am – 6:00pm</td><td>$L_{Aeq,adj,15min}$
Max $L_{pA,\ 15mins}$</td><td>L_{ABG} + 10dBA
55dBA</td><td>L_{ABG} + 8dBA
51dBA</td><td>L_{ABG} + 5dBA
45dBA</td></tr><tr><td>6:00pm – 10:00pm</td><td>$L_{Aeq,adj,15min}$
Max $L_{pA,\ 15mins}$</td><td>L_{ABG} + 10dBA
50dBA</td><td>L_{ABG} + 8dBA
46dBA</td><td>L_{ABG} + 5dBA
40dBA</td></tr><tr><td>10:00pm – 6:00am</td><td>$L_{Aeq,adj,15min}$
Max $L_{pA,\ 15mins}$</td><td>L_{ABG} + 3dBA
38dBA</td><td>L_{ABG} + 3dBA
36dBA</td><td>L_{ABG} + 3dBA
33dBA</td></tr><tr><td>6:00am – 7:00am</td><td>$L_{Aeq,adj,15min}$
Max $L_{pA,\ 15mins}$</td><td>L_{ABG} + 10dBA
50dBA</td><td>L_{ABG} + 8dBA
46dBA</td><td>L_{ABG} + 5dBA
40dBA</td></tr></table>
L_{Aeq} and Max L_{pA} are to be measured over any 15 minute period
L_{ABG} is the deemed background noise levels which for the purposes of Schedule F: Table 1 - Noise Limits at Sensitive Receptors are:
7:00am - 6:00pm: 35dBA
6:00pm – 10:00pm: 30dBA
10:00pm – 6:00am: 25dBA
6:00am – 7:00am: 30dBA</td><td></td></tr>
<tr><td>F4</td><td>The holder of this environmental authority must implement the Noise Management Plan.</td><td>All new projects are subject to a full risk assessment that involves reviewing the potential noise impacts and developing mitigation measures where necessary. This is part of AGLs management of change process to ensure that environmental impacts are managed appropriately.</td></tr>
<tr><td>F5</td><td>Prior to undertaking petroleum activities that will result in short-term, medium-term or long term noise events that are likely to impact on a sensitive receptor, the holder of this environmental authority must model or calculate any potential noise emissions from the relevant petroleum activity(ies) to ensure that noise emissions will not exceed the noise levels specified in Schedule F: Table 1 - Noise limits at Sensitive Receptors.</td><td>See above. This is part of AGLs management of change process – if noise impacts are expected to increase to levels that may cause exceedances of the limits within the licence.</td></tr>
<tr><td>F6</td><td>The emission of noise from the petroleum activity(ies) authorised under this environmental authority must not result in levels greater than those specified in Schedule F: Table 1 - Noise limits at Sensitive Receptors in the event of a valid complaint about noise being made to the administering authority.</td><td>See above. AGL has not received any complaints of environmental nuisance (noise) from the administering authority, nor from any affected person.</td></tr>
<tr><td>F7</td><td>If the noise subject to a complaint is tonal or impulsive, the adjustments detailed in Schedule F: Table 2 - Adjustments to be Added to Noise Levels at Sensitive Receptors are to be added to the measured noise level(s) to derive LAeq, adj, 15 min,</td><td>See above.</td></tr>
</table>

<table>
<tr><td></td><td>Schedule F: Table 2 - Adjustments to be Added to Noise Levels at Sensitive Receptors
<table><tr><th>Noise Characteristic</th><th>Adjustment to Noise</th></tr><tr><td>Tonal characteristic is just audible</td><td>+ 2dBA</td></tr><tr><td>Tonal characteristic is clearly audible</td><td>+ 5dBA</td></tr><tr><td>Impulsive characteristic is just audible</td><td>+ 2dBA</td></tr><tr><td>Impulsive characteristic is clearly audibly</td><td>+ 5dBA</td></tr></table></td><td></td></tr>
<tr><td>F8</td><td>Where alternative arrangements are in place with an affected person(s) at a sensitive receptor as referred to by condition (F3)U), the noise limits in Schedule F: Table 1 - Noise limits at Sensitive Receptors do not apply at that sensitive receptor for the duration for which the alternative arrangements are in place.</td><td>See above. AGL undertakes landholder liaison in instances where proposed projects may cause temporary or permanent noise impacts.</td></tr>
<tr><td>F9</td><td>Notwithstanding condition (F6), emission of any noise below 315Hz must not cause an environmental nuisance.</td><td>See above.</td></tr>
<tr><td>F10</td><td>Low frequency noise from the petroleum activity(ies) is not considered to be an environmental nuisance under condition (F9) if monitoring shows that noise emissions do not exceed the following limits:
a) 50dB(Z) measured inside the sensitive receptor; and
b) the difference between the internal A-weighted and Z-weighted noise levels is no greater than 15dB.</td><td>See above.</td></tr>
</table>

4.2. PFL27

<table>
<tr><th>Condition ID</th><th>Requirement</th><th>Actions and comments</th></tr>
<tr><td colspan="3">Schedule D - Noise</td></tr>
<tr><td>D1</td><td>The emission of noise from the petroleum activities authorised under this environmental authority must not result in levels greater than those specified in Schedule D, Table 1 – Noise limits at Sensitive Places in the event of a valid complaint about noise being made to the administering authority, other than where an alternative arrangement is in place.
Schedule D, Table 1 – Noise Limits at Sensitive Places
<table>
<tr><th>Time Period</th><th>Metric</th><th>Short Term Noise Event</th><th>Medium Term Noise Event</th><th>Long Term Noise Event</th></tr>
<tr><td>7:00 am – 6:00 pm</td><td>$L_{Aeq,adj,15\ min}$</td><td>L_{ABG} + 10 dBA</td><td>L_{ABG} + 8 dBA</td><td>L_{ABG} + 5 dBA</td></tr>
<tr><td>6:00 pm – 10:00 pm</td><td>$L_{Aeq,adj,15\ min}$</td><td>L_{ABG} + 10 dBA</td><td>L_{ABG} + 8 dBA</td><td>L_{ABG} + 5 dBA</td></tr>
<tr><td rowspan="2">10:00 pm – 7:00 am*</td><td>$L_{Aeq,adj,15\ min}$</td><td>L_{ABG} + 3 dBA</td><td>L_{ABG} + 3 dBA</td><td>L_{ABG} + 3 dBA</td></tr>
<tr><td>Max $L_{pA,\ 15\ mins}$</td><td>55 dBA</td><td>55 dBA</td><td>55 dBA</td></tr>
</table>
BG = background noise level
* For the time period 10.00 pm – 7.00 am the deemed minimum background noise level is 25 dBA.</td><td>The nearest occupied sensitive receptor is located 1.7km to the south west of the Wallumbilla Plant. Another (currently unoccupied) sensitive receptor is located 2km to the north east of the Plant. AGL has not received any complaints from either sensitive receptor.</td></tr>
<tr><td>D2</td><td>If the noise subject to a complaint is tonal or impulsive, the adjustments detailed in Schedule D, Table 2 – Adjustments to be added to Noise Levels at Sensitive Places are to be added to the measured noise level(s) to derive LAeq, adj, 15 min.
<table>
<tr><th colspan="2">Schedule D, Table 2 – Adjustments to be added to Noise Levels at Sensitive Places</th></tr>
<tr><th>Noise Characteristic</th><th>Adjustment to Noise</th></tr>
<tr><td>Tonal characteristic is just audible</td><td>+ 2 dBA</td></tr>
<tr><td>Tonal characteristic is clearly audible</td><td>+ 5 dBA</td></tr>
<tr><td>Impulsive characteristic is just audible</td><td>+ 2 dBA</td></tr>
<tr><td>Impulsive characteristic is clearly audibly</td><td>+ 5 dBA</td></tr>
</table></td><td>See above.</td></tr>
<tr><td>D3</td><td>Notwithstanding condition (D1), emission of any low frequency noise must not exceed the following limits in the event of a valid complaint about low frequency noise being made to the administering authority:
a) 60 dB(C) measured outside the sensitive place and the difference between the external A-weighted and C-weighted noise levels is no greater than 20 dB; or
b) 50 dB(Z) measured inside the sensitive place and the difference between the internal A-weighted and Z-weighted noise levels is no greater than 15 dB.</td><td>See above.</td></tr>
<tr><td>D4</td><td>Noise monitoring and recording required under this environmental authority as the result of a valid complaint must include, but not necessarily be limited to:
a) LAN,T (where N equals the statistical levels of 1, 10 and 90 and T=15 mins);
b) LAeq adj, 15 mins;</td><td>See above.</td></tr>
</table>

	c) background noise level; d) Max LpA, 15 mins ; e) the level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to measured noise levels; f) atmospheric conditions including temperature, relative humidity and wind speed and directions; g) effects due to any extraneous factors such as traffic noise; h) location, date and time of monitoring; i) if the complaint concerns low frequency noise, Max LpZ, 15 mins; and j) if the complaint concerns low frequency noise, one third octave band measurements in dB(L_{IN}) for centre frequencies in the 10 – 200 Hz range for both the noise source and the background noise in the absence of the noise source.	

4.3. PL192

Condition ID	Requirement	Actions and comments
Schedule H- Noise		
H1	Noise from activities must not cause an environmental nuisance at any noise sensitive place.	AGL operates several assets on PL192 and there are sensitive places within the lease area. AGL has not received any complaints of environmental nuisance in recent years. AGL undertakes landholder liaison when projects are planned on PL192 that have the potential to cause noise impacts. A full risk assessment is undertaken prior to any projects being implemented, and most projects are temporary in nature (e.g. workovers, strata stimulation).
H2	Prior to undertaking petroleum activities that will result in short-term, medium-term or long term noise events that are likely to impact on a sensitive receptor, the holder of this environmental authority must model or calculate any potential noise emissions from the relevant petroleum activity(ies) to ensure that noise emissions will not exceed the noise levels specified in *Schedule H: Table 1 - Noise limits at Sensitive Receptors.*	See above.

<table>
<tr><td></td><td>
Schedule H: Table 1 – Noise Limits at Sensitive Receptors
<table>
<tr><th>Time Period</th><th>Metric</th><th>Short Term Noise Event</th><th>Medium Term Noise Event</th><th>Long Term Noise Event</th></tr>
<tr><td>7:00 am – 6:00 pm</td><td>$L_{Aeq,adj,15\ min}$
Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 10 dBA
55 dBA</td><td>L_{ABG} + 8 dBA
51 dBA</td><td>L_{ABG} + 5 dBA
45 dBA</td></tr>
<tr><td>6:00 pm – 10:00 pm</td><td>$L_{Aeq,adj,15\ min}$
Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 10 dBA
50 dBA</td><td>L_{ABG} + 8 dBA
46 dBA</td><td>L_{ABG} + 5 dBA
40 dBA</td></tr>
<tr><td>10:00 pm – 6:00 am</td><td>$L_{Aeq,adj,15\ min}$
Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 3 dBA
38 dBA</td><td>L_{ABG} + 3 dBA
36 dBA</td><td>L_{ABG} + 3 dBA
33 dBA</td></tr>
<tr><td>6:00 am – 7:00 am</td><td>$L_{Aeq,adj,15\ min}$
Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 10 dBA
50 dBA</td><td>L_{ABG} + 8 dBA
46 dBA</td><td>L_{ABG} + 5 dBA
40 dBA</td></tr>
</table>
L_{Aeq} and Max L_{pA} are to be measured over any 15 minute period
L_{ABG} is the deemed background noise levels which for the purposes of Schedule G: Table 1 - Noise Limits at Sensitive Receptors are:
7:00 am - 6:00 pm: 35 dBA
6:00 pm – 10:00 pm: 30 dBA
10:00 pm – 6:00 am: 25 dBA
6:00 am – 7:00 am: 30 dBA
</td><td></td></tr>
<tr><td>H3</td><td>The emission of noise from the petroleum activity(ies) authorised under this environmental authority must not result in levels greater than those specified in Schedule G: Table 1 - Noise limits at Sensitive Receptors in the event of a valid complaint about noise being made to the administering authority.</td><td>See above. AGL has not received any complaints of environmental nuisance either direct from affected persons or from the administering authority in recent years.</td></tr>
<tr><td>H4</td><td>If the noise subject to a complaint is tonal or impulsive, the adjustments detailed in Schedule G: Table 2 - Adjustments to be Added to Noise Levels at Sensitive Receptors are to be added to the measured noise level(s) to derive LAeq, adj, 15 min.

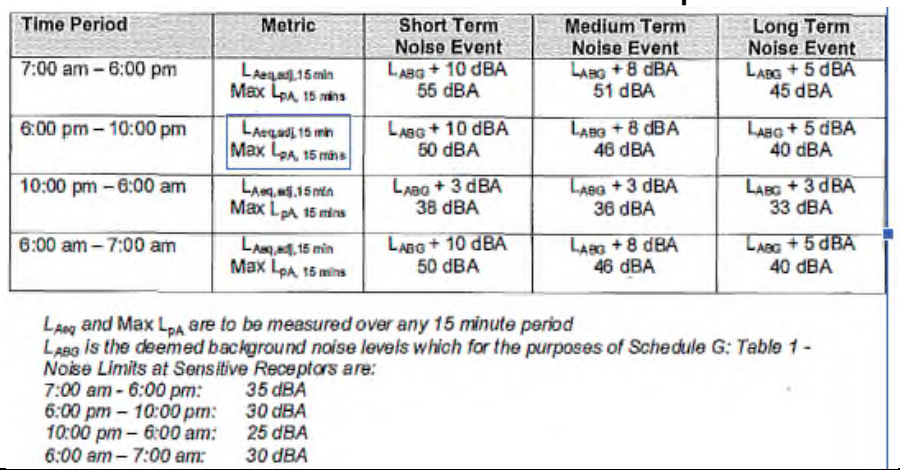
Schedule G: Table 2 - Adjustments to be Added to Noise Levels at Sensitive Receptors

<table>
<tr><th>Noise Characteristic</th><th>Adjustment to Noise</th></tr>
<tr><td>Tonal characteristic is just audible</td><td>+ 2 dBA</td></tr>
<tr><td>Tonal characteristic is clearly audible</td><td>+ 5 dBA</td></tr>
<tr><td>Impulsive characteristic is just audible</td><td>+ 2 dBA</td></tr>
<tr><td>Impulsive characteristic is clearly audible</td><td>+ 5 dBA</td></tr>
</table>
</td><td>See above.</td></tr>
<tr><td>H5</td><td>Where alternative arrangements are in place with an affected person(s) at a sensitive receptor, the noise limits in Schedule G: Table 1 - Noise limits at Sensitive Receptors do not apply at that sensitive receptor for the duration for which the alternative arrangements are in place.</td><td>See above.</td></tr>
</table>

4.4. PL213

<table>
<tr><th>Condition ID</th><th>Requirement</th><th>Actions and comments</th></tr>
<tr><td>10</td><td>a) Noise emitted from any aspect of petroleum activities must not exceed the noise levels, specified in the table below, at any sensitive place or commercial place.
<table>
<tr><td>Time period</td><td>Noise level at a sensitive place measured as the Adjusted Maximum Sound Pressure Level $L_{A, max adjT}$</td></tr>
<tr><td>7am – 6pm</td><td>Background noise level plus 5 dB(A)</td></tr>
<tr><td>6pm – 10pm</td><td>Background noise level plus 5 dB(A)</td></tr>
<tr><td>10pm – 7am</td><td>Background noise level plus 3 dB(A)</td></tr>
<tr><td>Time period</td><td>Noise level at a commercial place measured as the Adjusted Maximum Sound Pressure Level $L_{A, max adjT}$</td></tr>
<tr><td>7am – 6pm</td><td>Background noise level plus 10 dB(A)</td></tr>
<tr><td>6pm –10pm</td><td>Background noise level plus 10 dB(A)</td></tr>
<tr><td>10pm –7am</td><td>Background noise level plus 8 dB(A)</td></tr>
</table>
General note: In no case is the background noise level, LA90, 15 mins to be less than 25 dB(A). In the event that measured background noise level is less than 25 dB(A), then 25 dB(A) is to be used.
b) When requested by the administering authority, noise monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive place or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring, analysis and interpretation of results.
c) The method of measurement and reporting of oise levels must be in accordance with most recent edition of the Environmental Protection Agency (EPA) Noise Measurement Manual.</td><td>AGL has not received any noise complaints from sensitive or commercial premises, nor from the administering authority. AGL has not been contacted by the administering authority to request noise monitoring. There is a significant buffer distance between AGLs wells and any sensitive or commercial place.</td></tr>
</table>

4.5. PL 15

<table>
<tr><th>Condition ID</th><th>Requirement</th><th>Actions and comments</th></tr>
<tr><td colspan="3">Schedule G - Noise</td></tr>
<tr><td>G1</td><td>Noise from activities must not cause an environmental nuisance at any noise sensitive place.</td><td>There is a significant buffer distance between AGLs assets and any noise sensitive places. AGL has not received any complaints of environmental nuisance from any affected person or the administering authority, in recent years.</td></tr>
<tr><td>G2</td><td>Prior to undertaking petroleum activities that will result in short-term, medium-term or long term noise events that are likely to impact on a sensitive receptor, the holder of this environmental authority must model or calculate any potential noise emissions from the relevant petroleum activity(ies) to ensure that noise emissions will not exceed the noise levels specified in Schedule G: Table 1 - Noise limits at Sensitive Receptors.</td><td>AGL conducts a full risk assessment of proposed projects as part of its management of change process. This includes discussions with landholders.</td></tr>
<tr><td>G3</td><td>The emission of noise from the petroleum activity(ies) authorised under this environmental authority must not result in levels greater than those specified in Schedule G: Table 1 -Noise limits at Sensitive Receptors in the event of a valid complaint about noise being made to the administering authority.
Schedule G: Table 1 - Noise Limits at Sensitive Receptors
 
<table>
<tr><th>Time Period</th><th>Metric</th><th>Short Term Noise Event</th><th>Medium Term Noise Event</th><th>Long Term Noise Event</th></tr>
<tr><td>7:00 am – 6:00 pm</td><td>$L_{Aeq,adj,15\ min}$
Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 10 dBA
55 dBA</td><td>L_{ABG} + 8 dBA
51 dBA</td><td>L_{ABG} + 5 dBA
45 dBA</td></tr>
<tr><td>6:00 pm – 10:00 pm</td><td>$L_{Aeq,adj,15\ min}$
Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 10 dBA
50 dBA</td><td>L_{ABG} + 8 dBA
46 dBA</td><td>L_{ABG} + 5 dBA
40 dBA</td></tr>
<tr><td>10:00 pm – 6:00 am</td><td>$L_{Aeq,adj,15\ min}$
Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 3 dBA
38 dBA</td><td>L_{ABG} + 3 dBA
36 dBA</td><td>L_{ABG} + 3 dBA
33 dBA</td></tr>
<tr><td>6:00 am – 7:00 am</td><td>$L_{Aeq,adj,15\ min}$
Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 10 dBA
50 dBA</td><td>L_{ABG} + 8 dBA
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40 dBA</td></tr>
</table>
L_{Aeq} and Max L_{pA} are to be measured over any 15 minute period
L_{ABG} is the deemed background noise levels which for the purposes of Schedule G: Table 1 - Noise Limits at Sensitive Receptors are:
7:00 am - 6:00 pm: 35 dBA
6:00 pm – 10:00 pm: 30 dBA
10:00 pm – 6:00 am: 25 dBA
6:00 am – 7:00 am: 30 dBA</td><td>AGL has not received notification of any noise complaints made to the administering authority, nor directly from any affected person.</td></tr>
<tr><td>G4</td><td>If the noise subject to a complaint is tonal or impulsive, the adjustments detailed in Schedule G: Table 2 -Adjustments to be Added to Noise Levels at Sensitive Receptors are to be added to the measured noise level(s) to derive LAeq, adj, 15 mins.·
Schedule G: Table 2 - Adjustments to be Added to Noise Levels at Sensitive Receptors</td><td>See above.</td></tr>
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	<table><tr><th>Noise Characteristic</th><th>Adjustment to Noise</th></tr><tr><td>Tonal characteristic is just audible</td><td>+ 2 dBA</td></tr><tr><td>Tonal characteristic is clearly audible</td><td>+ 5 dBA</td></tr><tr><td>Impulsive characteristic is just audible</td><td>+ 2 dBA</td></tr><tr><td>Impulsive characteristic is clearly audible</td><td>+ 5 dBA</td></tr></table>	
G5	Where alternative arrangements are in place with an affected person(s) at a sensitive receptor, the noise limits in Schedule G: Table 1 - Noise limits at Sensitive Receptors do not apply at that sensitive receptor for the duration for which the alternative arrangements are in place.	See above.

4.6. PLs 48, 49, 66, 202

<table>
<tr><th>Condition ID</th><th>Requirement</th><th>Actions and comments</th></tr>
<tr><td colspan="3">Schedule G - Noise</td></tr>
<tr><td>G1</td><td>Noise from activities must not cause an environmental nuisance at any noise sensitive place.</td><td>There is a significant buffer distance between AGLs assets and any noise sensitive places. AGL has not received any complaints of environmental nuisance from any affected person or the administering authority, in recent years.</td></tr>
<tr><td>G2</td><td>Prior to undertaking petroleum activities that will result in short-term, medium-term or long term noise events that are likely to impact on a sensitive receptor, the holder of this environmental authority must model or calculate any potential noise emissions from the relevant petroleum activity(ies) to ensure that noise emissions will not exceed the noise levels specified in Schedule G: Table 1 - Noise limits at Sensitive Receptors.</td><td>AGL conducts a full risk assessment of proposed projects as part of its management of change process. This includes discussions with landholders.</td></tr>
<tr><td>G3</td><td>The emission of noise from the petroleum activity(ies) authorised under this environmental authority must not result in levels greater than those specified in Schedule G: Table 1 -Noise limits at Sensitive Receptors in the event of a valid complaint about noise being made to the administering authority.
Schedule G: Table 1 - Noise Limits at Sensitive Receptors
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Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 10 dBA
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33 dBA</td></tr>
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46 dBA</td><td>L_{ABG} + 5 dBA
40 dBA</td></tr>
</table>
L_{Aeq} and Max L_{pA} are to be measured over any 15 minute period
L_{ABG} is the deemed background noise levels which for the purposes of Schedule G: Table 1 - Noise Limits at Sensitive Receptors are:
7:00 am - 6:00 pm: 35 dBA
6:00 pm – 10:00 pm: 30 dBA
10:00 pm – 6:00 am: 25 dBA
6:00 am – 7:00 am: 30 dBA</td><td>AGL has not received notification of any noise complaints made to the administering authority, nor directly from any affected person.</td></tr>
<tr><td>G4</td><td>If the noise subject to a complaint is tonal or impulsive, the adjustments detailed in Schedule G: Table 2 -Adjustments to be Added to Noise Levels at Sensitive Receptors are to be added to the measured noise level(s) to derive LAeq, adj, 15 mins.·
Schedule G: Table 2 - Adjustments to be Added to Noise Levels at Sensitive Receptors</td><td>See above.</td></tr>
</table>

	<table><tr><th>Noise Characteristic</th><th>Adjustment to Noise</th></tr><tr><td>Tonal characteristic is just audible</td><td>+ 2 dBA</td></tr><tr><td>Tonal characteristic is clearly audible</td><td>+ 5 dBA</td></tr><tr><td>Impulsive characteristic is just audible</td><td>+ 2 dBA</td></tr><tr><td>Impulsive characteristic is clearly audible</td><td>+ 5 dBA</td></tr></table>	
G5	Where alternative arrangements are in place with an affected person(s) at a sensitive receptor, the noise limits in Schedule G: Table 1 - Noise limits at Sensitive Receptors do not apply at that sensitive receptor for the duration for which the alternative arrangements are in place.	See above.

4.7. PPL 4

Condition ID	Requirement	Actions and comments
Schedule E – Environmental nuisance		
E2	'Where major maintenance works or other activities which may result in short term, medium term or long term noise events that are likely to impact on a sensitive receptor are planned, the holder of this environmental authority must model or calculate any potential noise emissions from the relevant petroleum activity(ies) to ensure that noise emissions will not exceed the noise levels specified in Schedule E, Table 1 - Noise limits at Sensitive Receptors."	AGL has not carried out major maintenance activities or other activities that would be expected to impact on sensitive receptors. AGL maintains regular contact with landholders when projects are planned.
E3	The emission of noise from the petroleum activities authorised under this environmental authority must not result in levels greater than those specified in Schedule E, Table 1 - Noise limits at Sensitive Receptors in the event of a valid complaint about noise being made to the administering authorlty. Schedule E, Table 1 - Noise Limits at Sensitive Receptors	AGL has not received notification of any noise complaints made to the administering authority, nor directly from any affected person.

	<table><tr><th>Time Period</th><th>Metric</th><th>Short Term Noise Event</th><th>Medium Term Noise Event</th><th>Long Term Noise Event</th></tr><tr><td>7:00 am – 6:00 pm</td><td>$L_{Aeq,adj,15\ min}$ Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 10 dBA</td><td>L_{ABG} + 8 dBA</td><td>L_{ABG} + 5 dBA</td></tr><tr><td>6:00 pm – 10:00 pm</td><td>$L_{Aeq,adj,15\ min}$ Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 10 dBA</td><td>L_{ABG} + 8 dBA</td><td>L_{ABG} + 5 dBA</td></tr><tr><td>10:00 pm – 6:00 am</td><td>$L_{Aeq,adj,15\ min}$ Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 3 dBA</td><td>L_{ABG} + 3 dBA</td><td>L_{ABG} + 3 dBA</td></tr><tr><td>6:00 am – 7:00 am</td><td>$L_{Aeq,adj,15\ min}$ Max $L_{pA,\ 15\ mins}$</td><td>L_{ABG} + 10 dBA</td><td>L_{ABG} + 8 dBA</td><td>L_{ABG} + 5 dBA</td></tr></table> *L_{Aeq} and Max L_{pA} are to be measured over any 15 minute period* *L_{ABG} is the deemed background noise levels which for the purposes of Schedule E, Table 1 - Noise Limits at Sensitive Receptors are:* *7:00 am - 6:00 pm: 35 dBA* *6:00 pm – 10:00 pm: 30 dBA* *10:00 pm – 6:00 am: 25 dBA* *6:00 am – 7:00 am: 30 dBA*	
E4	If the noise subject to a complaint is tonal or impulsive, the adjustments detailed in Schedule E, Table 2 -Adjustments to be Added to Noise Levels at Sensitive Receptors are to be added to the measured noise level(s) to derive LAeq, adj, 15mins Schedule E, Table 2 -Adjustments to be Added to Noise Levels at Sensitive Receptors <table><tr><th>Noise Characteristic</th><th>Adjustment to Noise</th></tr><tr><td>Tonal characteristic is just audible</td><td>+ 2 dBA</td></tr><tr><td>Tonal characteristic is clearly audible</td><td>+ 5 dBA</td></tr><tr><td>Impulsive characteristic is just audible</td><td>+ 2 dBA</td></tr><tr><td>Impulsive characteristic is clearly audible</td><td>+ 5 dBA</td></tr></table>	See above.
E5	Where alternative arrangements are in place with an affected person(s) at a sensitive receptor, the noise limits in Schedule E, Table 1 - Noise limits at Sensitive Receptors do not apply at that sensitive receptor for the duration for which the alternative arrangements are in place.	See above.
E6	Notwithstanding condition (E3), emission of any noise below 315 Hz must not cause an environmental nuisance.	See above.
E7	Low frequency noise from the petroleum activities is not considered to be an environmental nuisance under condition (E6) if monitoring shows that noise emissions do not exceed the following limits: a) 50 dB(Z) measured inside the sensitive receptor; and b) the difference between the internal A-weighted and Z-weighted noise levels is no greater than 15 dB.	See above.

4.8. PPL 87 and 93

Condition ID	Requirement	Actions and comments
Schedule D - Noise		
D1	The holder of this authority must ensure that petroleum activities do not cause environmental nuisance at any sensitive or commercial place.	PPLs 87 and 93 are pipeline easements. There is a significant buffer distance between the easement and sensitive or commercial places. AGLs primary activities on the easements are limited to operations and maintenance. This can include periodic weed management work, and pipeline repairs (dig-ups). Risk assessments are carried out for proposed projects to capture issues such as environmental nuisance.
D2	Prior to undertaking petroleum activities that are likely to impact a noise sensitive or commercial place, the holder of this authority must investigate potential noise emissions from the proposed petroleum activities and determine if noise emissions are likely to exceed the limits set in Schedule D – Table 1. If noise emissions are likely to exceed these limits, then the holder must take appropriate measures to either relocate the petroleum activity or incorporate noise abatement and / attenuation measures to mitigate those impacts. These measures must be in place prior to undertaking the proposed petroleum activity.	See above.
D3	Notwithstanding condition (D1), the holder of this authority must ensure that noise emitted from any aspect of petroleum activities does not exceed the noise levels specified in Schedule D Table 1 – Noise Limits, at any sensitive place or commercial place. **Schedule D Table 1 – Noise Limits**	See above. AGL has not received any noise complaints relating to the pipeline easements in recent years. AGL maintains communications with landholders in relation to ROW activities.

	Sensitive place **Noise level dB(A) measured as:** / **Monday to Saturday** / **Sundays and public holidays** **7am to 6pm** / **6pm to 10pm** / **10pm to 7am** / **9am to 6pm** / **6pm to 10pm** / **10pm to 9am** $L_{A90, adj, 15 mins}$: lesser of bg+3 or 48 / lesser of bg+0 or 40 / lesser of bg+0 or 40 / lesser of bg+0 or 40 / lesser of bg+0 or 40 / lesser of bg+0 or 40 $L_{A10, adj, 15 mins}$: lesser of bg+5 or 50 / lesser of bg+5 or 45 / lesser of bg+0 or 40 / lesser of bg+5 or 45 / lesser of bg+5 or 40 / lesser of bg+0 or 35 $L_{A1, adj, 15 mins}$: lesser of bg+10 or 55 / lesser of bg+10 or 50 / lesser of bg+5 or 45 / lesser of bg+10 or 50 / lesser of bg+10 or 45 / lesser of bg+5 or 40 **Commercial place** **Noise level dB(A) measured as:** / **Monday to Saturday** / **Sundays and public holidays** **7am to 6pm** / **6pm to 10pm** / **10pm to 7am** / **9am to 6pm** / **6pm to 10pm** / **10pm to 9am** $L_{A90, adj, 15 mins}$: lesser of bg+5 or 50 / lesser of bg+0 or 45 / lesser of bg+0 or 40 / lesser of bg+3 or 43 / lesser of bg+0 or 40 / lesser of bg+0 or 40 $L_{A10, adj, 15 mins}$: lesser of bg+10 or 55 / lesser of bg+10 or 50 / lesser of bg+5 or 45 / lesser of bg+10 or 50 / lesser of bg+10 or 45 / lesser of bg+5 or 40 $L_{A1, adj, 15 mins}$: lesser of bg+15 or 60 / lesser of bg+15 or 55 / lesser of bg+10 or 50 / lesser of bg+15 or 55 / lesser of bg+15 or 50 / lesser of bg+10 or 45 • bg = background noise level • In the event that measured bg is less than 25 dB(A), then 25 dB(A) can be substituted for the measured level	
D4	The method of measurement and reporting of noise levels must be in accordance with the most recent edition of the Department of Environment and Resource Management's Noise Measurement Manual or the most recent version of AS1055 Acoustics – Description and measurement of environmental noise.	This is for information purposes.
D5	When requested by the administering authority, noise monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer) of environmental nuisance at any sensitive or commercial place, and the results must be notified within 14 days to the administering authority following completion of monitoring.	AGL has not received any such requests from the administering authority, nor have any complaints been received from any occupiers of sensitive or commercial places.
D6	If monitoring in accordance with Condition (D5), indicates Condition (D3) is not being met, then the holder of this authority must: a) address the complaint including the use of appropriate dispute resolution if required; and/or b) as soon as practicable implement noise abatement measures so that noise emissions from the activity do not result in further environmental nuisance.	See above.
D7	Upon agreement with any affected person(s), and where alternative arrangements are in place that prevent environmental nuisance of noise emissions within a sensitive place, the noise levels provided in Schedule D Table 1 – Noise Limits, do not apply for that period in which the alternative arrangement is in place. These arrangements will be made with all related costs incurred to be borne by the holder of this authority.	See above.

4.9. ATP1190

Condition ID	Requirement	Actions and comments
Schedule C – Operating standards		
PESCB2	Petroleum activities must not cause environmental nuisance from dust, odour, light, smoke or noise at a sensitive place, other than where an alternative arrangement is in place.	There have been very limited activities on ATP1190 in recent years, apart from some minor works at Waggamba North 1. Work is conducted during daylight hours only, and there is a significant buffer distance between the wells on ATP1190 and any sensitive places. AGL also communicates regularly with landholders as part of the risk assessment process for proposed projects.
PESCC21	A Blast Management Plan must be developed for each blasting activity in accordance with Australian Standard 2187.	There has been no blasting (seismic surveys) on ATP1190 in recent years.
PESCC22	Blasting operations must be designed to not exceed an airblast overpressure level of 120 dB (linear peak) at any time, when measured at or extrapolated to any sensitive place.	See above.
PESCC23	Blasting operations must be designed to not exceed a ground-borne vibration peak particle velocity of 10mm/s at any time, when measured at or extrapolated to any sensitive place.	See above.
PESCD9	Noise must be measured in accordance with the prescribed standards in the Environmental Protection Regulation 2008.	For information purposes only.

Silver Springs Project

BIODIVERSITY MANAGEMENT SUB-PLAN

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Document revision history

Date	Version	Author	Comments
May 2020	R0	John Moraitis	Updated for AGL HSEMS
June 2022	R1	John Moraitis	Review and update

1. Introduction

This Biodiversity Management Sub Plan was prepared as part of the Environment Management Plan (EMP) for AGL's Silver Springs Gas Project ("the project").

This Plan was developed to specifically address and manage potential land management issues for the project and is based on the previously prepared and approved Environment Health and Safety Management Plans. This Plan conforms with AGLs Biodiversity Standard (ALG-HSE-STD-009.6) and Biodiversity Methodology (AGL-HSE-SDM-009.6) as stipulated in the AGL Health, Safety and Environment Management System (HSEMS).

This standard applies to all activities carried out by AGL employees and contractors, in AGL controlled sites, that:

- Result or potentially result in clearing of native vegetation;
- Directly or indirectly may harm threatened plant and/or animal species, ecological communities and their habitats;
- Result or potentially result in the control of pests; and
- Result or potentially result in biodiversity impacts (e.g. habitat loss and/or fragmentation, disturbance/disruption of animal movements and behaviour, soil contamination, dust smothering and surface water/groundwater quality degradation).

1.1. Objectives

The intent of the Biodiversity Standard is to assist AGL controlled sites in ensuring that:

- Impacts to biodiversity (i.e. causing harm to/disturbance of threatened animal and plant species, ecological communities and their habitats) are minimised to as low as reasonably practicable;
- Native vegetation clearing is minimised as far as practicable, managed and controlled effectively in accordance with relevant legislation and approvals;
- Introduction and spread of declared pests is prevented, minimised and control measures are in place; and
- Regulatory licence/permit conditions and other compliance obligations with respect to biodiversity protection and conservation are met.

1.2. Responsibilities

The roles and responsibilities for the development, implementation and review of this Plan are summarised below.

1.2.1. General Manager, HSE

The General Manager, HSE is responsible for:

- Delegating authority to ensure adequate implementation, monitoring and review of the Biodiversity Standard, and associated Methodology, occurs; and
- Ensuring adequate resources are available for the development, implementation, monitoring and review of the Biodiversity Standard.

1.2.2. Head of Function

The Head of Function is responsible for:

- Ensuring the implementation and adherence to the Biodiversity Standard throughout the Business Unit; and
- Ensuring adequate resources are available for the implementation, monitoring and review of the Biodiversity Standard.

1.2.3. Senior Manager, Environment Operations

The Senior Manager, Environment Operations is responsible for:

- Managing the development, implementation and maintenance of the Biodiversity Standard;
- Ensuring consultation in the development, review and approval of the Biodiversity Standard, and associated Methodology;
- Providing guidance for the development of objectives, goals, targets and/or Key Performance Indicators (KPIs) associated with the Biodiversity Standard, as applicable;
- Ensuring that applicable environmental objectives, goals and targets associated with the Biodiversity Standard are introduced, adhered to and measured while meeting AGL-wide policies, objectives, goals and targets; and
- Overseeing audits and assurance activities to ensure compliance with the Biodiversity Standard and applicable regulatory requirements.

1.2.4. Environment Business Partner

The Environment Business Partner is responsible for:

- Overseeing and monitoring the implementation of the Biodiversity Standard within their Business Unit, and communicating Biodiversity Standard requirements to relevant personnel and/or contractors, as applicable;

- Developing processes and/or procedures related to management of biodiversity to ensure consistency with the Biodiversity Standard, and with applicable environmental legislation;
- Providing support and guidance in the implementation of biodiversity related processes and/or procedures at Business Unit level;
- Undertaking or providing guidance and assistance to Leaders in the completion and review of environmental risk assessments and control processes;
- Undertaking audit and assurance activities, to ensure compliance with the Biodiversity Standard and applicable regulatory requirements, and developing tracking and corrective action management plans; and
- Assisting with the delivery and tracking of environmental management projects, or the integration of environmental considerations into projects, to ensure Business Unit and site-specific targets are met.

1.2.5. Environment Advisor

The Environment Advisor is responsible for supporting the Senior Manager, Environment Operations and/or Environment Business Partner(s) with tasks associated with:

- Implementation of the Biodiversity Standard; and/or
- Management of the processes and/or procedures related to Biodiversity Standard, at Business Unit level.

2. Legal obligations

2.1. Key legislative requirements

The key regulatory requirements relating to land management are detailed below.

2.1.1. Environmental Protection Act 1994

- Section 22: Act binds all persons
- Section 125: Requirements to apply for an environmental authority
- Section 319: General environmental duty
- Section 320DA: Duty of owner, occupier or auditor to notify administering authority
- Section 437: Offences of causing serious environmental harm
- Section 438: Offences of causing material environmental harm
- Section 440: Offence of causing environmental nuisance
- Section 442: Offence of releasing prescribed contaminant
- Section 443: Offence to place contaminant where serious or material environmental harm may be caused
- Section 443A: Offence to place contaminant where environmental nuisance may be caused

2.1.2. Environmental Protection Regulation 2019

- Division 4: Environmental management and environmental offences .

2.1.3. Environmental Protection and Biodiversity Conservation Act 1999

- Section 18: Actions with significant impact on listed threatened species or endangered community prohibited without approval
- Part 4: Referral of proposals to take action

2.1.4. Nature Conservation Act 1992

- Part 5: Wildlife and habitat conservation
  - Division 4: Particular restrictions relating to protected wildlife
    - Subdivision 1: Particular restrictions relating to protected animals
    - Subdivision 2: Particular restrictions relating to protected plants

2.1.5. Nature Conservation (Wildlife Management) Regulation 2006

- Chapter 3, Part 1: Taking, keeping, using, moving or dealing with protected animals other than under a wildlife authority

- Chapter 4, Part 2: Requirements for and restrictions about taking and using protected plants
- Chapter 4, Part 3: Exemptions for taking or using protected plants
- Chapter 4, Part 4A: Protected plant clearing permits
- Chapter 4, Division 5: Exemptions for taking protected plants when clearing.

2.1.6. Vegetation Management Act 1999

- Section 19O: Accepted development vegetation clearing code
- Part 2, Division 5AA: Vegetation management maps
- Part 2, Division 6: Relationship with Planning Act

2.1.7. Environmental Offsets Act 2014

- Section 14: Imposing offset conditions

2.1.8. Environmental Offsets Regulation 2014

- Schedule 2: Prescribed environmental matters – Matters of State Environmental Significance (MSES)

2.2. Key licence requirements

The environmental licences held for each lease contain general and specific conditions for managing land. The table below shows the current environmental approvals (licences) held for each petroleum lease, issued by the Queensland Department of Environment and Science.

Petroleum lease	Environmental licence no.	Issue date	Anniversary date (each year)
PL446	EPPG00784013	29 September 2016	24 May
PFL27	EPPG01233113	22 December 2017	Not listed on EA
PL192	EPPG00770313	23 July 2014	10 August
PL213	EPPG00304213	7 July 2016	23 January
PL 15	EPPG00770613	1 April 2022	15 August
PLs 48, 49, 66, 202	P-EA-100227919	1 April 2022	15 August
PPL 4	PEN202330511	22 June 2011	22 June
PPL 87, 93	EPPG00370113	3 February 2015	29 April
ATP1190	EPSX02909615	16 February 2015	Not listed on EA

2.3. Approval conditions

The approval conditions for each environmental approval (licence) including AGLs actions and comments are displayed in Section 4 of this document. This provides a useful reference for auditing

and assurance activities as it demonstrates how AGL is specifically managing compliance against each condition.

3. Impacts and control measures

3.1. Potential impacts

The following specific activities are identified as having the potential to cause impacts on vegetation if not appropriately managed:

- Land disturbances (clearing, trenching, excavations)
- Vegetation management (e.g. herbicide applications, clearing)
- Storage of hazardous substances (e.g. aboveground and underground storage tanks)
- Handling of hazardous substances (e.g. movement, transport, vessel recharge)
- Operation of mobile plant and equipment (e.g. vehicles, machinery)

3.2. Control measures

3.2.1. HSEMS minimum controls

The following minimum controls are specified by AGLs Biodiversity Standard (AGL-HSE-STD-009.6) and Biodiversity Methodology (AGL-HSE-SDM-009.6).

General

RCM Ref	Minimum Controls
GENERAL	
9.6.1.1	Prior to the comment of activities or works that cause or may cause material environmental harm, a permit, licence or authorisation must be obtained, where required, to disturb, take or destroy any biodiversity related activities which includes the following: • protected flora and fauna species; • protected habitats; • native vegetation; and • pest species.
9.6.1.2	Notices or orders, issued by the regulatory authority, related to the management of biodiversity including protected flora and fauna, protected habitats, native vegetation and pest management, must be complied with, and all requirements adhered to.

Prior to the clearing of native vegetation, AGL controlled sites need to assess the requirement for a permit/licence or authorisation. The factors that generally determine this, as established by applicable legislation, relate to the:

- Type of vegetation to be cleared;
- Land tenure of the area to be cleared; and
- Extent and purpose of the proposed clearing.

An application for vegetation clearing is to be prepared in accordance with the applicable regulatory requirements. Key information to be provided to the regulatory authority – generally to be provided in a prescribed application form – includes, but not limited to:

- Location and extent of the proposed clearing area;
- Purpose for proposed clearing; and
- How regulatory requirements are going to be met.

AGL controlled sites may be requested to support a clearing application with information on the proposed clearing area, such as management plans, maps and/or aerial photography, biodiversity studies/ecological surveys and groundwater bore data.

Wherever applicable, if an AGL controlled site identifies that the proposed clearing activity can be done in accordance with a vegetation clearing code, then:

- The relevant regulatory authority is to be notified prior to any clearing activity; and
- The vegetation clearing code is to be adhered to.

Furthermore, independently of the need for a clearing permit/licence/authorisation, AGL controlled sites need to verify if there are other requirements under other state or federal laws that are to be complied with before clearing vegetation.

As part of the approval to clear native vegetation, conditions may be imposed on AGL controlled sites to prevent, control, mitigate environmental harm or offset the loss of cleared vegetation. The AGL controlled site may be required to:

- Offset the loss of the cleared vegetation, if a significant residual impact from the clearing activity remains, by establishing and maintaining vegetation on land other than the land cleared under the clearing permit.
- Revegetate an on-site and/or off-site area, including the preparation of a revegetation plan, in accordance with prescribed conditions and other regulatory requirements, to be approved by the regulatory authority. AGL controlled sites should verify the origin of any native vegetation used for revegetation purposes, and it should not acquire native vegetation obtained through the clearance and conversion of a threatened native vegetation community (with the exception of vegetation under a certification scheme).

AGL controlled sites may be requested to offset biodiversity as a condition of their approval(s), permit, licence or authorisation. The condition may specify if the offset is to be undertaken on the AGL controlled site land or other land. Current best practice in biodiversity management aims to achieve 'net positive impact', through the use of biodiversity offsets and additional conservation actions

Any notices or orders given by the regulatory authority must be complied with and adhered to. In the case of pest management, if a pest control notice requires the preparation of a property pest management plan, AGL controlled sites need to comply with the notice and other regulatory requirements.

Biodiversity Management

RCM	Minimum Controls

Ref	
9.6.1.3	Areas of high conservation value or special biodiversity significance, as defined by applicable legislation, that are likely to be affected by AGL controlled site activities must be identified and evaluated.
9.6.1.4	Potential or actual impacts on biodiversity from AGL controlled sites activities must be managed in accordance with the following management hierarchy: • Avoid; • Minimise; • Remedy; and • Offset.
9.6.1.5	Control measures must be implemented at AGL controlled sites to prevent and minimise potential or actual impacts from operations on biodiversity.
9.6.1.6	Wherever applicable, AGL controlled sites must comply with the relevant codes of practice and guidelines prescribed by the regulatory authority(ies) for: • Taking and using threatened plant species; • Protecting and conserving threatened and other protected plant and animal species, and protected areas; and/or • Restoring and offsetting biodiversity.

AGL controlled sites need to take reasonable and practicable measures to prevent and minimise the negative impacts of its activities on biodiversity, and take advantage of opportunities to benefit biodiversity conservation in or around its operations.

Information on plants, animals and ecological communities present within site boundaries may be available through:

- Baseline surveys;
- Monitoring programs;
- Consultation with the community, conservation groups and regulatory authority(ies); and/or
- An ecological survey of the designated area.

Appropriate control measures should be in place to prevent potential adverse effects of activities on biodiversity. Examples of control measures include (but not limited to):

- Restricting access to designated areas, including fencing-off and/or installing signage for protection areas and high-value biodiversity conservation areas;
- Establishing a permitting or authorisation process to control clearing of vegetation and land disturbance;
- Completion of an ecological survey, including mapping of potential critical habitat(s) and recording and documenting the threatened animal and plant species found; and
- Providing training and communication on biodiversity matters to AGL employees and contractors (e.g. site inductions and toolboxes).

Adverse impacts on biodiversity values should be avoided, wherever possible, by changing or stopping activities prior to them taking place. Where this is not possible, opportunities for implementing management hierarchy options for managing biodiversity impacts should be identified, as follows (in order of preference):

- Minimise impacts, through integration of biodiversity considerations in planning processes, and developing and implementing control measures;
- Remedy impacts, through rehabilitation of disturbed areas to a safe, stable and non-polluting condition, followed by revegetation of those areas (aiming for the establishment of a specific and agreed habitat type); and
- Offset impacts, through compensation of the unavoidable 'residual' impacts on biodiversity (i.e. by protecting and managing biodiversity values in one area in exchange for impacts on biodiversity values in another). Appropriate offset opportunities are to be identified only after the above mentioned management options have been considered and implemented (i.e. if AGL controlled sites are able to demonstrate that one or a combination of the two higher hierarchy options minimise the biodiversity impacts to as low as possible, then offsetting is not required).

Management of biodiversity at AGL controlled sites should not be contrary to any management plan established by local, state and/or government agencies (e.g. natural resource management plans, recovery plans for listed native species and listed ecological communities, and threat abatement plans for key threatening processes).

Procedures for managing biodiversity, at AGL controlled sites, should be developed and implemented. These procedures should align with legislative requirements (including licenses and regulatory approval(s)) and guidelines, relevant HSE Management System Standards and any commitments associated with biodiversity protection and conservation.

Clearing of Native Vegetation

RCM Ref	Minimum Controls
9.6.1.7	AGL controlled sites must develop and implement control measures to manage the clearing of native vegetation.

Clearing of native vegetation at AGL controlled sites should be minimised and conducted in a way as to limit or avoid:

- Damage to neighbouring native vegetation;
- Soil erosion and land degradation;
- Impact to the quality of surface water or groundwater; and
- Impact on biodiversity and cultural heritage conservation.

Personnel undertaking vegetation clearing works should be fully aware of the Health, Safety and Environment risks associated with the activity and the required control measures to minimise potential biodiversity impacts. Furthermore, prior to undertaking clearance of vegetation, personnel should be provided with the relevant area map, which clearly demarcates the approved area for clearing of vegetation.

Clearing of native vegetation at AGL controlled sites should not be carried out without the approval of the relevant site Leaders and Environment representative. If native vegetation clearing is followed by land disturbance and/or land rehabilitation works then the relevant minimum controls stated within the Land Standard (AGL-HSE-STD-009.1) need to be adhered to.

Procedures for managing clearing of native vegetation, at AGL controlled sites, should be developed and implemented. These procedures should align with legislative requirements (including licenses and regulatory approval(s)) and guidelines, relevant HSE Management System Standards and any commitments associated with management of vegetation.

Property Vegetation Plan

Clearing activities may require the preparation of a property vegetation plan (PVP), at state and/local level, describing how native vegetation will be managed on a property (exclusions apply and AGL controlled sites should refer to applicable legislation). The draft PVP is to comply with the prescribed format and content prescribed by the regulatory authority and be submitted for approval. AGL controlled sites should engage with a suitably qualified and experienced professional(s) to prepare the PVP.

Dealing with Protected Animals

RCM Ref	Minimum Controls
9.6.1.8	AGL controlled sites must not use any substance, animal, firearm, explosive, net, trap, spotlight, hunting device or instrument or other means whatever for the purpose of harming or relocating any protected animals, unless authorised.
9.6.1.9	Protected animal fatalities, as a result of AGL activities, or injured/sick protected animals or abandoned juvenile protected animals found within AGL controlled site boundaries must be reported to the relevant Leader and/or site Environment representative. If required by legislation, AGL controlled sites must also notify the relevant regulatory authority(ies).

A suitably qualified and experienced wildlife management professional, possessing the relevant and valid permit(s)/licence(s) and appropriate equipment, may have to be engaged by the AGL controlled site to carry-out animal control activities.

Pest Management

RCM Ref	Minimum Controls
9.6.1.10	Control measures for preventing the introduction of, and controlling pests present in AGL controlled sites, must be developed and implemented.
9.6.1.11	Declared pests must be managed in accordance with relevant protocols and guidelines prescribed by the regulatory authority(ies), wherever applicable.
9.6.1.12	Declared and emergency declared pests, identified or suspected to be present at AGL controlled sites must be reported to the regulatory authority(ies), in accordance with the notification requirements established by applicable legislation.

AGL controlled sites should take reasonable and practicable measures to:

- Prevent the introduction of pests;
- Prevent and minimise the growth and spread of pests, in particular if the site is in or adjacent to an protection area(s); and
- Control pests (including testing, treatment or destruction/eradication), as far as possible.

AGL controlled sites should minimise the introduction and further spread of pests at AGL controlled sites. Examples of control measures include (but not limited to):

- Notifying the presence of a declared pest and associated control measures to all employees and contractors through site inductions, toolbox talks and installation of signage;
- Providing designated washdown or cleaning/decontamination areas for vehicles, plant/equipment, clothing and Personal Protective Equipment (PPE);
- Implementing an inspection program for vehicles, plant/equipment, clothing and PPE that may carry pests;
- Controlling movement and restricting access of vehicles, employees/contractors within/from infested and protected areas;
- Temporarily or permanently fencing out protected areas or high-value land use areas; and
- Having processes in place for:
    - Ensuring that vehicles and plant/equipment brought to site are in a clean state (including being free of debris);
    - Purchasing of goods, materials, vehicles and machinery that may contain or carry pests;
    - Materials handling (e.g. soil, sand, gravel and stone) and other activities (e.g. land disturbance, rehabilitation and revegetation works) that may likely result in the spread of a pest.

When a pest(s) has been identified to be present at an AGL controlled site, an assessment of potential impacts of the pest on the environment and human health should be conducted and documented. This will assist in determining the aim of the pest control program to be developed and implemented. The pest control program should focus on priority areas affecting the operations (including high-value land use and protected areas) and where it will have the greatest sustained reduction of impact.

The most effective way to control pests is by using a variety of techniques/methods, therefore where possible, AGL controlled sites should investigate a full range of pest management strategies applicable to each situation. Measures to control pests include:

- Quarantine or isolation;
- Destruction; and
- Treatment, including:
    - Biological methods (e.g. using animal-specific diseases) and habitat manipulation (e.g. removing food and water sources);
    - Physical (e.g. trapping, hunting and fencing/netting) and mechanical methods (e.g. uprooting, grubbing, mulching or pruning); and
    - Chemical methods (e.g. baiting, spraying and fumigation). If chemicals are used for pest control activities, the relevant minimum controls stated within the Hazardous Chemicals Standard (AGL-HSE-STD-007.10.1) need to be adhered to.

The use of pesticides should be operated by a person who is trained and competent to use the chemical. Where required, a licence from the regulatory authority may be required.

Pest management activities carried out at AGL controlled sites should keep the damage to or destruction of other vegetation to a minimum and not be contrary to any pest management plan established by local and/or state government agencies. Furthermore, unless authorised, an AGL controlled site should not interfere with, remove or destroy a pest control device installed by regulatory authority(ies).

Procedures for managing pests, at AGL controlled sites, should be developed and implemented. These should align with legislative requirements (including licenses and regulatory approval(s)) and guidelines, relevant HSE Management System Standards and any commitments associated with management of vegetation.

There should not be intentional introduction of declared pests at AGL controlled sites, unless a risk assessment has been conducted and relevant approval(s) obtained. Declared pests permit(s) conditions need to be adhered to, as prescribed by the regulatory authority(ies). These may include, but not limited to:

- Keeping records on a declared pest;
- Setting a security enclosure or a quarantine facility, and/or providing shelter and care for a declared pest animal;
- Using a tag or other device to identify a declared pest;
- Restricting breeding and movement, and stopping the spread of a declared pest; and
- Maintaining adequate public liability insurance in relation to keeping a declared pest.

A property pest management plan may also be prepared by an AGL controlled site on a voluntary basis, as a tool to identify and manage the risks associated with pests in an AGL controlled site. When developing a pest management plan, AGL controlled sites need to consider the following:

- Consultation with other landholders and local groups, as pest management is more effective when carried out over a wider area;
- Integration with other management plans developed for the AGL controlled site (e.g. vegetation, cultural heritage, land and water management plans);
- Integration with relevant local, regional and state plans (e.g. pest, natural resources and protected areas management plans, recommended codes of practice and guidelines)
- Compliance with relevant legislation.

Incidents and Emergencies

RCM Ref	Minimum Controls
9.6.1.13	Incidents and emergencies resulting in significant impacts on biodiversity must be reported to the regulatory authority, in accordance with the notification requirements established by applicable legislation.
9.6.1.14	Incidents resulting in potential or actual biodiversity impacts must be investigated and reported using the AGL Incident Management System.

Incidents that result in biodiversity impacts at AGL controlled sites need to be reported as per the HSE Incident, Near Miss and Hazard Management Procedure' (AGL-HSE-PRO-012.1).

Training and Competence

RCM Ref	Minimum Controls
9.6.1.15	Ecological surveys and other biodiversity field work, biodiversity studies and assessments (e.g. revegetation and biodiversity offsets) must be carried out by suitably qualified and experienced professionals.

Professionals (e.g. ecologists and wildlife experts) appointed to carry-out biodiversity related field work and desktop studies, should have the appropriate qualifications or training, and are experienced and competent to conduct the work safely.

Personnel whose work is associated with managing biodiversity impacts, as identified by the AGL controlled site, should be competent to perform the tasks to which they are assigned. Specific training needs for individuals and teams should be determined through the implemented training and competency system, developed in alignment with the Training and Competency Methodology (AGL-HSE-SDM-013).

Definitions

Term	Definition
AGL Controlled Site	An AGL owned operated or controlled site, including a field operational site or an office site.
Animal	Animal refers to any member of the animal kingdom (other than a human being) - alive or dead - whether vertebrate or invertebrate, and includes: • Mammals, birds, insects, reptiles, amphibians, fish, coral, crustaceans and molluscs; • Egg, ova, sperm or embryo of an animal (other than a human being) or any other substance or thing directly relevant to the reproduction of an animal (other than a human being); and • Any other prescribed form of animal life, whether prescribed by reference to a species or in any other way.
Biodiversity	Biodiversity means: • The variety of living organisms represented by plants, animals and other organisms and micro-organisms, including the genes that they contain, and • The terrestrial, marine and other aquatic ecosystems and ecosystem processes of which they form a part.
Critical Habitat	Critical habitat refers to: • Habitat that is essential for the survival and conservation of threatened plant and/or animal species or ecological community; and

Term	Definition
	• Areas designed as 'critical habitat' under applicable legislation. Critical habitats are areas with high biodiversity value.
Ecological Community(ies)	Ecological community refers to a naturally occurring group of plants, animals and other organisms that interact in a unique habitat, and may depend on each other (e.g. for food or shelter).
Habitat	Habitat means the whole or part of an area, locality, site, particular type of environment or biophysical medium (e.g. terrestrial, freshwater or marine) or media: • Occupied (continuously, periodically or occasionally) by an organism or group of organisms; or • Once occupied (continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind have the potential to be reintroduced.
HSE	Health, Safety and Environment.
Key Threatening Processes	Key threatening processes refers to the natural events (e.g. cyclones, floods, drought, pests and fire) and human-induced threats (e.g. clearing of habitat, grazing and pollution) that impact on plant and/or animal species and contribute to their risk of extinction.
Leader	Any employee who has others reporting to him or her, or who has the authority to allocate resources.
Material Environmental Harm	Material environmental harm means environmental harm that: • Comprises an environmental nuisance of a high impact or on a wide scale; and/or • Involves actual or potential harm to the health or safety of human beings that is not trivial or other actual or potential environmental harm that is not trivial nor negligible; and/or • Results in incurring reasonable costs and expenses to take all reasonable and practicable measures to prevent, mitigate or make good harm to the environment. AGL controlled sites should refer to relevant state legislation for applicable definition.
Native Vegetation	Native vegetation means indigenous aquatic or terrestrial plant species that existed in Australia (states and territories) prior to European settlement. It includes native trees (including saplings, shrubs or scrub) and understorey, groundcover or wetland plants. AGL controlled site should refer to relevant state legislation for applicable definition.
Offset	Offset refers to measures undertaken by a company to counterbalance a significant residual impact of their activity (e.g. clearing for development) on biodiversity.
Plant	Plant refers to any member, alive or dead, of the plant kingdom or of the fungus kingdom, and includes: • Flowering plant, tree, palm, shrub, cycad, conifer, fern or fern ally, moss, liverwort, vine, alga, fungus and lichen; and

Term	Definition
	• The whole or any part of the flowers, seeds or genetic or reproductive material of a plant, whether attached to a plant or separate therefrom.
Pest	Pest refers to: • Any animal or plant that is declared as a pest by legislation; • Any virus/viroid, disorder, condition or cause of specified symptoms in animals or plants that is declared as a pest by legislation. Pests are a serious threat to primary industries, the environment and public safety, by: • Competing with crops, pasture, livestock and native animal and plant species; • Contaminating crops and seeds; • Contributing to soil erosion, land and waterway degradation; • Carrying and spreading disease; • Causing health problems; and • Creating a nuisance that reduces the quality of life for a community.
PPE	Personal Protective Equipment (PPE) refers to footwear, glasses, hard hat, clothing or other safety equipment designed to protect a person's body from injury.
Protected Animal	Protected animal refers to a native animal that is under an identifiable threat of extinction, or is rare, or otherwise in need of special protection. Protected animals are declared by the relevant regulatory authority(ies) and generally listed under applicable legislation or covered by protection/conservation notices/orders.
Protected Area (in relation to biodiversity)	Protected area refers to environmentally significant areas, such as (but not be limited to): • Land dedicated as a reserve for environmental purposes; • A world heritage area listed under the World Heritage Convention; • An area supporting a threatened ecological community; or • A declared Ramsar wetland. AGL controlled sites should refer to relevant state legislation for applicable definition.
Protected Area (in relation to a pest)	A place, declared by the regulatory authority, which has been deemed necessary to protect in order prevent the introduction of a pest into that area.
Revegetation	Revegetation refers to the process of replanting and rebuilding the soil of disturbed land. The aim of revegetation is to re-create or improve a vegetation remnant or cleared area.
Species	Species refers to a population, or group of individual animals or

Term	Definition
	plants, that: • Interbreeds to produce fertile offspring(s); or • Possesses common characteristics derived from a common gene pool; or • Is declared as a 'species' under applicable legislation. It includes a sub-species, hybrid, variant, race, mutation or geographically separated population of any animal or plant.
Threatened Plant and/or Animal Species	Threatened species refers to protected plant and/or animal species listed under applicable legislation. National legislation classification for threatened species includes: • Extinct; • Extinct in the wild; • Critically endangered; • Endangered; • Vulnerable; and • Conservation dependent. AGL controlled sites should refer to relevant state legislation for applicable classification.
Threatened Ecological Community(ies)	Threatened ecological community(ies) refers to an ecological community(ies) listed under applicable legislation and/or covered by a conservation/protection order/notice. Types of listed ecological communities include woodlands, grasslands, shrublands, forests, wetlands, marine, ground springs and cave communities.
Vegetation Clearing	Vegetation clearing refers to the removal, destruction in any way or cutting down of a tree, shrub or other plant on the land.

4. Approval conditions and comments

4.1. PL446

Condition ID	Requirement	Actions and comments
Schedule E - Land		
E1	Contaminants must not be directly or indirectly released to land except as permitted under this environmental authority.	All personnel receive inductions and training to ensure that contaminants are not released to land. AGL has a range of controls to ensure that contaminants are not released to land.
E2	Prior to conducting petroleum activities that involve significant disturbance to land, an assessment must be undertaken of the condition, type and ecological value of any vegetation in such areas where the activity is proposed to take place.	AGL has an established Management of Change Process in place, that captures environmental risks through an assessment by the Environment Business Partner. Third party technical specialists are engaged to carry out environmental assessments if required.
E3	The assessment required by condition (E2) must be undertaken by a suitably qualified person and include an assessment of the bio-condition of the vegetation to be disturbed, the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas and the presence of species classed as endangered, vulnerable, rare or near threatened under the Nature Conservation Act 1992.	Third party technical specialists are engaged to carry out environmental assessments if required.
E4	If the assessment required by conditions (E2) and (E3) indicates that a Regional Ecosystem mapped as Endangered or Of Concern by the Queensland Herbarium should be in a different conservation value classification, the holder of this environmental authority must advise the administering authority in writing before any significant disturbance to land takes place.	Third party technical specialists are engaged to carry out environmental assessments if required, and to determine if notification to the administering authority is required.
E5	If, within the 20 business days following the lodgement of the notification under condition (E4) the administering authority notifies the holder of this environmental authority, in writing, that the Regional Ecosystem mapping requires further validation, then significant disturbance to land in the mapped Regional Ecosystem is prohibited until the administering authority provides written advice that significant disturbance to land may proceed.	Third party technical specialists are engaged to carry out environmental assessments if required, and to determine if notification to the administering authority is required.
E6	The holder of this environmental authority, when carrying out the petroleum activity(ies) must:	AGL has an established Management of Change

	a) avoid, minimise or mitigate (in order of preference) any impacts on areas of vegetation or other areas of ecological value b) minimise disturbance to land that may otherwise result in land degradation c) ensure that for land that is to be significantly disturbed by the petroleum activity(ies): i. the top layer of the soil profile is removed ii. soils are stockpiled in a manner that will preserve its biological and chemical properties; and iii. soils are used for rehabilitation purposes. d) avoid clearing mature trees; and e) prior to carrying out field-based petroleum activities, make all relevant staff, contractors or agents carrying out those petroleum activities, aware of the location of any Category A, B or C Environmentally Sensitive Areas and the requirements of this environmental authority.	Process in place, that captures environmental risks through a desktop and field assessment by the Environment Business Partner. Third party technical specialists are engaged to carry out environmental assessments if required.
E7	Despite condition (E6), significant disturbance to land caused by the carrying out of the petroleum activities must not involve clearing vegetation or placing fill: a) in a way which significantly isolates, fragments or dissects tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional / local corridor networks) and/or results in an increase in threatening processes (e.g. potential impacts associated with edge effects or introduced species) b) on slopes greater than 10% for the petroleum activity(ies) other than for pipelines and wells; or c) in discharge areas.	See comment for condition E6.
E8	Clearing of remnant vegetation shall not exceed 10m in width for the purpose of establishing tracks or 20m in width for dual carriageway roads.	See comment for condition E6.
E9	Cleared vegetation must be stockpiled in a manner that facilitates respreading or salvaging and does not impede vehicle, stock or wildlife movements.	See comment for condition E6.
E10	The holder of this environmental authority must ensure that the petroleum activity(ies) is only conducted in accordance with Schedule E: Table 1 - Environmentally Sensitive Areas (ESAs) below for each of the ESA categories and associated primary and secondary protection zones.	See comment for condition E6.

<table>
<tr><td></td><td>
Schedule E: Table 1 – Environmentally Sensitive Areas (ESAs)
<table>
<tr><th>ESA Category</th><th>Within the ESA</th><th>Primary protection zone of the ESA</th><th>Secondary protection zone of the ESA</th></tr>
<tr><td>All Category A ESAs</td><td>No petroleum activities permitted</td><td>No petroleum activities permitted</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category B ESAs excluding 'Endangered' regional ecosystems</td><td>No petroleum activities permitted</td><td>No petroleum activities permitted</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category B ESAs: 'Endangered' regional ecosystems</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category C ESAs excluding 'Of Concern' regional ecosystems, State Forests and Timber Reserves</td><td>No petroleum activities permitted</td><td>No petroleum activities permitted</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category C ESAs: State Forests, Timber Reserves and 'Of Concern' regional ecosystems</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
</table>
</td><td></td></tr>
<tr><td>E11</td><td>Limited petroleum activities carried out in the secondary protection zone in accordance with condition (E 10) must be preferentially located in pre-existing areas of clearing or significant disturbance to the greatest practicable extent and avoid the clearing of mature trees.</td><td>See comment for condition E6.</td></tr>
<tr><td>E12</td><td>Limited petroleum activities carried out in the secondary protection zone in accordance with condition (E10) must be preferentially located in pre-existing areas of clearing or significant disturbance to the greatest practicable extent and avoid the clearing of mature trees.</td><td>See comment for condition E6.</td></tr>
<tr><td>E13</td><td>Where limited petroleum activities are proposed to be undertaken within the primary protection zone of, or in the Category B and C Environmentally Sensitive Area as authorised in Condition (E10), the holder of this environmental authority must be able to demonstrate that no reasonable or practicable alternative exists and that disturbance to land only be located and carried out in areas according to the following order of preference:
a) pre-existing cleared areas or significantly disturbed land within the primary protection zone of a Category C Environmentally Sensitive Area
b) pre-existing cleared areas or significantly disturbed land within the primary protection zone of a Category B Environmentally Sensitive Area
c) undisturbed areas within the primary protection zone of a Category C Environmentally Sensitive Area</td><td>See comment for condition E6.</td></tr>
</table>

	d) undisturbed areas within the primary protection zone of a Category B Environmentally Sensitive Area e) pre-existing areas of significant disturbance within a Category C Environmentally Sensitive Area (e.g. areas where significant clearing or thinning has been undertaken within a Regional Ecosystem, and/or areas containing high densities of weed or pest species which has inhibited re-colonisation of native regrowth) f) pre-existing areas of significant disturbance within a Category B Environmentally Sensitive Area (e.g. areas where significant clearing or thinning has been undertaken within a Regional Ecosystem and/or areas containing high densities of weed or pest species which has inhibited recolonisation of native regrowth) g) areas where clearing of a Category C Environmentally Sensitive Area is unavoidable; and h) areas where clearing of a Category B Environmentally Sensitive Area is unavoidable.	
E14	Notwithstanding Conditions (E10) and (E13), where limited petroleum activities are proposed to be undertaken within the primary protection zone of, or in a Category B or C Environmentally Sensitive Area, any vegetation clearing must not exceed any of the following areas: a) for the life of the project and before any activity commences, if the disturbance relates to an Endangered or Of Concern Regional Ecosystem, 10% of the remnant unit of Endangered or Of Concern Regional Ecosystem as ground truthed and mapped as per Conditions (E2) and (E3) of this environmental authority; and b) more than 30m2 for the construction of a sump; or c) more than 6m in width for tracks; or d) more than 12m in width for flow pipeline construction purposes.	See comment for condition E6.
E15	For each well site within the primary protection zone of, or in a Category B or C Environmentally Sensitive Area specified in condition (E10), all reasonable and practical measures must be taken to minimize the area cleared which must include but not be limited to, for each well site, ranked constraints mapping and a risk assessment which considers safety and environmental impacts.	See comment for condition E6.
E16	Details of any significant disturbance to land undertaken within the primary protection zone of, or in a Category B or C Environmentally Sensitive Area, along with a record of the assessment required by conditions (E2) and (E3) must be kept and submitted to the administering authority with each annual return.	The Annual Return form submitted to the administering authority requires AGL to consider whether any records must be attached to the submission. The draft submission is reviewed by Site Leaders and AGL Senior Leaders, including Group Counsel.
E17	A Soil Management Plan which has been certified by a suitably qualified person must be developed within 6 months of the date of issue of this approval.	The Silver Springs Soil Management Plan was developed in October 2011. A copy is maintained on the AGL network.

E18	The Soil Management Plan must include, but not necessarily be limited to: a) establishing baseline soils information for areas to be disturbed including soil depth, pH, electrical conductivity (EC), chloride, cations (aluminium, calcium, magnesium, potassium and sodium), exchangeable sodium percentage (ESP), particle size and soil fertility (including carbon, nitrogen, phosphorous, potassium, sulphur and micronutrients) b) a soils monitoring program outlining parameters to be monitored, frequency of monitoring and acceptable ranges for each parameter c) identification of soil units within areas to be disturbed by the petroleum activity(ies) at a scale of 1 :50,000, in accordance with the "Guidelines for Surveying Soil and Land Resources, 2nd Edition" (McKenzie et al. 2008), "Australian Soil and Land Survey Handbook, 3rd Edition" (National Committee on Soil and Terrain 2009) and "The Australian Soil Classification" (Isbell 2002), as amended from time time d) development of soil descriptions that are relevant to assessment for agricultural suitability, topsoil assessment, erodibility and rehabilitation, for example: i. black earths ii. shallow cracking clay soils iii. deep cracking clay soils iv. deep saline and/or sodic cracking clay soils with melon holes v. thin surface, sodic duplex soils vi. medium to thick surface (i.e > 15cm), sodic duplex soils; and vii. non-sodic duplex soils. e) detailed horizon and soils compaction management procedures, including top soil and top soil stockpile management procedures to minimise the impacts of soil disturbance and promote successful rehabilitation f) detailed mitigation measures and procedures to manage the risk of adverse soil disturbance in the carrying out of the petroleum activity(ies) g) for pipelines, methods of keeping soil horizons separate on excavation, storage and backfilling; and h) for areas of good quality agricultural land, detailed methods to be undertaken to minimise potential impacts to soil productivity.	See comment for condition E17.
E19	The holder of this environmental authority must implement the Soil Management Plan.	AGL implements the Soil Management Plan as part of its Management of Change process for new projects. The Environment Business Partner carries out an environmental assessment, which includes consideration of soils and land quality.
E20	A copy of the Soil Management Procedures must be submitted to any potentially affected landholder	A copy of the Plan is kept on AGLs servers. To

	upon request by that landholder.	date, there has been no such requests from landholders.
E21	Fauna management procedures must be developed within 6 months from the date of issue of this approval.	AGL developed an EMP which included Fauna Management Procedures at the commencement of operations.
E22	The fauna management procedures must be certified by a suitably quality person	See comment for condition E21.
E23	The fauna management procedures must ensure that the petroleum activity(ies) (including, but not necessarily limited to: pipeline construction, dam construction and operation) are carried out in a manner that minimises the risk of injury, harm, or entrapment to wildlife and stock.	See comment for condition E21.
E24	Well lease infrastructure and dams must be securely fenced and/or screened after construction is completed to: a) exclude and prevent the entrapment of livestock and terrestrial wildlife; and b) limit habitats for the introduction or spread of pests.	See comment for condition E21.
E25	The fauna management procedures must include training and awareness of staff and contractors.	AGLs inductions and contractor icebreaker sessions include training and awareness on fauna management procedures.
E26	Planned fauna handling must be undertaken by a suitably qualified person.	AGL has a licensed spotter/catcher in place at Silver Springs, being the Asset Manager (James Dean).
E27	The holder of this environmental authority must implement the fauna management procedures. *Note: The procedures required by conditions (E21) and (E27) should consider the "Australian Pipeline Industry Association Code of Environmental Practice - Onshore Pipelines" March 2009, as amended from time to time.*	This EMP is used to implement the fauna management procedures, along with AGLs Management of Change process.
Schedule I - Rehabilitation		
I1	Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than 3 months after completion.	There have not been any recent pipeline installations on PL446.
I2	During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.	See comment for condition I1.
I3	Backfilled and rehabilitated pipeline trenches must: a) be a stable landform b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and c) be re-profiled to a level consistent with surrounding soils d) be re-profiled to original contours and established drainage lines e) be visually consistent with the surround land features; and f) (f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	See comment for condition I1.

I4	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must commence as soon as practicable, but not longer than 9 months following the completion of any construction or operational works associated with the petroleum activity(ies).	AGL has plans to commence rehabilitation of disused dams in FY21, provided that the budget request is approved. This includes dams at the SSP facility (oily water dams) and dams located on landholder properties within PL446. AGL is currently running a Land Contamination Program across all of its national assets to identify and remediate contaminated land risks.
I5	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must: a) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt) b) reshape all significantly disturbed land to a stable landform c) reprofile all significantly disturbed land to original contours d) on all significantly disturbed land: i. re-establish surface drainage lines ii. reinstate the top layer of the soil profile iii. establish groundcover to ensure that erosion is minimised; or iv. establish vegetation based upon the floristic species composition found in analogue sites (using stock of local provenance where possible) to achieve the benchmark parameters outlined in condition (A7). e) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and/or minimise environmental harm.	See comment for Condition I4.
I6	All significantly disturbed land caused by the carrying out of the petroleum activity(ies) must be rehabilitated to meet the following final acceptance criteria: a) all significantly disturbed land is reinstated to the pre-disturbed land use unless otherwise agreed to between the holder of this environmental authority, the landholder and the administering authority and is provided for in the Operational Plan b) all significantly disturbed land is reinstated to the pre-disturbed soil suitability class c) the landform is safe for humans and fauna d) the landform is stable with no subsidence or erosion gullies for at least 5 years e) a minimum of 80% foliage cover of analogue sites is maintained in the rehabilitated sites for at least 3 years f) a minimum of 80% of the flora species diversity in analogue sites is maintained in the rehabilitated sites for at least 3 years	See comment for Condition I4.

	g) a minimum equal density of habitat structures, including but not limited to litter cover, fallen woody material and hollow logs, as that in analogue sites h) erosion is minimised with appropriate sediment traps and erosion control measures installed as determined by a suitably qualified person i) the water quality of any residual void or water bodies constructed by the petroleum activity(ies) meets criteria for subsequent uses and does not have potential to cause environmental harm; j) there is no ongoing contamination to waters k) there is no ongoing contamination to groundwater from dams or monocells (demonstrated via groundwater monitoring and leak detection monitoring systems); and l) (l) the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance caused by carrying out the petroleum activities.	
I7	Notwithstanding condition (16), all buried pipelines must be decommissioned in accordance with the requirements of Australian Standard 2885.	There are currently no plans to rehabilitate any buried pipelines.
I8	Notwithstanding condition (16), any dam may be decommissioned for a beneficial use provided that it is approved or authorised by the administering authority and the landowner.	This is a future requirement; see comments for Condition I4.

4.2. PFL27

Condition ID	Requirement	Actions and comments
Schedule G - Land		
C1	Contaminants must not be directly or indirectly released to land, except as permitted by conditions (C2) and (C3).	AGL has dedicated above ground storage tanks for waste oil and coolant. Contaminated soil from minor spills is temporarily stored in a dedicated intermediate bulk container (IBC) within a pallet bin.
C2	Measures to minimise stormwater entry onto significantly disturbed land must be implemented and maintained. (PESCC14)	The Wallumbilla facility is located on an elevated part of the landscape. Concentrated stormwater flow does not enter the site.
C3	Sediment and erosion control measures to prevent soil loss and deposition beyond significantly disturbed land must be implemented and maintained. (PESCC15)	There is a variety of drainage and erosion controls on-site to minimise erosion and subsequent sedimentation. Drainage controls consist of flow diversion berms located in strategic areas, and erosion controls consist of groundcover including blue metal aggregate and grassed areas. The Environment Business Partner is a Certified Professional in Erosion and Sediment Control and frequent inspections are carried out.
C4	Chemicals and fuels on the relevant tenures must be stored in, or serviced by, an effective containment system that meets Australian Standards, where such a standard is relevant. (PESCC16)	Chemicals are stored in intermediate bulk containers within bunded areas. Diesel is stored in double skinned steel tanks, which are subject to integrity tests and inspections.
Schedule G - Rehabilitation		
G1	All buried pipelines must be decommissioned in accordance with the requirements of Australian Standard 2885, as amended from time to time.	This a future requirement at the end of the asset life.
G2	When no longer required all low hazard dams must be decommissioned to no longer accept inflow from the petroleum activities and be either: a) rehabilitated; or b) agreed to in writing by the administering authority and the landholder to remain in situ following the cessation of the petroleum activities associated with the dam, with the contained water of a quality suitable for the intended ongoing uses by that landholder. (PESCC20)	There is a small (disused) firewater dam on-site that was replaced in 2019 with a large steel firewater tank.
G3	Significantly disturbed areas must be rehabilitated so that: a) the areas are reshaped to a stable landform b) the areas are re-profiled to contours consistent with the surrounding landform c) surface drainage lines are re-established	This is a future requirement. The entire site (7ha) is a significantly disturbed area, however there are decades of asset life remaining.

	d) top soil is reinstated.	
G4	All significantly disturbed land caused by the carrying out of the petroleum activities must be rehabilitated to meet condition (G3) and the following final acceptance criteria: a) any contaminated land (e.g. contaminated soils, decommissioned dams containing salt) is remediated and rehabilitated b) rehabilitation is undertaken in a manner such that any actual or potential acid sulfate soils on the area of significant disturbance are treated to prevent or minimise environmental harm in accordance with the Instructions for the treatment and management of acid sulfate soils c) (2001), published by the Queensland Government and amended from time to time. d) for land that is not being cultivated by the landholder: i. groundcover, that is not a declared pest species is established and self-sustaining ii. vegetation of similar species richness and species diversity to pre-selected analogue sites is established and self-sustaining e) for land that is to be cultivated by the landholder, cover crop is reinstated, unless the landholder will be preparing the site for cropping within 3 months of petroleum activities being completed.	See comments for condition G3.
G5	Monitoring of performance indicators must be carried out on rehabilitation activities until final acceptance criteria in condition (G4) have been met for the rehabilitated area	See comments for condition G3.

4.3. PL192

Condition ID	Requirement	Actions and comments
Schedule F- Land		
F1	Contaminants must not be directly or indirectly released to land except as authorised by condition (C5).	The Churchie facility is located on PL192. The facility has a dedicated bunded area for the storage of raw materials. Chemicals are stored in intermediate bulk containers (IBCs). There is also two lined produced water dams (0.5ML each) in place.
F2	Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.	The pipelines were installed several years ago. Future pipe laying will be subject to AGLs Management of Change process and the Environment Business Partner is responsible for ensuring all licence conditions have been complied with.
F3	During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.	Future pipe laying will be subject to AGLs Management of Change process and the Environment Business Partner is responsible for ensuring all licence conditions have been complied with.
F4	Backfilled and rehabilitated pipeline trenches must: a) be a stable landform; b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and c) be re-profiled to a level consistent with surrounding soils; and d) be re-profiled to original contours and established drainage lines; and e) be visually consistent with the surround land features; and. f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	Future pipe laying will be subject to AGLs Management of Change process and the Environment Business Partner is responsible for ensuring all licence conditions have been complied with.
F5	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must	AGL's operations are confined to specific areas of land disturbance

	commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity(ies).	that are necessary to operate the project. As such, there are no current opportunities to progressively rehabilitate the land to reduce significantly disturbed areas.
F6	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must: a) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt); b) reshape all significantly disturbed land to a stable landform; c) reprofile all significantly disturbed land to original contours; d) on all significantly disturbed land: i. re-establish surface drainage lines; ii. reinstate the top layer of the soil profile; iii. establish groundcover to ensure that erosion is minimised; iv. establish vegetation of floristic species composition found in analogue sites; e) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and I or minimise environmental harm.	See comments for condition F5.
Schedule G – Disturbance to Land		
G1	Prior to undertaking activities that result in significant disturbance to land in areas of native vegetation, confirmation of on-the-ground biodiversity values of the native vegetation communities at that location must be undertaken by a suitably qualified person.	AGL has implemented a Management of Change process that involves the Environment Business Partner undertaking an initial assessment of land disturbance activities to ascertain the likely impacts. Third party consultants are engaged if advice from technical specialists is required.
G2	A suitably qualified person must develop and certify a methodology so that condition (G1) can be complied with and which is appropriate to confirm on-the-ground biodiversity values.	See comments for condition G2.
G3	Where mapped biodiversity values differ from those confirmed under conditions (G1) and (G2), petroleum activities may proceed in accordance with the conditions of the environmental authority based on the confirmed on-the-ground biodiversity value.	See comments for condition G2.
G4	The location of the petroleum activity(ies) must be selected in accordance with the following site planning principles:	See comments for condition G2.

	a) maximise the use of areas of pre-existing disturbance b) in order of preference, avoid, minimise or mitigate any impacts, including cumulative impacts, on areas of native vegetation or other areas of ecological value c) minimise disturbance to land that may otherwise result in land degradation d) in order of preference, avoid then minimise isolation, fragmentation, edge effects or dissection of tracts of native vegetation; and e) in order of preference, avoid then minimise clearing of native mature trees.	
G5	Linear infrastructure construction corridors must: a) maximise co-location b) be minimised in width to the greatest practicable extent; and c) for linear infrastructure that is an essential petroleum activity authorised in an environmentally sensitive area or its protection zone, be no greater than 40m in total width.	See comments for condition G2.
G6	Where petroleum activities are to be carried out in environmentally sensitive areas or their protection zones, the petroleum activities must be carried out in accordance with Protection of Biodiversity Values, Table 1 - Authorised Petroleum Activities in Environmentally Sensitive Areas and their protection zones (see environmental authority).	See comments for condition G2.

Protection of Biodiversity Values, Table 1 – Authorised petroleum activities in Environmentally Sensitive Areas and their protection zones

Environmentally sensitive area	Within the environmentally sensitive area	Primary protection zone of the environmentally sensitive area	Secondary protection zone of the environmentally sensitive area
Category A environmentally sensitive areas	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are other than 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.
Category C environmentally sensitive areas that are 'nature refuges' or 'koala habitat'	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	
Category C environmentally sensitive areas that are 'essential habitat', 'essential regrowth habitat', or 'of concern' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'regional parks' (previously known as 'resources reserves')	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'state forests' or 'timber reserves'	Only essential petroleum activities permitted.	Petroleum activities permitted.	
Areas of vegetation that are 'critically limited'	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	

<table>
<tr><td>G7</td><td>Despite condition (G6) of this environmental authority, the infrastructure (and associated activities necessary for construction, operational and maintenance purposes) within Schedule G: Table 2 - Authorised Petroleum Activity(ies) Disturbance are permitted within a Category B ESA that is an Endangered Regional Ecosystem at the location specified.

Schedule G: Table 2 – Authorised Petroleum Activity(ies) Disturbance
<table><tr><th>Tenure</th><th>Description of Infrastructure</th><th>Number</th><th>Location</th></tr><tr><td rowspan="4">PL192</td><td>Churchie 1 Well Site</td><td>1</td><td>Lat – 27^0 05' 53.448" S
Long – 149^0 12' 55.3357" E</td></tr><tr><td>Churchie 1A Well Site</td><td>1</td><td>Lat – 27^0 05' 40.1407" S
Long – 149^0 12' 53.7600" E</td></tr><tr><td>Churchie 2 Well Site</td><td>1</td><td>Lat – 27^0 06' 07.7582" S
Long – 149^0 12' 12.2389" E</td></tr><tr><td>Churchie 4 Well Site</td><td>1</td><td>Lat – 27^0 05' 15.1476" S
Long – 149^0 12' 32.3397" E</td></tr></table></td><td>See comments for condition G2.</td></tr>
<tr><td>G8</td><td>A report must be prepared for each annual return period for all petroleum activities that involved clearing of any environmentally sensitive area or protection zone which includes:
a) Records able to demonstrate compliance with condition (G4), (G5) and (G6)
b) a description of the works
c) a description of the area and its pre-disturbance values (which may include maps or photographs, but must include GPS coordinates for the works); and
d) (d) based on the extent of environmentally sensitive areas and primary protection zones on the relevant resource authority(ies), the proportion of native vegetation cleared per environmentally sensitive area and primary protection zone, including regional ecosystem type, over the annual return period.</td><td>The Environment Business Partner prepares the Annual Return for each lease. The draft Annual Report and all supporting information is reviewed by Site Leaders, Senior Managers and Group Counsel before lodgement with the administering authority.</td></tr>
<tr><td>G9</td><td>Impacts to State significant biodiversity values are not authorised, except as permitted by condition (G7).</td><td>See comments for condition G2.</td></tr>
</table>

4.4. PL213

Condition ID	Requirement	Actions and comments
4	The holder of the environmental authority must ensure that petroleum activities: a) are not conducted within a category A or B environmentally sensitive area; and b) do not cause a significant disturbance within 1 km of a category A environmentally sensitive area or within 500m of a category B environmentally sensitive area; c) are not conducted in a category C environmentally sensitive area unless there is a written agreement to enter the area from the relevant administering authority. d) Notwithstanding, condition 4(a) and 4(b), the proposed well within graticular block CHAR2727F and petroleum activities carried out within the 500m buffer zone to any Endangered Regional Ecosystem (ERE), but not within 50m of any ERE, must be in accordance with the scale and intensity of activities outlined below: i. the drill site must not disturb an area greater than 10,000 m2; ii. the flare pit size must not be greater than 10 m2; iii. the mud pit size must not be greater than 600 m2; iv. topsoil stripping must be limited to the sump and flare pit area; v. clearing of mature trees must be prevented or minimised during drill site construction; vi. existing access and fence line tracks must be used where possible and any new tracks must be constructed by linking natural clearings where possible; and vii. track construction involving blade clearing of established ground cover vegetation and/or clearing of mature trees must be prevented or minimised.	AGL has implemented a Management of Change process that involves the Environment Business Partner undertaking an initial assessment of land disturbance activities to ascertain the likely impacts. Third party consultants are engaged if advice from technical specialists is required.
5	The holder of the environmental authority must: a) take all reasonable and practicable measures to minimise disturbance to land in order to prevent land degradation; and b) ensure that for land that is to be significantly disturbed by petroleum activities, the top layer of the soil profile is removed and i. stockpiled in a manner that will preserve its biological and chemical properties; and ii. used for rehabilitation purposes (refer Condition 18).	See comments for Condition 4.

6	The holder of this environmental authority must: a) take all reasonable and practicable measures to prevent or minimise disturbance to vegetation by petroleum activities and manage the effects of clearing to prevent the loss of biodiversity, maintain ecological processes and prevent land degradation. b) The holder of the environmental authority must not clear: i. in, or within 50 metres of, the high bank of a watercourse; ii. in, or within 50 metres of, the static high water mark of wetlands, lakes or springs; iii. in a way that isolates clumps or dissects corridors of vegetation; iv. on slopes greater than 5%; v. on dispersible soils vi. in existing or potential discharge areas; and vii. in areas subject to waterlogging or at risk of waterlogging as a result of clearing; viii. except for necessary construction and maintenance of roads, tracks and pipelines where there is no suitable alternative site for the road, track or pipeline. c) the holder of the environmental authority must not clear in areas with a high probability of acid sulfate soils unless the clearing is conducted in accordance with an acid sulfate soil environmental management plan prepared in accordance with the State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils and Guideline.	See comments for Condition 4.
13	The holder of the environmental authority must ensure that the storage of all flammable and combustible liquids: a) is contained within an on-site containment system; and b) is controlled in a manner that prevents environmental harm; and c) is maintained in accordance with Section 2.4 for minor storages and Section 5.8 for storages above 10,000L of Australian Standard AS 1940-2004 The Storage and Handling of Flammable and Combustible Liquids.	AGL does not store any flammable and combustible liquids on PL213.
14	Notwithstanding the other conditions of this environmental authority, if a hazardous contaminant is released to waters or land, the holder of the environmental authority must: a) take immediate action to stop any further release; b) take immediate action to contain the hazardous contaminant to the affected area,	AGLs HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1) is used by personnel to respond to situations involving contamination of land or waters.

<table>
<tr><td></td><td>taking particular care to protect environmentally sensitive areas;
c) restore or rehabilitate the environment to its condition before the release occurred; and
d) prevent a recurrence of the release.</td><td></td></tr>
<tr><td>18</td><td>As soon as practicable and within 6 months (or longer period agreed in writing with the administering authority) of the completion of petroleum activities causing significant disturbance to land, the holder of the environmental authority must:
a) remediate contaminated land (e.g. evaporation ponds containing hazardous waste) in accordance with Environmental Protection Act 1994 requirements;
b) reshape all significantly disturbed land to a stable landform similar to that of surrounding undisturbed areas; and
c) on all significantly disturbed land, take all reasonable and practicable measures to:
i. re-establish surface drainage lines; and
ii. reinstate the top layer of the soil profile.
d) revegetate the areas identified as Endangered Regional Ecosystems with plant species from the same ecosystem type. Consult with the Environmental Protection Agency prior to commencing rehabilitation to determine the most appropriate techniques and seed mixture for the specific area.
e) Rehabilitation of all areas disturbed within the Endangered Regional Ecosystem will be completed as soon as practical but no longer than three months after completion of the disturbance activity.
f) Environmentally Sensitive areas identified within and adjacent to PL213 are listed in the table below.

<table><tr><td>Category</td><td>Land Classification</td></tr><tr><td>B</td><td>Endangered Regional Ecosystem (including but not limited to): 11.3.17</td></tr></table></td><td>This is a future requirement.</td></tr>
<tr><td>19</td><td>All infrastructure, constructed by or for the holder of the environmental authority, including water storage structures, must be removed by the holder from the site and the sites rehabilitated according to Condition 18, prior to surrender of the petroleum authority, except where it is to remain with the written agreement of the administering authority and post petroleum authority landowner/holder.</td><td>This is a future requirement.</td></tr>
</table>

4.5. PL 15

Condition ID	Requirement	Actions and comments
Schedule F - Land		
F1	Contaminants must not be directly or indirectly released to land.	AGL does not store contaminants on PLs 15, 48, 49, 66, 202.
F2	Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.	The underground pipelines that traverse the leases are PPL93 (Waggamba to Taylor) and also PPL4 (Silver Springs to Wallumbilla). These pipelines are operated under separate environmental licences.
F3	During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.	The pipelines were installed several years ago, prior to AGL acquiring the assets.
F4	Backfilled and rehabilitated pipeline trenches must: a) be a stable landform; b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and c) be re-profiled to a level consistent with surrounding soils; and d) be re-profiled to original contours and established drainage lines; and e) be visually consistent with the surround land features; and. f) (f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	See comments for Condition F3.
F5	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity(ies).	This is a future requirement at end of asset life.
F6	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must: a) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt); b) reshape all significantly disturbed land to a stable landform; c) reprofile all significantly disturbed land to original contours; d) on all significantly disturbed land: i. re-establish surface drainage lines; ii. reinstate the top layer of the soil profile;	AGL has not undertaken any formal progressive rehabilitation of significantly disturbed areas as this is a future requirement at the end of asset life. AGL undertakes periodic inspections to determine whether any contamination or drainage issues are present.

	iii. establish groundcover to ensure that erosion is minimised; iv. establish vegetation of floristic species composition found in analogue sites; e) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and / or minimise environmental harm.	

4.6. PLs 48, 49, 66, 202

Condition ID	Requirement	Actions and comments
Schedule F - Land		
F1	Contaminants must not be directly or indirectly released to land.	AGL does not store contaminants on PLs 15, 48, 49, 66, 202.
F2	Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.	The underground pipelines that traverse the leases are PPL93 (Waggamba to Taylor) and also PPL4 (Silver Springs to Wallumbilla). These pipelines are operated under separate environmental licences.
F3	During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.	The pipelines were installed several years ago, prior to AGL acquiring the assets.
F4	Backfilled and rehabilitated pipeline trenches must: g) be a stable landform; h) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and i) be re-profiled to a level consistent with surrounding soils; and j) be re-profiled to original contours and established drainage lines; and k) be visually consistent with the surround land features; and. l) (f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	See comments for Condition F3.
F5	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity(ies).	This is a future requirement at end of asset life.
F6	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must: f) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt); g) reshape all significantly disturbed land to a stable landform; h) reprofile all significantly disturbed land to original contours; i) on all significantly disturbed land: v. re-establish surface drainage lines; vi. reinstate the top layer of the soil profile;	AGL has not undertaken any formal progressive rehabilitation of significantly disturbed areas as this is a future requirement at the end of asset life. AGL undertakes periodic inspections to determine whether any contamination or drainage issues are present.

	vii. establish groundcover to ensure that erosion is minimised; viii. establish vegetation of floristic species composition found in analogue sites; j) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and / or minimise environmental harm.	

4.7. PPL 4

Condition ID	Requirement	Actions and comments
Schedule D - Land		
D1	Contaminants must not be directly or indirectly released to land except as permitted under this environmental authority.	AGL does not store contaminants on PPL4, being the pipeline between Silver Springs and Wallumbilla. A breach of the pipeline would result in high pressure gas escaping to atmosphere. Many control measures are in place to prevent pipeline breaches.
D2	Prior to conducting petroleum activities that involve significant disturbance to land, an assessment must be undertaken of the condition, type and ecological value of soils and vegetation in such areas where the activity is proposed to take place.	The pipeline was installed several years ago (approx. mid 1980s). Activities now include inspecting and maintaining the right of way. If new disturbances are required, AGLs management of change process is used to determine potential impacts and control measures.
D3	The assessment required by condition (D2) must be undertaken by a suitably qualified person and include the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas, wetlands and the presence of species classed as endangered, vulnerable, rare or near threatened under the Nature Conservation Act 1992.	AGLs Environment Business Partner carries out the initial assessment as part of the risk management process. If specialist advice is required, third party technical specialists are engaged.
D4	The assessment required by condition (D2) must include, but not necessarily be limited to: a) identification of the vegetation communities present (including species composition and regional ecosystem type2 for native vegetation communities) within each area(s) to be disturbed; b) data representing each vegetation community present within each area(s) to be rehabilitated including:	AGLs Environment Business Partner carries out the initial assessment as part of the risk management process. If specialist advice is required, third party technical specialists are engaged.

	i. flora species richness and diversity; ii. structural data including woody stem count densities for dominant species within each stratum; and iii. percent foliage cover (accounting for seasonal variation and excluding pests); c) data regarding habitat features, including but not necessarily limited to: i. organic litter cover (%); and ii. trees with hollows 10cm diameter (count and number per hectare); iii. hollow bearing logs (count and number per hectare); and iv. a map or series of maps of suitable scale displaying the distributing of vegetation communities.	
D5	Notwithstanding conditions (D2) - (D4), the as-constructed pipeline right of way is authorised.	This condition is for information purposes.
D6	Pest management procedures must be developed by 22 September 2011.	AGL developed and implemented an Environmental Management Plan upon acquisition of the project. The Plan included a section on fauna management and it was prepared by a suitably qualified person. The Plan is implemented through business as usual activities, including raising matters at daily toolbox meetings and/or through direct communication with the Environment Business Partner.
D7	The pest management procedures must be certified by a suitably qualified person.	See comment for Condition D6.
D8	The pest management procedures must include, but not necessarily be limited to: a) identification of pest species and infestation areas; b) prevention and/or minimisation of the introduction and/or spread of pests; c) control and management of pest outbreaks as a result of the petroleum activity(ies); d) details of community consultation ln developing the pest management procedures.	See comment for Condition D6.
D9	A copy of the pest management procedures must be made available to any potentially affected landholder upon request by that landholder.	AGL has not received any such requests from landholders.
D10	The holder of this environmental authority must implement the pest management procedures.	See comment for Condition D6.
D11	All explosives, hazardous chemicals, corrosive substances, toxic substances, gases, dangerous goods, flammable and combustible liquids (Including petroleum products and associated piping and infrastructure) must be stored and handled in accordance with the relevant Australian Standard where such is available.	AGL does not store any of these materials on PPL4.
D12	Notwithstanding the requirements of any Australian Standard, any liquids stored on site that have the potential to cause environmental harm must be stored in, or serviced by, an effective containment system that is impervious to the materials stored and managed to prevent the	AGL does not store any of these materials on PPL4.

	release of liquids to waters or land.	
D13	Where no relevant Australian Standard is available for the chemical and / or fuel storage activity, the following requirements apply: a) storage tanks must be bunded so that the capacity and construction of the bund is sufficient to contain at least 110% of a single storage tank or 100% of the largest storage tank plus 10% of the second largest storage tank in multiple storage areas; and b) drum storages must be bunded so that the capacity and construction of the bund is sufficient to contain at least 25% of the maximum design storage volume within the bund.	AGL does not store any of these materials on PPL4.
D14	All containment systems must be designed to minimise rainfall collection within the system.	AGL does not store any of these materials on PPL4.
Schedule H – Pipelines		
H1	The holder of this authority must ensure that the pipeline is operated and maintained in accordance with AS2885 or any subsequent versions thereof, and accepted engineering standards.	AGL has a multidisciplinary team of personnel in place to meet compliance with this condition. The team consists of a variety of engineering disciplines (process, electrical, instruments, pipeline integrity) who are responsible for managing compliance of the pipeline.
H2	The condition of the relevant pipelines must be assessed by a suitably qualified and experienced person on an annual basis.	AGL engages a third party technical specialist to perform an annual pipeline survey, which involves a leak detection program.
H3	The condition of pipelines must be monitored for early signs of loss of structural or hydraulic integrity based on the advice of a suitably qualified and experienced person.	AGLs Pipeline and Integrity Engineer oversees an inspection program to ensure that the pipeline is subject to an appropriate monitoring system. This includes surveys to assess coating integrity, and intelligent pigging programs.
H4	In the event of early signs of loss of structural or hydraulic integrity, the holder of this authority must take action to prevent or minimize any actual or potential environmental harm, and report any findings and actions taken to the administering authority.	AGLs Hazard, Near Miss and Incident Reporting Procedure is used to manage environmental events including notification to the administering authority.
H5	The holder of this authority must decommission the pipeline in accordance with AS2885 and to a situation where ongoing environmental harm is prevented. As a minimum, pipelines must be decommissioned such that: a) pipelines no longer contain hazardous contaminants; b) pipelines are left in stable condition; c) all the above ground Infrastructure Is removed, and d) all areas disturbed by above ground Infrastructure are rehabilitated in accordance with the requirements of this authority.	This is a future requirement for AGL.

H6	Prior to the commencement of decommissioning or abandonment activities, the scope of work for decommissioning or abandonment shall be developed and agreed to with the administering authority.	See comment for Condition H5.
H7	The holder of this environmental authority must ensure that activities conducted in accordance with this authority do not compromise the integrity of another pipeline, whether or not that pipeline is under the control of the holder.	AGL is not aware of any other pipelines being affected by the activities relating to the operation of PPL4 or the maintenance of the right of way.
Schedule I - Rehabilitation		
I1	A Rehabilitation Plan which has been certified by a suitably qualified person must be developed by 22 December 2011.	The current Rehabilitation Plan for PPL4 is dated 15 November 2013. It was prepared by Nigel Goulding of M.S Environmental Science and Engineering.
I2	The Rehabilitation Plan must include strategies for the determination of final land use(s) and rehabilitation goals and details of how rehabilitation objectives will be achieved. The Rehabilitation Plan must include: a) a rehabilitation hierarchy for: i. reinstating a native ecosystem as similar as possible to the original ecosystem as the preferred option; then ii. establishing an alternative outcome with a higher environmental value than the previous land use; then iii. reinstating the previous land use (e.g. grazing or cropping); and b) methods to achieve rehabilitation goals Including, but not necessarily being limited to: i. establishing final land use(s) in consultation with affected landholder(s) and the administering authority; ii. identifying suitable analogue sites to measure rehabilitation success that may either be the pre-disturbed area or another area that has equivalent values and characteristics as the intended final land use(s); and iii. for sites that are being reinstated to a land use other than a native ecosystem, the Rehabilitation Plan must identify any additional and relevant indicators to be measured at both the analogue and rehabilitation site(s) so as to assess progressive and final rehabilitation success for that land use; iv. for sites that are being reinstated to native ecosystems and the analogue site is the pre-disturbed site, the Rehabilitation Plan must Include indicators that, as a minimum include those in condition (D3)(a) - (03)(d) and will be able to measure success against the progressive and final rehabilitation criteria in this environmental authority; v. identification of any land use constraints which have resulted from the petroleum activity(ies);	The Plan was prepared against the requirements of this condition.

	vi. residual pollution risks with strategies for managing and mitigating them; vii. landscape planning and landform design principles to achieve stable landforms including slope designs, erosion controls and drainage lines; viii. integrating rehabilitated areas so they are compatible with the surrounding landscape, including linking rehabilitated areas of native vegetation with undisturbed native vegetation to provide larger areas and wildlife corridors where feasible; ix. ensuring that significantly disturbed areas are rehabilitated progressively and that the progressive rehabilitation criteria are routinely measured; x. site preparation such as re-profiling, re-instating surface drainage systems; xi. top soil management such as top soil handling and stockpiling to preserve soil fertility and biota, respreading techniques, planned thickness, ripping, top soil treatments I amendments and mulching in consideration of analogue data; xii. flora to be established, Including required species diversity, abundance and composition and projective cover in consideration of analogue data; xiii. plant propagation and / or supply methods including using seeds/ spores of local provenance where feasible; xiv. establishment methods to maximise rehabilitation success such as seed treatments, seed spreading, timing of seeding to suit best local climatic conditions, hydroseeding, transplanting; xv. weed control; xvi. sourcing habitat structures for native fauna and installation .methods in consideration of matching analogue data; xvii. on going maintenance program for rehabilitated areas; and xviii. rehabilitation monitoring program as required by conditions (111) and (112) of this environmental authority; and c) timeframes for commencing rehabilitation of significantly disturbed areas not required for the ongoing conduct of the petroleum activity(les), not greater than three (3) months for the rehabilitation of buried pipelines and not greater than nine (9) months for any other disturbed area.	
I3	The holder of this environmental authority must implement the Rehabilitation Plan.	This is a future requirement.
I4	Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.	The pipeline was installed decades ago (approximately mid-1980s), and no new pipelines have been installed on PPL4 by AGL.
I5	During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are	See comment for Condition I4.

	consistent with the soil horizons of the immediately surrounding area.	
I6	Backfilled and rehabilitated pipeline trenches must: a) be a stable landform; b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and c) be re-profiled to a level consistent with surrounding soils; and d) be re-profiled to original contours and established drainage lines; and e) be visually consistent with the surround land features; and f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	See comment for Condition I4.
I7	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity(ies).	See comment for Condition I4. AGL has not undertaken any certified progressive rehabilitation. This will be a future requirement.
I8	Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must: a) remediate any contaminated land (e.g. contaminated soils); b) reshape alt significantly disturbed land to a stable landform; c) re-profile all significantly disturbed land to original contours; d) on all significantly disturbed land: i. re-establish surface drainage lines; ii. reinstate the top layer of the soil profile; iii. establish groundcover to ensure that erosion is minimised; iv. establish vegetation of floristic species composition found in analogue sites; e) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and / or minimise environmental harm.	See comment for Condition I4.
I9	All significantly disturbed land caused by the carrying out of the petroleum activity(ies) must be rehabilitated to meet the following final acceptance criteria: a) all significantly disturbed land is reinstated to the pre-disturbed soil suitability class; b) the landform is safe for humans and fauna; c) the landform Is stable with no subsidence or erosion gullies for at least three (3) years; d) all significantly disturbed land is reinstated so that the distribution of vegetation communities represents the analogue site; e) each vegetation community must be re-established so that each of the following rehabilitation parameters are maintained for at least three {3) years:	See comment for Condition I4.

	i. the rehabilitated site shows distinct and progressive re-establishment of the various strata which characterise the vegetation community In the analogue site; ii. all dominant species within each strata are re-established at densities equivalent to that of the analogue site; iii. notwithstanding (i} and (ii) above, a minimum of 70% floral species richness and diversity is observed when compared to the relevant analogue site; iv. a minimum of 50% foliage cover is observed when compared to the relevant analogue site. f) each vegetation community must be rehabilitated and maintained until it can be demonstrated that it is resilient and self-sustaining g) percent organic litter cover, count and density of hollow bearing logs and nest boxes (as replacement for trees with hollows ≥ 10cm diameter) and fallen woody material (total length of logs ≥ 10 cm diameter per hectare and number of logs ≥ 10cm per hectare) have been installed at numbers and densities no lower than the analogue site; h) the water quality of any residual void or water bodies constructed by the petroleum activity(ies) meets criteria for subsequent uses and does not have potential to cause environmental harm; i) there Is no ongoing contamination to waters; and j) the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance caused by carrying out the petroleum activity(ies).	
I10	Notwithstanding condition (19), all buried pipelines must be decommissioned in accordance with the requirements of Australian Standard 2885, as amended from time to time.	This is a future requirement.
I11	A Rehabilitation Monitoring Program which has been certified by a suitably qualified person must be developed by 22 December 2011.	The current Rehabilitation Plan for PPL4 is dated 15 November 2013. It was prepared by Nigel Goulding of M.S Environmental Science and Engineering. The Plan includes a section on Rehabilitation Monitoring.
I12	A Rehabilitation Monitoring Program which has been certified by a suitably qualified person must be developed by 22 December 2011. a) methods to measure subsidence and erosion rates at rehabilitated buried transmissions pipeline corridors and buried flow lines. b) monitoring of indicators identified in the Rehabilitation Plan at analogue sites to measure progressive and final rehabilitation success relevant to the final land use(s}; and c) frequency and seasonality of monitoring analogue sites and rehabilitated areas to assess rehabilitation success; and d) identification of the experimental design for analysing analogue and rehabilitated site data	See comment for Condition I11. AGL has not carried out any formal certified progressive rehabilitation. The area is accessed to carry out inspections and maintenance of the right of way.

	including statistical methods of analyses.	
I13	The holder of this environmental authority must implement the Rehabilitation Monitoring Program.	This is a future requirement.
I14	At least yearly monitoring of rehabilitated areas must be undertaken to demonstrate compliance with the requirements of condition (I9) for a minimum of five (5) years after rehabilitation is completed.	This is a future requirement.

4.8. PPL 87 and 93

Condition ID	Requirement	Actions and comments
Schedule F – Land Management		
F1	The holder of this authority must: a) minimise disturbance to land in order to prevent land degradation; and b) ensure that for land that is to be significantly disturbed by petroleum activities (except in area of highly erosive soils), the top layer of the soil profile is removed; and i. stockpiled in a manner that will preserve its biological and chemical properties; and ii. used for rehabilitation purposes in accordance with condition (F14).	The pipeline was installed several years ago by a previous asset owner. AGLs activities include inspecting and maintaining the right of way, and carrying out pipeline surveys and repairs. If new disturbances are required, AGLs Management of Change process is used to determine potential impacts and control measures (e.g. dig-ups to repair pipeline coatings).
F2	The holder of this authority must: a) prevent or minimise disturbance to vegetation by petroleum activities; and b) manage the effects of clearing to prevent the loss of biodiversity, reduction of ecological processes and land degradation.	See comment for Condition F1.
F3	The holder of this authority must consider whether it is feasible to avoid clearing, and where viable alternatives exist, must not clear vegetation: a) in, or within 50 metres of, the high bank of a watercourse; b) in, or within 50 metres of, the static high water mark of wetlands, lakes or springs; c) in a way that isolates clumps or dissects corridors of vegetation; d) on slopes greater than 5%; e) on dispersible soils; and f) in existing or potential discharge areas.	See comment for Condition F1. The Environment Business Partner is able to carry out desktop searches as part of the risk management process.
F4	During construction, pipe must be strung with gaps to allow for fauna movement across the line of the pipe.	The pipeline was constructed several years ago by a prior asset owner.
F5	Measures must be employed to prevent fauna entrapment in pipe section or within the pipeline	See comment for Condition F4.

	trench.	
F6	Open trenches and pipes must be checked for fauna prior to backfill and any trapped animals removed.	See comment for Condition F4.
F11	Progressive rehabilitation of disturbed areas must commence as soon as practicable following the completion of any construction or operational works associated with the authorised petroleum activities on the relevant petroleum authority.	AGL has not carried out any certified progressive rehabilitation. The pipeline was constructed several years ago by a prior asset owner, and the vegetative groundcover percentages fluctuate in accordance with climatic conditions. As AGL accesses the right of way areas as part of operations, it is unlikely that any certified progressive rehabilitation will take place until the end of asset life.
F12	The holder of the authority must: a) remediate contaminated land caused by petroleum activities in accordance with EP Act requirements and this environmental authority; and b) undertake works to establish a safe, stable, non-polluting landform similar to that of surrounding undisturbed areas, including where relevant excavate or place fill in a way that does not interfere with the flow of water in a watercourse, wetland, or spring, including: i. backfilling any voids and trenches; ii. neutralising and/or encapsulating any acid producing or potentially acid producing material; iii. re-establishing surface drainage lines; iv. minimising the potential for slumping, subsidence or erosion; v. reinstating the top layer of the soil profile; vi. respreading any cleared vegetation; and vii. promoting establishment of vegetation of similar species composition and density of cover to the surrounding undisturbed land; unless the holder of this authority has the written consent of the landowner/holder and the administering authority.	See comment for Condition F11.
F13	As soon as practicable and within three (3) months from the date of cessation of petroleum activities that cause any significant disturbance to land, the holder of this authority must: a) investigate contaminated land status in accordance with *Environmental Protection Act 1994* requirements and the *National Environment Protection (Site Assessment) Measure 1999 (NEPM)* where land has been subject to contamination caused by petroleum activities authorised under this authority.	This is a future requirement for AGL.
F14	All land significantly disturbed by petroleum activities must be rehabilitated to:	This is a future requirement for AGL.

	a) a stable landform with a self-sustaining vegetation cover with the same species and density of cover to that of the surrounding undisturbed areas; b) ensure that all land is reinstated to the pre-disturbed land use and suitability class; c) ensure that the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities; and d) ensure that the water quality of any residual void or water bodies constructed by petroleum activities meets criteria for subsequent uses and does not have potential to cause environmental harm.	
F15	Maintenance of rehabilitated areas must take place to ensure and demonstrate: a) stability of landforms; b) erosion control measures remain effective; c) stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters; d) plants show healthy growth and recruitment is occurring; and e) rehabilitated areas are free of any declared pest plants.	Aerial inspections (helicopter) are undertaken every three (3) months for PPL87 and 93. Ground inspections are undertaken annually. The inspections are carried out to assist AGL in determining whether any maintenance is required. Maintenance requirements are scheduled via AGLs work order system, following site leader approval.
F16	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 (3) years.	AGL has not undertaken any formal certified progressive rehabilitation on PPL87 and 93. This is expected to be undertaken at end of project life.
F17	All explosives, hazardous chemicals, corrosive substances, toxic substances, gases and dangerous goods must be stored and handled in accordance with the relevant Australian Standard where such is available.	AGL does not store these types of substances on the leases. AGLs routine activities are limited to vegetation management (possibly including the use of herbicides) and also periodic inspections undertaken at ground level (annually).
F18	Flammable and combustible liquids (including petroleum products and associated piping and infrastructure), must be stored, handled and maintained in accordance with the latest edition of Australian Standard 1940 – The Storage and Handling of Flammable and Combustible Liquids.	See comment for Condition F17.
F19	Any liquids stored on site that have the potential to cause environmental harm must be stored in or serviced by an effective containment system that is impervious to the materials stored and managed to prevent the release of liquids to waters or land.	See comment for Condition F17.
F20	Drum storages must be bunded so that the capacity and construction of the bund is sufficient to contain at least 25% of the maximum design storage volume within the bund.	See comment for Condition F17.
F21	All containment systems must be designed to minimise rainfall collection within the system.	See comment for Condition F17.
Schedule G – Cultural Heritage		

G1	The holder of the environmental authority must take all reasonable and practicable measures to avoid impacting upon places of known or potential cultural heritage significance whilst carrying out petroleum activities.	From a cultural heritage perspective, the pipeline right of ways are previously disturbed areas. Ground disturbance works are subject to an assessment by the Environment Business Partner as part of the management of change process. This includes the Environment Business Partner determining the control measures required to manage cultural heritage if items or areas of significance are discovered (e.g. stop work).
Schedule H – Nature Conservation		
H1	Notwithstanding any other condition of this authority, the holder of this authority must ensure that: a) petroleum activities are not conducted within a Category A or Category B environmentally sensitive area; b) petroleum activities do not cause a significant disturbance within 1km of a Category A environmentally sensitive area or within 500m of a Category B environmentally sensitive area; and c) petroleum activities are not conducted in a Category C environmentally sensitive area	The Environment Business Partner is responsible for determining the potential impacts of any petroleum activities that are proposed to be carried out on the leases. AGLs Management of Change Process is used as part of the risk management process for proposed activities. This would include the Environment Business Partner carrying out a desktop search to determine if any activities were proposed in environmentally sensitive areas. Third party technical specialists (e.g. environmental planners and ecologists) would be engaged if ground-truthing of the desktop assessment was required.
Schedule J – Pipeline		
J1	All petroleum infrastructure (including buildings, structures, plant and equipment erected and/or used for the petroleum activities) authorised under this authority must be located within the PPL87 and PPL93 licence areas as defined by the coordinates in Schedule J, Table 1 – Table 2.	AGL has limited aboveground infrastructure along the pipeline leases, that are located within the coordinates. AGL uses an internal mapping system (ArcGIS) and survey data to ensure any new infrastructure is situated within the coordinate areas. Any new project or installation is subject to AGLs Management of Change Process, which will involve a risk assessment with input from a variety if disciplines.

<table>
<tr><td></td><td>

Schedule J Table 1 – Location of the PPL87 pipeline corridor

Location	Longitude	Latitude
Start	E 149°11'23.7"	S 27°06'16"
Finish	E 149°08'29.3"	S 27°07'0.7"

Schedule J Table 2 – Location of the PPL93 pipeline corridor

Location	Longitude	Latitude
Start	E 149°27'31.07"	S 27°39'40.8"
Finish	E 149°13'31.4"	S 27°35'44.6"

</td><td></td></tr>
<tr><td>J2</td><td>

The gas pipeline authorised under this authority is constructed in accordance with the design specifications and operating parameters as described in Schedule J, Table 4 – Table 5.

Schedule J Table 4 – Pipeline Design Specifications for PPL87 and PPL93

Pipeline Component	PPL87	PPL93
Length (km)	5.0	24.0
Material	Steel	Steel
Nominal diameter	150mm	200mm
Design Standards and Codes	AS 2885	AS 2885
MAOP	Not specified	Not specified
Coating	Not specified	Not specified
Cathodic protection	Not specified	Not specified

Schedule J Table 5 – Pipeline Operating Parameters for PPL87 and PPL93

Operating Parameters	PPL 87	PPL 93
Coating	HDPE	HDPE
Minimum depth of burial	750mm	750mm
Width of easement, where applicable	15m	15m

</td><td>This condition is now for information purposes only.</td></tr>
<tr><td>J3</td><td>Prior to the commencement of decommissioning or abandonment activities the scope of work for decommissioning or abandonment of project infrastructure shall be developed and agreed to by the administering authority.</td><td>This is a future requirement for AGL.</td></tr>
<tr><td>J4</td><td>All petroleum infrastructure must be removed from the relevant petroleum authority prior to surrender of this authority, except where agreed in writing by the administering authority and the current landowner.</td><td>This is a future requirement for AGL.</td></tr>
</table>

J5	The holder of this authority must implement an Emergency Response Plan from the date of grant of this authority and submit to the Administering Authority a copy of the original or subsequently amended Emergency Response Plan for the operating of the pipelines and associated facilities to aid in the effective response to an emergency situation that may result in environmental harm. The plan shall include: a) means by which an emergency response is initiated; b) defined key roles and responsibilities required to respond to an emergency; c) facilities required to coordinate the emergency response; d) key contact list; e) criteria for escalation of an emergency f) likely emergency scenarios and guidelines for responding to such scenarios; g) communication and documentation requirements; and h) evacuation protocols and muster points.	AGL has an Emergency Response Plan for the Surat assets, that covers the facilities and pipelines. A copy of the Plan is kept on AGLs network.
J6	The Emergency Response Plan shall be reviewed annually to validate the adequacy of the scope of emergency scenarios and adequacy of the content.	The Plan is reviewed annually by AGL to ensure the scope is valid and adequate, and all contact details are correct. AGL uses a SAP Application to manage reminders for the annual review that is led by the Safety Team.
J7	In accordance with Condition (J6), the holder of this authority must ensure that relevant personnel shall be trained and competent to effectively fulfil their roles required as detailed in the Emergency Response Plan to deal with pipeline incidents that could potentially result in environmental harm. Training records are to be kept for five (5) years.	See comment for Condition J6. AGL keeps records for an indefinite period.
J8	The holder of this authority must undertake emergency exercises to: a) test the effectiveness of the emergency response plan; b) validate the competency of key emergency response personnel; c) assess capability to respond to an emergency; d) reinforce prior training; and e) identify opportunities for improvement. Emergency response exercises may be in the form of simulated emergencies, practical drills, desktop exercises, resources and equipment checks, or other exercises designed to systematically include all personnel likely to be involved.	AGL uses a SAP Application to provide reminders for undertaking emergency exercises. The exercises are organised by the Environment Business Partner, and records are kept on AGLs servers.

4.9. ATP1190

Condition ID	Requirement	Actions and comments
Schedule A – Authorised activities		
PESCA 2	The following types of petroleum activities are not authorised: a) processing or storing petroleum or petroleum by-products that are not necessarily associated with well operations b) extracting earthen materials (other than drilling waste rock) of more than 100,000t/year c) extracting by dredging of more than 1 000t/year of material from the bed of naturally occurring surface waters d) drilling wells with fluids that are oil-based or synthetic oil-based e) carrying out stimulation activities using stimulation fluid that contains chemical additives where polycyclic aromatic hydrocarbons are in concentrations above the reporting limit.	AGL has undertaken limited activities on ATP1190 since acquiring the asset. Any new activities/projects are captured through AGLs Management of Change process that includes risk workshops with input from all disciplines. The Environment Business Partner is responsible for assessing the projects against the licence conditions and overarching legislation.
PESCA 3	Only low impact petroleum activities can be undertaken within Category B Environmentally Sensitive Areas (ESAs) or Category C ESAs other than state forests or timber reserves, or within the primary protection zone of Category A ESAs. *Explanatory note: Category A ESAs are excised from DAA, WMA and ATP tenure types and therefore petroleum activities cannot occur in these areas.*	Any new activities/projects proposed for the lease areas is subject to a full risk assessment in accordance with AGLs Management of Change process. The Environment Business Partner is responsible for undertaking desktop assessments of environmentally sensitive areas (ESAs) to provide advice on likely impacts and required mitigation measures. Third party experts are commissioned by AGL if specialist advice is required (e.g. environmental planners and ecologists).
PESCA 4	Only essential petroleum activities can be undertaken in: a) the primary protection zone of Category B ESAs or Category C ESAs other than state forests or timber reserves b) the secondary protection zone of Category A ESAs or Category B ESAs c) Category C ESAs that are state forests or timber reserves.	See comment for Condition PESCA 3.
PESCA 5	Essential petroleum activities carried out in a primary protection zone must: a) be located in areas of pre-existing disturbance; and b) not negatively impact the ESA.	See comment for Condition PESCA 3.
PESCB 1	Petroleum activities that cause significant disturbance to land must not be carried out until financial assurance has been given to the administering authority as security for compliance with the environmental authority and any costs or expenses, or likely costs or expenses, mentioned in Section 298 of the	See comment for Condition PESCA 3.

	Environmental Protection Act 1994.	
PESCB 2	Petroleum activities must not cause environmental nuisance from dust, odour, light, smoke or noise at a sensitive place, other than where an alternative arrangement is in place.	There is potential for AGL to cause temporary environmental nuisances due to the activities conducted on the pipeline. These would mainly include dust and noise associated with vehicles and machinery accessing the easement to conduct inspections.
PESCB 3	Contaminants must not be directly or indirectly released to land or air except for those releases authorised by standard conditions (PESCC 11), (PESCC 15), (PESCC 22), (PESCC 23), (PESCC 25), (PESCC26), (PESCC 27), (PESCC 28), (PESCC 29), (PESCC 30), (PESCC 31), (PESCC 32), (PESCC 34) or (PESCC 35).	See comments for Condition PESCB 2.
PESCB 4	For petroleum activities to be carried out in a wild river area, the activities must comply with the conditions stated for relevant petroleum activities in the wild river declaration for that area.	AGL does not propose to carry out further petroleum activities in any wild river areas.
PESCB 5	Prior to carrying out petroleum activities, the location of petroleum activities must be selected to: a) firstly avoid, then minimise, then mitigate any negative impacts on areas of vegetation or other areas of ecological value b) minimise disturbance to land that may otherwise result in land degradation c) minimise isolation, fragmentation or dissection of tracts of vegetation that would lead to a reduction in the current level of ecosystem functioning or ecological connectivity d) minimise clearing of mature or hollow bearing trees.	Any new proposed activities would be subject to AGLs Management of Change process that involves a full risk assessment with multi-disciplinary input. The Environment Business Partner is responsible for ensuring that all legislative requirements are considered when selecting new project areas.
PESCB 6	Records must be kept to demonstrate compliance with standard condition (PESCB 5).	AGL keeps records of risk assessments conducted, including Management of Change documents such as Engineering Change Requests.
PESCB 7	Prior to any significant disturbance to land: a) an ecological assessment of areas with native vegetation that are to be significantly disturbed, must be conducted in accordance with the Queensland Government's Biocondition, a Condition Assessment Framework for Terrestrial Biodiversity in Queensland, Assessment Manual; and b) an assessment of the impacts that will occur as a result of significant disturbance to land must be undertaken.	Any new activities/projects proposed for the lease areas is subject to a full risk assessment in accordance with AGLs Management of Change process. The Environment Business Partner is responsible for undertaking desktop assessments of environmentally sensitive areas (ESAs) to provide advice on likely impacts and required mitigation measures. Third party experts are commissioned by AGL if specialist advice is required (e.g. environmental planners and ecologists).
PESCC 9	Petroleum activities that require earthworks, vegetation clearing and/or placing fill, other than that associated with the construction of linear infrastructure, are not permitted in or within:	Any new proposed activities would be subject to AGLs Management of Change process that involves a full risk assessment with multi-disciplinary input. The Environment Business Partner is responsible for

	a) 200 metres of any wetland, lake or spring; or b) 100 metres of the outer bank of any other watercourse.	ensuring that all legislative requirements are considered when selecting new project areas.
PESCC 14	Measures to minimise stormwater entry onto significantly disturbed land must be implemented and maintained.	Aerial inspections are carried out every three months to check for drainage issues. Measures to prevent issues include the construction and maintenance of flow diversion bunds to direct water around or through the easement in a controlled manner.
PESCC 15	Sediment and erosion control measures to prevent soil loss and deposition beyond significantly disturbed land must be implemented and maintained.	The leases are approximately 20m wide and AGLs focus is on maintaining drainage controls to prevent erosion and subsequent sedimentation. Aerial inspections are conducted every three months to check for drainage and erosion issues, and ground level inspections are carried out annually.
PESCC 16	Chemicals and fuels on the relevant tenures must be stored in, or serviced by, an effective containment system that meets Australian Standards, where such a standard is relevant.	No chemicals or fuels are stored on the leases, however herbicide spraying may be undertaken at times. The herbicides are stored in a purpose built trailer mounted tank.
PESCC 17	Other than for flare pits and sumps used to store residual drilling material and drilling fluids, the hazard category of any dam or levee to be used in carrying out petroleum activities must be assessed in accordance with the Queensland Government Manual for Assessing Hazard Categories and Hydraulic Performance of Dams.	There are no dams located on the leases.
PESCC 38	Significantly disturbed areas that are no longer required for the ongoing conduct of the petroleum activities must be progressively rehabilitated within 6 months (unless an exceptional circumstance in the area to be rehabilitated (e.g. a flood event) prevents this timeframe being met) so that: a) the areas are reshaped to a stable landform b) the areas are re-profiled to contours consistent with the surrounding landform c) surface drainage lines are re-established d) top soil is reinstated.	AGL does not plan on undertaking any certified progressive rehabilitation because the easements are needed until end of project life.
PESCC 39	All significantly disturbed land caused by the carrying out of the petroleum activity(ies) must be rehabilitated to meet standard condition (PESCC 38) and the following final acceptance criteria: a) any contaminated land (e.g. contaminated soils, decommissioned dams containing salt) is remediated and rehabilitated b) rehabilitation is undertaken in a manner such that any actual or potential	This is a future requirement for AGL.

	acid sulfate soils on the area of significant disturbance are treated to prevent or minimise environmental harm in accordance with the Instructions for the treatment and management of acid sulfate soils (2001) c) for land that is not being cultivated by the landholder: i. groundcover, that is not a declared pest species is established and self-sustaining ii. vegetation of similar species richness and species diversity to pre-selected analogue sites is established and self-sustaining d) for land that is to be cultivated by the landholder, cover crop is reinstated, unless the landholder will be preparing the site for cropping within 3 months of petroleum activities being completed.	
PESCC 40	Monitoring of performance indicators must be carried out on rehabilitation activities until final acceptance criteria in standard condition (PESCC 39) have been met for the rehabilitated area.	This is a future requirement for AGL.
PESCC 41	Prior to any changes in petroleum activities which would result in an increase to the maximum disturbance since the last financial assurance calculation was submitted, the holder of the environmental authority must submit, and the administering authority must have approved, an application to amend the financial assurance.	No changes are proposed to the petroleum activities carried out on the leases at this stage.

Silver Springs Project

WASTE MANAGEMENT SUB-PLAN

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Document revision history

Date	Version	Author	Comments
May 2020	R0	John Moraitis	AGL HSEMS update
June 2022	R1	John Moraitis	Review and update

1. Introduction

This Waste Management Sub Plan was prepared as part of the Environment Management Plan (EMP) for AGL's Silver Springs Gas Project ("the project").

This Plan was developed to specifically address and manage potential waste management issues for the project and is based on the previously prepared and approved Environment Health and Safety Management Plans. This Plan conforms with the Waste Management Standard (AGL-HSE-STD-009.7) as stipulated in the AGL Health, Safety and Environment Management System (HSEMS).

1.1. Objectives

The intent of this Plan is to assist AGL controlled sites in ensuring that:

- Potential risks from waste management activities (e.g. waste transportation, treatment, and disposal) to the environment and human health are minimised to as low as reasonably practicable;
- Generation of waste is managed and minimised as far as practicable and in accordance with the waste management hierarchy, relevant legislation, and approvals; and
- Regulatory license conditions and other compliance obligations with respect to the management of waste are met.

In accordance with the *Environmental Protection (Waste Management) Regulation 2000*, AGL seeks to protect the environment by:

- Minimising the impact of waste on the environment including in particular, the impact of waste so far as it directly affects human health; and
- Establishing a framework for minimising and managing waste in an ecologically sustainable manner.

AGLs objectives are also consistent with the objectives of the *Waste Reduction and Recycling Act 2011*, which are:

- To promote waste avoidance and reduction, and resource recovery and efficiency actions
- to reduce the consumption of natural resources and minimise the disposal of waste by encouraging waste avoidance and the recovery, re-use and recycling of waste;
- to minimise the overall impact of waste generation and disposal;
- to ensure a shared responsibility between government, business and industry and the community in waste management and resource recovery;
- to support and implement national frameworks, objectives and priorities for waste management and resource recovery.

1.2. Responsibilities

The roles and responsibilities for the development, implementation and review of this Plan are summarised below.

1.2.1. General Manager, HSE

The General Manager, HSE is responsible for:

- Delegating authority to ensure adequate implementation, monitoring and review of the Waste Standard, and associated Methodology, occurs; and
- Ensuring adequate resources are available for the development, implementation, monitoring and review of the Waste Standard.

1.2.2. Head of Function

The Head of Function is responsible for:

- Ensuring the implementation and adherence to the Waste Standard throughout the Business Unit; and
- Ensuring adequate resources are available for the implementation, monitoring and review of the Waste Standard.

1.2.3. Senior Manager, Environment Operations

The Senior Manager, Environment Operations is responsible for:

- Managing the development, implementation and maintenance of the Waste Standard;
- Ensuring consultation in the development, review and approval of the Waste Standard, and associated Methodology;
- Ensuring processes and/or procedures related to the Waste Standard are developed, implemented, followed and meet obligations and/or requirements under applicable environmental legislation;
- Providing guidance for the development of objectives, goals, targets and/or Key Performance Indicators (KPIs) associated with the Waste Standard, as applicable;
- Ensuring that applicable environmental objectives, goals and targets associated with the Waste Standard are introduced, adhered to and measured while meeting AGL-wide policies, objectives, goals and targets; and
- Overseeing audits and assurance activities to ensure compliance with the Waste Standard and applicable regulatory requirements.

1.2.4. Environment Business Partner

The Environment Business Partner is responsible for:

- Overseeing and monitoring the implementation of the Waste Standard within their Business Unit, and communicating Waste Standard requirements to relevant personnel and/or contractors, as applicable;

- Developing processes and/or procedures related to management of waste to ensure consistency with the Waste Standard, and with applicable environmental legislation;
- Providing support and guidance in the implementation of waste related processes and/or procedures at Business Unit level;
- Undertaking or providing guidance and assistance to Leaders in the completion and review of environmental risk assessments and control processes;
- Undertaking audit and assurance activities, to ensure compliance with the Waste Standard and applicable regulatory requirements, and developing tracking and corrective action management plans; and
- Assisting with the delivery and tracking of environmental management projects, or the integration of environmental considerations into projects, to ensure Business Unit and site-specific targets are met.

1.2.5. Environment Advisor

The Environment Advisor is responsible for supporting the Environment Manager and/or Environment Business Partner(s) with tasks associated with:

- Implementation of the Waste Standard; and/or
- Management of the processes and/or procedures related to Waste Standard, at Business Unit level.

2. Legal obligations

2.1. Key legislative requirements

The key regulatory requirements relating to air quality are detailed below.

2.1.1. Environmental Protection Act 1994

- Section 22: Act binds all persons
- Section 125: Requirements to apply for an environmental authority
- Section 319: General environmental duty
- Section 320DA: Duty of owner, occupier or auditor to notify administering authority
- Section 437: Offences of causing serious environmental harm
- Section 438: Offences of causing material environmental harm
- Section 440: Offence of causing environmental nuisance
- Section 442: Offence of releasing prescribed contaminant
- Section 443: Offence to place contaminant where serious or material environmental harm may be caused
- Section 443A: Offence to place contaminant where environmental nuisance may be caused

2.1.2. Environmental Protection Regulation 2019

- Chapter 7 and Chapter 10: National Pollutant Inventory
- Division 4: Environmental management and environmental offences

2.1.3. Environmental Protection (Waste Management) Regulation 2000

- Part 2A, Subdivision 1: Storage of general waste
- Part 2A, Subdivision 2: Removal of general waste
- Part 2A, Division 3: Storage and treatment of industrial waste
- Part 3: Waste receival and disposal
- Part 4: Waste tracking
- Part 4, Division 3: Obligations of waste handlers
- Part 6: Management of polychlorinated biphenyls (PCBs)
- Schedule 1: Trackable waste
- Schedule 3: National environment protection (movement of controlled waste between States and Territories) measure, schedule A, list 2

2.1.4. Waste Reduction and Recycling Act 2011

- Section 251: Person must comply with (show cause) notice
- Section 254: Recipient must comply with (waste audit) notice

2.2. Key licence requirements

The environmental licences held for each lease contain general and specific conditions for managing air quality. The table below shows the current environmental approvals (licences) held for each petroleum lease, issued by the Queensland Department of Environment and Science.

Petroleum lease	Environmental licence no.	Issue date	Anniversary date (each year)
PL446	EPPG00784013	29 September 2016	24 May
PFL27	EPPG01233113	22 December 2017	Not listed on EA
PL192	EPPG00770313	23 July 2014	10 August
PL213	EPPG00304213	7 July 2016	23 January
PL 15	EPPG00770613	1 April 2022	15 August
PLs 48, 49, 66, 202	P-EA-100227919	1 April 2022	15 August
PPL 4	PEN202330511	22 June 2011	22 June
PPL 87, 93	EPPG00370113	3 February 2015	29 April
ATP1190	EPSX02909615	16 February 2015	Not listed on EA

2.3. Approval conditions

The approval conditions for each environmental approval (licence) including AGLs actions and comments are displayed in Section 4 of this document. This provides a useful reference for auditing and assurance activities as it demonstrates how AGL is specifically managing compliance against each condition.

3. Emissions and control measures

3.1. Waste generation

AGLs activities involve the generation of the following solid wastes. Note that the generation of produced water from the gas fields is included in the Surface Water Sub-Plan in accordance with AGLs HSEMS.

3.1.1. General wastes

- Putrescible wastes – from camp area
- Paper and cardboard
- Timber and steel
- Construction and demolition waste
- Concrete slurry
- Liquid wastes (pH neutralised) from workover campaigns

3.1.2. Regulated (trackable) wastes

- Grease trap waste
- Lead acid batteries
- Mercury and mercury compounds
- Mineral oils
- Non-toxic salts (e.g. saline effluent)
- Organic solvents
- Pesticides
- Sewage sludge and residues (septic tank sludge)
- Tyres
- Vegetable oils

3.2. Control measures

3.2.1. Management hierarchy

AGL abides by the waste management hierarchy described in the *Waste Reduction and Recycling Act 2011*, which specifies the preferred order in which waste and resource management options should be considered:

- AVOID unnecessary resource consumption;
- REDUCE waste generation and disposal;

- RE-USE waste resources without further manufacturing;
- RECYCLE waste resources to make the same or different products;
- RECOVER waste resources, including the recovery of energy;
- TREAT waste before disposal, including reducing the hazardous nature of waste;
- DISPOSE of waste only if there is no viable alternative.

3.2.2. HSEMS minimum controls

AGL implements a variety of general control measures to manage air quality as shown in the tables below, consistent with AGLs Waste Management Standard (AGL-HSE-STD-009.7) and Waste Methodology (AGL-HSE-SDM-009.7).

General

RCM Ref	Minimum Controls
9.7.1.1	Where required, licences, permits or authorisations for waste storage, transportation, management, treatment, reuse/recycling, disposal and monitoring must be obtained and adhered to.
9.7.1.2	Notices or orders, issued by the regulatory authority, requesting information on trackable/controlled waste, must be complied with and all requirements adhered to

If an approval or authorisation for reuse or recycling of waste is granted, conditions imposed by the regulatory authority may include, but not limited to:

- Waste characteristics, including:
    - Physical form;
    - Quantity to be managed during the time-period; and
    - Presence and concentration of any permissible contaminants.
- Prescribed waste generator;
- Waste reuse and/or recycling facility(ies) that are authorised to receive the waste;
- Waste characterisation (i.e. sampling and analysis), monitoring and reporting requirements for the waste generator and/or the waste reuse and/or recycling facility(ies);
- Control measures for waste generation, waste transportation, waste reuse and recycling activities; and
- Other requirements prescribed by the regulatory authority.

Procedures for monitoring waste generation and conducting visual inspections of waste storage areas and/or waste disposal facilities at AGL controlled sites, should be developed and implemented. Waste monitoring information should be used to track and identify opportunities for continuous improvement in waste management at AGL controlled sites.

Sampling of regulated waste may be required to be carried out by competent and qualified professional(s).

Waste Management

RCM	Minimum Control
9.7.1.3	Waste generated at AGL controlled sites must be identified, classified, and documented in a waste register.
9.7.1.4	Waste generated at AGL controlled sites must be assessed and managed in accordance with the waste management hierarchy.
9.7.1.5	Waste characterisation must be conducted in accordance with relevant methods, protocols, and guidelines, as prescribed or agreed by the regulatory authority.
9.7.1.6	Analytical testing of waste, when required, must be carried out at a laboratory accredited - for the type of analyses required - by the National Association of Testing Authorities (NATA) or equivalent accreditation bodies.
9.7.1.7	Regulated waste must be managed in accordance with relevant codes of practice and guidelines, where prescribed by the regulatory authority.
9.7.1.8	AGL controlled sites must not receive waste from off-site, unless authorised by the relevant regulatory authority(ies).

Waste generation at AGL controlled sites should be avoided, as far as practicable (e.g. implementation of resource efficiency and conservation measures). Waste generated at AGL controlled sites should be identified and classified, in accordance with the waste classification prescribed by the regulatory authority. This will allow AGL controlled sites to group types of waste in accordance to the risks posed to the environment and human health. This information should be documented in a waste register to be maintained by the AGL controlled site.

Furthermore, AGL controlled sites should assess the identified waste types to determine the most appropriate way to deal with each of the waste individually – so that the risk of harm to human health and pollution of the environment is reduced to as low as reasonably practicable. Where waste generation is unavoidable, opportunities for maximising the implementation of the waste management hierarchy should be identified, as follows (in order of preference):

- Waste reduction, i.e. minimising waste generation;
- Waste reuse, i.e. waste is used as a resource without further re-manufacturing;
- Waste recycling, i.e. waste is used as a resource to make the same or different product(s);
- Recovery of energy and other resources from waste; and
- Waste treatment, i.e. to reduce the hazardous nature of the waste prior to safe and environmentally sound disposal.

The option(s) selected for managing each identified waste, in accordance with the waste management hierarchy above, should be documented in the site waste register.

Waste must be characterised, whenever required. Furthermore, waste that is known, or suspected, to contain hazardous substances (e.g. industrial process waste) should be characterised, i.e. to identify and quantify the contaminant(s) present in the waste so that the risks posed by the waste can be understood.

Waste management procedures, capturing the processes for dealing with waste at AGL controlled sites, should be developed and implemented. This should align with legislative requirements (including

licenses and regulatory approval(s) and guidelines, relevant HSE Management System Standards and any other commitments made with regard to waste management.

Waste Reuse and Recycling

Waste reuse and/or recycling options to be implemented by AGL controlled sites should not pose an environmental risk, and in particular protect land use and soil characteristics, if waste is applied to land.

Off-site waste recycling facility(ies) used by AGL controlled sites should be periodically audited to verify if waste recycling has been carried out appropriately.

Waste Treatment

Waste treatment option(s) to be considered by AGL controlled sites should take into account the waste characteristics and regulatory requirements. Selected waste treatment options are to render the waste to a safe state, and to a required standard, prior to disposal.

AGL controlled sites should develop and implement control measures for waste treatment option(s) carried out on-site. On-site waste treatment options should be developed and implemented by engaging a suitably qualified professional(s), specialising in the waste type(s) to be treated.

Off-site waste treatment facility(ies) used by AGL controlled sites should be periodically audited to verify if the treatment of waste has been carried out appropriately.

The following sections further explain how AGL controlled sites are to manage waste management related activities including:

- Waste Segregation and Storage;
- Waste Transportation;
- Waste Disposal.

Waste Segregation and Storage

RCM Ref	Minimum Control
9.7.1.9	Waste generated at AGL controlled sites must be placed in the designated or prescribed waste container(s)/bin(s).
9.7.1.10	Waste container(s)/bin(s) used at AGL controlled sites must be: • Safe to contain the waste type(s) (e.g. design and material compatibility); • Impervious to water; and • Identifiable (i.e. color/labelling).

Waste containers/bins, for identified waste types at AGL controlled sites, should be made available in sufficient number, and adequately hold the waste without causing a nuisance. Waste containers/bins should be kept clean and in good condition, inaccessible to pests and other animals, and placed at a designated location(s).

Depending on the waste type, and in particular for hazardous waste, waste containers/bins should be physically separated from incompatible materials. Underground storage tanks should not be used for the storage of hazardous waste at AGL controlled sites.

Waste awaiting collection and transportation at AGL controlled sites should be safely and securely stored. Taking into consideration the level of environmental risk posed by the waste, requirements for a designated waste storage area could include:

- A suitable enclosure, limiting access to waste containers/bins;
- Adequate ventilation;
- Protection of waste containers against weather conditions;
- An imperviously paved area (including appropriate drainage) or an elevated stand (at a required height);
- A hose, to be located in the vicinity of the elevated stand or paved area;
- Bunding and/or secondary containment, if storing hazardous waste;
- Spill kits, adequate to the type of waste being stored; and
- Signage and/or labelling.

The quantity (i.e. volume and/or weight) of waste generated, for each identified waste type at AGL controlled sites, should be documented in the site waste register. This information can be estimated or measured on-site by the relevant AGL personnel, and/or provided by the AGL controlled site's waste contractors. AGL controlled sites should keep waste generation records.

Waste Transportation

RCM Ref	Minimum Control
9.7.1.11	Waste transporter(s) engaged to remove waste from an AGL controlled site must be licensed, where required, by the regulatory authority to transport the waste type(s).
9.7.1.12	Where required, prior to transportation of regulated waste, the waste or waste container(s)/bin(s) must be contained in a designated waste transport receptacle fit for safe transport.

Prior to regulated waste being transported from an AGL controlled site:

- Waste should be characterised using an accredited laboratory, and whenever required, the analysis information provided to the waste transporter;
- Verify that the waste transporter is licensed or legally allowed to transport the type of waste(s) to be transported;
- Verify that the waste is to be taken to a waste facility that is licensed or legally able to accept the type of waste being transported;
- If the waste to be transported is required to be tracked (i.e. trackable waste), then:
    - Obtain a consignment authorisation or approval, for the waste to be transported from premises, from the relevant regulatory authority or approved representative. If the waste facility is located in another state/territory other than where the waste was generated, then the consignment authorisation needs to be obtained from the relevant regulatory authority in that state/territory;

- If waste is to be transported interstate, verify that the waste transporter has a valid transport permit/license and comply with relevant transportation requirements from that state/territory;
- Complete the required information in the waste transport certificate regarding the load of waste to be transported, and provide the waste transport certificate to the waste transporter;
- Provide a copy of the completed waste transport certificate, within the prescribed timeframe, to the appropriate regulatory authority(ies); and
- Keep waste transportation records. If an AGL controlled site is not currently using the approved online waste tracking system(s), waste transportation records are to be kept for the amount of time prescribed by the relevant regulatory authority.

Waste transporter(s) engaged by an AGL controlled site should be periodically audited (based upon the risks associated with the types and quantities of wastes being transported) to verify if waste transportation has been conducted appropriately.

AGL controlled sites should keep waste transportation records.

Waste Disposal

RCM Ref	Minimum Control
9.7.1.13	Waste from AGL controlled sites must be disposed at a waste disposal facility(ies) or premise(s) that can lawfully accept that type of waste.

Waste disposal should be considered as a last option for managing waste, when all other options have been evaluated (as per waste management hierarchy order of preference) and there is no viable alternative. Waste from AGL controlled sites is only to be disposed in engineered and approved waste disposal facilities, managed in a safe and environmentally sound manner.

No other waste should be deposited in an on-site waste disposal facility, other than the approved waste type(s) and in accordance to the approved disposal method(s), unless authorised by the relevant regulatory authority. Furthermore, hazardous waste should be disposed of in a manner that ensures segregation from other waste. AGL controlled sites need to develop and implement control measures for disposal of waste carried out on-site.

Depending on the nature of the waste to be disposed of, the design/construction and operation of an on-site waste disposal facility may require specialist advice and therefore AGL controlled sites should engage a suitably qualified waste disposal facility professional(s).

Information (e.g. location) on the waste disposal facilities used by AGL controlled sites, and the quantity (i.e. volume and/or weight) of waste disposed on-site or off-site at each of those facilities, should to be documented in the site waste register. Information on waste disposal facility(ies) used by AGL controlled site that have been closed during the site operational life, or any historical waste disposal facilities located on-site, should also be recorded in the site waste register.

Off-site waste disposal facility(ies) used by AGL controlled sites should be periodically audited (based upon the risks associated with the types and quantities of wastes being disposed of) to verify if the disposal of waste has been carried out appropriately.

AGL controlled sites should keep waste disposal records.

Waste Monitoring and Reporting

RCM Ref	Minimum Control
9.7.1.14	Waste, to be sent to final destination, containing National Pollutant Inventory (NPI) substances must be identified and assessed, to determine if the AGL controlled sites need to report to the NPI.

NPI reporting for AGL controlled sites is managed by the AGL Environment Team. A consultant has been engaged to conduct NPI reporting for all AGL sites that trigger NPI Reporting. The AGL NPI reporting process is described in the NPI Reporting Guideline (AGL-HSE-GUI-015.3.1).

The Environment Business Partners are responsible for project managing the NPI reporting process at site level, with assistance from relevant data owners and other key stakeholders. The final NPI results are approved by the site's Head of Function, and if required by other AGL Leaders, prior report submission to the relevant regulatory authority.

Incidents and Emergencies

RCM Ref	Minimum Control
9.7.1.15	Waste storage, waste transportation and waste disposal incidents and emergencies resulting in potential or actual pollution of land, surface water or groundwater need to adhere to the relevant minimum controls within the: • Land Standard (AGL-HSE-STD-009.1); • Surface Water Standard (AGL-HSE-STD-009.3); and • Groundwater Standard (AGL-HSE-STD-009.2).

Training and Competency

RCM Ref	Minimum Control
9.7.1.16	Activities carried out for the development, implementation or operation of on-site waste treatment and/or disposal options must be carried out by qualified and experienced professionals.

Professionals appointed to carry out tasks associated with on-site waste treatment and/or disposal options should have the appropriate qualifications or training, and are experienced and competent to conduct the work safely.

Personnel responsible for waste management activities that could cause significant impacts to land, surface water and/or groundwater, as identified by the AGL controlled site, should be competent to perform the tasks to which they are assigned. Specific training needs for individuals and teams should be determined through the implemented training and competency system, developed in alignment with the Training and Competency Methodology (AGL-HSE-SDM-013).

Definitions

Term	Definition
AGL Controlled Site	An AGL owned operated or controlled site, including a field operational site or an office site.
Consignment Authorisation	Consignment authorisation means an approval granted by a regulatory authority, or a waste facility authorised by a regulatory authority, in the jurisdiction of destination to allow the movement of controlled waste.
Controlled Waste	Controlled waste means any waste that is: • Included in the definition of controlled waste under the *National Environment Protection Measure (Movement of Controlled Waste Between States and Territories) 1998*; and • Prescribed by legislation to be controlled waste. Controlled waste is trackable waste that is transported to, and managed in, a different state/territory from where the waste was generated.
Disposal	Disposal refers to the permanent, indefinite, or long-term deposit and storage of waste, most commonly into land.

Term	Definition
Hazardous Waste	Hazardous waste refers to any waste with toxic, corrosive, flammable, explosive, infectious, or other characteristics that can cause significant harm to human health or the environment, if managed improperly. Wastes may also be defined as "hazardous" by state and national legislation, or international conventions, based on the waste origin and its inclusion on hazardous waste lists. Examples of hazardous waste include solvents, paints, batteries, used motor oils and clinical waste.
HSE	Health, Safety and Environment.
Landfill	Landfill is a licensed waste disposal site, used for the controlled deposit of solid waste onto or into land.
Leader	Any employee who has others reporting to him or her, or who has the authority to allocate resources.
National Pollutant Inventory	The National Pollutant Inventory (NPI) is an online, publicly available database that contains data on key substances being emitted to air, land, and water across Australia. These key substances have been identified as potentially having a negative impact on human health and the environment.
Recycling	Recycling refers to the use of a waste as a resource to produce a new product, different from the product that originated the waste.
Regulated Waste	Regulated wastes (also known as prescribed, listed or scheduled wastes) refers to commercial or industrial waste that is prescribed by legislation to be regulated waste. Regulated waste is generally of hazardous nature (refer to hazardous waste definition).
Reuse	Reuse refers to the use of a waste, for the same or similar purpose of the original product, without subjecting the waste to a re-manufacturing process.
Segregation	Segregation means the separation of waste, at the point of generation, into relevant waste categories for subsequent management.
Waste Storage Area	Waste storage area refers to a specific location where waste containers/bins are placed, for a determined amount of time, with the intention for these to be collected and transported to a waste facility for reuse, recycling, treatment, or disposal.
Trackable Waste	Trackable waste refers to a type of regulated waste to which waste tracking provisions apply, as prescribed by relevant legislation. Waste tracking requires all parties involved with managing the waste to take specific measures, so that the waste is transported and managed appropriately.
Treatment	Treatment means the physical, chemical, or biological processing of a waste (e.g. incineration, steam sterilisation, chemical disinfection).

Term	Definition
Waste	Waste refers to any solid or liquid matter, or contained gas, that is: • Discarded, rejected, abandoned, unwanted or in surplus, whether of value or not; • Discarded, rejected, abandoned, unwanted or in surplus, whether of value or not, intended for: • Sale; or • Recycling, reuse, reprocessing, recovery, treatment, or disposal by a separate waste facility from that which produced the waste; and/or • Prescribed by legislation to be waste. Waste can be a by-product of an activity (e.g. industrial process), result from an excavation, or an obsolete substance/product that can no longer be used for its intended purpose, and requires safe and environmentally sound management and/or disposal.
Waste Facility	Waste facility refers to any approved premises used for recycling, treating, processing, sorting or disposing of waste.
Waste Management Hierarchy	The waste management hierarchy is a framework that prioritises waste management practices. Typically represented by an inverted pyramid, ranking from the most to the least environmentally sound option, it includes: • Waste avoidance; • Waste reduction; • Waste reuse; • Waste recycling; • Waste resources recovery (e.g. energy from waste); • Waste treatment; and • Waste disposal.
Wastewater	Wastewater means water used in an activity (e.g. washing, flushing, manufacturing or processing), and therefore mixed with different substances/materials or exposed to a source of heat. It is a liquid waste, mainly consisting of water (e.g. wash down water, cooling water, produced water and effluent).

4. Approval conditions and comments

PL446

Condition ID	Requirement	Actions and comments
Schedule H - Waste		
H1	All general and regulated waste (other than authorised under condition (H2) must be removed from the site and sent to a recycling facility or disposal facility licensed to accept the waste under the *Environmental Protection Act 1994*.	AGL uses licenced companies to undertake waste transport. The Environment Business Partner undertakes checks to ensure that all transport companies are licensed under the *Environmental Protection Act 1994*.
H2	The only waste that can be disposed of on site is waste generated on site and is limited to putrescible waste.	AGL does not dispose of any putrescible waste on-site.
H3	Waste authorised to be disposed of on-site must only be disposed of into the 160m3 waste disposal facility identified in Appendix 2.	See above.
H4	Waste deposited in the waste disposal facility must be compacted and covered with a layer of inert material following placement of the waste in the facility.	See above.
H5	Litter control methods must be effectively implemented at the waste disposal facility.	Skip bins are in place to manage general waste. All personnel and contractors undertake an environmental induction which includes litter management.
H6	The waste disposal facility must be operated to minimise the generation of leachate including a system of diversion drains or embankments to divert surface waters away from any area where contact with wastes or sources of contamination may occur.	AGL does not dispose of any putrescible waste on-site.
H7	All regulated waste must only be removed from the site by a person who holds a current authority to transport such waste under the provisions of the *Environmental Protection Act 1994* and sent to a recycling facility or disposal facility licensed to accept the waste.	AGL uses licenced companies to undertake waste transport. The Environment Business Partner undertakes checks to ensure that all transport companies are licensed under the Environmental Protection Act 1994.
H8	Waste must not be burned or be allowed to be burned on the site.	AGL does not burn waste on-site. All general and regulated waste is removed from the site by licensed waste transport companies.

H9	All waste fluids and drilling muds resulting from drilling and exploration petroleum activities must be contained in a dam or containment structure for disposal, remediation or reuse where applicable.	AGL commissions licensed waste transporters to transport and dispose of these types of waste to licensed facilities. AGL maintains records of waste tracking documents. In some cases, AGL will dispose of minor volumes of waste fluids into the lined evaporation dam.
H10	The holder of this environmental authority must develop and submit a Produced Water Management Plan, within 18 months of the date of this approval.	The Plan was submitted to the regulatory authority by the due date, with no comments received back from the regulatory authority.
H11	The Produced Water Management Plan must include, but not necessarily be limited to: a) a water management strategy that: i. addresses water management across all integrated operations ii. minimises the development footprint of water management infrastructure iii. identifies means in addition to evaporation, to dispose of or reuse produced waters.	See above.
H12	The holder of this environmental authority must not implement or amend a Produced Water Management Plan where such implementation or amendment would result in a contravention of any condition of this environmental authority.	The Plan has not been amended since it was submitted to the regulatory authority.
H13	The holder of this environmental authority must submit any amendments to the Produced Water Management Plan to the administering authority prior to its implementation.	See above.
H14	If, within 20 business days following the submission of the amended Produced Water Management Plan, the administering authority provides comments on the amended Produced Water Management Plan, the holder of this environmental authority must: a) have due regard to that comment in the finalisation of the amended Produced Water Management Plan; b) submit the finalised amended Produced Water Management Plan within 40 business days after the administering authority provided comments; and c) implement the amended Produced Water Management Plan.	See above.

H15	The holder of this environmental authority must ensure that produced water is contained, is not released to land or waters and is only used for purposes specifically authorised: a) under this environmental authority b) under Section 186 of the *Petroleum and Gas (Production and Safety) Act 2004* c) under Section 86 of the *Petroleum Act 1923*; or d) under an approval of resource for beneficial use as provided for under the *Environmental Protection Act 1994.*	All produced water is contained within the lined evaporation pond ("RD01") at the Silver Springs facility. To date, there has not been a need to dispose of the water.
H16	The holder of this environmental authority must ensure that the produced water to be used for domestic or stock purposes meets the ANZECC and ARMCANZ Water Quality Guidelines 2000 for stock and domestic purposes, as amended from time to time.	See above.
H17	Produced water released to the environment in accordance with condition (H15) must not have any properties that could cause, nor contain any contaminants in concentrations that are capable of causing environmental harm.	See above.

4.1. PFL27

Condition ID	Requirement	Actions and comments
Schedule F - Waste		
F1	Measures must be implemented so that waste is managed in accordance with the waste and resource management hierarchy and the waste and resource management principles.	The Wallumbilla facility (PFL27) only generates small volumes of general and regulated wastes. All wastes are transported off-site by licensed waste contractors for disposal at licensed facilities. All wastes are stored in appropriate receptacles prior to transport off-site (e.g. skip bins, pallet bins, closed drain tanks).
F2	Waste, including waste fluids but excluding waste gas, must be transported off-site for lawful re-use, remediation, recycling or disposal	See above.

4.2. PL192

Condition ID	Requirement	Actions and comments
Schedule I – Waste		
I1	Any spillage of regulated waste must be cleaned up forthwith.	All spillages of hydrocarbons to land are cleaned up by excavating the soils and placing the contaminated material in the landfarm (at Silver Springs) or in the dedicated IBC within a pallet bin (at Wallumbilla).
I2	Regulated waste must be handled and transferred in a proper and efficient manner to prevent any leakage or spillage of waste.	Regulated wastes are not handled and transferred on PL192 except at the Churchie Facility (pre-commissioning phase) and for various projects (e.g. Churchie 12 strata stimulation). All waste fluids (e.g. produced water) are collected and disposed of by licensed waste contractors.
I3	All regulated waste removed from the site must be removed by a person who holds a current authority to transport such waste under the provisions of the *Environmental Protection Act 1994* and sent to a facility licensed to accept such waste.	The Environment Business Partner is responsible for checking that all waste contractors hold the required environmental permits to undertake transport of regulated waste. These checks occur during the risk assessment before projects are undertaken.
I4	Except as otherwise provided by the conditions of this authority, all disposal of waste generated in carrying out the environmentally relevant activity must be to a proper and appropriate facility that accepts that waste.	See above. AGL maintains waste tracking records provided by licensed waste transport companies.
I5	Where regulated waste is removed from within the boundary of the environmental authority (other than by a release as permitted under another schedule of this environmental authority), the holder of this environmental authority must monitor and record the following: a) the date, quantity and type of waste removed; and b) name of the waste transporter and/or disposal operator that removed the waste.	See above.

4.3. PL213

Condition ID	Requirement	Actions and comments
11	The holder of the environmental authority must: a) Ensure that petroleum activities do not result in the release or likely release of contaminants to land or waters that results in unlawful environmental harm; and b) As soon as practicable, remove and dispose of all regulated waste to a licensed waste disposal facility or recycling facility.	There are no active wells on PL213 and no other petroleum activities occurring as at December 2019.
12	The holder of this environmental authority must ensure that: a) Plant and equipment used in the carrying out of the activity is installed, maintained and operated in a proper and efficient manner b) Sewage effluent is not released to waters (including groundwater)' c) The disposal of sewage effluent does not cause the contamination of any water used for drinking or domestic purposes or manufacturing purposes or for consumption by animals d) Any areas used for disposal of sewage wastes (liquids or solids) is securely fenced to prevent animals entering such areas e) Where sewage sludge is buried on land, the sludge is covered with at least 250mm of top soil and where practicable located above known flood levels f) Where sewage effluent is irrigated on land it is carried out in accordance with the National Water Quality Management Strategy Guidelines for Sewerage Systems – Use of Reclaimed Water g) There is no surface ponding of effluent on land disposal areas h) Any noxious or offensive odours or any other noxious or offensive contaminant resulting from the activity do not cause a nuisance at any odour sensitive place; and i) Public access to any sewage effluent land disposal area must be denied during the release of contaminants to the land until the irrigation/disposal area has dried.	See above
14	Notwithstanding the other conditions of this environmental authority, if a hazardous contaminant is released to waters or land, the holder of the environmental authority must: a) Take immediate action to stop any further release; b) Take immediate action to contain the hazardous contaminant to the affected area, taking particular care to protect environmentally sensitive areas c) Restore or rehabilitate the environment to its condition before the release occurred; and d) Prevent a recurrence of the release.	See above
15	The holder of the environmental authority must ensure that associated water that is a hazardous waste, as determined from Table 1 of Appendix B of this environmental authority is not:	

	a) released to land or waters, other than to an evaporation pond or to a landowner/holder containment for domestic purposes or stock purposes provided the owner/holder has: i. given their written permission; and ii. has written agreement from the administering authority that it will be stored and used in a way that will not result in the associated water being released to waters or land causing or having the potential to cause environmental harm. Note: Associated water that is not a hazardous waste cannot be discharged to land or waters without an amendment to the environmental authority.	
16	The holder of this environmental authority must ensure all dams and evaporation ponds are: a) Designed, constructed, operated, maintained and decommissioned in accordance with the criteria outlined in Appendix B; and b) Not located within 100m of any natural drainage feature (i.e. watercourse, waterway, wetland or lake).	AGL does not operate dams or evaporation ponds on PL213.
17	For dams, ponds and other excavations which are constructed as part of the petroleum activities, the holder of the environmental authority must where relevant either: a) Provide safe access for livestock where contained water quality is adequate for live stock; or b) Construct and maintain bunds and/or fences sufficient to exclude livestock.	See above – there are no dams, evaporation ponds or excavations under AGL care and maintenance for livestock purposes.

4.4. PL 15

Condition ID	Requirement	Actions and comments
Schedule H - Waste		
H1	Any spillage of regulated waste must be cleaned up forthwith.	Regulated wastes are not stored on these leases areas, as there are dedicated storage facilities at PL446 (Silver Springs) and PFL27 (Wallumbilla). The potential for hazardous substance spills to land during workover campaigns or other projects, is managed through appropriate storage and handling techniques. Contaminated soils are recovered into suitable containers and transported off-site by licensed waste contractors for disposal at licensed facilities. AGL receives waste tracking certificates from licensed contractors. The Environment Business Partner verifies that all contractors hold the appropriate waste authorisations.

H2	Regulated waste must be handled and transferred in a proper and efficient manner to prevent any leakage or spillage of waste.	Regulated wastes are stored in appropriate containers and handled by experienced operators when projects or workovers are underway.
H3	All regulated waste removed from the site must be removed by a person who holds a current authority to transport such waste under the provisions of the *Environmental Protection Act 1994* and sent to a facility licensed to accept such waste.	AGL uses licensed waste contractors to transport and dispose of regulated wastes. AGL receives waste tracking certificates from licensed contractors. The Environment Business Partner verifies that all contractors hold the appropriate waste authorisations.
H4	Except as otherwise provided by the conditions of this authority, all disposal of waste generated in carrying out the environmentally relevant activity must be to a proper and appropriate facility that accepts that waste.	Wastes may be generated during workover campaigns or other temporary projects, however all waste is either removed directly from the sites by licensed contractors, or in the case of general waste it may be transported to PL446 (Silver Springs) for transferring to the skip bins onsite.
H5	Where regulated waste is removed from within the boundary of the environmental authority (other than by a release as permitted under another schedule of this environmental authority), the holder of this environmental authority must monitor and record the following: a) the date, quantity and type of waste removed; and b) name of the waste transporter and/or disposal operator that removed the waste.	AGL receives waste tracking certificated from licensed waste transporters, for all regulated waste collections.

4.5. PLs 48, 49, 66, 202

Condition ID	Requirement	Actions and comments
Schedule H - Waste		
H1	Any spillage of regulated waste must be cleaned up forthwith.	Regulated wastes are not stored on these leases areas, as there are dedicated storage facilities at PL446 (Silver Springs) and PFL27 (Wallumbilla). The potential for hazardous substance spills to land during workover campaigns or other projects, is managed through

		appropriate storage and handling techniques. Contaminated soils are recovered into suitable containers and transported off-site by licensed waste contractors for disposal at licensed facilities. AGL receives waste tracking certificates from licensed contractors. The Environment Business Partner verifies that all contractors hold the appropriate waste authorisations.
H2	Regulated waste must be handled and transferred in a proper and efficient manner to prevent any leakage or spillage of waste.	Regulated wastes are stored in appropriate containers and handled by experienced operators when projects or workovers are underway.
H3	All regulated waste removed from the site must be removed by a person who holds a current authority to transport such waste under the provisions of the *Environmental Protection Act 1994* and sent to a facility licensed to accept such waste.	AGL uses licensed waste contractors to transport and dispose of regulated wastes. AGL receives waste tracking certificates from licensed contractors. The Environment Business Partner verifies that all contractors hold the appropriate waste authorisations.
H4	Except as otherwise provided by the conditions of this authority, all disposal of waste generated in carrying out the environmentally relevant activity must be to a proper and appropriate facility that accepts that waste.	Wastes may be generated during workover campaigns or other temporary projects, however all waste is either removed directly from the sites by licensed contractors, or in the case of general waste it may be transported to PL446 (Silver Springs) for transferring to the skip bins onsite.
H5	Where regulated waste is removed from within the boundary of the environmental authority (other than by a release as permitted under another schedule of this environmental authority), the holder of this environmental authority must monitor and record the following: c) the date, quantity and type of waste removed; and d) name of the waste transporter and/or disposal operator that removed the waste.	AGL receives waste tracking certificated from licensed waste transporters, for all regulated waste collections.

4.6. PPL 4

Condition ID	Requirement	Actions and comments
Schedule G – Waste		
G1	All general waste must only be removed from the site and sent to a recycling facility or disposal facility licensed to accept the waste under the *Environmental Protection Act 1994*.	PPL is a pipeline easement. Maintenance activities currently include ROW inspections, weed control, and pipeline repairs. General wastes generated during these activities is taken to PL446 (Silver Springs facility) where it is placed into skip bins for collection by a licensed waste contractor. AGL receives waste tracking certificates when waste is collected from the Silver Springs facility. The Environment Business Partner verifies that waste contractors hold an appropriate licence under the Environmental Protection Act 1994.
G2	All regulated waste must only be removed from the site by a person who holds a current authority to transport such waste under the provisions of the *Environmental Protection Act 1994* and sent to a recycling facility or disposal facility licensed to accept the waste.	See above.
G3	Waste must not be burned or be allowed to be burned on the site.	AGL does not burn any waste on PPL4, nor at the gas facilities on PL446 (Silver Springs) and PFL27 (Wallumbilla).

4.7. PPL 87 and 93

Condition ID	Requirement	Actions and comments
Schedule E – Waste Management		
E1	The holder of this authority must ensure that petroleum activities do not result in the release or likely release of a hazardous contaminant to land or waters.	PPL87 and 93 are pipeline easements, and hazardous contaminants are not stored within the lease. The potential for hazardous contaminants to be released to land are limited to a pipeline breach (underground), or a spill to land or waters from operational/maintenance activities above ground. These activities may include weed control (spraying), pipeline repairs (excavations) or other temporary projects. Before undertaking field work, AGL undertakes a risk assessment of the work to ensure that control measures are in place. This includes avoiding refuelling activities on the lease, avoiding storage and handling of herbicides, and removing all wastes from the lease.
E2	Where practicable, general waste generated in carrying out the petroleum activities must be reused, recycled or removed to a facility that can lawfully accept the waste under the *Environmental Protection Act 1994.*	All general waste generated from maintenance activities is taken to PL446 (Silver Springs) for disposal in the skip bins. All general waste is collected from PL446 by licensed waste contractors.
E3	Waste, including vegetation, must not be burnt on site.	AGL does not burn waste on this lease, or any other leases associated with the Silver Springs Project.
E4	Any spillage of hazardous waste or other contaminants that may cause environmental harm, must be effectively contained and/or cleaned up as quickly as practicable. Such spillage must not be cleaned up by hosing, or otherwise thereby releasing such waste or contaminants to any land or waters.	Any spillages to land are recovered by excavating the affected area of soil and placing into a suitable container for transport to PL446 (Silver Springs). AGL uses licensed waste contractors to transport and dispose of wastes collected from the site, and waste tracking certificates are obtained. The Environment Business Partner verifies that waste contractors hold a current environmental authority under the Environmental Protection Act 1994.
E5	All regulated waste removed from the site must be removed by a person who holds a current authority to transport such waste under the provisions of the *Environmental Protection Act 1994* and sent to a facility licensed to accept such waste.	See above.

E6	When regulated waste is removed from within the boundary of the operational land and transported by the holder of this authority, a record must be kept of the following: a) date of waste transport; b) quantity of waste removed and transported; c) type of waste removed and transported; d) route selected for transport of waste; e) quantity of waste delivered; and f) any incidents (e.g. spillage) that may have occurred on route.	See above.
E7	If a person removes regulated waste associated with activities within the operational land and disposes of such waste in a manner which is not authorised or is improper or unlawful then, as soon as practicable, notify the administering authority of all relevant facts, matters and circumstances known concerning the disposal.	See above. AGL operates under a HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1), which contains minimum standards on the identification, reporting and investigation of notifiable incidents.

4.8. ATP1190

Condition ID	Requirement	Actions and comments
Schedule C – Operating standards		
PESCC24	Measures must be implemented so that waste is managed in accordance with the waste and resource management hierarchy and the waste and resource management principles.	Wastes are not stored on ATP1190. Minimal exploration activities have been undertaken on the lease in recent years. Minor work was recently conducted on Waggamba North 1, however waste generation was negligible.
PESCC25	Waste, including waste fluids but excluding waste gas, must be transported off-site for lawful re-use, remediation, recycling or disposal unless the waste is specifically authorised by standard conditions (PESCC 26), (PESCC 27), (PESCC 28), (PESCC 29), (PESCC 30), (PESCC 31), (PESCC 32) or (PESCC 34) to be disposed of or used on-site.	See above.
PESCC26	Sumps may be used for residual drilling material and drilling fluids only for the duration of drilling activities.	See above.

PESCC27	Green waste may be used on-site for rehabilitation and/or sediment and erosion control purposes.	See above.
PESCC28	Treated sewage effluent or greywater can be released to land provided it: (a) meets or exceeds secondary treated class B standards for a treatment system with a daily peak design capacity of between 150 EP and 1500 EP; or (b) meets or exceeds secondary treated class C standards for a treatment system with a daily peak design capacity of less than 150 EP; and (c) is released within fenced and signed contaminant release area(s) and does not result in pooling or run-off or aerosols or spray drift or vegetation die-off.	AGL does not operate water treatment facilities on ATP1190.
PESCC29	Produced water and stimulation flow-back water may be reused in: (a) drilling and well hole activities; or (b) stimulation activities where its use will not result in negative effects on waters beyond the stimulation impact zone.	No produced water has been generated on this lease in recent years.
PESCC30	Produced water may be used for dust suppression and construction activities provided that it does not result in adverse effects on the composition and structure of soil or subsoils and can be demonstrated to meet the following standards: (a) pH between 6-9 (b) electrical conductivity (EC) not exceeding 3000µ8/cm (c) sodium adsorption ratio (SAR) not exceeding 8 (d) bicarbonate ion concentration not exceeding 100mg/L.	See above.
PESCC31	Produced water used by an owner or occupier for domestic purposes or stock purposes in accordance with section 186 of the Petroleum and Gas (Production and Safety) Act 2004 or section 86 of the Petroleum Act 1923 must meet the irrigation or livestock watering criteria as relevant to those purposes in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000).	See above.
PESCC32	Residual drilling material can only be disposed of on-site: (a) by mix-bury-cover method if the residual drilling material meets the approved quality criteria; or (b) if it is certified by a suitably qualified third party as being of acceptable quality for disposal to land by the proposed method and that environmental harm will not result from the proposed disposal.	No drilling has taken place on this lease in recent years.
PESCC33	Records must be kept of drilling fluids and all additives used in drilling activities.	See above.

Silver Springs Project

CULTURAL HERITAGE MANAGEMENT SUB-PLAN

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Document revision history

Date	Version	Author	Comments
May 2020	R0	John Moraitis	Updated for AGL HSEMS
June 2022	R1	John Moraitis	Review and update

1. Introduction

This Cultural Heritage Management Sub Plan was prepared as part of the Environment Management Plan (EMP) for AGL's Silver Springs Gas Project ("the project").

This Plan was developed to specifically address and manage potential cultural heritage risks (Aboriginal and non-Aboriginal) for the project and is based on the previously prepared and approved Environment Health and Safety Management Plans. This Plan conforms with the Cultural Heritage Standard (ALG-HSE-STD-009.8) as stipulated in the AGL Health, Safety and Environment Management System (HSEMS).

1.1. Objectives

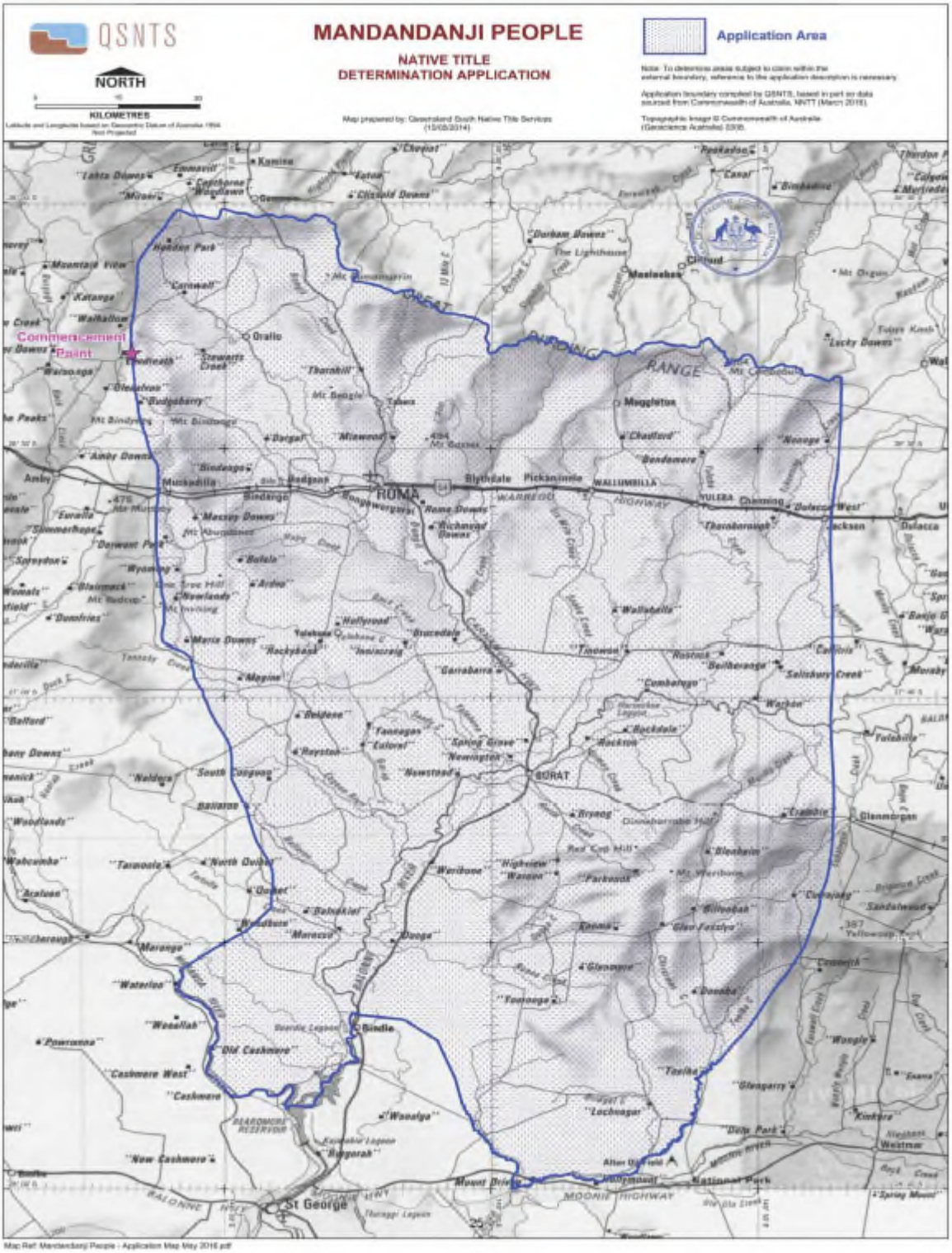
In accordance with the abovementioned legislation, AGL seeks to provide for the conservation of Queensland's cultural heritage for the benefit of the community and future generations. This includes:

- preventing and minimising impacts to known Aboriginal and non-Aboriginal heritage places and/or objects including unexpected finds
- effectively managing heritage places and/or objects in accordance with legislation and approvals
- meeting regulatory approval conditions and other compliance obligations (including the *Cultural Heritage Duty of Care Guidelines*) with respect to heritage management.

1.2. Existing environment

The relevant Aboriginal Party in the Roma area is the Mandandanji People, who date back to 9,000 years ago and have a strong connection with the country. Mandandanji People were and are known as the 'fishing people' which was a reference to Mitchell's observation of a group weaving fishing nets for use in the Condamine River.

The Mandandanji People provide a cultural heritage service with the primary objective of supporting proponents undertaking works in the Mandandanji Claim area, to meet their obligations under the *Aboriginal Cultural Heritage Act 2003* (Qld). The Mandandanji Claim area is shown below for Native Title, which would be the same area that applies to cultural heritage.



Mandandanj People – Claim Area

1.3. Features of cultural heritage significance

The following features are highly likely to have cultural heritage significance. These features include but are not limited to:

- Ceremonial places: The material remains of past Aboriginal ceremonial activities come in the form of earthen arrangements or bora grounds and their associated connecting pathways, and stone circles, arrangements and mounds. Indigenous people used these places for ceremonies, including initiation and inter-group gatherings.
- Scarred or carved trees: Scars found on large mature trees often indicate the removal of bark by Indigenous people to make material items like canoes, containers, shields and boomerangs. Carved trees generally feature larger areas of bark that have been removed and carved lines deeply etched into the timber. Carvings include geometric or linear patterns, human figures, animals and birds.
- Burials: Pre-contact Aboriginal burials are commonly found in caves and rock shelters, midden deposits and sand dunes. Burial sites are sensitive places of great significance to Indigenous people.
- Rock art: Queensland has a rich and diverse rock art heritage. Rock art sites can include engravings, paintings, stencils and drawings. Paintings, stencils and drawings may have been done for everyday purposes, but are often used for ceremonial and sacred functions. Engravings include designs scratched, pecked or abraded into a rock surface.
- Fish traps and weirs: Fish traps and weirs are stone or wooden constructions designed to capture aquatic animals, predominantly fish. Traps are considered as structures made Duty of Care Guidelines Department of Aboriginal and Torres Strait Islander Partnerships 12 predominantly from stone to form a type of pen or enclosure. Weirs are constructions designed to block the natural flow of water in creeks, streams and other watercourses.
- Occupation sites: These are places where the material remains of human occupation are found. Such sites contain discarded stone tools, food remains, ochre, charcoal, stone and clay hearths or ovens, shell middens and shell scatters, including deposits found in rock shelters and caves. These deposits may be buried. Other evidence of occupation sites includes the remains of Aboriginal dwellings or "gunyahs".
- Quarries and artefact scatters: Quarries are places where raw materials such as stone or ochre were obtained through either surface collection or sub-surface quarrying. Stone collected or extracted from stone quarries was used for the manufacture of stone tools. Ochre, a type of coloured clay, was utilised by Indigenous people in rock art and for body and wooden tool decoration.
- Grinding grooves: Grinding grooves represent the physical evidence of past tool making or food processing activities. They are generally found near water sources. The presence of long thin grooves may indicate where the edges of stone tools were ground. Food processing activities such as seed grinding can leave shallow circular depressions in rock surfaces.
- Contact Sites: The material remains of Indigenous participation in the development of Queensland after the arrival of European settlers. These include former or current Aboriginal missions, native mounted police barracks and historical camping sites.

- Wells: Rock wells are reliable water sources that have been altered by Indigenous people for the storage of water. The presence of wells often indicates the location of routes frequently travelled by Indigenous people in the past.
- Landscape features, which may also have cultural heritage significance include:
    - Rock outcrops
    - Caves
    - Foreshores and coastal dunes
    - Sand Hills
    - Areas of biogeographical significance, such as natural wetlands
    - Permanent and semi-permanent waterholes, natural springs.
    - Particular types of native vegetation
    - Some hill and mound formations.

1.4. Responsibilities

The roles and responsibilities for the development, implementation and review of this Plan are summarised below.

1.4.1. General Manager, HSE

The General Manager, HSE is responsible for:

- Delegating authority to ensure adequate implementation, monitoring and review of the Cultural Heritage Standard, and associated Methodology, occurs; and
- Ensuring adequate resources are available for the development, implementation, monitoring and review of the Cultural Heritage Standard.

1.4.2. Head of Function

The Head of Function is responsible for:

- Ensuring the implementation and adherence to the Cultural Heritage Standard throughout the Business Unit; and
- Ensuring adequate resources are available for the implementation, monitoring and review of the Cultural Heritage Standard.

1.4.3. Senior Manager, Environment Operations

The Senior Manager, Environment Operations is responsible for:

- Managing the development, implementation and maintenance of the Cultural Heritage Standard;
- Ensuring consultation in the development, review and approval of the Cultural Heritage Standard, and associated Methodology;

- Providing guidance for the development of objectives, goals, targets and/or Key Performance Indicators (KPIs) associated with the Cultural Heritage Standard, as applicable;
- Ensuring that applicable environmental objectives, goals and targets associated with the Cultural Heritage Standard are introduced, adhered to and measured while meeting AGL-wide policies, objectives, goals and targets; and
- Overseeing audits and assurance activities to ensure compliance with the Cultural Heritage Standard and applicable regulatory requirements.

1.4.4. Environment Business Partner

The Environment Business Partner is responsible for:

- Overseeing and monitoring the implementation of the Cultural Heritage Standard within their Business Unit, and communicating Cultural Heritage Standard requirements to relevant personnel and/or contractors, as applicable;
- Developing processes and/or procedures related to management of cultural heritage to ensure consistency with the Cultural Heritage Standard, and with applicable environmental legislation;
- Providing support and guidance in the implementation of cultural heritage related processes and/or procedures at Business Unit level;
- Undertaking or providing guidance and assistance to Leaders in the completion and review of environmental risk assessments and control processes;
- Undertaking audit and assurance activities, to ensure compliance with the Cultural Heritage Standard and applicable regulatory requirements, and developing tracking and corrective action management plans; and
- Assisting with the delivery and tracking of environmental management projects, or the integration of environmental considerations into projects, to ensure Business Unit and site-specific targets are met.

1.4.5. Environment Advisor

The Environment Advisor is responsible for supporting the Senior Manager, Environment Operations and/or Environment Business Partner(s) with tasks associated with:

- Implementation of the Cultural Heritage Standard; and/or
- Management of the processes and/or procedures related to Cultural Heritage Standard, at Business Unit level.

2. Legal obligations

2.1. Key legislative requirements

The key regulatory requirements relating to cultural heritage are detailed below.

2.1.1. Queensland Aboriginal Cultural Heritage Act 2003

- Section 3 – Act binds all persons
- Section 23 – Cultural heritage duty of care
- Section 25 – Unlawful harm to Aboriginal cultural heritage
- Section 26 – Unlawful possession of Aboriginal cultural heritage
- Section 27 – Court may order costs of rehabilitation or restoration
- Section 28 – Cultural heritage duty of care guidelines
- Section 32 – Stop orders
- Part 6 – Cultural heritage studies

2.1.2. Queensland Heritage Act 1992

- Section 5 – Act binds all persons
- Part 3 – The Queensland heritage register
- Division 5 – Council to decide about entry of place in, or removal of place from register
- Part 6 – Development in Queensland heritage places and local heritage places

2.2. Key licence requirements

The environmental licences held for each lease contain general and specific conditions for managing cultural heritage. The table below shows the current environmental approvals (licences) held for each petroleum lease, issued by the Queensland Department of Environment and Science.

Petroleum lease	Environmental licence no.	Issue date	Anniversary date (each year)
PL446	EPPG00784013	29 September 2016	24 May
PFL27	EPPG01233113	22 December 2017	Not listed on EA
PL192	EPPG00770313	23 July 2014	10 August
PL213	EPPG00304213	7 July 2016	23 January
PL 15	EPPG00770613	1 April 2022	15 August
PLs 48, 49, 66, 202	P-EA-100227919	1 April 2022	15 August
PPL 4	PEN202330511	22 June 2011	22 June

PPL 87, 93	EPPG00370113	3 February 2015	29 April
ATP1190	EPSX02909615	16 February 2015	Not listed on EA

2.3. Approval conditions

The approval conditions for each environmental approval (licence) including AGLs actions and comments are displayed in Section 4 of this document. This provides a useful reference for auditing and assurance activities as it demonstrates how AGL is specifically managing compliance against each condition.

3. Impacts and control measures

3.1. Potential impacts

The following AGL activities have the potential to cause impacts on cultural heritage areas and items of significance:

- Accessing or traversing land or waters
- Excavation and/or development of land and water areas
- Vegetation management (e.g. clearing, thinning, removal)
- Relocation, removal or accidental damage of a cultural heritage find
- Irrigation of sewage effluent onto land areas
- Hazardous substance spills to culturally significant areas.

3.2. Control measures

The minimum controls specified by AGLs Cultural Heritage Standard (AGL-HSE-STD-009.8) and Cultural Heritage Methodology (AGL-HSE-SDM-009.8) are shown below.

RCM	Minimum Control
9.8.1.1	Prior to the commencement of activities and works, cultural heritage that is likely to be affected by AGL controlled site activities must be identified, evaluated and documented.
9.8.1.2	Whenever required, AGL controlled sites must engage a competent and experienced cultural heritage expert(s) to conduct a cultural heritage survey(s), study(ies) and/or assessment(s).
9.8.1.3	Control measures must be developed and implemented at AGL controlled sites to prevent and minimise potential or actual impacts from operations on cultural heritage.
9.8.1.4	Wherever applicable, AGL controlled sites must comply with the relevant codes of practice and guidelines prescribed by the regulatory authority(ies) for: • Identifying and managing cultural heritage; • Protecting and conserving cultural heritage; • Carrying-out activities and/or works on a cultural heritage place; • Conducting a survey on a cultural heritage place; and/or • Conducting restoration, reconstruction and/or maintenance works on a cultural heritage place and/or object.
9.8.1.5	Unless covered under an existing regulatory approval held by the AGL controlled site, or the activities and/or works are subject to an exemption, a permit or authorisation must be obtained from the regulatory authority(ies) in order to: • Enter or remain within, excavate or disturb a listed cultural heritage place or place covered by a protection/conservation order; • Interfere with fencing, shelter, drain, protective work and signage erected at a cultural heritage place;

	• Remove and/or relocate a cultural heritage object(s) from a listed cultural heritage place or place covered by a protection/conservation order; • Excavate or disturb any land, in accordance with a code of practice (if applicable), for the purpose of: o Searching and recovering cultural heritage object(s); and o Searching and uncovering an indigenous cultural heritage place and/or human remains of indigenous origin; • Bring vehicles, plant, equipment and/or materials onto land covered by cultural heritage legislation; • Carry-out land disturbance or vegetation clearing works that are known or suspected to endanger, cause harm or reduce the significance of a cultural heritage place and/or object; • Damage, destroy, dispose of or alter a listed cultural heritage place and/or object or place covered by a protection/conservation order; and • Conduct restoration, reconstruction and/or maintenance works on a cultural heritage place and/or object, or land restoration. If a permit or authorisation is granted by the regulatory authority(ies), all conditions must be adhered to.
9.8.1.6	If an AGL controlled site has possession of a listed cultural heritage place and/or object, it must: • Restrict access to the cultural heritage place and/or object, including fencing-off and installing signage; • Maintain, and if required repair, the place and/or object to ensure its conservation; • Carry-out any works, in relation to the place and/or object, in accordance with the approved management plan or prescribed regulatory requirement(s); and • Whenever required, notify of any works undertaken or proposed, in relation to the place and/or object, to the relevant regulatory authority(ies).
9.8.1.7	Notices or orders, issued by the regulatory authority, related to cultural heritage, must be complied with, and all requirements adhered to.

AGL controlled sites should to take reasonable and practicable measures to prevent and minimise the negative impacts (i.e. damage and disturbance) of its operations on cultural heritage. Cultural heritage places and/or objects present within site boundaries should be documented in a database or risk register to be maintained by the AGL controlled site.

Information on cultural heritage present within site boundaries may be available through:

- Cultural heritage registers, databases, inventories and/or lists (available at different levels of government);
- Cultural heritage baseline surveys;
- Cultural heritage monitoring programs;
- Consultation with the relevant indigenous community(ies) or representative(s), cultural heritage conservation groups (including anthropologists, archaeologists and historians), and regulatory authority(ies); and/or
- A cultural heritage survey of the designated area.

Appropriate control measures should be in place to prevent potential adverse effects of activities or works on cultural heritage. Examples of control measures include (but not limited to):

- Completing a cultural heritage survey, including recording known cultural heritage places and/or objects on works plans and maps. Prior to carrying-out a cultural heritage survey, the AGL controlled site may need to notify the regulatory authority(ies) and relevant stakeholders (e.g. indigenous community(ies) and land owner). A copy of the final report and related documentation (e.g. site records, photographs, maps and plans) is to be provided to the regulatory authority;
- Engaging a cultural heritage expert(s) and/or other professionals to supervise activities and/or works that may affect cultural heritage;
- Establishing a permitting or authorisation process to control land disturbance and vegetation clearing works;
- Restricting access to designated cultural heritage areas, including fencing-off and installing signage for protection of those areas (i.e. No-Go zones);
- Providing continued access, or alternative safe access route, to an indigenous cultural heritage place(s) and/or object(s), which was previously accessible for use by an indigenous community(ies);
- Training and communicating matters of cultural heritage significance to AGL employees and contractors (e.g. site inductions and toolboxes to include information on cultural heritage present on-site, or in an operational area, and the control measures taken to protect it); and
- Having processes in place for:
    - Moving cultural heritage that will be affected by the activities and/or works, including establishing a suitable and safe (temporary or permanent) keeping place or storage facility;
    - Dealing with unexpected cultural heritage finds;
    - Controlling documentation that contains culturally sensitive information, in particular information on indigenous cultural heritage; and
    - Maintaining and repairing cultural heritage places and/or objects.

Procedures for protecting and managing cultural heritage, at AGL controlled sites, should be developed and implemented. These should align with legislative requirements (including permits and regulatory approval(s)) and guidelines, relevant HSE Management System Standards and any commitments associated with cultural heritage management.

Management of cultural heritage at AGL controlled sites should not be contrary to any cultural heritage management plans and cultural heritage agreements/covenants, which can be established by state and/or national government agencies.

Any permit application is to be prepared in accordance with the applicable regulatory requirements. Key information to be provided to the regulatory authority(ies) includes, but may not limited to, a cultural heritage assessment report. Certain permits cannot be obtained for activities/works that impact on indigenous human remains and indigenous objects of sacred or secret nature.

AGL controlled sites that possess listed cultural heritage places and/or objects need to identify if minimum standards for maintenance and/or repair (e.g. weather protection, essential maintenance and repair, fire protection and security) have been defined within legislation, and how these relate to

the approved management plan or other prescribed regulatory requirements. Furthermore, particular maintenance/repair works, or an amendment of the works covered by the approved management plan, may require a permit to be obtained from the regulatory authority(ies).

Notices or orders may be issued by the regulatory authority and may include but not limited to the following:

- Protecting and conserving cultural heritage;
- Prohibiting access/entry of people to a cultural heritage place, or the area surrounding a cultural heritage place and/or object;
- Prohibiting the start, stopping, restricting and/or regulating any works and/or activities to be carried-out within a cultural heritage place, or the area surrounding a cultural heritage place and/or object;
- Conducting restoration, reconstruction and/or maintenance works to a cultural heritage place and/or object, or land restoration;
- Surrendering a cultural heritage object to a specific person, museum or other cultural heritage conservation body; and
- Conducting a cultural heritage audit.

Unexpected cultural heritage finds

RCM Ref	Minimum Control
9.8.1.8	If during a land disturbance or vegetation clearing works, at an AGL controlled site, personnel believes or knows that they may have discovered a cultural heritage place and/or object, they must: • Immediately stop the works, within the area where the object/human remains has been discovered; • Advise the relevant Leader and/or the site Environment representative; • Take no further action (i.e. do not disturb, interfere, inter or remove), until notice is received from the relevant Leader(s) on how to proceed. If required, the AGL controlled site must apply for a permit or authorisation for the recovery of the object and/or human remains. Conditions prescribed in the permits or authorisation must be adhered to.
9.8.1.9	The discovery of a cultural heritage place and/or object must be reported, as soon as practicable, to the relevant regulatory authority(ies), unless this information is believed to be known by the regulatory authority(ies). If it is reasonably likely that the place and/or object found is of indigenous origin, the AGL controlled site must also notify and consult with the relevant indigenous community(ies) or representative(s).
9.8.1.10	If human remains are found in an AGL controlled site, personnel must: • Immediately stop any works being carried-out within the area where the human remains have been discovered;

	• Report discovery to the Police, as soon as practicable, and to the relevant regulatory authority(ies) if required; and • If it is reasonably likely that the human remains found are of indigenous origin, the AGL controlled site must also notify and consult with the relevant indigenous community(ies) or representative(s).

Whenever cultural heritage places and/or objects are discovered unexpectedly during land disturbance/vegetation clearing works at an AGL controlled site, reasonable and practical measures should be taken to secure the area (e.g. buffer zones or temporary barriers). No further land disturbance/vegetation clearing is to occur until an assessment of the area is carried-out by a cultural heritage expert. Subsequent actions to be taken by the AGL controlled site will be determined in consultation with the relevant regulatory authority(ies), and the indigenous community(ies) or representative(s) if the place and/or object is of indigenous origin, taking into consideration the results of the cultural heritage survey or assessment.

When reporting the discovery of a cultural heritage place, human remains and/or object, the information should be provided to the regulatory authority(ies) in the prescribed form and format. Information requested generally includes the location of the place/where the place, object and/or human remains was found, the description and photograph(s) of the place/object/human remains.

AGL controlled sites may need to apply for a permit or authorisation in order to recover a cultural heritage object from the location where it was found. Conditions prescribed in the permits or authorisation are to be adhered to. Furthermore, the regulatory authority may request the AGL controlled site to:

- Take immediate necessary actions to protect or preserve the place, object and/or human remains (e.g. buffer zones or temporary barriers); or
- Inspect the object discovered and, by agreement with the AGL controlled site, take any action deemed necessary to conserve, study or investigate the object. Furthermore, the regulatory authority may decide that the AGL controlled site will need to surrender the object, which will then be delivered to a specific person or body that has the facilities and expertise to conserve the object.

Indigenous Cultural Heritage

RCM Ref	Minimum Control
9.8.1.11	Whenever required, an AGL controlled site must engage and consult with the relevant indigenous community(ies) or representative(s), when required to: • Identify, assess and manage potential impacts on known indigenous cultural heritage; • Identify, assess and manage unexpected indigenous cultural heritage finds; • Monitor activities and/or works that may impact on indigenous cultural heritage; • Repair any damage caused to indigenous cultural heritage; • Develop and/or communicate indigenous cultural heritage information to personnel and contractors at the AGL controlled site.
9.8.1.12	Indigenous cultural heritage knowledge or other information that is of sacred or secret nature must not be included in reports, registers or databases, unless:

	• Disclosure has been agreed by the relevant indigenous community(ies) or representative(s); or • If required to be notified to the regulatory authority(ies).
9.8.1.13	An AGL controlled site must only possess an indigenous cultural heritage object if: • Allowed by an authorisation, permit, cultural heritage agreement or approved Cultural Heritage Management Plan (CHMP); • It has the consent of the owner; or • Necessary in case of an emergency (e.g. bushfire or other natural disaster).

Engagement and consultation with indigenous community(ies) or representative(s) is to be conducted in alignment with applicable regulatory requirements (e.g. indigenous community consultation process for permit application) and AGL policies. Furthermore, engagement and consultation with indigenous community(ies) or representative(s) should foster participation and provide the opportunity for their input in the decision-making process regarding the management of affected indigenous cultural heritage (i.e. actions required for avoiding and minimising harm from operations and protection and conservation of indigenous places and/or objects).

AGL controlled sites should consult with indigenous community(ies) or representative(s) on matters of cultural heritage significance, as required, throughout the life of the asset/project.

Cultural Heritage Management Plan (Indigenous – Victoria & Queensland)

RCM Ref	Minimum Control
9.8.1.14	AGL controlled sites must verify whether a Cultural Heritage Management Plan (CHMP) is to be developed and approved for the proposed activity. If a CHMP is not required, an AGL controlled site may decide to prepare a CHMP on a voluntary basis.
9.8.1.15	An AGL controlled site intending to develop a CHMP must: • Notify the relevant stakeholders before starting to prepare the plan; • Consult and negotiate with relevant stakeholders during the preparation of the plan; and • Get approval for the plan from each of the relevant stakeholders.
9.8.1.16	A CHMP must be developed in accordance with prescribed regulatory requirements and guidelines, whenever applicable.
9.8.1.17	AGL controlled sites must engage a competent and experienced cultural heritage expert, and other professionals (e.g. land surveyor or civil engineer) if required, to assist in the preparation of a CHMP.

AGL controlled sites located in Victoria and Queensland need to establish if the nature of the proposed activity (and its potential impacts on land) and/or cultural heritage significance of the area (also taking into consideration area's level of land disturbance) trigger the need to develop a Cultural Heritage Management Plan (CHMP). Generally, a CHMP is required if:

- Prescribed by relevant legislation for the proposed activity;
- Directed by a relevant regulatory authority; or

- An Environmental Impact Statement or any other environmental assessment is required for the activity.

If a CHMP is not required (e.g. exempt activity), the AGL controlled sites may still need to justify to the regulatory authority(ies) how they meet the exemption(s) from the requirement to prepare a CHMP. A cultural heritage expert may be engaged by the AGL controlled site to assist in the development of the required documentation.

AGL controlled sites need to consult the applicable legislation to determine the prescribed format and content requirements, and/or statutory process for the CHMP. Furthermore, AGL controlled sites are to engage a cultural heritage expert to assist in preparation of a CHMP, including working with the indigenous community(ies) or representative(s) to identify and assess cultural heritage values in relation to the proposed activity.

The process of preparation of a CHMP consists of two main stages:

- Conducting a cultural heritage assessment of the area of the proposed activity, to determine the nature of any cultural heritage present in the area. The level of assessment required for the proposed activity will need to be determined by the AGL controlled site, taking into consideration regulatory requirements. As a minimum, the assessment should encompass a desktop study and if required more comprehensive assessments may need to be carried-out (e.g. involving consultation, field survey and/or excavation). If required, the AGL controlled site needs to consult with the land owner and/or occupier about obtaining access to the land prior to conducting the more comprehensive assessments; and
- Producing a written report, which includes:
    - A statement addressing why the plan was developed. In addition, if the CHMP is prescribed by relevant legislation, the statement will also explain the reason why the legislation requires the plan;
    - The results of the cultural heritage assessment; and
    - The proposed measures to manage potential impacts and minimise harm to cultural heritage in the area, before, during and after the activity, including contingency plans (e.g. for managing cultural heritage uncovered during works).

Prior to developing a CHMP, the AGL controlled site is required to identify and notify relevant stakeholders of the intent to prepare a CHMP. A written notice, developed in accordance with regulatory requirements, is to be given to each of the following stakeholders:

- Regulatory authority(ies);
- Relevant indigenous community(ies) or representative(s); and
- Land owner(s) and/or occupier(s) of the land to which the plan relates, if required.

If indigenous communities or representative(s) fail to respond to the notice or decline to participate in the evaluation of the plan, or if there is no indigenous community or representative(s) for the land to which the plan relates, the AGL controlled site will need to refer to the applicable legislation to determine on how to proceed. The regulatory authority may request the AGL controlled site to advise, if an indigenous community/representative have failed to respond to the notice or declined to participate in the evaluation of the plan.

Each indigenous community/representative that responds positively to the notice will participate in the evaluation of the CHMP. The AGL controlled site should make reasonable efforts to engage indigenous community(ies) or representative(s) in the process of preparation of the CHMP, in particular during:

- The assessment of the area, to determine the nature of cultural heritage present; and
- The development of proposed management measures. The AGL controlled site needs to get agreement from the indigenous community(ies) or representative(s) on these measures.

Adequate consultation and negotiation should occur with each of the stakeholders in the development of the AGL controlled site's CHMP, so that the proposed management measures result in effective protection and conservation of the identified cultural heritage.

After being approved by each of the engaged indigenous community(ies) or representative(s), the CHMP is to be submitted to the relevant regulatory authority(ies).

Incidents and Emergencies

RCM Ref	Minimum Control
9.8.1.18	Incidents and emergencies resulting in significant impacts on cultural heritage must be reported to the regulatory authority, in accordance with the notification requirements established by applicable legislation.
9.8.1.19	Incidents resulting in potential or actual impacts to cultural heritage must be investigated and reported using the AGL Incident Management System.

Incidents at AGL controlled sites that result in impacts to cultural heritage need to be reported as per the HSE Incident, Near Miss and Hazard Management Procedure (AGL-HSE-PRO-012.1).

Training and Competence

RCM Ref	Minimum Control
9.8.1.20	Cultural heritage maintenance and repair works, and the recovery of cultural heritage objects and/or human remains, must be carried out by a competent and experienced cultural heritage expert and if required, assisted by other suitably qualified professionals.
9.8.1.21	AGL controlled sites must provide Health, Safety and Environment (HSE) and other relevant training to the indigenous community representative(s), who have been nominated to monitor specific activities and/or works on-site.

Cultural heritage experts, and other professionals, engaged by AGL controlled sites to conduct cultural heritage related works are experienced and competent to conduct the work safely.

Personnel whose work may impact on cultural heritage, as identified by the AGL controlled site, should be competent to perform the tasks to which they are assigned. Personnel need to be fully aware of their responsibilities to protect cultural heritage within their operational area. Specific training needs for individuals and teams should be determined through the implemented training and competency system, developed in alignment with the Training and Competency Methodology (AGL-HSE-SDM-013).

Definitions

Term	Definition
AGL Controlled Site	An AGL owned operated or controlled site, including a field operational site or an office site.
Competent	Competent refers to a person that has acquired the necessary knowledge and has the skills and ability to safely carry-out the designated task.
Conservation	Conservation refers to actions taken in order to retain the cultural heritage significance of place and/or object. It may include: maintenance, preservation, restoration, stabilisation, reconstruction, adaptation or sustainable use of a cultural heritage place and/ or object.
Cultural Heritage (Indigenous & Non-Indigenous)	Cultural heritage refers to forms of cultural heritage of significance to both indigenous and non-indigenous people. Indigenous cultural heritage comprises of places and/or objects of significance to indigenous people due to: • Their tradition (i.e. the body of traditions, observances, customs and beliefs); and/or • The history (including contemporary history) of an indigenous community(ies) for an area. An area does not necessarily have to contain markings or other physical evidence indicating indigenous occupation to be considered an indigenous cultural heritage place. Non-indigenous cultural heritage refers to places and/or objects associated with non-indigenous people's (e.g. European) visitation, exploration and settlement activities.
Cultural Heritage Agreement/ Covenant	Cultural heritage agreement/covenant is an agreement made between two or more people regarding the protection and/or management of cultural heritage. The agreement attaches to the land and is binding to the owner of that land.
Cultural Heritage Expert	A cultural heritage expert is either: • A relevant indigenous community member or representative; or • An appropriately qualified person in a discipline directly relevant to the assessment (such as anthropology, archaeology or history); or • Another person who has particular knowledge or experience making the person suitable for engagement as a cultural heritage expert.

Term	Definition
Cultural Heritage Assessment Report	A cultural heritage assessment report presents the outcome of a cultural heritage assessment. It covers the following matters: • The cultural heritage place(s) and/or object(s) identified; • The actual or likely harm to cultural heritage from the proposed activities and/or works; • The practical measures that may be taken to protect and conserve cultural heritage; • The practical measures that may be taken to avoid or mitigate any actual or likely harm to cultural heritage. The report is also to include, if required, information on the process to engage and consult with indigenous community(ies) or representative(s).
Cultural Heritage Management Plan (CHMP)	A Cultural Heritage Management Plan is a document that outlines the potential impacts of an activity on the cultural heritage present within the designated area, and the proposed management measures to prevent and minimise those impacts.
HSE	Health, Safety and Environment.
Indigenous	Indigenous refers to people and their descendants, characteristic of a particular region or country, with a distinct social and cultural background that developed prior to exposure to civilisations associated with Western culture. Indigenous people of Australia are known as Aboriginals and includes Torres Strait Islanders.
Land Disturbance	Land disturbance refers to a change in the land surface, as a result of clearing, grading or excavation works. These works can be carried out manually and/or by use of machinery.
Leader	Any employee who has others reporting to him or her, or who has the authority to allocate resources.
Listed Cultural Heritage	Listed cultural heritage refers to indigenous and non-indigenous places and/or objects of cultural heritage significance, which have been included in lists, registers, databases and inventories – at world, national, state and local levels - in order to be protected and conserved. Land within a certain distance (AGL controlled sites need to refer to applicable legislation) of a listed cultural heritage place and/or object is still considered of cultural heritage significance, unless that land has been subject to significant land disturbance. Examples of places in Australia that have been listed include: • World cultural heritage value: Kakadu National Park (Northern Territory), the Great Barrier Reef (Queensland) and the Royal Exhibition Building and Carlton Gardens (Victoria);

Term	Definition
	• National cultural heritage value: Brewarrina Aboriginal Fish Traps (New South Wales), Australian War Memorial and Anzac Parade (Australian Capital Territory) and the Stirling Range National Park (Western Australia).
Object (Indigenous & Non-Indigenous)	Indigenous objects refer to any deposit, object or material evidence related to the indigenous people's occupation of an area, whether or not the objects existed prior to the occupation of that area by non-indigenous people. Examples of indigenous objects include rock art (paintings and engravings), carvings, arrangement of stones, middens or other object made or created by indigenous people or their descendants. Non-indigenous objects include for example: historic or rare books and manuscripts, modern or historic religious artefacts, historic costumes, jewellery and textiles.
Place (Indigenous & Non-Indigenous)	Indigenous places refer to any area that bear signs of the activities of indigenous people or their descendants, including: • An area of land, including land used for the purposes of a burial-ground or cemetery; • An expanse of water; • A natural feature, formation or landscape; • A building or structure. Non-indigenous places refer to any areas that bear signs of habitation by non-indigenous people or their descendants. Examples of non-indigenous places include historic structures including groups of buildings, structures and open spaces constituting non-indigenous settlements.
Vegetation Clearing	Vegetation clearing refers to the removal, destruction in any way or cutting down of a tree, shrub or other plant on the land.

4. Approval conditions and comments

4.1. PL446

<table>
<tr><th>Condition ID</th><th>Requirement</th><th>Actions and comments</th></tr>
<tr><td colspan="3">Schedule E - Land</td></tr>
<tr><td>E10</td><td>The holder of this environmental authority must ensure that the petroleum activity(ies) is only conducted in accordance with Schedule E: Table 1 - Environmentally Sensitive Areas (ESAs) below for each of the ESA categories and associated primary and secondary protection zones.
Schedule E: Table 1 - Environmentally Sensitive Areas (ESAs)
<table>
<tr><th>ESA Category</th><th>Within the ESA</th><th>Primary protection zone of the ESA</th><th>Secondary protection zone of the ESA</th></tr>
<tr><td>All Category A ESAs</td><td>No petroleum activities permitted</td><td>No petroleum activities permitted</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category B ESAs excluding 'Endangered' regional ecosystems</td><td>No petroleum activities permitted</td><td>No petroleum activities permitted</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category B ESAs: 'Endangered' regional ecosystems</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category C ESAs excluding 'Of Concern' regional ecosystems, State Forests and Timber Reserves</td><td>No petroleum activities permitted</td><td>No petroleum activities permitted</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
<tr><td>Category C ESAs: State Forests, Timber Reserves and 'Of Concern' regional ecosystems</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E12, E13 E14, E15 and E16</td><td>Limited petroleum activities permitted subject to E11 and E12</td></tr>
</table></td><td>AGLs management of change process ensures that a full risk assessment is carried out for proposed projects. This includes a full suite of desktop and field controls including: online mapping searches, ground truthing, pre-clearing inspections.</td></tr>
<tr><td>E11</td><td>Limited petroleum activities carried out in the secondary protection zone in accordance with condition (E 10) must be preferentially located in pre-existing areas of clearing or significant disturbance to the greatest practicable extent and avoid the clearing of mature trees.</td><td>See above.</td></tr>
<tr><td>E12</td><td>Limited petroleum activities carried out in the secondary protection zone in accordance with condition (E10) must be preferentially located in pre-existing areas of clearing or significant disturbance to the greatest practicable extent and avoid the clearing of mature trees.</td><td>See above.</td></tr>
</table>

E13	Where limited petroleum activities are proposed to be undertaken within the primary protection zone of, or in the Category B and C Environmentally Sensitive Area as authorised in Condition (E10), the holder of this environmental authority must be able to demonstrate that no reasonable or practicable alternative exists and that disturbance to land only be located and carried out in areas according to the following order of preference: a) pre-existing cleared areas or significantly disturbed land within the primary protection zone of a Category C Environmentally Sensitive Area b) pre-existing cleared areas or significantly disturbed land within the primary protection zone of a Category B Environmentally Sensitive Area c) undisturbed areas within the primary protection zone of a Category C Environmentally Sensitive Area d) undisturbed areas within the primary protection zone of a Category B Environmentally Sensitive Area e) pre-existing areas of significant disturbance within a Category C Environmentally Sensitive Area (e.g. areas where significant clearing or thinning has been undertaken within a Regional Ecosystem, and/or areas containing high densities of weed or pest species which has inhibited re-colonisation of native regrowth) f) pre-existing areas of significant disturbance within a Category B Environmentally Sensitive Area (e.g. areas where significant clearing or thinning has been undertaken within a Regional Ecosystem and/or areas containing high densities of weed or pest species which has inhibited re-colonisation of native regrowth) g) areas where clearing of a Category C Environmentally Sensitive Area is unavoidable; and h) areas where clearing of a Category B Environmentally Sensitive Area is unavoidable.	See above.
E14	Notwithstanding Conditions (E10) and (E13), where limited petroleum activities are proposed to be undertaken within the primary protection zone of, or in a Category B or C Environmentally Sensitive Area, any vegetation clearing must not exceed any of the following areas: a) for the life of the project and before any activity commences, if the disturbance relates to an Endangered or Of Concern Regional Ecosystem, 10% of the remnant unit of Endangered or Of Concern Regional Ecosystem as ground truthed and mapped as per Conditions (E2) and (E3) of this environmental authority; and b) more than 30m2 for the construction of a sump; or c) more than 6m in width for tracks; or d) more than 12m in width for flow pipeline construction purposes.	See above.
E15	For each well site within the primary protection zone of, or in a Category B or C Environmentally Sensitive Area specified in condition (E10), all reasonable and practical measures must be taken to minimize the area cleared which must include but not be limited to, for each well site, ranked constraints mapping and a risk assessment which considers safety and environmental impacts.	See above.
E16	Details of any significant disturbance to land undertaken within the primary protection zone of, or in a Category B or C Environmentally Sensitive Area, along with a record of the assessment required by conditions (E2) and (E3) must be kept and submitted to the administering authority with each annual return.	See above.

4.2. PFL27

Condition ID	Requirement	Actions and comments
No conditions additional to the Land Sub Plan. The site is heavily disturbed and was inspected by a representative of the Mandandanji People in 2019, with full clearance obtained.		

4.3. PL192

Condition ID	Requirement	Actions and comments
Schedule G – Land		
G4	The location of the petroleum activities must be selected in accordance with the following site planning principles: a) maximise the use of areas of pre-existing disturbance b) in order of preference, avoid, minimise or mitigate any impacts, including cumulative impacts, on areas of native vegetation or other areas of ecological value c) minimise disturbance to land that may otherwise result in land degradation d) in order of preference, avoid then minimise isolation, fragmentation, edge effects or dissection of tracts of native vegetation; and e) in order of preference, avoid then minimise clearing of native mature trees.	AGLs management of change process ensures that a full risk assessment is carried out for proposed projects. This includes a full suite of desktop and field controls including: online mapping searches, ground truthing, pre-clearing inspections.
G5	Linear infrastructure construction corridors must: a) maximise co-location b) be minimised in width to the greatest practicable extent; and c) for linear infrastructure that is an essential petroleum activity authorised in an environmentally sensitive area or its protection zone, be no greater than 40m in total width.	See above.
G6	Where petroleum activities are to be carried out in environmentally sensitive areas or their protection zones, the petroleum activities must be carried out in accordance with Protection of Biodiversity Values, Table 1 - Authorised Petroleum Activities in Environmentally Sensitive Areas and their protection zones. **Protection of Biodiversity Values, Table 1 - Authorised petroleum activities in Environmentally Sensitive Areas and their protection zones**	See above.

G7	Despite condition (G6) of this environmental authority, the infrastructure (and associated activities necessary for construction, operational and m intenance purposes) within Schedule G: Table 2 - Authorised Petroleum Activity(ies) Disturbance are permitted within a Category B ESA that is Endangered Regional Ecosystem at the location specified. **Schedule G: Table 2 - Authorised Petroleum Activity(ies) Disturbance**	See above.

Environmentally sensitive area	Within the environmentally sensitive area	Primary protection zone of the environmentally sensitive area	Secondary protection zone of the environmentally sensitive area
Category A environmentally sensitive areas	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are other than 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.
Category C environmentally sensitive areas that are 'nature refuges' or 'koala habitat'	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	
Category C environmentally sensitive areas that are 'essential habitat', 'essential regrowth habitat', or 'of concern' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'regional parks' (previously known as 'resources reserves')	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'state forests' or 'timber reserves'	Only essential petroleum activities permitted.	Petroleum activities permitted.	
Areas of vegetation that are 'critically limited'	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	

<table>
<tr><td></td><td>
<table>
<tr><th>Tenure</th><th>Description of Infrastructure</th><th>Number</th><th>Location</th></tr>
<tr><td rowspan="4">PL192</td><td>Churchie 1 Well Site</td><td>1</td><td>Lat – 27^0 05' 53.448" S
Long – 149^0 12' 55.3357" E</td></tr>
<tr><td>Churchie 1A Well Site</td><td>1</td><td>Lat – 27^0 05' 40.1407" S
Long – 149^0 12' 53.7600" E</td></tr>
<tr><td>Churchie 2 Well Site</td><td>1</td><td>Lat – 27^0 06' 07.7582" S
Long – 149^0 12' 12.2389" E</td></tr>
<tr><td>Churchie 4 Well Site</td><td>1</td><td>Lat – 27^0 05' 15.1476" S
Long – 149^0 12' 32.3397" E</td></tr>
</table>
</td><td></td></tr>
<tr><td>G8</td><td>A report must be prepared for each annual return period for all petroleum activities that involved clearing of any environmentally sensitive area or protection zone which includes:
a) Records able to demonstrate compliance with condition (G4), (G5) and (G6)
b) a description of the works
c) a description of the area and its pre-disturbance values (which may include maps or photographs, but must include GPS coordinate_s for the works); and
d) based on the extent of environmentally sensitive areas and primary protection zones on the relevant resource authority(ies), the proportion of native vegetation cleared per environmentally sensitive area and primary protection zone, including regional ecosystem type, over the annual return period.</td><td>AGLs Environment Business Partner prepares these records for submission with the annual return.</td></tr>
</table>

4.4. PL213

Condition ID	Requirement	Actions and comments
Standard environmental conditions		
4	The holder of the environmental authority must ensure that petroleum activities: a) are not conducted within a category A or B environmentally sensitive area; and b) do not cause a significant disturbance within 1 km of a category A environmentally sensitive area or within 500m of a category B environmentally sensitive area; c) are not conducted in a category C environmentally sensitive area unless there is a written agreement to enter the area from the relevant administering authority. d) Notwithstanding, condition 4(a) and 4(b), the proposed well within graticular block CHAR2727F and petroleum activities carried out within the 500m buffer zone to any Endangered Regional Ecosystem (ERE), but not within 50m of any ERE, must be in accordance with the scale and intensity of activities outlined below: i. the drill site must not disturb an area greater than 10,000m^2; ii. the flare pit size must not be greater than 10m^2; iii. the mud pit size must not be greater than 600m^2; iv. topsoil stripping must be limited to the sump and flare pit area v. clearing of mature trees must be prevented or minimised during drill site construction; vi. existing access and fence line tracks must be used where possible and any new tracks must be constructed by linking natural clearings where possible; and vii. track construction involving blade clearing of established ground cover vegetation and/or clearing of mature trees must be prevented or minimised.	AGLs management of change process ensures that a full risk assessment is carried out for proposed projects. This includes a full suite of desktop and field controls including: online mapping searches, ground truthing, pre-clearing inspections.

4.5. PL 15

Condition ID	Requirement	Actions and comments
No specific conditions relating to Cultural Heritage.		

4.6. PLs 48, 49, 66, 202

Condition ID	Requirement	Actions and comments
No specific conditions relating to Cultural Heritage.		

4.7. PPL 4

Condition ID	Requirement	Actions and comments
Schedule D – Land		
D2	Prior to conducting petroleum activities that involve significant disturbance to land, an assessment must be undertaken of the condition, type and ecological value of soils and vegetation in such areas where the activity is proposed to take place.	AGLs management of change process ensures that a full risk assessment is carried out for proposed projects. This includes a full suite of desktop and field controls including: online mapping searches, ground truthing, pre-clearing inspections.
D3	The assessment required by condition (D2) must be undertaken by a suitably qualified person and include the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas, wetlands and the presence of species classed as endangered, vulnerable, rare or near threatened under the Nature Conservation Act 1992.	AGLs Environment Business Partner is responsible for conducting the desktop assessments and ground truthing, as part of the planning process.

4.8. PPL 87 and 93

Condition ID	Requirement	Actions and comments
Schedule G – Cultural Heritage		
G1	The holder of the environmental authority must take all reasonable and practicable measures to avoid impacting upon places of known or potential cultural heritage significance whilst carrying out petroleum activities.	AGLs management of change process ensures that a full risk assessment is carried out for proposed projects. This includes a full suite of desktop and

		field controls including: online mapping searches, ground truthing, pre-clearing inspections.
H1	Notwithstanding any other condition of this authority, the holder of this authority must ensure that: a) petroleum activities are not conducted within a Category A or Category B environmentally sensitive area; b) petroleum activities do not cause a significant disturbance within 1km of a Category A environmentally sensitive area or within 500m of a Category B environmentally sensitive area; and c) petroleum activities are not conducted in a Category C environmentally sensitive area	See above.

4.9. ATP1190

Condition ID	Requirement	Actions and comments
Schedule B – Protecting environmental values		
PESCB5	Prior to carrying out petroleum activities, the location of petroleum activities must be selected to: a) firstly avoid, then minimise, then mitigate any negative impacts on areas of vegetation or other areas of ecological value b) minimise disturbance to land that may otherwise result in land degradation c) minimise isolation, fragmentation or dissection of tracts of vegetation that would lead to a reduction in the current level of ecosystem functioning or ecological connectivity d) minimise clearing of mature or hollow bearing trees.	AGL has not established any new activities on ATP1190 in recent years. AGLs management of change process ensures that a full risk assessment is carried out for proposed projects. This includes a full suite of desktop and field controls including: online mapping searches, ground truthing, pre-clearing inspections.
PESCB6	Records must be kept demonstrating compliance with standard condition (PESCB 5)	AGL maintains all records on its electronic servers for an indefinite period.
PESCB7	Prior to any significant disturbance to land: a) an ecological assessment of areas with native vegetation that are to be significantly disturbed, must be conducted in accordance with the Queensland Government's *Biocondition, a Condition Assessment Framework for Terrestrial Biodiversity in Queensland, Assessment Manual*; and b) an assessment of the impacts that will occur as a result of significant disturbance to land must be undertaken.	See above.

Silver Springs Project

GREENHOUSE GAS MANAGEMENT SUB-PLAN

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Document revision history

Date	Version	Author	Comments
May 2020	R0	John Moraitis	Updated for AGL HSEMS
June 2022	R1	John Moraitis	Review and update

1. Introduction

This Greenhouse Gas Emissions Sub Plan was prepared as part of the Environment Management Plan (EMP) for AGL's Silver Springs Gas Project ("the project").

This Plan was developed to specifically address and manage potential greenhouse gas issues for the project and is based on the previously prepared and approved Environment Health and Safety Management Plans. This Plan conforms with the Greenhouse Gas Emissions Standard (ALG-HSE-STD-009.9) as stipulated in the AGL Health, Safety and Environment Management System (HSEMS).

1.1. Objectives

The purpose of this Plan is to provide guidance on how to achieve the minimum controls established by the Greenhouse Gas (GHG) Emissions Standard (AGL-HSE-STD-009.9). The intent of the GHG Emissions Standard is to ensure that AGL controlled operations (i.e. both AGL controlled sites and non-AGL controlled sites) comply with GHG emissions and energy data/information requests made by AGL Economic Policy and Sustainability team in accordance with the AGL Energy and GHG Manual.

1.2. Responsibilities

The roles and responsibilities for the development, implementation and review of this Plan are summarised below. These are consistent with the AGL Greenhouse Gas Emissions Methodology (AGL-HSE-SDM-009.9).

1.2.1. General Manager, HSE

The General Manager HSE is responsible for:

- Delegating authority to ensure adequate implementation of the GHG Emissions Standard; and
- Ensuring adequate resources are available for the implementation and enforcement of the GHG Emissions Standard.

1.2.2. Head of Function

The Head of Function is responsible for:

- Ensuring the implementation and adherence to the GHG Emissions Standard by the Business Unit;
- Ensuring adequate resources are available for the implementation and enforcement of the GHG Emissions Standard; and
- Ensuring AGL procedures and processes for reporting of GHG emissions and energy are followed.

1.2.3. Senior Manager, Environment Operations

The Senior Manager, Environment Operations is responsible for:

- Managing the development, implementation and maintenance of the GHG Emissions Standard;
- Ensuring consultation in the development, review and approval of the GHG Emissions Standard; and
- Overseeing audits and assurance activities to ensure compliance with the GHG Emissions Standard and applicable regulatory requirements.

1.2.4. Environment Business Partner

The Environment Business Partner and/or Health, Safety and Environment (HSE) Business Partner are responsible for:

- Monitoring and providing support in the implementation of GHG emissions and energy reporting procedures and processes at site level; and
- Undertaking audit and assurance activities, to ensure compliance with the GHG Emissions Standard and applicable regulatory requirements and developing and tracking corrective action management plans.

1.2.5. AGL Economic Policy and Sustainability Team

The AGL Economic Policy and Sustainability Team is responsible for:

- maintaining the AGL Energy and GHG Manual, which documents the process for complying with the NGER legislative framework, including the process for collecting relevant information from sites.

2. Legal obligations

2.1. Key legislative requirements

The key regulatory requirements relating to air quality are detailed below.

2.1.1. National Greenhouse and Energy Reporting Act 2007

- Section 12: Obligation to apply to register
- Section 13: Thresholds
- Section 14: Applying to register in relation to a greenhouse gas project
- Section 15: Requirements for applications
- Section 17: Registration of corporations
- Section 19: Report to be given to Greenhouse and Energy Data Officer
- Section 21: Reports relating to greenhouse gas projects
- Section 22: Records to be kept
- Part 5: Enforcement (Civil penalties, orders, enforceable undertakings)

2.1.2. National Greenhouse and Energy Reporting Regulation 2008

- Division 4.4: Reporting Scope 1, Scope 2 emissions, energy production and energy consumption
- Section 4A.01: Duty to ensure excess emissions situation does not exist
- Part 5: Disclosure of information
- Schedule 1A: Things that are not natural gas supply pipelines
- Schedule 1: Fuels and other energy commodities
- Schedule 3: Scope 1 emissions from particular sources

2.1.3. NPI National Environment Protection Measure

In November 2008, the NEPM was varied to exclude greenhouse gas emissions that were already covered by the *National Greenhouse and Energy Reporting Act 2007.* AGL still reports relevant data to the National Pollutant Inventory to help track Australia's air emissions.

2.2. AGL licences

The environmental licences held for each lease are shown in the table below, as issued by the Queensland Department of Environment and Science.

Petroleum lease	Environmental licence no.	Issue date	Anniversary date (each year)
PL446	EPPG00784013	29 September 2016	24 May
PFL27	EPPG01233113	22 December 2017	Not listed on EA
PL192	EPPG00770313	23 July 2014	10 August
PL213	EPPG00304213	7 July 2016	23 January
PL 15	EPPG00770613	1 April 2022	15 August
PLs 48, 49, 66, 202	P-EA-100227919	1 April 2022	15 August
PPL 4	PEN202330511	22 June 2011	22 June
PPL 87, 93	EPPG00370113	3 February 2015	29 April
ATP1190	EPSX02909615	16 February 2015	Not listed on EA

2.3. Approval conditions

The approval conditions do not specifically include requirements for reporting under the N*ational Greenhouse and Energy Reporting Act 2007,* because the approvals are issued specifically under the *Environmental Protection Act 1994*.

3. Reporting obligations and controls

3.1. Data capture and collation

AGL has control measures in place to ensure that data reporting takes place in accordance with commitments made under the legislation and AGLs HSEMS.

These control measures include:

- Raw data is collected and collated by site personnel for the Project, and stored in electronic files located in SharePoint or network drives
- Raw data is evaluated by Environment Business Partner and included into a reporting document
- Report is forwarded to an external auditor for review
- Environment Business Partner validates the reviewed data and uploads the reports to the National Pollutant Inventory website
- Environment Business Partner and external auditor process any required clarifications from the National Pollutant Inventory.

3.2. Reported parameters

AGL prepares two separate reports for the Silver Springs Project. One report covers the Silver Springs facility and the gas fields, and the other covers the Wallumbilla LPG Plant. The data reported by AGL for the two project areas is as follows:

- Cleaner production activities
- Installation of pollution control equipment
- Production statistics
    - Produced water throughput
    - Gas throughput
    - Oil throughput
    - Truck loading of oil
- Gas flared
- Point source – gas consumption
    - Flare Pilot Gas
    - H-706 TEG Reboiler
    - CM400A compressor
    - H-167 TEG Reboiler
    - H-405 fuel gas
    - Flare purge gas
    - H-706 stripping gas

    - Pit flare
    - CM200A Ajax compressor
    - CM200B Ajax compressor
    - CM200C Ajax compressor
    - Gas generator #1
    - Gas generator #2
- Point source – oil consumption
    - Diesel tank throughput
- Fuel tank throughput
    - Diesel tanks
    - ULP tanks

3.3. HSEMS minimum controls

The following minimum controls are taken from AGLs Greenhouse Gas Emissions Standard (AGL-HSE-STD-009,9) and the Greenhouse Gas Emissions Methodology (AGL-HSE-SDM-009.9).

GHG Emissions and energy reporting

RCM Ref	Minimum Controls
9.9.1.1	AGL controlled operations must collate specific GHG emissions and energy data, and other energy related information, in accordance with the reporting requirements prescribed by the AGL Economic Policy and Sustainability team.
9.9.1.2	Whenever required, relevant AGL controlled operations leaders and/or technical experts must support the AGL Economic Policy and Sustainability team in: • Clarifying site level GHG emissions and/or energy data or energy related information; • Assisting in the development of site specific GHG emissions and energy reporting procedures; and • Assisting with regulatory audits and other adhoc GHG emissions and energy data/information queries.

AGL controlled operations' GHG emissions and energy data, and other energy related information, is to be provided to the AGL Economic Policy and Sustainability team in a timely manner, and in accordance with the established data/information request frequency and reporting timeframes. AGL controlled operations should contact the relevant AGL Economic Policy and Sustainability representative for assistance, whenever required.

GHG emissions and energy data sources - defined by the National Greenhouse and Energy Reporting (NGER) legislative framework - include (but are not limited to) fuel consumption and composition, electricity metering records and invoices. Related energy information includes (but is not limited to) calibration certificates and plant operating statistics. Relevant AGL controlled operations should keep these records, as required.

AGL statutory GHG emissions and energy reporting for sites which are under AGL's "operational control" is carried-out by the AGL Economic Policy and Sustainability team, using the relevant reporting and calculation methodologies prescribed by the NGER legislative framework.

Definitions

Term	Definition
AGL Controlled Operations	AGL controlled operations includes both AGL controlled sites and non-AGL controlled sites.
Greenhouse Gases (GHG) Emissions	Greenhouse gases emissions are gases released into the atmosphere, from natural and human sources, including but not limited to: • Water vapour; • Ozone; • Carbon dioxide (CO_2); • Methane (CH_4); • Nitrous oxide (NO_2); • Sulphur hexafluoride (SF_6); • Hydrofluorocarbons (HFCs); and • Perfluorocarbons (PFCs). For the purpose of statutory GHG emissions reporting, the *National Greenhouse and Energy Reporting Act 2007* defines a specific list of greenhouse gas types that should be included. GHG emissions are measured as tonnes of carbon dioxide equivalence (t CO_2-e).
HSE	Health, Safety and Environment.
Leader	Any employee who has others reporting to him or her, or who has the authority to allocate resources.
National Greenhouse and Energy Reporting (NGER) legislative framework	National Greenhouse and Energy Reporting (NGER) legislative framework establishes the GHG and energy reporting system in Australia. It includes the *National Greenhouse and Energy Reporting Act 2007* and supporting legislative instruments. The NGER Act makes reporting mandatory for businesses whose energy production, energy consumption or GHG emissions meet certain specified thresholds.
Operational Control	Operational control is defined under the NGER legislative framework. This concept is key to determining AGL's obligations under the *National Greenhouse and Energy Reporting Act 2007*.

APPENDIX D EA EPPG00770313 FOR PL192

Permit

Environmental Protection Act 1994

Environmental authority EPPG00770313

This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act 1994.

Environmental authority number: EPPG00770313

Environmental authority takes effect on 19 July 2022.

The anniversary date of this environmental authority is 15 August each year.

Environmental authority holder(s)

Name(s)	**Registered address**
AGL GAS STORAGE PTY LTD	Level 24, 200 George Street, Sydney NSW 2000

Environmentally relevant activity and location details

Environmentally relevant activity/activities	**Location(s)**
Non-Scheduled - Petroleum Activity - Petroleum Lease (PL)	PL192

Additional information for applicants

Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority (EA) is issued is a restatement of the ERA as defined by legislation at the time the EA is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an EA as to the scale, intensity or manner of carrying out an ERA, the conditions prevail to the extent of the inconsistency.

An EA authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the EA specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the *Environmental Protection Act 1994* (EP Act).

Contaminated land

It is a requirement of the EP Act that an owner or occupier of contaminated land give written notice to the administering authority if they become aware of the following:

ABN 46 640 294 485

- the happening of an event involving a hazardous contaminant on the contaminated land (notice must be given within 24 hours); or
- a change in the condition of the contaminated land (notice must be given within 24 hours); or
- a notifiable activity (as defined in Schedule 3) having been carried out, or is being carried out, on the contaminated land (notice must be given within 20 business days)

that is causing, or is reasonably likely to cause, serious or material environmental harm.

For further information, including the form for giving written notice, refer to the Queensland Government website www.qld.gov.au, using the search term 'duty to notify'.

Take effect

Please note that, in accordance with section 200 of the EP Act, an EA has effect:

a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority - on the nominated day; or

b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or

c) otherwise on the day the authority is issued.

However, if the EA is authorising an activity that requires an additional authorisation (a relevant tenure for a resource activity, a development permit under the *Planning Act 2016* or an SDA Approval under the *State Development and Public Works Organisation Act 1971*), this EA will not take effect until the additional authorisation has taken effect.

If this EA takes effect when the additional authorisation takes effect, you must provide the administering authority written notice within 5 business days of receiving notification of the related additional authorisation taking effect.

The anniversary day of this environmental authority is the same day each year as the original take effect date unless you apply to change the anniversary day. The payment of the annual fee will be due each year on this day.

If you have incorrectly claimed that an additional authorisation is not required, carrying out the ERA without the additional authorisation is not legal and could result in your prosecution for providing false or misleading information or operating without a valid environmental authority.

Signature

19 July 2022

Date

Rachel Copp
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Energy and Extractive Resources
GPO Box 2454, BRISBANE QLD 4001
Phone: (07) 3330 5715
Email: EnergyandExtractive@des.qld.gov.au

Privacy statement

Pursuant to section 540 of the EP Act, the Department is required to maintain a register of certain documents and information authorised under the EP Act. A copy of this document will be kept on the public register. The register is available for inspection by members of the public who are able take extracts, or copies of the documents from the register. Documents that are required to be kept on the register are published in their entirety, unless alteration is required by the EP Act. There is no general discretion allowing the Department to withhold documents or information required to be kept on the public register. For more information on the Department's public register, search 'public register' at www.qld.gov.au. For queries about privacy matters please email privacy@des.qld.gov.au or telephone 13 74 68.

Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443)

Other permits required

This permit only provides an approval under the *Environmental Protection Act 1994*. In order to lawfully operate you may also require permits / approvals from your local government authority, other business units within the department and other State Government agencies prior to commencing any activity at the site. For example, this may include permits / approvals with your local Council (for planning approval), the Department of Transport and Main Roads (to access state controlled roads), the Department of Resources (to clear vegetation), and the Department of Agriculture and Fisheries (to clear marine plants or to obtain a quarry material allocation).

Conditions of environmental authority
This environmental authority consists of the following schedules

Schedule A General
Schedule B Air
Schedule C Water
Schedule D Stormwater
Schedule E Dams
Schedule F Land
Schedule G Disturbance to Land
Schedule H Noise
Schedule I Waste
Schedule J Well Construction, Maintenance and Stimulation Activities
Schedule K Monitoring and Reporting
Schedule L Notification Procedures
Schedule M Definitions

SCHEDULE A – GENERAL

Authorised Petroleum Activities

(A1) 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 – Authorised Petroleum Activities* for each petroleum tenure.

Schedule A: Table 1 – Authorised Petroleum Activities

Resource Authority Number	Petroleum Activity	Number of Existing Petroleum activities	Number of Proposed Petroleum activities	Maximum Area and Capacity (where applicable)
PL192	Seismic (kilometres)	1072km	800	160Ha
	Total wells	12	4	4.5Ha
	- Exploration Wells (indicative)	0	0	
	- Appraisal Wells (indicative)	0	0	
	- Development Wells (indicative)	0	0	
	Compressor Stations	1	1	1200m^2
	Regulated dams > 401 megalitres	0	0	
	Regulated dams < 400 megalitres	0	0	
	Low hazard dams	1	1	1360m2 1.2ML
	Water treatment Facilities	0	0	
	Brine Encapsulation Facilities	0	0	
	Sewage Treatment Plants	0	0	

Prevent or Minimise Likelihood of Environmental Harm

(A2) This environmental authority does not authorise environmental harm unless a condition contained in this environmental authority explicitly authorises that harm. Where there is no condition, the lack of a condition shall not be construed as authorising harm.

(A3) Any record required to be kept by a condition of this environmental authority must be kept at the licensed place and be available for examination by an authorised person.

(A4) Copies of any record required to be kept by a condition of this environmental authority must be provided to any authorised person or the administering authority on request.

(A5) A copy of the environmental authority must be kept in a location readily accessible to personnel carrying out the activity.

(A6) All complaints received by the holder of this environmental authority relating to operations at the licensed place must be recorded.

Maintenance of Measures, Plant and Equipment

(A7) The holder of the environmental authority must:

(a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority;
(b) maintain such measures, plant and equipment in their proper and effective condition; and
(c) operate such measures, plant and equipment in a proper and effective manner.

(A8) No change, replacement or alteration of any plant or equipment is permitted if the change, replacement or alteration materially increases, or is likely to increase, the environmental harm caused by the petroleum activity(ies).

Contingency Plan for Emergency Environmental Incidents

(A9) A Contingency Plan for Emergency Environmental Incidents which has been certified by a suitably qualified person must be developed within 3 months of the date of issue of this authority.

(A10) The Contingency Plan for Emergency Environmental Incidents must include, but not necessarily be limited to:

(a) a clear definition of what constitutes an environmental emergency incident or near miss for the petroleum activity(ies) authorised to be carried out under this environmental authority;
(b) identification of the types of environmental incidents that may occur, relevant to the petroleum activity(ies) authorised to be carried out under this environmental authority;
(c) response procedures to be implemented to prevent or minimise the risk of environmental harm arising from environmental incidents or emergency events;
(d) response procedures to minimise the extent and duration of environmental harm caused by environmental incidents or emergency events;
(e) communication procedures and lines of communication within and beyond the organisation to be employed in responding to environmental incidents or emergency events;
(f) the resources to be used in response to environmental incidents or emergency events;
(g) procedures to investigate the cause of any incidents, including releases, and where necessary, the remedial actions to be implemented to reduce the likelihood of recurrence of similar events;
(h) a receiving environment monitoring program, to be specifically implemented in the event of a emergency event or incident to examine / assess environmental impacts;
(i) the provision and availability of documented procedures to staff attending any environmental incidents or emergency events to enable them to effectively respond;
(j) training of staff that will be called upon to respond to environmental incidents or emergency events to enable them to effectively respond;
(k) timely and accurate reporting of the circumstance and nature of environmental incidents or emergency events to the administering authority in accordance with conditions of this environmental authority;
(l) procedures for accessing monitoring locations during environmental incidents or emergency events; and
(m) procedures to notify any potentially affected landholder, occupier and / or their nominated representative.

(A11) The holder of this environmental authority must implement the Contingency Plan for Emergency Environmental Incidents.

SCHEDULE B – AIR

(B1) The release of any dust, particulate, aerosol or odour resulting from the activity must not cause an environmental nuisance at any sensitive place.

SCHEDULE C – WATER

(C1) Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority.

(C2) Produced water is not authorised to be released into the environment.

Authorised impacts to wetlands

(C3) The extraction of groundwater as part of the petroleum activity(ies) from underground aquifers must not directly or indirectly cause environmental harm to a wetland.

Authorised activities in waters

(C4) Petroleum activities must not occur in or within 200m of a:
(a) wetland of high ecological significance
(b) Great Artesian Basin Spring
(c) subterranean cave GDE

(C5) Only construction or maintenance of linear infrastructure is permitted in or within any wetland of other environmental value or in a watercourse.

(C6) The construction or maintenance of linear infrastructure in a wetland of other environmental value must not result in the:
(a) clearing of riparian vegetation outside of the minimum area practicable to carry out the works; or
(b) ingress of saline water into freshwater aquifers; or
(c) draining or filling of the wetland beyond the minimum area practicable to carry out the works.

(C7) After the construction or maintenance works for linear infrastructure in a wetland of other environmental value are completed, the linear infrastructure must not:
(a) drain or fill the wetland
(b) prohibit the flow of surface water in or out of the wetland
(c) lower or raise the water table and hydrostatic pressure outside the bounds of natural variability that existed before the activities commenced
(d) result in ongoing negative impacts to water quality
(e) result in bank instability; or
(f) result in fauna ceasing to use adjacent areas for habitat, feeding, roosting or nesting.

(C8) The construction or maintenance of linear infrastructure activities in a watercourse must be conducted in the following preferential order:
(a) firstly, in times where there is no water present
(b) secondly, in times of no flow
(c) thirdly, in times of flow, providing a bankfull situation is not expected and that flow is maintained.

(C9) The construction or maintenance of linear infrastructure authorised under condition (C5) must comply with the water quality limits as specified in **Protecting Water Values, Table 1—Release limits for construction or maintenance of linear infrastructure**.

Protecting Water Values, Table 1—Release limits for construction or maintenance of linear infrastructure

Water Quality Parameters	Units	Water Quality Limits
Turbidity	Nephelometric Turbidity Units (NTU)	For a wetland of other environmental value, if background water turbidity is above 45 NTU, no greater than 25% above background water turbidity measured within a 50 metre radius of the construction or maintenance activity. For a watercourse, if background water turbidity is above 45 NTU, no greater than 25% above background water turbidity measured within 50 meters downstream of the construction or maintenance activity.
		For a wetland of other environmental value, if background water turbidity is equal to, or below 45 NTU, a turbidity limit of no greater than 55 NTU applies, measured within a 50 radius of the construction or maintenance activity. For a watercourse, if background water turbidity is equal to, or below 45 NTU, a turbidity limit of no greater than 55NTU applies, measured within 50 metres downstream of the construction or maintenance activity.
Hydrocarbons	-	For a wetland of other environmental value, or watercourse, no visible sheen or slick

(C10) Monitoring must be undertaken at a frequency that enables compliance with condition (C9).

Register of activities in wetlands and watercourses

(C11) A register must be kept of all linear infrastructure construction and maintenance activities in a wetland of other environmental value and watercourses, which must include:
(a) location of the activity (e.g. GPS coordinates (GDA94) and watercourse name)
(b) estimated flow rate of surface water at the time of the activity
(c) duration of works, and
(d) results of impact monitoring carried out under condition (C10).

Activities in River Improvement Areas

(C12) Measures must be taken to minimise negative impacts to, or reversal of, any river improvement works carried out in River Improvement Areas by Queensland's River Improvement Trusts.

Activities in Floodplains

(C13) Petroleum activity(ies) on floodplains must be carried out in a way that does not:
(a) concentrate flood flows in a way that will or may cause or threaten a negative environmental impact; or
(b) divert flood flows from natural drainage paths and alter flow distribution; or
(c) increase the local duration of floods; or
(d) increase the risk of detaining flood flows.

Seepage monitoring program

(C14) A seepage monitoring program must be developed by a suitably qualified person which is commensurate with the site-specific risks of contaminant seepage from containment facilities, and which requires and plans for detection of any seepage of contaminants to groundwater as a result of storing contaminants by **10 October 2014.**

(C15) The seepage monitoring program required by condition (C14) must include but not necessarily be limited to:
- (a) identification of the containment facilities for which seepage will be monitored
- (b) identification of trigger parameters that are associated with the potential or actual contaminants held in the containment facilities
- (c) identification of trigger concentration levels that are suitable for early detection of contaminant releases at the containment facilities
- (d) installation of background seepage monitoring bores where groundwater quality will not have been affected by the petroleum activities authorised under this environmental authority to use as reference sites for determining impacts
- (e) installation of seepage monitoring bores that:
  - i. are within formations potentially affected by the containment facilities authorised under this environmental authority (i.e. within the potential area of impact)
  - ii. provide for the early detection of negative impacts prior to reaching groundwater dependent ecosystems, landholder's active groundwater bores, or water supply bores
  - iii. provide for the early detection of negative impacts prior to reaching migration pathways to other formations (i.e. faults, areas of unconformities known to connect two or more formations)
- (f) monitoring of groundwater at each background and seepage monitoring bore at least quarterly for the trigger parameters identified in condition (C15(b))
- (g) seepage trigger action response procedures for when trigger parameters and trigger levels identified in conditions (C15(b)) and (C15(c)) trigger the early detection of seepage, or upon becoming aware of any monitoring results that indicate potential groundwater contamination
- (h) a rationale detailing the program conceptualisation including assumptions, determinations, monitoring equipment, sampling methods and data analysis; and
- (i) provides for annual updates to the program for new containment facilities constructed in each annual return period.

Seepage monitoring bore drill logs

(C16) A bore drill log must be completed for each seepage monitoring bore in condition (C15) which must include:
- (a) bore identification reference and geographical coordinate location
- (b) specific construction information including but not limited to depth of bore, depth and length of casing, depth and length of screening and bore sealing details
- (c) standing groundwater level and water quality parameters including physical parameter and results of laboratory analysis for the possible trigger parameters
- (d) lithological data, preferably a stratigraphic interpretation to identify the important features including the identification of any aquifers; and
- (e) target formation of the bore.

(C17) The method of water sampling required by this environmental authority must comply with that set out in the most recent version of the Department of Environment and Resource Management's "Monitoring and Sampling Manual 2009 – Environmental Protection (Water) Policy 2009 Version 2 September 2010".

(C18) All laboratory analyses and tests required to be conducted under this environmental authority must be carried out by a laboratory that has NATA accreditation for such analyses and tests, except as otherwise authorised by the administering authority.

Erosion and Sediment Control

(C19) For activities involving significant disturbance to land, control measures that are commensurate to the site-specific risk of erosion, and risk of sediment release to waters must be implemented to:
- (a) allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities
- (b) minimise soil erosion resulting from wind, rain, and flowing water
- (c) minimise the duration that disturbed soils are exposed to the erosive forces of wind, rain, and flowing water
- (d) minimise work-related soil erosion and sediment runoff; and

(e) minimise negative impacts to land or properties adjacent to the activities (including roads).

SCHEDULE D – STORMWATER

(D1) The holder must implement and maintain measures to minimise the likelihood of the release of contaminated stormwater from the place where the activities are carried out to any stormwater drain or any waters.

(D2) The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas from where the resultant contaminants are unlikely to be released into any waters, roadside gutter or stormwater drainage system.

(D3) Any spillage of wastes or contaminants that may cause environmental harm must be effectively contained and/or cleaned up as quickly as practicable.

(D4) Any spillage of wastes or contaminants must not be cleaned up by hosing, or otherwise releasing such waste or contaminants to any stormwater drainage system, roadside gutter or waters.

SCHEDULE E – DAMS

(E1) The dams used for the storage of contaminants must be maintained:
(a) so as to prevent any release of contaminants through the bed or banks of the pond to any waters (including groundwater);
(b) so that a freeboard of not less than 0.5 metres is maintained at all times; and
(c) so as to ensure the stability of the dams' construction.

(E2) Dams must be securely fenced and / or screened to:
(a) exclude and prevent the entrapment of livestock and wildlife; and
(b) limit habitats for the introduction or spread of pests.

Assessment of Hazard Category

(E3) The hazard category of any dam must be assessed by a suitably qualified and experienced person in accordance with the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.

(E4) The hazard assessment required under condition (E2) must occur in any of the following situations:
(a) prior to the design and construction of the dam;
(b) prior to any change in its purpose or its stored contents;
(c) for an existing low hazard dam, within 120 business days of **16 August 2011.**

(E5) All certifications must be in the form set out in the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", as amended from time to time.

(E6) Only low hazard dams are permitted under this authority.

Decommissioning

(E7) The holder of this environmental authority must not abandon any dam but must decommission each dam such that ongoing environmental harm is prevented.

SCHEDULE F — LAND

Preventing Contaminant Release to Land

(F1) Contaminants must not be directly or indirectly released to land except as authorised by condition (C5).

Progressive Rehabilitation for Significantly Disturbed Land

(F2) Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.

(F3) During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.

(F4) Backfilled and rehabilitated pipeline trenches must:
- (a) be a stable landform;
- (b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; and
- (c) be re-profiled to a level consistent with surrounding soils; and
- (d) be re-profiled to original contours and established drainage lines; and
- (e) be visually consistent with the surround land features; and.
- (f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.

(F5) Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of the petroleum activity(ies) must commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity(ies).

(F6) Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must:

- (a) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt);
- (b) reshape all significantly disturbed land to a stable landform;
- (c) reprofile all significantly disturbed land to original contours;
- (d) on all significantly disturbed land:
  - I. re-establish surface drainage lines;
  - II. reinstate the top layer of the soil profile;
  - III. establish groundcover to ensure that erosion is minimised;
  - IV. establish vegetation of floristic species composition found in analogue sites;
- (e) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and / or minimise environmental harm.

SCHEDULE G – DISTURBANCE TO LAND

Confirming biodiversity values

(G1) Prior to undertaking activities that result in significant disturbance to land in areas of native vegetation, confirmation of on-the-ground biodiversity values of the native vegetation communities at that location must be undertaken by a suitably qualified person.

(G2) A suitably qualified person must develop and certify a methodology so that condition (G1) can be complied with and which is appropriate to confirm on-the-ground biodiversity values.

(G3) Where mapped biodiversity values differ from those confirmed under conditions (G1) and (G2), petroleum activities may proceed in accordance with the conditions of the environmental authority based on the confirmed on-the-ground biodiversity value.

Planning for land disturbance

(G4) The location of the petroleum activity(ies) must be selected in accordance with the following site planning principles:

(a) maximise the use of areas of pre-existing disturbance
(b) in order of preference, avoid, minimise or mitigate any impacts, including cumulative impacts, on areas of native vegetation or other areas of ecological value
(c) minimise disturbance to land that may otherwise result in land degradation
(d) in order of preference, avoid then minimise isolation, fragmentation, edge effects or dissection of tracts of native vegetation; and
(e) in order of preference, avoid then minimise clearing of native mature trees.

Planning for land disturbance – linear infrastructure

(G5) Linear infrastructure construction corridors must:

(a) maximise co-location
(b) be minimised in width to the greatest practicable extent; and
(c) for linear infrastructure that is an essential petroleum activity authorised in an environmentally sensitive area or its protection zone, be no greater than 40m in total width.

(G6) Where petroleum activities are to be carried out in environmentally sensitive areas or their protection zones, the petroleum activities must be carried out in accordance with **Protection of Biodiversity Values, Table 1 – Authorised Petroleum Activities in Environmentally Sensitive Areas and their protection zones**.

Protection of Biodiversity Values, Table 1 – Authorised petroleum activities in Environmentally Sensitive Areas and their protection zones

Environmentally sensitive area	**Within the environmentally sensitive area**	**Primary protection zone of the environmentally sensitive area**	**Secondary protection zone of the environmentally sensitive area**
Category A environmentally sensitive areas	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are other than 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.
Category C environmentally sensitive areas that are 'nature refuges' or 'koala habitat'	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	
Category C environmentally sensitive areas that are 'essential habitat', 'essential regrowth habitat', or 'of concern' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'regional parks' (previously known as 'resources reserves')	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'state forests' or 'timber reserves'	Only essential petroleum activities permitted.	Petroleum activities permitted.	
Areas of vegetation that are 'critically limited'	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	

(G7) Despite condition (G6) of this environmental authority, the infrastructure (and associated activities necessary for construction, operational and maintenance purposes) within Schedule G: Table 2 – Authorised Petroleum Activity(ies) Disturbance are permitted within a Category B ESA that is Endangered Regional Ecosystem at the location specified.

Schedule G: Table 2 – Authorised Petroleum Activity(ies) Disturbance

Tenure	Description of Infrastructure	Number	Location
PL192	Churchie 1 Well Site	1	Lat – 27^0 05’ 53.448” S Long – 149^0 12’ 55.3357” E
	Churchie 1A Well Site	1	Lat – 27^0 05’ 40.1407” S Long – 149^0 12’ 53.7600” E
	Churchie 2 Well Site	1	Lat – 27^0 06’ 07.7582” S Long – 149^0 12’ 12.2389” E
	Churchie 4 Well Site	1	Lat – 27^0 05’ 15.1476” S Long – 149^0 12’ 32.3397” E

(G8) A report must be prepared for each annual return period for all petroleum activities that involved clearing of any environmentally sensitive area or protection zone which includes:

(a) Records able to demonstrate compliance with condition (G4), (G5) and (G6)
(b) a description of the works
(c) a description of the area and its pre-disturbance values (which may include maps or photographs, but must include GPS coordinates for the works); and
(d) based on the extent of environmentally sensitive areas and primary protection zones on the relevant resource authority(ies), the proportion of native vegetation cleared per environmentally sensitive area and primary protection zone, including regional ecosystem type, over the annual return period.

Impacts to State significant biodiversity values

(G9) Impacts to State significant biodiversity values are not authorised, except as permitted by condition (G7).

SCHEDULE H – NOISE

(H1) Noise from activities must not cause an environmental nuisance at any noise sensitive place.

(H2) Prior to undertaking petroleum activities that will result in short-term, medium-term or long term noise events that are likely to impact on a sensitive receptor, the holder of this environmental authority must model or calculate any potential noise emissions from the relevant petroleum activity(ies) to ensure that noise emissions will not exceed the noise levels specified in *Schedule G: Table 1 – Noise limits at Sensitive Receptors*.

(H3) The emission of noise from the petroleum activity(ies) authorised under this environmental authority must not result in levels greater than those specified in *Schedule G: Table 1 – Noise limits at Sensitive Receptors* in the event of a valid complaint about noise being made to the administering authority.

Schedule H: Table 1 – Noise Limits at Sensitive Receptors

Time Period	Metric	Short Term Noise Event	Medium Term Noise Event	Long Term Noise Event
7:00 am – 6:00 pm	$L_{Aeq,adj,15\ min}$ Max $L_{pA,\ 15\ mins}$	L_{ABG} + 10 dBA 55 dBA	L_{ABG} + 8 dBA 51 dBA	L_{ABG} + 5 dBA 45 dBA
6:00 pm – 10:00 pm	$L_{Aeq,adj,15\ min}$ Max $L_{pA,\ 15\ mins}$	L_{ABG} + 10 dBA 50 dBA	L_{ABG} + 8 dBA 46 dBA	L_{ABG} + 5 dBA 40 dBA
10:00 pm – 6:00 am	$L_{Aeq,adj,15\ min}$ Max $L_{pA,\ 15\ mins}$	L_{ABG} + 3 dBA 38 dBA	L_{ABG} + 3 dBA 36 dBA	L_{ABG} + 3 dBA 33 dBA
6:00 am – 7:00 am	$L_{Aeq,adj,15\ min}$ Max $L_{pA,\ 15\ mins}$	L_{ABG} + 10 dBA 50 dBA	L_{ABG} + 8 dBA 46 dBA	L_{ABG} + 5 dBA 40 dBA

L_{Aeq} and Max L_{pA} *are to be measured over any 15 minute period*
L_{ABG} is the deemed background noise levels which for the purposes of Schedule G: Table 1 - Noise Limits at Sensitive Receptors are:
7:00 am - 6:00 pm: 35 dBA
6:00 pm – 10:00 pm: 30 dBA
10:00 pm – 6:00 am: 25 dBA
6:00 am – 7:00 am: 30 dBA

(H4) If the noise subject to a complaint is tonal or impulsive, the adjustments detailed in *Schedule G: Table 2 – Adjustments to be Added to Noise Levels at Sensitive Receptors* are to be added to the measured noise level(s) to derive **$L_{Aeq,\ adj,\ 15\ min}$**.

Schedule G: Table 2 – Adjustments to be Added to Noise Levels at Sensitive Receptors

Noise Characteristic	Adjustment to Noise
Tonal characteristic is just audible	+ 2 dBA
Tonal characteristic is clearly audible	+ 5 dBA
Impulsive characteristic is just audible	+ 2 dBA
Impulsive characteristic is clearly audible	+ 5 dBA

(H5) Where alternative arrangements are in place with an affected person(s) at a sensitive receptor, the noise limits in *Schedule G: Table 1 – Noise limits at Sensitive Receptors* do not apply at that sensitive receptor for the duration for which the alternative arrangements are in place.

SCHEDULE I – WASTE

(I1) Any spillage of regulated waste must be cleaned up forthwith.

(I2) Regulated waste must be handled and transferred in a proper and efficient manner to prevent any leakage or spillage of waste.

(I3) All regulated waste removed from the site must be removed by a person who holds a current authority to transport such waste under the provisions of the *Environmental Protection Act 1994* and sent to a facility licensed to accept such waste.

(I4) Except as otherwise provided by the conditions of this authority, all disposal of waste generated in carrying out the environmentally relevant activity must be to a proper and appropriate facility that accepts that waste.

(I5) Where regulated waste is removed from within the boundary of the environmental authority (other than by a release as permitted under another schedule of this environmental authority), the holder of this environmental authority must monitor and record the following:

(a) the date, quantity and type of waste removed; and
(b) name of the waste transporter and/or disposal operator that removed the waste.

SCHEDULE J – WELL CONSTRUCTION, MAINTENANCE AND STIMULATION ACTIVITIES

Drilling Activities

(J1) Oil based or synthetic based drilling muds must not be used in the carrying out of the petroleum activity(ies).

(J2) Drilling activities must not result in the connection of the target gas producing formation and another aquifer.

(J3) 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.

(J4) Well infrastructure must be securely fence and / or screened to:

(a) exclude and prevent the entrapment of livestock and wildlife; and
(b) limit habitats for the introduction or spread of pests.

Stimulation Activities

(J5) Polycyclic aromatic hydrocarbons or products that contain polycyclic aromatic hydrocarbons must not be used in stimulation fluids in concentrations above the reporting limit.

(J6) Stimulations activities must not negatively affect water quality, other than that within the stimulation impact zone of the target gas producing formation.

(J7) Stimulation activities must not cause the connection of the target gas producing formation and another aquifer.

(J8) 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.

(J9) 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.

(J10) Prior to undertaking stimulation activities, a risk assessment must be developed to ensure that stimulation activities are managed to prevent environmental harm.

(J11) The stimulation risk assessment must be carried out for every well to be stimulated prior to stimulation being carried out at that well and address issues at a relevant geospatial scale such that changes to features and attributes are adequately described and must include, but not necessarily be limited to:

(a) a process description of the stimulation activity to be applied, including equipment and a comparison to best international practice
(b) provide details of where, when and how often stimulation is to be undertaken on the tenures covered by this environmental authority
(c) a geological model of the field to be stimulated including geological names, descriptions and depths of the target gas producing formation(s)
(d) naturally occurring geological faults
(e) seismic history of the region (e.g. earth tremors, earthquakes)
(f) proximity of overlying and underlying aquifers
(g) description of the depths that aquifers with environmental values occur, both above and below the target gas producing formation
(h) identification and proximity of landholder' active groundwater bores in the area where stimulation activities are to be carried out
(i) the environmental values of groundwater in the area
(j) an assessment of the appropriate limits of reporting for all water quality indicators relevant to stimulation monitoring in order to accurately assess the risks to environmental values of groundwater

(k) description of overlying and underlying formations in respect of porosity, permeability, hydraulic conductivity, faulting and fracture propensity
(l) consideration of barriers or known direct connections between the target gas producing formation and the overlying and underlying aquifers
(m) a description of the well mechanical integrity testing program
(n) process control and assessment techniques to be applied for determining extent of stimulation activities (e.g. micro-seismic measurements, modelling etc.)
(o) practices and procedures to ensure that the stimulation activities are designed to be contained within the target gas producing formation
(p) groundwater transmissivity**,** flow rate, hydraulic conductivity and direction(s) of flow
(q) a description of the chemical compounds used in stimulation activities (including estimated total mass, estimated composition, chemical abstract service numbers and properties), their mixtures and the resultant compounds that are formed after stimulation
(r) a mass balance estimating the concentrations and absolute masses of chemical compounds that will be reacted, returned to the surface or left in the target gas producing formation subsequent to stimulation
(s) an environmental hazard assessment of the chemicals used including their mixtures and the resultant chemicals that are formed after stimulation including:
    i. toxicological and ecotoxicological information of chemical compounds used
    ii. information on the persistence and bioaccumulation potential of the chemical compounds used; and
    iii. identification of the chemicals of potential concern in stimulation fluids derived from the risk assessment
(t) an environmental hazard assessment of use, formation of, and detection of polycyclic aromatic hydrocarbons in stimulation activities
(u) identification and an environmental hazard assessment of using radioactive tracer beads in stimulation activities
(v) an environmental hazard assessment of leaving chemical compounds in stimulation fluids in the target gas producing formation for extended periods subsequent to stimulation
(w) human health exposure pathways to operators and the regional population
(x) risk characterisation of environmental impacts based on the environmental hazard assessment
(y) potential impacts to landholder bores as a result of stimulation activities
(z) an assessment of cumulative underground impacts, spatially and temporally of the stimulation activities to be carried out on the tenures covered by this environmental authority; and
(aa) potential environmental or health impacts which may result from stimulation activities including but not limited to water quality, air quality (including suppression of dust and other airborne contaminants), noise and vibration.

Water quality baseline monitoring

(J12) 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 two (2) kilometre 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 200m above or below the target gas producing formation and is spatially located with a two (2) kilometre radius from the location of the stimulation initiation point; and
(c) any other bore that could potentially be adversely impacted by the stimulation activities in accordance with the findings of the risk assessment required by conditions (J10) and (J11).

(J13) Prior to undertaking stimulation activities at a well, there must be sufficient water quality data to accurately represent the water quality in the well to be stimulated. The data must include as a minimum the results of analyses for the parameters in condition (J14).

(J14) Baseline bore and well assessments must include relevant analytes and physico-chemical parameters to be monitored in order to establish baseline water quality and must include, but not necessarily be limited to:

(a) pH
(b) electrical conductivity [µS/m]
(c) turbidity [NTU]
(d) total dissolved solids [mg/L]
(e) temperature [ºC]
(f) dissolved oxygen [mg/L]
(g) dissolved gases (methane, chlorine, carbon dioxide, hydrogen sulfide) [mg/L]
(h) alkalinity (bicarbonate, carbonate, hydroxide and total as CaCO3) [mg/L]
(i) sodium adsorption ratio (SAR)
(j) anions (bicarbonate, carbonate, hydroxide, chloride, sulphate) [mg/L]
(k) cations (aluminium, calcium, magnesium, potassium, sodium) [mg/L]
(l) dissolved and total metals and metalloids (including but not necessarily being limited to: aluminium, arsenic, barium, borate (boron), cadmium, total chromium, copper, iron, fluoride, lead, manganese, mercury, nickel, selenium, silver, strontium, tin and zinc) [µg/L]
(m) total petroleum hydrocarbons [µg/L]
(n) BTEX (as benzene, toluene, ethylbenzene, ortho-xylene, para- and meta-xylene, and total xylene) [µg/L]
(o) polycyclic aromatic hydrocarbons (including but not necessarily being limited to: naphthalene, phenanthrene, benzo[a]pyrene) [µg/L]
(p) sodium hypochlorite [mg/L]
(q) sodium hydroxide [mg/L]
(r) formaldehyde [mg/L]
(s) ethanol [mg/L]; and
(t) gross alpha + gross beta or radionuclides by gamma spectroscopy [Bq/L].

Stimulation Impact Monitoring Program

(J15) A Stimulation Impact Monitoring Program must be developed prior to the carrying out of stimulation activities which must be able to detect adverse impacts to water quality from stimulation activities and must consider the findings of the risk assessment required by conditions (J10) and (J11) that relate to stimulation activities and must include, as a minimum, monitoring of:
(a) the stimulation fluids to be used in stimulation activities at sufficient frequency and which sufficiently represents the quantity and quality of the fluids used
(b) flow back waters from stimulation activities at sufficient frequency and which sufficiently represents the quality of that flow back water
(c) flow back waters from stimulation activities at sufficient frequency and accuracy to demonstrate that 150% of the volume used in stimulation activities has been extracted from the stimulated well; and
(d) all bores in accordance with condition (J12).

(J16) The Stimulation Impact Monitoring Program must provide for monitoring of:
(a) analytes and physico-chemical parameters relevant to baseline bore and well assessments to enable data referencing and comparison including, but not necessarily being limited to the analytes and physico-chemical parameters in condition (J14); and
(b) any other analyte or physico-chemical parameters that will enable detection of adverse water quality impacts and the inter-connection with a non-target aquifer as a result of stimulation activities including chemical compounds that are actually or potentially formed by chemical reactions with each other or coal seam materials during stimulation activities.

(J17) The Stimulation Impact Monitoring Program must provide for monitoring of the bores in condition (J15(J15.d)) at the following minimum frequency:
(a) monthly for the first six (6) months subsequent to stimulation activities being undertaken; then
(b) annually for the first five (5) years subsequent to stimulation being undertaken or until analytes and physico-chemical parameters listed in conditions (J14(a)) to (J14(t)) inclusive, are not detected in concentrations above baseline bore monitoring data on two (2) consecutive monitoring occasions.

(J18) The results of the Stimulation Impact Monitoring Program must be made available to any potentially affected landholder upon request by that landholder.

SCHEDULE K - MONITORING and REPORTING

General

(K1) The holder of this environmental authority must develop and implement a monitoring program for all monitoring required by the conditions of this environmental authority.

(K2) All monitoring under this environmental authority must be conducted by a suitably qualified person.

(K3) All instruments, equipment and measuring devices used for measuring or monitoring in accordance with any condition of this environmental authority must be calibrated and operated and maintained effectively in accordance with the manufacturer's specifications.

SCHEDULE L - NOTIFICATION PROCEDURES

(L1) The holder of this environmental authority must telephone the Department of Environment and Resource Management's Pollution Hotline (telephone: 1300 130 372) and any affected landholder, occupier or their nominated representative as soon as reasonably practicable, but within 24 hours after becoming aware of:
(a) any release of contaminants not in accordance with the conditions of this environmental authority; or
(b) any event where environmental harm (excluding environmental nuisance) has been caused or may be caused.

(L2) Notwithstanding condition (L1), the holder of this environmental authority must telephone the Department of Environment and Resource Management's Pollution Hotline (telephone: 1300 130 372) as soon as reasonably practicable, but within 24 hours after becoming aware of:
(a) any non-compliance with any condition of this environmental authority other than in relation to a release of contaminants; or
(b) a potential or actual loss of structural or hydraulic integrity of a dam.

(L3) Subject to condition (M1), the holder of this environmental authority must report spills of contaminants (including but not limited to hydrocarbons) of the following volumes or kind:
(a) releases of any volume of contaminants to water;
(b) releases of greater than 200L of hydrocarbons and/or 10,000L of produced water to land; and
(c) releases of any volumes of contaminants where potential serious or material environmental harm has occurred or may occur.

(L4) The notification of emergencies or incidents as required by conditions (M1), (M2) and (M3) must include but not be limited to the following information:
(a) the environmental authority number and name of the holder;
(b) the tenure type and number where the emergency or incident occurred;
(c) the name and telephone number of the designated contact person;
(d) the location of the emergency or incident (GDA94);
(e) the date and time that the emergency or incident occurred;
(f) the date and time the holder of this environmental authority became aware of the emergency or incident;
(g) details of the nature of the event and the circumstances in which it occurred;
(h) the estimated quantity and type of any contaminants involved in the incident;
(i) the actual or potential suspected cause of the emergency or incident;
(j) a description of the land use at the site of the emergency or incident (e.g. grazing, pasture, forest etc) and / or the name of any relevant waters and other environmentally sensitive features;
(k) a description of the possible impacts from the emergency or incident;
(l) a description of whether stock and / or wildlife were actually or potentially exposed to any contaminants released and measures taken to prevent access for the duration of the emergency or incident;
(m) any sampling conducted or proposed, relevant to the emergency or incident;
(n) landholder details and details of landholder consultation;
(o) immediate actions taken to control the impacts of the emergency or incident and how environmental harm was mitigated at the time of the emergency or incident; and
(p) whether further examination / root cause analysis is required and if so, the expected date by when this examination will be completed and reported to the administering authority.

(L5) Within 10 business days following the initial notification, unless a longer time is agreed to by the administering authority, a written report must be provided to the administering authority, including the following (where relevant to the emergency or incident):
(a) the information required by condition (M4);
(b) the root cause of the emergency or incident;
(c) the confirmed quantities and types of any contaminants involved in the incident;
(d) results and interpretation of any analysis of samples taken at the time of the emergency or incident (including the analysis results of any impact monitoring);

(e) a final assessment of the impacts from the emergency or incident including any actual or potential environmental harm that has occurred or may occur in the longer term as a result of the release;
(f) the success or otherwise of actions taken at the time of the incident to prevent or minimise environmental harm;
(g) results and current status of landholder consultation, including commitment to resolve any outstanding issues / concerns; and
(h) actions and / or procedural changes to prevent a recurrence of the emergency or incident.

SCHEDULE M - DEFINITIONS

Key terms and/or phrases used in this document are defined in this section. Where a term is not defined, the definition in the *Environmental Protection Act 1994*, its regulations or environmental protection policies must be used. If a word remains undefined it has its ordinary meaning.

Note: Where a term is not defined in this environmental authority the definition in the Environmental Protection Act 1994, its regulations and Environmental Protection Policies, or the Acts Interpretation Act 1954, or the Macquarie Dictionary or the Petroleum and Gas (Production and Safety) Act 2004 or its regulations must be used in that order.

acid sulfate soils	means soil or sediment containing highly acidic soil horizons or layers affected by the oxidation of iron sulfides (*actual acid sulfate soils*) and / or soil or sediment containing iron sulfides or other sulfidic material that has not been exposed to air and oxidised (*potential acid sulfate soils*). The term acid sulfate soil generally includes both actual and potential acid sulfate soils. Actual and potential acid sulfate soils are often found in the same soil profile, with actual acid sulfate soils generally overlying potential acid sulfate soil horizons.
alternative arrangement	means a written agreement between the holder of this environmental authority and an affected or potentially affected person at a sensitive receptor for a defined noise nuisance impact and may include an agreed period of time for which the arrangement is in place. An agreement for alternative arrangements may include, but not necessarily be limited to a range of noise abatement measures to be installed at a sensitive receptor and / or provision of alternative accommodation for the duration of the defined noise nuisance impact.
analogue site	means the pre-disturbance state of a site to be disturbed by petroleum activities, from which benchmark parameters for rehabilitation success can be established.
annual return period	means the most current 12-month period between two anniversary dates.
areas of pre-existing disturbance	means areas where environmental values have been negatively impacted as a result of anthropogenic activity and these impacts are still evident. Areas of pre-disturbance may include areas where legal clearing, logging, timber harvesting, or grazing activities have previously occurred, where high densities of weed or pest species are present which have inhibited re-colonisation of native regrowth, or where there is existing infrastructure (regardless of whether the infrastructure is associated with the authorised petroleum activities). The term 'areas of pre-disturbance' does not include areas that have been impacted by wildfire/s, controlled burning, flood or natural vegetation die-back.
associated water	means underground water taken or interfered with, if the taking or interference happens during the course of, or results from, the carrying out of another authorised activity under a petroleum authority, such as a petroleum well, and includes waters also known as produced formation water. The term includes all contaminants suspended or dissolved within the water.
associated works	in relation to a dam, means: o any kind and all things associated with the construction and operation of a dam; and o any land used for those operations.
authorised person	means a person holding office as an authorised person under an appointment under the *Environmental Protection Act 1994* by the chief executive or chief executive officer of a local government.

background noise level	means the sound pressure level, measured in the absence of the noise under investigation, as the $L_{A90,T}$ being the A-weighted sound pressure level exceeded for 90 percent of the measurement time period T of not less than 15 minutes, using Fast response.
bankfull	means the channel flow rate that exists when the water is at the elevation of the channel bank above which water begins to spill out onto the floodplain. The term describes the condition of the channel relative to its banks (e.g. overbank, in-bank, bankfull, low banks, high bank).
biodiversity values	for the purposes of this environmental authority, means environmentally sensitive areas, areas of State significant biodiversity value and wetlands.
brine	means saline water with a total dissolved solid concentration greater than 40 000 mg/l.
brine dam	means a regulated dam that is designed to receive, contain or evaporate brine.
business day	has the meaning in the *Acts Interpretation Act 1954* and means a day that is not— o a Saturday or Sunday; or o a public holiday, special holiday or bank holiday in the place in which any relevant act is to be or may be done.
Category A Environmentally Sensitive Area	means any area listed in Schedule 12, Section 1 of the Environmental Protection Regulation 2008.
Category B Environmentally Sensitive Area	means any area listed in Schedule 12, Section 2 of the Environmental Protection Regulation 2008.
Category C Environmentally Sensitive Area	means any of the following areas: o nature refuges as defined in the conservation agreement for that refuge under the *Nature Conservation Act 1992* o koala habitat areas as defined under the Nature Conservation (Koala) Conservation Plan 2006 o state forests or timber reserves as defined under the *Forestry Act 1959* o regional parks (previously known as resource reserves) under the *Nature Conservation Act 1992* o an area validated as 'essential habitat' or 'essential regrowth habitat' from ground-truthing surveys in accordance with the Vegetation Management Act 1999 for a species of wildlife listed as endangered or vulnerable under the *Nature Conservation Act 1992* o 'of concern regional ecosystems' that are remnant vegetation and identified in the database called 'RE description database' containing regional ecosystem numbers and descriptions.
certification or certified by a suitably qualified and experienced person	in relation to a design plan, 'as constructed' drawings or an annual report regarding dams, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit at any time: o exactly what is being certified and the precise nature of that certification;

	o the relevant legislative, regulatory and technical criteria on which the certification has been based; o the relevant data and facts on which the certification has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and o the reasoning on which the certification has been based using the relevant data and facts, and the relevant criteria.
Certify or certification or certified	in relation to any matter other than a design plan, 'as constructed' drawings or an annual report regarding dams in this environmental authority means a Statutory Declaration by a suitably qualified person accompanying the written document stating that: o all relevant material has been considered in the written document; and o that the content of the written document is accurate and true; and o that the written document meets the requirements of the relevant conditions of the environmental authority.
clearing	has the meaning in the dictionary of the Vegetation Management Act 2000 and for vegetation— (a) means remove, cut down, ringbark, push over, poison or destroy in any way including by burning, flooding or draining; but (b) does not include destroying standing vegetation by stock, or lopping a tree.
construction	in relation to a dam includes building a new dam and modifying or lifting an existing dam but does not include investigations and testing necessary for the purposes of preparing a design plan.
control measure	has the meaning in section 47 of the Environmental Protection Regulation 2008 and means a device, equipment, structure, or management strategy used to prevent or control the release of a contaminant or waste to the environment.
critically limited regional ecosystem	means the regional ecosystems defined and listed in Appendix 5 of the Queensland Biodiversity Offset Policy.
dam	means a land-based structure or a void that is designed to 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. A dam does *not* mean a fabricated or manufactured tank or container, designed and constructed to an Australian Standard that deals with strength and structural integrity of that tank or container.
Design plan	is the documentation required to describe the physical dimensions of the dam, the materials and standards to be used for construction of the dam, and the criteria to be used for operating the dam. The documents must include design and investigation reports, specifications and **certifications**, together with the planned decommissioning and rehabilitation works and outcomes. A design plan may include 'as constructed' drawings.
Development well	means a petroleum well which produces or stores petroleum. For clarity, a development well does not include an appraisal well.
document	has the meaning in the *Acts Interpretation Act 1954* and means: o any paper or other material on which there is writing; and o any paper or other material on which there are marks; and

	o figures, symbols or perforations having a meaning for a person qualified to interpret them; and o any disc, tape or other article or any material from which sounds, images, writings or messages are capable of being produced or reproduced (with or without the aid of another article or device).
end	means the stopping of the particular activity that has caused a significant disturbance in a particular area. It refers to, among other things, the end of a seismic survey or the end of a drilling operation. It does not refer to the end of all related petroleum activities such as rehabilitation. In other words, it does not refer to the 'completion' of the petroleum activity(ies), the time at which the petroleum authority ends or the time that the land in question ceases to be part of an authority.
environmental harm	has the meaning in section 14 of the Environmental Protection Act 1994 and means any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance. Environmental harm may be caused by an activity— (a) whether the harm is a direct or indirect result of the activity; or (b) whether the harm results from the activity alone or from the combined effects of the activity and other activities or factors.
environmentally sensitive area	means Category A, B or C environmentally sensitive areas (ESAs)
Equivalent person or EP	means an equivalent person under volume 1, section 2 of the "Guidelines for Planning and Design of Sewerage Schemes", October 1991, published by the Water Resources Commission, Department of Primary Industries, Fisheries and Forestry.
essential petroleum activities	means activities that are essential to bringing the resource to the surface and are only the following: o low impact petroleum activities o geophysical, geotechnical, geological, topographic and cadastral surveys (including seismic, sample /test / geotechnical pits, core holes) o single well sites not exceeding 1 hectare disturbance and multi-well sites not exceeding 1.5 hectare disturbance o well sites with monitoring equipment (including monitoring bores): o for single well sites, not exceeding 1.25 hectares disturbance o for multi-well sites, not exceeding 1.75 hectares disturbance • well sites with monitoring equipment (including monitoring bores) and tanks (minimum 1 ML) for above ground fluid storage: o for single well sites, not exceeding 1.5 hectares disturbance o for multi-well sites, not exceeding 2.0 hectares disturbance • associated infrastructure located on a well site necessary for the construction and operations of wells: o water pumps and generators

	o flare pits o chemical / fuel storages o sumps for residual drilling material and drilling fluids o tanks, or dams which are not significant or high consequence dams to contain wastewater (e.g. stimulation flow back waters, produced water) o pipe laydown areas o soil and vegetation stockpile areas o a temporary camp associated with a drilling rig that may involve sewage treatment works that are no release works o temporary administration sites and warehouses o dust suppression activities using water that meets the quality and operational standards approved under the environmental authority • communication and power lines that are necessary for the undertaking of petroleum activities and that are located within well sites, well pads and pipeline right of ways without increasing the disturbance area of petroleum activities • supporting access tracks • gathering / flow pipelines from a well head to the initial compression facility • activities necessary to achieve compliance with the conditions of the environmental authority in relation to another essential petroleum activity (e.g. sediment and erosion control measures, rehabilitation).
Existing low hazard dam	means [insert names and locations of existing low hazard dams that are constructed and / or whose construction had substantially commenced on the approval date of this environmental authority].
Exploration well	means a petroleum well that is drilled to: o explore for the presence of petroleum or natural underground reservoirs suitable for storing petroleum; or o obtain stratigraphic information for the purpose of exploring for petroleum. For clarity, an exploration well does not include an appraisal or development well.
floodplains	has the meaning in the Water Act 2000 and means an area of reasonably flat land adjacent to a watercourse that— • is covered from time to time by floodwater overflowing from the watercourse; and • does not, other than in an upper valley reach, confine floodwater to generally follow the path of the watercourse; and • has finer sediment deposits than the sediment deposits of any bench, bar or in-stream island of the watercourse.

Flowable substance	means matter or a mixture of materials which can flow under any conditions potentially affecting that substance. Constituents of a flowable substance can include water, other liquids fluids or solids, or a mixture that includes water and any other liquids fluids or solids either in solution or suspension.
GDA	means Geocentric Datum of Australia.
Great Artesian Basin (GAB) spring	means an area protected under the Environment Protection and Biodiversity Conservation Act 1999 because it is considered to be a Matter of National Environmental Significance and identified as a: • community of native species dependent on natural discharge of groundwater from the Great Artesian Basin; or • Great Artesian Basin spring; or • Great Artesian Basin discharge spring wetland. A GAB spring includes a spring vent, spring complex or watercourse spring and includes the land to which water rises naturally from below the ground and the land over which the water then flows. Note: The Australian Government's Protected Matters Search Tool should be used to get an indication of whether the area of interest may contain an MNES spring. Note: The GAB springs dataset can be requested from the Queensland Government Herbarium
Hazard category	means a category, either low significant or high, into which a dam is assessed as a result of the application of tables and other criteria in "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", prepared by the Department of Environment and Resource Management, as amended from time to time.
Hydraulic performance	means the capacity of a regulated dam to contain or safely pass flowable substances based on a probability (AEP) of performance failure specified for the relevant hazard category "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", prepared by the Department of Environment and Resource Management, as amended from time to time.
impacts to state significant biodiversity values	means to have a negative effect on a state significant biodiversity value as identified by the Queensland Biodiversity Offset Policy (Department of Environment and Heritage Protection, 2014). Examples may include, but are not necessarily limited to: • clearing, removal or fragmentation of vegetation • interference or disturbance of fauna habitat.
Impulsive noise	means sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the background sound pressure. The duration of a single impulsive sound is usually less than one second.
infrastructure	means plant or works including for example, communication systems, compressors, powerlines, pumping stations, reservoirs, roads and tracks, water storage dams, evaporation or storage ponds and tanks, equipment,

	buildings and other structures built for the purpose and duration of the conduct of the petroleum activity(ies) including temporary structures or structures of an industrial or technical nature, including, for example, mobile and temporary camps. Infrastructure does not include other facilities required for the long term management of the impact of those petroleum activities or the protection of potential resources. Such other facilities include dams other than water storage dams (e.g. evaporation dams), pipelines and assets, that have been decommissioned, rehabilitated, and lawfully recognised as being subject to subsequent transfer with ownership of the land.
$L_{Aeq, adj, 15 mins}$	means the A-weighted sound pressure level of a continuous steady sound, adjusted for tonal character, that within any 15 minute period has the same square sound pressure as a sound level that varies with time.
$L_{A 90, adj, 15 mins}$	means the A-weighted sound pressure level, adjusted for tonal character, that is equal to or exceeded for 90% of any 15 minutes sample period equal, using Fast response
land degradation	has the meaning in the Vegetation Management Act 1999 and means the following: • soil erosion • rising water tables • the expression of salinity • mass movement by gravity of soil or rock • stream bank instability • a process that results in declining water quality.
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.
linear infrastructure	means powerlines, pipelines, flowlines, roads and access tracks.
long term noise event	is a noise exposure, when perceived at a sensitive receptor, persists for a period of greater than five (5) days, even when there are respite periods when the noise is inaudible within those five (5) days.
low hazard dam	means any dam in the low hazard category as assessed using the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams", prepared by the Department of Environment and Resource Management, as amended from time to time.
low impact petroleum activities	means petroleum activities which do not result in the clearing of native vegetation, cause disruption to soil profiles through earthworks or excavation or result in significant disturbance to land which cannot be rehabilitated immediately using hand tools after the activity is completed. Examples of such activities include but are not necessarily limited to soil surveys (excluding test pits), topographic surveys, cadastral surveys and ecological surveys, may include installation of monitoring equipment provided that it is within the

	meaning of low impact and traversing land by car or foot via existing access tracks or routes or in such a way that does not result in permanent damage to vegetation.
Max $L_{pZ, 15\ min}$	means the maximum value of the Z-weighted sound pressure level measured over 15 minutes.
Max $L_{pA, 15\ min}$	means the absolute maximum instantaneous A-weighted sound pressure level, measured over 15 minutes.
medium term noise event	is a noise exposure, when perceived at a sensitive receptor, persists for an aggregate period not greater than five (5) days and does not re-occur for a period of at least four (5) weeks. Re-occurrence is deemed to apply where a noise of comparable level is observed at the same receptor location for a period of one hour or more, even if it originates from a difference source or source location.
month	has the meaning in the Acts Interpretation Act 1954 and means a calendar month and is a period starting at the beginning of any day of one (1) of the 12 named months and ending— o immediately before the beginning of the corresponding day of the next named month; or o if there is no such corresponding day—at the end of the next named month.
NATA accreditation	means accreditation by the National Association of Testing Authorities Australia.
primary protection zone	means an area within 200m from the boundary of any Category A, B or C ESA.
produced water	has 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.
protection zone	means the primary protection zone of any Category A, B or C ESA or the secondary protection zone of any Category A or B ESA.
regulated dam	means any dam in the significant or high hazard category as assessed using the “Manual for Assessing Hazard Categories and Hydraulic Performance of Dams”, prepared by the Department of Environment and Resource Management , as amended from time to time.
rehabilitation	means the process of reshaping and revegetating land to restore it to a stable landform and in accordance with the acceptance criteria set out in this environmental authority and, where relevant, includes remediation of contaminated land
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.
secondary protection zone	in relation to a Category A or Category B ESA means an area within 100 metres from the boundary of the primary protection zone.
sensitive place	means: o a dwelling (including residential allotment, mobile home or caravan park, residential marina or other residential premises, motel, hotel or hostel; or o a library, childcare centre, kindergarten, school, university or other educational institution; o a medical centre, surgery or hospital; or o a protected area; or o a public park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment; or o a work place used as an office or for business or commercial purposes, which is not part of the petroleum activity(ies) and does not include employees accommodation or public roads.
sensitive receptor	means an area or place where noise (including low frequency, vibration and blasting) is measured investigate whether nuisance impacts are occurring and includes: o a dwelling (including residential allotment, mobile home or caravan park, residential marina or other residential premises, motel, hotel or hostel; or o a library, childcare centre, kindergarten, school, university or other educational institution; o a medical centre, surgery or hospital; or o a protected area; or o a public park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment; or o a work place used as an office or for business or commercial purposes, which is not part of the petroleum activity(ies) and does not include employees accommodation or public roads.
short term noise event	is a noise exposure, when perceived at a sensitive receptor, persists for an aggregate period not greater than eight hours and does not re-occur for a period of at least seven (7) days. Re-occurrence is deemed to apply where a noise of comparable level is observed at the same receptor location for a period of one hour or more, even if it originates from a different source or source location.
significantly disturbed land or significant disturbance to land or significant disturbance	means disturbance to land as defined in section 28 of the Environmental Protection Regulation 2008.
State significant biodiversity values	means those regional ecosystems, essential habitat, wetlands, watercourses, legally secured offset areas and connectivity areas provided in Appendix 1 of the Queensland Biodiversity Offsets Policy (Department of Environment and Heritage Protection, 2014).
stimulation	means a technique used to increase the permeability of natural underground reservoir that is undertaken above the formation pressure and involves the addition of chemicals. It includes hydraulic fracturing / hydrofraccing, fracture acidizing and the use of proppant treatments.

	Explanatory note: This definition is restricted from that in the Petroleum and Gas (Production and Safety) Act 2004 in order to only capture the types of stimulation activities that pose a risk to environmental values of water quality in aquifers.
stimulation fluid	means the fluid injected underground to increase permeability. For clarity, the term stimulation fluid only applies to fluid injected down well post-perforation.
stimulation impact zone	means a 100m maximum radial distance from the stimulation target location within a gas producing formation.
subterranean cave GDE	• means an area identified as a subterranean cave in the mapping produced by the Queensland Government and identified in the Queensland Government Information System, as amended from time to time; and • means a cave ecosystem which requires access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain its communities of plants and animals, ecological processes and ecosystem services. Subterranean cave GDEs are caves dependent on the subterranean presence of groundwater. Subterranean cave GDEs have some degree of groundwater connectivity and are indicated by either high moisture levels or the presence of stygofauna, or both, referred to in the Queensland Government WetlandsInfo mapping program, as amended from time to time. Note: the Subterranean GDE (caves) dataset can be displayed through the Queensland Government WetlandInfo mapping program. Note: the Subterranean GDE (caves) dataset can be obtained from the Queensland Government Information System.
suitably qualified person	means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis to performance relative to the subject matter using the relevant protocols, standards, methods or literature.
suitably qualified and experienced person in relation to a hazard assessment of a dam	means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit at any time: o exactly what has been assessed and the precise nature of that assessment; o the relevant legislative, regulatory and technical criteria on which the assessment has been based; o the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and o the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.

suitably qualified and experienced person in relation to dams	means one who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the Professional Engineers Act 1988, or registered as a National Professional Engineer (NPER) with the Institution of Engineers Australia, or holds equivalent professional qualifications to the satisfaction of the administering authority for the *Environmental Protection Act 1994*, and the administering authority for the *Environmental Protection Act 1994* is satisfied that person has knowledge, suitable experience and demonstrated expertise in relevant fields, as set out below: o knowledge of engineering principles related to the structures, geomechanics, hydrology, hydraulics, chemistry and environmental impact of dams; and o a total of five (5) years of suitable experience and demonstrated expertise in the geomechanics of dams with particular emphasis on stability, geology and geochemistry, and o a total of five (5) years of suitable experience and demonstrated expertise each, in three (3) of the following categories: • investigation and design of dams. • construction, operation and maintenance of dams. • hydrology with particular reference to flooding, estimation of extreme storms, water management or meteorology. • hydraulics with particular reference to sediment transport and deposition, erosion control, beach processes. • hydrogeology with particular reference to seepage, groundwater. • solute transport processes and monitoring thereof. • dam safety.
synthetic based drilling mud	means a mud where the base fluid is a synthetic oil, consisting of chemical compounds which are artificially made or synthesised by chemically modifying petroleum components or other raw materials rather than the whole crude oil.
transmissivity	means the total length of logs on the ground greater than or equal to 10cm diameter per hectare and number of logs on the ground greater than or equal to 10cm diameter per hectare.
valid complaint	means a complaint the administering authority considers is not frivolous, nor vexatious, nor based on mistaken belief.
void	means any man-made, open excavation in the ground (includes borrow pits, drill sumps, frac pits, flare pits, cavitation pits and trenches).
waters	includes all or any part of a creek, river, stream, lake, lagoon, swamp, wetland, spring, unconfined surface water, unconfined water in natural or artificial watercourses, bed and bank of any waters, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and underground water.
watercourse	has the meaning in Schedule 4 of the Environmental Protection Act 1994 and means: 1) a river, creek or stream in which water flows permanently or intermittently— (a) in a natural channel, whether artificially improved or not; or

	(b) in an artificial channel that has changed the course of the watercourse. 2) Watercourse includes the bed and banks and any other element of a river, creek or stream confining or containing water.
	for the purpose of this environmental authority, wetland means: • areas shown on the Map of referable wetlands which is a document approved by the chief executive on 4 November 2011 and published by the department, as amended from time to time by the chief executive under section 144D of the Environmental Protection Regulation 2008; and • areas defined under the Queensland Wetlands Program as permanent or periodic / intermittent inundation, with water that is static or flowing fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six (6) metres, and possess one or more of the following attributes: o at least periodically, the land supports plants or animals that are adapted to and dependent on living in wet conditions for at least part of their life cycle, or o the substratum is predominantly undrained soils that are saturated, flooded or ponded long enough to develop anaerobic conditions in the upper layers, or o the substratum is not soil and is saturated with water, or covered by water at some time. The term wetland includes riverine, lacustrine, estuarine, marine and palustrine wetlands; and it does not include a Great Artesian Basin Spring or a subterranean wetland that is a cave or aquifer.
wetland of high ecological significance	means a wetland that meets the definition of a wetland and that is shown as a wetland of 'high ecological significance' or wetland of 'high ecological value' on the Map of referable wetlands.
wetland of other environmental value	means a wetland that meets the definition of a wetland and that is shown as a wetland of 'general environmental significance' or wetland of 'other environmental value' on the Map of referable wetlands.
year	means a period of 12 months.

END OF ENVIRONMENTAL AUTHORITY

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