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Surat Low Pressure Header Pipelines Regional Interests Development Approval

An application for a RIDA under the *Regional Planning Interests Act 2014*

Amendment Application to Remove 5 Lots

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Reason for the RIDA Amendment Application

Since lodgement of the RIDA application, voluntary agreements have been reached with landowners for five of the Lots the subject of the original application. As such, the report and appendices have been updated to remove information related to each of the five Lots. The table below describes the lots that have been removed.

Lot Plan	Voluntary Agreement in place	Mapped as PAA	Mapped as SCA
27SP253612	Yes	Yes	No
2DER3455	Yes	Yes	Yes
1RP181072	Yes	Yes	Yes
2RP181072	Yes	Yes	Yes
3RP181072	Yes	Yes	Yes

The following updates have been made within each section of the application report:

Section of Report	Updates Made to Each Section
Chapter 1	• Removed references to the 5 Lots due to reaching voluntary CCAs; • Updated the number of remaining Lots, with 5 lots now remaining; • Updated Figure 1.2; and • Updated Table 1-3 and 1-4
Chapter 2	• Removed references to the 5 Lots due to reaching voluntary CCAs; • Updated Table 2-1 and 2-3; and • Removed reference to PPL2037
Chapter 3	• No change to this chapter
Chapter 4	• Removed references to the 5 Lots due to reaching voluntary CCAs; • Updated disturbance distances; • Updated Table 4-1, 4-2 and 4-3; and • Removed reference to Appendix 5
Chapter 5	• Removed references to the 4 of the 5 Lots due to reaching voluntary CCAs; • Updated disturbance distances; and • Updated Table 5-1
Chapter 6	• No change to this chapter
Chapter 7	• No change to this chapter
Chapter 8	• No change to this chapter
Chapter 9	• No change to this chapter
Chapter 10	• No change to this chapter

Section of Report	Updates Made to Each Section
Chapter 11	• Removed references to the 2 of the 5 Lots due to reaching voluntary CCAs; and • Updated Table 11-1 and 11-2
Chapter 12	• No change to this chapter
Chapter 13	• No change to this chapter
Appendix 1	• New title searches for the remaining 5 Lots
Appendix 2	• Removed references to the 5 Lots due to reaching voluntary CCAs
Appendix 3	• Removed references to the 5 Lots due to reaching voluntary CCAs
Appendix 4	• Removed references to the 5 Lots due to reaching voluntary CCAs
Appendix 5	• Removed entire Appendix
Appendix 6	• Removed references to the 5 Lots due to reaching voluntary CCAs
Appendix 7	• No change to this appendix
Appendix 8	• Removed references to the 5 Lots due to reaching voluntary CCAs
Appendix 9	• Removed references to the 5 Lots due to reaching voluntary CCAs

1. Introduction

1.1 Purpose

The Applicant proposes to undertake petroleum activities within an Area of Regional Interest (ARI) including Priority Agricultural Area (PAA) and Strategic Cropping Area (SCA). This report provides the required supporting information for an application for a Regional Interest Development Approval (RIDA) under the *Regional Planning Interests Act 2014* (RPI Act).

1.2 Scope

The Applicant proposes to construct up to three pipelines and associated infrastructure within a common right-of way (RoW), known as the Surat Low Pressure Header Pipelines (LPH pipelines). Two of the proposed LPH pipelines will transport gas and produced water from gas production areas in the Surat Basin to field compression and water management facilities that are currently in operation in Arrow's Daandine and Tipton fields. In some sections of the RoW, there will be two gas pipelines. A third pipeline, known as the Beneficial Use Network (BUN), will transport treated water from Arrow's Daandine storage dams to beneficial water users on Arrow's tenures. The associated infrastructure includes low point drains and high point vents, all of which will be located within the boundaries of the RoW.

Figure 1-1 shows the alignment of the LPH pipelines and the overlap between the majority of the alignment and PAA and SCA.

The LPH pipelines will be located across five seperate petroleum authorities being Petroleum Lease (PL) 198, PL230, PL252, PL260 and Petroleum Pipeline Licence (PPL) 2052. PLs 198, 230, 252 and 260 are authorised by the same Environmental Authority (EA) EPPG00972513 and PPL2052 is authorised by a separate EA (EA0002659).

The LPH pipelines traverse 37 land parcels. The Applicant has been negotiating Conduct and Compensation Agreements (CCAs) with the relevant parties of these land holdings. To date, agreements have been reached or will shortly be reached for 32 of the 37 land holdings. Negotiations will continue with the relevant parties of the remaining 5 land holdings.

The scope of this application is the LPH pipelines as described above and illustrated on Figure 1-1 on the 5 land pacels traversed by the proposed alignment where a CCA has not yet been agreed. Section 1.5 provides additional details with regards to the land holdings the subject of this RIDA application (see Table 1.3) and those land holdings traversed by the alignment but are not the subject of this RIDA application (see Table 1-4).

This RIDA application does not include resource activities associated with the installation or operation of CSG wells. Such activities would be the subject of a separate RIDA application if required.

1.3 Context

Section 29 of the RPIA requires that a RIDA be accompanied by a report that:

- Assesses the resource activity or regulated activity's impact on the area of regional interest; and
- Identifies any constraints on the configuration or operation of the activity.

The *RPI Act Guideline 01/14 - How to make an assessment application for a regional interests development approval under the Regional Planning Interests Act 2014* provides further guidance about the matters to be addressed by an assessment application report. These requirements and the sections where they are addressed, is listed in Table 2-1.

This report has also been drafted in accordance with the RPI Act Guidelines that directly address resource activities proposed in PAA and SCA, the guideline on identification of Priority Agricultural Land Use (PALU) and the RPI Act Guideline companion guide.

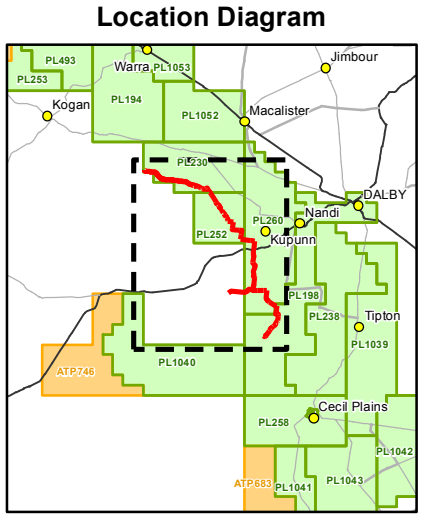
Table 1-1: Assessment Report Information Requirements

Information Requirement	Section Addressed
The location, nature, extent (in hectares) and duration of the surface impacts of the proposed activity.	Refer Sections 4.3 & 5.2 _
A description of the impact of the proposed activities on the feature, quality, characteristic or other attribute of the area.	Refer to sections 4 & 5
Include a table identifying the location and surface area of each of the proposed activities.	Refer to Section 2.1
The report must also include an explanation of how the proposed activity will meet the required outcome/s and address the prescribed solution/s contained in the assessment criteria for the area of regional interest.	Refer to Section 11

150°55'0"E
151°0'0"E
151°5'0"E
27°10'0"S
27°15'0"S
27°20'0"S
27°25'0"S

David IPF
PL230
PL252
PL260
PL198
Kupunn
Tipton CGPF
KUMBARILLA LANE
THETEN ROAD
SKERMANS ROAD
DAANDINE NANDI ROAD
LEAHYS ROAD
Condamine River
DALBY KOGAN ROAD
GREENBANK ACCESS
HEREWARD ROAD
HOADLEYS ROAD
KUPUNN ROAD
KUPUNN DULEEN ROAD
WATTLE DRIVE
BULLOAK DRIVE
Wilkie Creek
WILSONS ROAD
DUCKLO SCHOOL ROAD
DULEEN DAANDINE ROAD
GULERA ROAD
DUCKLO GULERA ROAD
CAVES ROAD
REDGUM ROAD
WILGA DRIVE
TEMPORARILY CLOSED ROAD
MOONIE HIGHWAY
SCHULTZS ROAD
BROADWATER ROAD
NANDI ROAD
UNCONSTRUCTED ROAD
JONES ROAD
HALLIFORD ROAD
WILKIN ROAD

Location Diagram



Legend

- Qld Populated Places
- Low Pressure Header David IPF to the Tipton Facility
- Road
- Waterway
- Arrow Facility
- Strategic Cropping Area
- Priority Agricultural Area
- PL (Arrow)

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Scale @ A3: 1:100,000 **Coordinate System:** GCS GDA 1994

Metres
0 750 1,500 3,000 4,500 6,000

N

Confidential: For Internal Use Only

Rev	Date	Revision Description	Orig	Ckd'd	Eng	QA	Appr
1	15.04.21	Issued for Use	AF	DP			DP
0	27.11.20	Issued for Use	AF	DP			DP

Source:
Arrow Energy Limited, Geosciences Australia
Qld Gov.

Status: IFU
Issued To: C Wicks
Author: aferguson

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Surat Basin
Low Pressure Header
David IPF to Tipton
(including Harry Stalk)
- Priority Agricultural Areas
- Strategic Cropping Areas

Document: V:\Products\Australia\Queensland\Surat_Basin\Infrastructure\201125_RITM0260706_LPH_DavidIPF_2_Tipton_DP\SGP_LowPressureHeader_Tipton_2_DavidIPF_1.mxd

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Print Date: 15/04/2021

1.4 Applicant

The Applicant for this assessment application are the following Arrow Energy entities:

- Arrow Energy Pty Ltd – ABN 73 078 521 936;
- Arrow (Tipton) Pty Ltd – ABN 17 114 927 507;
- Arrow (Tipton Two) Pty Ltd – ABN 36 117 853 755;
- Arrow CSG (Australia) Pty Ltd – ABN 54 054 260 650;
- Arrow (Daandine) Pty Ltd – 99 114 927 481.

1.5 Land Subject to the Application

Table 1-2 identifies the relevant Local Government Area, zoning and Regional Plan for all of the land the subject of this application.

Table 1-2 – Land Description

Local Government	Western Downs Regional Council
Zoning	Rural and Rural Activity
Regional Plan	Darling Downs Regional Plan
Areas of Regional Interest	PAA, SCA

The land parcels traversed by the LPH pipelines which are the subject of this application are described in Table 1-3 and illustrated on Figure 1-2.

Table 1-3 - Land Parcel in Scope of Application

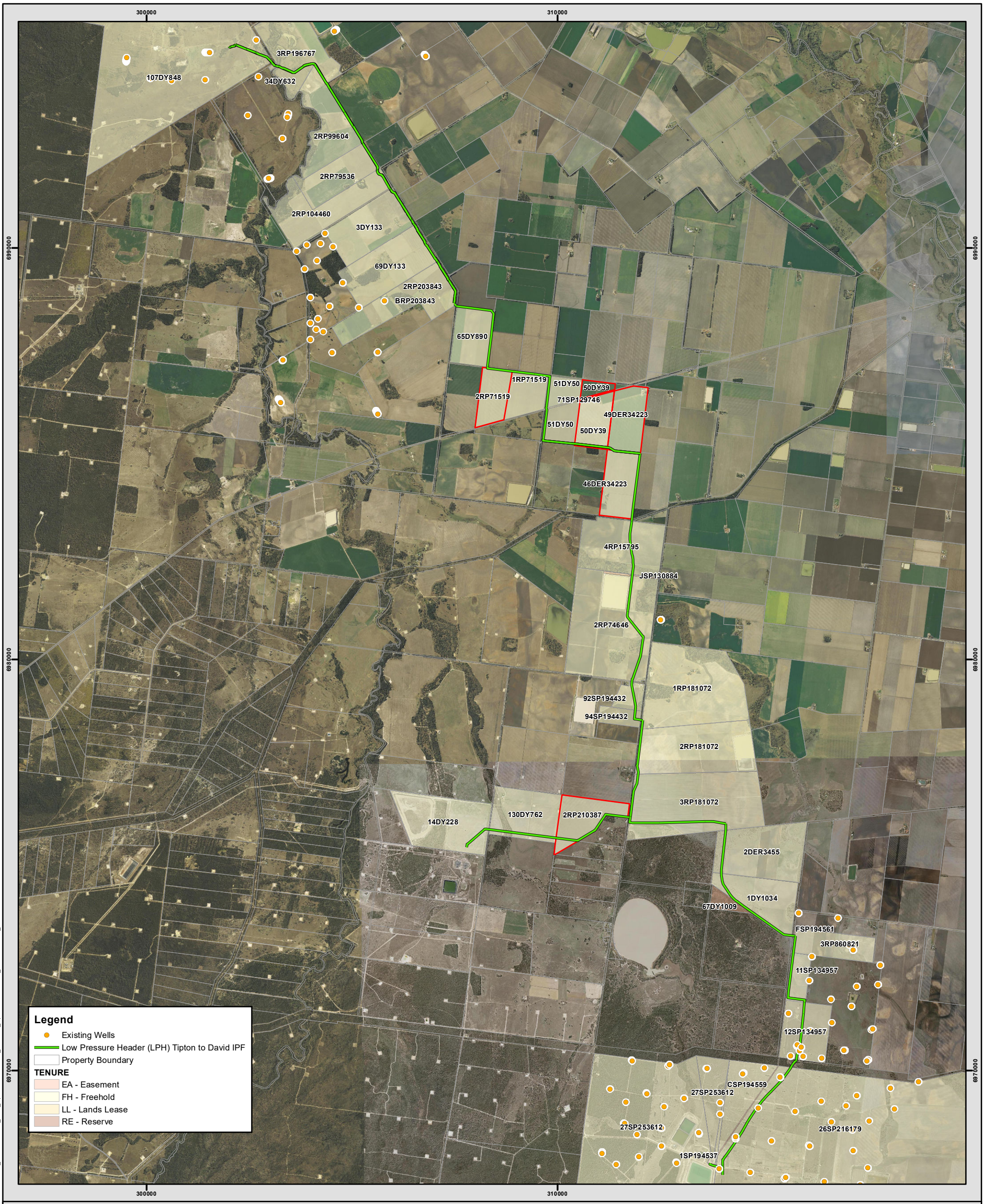
Lot Plan	Area of Reginal Interest (ARI)	
	PAA	SCA
2RP210387	Yes	Yes
46DER34223	Yes	Yes
49DER34223	Yes	Yes
50DY39	Yes	Yes
2RP71519	Yes	Yes

Table 1-4 lists the land parcels traversed by the LPH pipelines but are outside the scope of this application.

The land parcel situated on the LPH listed as Lot 12 SP134957 is owned by Arrow (Tipton) Pty Ltd. While this is the same entity as the petroleum authority holder for this section of the LPH, a RIDA already exists for this lot and includes the LPH as an authorised activity under that approval. This RIDA (SARA Reference is RPI18/011/Arrow Glenelg) was completed on 22 October 2018 with an amendment finalised approximately a month later on 26 November.

Also, the land parcel at the northern end of the alignment listed as Lot 2 SP214220 and held by the Western Downs Regional Council is not located within any RPI Act trigger mapping layers and therefore is not the subject of this application.

Further, the Arrow RIDA (SARA Reference 16/007/Arrow Tipton – Longswamp Gatherign Project) authorised a small, now constructed project (disturbance area of 0.068 ha) on an Arrow owned property which is near to but not on the LPH alignment and is therefore not relevant to this application.



Low Pressure Header (LPH) Tipton to David IPF

Source: Arrow Energy Pty Ltd
Geoscience Australia
DNRME

Date: 9/06/2021
Issued To: A Hall
Author: jluke

0 1 2 4 6 8 Kilometres

Scale 1:85,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

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Note: The dimensions, areas, number of lots, size and location of corridor information are approximate only and may vary.

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Table 1-4 – Land Parcels not the subject (i.e. outside the scope of) of this RIDA Application

Lot Plan	Voluntary Agreement in place	Mapped as PAA	Mapped as SCA
27SP253612	Yes	Yes	No
2DER3455	Yes	Yes	Yes
1RP181072	Yes	Yes	Yes
2RP181072	Yes	Yes	Yes
3RP181072	Yes	Yes	Yes
1SP194537	Yes	Yes	No
94SP194432	Yes	Yes	Yes
92SP194432	Yes	Yes	Yes
2RP74646	Yes	Yes	Yes
4RP15795	Yes	Yes	Yes
3RP196767	Yes	Yes	Yes
34DY632	Yes	Yes	Yes
107DY848	Yes	Yes	No
12SP134957	Yes Existing RIDA RPI18/011/Arrow Glenelg	Yes	Yes
26SP216179	Yes	Yes	No
3RP860821	Yes	Yes	Yes
11SP134957	Yes	Yes	Yes
1DY1034	Yes	Yes	Yes
2RP203843	Yes	Yes	Yes
69DY133	Yes	Yes	Yes
65DY890	Yes	Yes	Yes
1RP71519	Yes	Yes	Yes
51DY50	Yes	Yes	Yes
130DY762	A voluntary agreement is being negotiated	Yes	Yes
14DY228	A voluntary agreement is being negotiated	Yes	Yes
67DY1009	A voluntary agreement will be negotiated with the State for this lot as per the usual practice when working on State land	Yes	Yes
71SP129746	A voluntary agreement will be negotiated with the State for this lot as per the usual practice	Yes	Yes

Lot Plan	Voluntary Agreement in place	Mapped as PAA	Mapped as SCA
	when working on State land		
2SP214220	Yes	No	No
3DY133	Yes	Yes	Yes
2RP104460	Yes	Yes	Yes
2RP79536	Yes	Yes	Yes
2RP99604	Yes	Yes	Yes

1.6 Arrow Activities

Arrow is an integrated coal seam gas (CSG) company, exploring and developing gas fields, producing and selling CSG, and generating electricity. Arrow has been safely and sustainably developing CSG since 2000 and supplying it commercially since 2004. Arrow delivers approximately 20 per cent of Queensland's gas from CSG fields in the Bowen and Surat basins.

Arrow owns one of Queensland's largest power stations, Breamar 2 near Dalby, and has interests in a further two, with power generation capacity equivalent to the power requirements of around 800,000 homes. Arrow's first Surat Basin tenure was granted in March 2000 and Arrow drilled its first Surat Basin exploration well in June 2001.

The proposed Surat LPH will transport CSG and produced water from Arrow's Surat Basin gas fields to field compression stations and water treatment facilities in the Tipton and Daandine fields and treated water for beneficial use to Condamine Alluvium water users.

1.6.1 Overview of the Surat Gas Project

Arrow Energy is expanding its coal seam gas (CSG) operations in the Surat Basin through the SGP. The project seeks to commercialise gas reserves held in Arrow's petroleum tenements. The proposed LPH water, gas and BUN pipelines are essential infrastructure to the SGP.

On 1 December 2017, Arrow Energy and the Shell-operated QCLNG joint venture announced a Gas Sales Agreement (GSA) to commercialise the majority of Arrow's gas reserves in the Surat Basin. The collaboration between the parties will see the use of existing QGC-operated infrastructure such as gas compression, processing and transmission infrastructure as well as water transport and treatment facilities. Improving the utilisation of the existing upstream infrastructure will reduce impacts to landholders, communities and the environment.

The nature of the delivery points for the sales gas within this commercial agreement enables Arrow to develop and commercialise its Surat tenure whilst reducing the land disturbance footprint of its SGP development in comparison with the proposed development approved in 2013. Arrow is also progressing a

Water Services Agreement for the receipt of raw water, storage, processing and re-delivery of treated water, utilising capacity made available by the Water Services provider. This similarly reduces the land disturbance footprint of the SGP development in comparison to plans presented in 2013.

1.6.2 Applicant's co-existence commitments

Arrow considers coexistence to mean allowing Australia to enjoy the full benefits from both agricultural and resource industries. Arrow has made 12 commitments to coexistence on Intensively Farmed Land ("IFL") in the Surat Basin:

1. No permanent alienation
2. Minimised operational footprint - less than 2% of total IFL area
3. Flexibility on CSG well locations, but all wells located by edge of farm paddocks
4. Pad drilling (up to 8 wells from a single pad) used where coal depth and geology allows
5. Spacing between wells maximised (average of between 800m - 1500m)
6. Pitless drilling only
7. No major infrastructure facilities on IFL (dams, compression stations, gas gathering stations, water treatment)
8. Treated CSG water used to substitute existing users' allocations on IFL
9. No brine/salt treatment or disposal on IFL
10. Flexibility on power supply option - above or below ground
11. Fair compensation - including elements of 'added value'
12. Continued proactive engagements with community and transparency on coexistence field activities

*Commitment 8 refers to the area of greatest predicted drawdown on the Condamine Alluvium resulting from CSG extraction by Arrow Energy.

1.6.3 Area Wide Planning

Area Wide Planning (AWP) is a unique program developed by Arrow to incorporate landholders' knowledge into its field development plans. Landholders and Arrow staff work together to identify locations for infrastructure, such as well pads, gathering lines and access tracks, across farming districts and on flood plains.

The process strengthens Arrow's ability to coexist with agricultural activities. Planning occurs one-on-one with landholders and, where appropriate, in local area meetings with neighbouring landholders. Specific landholder agreements are then formalised in Conduct and Compensation Agreements ("CCAs"). The program demonstrates a commitment to genuine engagement and a commitment to preserving the values that are important to landholders.

1.7 Existing Authorities

Arrow holds the following necessary approvals for the construction and operation of the proposed LPH, as outlined in the following sections.

1.7.1 Arrow's Petroleum Authorities

The following Petroleum Authorities issued under the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act) and Environmental Authorities issued under the *Environmental Protection Act 1994* relate to the LPH alignment (refer to Figure 1-1). Those authorities related to land parcels within the scope of this application are marked with an *.

Table 1-5 – Arrow Petroleum Authorities

Tenure	Grant Date	Holder/s	Location	Dimension	EA Name	EA Number
PL198	9 December 2004	• Arrow (Tipton) Pty Ltd • Arrow (Tipton Two) Pty Ltd • Arrow CSG (Australia) Pty Ltd	Tipton West (South-West of Dalby)	258.9 km²	Dalby Expansion Project(DXP)	EPPG00972513
PL230	19 December 2005	• Arrow (Daandine) Pty Ltd • Arrow CSG (Australia) Pty Ltd	Daandine (North-West of Dalby)	140.40 km²		
PL252*	20 September 2008	• Arrow Energy Pty Ltd • Arrow CSG (Australia) Pty Ltd	Stratheden (South-West of Dalby)	76.25 km²		
PL260*	1 April 2011	• Arrow (Tipton) Pty Ltd • Arrow (Tipton Two) Pty Ltd • Arrow CSG (Australia) Pty Ltd	Longswamp (South of Dalby)	219.52 km²		
PPL2052*	26 February 2021	• Arrow CSG (Australia) Pty Ltd	West of Tipton	20 sub-blocks	Harry EA	EA0002659

1.7.2 Regional Interests Development Approvals

The following RIDAs relate to land parcels along the LPH alignment.

Table 1-6 – Arrow RIDAs

Name	Issue Date	Holder/s	RIDA No
Glenelg	26 November 2018	• Arrow CSG (Australia) Pty Ltd • Arrow (Tipton Two) Pty Ltd • Arrow (Tipton) Pty Ltd	RPI18/011/Arrow Glenelg
Tipton CGPF	5 July 2018	• Arrow CSG (Australia) Pty Ltd • Arrow (Tipton Two) Pty Ltd • Arrow (Tipton) Pty Ltd	RPI18/012/Arrow Tipton

1.7.3 Other Approvals Required

Further, the following agreements and approvals will be obtained prior to the commencement of construction of the LPH:

- Conduct and Compensation Agreements pursuant to the P&G Act with all impacted landholders on the proposed route, and
- Crossing agreements with State and Local Government agencies such as the Department of Transport and Main Roads and Western Downs Regional Council and infrastructure providers such as Powerlink and Alinta Energy, where applicable.

Where CCA's are reached with landholders within the scope of this application prior to the approval of the application, Arrow will apply to amend the application to exclude lots subsequently covered under a CCA.

2. Application Form Information

2.1 Property Details and Proposed Activity

Table 2-1 provides summary of the proposed activities, location and proposed disturbance area. Figures illustrating the location of disturbance on each land parcel are provided in Appendix 2.

Table 2-1 - Property Details and Proposed Activities

Parcel	Whole/Part	Activity	Area of Surface Disturbance (ha)	
			PAA	SCA
2RP210387	Part	Gas and Water Pipelines	7.8	7.5
46DER34223	Part	Gas and Water Pipelines	7.4	6.7
49DER34223	Part	Gas and Water Pipelines	1.7	1.7
50DY39	Part	Gas and Water Pipelines	4	3.1
2RP71519	Part	Gas and Water Pipelines	2.4	2.4
Total			**23.3 ha**	**21.44 ha**

The resource activity of gas and water pipeline is defined as a low pressure pipeline header comprising:

- Underground gas pipelines.
- Underground water pipelines.
- Underground power and fibre optic cables.
- Pipeline signage, low point drains (LPD), high point vents (HPV) and valve pits.

Refer to Section 3 for additional details.

2.2 Land Use

2.2.1 Current Land Use

The current land use for the vast majority of the Land along the alignment is primarily agricultural land with some grazing (refer to Figures in Appendix 2). The initial section of LPH beginning near Tipton also includes some industrial uses, primarily CSG Dams and the end of the LPH includes some forestry areas. The majority of lots are held as freehold land by private landholders.

2.2.2 Surrounding Land Uses

The existing surrounding land uses comprise areas used for ongoing operation of existing petroleum activities as well as for productive rural purposes, such as dryland cropping, irrigated cropping, grazing of beef cattle and some forestry areas (refer to Figures in Appendix 2).

2.2.3 Easements

Easements related to land parcels along the LPH alignment are listed in Table 2-2. None of these asements located on land parcels within the scope of this application and intersected by the LPH.

Table 2-2 – Easements Intersected

Land parcel	Easement	Purpose	Location	Dimension		
				Area	Length	Approx Width
27SP253612	ASP194537	Easement	Grassdale	108,957 m²	5,663 m	20 m
2RP203843	BRP203843	Easement associated with Ergon Poles and Towers	Ducklo	26,030 m²	1,285 m	12 m
3RP860821	FSP194561	Easement associated with the Braemar 1 Pipeline (PPL102)	Springvale	12,009 m²	600 m	20 m
2RP74646	JSP130884	Easement	Ducklo	58,077 m²	1,347 m	31.5 m
3RP860821	FSP194561	Easement associated with the Braemar 1 Pipeline (PPL102)	Ducklo	58,077 m²	1,347 m	31.5 m
11SP134957	ESP194561	Easement associated with the Braemar 1 Pipeline (PPL102)	Springvale	23,366 m²	1,168 m	20 m
2RP79536	ARP79536	Easement	Ranges Bridge	15,188 m²	756 m	20 m

2.2.4 Overlapping Resource Authorities

In addition to Arrow held resource authorities (refer to Table 1-5), the following resource authorities exist over varying parts of the proposed LPH alignment. Overlapping authorities related to land parcels within the scope of this application are marked with an *.

Table 2-3 – Overlapping Resource Authorities

Tenure Number	Tenure Type	Holder	Grant Date	Related Environmental Authority	Location	Dimension
EPC899	Exploration Permit for Coal	New Emerald Energy Pty Ltd	05/08/2005	EPSX00647913	South of Chinchilla	47 Sub-Blocks
EPC1770*	Exploration Permit for Coal	New Emerald Energy Pty Ltd	12/11/2009	EPSX00446313	20km West-South-West of Dalby	111 Sub-Blocks
PL279*	Petroleum Lease	QGC Pty Ltd	27/06/2011	EPPG00797813	20km West of Dalby	70 Sub-Blocks
PPL102	Petroleum Pipeline Licence	Braemar Power Project Pty Ltd	22/10/2004	EPPG00373913	described as Tipton to Oakey; Tipton to Dalby; Dalby to Kogan	58.791 km

2.2.5 SCL Compliance Certificates

Apart from Arrow held RPI Decisions (refer to Table 1-6), Arrow holds a SCL Compliance certificate (reference no SCLRD2014/000178) over all or part of the land subject to this application.

2.2.6 Title Searches

Copies of titles searches for land parcels subject to this application accompany this application and are presented at Appendix 1.

2.2.7 Road Reserves

The following road reserves are not subject to this application due to their use as infrastructure. Further, Arrow will negotiate voluntary agreements with the relevant authority for each road prior to commencement of disturbance.

Table 2-4 – Road Reserves crossed by LPH

Road	Description
Kumbarilla Lane	Council Controlled Road
Unamed Road between 107DY848 & 34DY632	Unformed road
Duklo School Road	Council Controlled Road
Duleen Daandine Road	Council Controlled Road (Formed)
Kupuun Duleen Road	Council Controlled Road (Sealed)
Unamed Road between 1RP71519 & 51DY50	Council Controlled Road (Formed-Track)
Moonie Highway	State Controlled Road
Broadwater Road	Council Controlled Road
Jones Road	Council Controlled Road
Unamed Road between 12SP134957 & 26SP216179	Unformed Road

3. Resource Activities

3.1 Description of project and work activities

The function of the proposed Surat LPH gas and water pipelines is to convey gas from the well gathering networks to compression infrastructure, to convey produced water to the water treatment system and treated water to beneficial water users. Water pipelines, gas pipelines, fibre optic cables and power cables will be installed in a common easement. The RoW width for the co-located pipelines will be up to 50 m.

The LPH pipeline route will be located between the David Inlet Processing Facility (IPF) on PL230 and the Tipton Central Gas Processing Facility (CGPF) on PL198 approximately 40 kilometres to the south. A spur line of approximately 4.3 kilometres also connects the main trunk of the LPH to the Harry IPF on QGC's PL279.

Figure 1-1 and 1-2 show the extent of the pipeline alignment and the petroleum tenures and land holdings this alignment traverses. The LPH is a key component of the SGP which will develop Arrow's Surat Basin gas fields and deliver gas to the Southeast Queensland gas and energy markets.

The proposed pipelines will be up to three buried HDPE pipelines up to DN800 in size, approximately 40 km carrying produced water, Coal Seam Gas (CSG) and treated water. The pipelines will be built to APGA Code of Practice for Upstream Polyethylene Gathering Networks in the Coal Seam Gas Industry (APGA Code of Practice).

In addition to the pipelines, the LPH comprises mimimal above ground facilities including pipeline signage, drains, vents and valve pits.

3.2 Definition of work activities

The pipelines will be installed by conventional trenching with a trenching machine or excavator. Where the pipelines are required to be installed below existing roads or infrastructure, other trenchless technologies may be used.

Conventional trenching involves an open trench as deep and as long as needed to install, inspect or maintain piping, conduits or cables. After installation, the trench is filled with the dirt removed during the trenching phase and the surface is restored.

Examples of a pipeline being laid using the trenching method is shown in Plate 3-1 and Plate 3-2.

Plate 3-1 – Image of pipeline being installed by trench method

Plate 3-2 – Image of pipeline being installed by trench method

3.3 Pipeline construction for purposes of assessment

Pipeline construction requires the following activities to be undertaken:

- Detailed survey of the RoW and construction areas
- Establishing temporary access tracks if necessary
- Installing temporary gates and fences as required
- Clearing vegetation, where required, and grading the RoW to prepare a safe construction working area (on average the construction RoW will be 50 m in width to provide area to spread soil during rehabilitation)
- Separating and stockpiling topsoil and subsoil to protect and preserve topsoil
- Crossing watercourses, roads and existing buried pipelines by open cut, boring or alternate trenchless technology (e.g. Horizontal Directional Drilling (HDD) methods) depending upon the type and nature of the crossing
- Delivering pipe sections along the RoW

- Welding the low pressure HDPE pipe sections together to form ‘a string’
- Creating a trench in which to lay the pipeline. The trench is excavated by a trenching machine or excavator and may include the use of rock saws, excavators, rock hammers or blasting in hard rock terrain
- Lowering the pipeline strings into the trench and placing padding (e.g. screened trench subsoil) around the pipe to protect the pipe from external damage
- Returning the subsoil and topsoil to their original horizons
- Testing the integrity of the pipeline by pneumatic testing or filling it with water and pressurising it to above the maximum allowable operating pressure (i.e. hydrostatic pressure testing)
- Cleaning up, restoring and progressively rehabilitating the construction RoW and all temporary tracks, gates and fences
- Installing permanent gates and signage where required

Installation of multiple pipelines in a single RoW is generally sequential, i.e.; the first pipeline is installed and the trench backfilled before the next pipeline installation commences. A diagram of a typical construction Right-Of-Way (RoW) with multiple pipelines is provided in Figure 3-1.

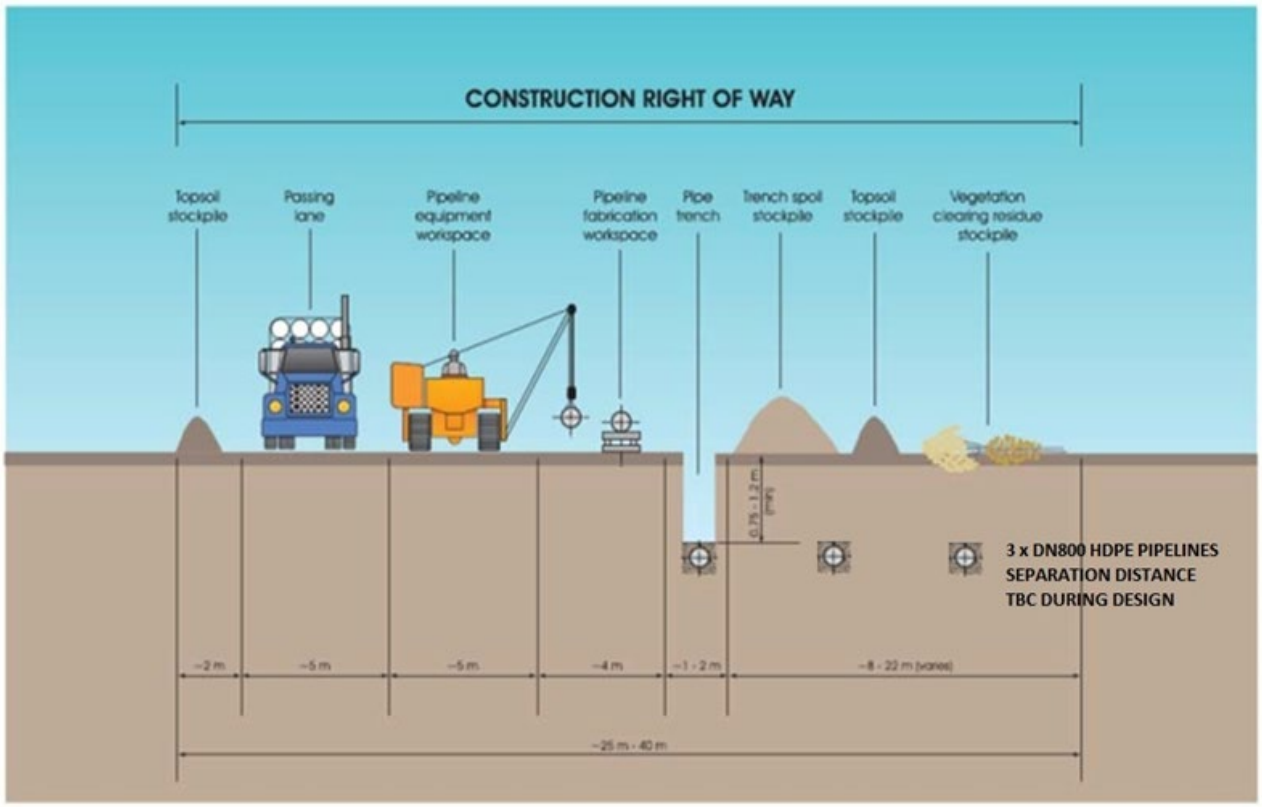


Figure 3-1 - Typical Profile ROW Layout (Exact configuration to be confirmed during design)

The width of the construction RoW has been reduced as far as possible to minimise surface imapcts, however, Arrow has also ensured that adequate space is available to safely construct the pipeline and implement the necessary mitigation measures (e.g. separation of soil stockpiles) to provide the best reinstatement outcome. The ROW width will also be influenced by the number of pipelines required for each section of the LPH.

Where possible, construction vehicles will utilise existing roads, road verges and tracks to further reduce the width of the RoW. The nature and extent of extra work areas (outside of the RoW) has also been minimised and is generally only required for road crossings. The extent of any extra work areas for each parcel are illustratrated in Appenidix 2.

3.3.1 Watercourse Crossings

Watercourse crossings will be constructed using the method most appropriate to the crossing, having regard to the protection of the riparian zone, erosion potential and construction difficulty. Crossing methods will include:

- Minor watercourses, ephemeral streams and gullies will be crossed using an open cut construction method.
- Watercourses with standing or flowing water will be crossed by open cut methods, or if required by open cut methods with water flow controls.

In addition to pipe laying, temporary vehicle crossings will be constructed to facilitate the movement of construction vehicles over watercourses. To minimise the period of construction and subsequent environmental disturbance, the construction contractor will complete watercourse crossings within the shortest period practicable.

3.3.2 Road Crossings

Paved and sealed road crossings will be bored to reduce impacts on traffic flow and ensuring no damage to \ road pavement integrity. Boring is a low impact technique involving drilling short distances from below ground within an enlarged trench area (borepit) either side of the road or rail within the ROW. The feasibility of using a bore is limited by site conditions including depth required, width of crossing, geology, landform, soil type and service / infrastructure. Soil measures for removal, stockpiling and reinstatement for the bore pits will follow the same protocols as for the ROW.

Minor roads (including where permitted, minor roads that are paved) will be crossed using open cut construction methods.

3.3.3 Extra Work Areas

Areas of additional work areas (EWA) adjacent to the ROW will be required to provide additional temporary construction areas for a range of activities including truck turn around areas, equipment storage areas, soil and vegetation stockpiles and space for installation of bore pits for bored crossings. The location of EWA's on land parcels included in the scope of this application are illustrated in Appendix 2.

These EWA are temporary during construction only and are typically fully rehabilitated within 12 months of use.

3.3.4 Access Tracks

Access to the pipeline RoW will occur predominanty via existing access tracks located adjacent the RoW. In some instances new tracks my need to be constructed, however there are no new tracks required on any of the lots subject of this application.

4. Priority Agricultural Land Use (PALU)

4.1 Overview

PAAs are strategic areas, identified on a regional scale, that contain significant clusters of a region's high value intensive agricultural land uses. The PAA surrounding the Land includes areas of high value agricultural land uses, in particular areas of dryland cropping and grazing.

Within the PAA, Priority Agricultural Land Use (PALU) is given priority by ensuring that the location of resource activities can coexist with these uses.

4.2 Identification of PALU

The RPI Act Guideline 07/14: *How to identify a priority agricultural land use* (PALU) was consulted to determine if the Land within the Darling Downs Regional Plan is, or has been, utilised as PALU.

Section 2 of the RPI Regulation states that :

> *For land or property in relation to PALU, means the land or property has been used for PALU for at least 3 years during the 10 years immediately before an assessment application is made in relation to the land.*

To determine the extent of PALU on land included within the scope of this application, an assessment of the historical and current land use within the study area was undertaken for the years 2011 - 2020 utilising the following information sources:

- Reference to GIS satellite imagery (Appendix 2) and the Darling Downs Regional Plan (Department of State Development, Infrastructure and Planning, 2013) to confirm the Project is located within a PAA.
- Reference to the Queensland Land Use Mapping Program (QLUMP) to confirm dominant Australian Land Use and Management (ALUM) classification for the area, cropping and grazing native vegetation (Appendix 3).
- Department of Science, Information Technology, Innovation and the Arts (DSITIA) Forage Crop Frequency Data for the years 2011 – 2020 (Appendix 4),

A summary of the findings is provided in Table 4-1 and additional details provided in Appendices 2 to 4 as outlined above.

Table 4-1 – Outcome of Identification of PALU on land parcels

Parcel	QLUMP Classification	Cropping Frequency >3 in past 10 years	Field Review of Area to be disturbed (refer to Appendix 2)	PALU
2RP210387	Cropping	**Yes**	**Used for cropping dryland cereals and pulses**	**Yes**
46DER34223	Cropping	**Yes**	**Used for dryland cropping**	**Yes**
49DER34223	Cropping	**Yes**	**Used for dryland cotton, cereals and pulses**	**Yes**
50DY39	Cropping	**Yes**		**Yes**
2RP71519	Cropping	**Yes**		**Yes**

4.2.1 Outcome of PALU Identification

As outlined in Table 4-1, PALU has been identified as occurring in the disturbance area on all impacted land parcels..

4.3 Extent & Impact PALU on LPH

The LPH will be constructed within a RoW up to 50 m in width which temporarily impacts no more than 6% of an individual lot during construction and less than 1% during operations. Additionally, construction of the pipeline is relatively quick, with the duration of construction expected to be a maximum of 3 months on each property and surface activities able to recommence post constructon.

However, construction activities will only be occurring on a portion of the properties and agricultural activies on the balance of the properties will not be impacted. Agricultural activites on the area used for construction will be able to recommence upon completion of rehabilitation after construction and the disruption to agricultural activities will be limited to less than one cropping season.

On some properties, high point vents and/or low point drains will be required to be installed (refer to Appendix 2). This infrastructure will be located on property boundaries and outside of cropping areas to limit the potential impact on landholders. The surface area of such infrastructure will typically be between 16 and 36 m^2 per site.

Due to the nature, duration and limited extent of the expected area of impact of the authorised petroleum activities, the Applicant considers the authorised activities would not have a significant impact on PALU. Measures implemented to minimise potential adverse impacts to PALU include:

- Preferentially locating the alignment adjacent to roadways, property boundaries or edge of cropping as far as possible given other contraints (e.g. EA conditions around the primary protection zones of Environmentally Sensitive Areas, restricted land requirments under the *Mineral and Energy Resources (Common Provisions) Act 2014*). This maximises the balance of land for agricultural activities;
- Minimising the ROW width, while also still ensuring sufficient work area to safety construct the pipeline and ensure adequate space for separation of soil stockpiles and implementation of sediment and erosion control measures;
- utilising the minimum area possible
- Locating the the RoW on previously disturbed areas where available;
- Locating the RoW alongside roadways and existing landholder tracks removing the requirement for an additional access track;
- Location and design of the RoW to avoid interference with farm machinery such as tractor routes and will not interfere with the use of booms on farm machinery as they can be raised above when turning close to the infrastructure. In this way,

the design of the infrastructure will not impact on the style of farming on the property;

- Locating with the input of landholders any high point valves, low point drains, inspection pits or valves adjacent to property boundaries and access tracks and outside of cropped areas so that they do not have any impact on PALU on the property;
- Minimising the construction period on each land parcel. Construction period for the LPH will be minimised to as short as possible to avoid impacts to landholders as much as possible (refer also to 4.3.2);
- Implementation of control measures during construction to minimise impacts to areas subject to disturbance and ensure soil is returned to pre-construction productive capacity (refer to Section 7);
- Implementation of rehabilitation techniques to ensure the construction footprint does not have a significant or long term impact on the ability to use the underlying area for agricultural activities in the future (refer to Section 7);; and
- Implementation of rehabilitation techniques to ensure that when the LPH is decommissioned, the operational area is rehabilitated and returned to productive agricultural use, in accordance with the Environmental Authority (refer to Section 7).
- Once the project has been decommissed, all pipelines are made safe and left in the ground. Above ground infrastructure is removed.

4.3.1 Nature of Surface Impacts

The nature of surface impact to PALU subject to this application will involve construction duration disturbance of up to 23.1 ha (across all Lots combined) to the existing land use, consisting of up to 5.3 km of pipeline construction RoW and extra work areas on PALU. The scale of impact to PALU on each land parcel is illustrated on the Property Maps in Appendix 2 and summarised in Table 4-2.

Following completion of the construction, reinstatement and commissioning phases of the pipeline, with normal agricultural activities , including cropping activities, able to be re-established over the pipeline. While there are some impacts following initial rehabilitation, compaction in the construction area will be naturally remediated by the wetting and drying of soils. The minimum depth of cover for the pipeline will be 900mm which is considered sufficient to enable existing cropping activities to occur post construction. This has been evidenced on previous pipeline projects on intensively farmed land between Daandine and Tipton.

As an example, the image below (Plate 4-1) shows Arrow's Theten farm and a RoW where crops have been re-established post construction compared to the condition of the surrounding crops. The photo was taken approximately 12 months after construction. The rehabilitated RoW includes two HDPE pipes (DN630 and DN450) running parallel to the access track within the edge of the cropped area of the paddock.

Plate 4-1 - Image of the re-establishment of crops within a pipeline ROW

For larger diameter pipes, the trench depth may be up to 2 m deep at road crossings.

Future activities requiring excavation or establishment of permanent infrastructure are restricted above the pipelines during their operational life. This includes high point vents, low point drains and isolation valves. This area is recorded as surface impacts post construction in Table 4-2. Such infrastrucute is located on property boundaries, outside of areas of cropping.

Additional temporary indirect impacts to PALU will occur on some land parcels including:

- Use of alternate access for accessing areas adjacent the RoW;
- Limitation of access to adjacent land with large agricultural equipment, particularly where the alignment runs perpendicular to the cropping direction;
- Temporary isolation of areas of paddocks due to the location of the pipeline alignment.

In general, the landholder will be able to plant or harvest directly up to the RoW corridor as there will be no gap or break between the RoW and where a landholder can farm. Circumstances where temporary impact may occur include:

- Parallel scenario can disrupt planting rows along the edge of the RoW during construction, where the RoW doesn't line up with the guess row of the planter
- Perpendicular scenario creates a new headland alongside the RoW during construction only and this may result in a reduction in potential yield due to vehicle traffic and double planting
- Compaction in the ROW area

The majority of surface impacts will be temporary and limited to the duration of construction only (refer to Section 4.3.2). Areas where indirect impacts may potentially occur as a result of the construction process have been identified in Appendix 2.

Table 4-2 – Extent of Impact on PALU

Parcel	LPH Infrastructure	Parcel Size (Ha)	PALU on Parcel (Ha)	Surface Disturbance to PALU (Ha) during Construction	Surface Impact to PALU (Ha) – during Operations	% PALU Impacted during construction	%PALU impacted during operations
2RP210387	2 x pipelines, fibre optic cable & 2 x low point drains	132.7	132.7	7.8	0.007	5.88%	0.005%
46DER34223	3 x pipelines, fibre optic cable, electrical cable & 2 x high point vents	129.6	125.7	7.3	0.003	5.81%	0.002%
49DER34223	3 x pipelines, fibre optic cable & 3 x high point vents	125.7	123.6	1.7	0.005	1.38%	0.004%
50DY39	3 x pipelines, fibre optic cable, electrical cable & 1 x high point vent	127.0	126.8	3.9	0.002	3.08%	0.002%
2RP71519	3 x pipelines & fibre optic cable	93.3	93.3	2.4	0	2.57%	0.000%

4.3.2 Construction Timeframe

The installation timeframe is variable for each property. Factors to determine the overall installation timeframe include:

- The number of pipelines to be installed and their associated lengths
- The number of features along the pipeline e.g. LPDs, valves, HPVs, crossings
- The sequence of construction
- Soil conditions (construction progress is slower in rock areas)
- If there is fibre optic or electrical cables to be installed

The pipeline construction crews move in train like fashion. They will be on the property to install the first line (moving at 400-500 m/day) and will then move off the property to continue installing on neighbouring properties. Backfilling is carried out soon after the pipe is laid in the trench and is nearly always concluded in less than a week. The process is repeated for each of the three pipelines.

FOC/electrical cables are typically installed after pipeline installation and can be installed much faster than pipeline installation.

This is followed by ROW reinstatement and commissioning activities including pressure testing.

As a guide for an average size property the overall construction duration is usually from 2 to 3 months from start to finish. This is subject to the factors outlined above.

The number of pipes and the timing for construction on each property the subject of this application is included in the Table 4-3 .

Table 4-3 - Number of pipes and construction timing

Parcel	Number of pipes on each property	Approximate construction time on each property
2RP210387	2	1-2 months
46DER34223	3 + elec cable	1-2 months
49DER34223	3	1-2 months
50DY39	3 + elec cable	1-2 months
2RP71519	3	1-2 months

4.3.3 Production & Productive Capacity

Construction of the LPH may result in the temporary loss of crop from within the area impacted by construction where:

- Crop is disturbed prior to harvesting;
- Crop is unable to be planted or planting is delayed due to timing of construction.
- Compaction post rehabilitation for a period until remediated by wetting of soils.

In addition, the nature of disturbance may result in a temporary decrease in the productive capacity of the disturbed area. Arrow will implement a range of management measures during construction to minimize the extent of impacts and duration of recovery of the productive capacity. These measures include preservation of removed topsoil, clear separation to excavated topsoil and sub-soil, replacement to match existing horizons compaction relief and utilization of ameliorants (gypsum and organic matter/fertilizer) during rehabilitation (refer to Section 7 for additional details). Based on past experience in the area, Arrow have found that implementation of such measures returns the impacted areas to full productive capacity within 12 months. This period is also dependent on soil type, rainfall and cropping regime.

4.3.4 Overland Flow

A review of the topography of the proposed alignment indicates that the slope within majority of the LPH study area range from near level (<1%) to 3%, with only minor patches of land with slope >3% .

This is illustrated by mapping of subject lots of this application with contour lines at 1 m intervals within a 1,000 m buffer of the proposed pipeline which is provided in Appendix 6.

Drainage on these land parcels flow from the south-east to the north-west. The construction of the pipeline will be prepared to work with this natural drainage line and allow water to flow across the alignment or around it during construction. Pre-construction flow pathways will be reinstated post construction, including irrigated levelled properties.

Based on past experience in the area (previous pipelines constructed), Arrow have not observed any pipeline subsidence or impacts to overland water flow or creation of waterlogged areas.

4.3.5 Weed & Pathogen Management impact on PALU

During construction, comprehensive biosecurity management measures will be implemented to prevent the introduction or spread of weeds or pathogens during construction. This will include:

- Contact with landholders and identification biosecurity matters and plans for each property;
- Ensuring vehicles and equipment are clean of any biosecurity contamination upon arrival on site;
- Clean down of vehicles/equipment between properties to prevent transfer of soil and biosecurity matter;

4.4 Measures to Minimise Impacts to PALU

Arrow has undertaken extensive consultation with landholders and will continue to do this to identify existing and future agricultural activities, location of farm infrastructure and property management logistics and develop an alignment of the pipeline route to minimise potential impacts.

The construction and operational footprint of the activity and potential impacts to PALU have been minimised through:

- Reducing the number and location of extra work areas (EWAs) to the minimum necessary to safety construct the pipeline in compliance with EA requirements. This has taken into consideration the extra work area required to construct watercourse crossing & infrastructure crossings, areas for stockpiling of heavy vegetation, areas of side slope and additional stockpile areas adjacent areas of ROW narrowing.
- Increasing the minimum depth of cover above the pipeline to 900mm, to enable pre-existing landholder activities, in particular agricultural activities such as ploughing, planting and harvesting to continue post construction;
- Alignment of the pipeline adjacent to land parcel and/or property boundaries whereever possible and in consultation with the landholder;
- Aligning the pipeline around the boundary of cropped areas or within areas of properties with less intensive agricultural activity;

- Placement of end of pipeline infrastructure adjacent to existing petroleum infrastructure;
- Alignment of the pipeline adjacent to existing pipeline infrastructure;
- Utilisation of existing disturbance/infrastructure for access tracks and laydown areas;
- Locating with the input of landholders any high point valves, low point drains, inspection pits or valves adjacent to property boundaries and access tracks and outside of cropped areas so that they do not have any impact on PALU on the property
- Prompt reinstatement of the ROW to enable cropping activities to re-establish post construction and continue during pipeline operation;
- Implementation of soil management measures as detailed in the following sections;
- Arrow willadopt a simultaneous operations approach where it is safe to do so so that agricultural activities in the balance of the paddock can be undertaken while construction is occurring;
- Arrow has previously provided heavy vehicle crossing points and if this is agreed to by the relevant landholder along the RoW, they will be installed in appropriate locations;
- The pipeline has been engineered such that a vehicle of 14 tonne axle weight can be driven over the top of it, thus enabling typical farm machinery (such as a John Deere Cotton Round Bale Picker) to continue operation post construction of the pipeline;
- Adopting appropriate weed management practices as described earlier in section 4.3.5.

Refer also to measures provided in Section 4.3.

5. Strategic Cropping Areas

5.1 Overview

SCAs consist of the areas shown on the strategic cropping land (SCL) trigger map as SCL. SCL is land that is, or is likely to be, highly suitable for cropping because of a combination of the land's soil, climate and landscape features.

5.2 Extent of SCL on Alignment

For purpose of application, Arrow accepts the extent of SCL as mapped. The extent of SCL on the proposed alignment has been illustrated on Figure 1-1 and summarised in Table 5-1.

5.3 Nature of Surface Impacts

The nature of surface impact to SCL on parcels subject to this application will involve disturbance of up 21.4 ha (Lots combined) to the existing land use, consisting of up to 5.3 km of pipeline construction RoW, extra work area and access on SCL. The location of impact on each land parcel is illustrated in Appendix 2 and scale of impact on SCL detailed in Table 5-1 including construction impact and surface impact during operations (includes area of surface infrastructure including drains and vents).

Table 5-1 – Scale of Impact to SCA

Parcel	Parcel Size (Ha)	Area SCL on parcel (Ha)	Surface Disturbance (Ha) during Construction	Surface Impact (Ha) during operations	% Impact on SCL - construction	% Impact on SCL during operations
2RP210387	132.7	126.2	7.5	0.007	5.94%	0.006%
46DER34223	129.6	126.5	6.7	0.003	5.30%	0.002%
49DER34223	125.7	125.7	1.7	0.005	1.35%	0.004%
50DY39	127.0	126.0	3.1	0.002	2.46%	0.002%
2RP71519	93.3	93.3	2.4	0	2.57%	0.000%

Following completion of the construction and reinstatement phases of the pipeline, normal agricultural activities will recommence, with existing agricultural activities, including cropping activities, able to re-establish over the pipeline. The minimum depth of cover for the pipeline will be 900mm which is considered sufficient to enable existing cropping activities to occur post construction. Activities requiring excavation or establishment of permanent infrastructure are restricted above the pipelines.

The activity will not result in a material or significant impact on SCL on the property or on the SCL in the area due to the implementation of mitigation measures (refer to Section 4.4 as applied to PAA and Section 7) and the small percentage of sort term construction disturbance comparable to the mapped SCL of impacted properties (refer to Table 5-1). Through implementation of these measures, the land can be restored to pre-existing land condition and pre-existing land use.

A soils assessment of the land associated with the Project has been undertaken and is documented within the AECOM LPH Soil Assessment Report which accompanies this application (Appendix 7). This report provides a characterisation of the current condition of the land and soils, evaluation of the potential impact of the proposed activity on SCL and recommendations in regards to management measures to minimise any predicted impacts to SCL.

In addition, Arrow will work closely with individual landholders to ensure that proposed measures are compatible with existing land management practices on the property. Adjustments to mitigation measures may be made (e.g. stripping depth, amelioration rates, fertiliser type and rates) based on feedback from landholders.

6. Landholder Consultation

6.1.1 Consultation Process

Consultation with both private and public landowners has commenced and will continue throughout the duration of the project. The owners of the land traversed by the pipeline alignment have been identified and the land parcels intersected by the current alignment, where mapped PAA and SCA will be impacted, are listed in Section 1.5 of this report.

Arrow is seeking voluntary agreements with each landholder along the alignment and will seek to amend this application should all agreements be obtained by providing additional notice to the Department of State Development, Infrastructure, Local Government and Planning (DSDILGP) of these agreements, and request that the relevant land parcels be removed from the scope of this application. Arrow's land access process involves four steps which are included in Table 6-1.

Table 6-1 – Arrow Energy Access Process

Step	Activities
Area Wide Planning (AWP)	• First landholder engagement including discussion of proposal and identification of areas of concern • Concept layout • Site scouting • Issued For Site Assessment (IFSA) GIS layer
Site Assessment	• Subject Matter Experts review IFSA GIS layer to identify required agreements • Site assessment including review and assessment of concerns raised by landholder • Released From Survey (RFS) GIS layer
Drafting and presenting Conduct and Compensation Agreements (CCAs)	• RFS GIS layer reviewed, scope is locked, budget approved - termed Final Layout Approval (FLA) • Drafting of CCA/AA • Presenting CCA/AA to landholder including proposed measures to address concerns raised
Negotiating and executing CCAs	• Negotiating on measures to address any outstanding concerns • Negotiations to settle terms and conditions and compensation amount • Execution (signing) of CCA/AA by landholder and Arrow

The strategy to engage with landholders is as follows:

Land Liaison Officer's (LLO) contact each landholder directly and then meet with them to describe the project. During intital discussions, all property constraints are discussed and captured on a map. A landholder questionnaire is used to capture additional information about the property. If it's considered appropriate, conceptual maps of Arrow's proposed development may be provided during this meeting.

Questions raised by the landholder are answered by the LLO either by phone or email-depending on the nature of the question and detail required. All intereactions are captured in file notes.

During initial scouting (which the landholder is encouraged to attend) the field design is established. If the property being scouted is used for cropping activities, then further consideration is given to the placement of infrastructure with regard to their farming operation ie HPV / LPD locations, placement and orientation of well pads to align with A-B Farming tracks, access tracks, pipelines (including placement of pipelines within the ROW).

This information is then surveyed and the results are included in a sketch map which is presented back to the LH to confirm the accuracy of the survey.

Arrow provides landholders with a minimum of 20 business days up to 140 business days to consider the sketch map and provide feedback. The timing allowed for this step is dependant on the proposed development and the complexity. Arrow always respond to any concerns about the proposed development or other issues identified by the landholder.

Arrow will negotiate in good faith with landholders and aim to reach voluntary agreement. This means that each of our engagements with landholders and their legal representatives are to be undertaken in a manner that:

- demonstrates respect
- demonstrates open and transparent dialogue
- adopts the technique of active listening
- is empathetic to grievances/complaints and seeks to resolve disputes in a timely manner
- provides transparency of our proposed activities and potential impacts
- allows sufficient time to negotiate and reach agreement (e.g. recognising that an agreement will not be resolved in a single or even a few meetings)
- Seeks to be as efficient as possible in the use of time and provides an acceptable outcome for both parties.

Several CCAs with landholders along the alignment have already been secured. These agreements are identified in Table 1-4.

6.2 Status of Consultation

A summary of the progress of consultation with landholders subject to this application is provided in Appendix 9. This Appendix is considered confidential and not subject to public release.

7. Management of Mitigation Measures

7.1 Route Selection & Assessment of Alternates

The initial stages of route selection for the LPH involved a desktop assessment of topographical and ecological mapping, preliminary landholder discussions and field scouting where access to the alignment was available.

Arrow commenced investigation of the pipeline alignment in 2018, which has involved:

- Site scouting activities;
- Ecological and cultural heritage desktop analyses;
- Ecological field assessments;
- Engineering and constructability assessments;
- Desktop soil assessment;
- Detailed landholder discussions; and
- Cultural heritage field assessments.

The current alignment has taken into account the competing interests of stakeholders, environmental and cultural values, cropping land and landholders whilst selecting a route that is feasible, safe and cost-effective. Engineering, constructability, environment, cultural heritage, overlapping tenure holders and landholders have all been considered during the route selection process.

As with most pipelines, the design and construction of the LPH will be focused on minimising impacts to land by locating the alignment along fence lines and roadways (refer to Appendix 2).

Where this is not possible, sections of the alignment has been located to try and minimize impacts as much as practicable and will be constructed on the edges of paddocks where possible (refer to Appendix 2, which contains a summary of property specific constraints impacting on the alignment on the land parcels).

Further minor refinements to the alignment may be required in response to design and engineering work and negotiations with landholders. Any proposed refinements that may arise will be subject to internal Arrow assessment processes.

Alternative routes were considered during the selection of the current proposed alignment of the LPH. The current alignment was preferred for a number of reasons including (refer to Figure 1-1 & Figure 1-2):

- The pipeline is a relatively direct route between the two facilities being the existing Tipton compression infrastructure and the future IPF at David;
- The pipeline was able to be located on existing Arrow petroleum authorities with no requirement for additional petroleum authority or environmental approvals;
- The pipeline also functions as Arrow's gathering pipelines therefore reducing cumulative impacts (refer to Appendix 2);

- The pipeline will be located amongst existing and future Arrow CSG wells and will make use of existing and future access tracks;
- The alignment avoids the Lake Broadwater Conservation Park which is a Category A Environmentally Sensitive Area; and
- An alignment further to the west would have had multiple interactions with other proponent's existing CSG wells and gathering infrastructure and would not have been viable because of the significant amount of existing infrastrucuture the pipeline would need to cross below.

7.2 Biosecurity Measures

Arrow is aware of the potential impact of the introduction of weeds and/or pathogens on land holdings as a result of their activities and have existing procedures in place to manage this such as Arrow's Biosecurity Guideline (ORG-ARW-HSM-GUI-00123). Comprehensive biosecurity measures will be introduced for the LPH and will include:

- Discussion of property specific biosecurity requirements with landholders;
- Preconstruction weed survey and removal where required;
- Establishment of approved access to the ROW;
- Wash down of vehicles and equipment prior to arrival on site & maintenance of 'clean' status;
- Brush down / clean down of equipment between properties to prevent the transfer of soil or pathogens between properties;
- Pre & post construction monitoring and control as required.

7.3 Reinstatement and rehabilitation

Reinstatement and rehabilitation measures will be applied to all areas disturbed during construction as soon as practical following the completion of the construction of authorised petroleum activities.

All reinstatement and rehabilitation will be carried out in accordance with the Environmental Authority requirements. Generally, this will include:

- Stockpiling of grasses, woody vegetation after clearing and prior to construction;
- Segregation of topsoil to ensure topsoil integrity when soil clearing is required as part of construction;
- Reinstatement of the land contours/land surface and drainage;

- Reinstatement of topsoils;
- Utilisation of soil ameliorants such as gypsum, fertiliser & organic matter;
- Implementation of stabilisation measures (which may include re-seeding for local grass specifies if applicable).

Measures outlined in Section 6 of the LPH Soil Assessment Report (refer to Appendix 7) will also be implemented. Note, this report presently only contains the results of the Desktop Assessment. Further field assessment is progressing and mitigation measures will be revised (as required) based on the results of the field assessment.

The construction footprint of the land will be returned to its previous general state and use once construction is completed and rehabilitation is undertaken leaving only the operational footprint and, the land will be visually consistent with the surrounding land features. Periodic monitoring will be undertaken to ensure integrity of the rehabilitation.

Detailed erosion and sediment control measures will also be implemented and maintained consistent with the Environmental Authority during construction, and as required following construction.

Other reinstatement activities will include:

- Removal of any foreign construction material and waste;
- Restoration of fencing as required.

7.3.1 Rehabilitation from construction to operational footprint

To create a stable landform after pipelines are lowered in, the pipeline trenches are backfilled and compacted to the requirements of Australian Standard AS/NZS 2566 Buried Flexible Pipelines Part 1: Structural Design.

Compaction and testing of embedment / backfill in trenches and bell holes is completed to AS/NZS 2566 Buried Flexible Pipelines Part 2: Installation.

These requirements are specified for in the Arrow Specification for PE Gathering Systems (ORG-ARW-PPL-SPR-00005).

An extract of the backfill and compaction specification that Arrow mandates to contractors is provided in the below.

Table 7-1 – Backfill Grading

Description of Backfill Layer Material	Maximum Particle Size in any Dimension (Grading)
Around the pipe, and to 150 mm above pipe	Embedment material as specified in AS/NZS 2566.1
From 150 mm above pipe, to 300mm below natural surface	Rock -150 mm Clay- 150 mm
From 300mm below natural surface to underside level of topsoil or seed stock layer	Soft spoil to 80mm
Stored topsoil spread over finished surface	N/A

Table 7-2 – Minimum Relative Compaction (Note1)

Soil type	Test Method	Trafficable Areas		Non-Trafficable Areas	
		Embedment Material %	Embedment Material %	Trench /Embankment Fill Material %	Trench /Embankment Fill Material %
Cohessionless	Density Index AS1289.5.6.1	70	70	60	60
Cohesive	Standard Dry Density Ratio AS1289.5.4.1	95	95	90	90

Note 1: Source: AS2566.2:2002 Table 5.5

The embedment material surrounding the pipe, and up to 150mm above the pipe, is screened so that the max particle size less than 20mm.

The Arrow gathering pipeline specification (ORG-ARW-PPL-SPR-00005_3.0_Specification for PE Gathering Systems) requires a minimum 90% standard dry density (SDDR) ratio in non-trafficable areas, and 95% in trafficable areas, tested to Aust Standard 1289.5.4.1.

90% SDDR refers to well compacted soil, which has been compacted mechanically, i.e. using a compaction roller on an excavator or similar. As an example of what 90% compaction feels like, if you press your thumb down as hard as you can on the surface there will be a slight indentation.

Trench compaction testing frequency is per below:

- Compact in 300 mm Layers (measured loose/unconsolidated).
- One test in the embedment zone every 250 m.

- One test in the backfill zone every 250 m - tests shall be conducted in alternate layers at locations nominated by the Principals Representative.

The installation contractor is required to comply with these compaction values and is required to provide compaction test reports from an accredited soil testing company, to verify that adequate compaction has been achieved. This process minimises the risk of localised subsidence over the pipeline.

Minimising subsidence post construction is controlled by strict adherence to the compaction specification described above. Compaction test records provided by the construction contractor are checked and verified by Arrow Energy.

The subsoil in the trenches is mechanically compacted (as described above) however the topsoil layer is not compacted. Once reinstatement of the ROW is completed, the landholder is able to resume cropping on the ROW.

7.4 Operational activities

Other ongoing activities will be required to be undertaken by the Tenement Holder to support the operation of the pipeline, including:

- Monitoring and maintenance associated with the above ground infrastructure
- Regular inspections to ascertain whether there are weeds and pests requiring management on the RoW and immediately surrounding areas and the most appropriate method of management given the surrounding activities (e.g. use of a pesticide or herbicide which will not negatively impact on any surrounding crops or cattle grazing or farm biosecurity requirements);
- Weed and pest management in accordance with the Environmental Authority, the *Biosecurity Act 2014*, the *Local Government Act 2009* and the Land Access Code 2016;
- Regular inspections for any erosion or subsidence along the RoW and its immediate surrounds, and the most appropriate method of management and mitigation;
- Regular inspections to ascertain whether the area used for construction has been successfully rehabilitated with an establishment of appropriate ground cover (as the case may be) and the soil has stabilised adequately and, if not, what further management actions are required.

Access to the site for operations and maintenance will be undertaken according to the Land Access Code (September 2016) and the requirements of the relevant legislation.

Generally, works will temporarily cease during wet weather to minimise impacts to the land and soil erosion.

In accordance with the co-existence commitments, operational activities will be undertaken in consultation with the Landholder and Occupier in in a manner (timing) to minimise impacts on the Land.

Given that the pipeline will be buried, land users are able to resume previous land use activities on top of the pipeline provided that the use does not include excavation activities. Whilst deep-rooted vegetation cannot be re-established directly across the pipeline, shallow root cropping and grassland re-establishment is encouraged and no long-term impacts would be expected to such areas.

7.5 Decommissioning

7.5.1 Decommissioning of the infrastructure

At the conclusion of the activity, the pipeline will be decommissioned. This involves:

- Purging the pipeline by filling it with water;
- Removal of all surface infrastructures;
- Leaving buried infrastructure in place; andLandholder endorsement of rehabilitated locations.

7.5.2 Final rehabilitation from operational footprint

The rehabilitation involves:

Rehabilitation Action	Description
Soil Assessment	Assessment of the soil type at the site and the risks of impacts of the proposed rehabilitation activities in accordance with Arrow's Land Disturbance Procedure. A plan of rehabilitation is then developed to support the return of the site to the surrounding land use.
Soil compaction	Where soil is likely to have become compacted the soil will be treated (i.e. deep ripped) to alleviate the compaction. This will occur prior to reshaping the upper layers of the soil stratum.
Sodic soil amelioration	When sodic soil is encountered it will be blended with an appropriate soil ameliorant (i.e. gypsum or a calcium based ameliorant) during rehabilitation to reduce depressiveness. Topsoil will then be placed above the sodic soils.
Topsoil management	Topsoil which was stripped and stored as part of the construction activities will be re-spread as part of the stabilisation and rehabilitation activities. Correctly preserved topsoil can assist greatly with establishment of vegetation. Where necessary, the topsoil will be

	ameliorated with gypsum, lime or organic mulch to improve soil structure, infiltration and soil aeration which in turn promotes vegetation establishment.
Establishment of vegetation	The surface of the land will be returned to its former use, or a use consistent with its former use and current surrounding land uses as identified in the initial rehabilitation assessment. Where the area is to be established for grazing this will involve reseeding with a seed mix complementary to the surrounding grasses, application of fertiliser if required and stock proof fencing of the area if required to protect the establishing vegetation.

8. Public Notification

The Land is not mapped as Priority Living Area (PLA). Accordingly this assessment application does not meet the definition of a notifiable application pursuant to Section 34(2) of the RPI Act or section 13 of the *Regional Planning Interests Regulation 2014*.

Arrow has also undertaken consultation with the relevant landholders as part of an Area-Wide planning process and negotiations related to the LPH. Pursuant to s35(1)(b) of the Act, if the application is to be notified, Arrow will provide a copy of the notice to each impacted landholder along the alignment where there is no voluntary agreement in place and therefore exemptions under the Act do not apply. Regardless if it is determined that notification is required or not, a copy of the full application will be provided to each landholder.

9. Financial Assurance

Arrow is required to provide estimated rehabilitation costs (ERC) for the LPH prior to any disturbance as per the conditions of the relevant EAs which authorise activities on the petroleum authorities where the LPH will be situated. This ERC provides for the rehabilitation of land back to its original landform.

10. Assessment Application Fees

This assessment application is accompanied by the fee prescribed under the RPI Regulation 2014.

Schedule 4 of the RPI Regulation provides a definition of the expected area of impact for an assessment application, which means the area in which:

- The activity is proposed to be carried out; and
- Carrying out the activity is likely to have an impact

Given the authorised petroleum activities and the expected area of impact (54.4 ha on PAA and 47.4 ha on SCA) on land parcels subject to this application, the following assessment application fees have been calculated and were paid on 8 April 2021 (Reference number RPI21/025).

Area of Regional Interest	Nature of assessment application	Fee
Priority Agricultural Area	For an assessment application with an expected area of impact of 30 hectares or more, but less than 100 hectares	$13,490.00
Strategic Cropping Area	For an assessment application with an expected area of impact of 30 hectares or more, but less than 100 hectares	$13,490.00
Total		$26,980.00

11. Required Outcome Assessment

11.1 Priority Agricultural Area

The PAA Assessment Criteria provides a required outcome for activities in PAAs that deals with impacts on a property level and a regional level. As the authorised petroleum activities are situated on more than two lots across the region, impacts on a regional level (Required Outcome 2) apply for the purposes of this assessment application.

Schedule 2, Part 2 of the RPI Regulation set out the Required Outcomes and prescribed solutions for activities carried out in a PAA. Please refer to Table 11-1for evidence associated with the prescribed solution of Required Outcome 1 and refer to for evidence associated with the prescribed solution of Required Outcome 2.

Table 11-1 - PAA Assessment Criteria – Required Outcome 1

Required Outcome 1 - Managing impacts on use of property for priority agricultural land use in a priority agricultural area This section applies if the activity is to be carried out on a property in a priority agricultural area. The activity will be carried out on a property in a priority agricultural area and will not result in a material impact on the use of the property for a priority	
Prescribed Solution	**Evidence/Response**
(1) Subsections (2) and (3) each state a prescribed solution for required outcome 1.	

PS (2) The application demonstrates the activity will not be located on land that is used for a priority land use.	• As discussed in Section 7.1, the current alignment provides for the least impacts to landholders in the region and reduces the operational footprint as much as possible. The pipeline is aligned in a south-easterly direction due to the location of the existing facilities and where the gas and water needs to be transported to and between. The vast majority of land between these two points is mapped as PAA & PALU and could not be avoided. Refer to Figure 1-1 and Figure 1-2. Also, Arrow has located the alignment on each individual property by utilising boundaries and running in parallel with roads and fencelines where possible to try and minimise impacts to the landholder. The LPH cannot be entirely carried out on land that is not PALU due to the extent of PALU on the alignment and consideration of other constraints as detailed in Section 7.1 and Appendix 2. The nature of impacts have been minimized as outlied in the response to PS2.

PS (3) The application demonstrates all of the following i. If the applicant is not the owner of the land and has not entered into a voluntary agreement with the owner: a. The applicant has taken all reasonable steps to consult and negotiate with the owner about the expected impact of carrying out the activity on each priority agricultural land use for which the land is used; and	The applicant is not the owner of land. A summary of landholder consultation undertaken is provided in Section 6. Voluntary agreements and CCA's reached with landholders are summarised in to Table 1-4..

ii. Carrying out the activity on the property will not result in a loss of more than 2% of both: a. The land on the property used for a priority agricultural land use; and b. The productive capacity of any priority agricultural land use on the property	Carrying out the activity will not result in the loss of more than 2% of both the land on the property used for PALU and the productive capacity of PALU on the property as : • The surface impact due to the construction of the LPH is short term and temporary. The PALU will be able to recommence upon completion of constructon and will not be impacted by operational activities; • The impact to the productive capacity of PALU will be limited to the area of disturbance and implementation of proposed mititagion measures will ensure the capacity is return to the pre-construciton condition. The area of temporary disturbance and the % impact for each property is summarised in Table 4-2 and demonstrates that less than 2% of each property will be impacted during operations by the LPH. Refer to Section 4.3 for additional details. One of Arrow's key Co-existence commitments (refer to Section 1.6.2) is to minimise it's operational footprint to less than 2% of the total Intensively Farmed Land area such as the land holdings along the LPH alignment.

iii.	the activity cannot be carried out on other land that is not used for a priority agricultural land use, including for example, land elsewhere on the property, on an adjacent property or at another nearby location;	The LPH alignment has been selected to minimise impacts to PALU as much as practicable including locating the pipeline along fencelines and roads and across non-productive areas of land where possible. Following landholder discussion, a section of the alignment was moved further to the east to run alongside Duleen Kupunn Road. This realignment avoided impacts to several properties and also reduced the overall length of the pipeline. Further discussion about the selection of the alignment is presented in Section 7 and specific land parcels constraints influencing the location of the alignment is presented in Appendix 2. Land that is not being used for PALU has been selected as much as possible, however the majority of the area is intensively farmed and therefore some PALU is unavoidable. The activity cannot be carried out on other land as evidenced by the need to transport gas and water from existing and future wells to existing facilities located at either end of the proposed LPH alignment. The use of these existing facilities greatly reduces the impacts from avoiding having to construct new facilities.

iv.	the construction and operation footprint of the activity on the part of the property used for a priority agricultural land use is minimised to the greatest extent possible.	The proposed area of construction of the LPH has been selected to have minimal impact where possible (refer to Section 3.3 and property maps in Appendix 2). The following mitigation measures will be employed to avoid and minimise impacts as much as practicable during construction and operation of the LPH: • Minimise the disturbance footprint and vegetation clearing • Use existing roads and tracks, where practicable • Reduce the width of construction ROW within areas of sensitivity to the greatest extent practicable without compromising the safety of workers • Ensure construction activities do not extend beyond the work site boundaries • Mark site boundaries clearly for site-specific sensitive areas that require avoidance

v.	the activity will not constrain, restrict or prevent the ongoing conduct on the property of a priority agricultural land use, including, for example, everyday farm practices and an activity or infrastructure essential to the operation of a priority agricultural land use on the property	As outlined in Secton 4.3, the proposed activity will have a temporary impact on the operation of PALU associated with construction area, which will be able to recommence following construction. To this extent, the design and location of infrastructure minimises the impacts on the agricultural use of the Land. As evidenced by Section 4.3 the authorised petroleum activity will not constrain, restrict or prevent the ongoing use of the balance of the Land for agricultural activities.
vi.	the activity is not likely to have a significant impact on the priority agricultural area	Due to the nature, duration and limited extent of the expected area of impact of the authorised petroleum activities, there will not be significant impact on the use of the Land for agricultural purposes. The impacts on PALU will be temporary and the mitigation measure to be implemented will ensure that the producitve capacity of the land impacted by construction will be returned to pre-construction condition. Refer to Sections 4.3 and 7 for additional informaton

vii.	the activity is not likely to have an impact on land owned by a person other than the applicant or the land owner mentioned in paragraph (a).	The authorised petroleum activities, due to the nature and extent of the expected area of impact, will not have an impact upon other landowners or neighbours along the RoW. Further, the location of infrastructure, construction methods and rehabilitation has taken into consideration any potential impacts on water overland flow. No additional impact is expected from the proposed development and therefore no impacts on other landowners or neighbours should be expected from overland flow.

Table 11-2 PAA Assessment Criteria – Required Outcome 2

Required Outcome 2 - managing impacts on a region in relation to use of an area in the region for a priority agricultural land use The activity will be carried out on out on 2 or more properties in a priority agricultural area in a region. The activity will not result in a material impact on the region because of the activity's impact on the use of land in the priority agricultural area for 1 or more priority agricultural land uses.	
Prescribed Solution	Evidence/Response
The application demonstrates all of the following	

(1) (a) if the activity is to be carried out in a priority agricultural area identified in a regional plan—the activity will contribute to the regional outcomes, and be consistent with the regional policies, stated in the regional plan	The Darling Downs Regional Plan PAA co-existence criteria enable compatible resource activities to co-exist with high-value agricultural land uses within PAAs. This will in turn maximise opportunities for economic growth to ensure that the Darling Downs remains a resilient, diversified and prosperous region. The key drivers for preparing the plan included the following factors which are supported by Arrow's SGP and the proposed LPH which will deliver gas and water to existing facilities and provide economic and employment outcomes for the region while respecting and co-existing with the agricultural users of the area: • enable opportunities for economic growth to ensure our regions are resilient and prosperous • protect areas of regionally significant agricultural production from incompatible resource activities while maximising
	opportunities for co-existence of resource and agricultural land uses • safeguard the areas required for the growth of towns • drive the region's economic diversity and opportunity • identify infrastructure outcomes that will support economic growth Further, the proposed construction and operation of the LPH is consistent with Regional policy 2 which is to:

	Maximise opportunities for co-existence of resource and agricultural land uses within Priority Agricultural Areas.
(b) the activity can not be carried out on other land in the region that is not used for a priority agricultural land use, including, for example, land elsewhere on a property, on an adjacent property or at another nearby location	The LPH will feed gas and water from existing and future wells located near the existing Tipton facility and from the Tipton facility itself, to QGC's existing facility at David. The current alignment provides for the least impacts to landholders in the region and reduces the operational footprint as much as possible. Information about the selection of the alignment is provided in Section 7.1. Further, by utilising these existing assets, reduces the need for multiple new large facilities to be constructed in these areas and region. Where PALU canont be avoided, the LPH alignment has been selected to minimise impacts to PALU as much as practicable including locating the pipeline along fencelines and roads and across non-productive areas of land where possible (refer to Appendix 2). There are no alternatives which would reduce impacts to the area any further than the current design will allow.

(c) the construction and operation footprint of the activity on the area in the region used for a priority agricultural land use is minimised to the greatest extent possible	The proposed area of construction of the LPH has been selected to minimise the impact on land used for PALU thorugh route selection (refer to Section 7.1) and minimisation of disturbance on impacted properties (refer to Section 3.3 and property maps in Appendix 2). The following mitigation measures will be employed to avoid and minimise impacts as much as practicable during construction and operation of the LPH: • Minimise the disturbance footprint and vegetation clearing • Use existing roads and tracks, where practicable • Reduce the width of construction ROW within areas of sensitivity to the greatest extent practicable without compromising the safety of workers • Ensure construction activities do not extend beyond the work site boundaries • Mark site boundaries clearly for site-specific sensitive areas that require avoidance

(d) the activity will not result in widespread or irreversible impacts on the future use of an area in the region for 1 or more priority agricultural land uses	Arrow's first co-existence commitment states, No permanent alienation. Arrow is committed to co-existence with regional communities and in particular agricultural practices in the areas where it operates. As demonstrated throughout the application, the impact to PALU of the proposed LPH will be temporary, revsersible and limited to the land parcels on the alignment. Upon completion of construction, impacted PALU activites will be able to recommence and will not be impacted by operational activities. Arrow has constructed and operated multiple pipelines over the past 15 years or more and is confident that the LPH will have no great impact on the area and certainly would not forsee any widespread or irreversible impact from its operation.

(e) the activity will not constrain, restrict or prevent the ongoing use of an area in the region for 1 or more priority agricultural land uses, including, for example, infrastructure essential to the operation of a priority agricultural land use	Arrow employs AWP to discuss its proposed development activities and to understand the operations, needs and requirements of an individual landholder. Information obtained during AWP and at shed meetings with local communities is used to best locate infrastructure to ensure impacts to the individuals and communities lifestyles, and employment and economic activities are minimised as much as possible. This is particularly so when co-existence with farming practices is required. Details of existing farming practices, machinery operation and future aspirations are key considerations to ensure co-existence but also for factors such as ensuring the safety of Arrow staff, contractors and personal but more importantly the safety and security of landholders, their families and their visitors as well as the local community.
(2) Subsection (3) applies if the activity is to be carried out in a priority agricultural area that includes a regionally significant water source and— (a)if the activity is to be carried out under an authority to prospect or a petroleum lease under the *Petroleum and Gas (Production and Safety) Act 2004*—the activity is likely to produce CSG water; or (b)if the activity is to be carried out under a mineral development licence or a mining lease under the *Mineral Resources Act 1989*—the activity is likely to produce associated water.	This is not relevant as the construction and operation of the LPH, while authorised by existing petroleum leases and petroleum pipeline licences, will not produce CSG water.

(3) Also, the application must demonstrate the applicant has in place a strategy or plan for managing the CSG water or associated water that provides for the net replenishment of the regionally significant water source. (4) For subsection (3), ***net replenishment*** of a regionally significant water source is the replacement to the water source, whether directly or indirectly, of all water that is no longer available for a priority agricultural land use in a priority agricultural area because carrying out a resource activity in the area produces CSG water or associated water.	It should be noted that the LPH will have no impact on the use and management of CSG water.
(5) Subsection (6) applies for each property on which the activity is to be carried out if the applicant is not the owner of the land and has not entered into a voluntary agreement with the owner. (6) The application must demonstrate the matters listed in this schedule, section 3 for a prescribed solution for required outcome 1 for the property.	Refer to Table 11-1 – PAA Assessment Criteria for Required Outcome 1.

11.2 Strategic Cropping Area

The SCA Assessment Criteria provides a required outcome for activities in SCAs that deals with impacts on Strategic Cropping Land (SCL). As the authorised petroleum activities are situated on an area of SCL and is being undertaken on more than two lots across the region, impacts on a regional level, Required Outcomes 1,2 and 3 apply for the purposes of this assessment application.

Schedule 2, Part 4 of the RPI Regulation set out the Required Outcomes and prescribed solutions for activities carried out in a SCA. Please refer to Table 11-3 for evidence associated with the prescribed solution of Required Outcome 1, Table 11-4 for evidence associated with the prescribed solution of Required Outcome 2 and refer to Table 11-5 for evidence associated with the prescribed solution of Required Outcome 5.

Table 11-3 - SCA Assessment Criteria – Required Outcome 1

Required Outcome 1 - managing impacts on strategic cropping land in the strategic cropping area	
Prescribed Solution	Evidence/Response
The application demonstrates the activity will not be carried out on strategic cropping land that meets the criteria stated in schedule 3, part 2	The construction and operation of the LPH will be carried out on SCL.

Table 11-4 - SCA Assessment Criteria – Required Outcome 2

Required Outcome 2 - managing impacts on strategic cropping land in the strategic cropping area (1) This section applies if the activity— (a) does not meet required outcome 1; and (b) is being carried out on a property (SCL) in the strategic cropping area. (2) The activity will not result in a material impact on strategic cropping land on the property (SCL).	
Prescribed Solution	Evidence/Response
The application demonstrates all of the following	
(a) if the applicant is not the owner of the land and has not entered into a voluntary agreement with the owner—the applicant has taken all reasonable steps to consult and negotiate with the owner of the land about the expected impact of carrying out the activity on strategic cropping land;	The applicant is not the owner of land. A summary of landholder consultation undertaken is provided in Section 6. Voluntary agreements and CCA's reached with landholders are summarised in Table 1-4.. Arrow has already undertaken consultation with each relevant landholder along the proposed LPH alignment as part of an Area Wide Planning (AWP) process and as part of shed meetings and community consultation across the region. .
(b) the activity can not be carried out on land that is not strategic cropping land, including, for example, land elsewhere on the property (SCL), on adjacent land or at another nearby location;	As discussed in Section 7.1, the current alignment provides for the least impacts to landholders in the region and reduces the operational footprint as much as possible. The pipeline is aligned in a south-eaterly direction due to the location of the existing facilities and where the gas and water needs to be transported to and between. The vast majority of land between these two points is mapped as SCL and could not be avoided. Refer to Figure 1-1 and Figure 1-2.

	Also, Arrow has located the alignment on each individual property by utilising boundaries and running in parallel with roads and fencelines where possible to try and minimise impacts to the landholder. The LPH cannot be entirely carried out on land that is not strategic cropping land due to the extent of SCL on the alignment and consideration of other constraints as detailed in Section 7.1 and Appendix 2.
(c) the construction and operation footprint of the activity on strategic cropping land on the property (SCL) is minimised to the greatest extent possible;	The proposed area of construction of the LPH has been selected to have minimal impact where possible (refer to Section 3.3 and property maps in Appendix 2). The following mitigation measures will be employed to avoid and minimise impacts as much as practicable during construction and operation of the LPH: • Minimise the disturbance footprint and vegetation clearing • Use existing roads and tracks, where practicable • Reduce the width of construction ROW within areas of sensitivity to the greatest extent practicable without compromising the safety of workers • Ensure construction activities do not extend beyond the work site boundaries • Mark site boundaries clearly for site-specific sensitive areas that require avoidance

(d) if the activity will have a permanent impact on strategic cropping land on a property (SCL)—no more than 2% of the strategic cropping land on the property (SCL) will be impacted.	Arrow consideres that the carrying out the activity will not result in the a permanent impact on SCL on a property as : • The surface impact due to the construction of the LPH is short term and temporary. The pre-exisitng land use will be able to recommence upon completion of constructon and will not be impacted by operational activities; • The impact to the productive capacity of the land will be limited to the area of disturbance and implementation of proposed mititagion measures will ensure the capacity is return to the pre-construciton condition. • Buried to a depth of at least 900 mm below surface to allow for most agricultural practices and use of machinery above The area of temporary disturbance and the % impact on Sculfor each property is summarised in Table 5-1 and demonstrates that less than 2% of each property will be impacted during operations by the LPH. Refer to Section 5.3 for additional details. Lastly, one of Arrow's key Co-existence commitments (refer to Section 1.6.2) is to minimise it's operational footprint to less than 2% of the total Intensively Farmed Land area such as the land holdings along the LPH alignment.

Table 11-5 - SCA Assessment Criteria – Required Outcome 3

Required Outcome 3 - managing impacts on strategic cropping land in the strategic cropping area (1) This section applies if the activity— (a) does not meet required outcome 1; or (b) is being carried out on 2 or more properties (SCL) in the strategic cropping area. (2) The activity will not result in a material impact on strategic cropping land in an area in the strategic cropping area.	
Prescribed Solution	Evidence/Response
The application demonstrates all of the following	
(1) The application demonstrates all of the following— (a) the activity can not be carried out on other land in the area that is not strategic cropping land, including, for example, land elsewhere on the property (SCL), on adjacent land or at another nearby location;	As discussed in Section 7.1, the current alignment provides for the least impacts to landholders in the region and reduces the operational footprint as much as possible. The pipeline is aligned in a south-eaterly direction due to the location of the of the existing facilities and where the gas and water needs to be transported to and between. The vast majority of land between these two points is mapped as SCL and could not be avoided. Refer to Figure 1-1 and Figure 1-2. Also, Arrow has located the alignment on each individual property by utilising boundaries and running in parallel with roads and fencelines where possible to try and minimise impacts to the landholder. The LPH cannot be entirely carried out on land that is not strategic cropping land due to the extent SCL on the alignment and consideration of other constraints as detailed in Section 7.1 and Appendix 2
(b) if there is a regional plan for the area in which the activity is to be carried out—the activity will contribute to the regional outcomes, and be	The Darling Downs Regional Plan encourages co-existence between compatible resource activities with high-value agricultural land uses.

consistent with the regional policies, stated in the regional plan;	This will in turn maximise opportunities for economic growth to ensure that the Darling Downs remains a resilient, diversified and prosperous region. The key drivers for preparing the plan included the following factors which are supported by Arrow's SGP and the proposed LPH which will deliver gas and water to existing facilities and provide economic and employment outcomes for the region while respecting and co-existing with the agricultural users of the area: • enable opportunities for economic growth to ensure our regions are resilient and prosperous • protect areas of regionally significant agricultural production from incompatible resource activities while maximising opportunities for co-existence of resource and agricultural land uses • safeguard the areas required for the growth of towns • drive the region's economic diversity and opportunity • identify infrastructure outcomes that will support economic growth The proposed construction and operation of the LPH is consistent with Regional policy 2 which is to: • Maximise opportunities for co-existence of resource and agricultural land uses within Priority Agricultural Areas.

(c) the construction and operation footprint of the activity on strategic cropping land is minimised to the greatest extent possible;	The proposed area of construction of the LPH has been selected to have minimal impact where possible (refer to Section 3.3 and property maps in Appendix 2). The following mitigation measures will be employed to avoid and minimise impacts as much as practicable during construction and operation of the LPH: • Minimise the disturbance footprint and vegetation clearing • Use existing roads and tracks, where practicable • Reduce the width of construction ROW within areas of sensitivity to the greatest extent practicable without compromising the safety of workers • Ensure construction activities do not extend beyond the work site boundaries • Mark site boundaries clearly for site-specific sensitive areas that require avoidance
(d) either— (i) the activity will not have a permanent impact on the strategic cropping land in the area; or (ii) the mitigation measures proposed to be carried out if the chief executive decides to grant the approval and impose an SCL mitigation condition.	Arrow's first co-existence commitment states, No permanent alienation. Arrow is committed to co-existence with regional communities and in particular agricultural practices in the areas where it operates. Arrow consideres that the carrying out the activity will not result in the a permanent impact on SCL on a property as : • The surface impact due to the construction of the LPH is short term and temporary. The pre-exisitng land use will be able to recommence upon

	completion of constructon and will not be impacted by operational activities; • The impact to the productive capacity of the land will be limited to the area of disturbance and implementation of proposed mititagion measures will ensure that the capacity is returned to the pre-construciton condition. Mitigation measures will be implemented to ensure that the productive capacity of the land is returned to its pre-existing conditon post construction (refer to Sections 5 and 7. Once the project concludes and the LPH is decommissioned, the land will be returned to its former use and rehabilitated to the same or similar condition as it was prior to the LPH being constructed, as per relevant conditions within Arrow's environmental approvals including each relevant environmental authority.
(2) Subsection (3) applies for each property (SCL) on which the activity is to be carried out if the applicant is not the owner of the land and has not entered into a voluntary agreement with the owner. (3) The application must demonstrate the matters listed in this schedule, section 11 for a prescribed solution for required outcome 2 for the property (SCL).	Arrow intends to negotiate voluntary CCAs with each landholder along the alignment for the proposed LPH and has already successfully negotiated several CCAs with landholders along the alignment.

(4)	Refer to Table 11-4 – SCA Assessment Criteria for Required Outcome 2.

12. References

Environmental Impact Statement (EIS) Assessment Report under the Environmental Protection Act 1994, Surat Gas Project

Code of Environmental Practice Onshore Pipelines, Australian Pipeline Industry Association, June 2013

RPI Act Statutory Guideline (11/16), specifically guidelines 2, 3, 6 and 7, Department of State Development, Infrastructure, Local Government and Planning, 2014

13. Definitions

Definitions of terms used in this standard:

Term	Definition
LPH	Surat Low Pressure Header pipelines
Arrow	Arrow Energy Pty Ltd
AS	Australian standard
BUN	Beneficial Use Network
CSG	Coal seam gas
DSDILGP	Department of State Development, Infrastructure, Local Government and Planning (
DoE	Department of Environment (Commonwealth)
EA	Environmental Authority
EIS	Environmental impact statement
EMP	Environmental management plan
EPBC Act	Commonwealth Environmental Protection and Biodiversity Conservation Act 1994
EP Act	Environmental Protection Act 1994
PPL	Petroleum pipeline licence
RIDA	Regional interests development application
ROW	Right of way

Appendices

Appendix 1: Title Searches

Queensland Government

TITLES REGISTRY

Current Title Search

Department of Resources
ABN 59 020 847 551

Title Reference:	**12643121**	**Search Date:**	14/06/2021 11:32
Date Title Created:	16/05/1952	**Request No:**	37534140
Previous Title:	12093205		

ESTATE AND LAND

Estate in Fee Simple

LOT 2 REGISTERED PLAN 71519
Local Government: WESTERN DOWNS

REGISTERED OWNER — INTEREST

Dealing No: 719041074 12/10/2018

MARK DAVID SCHUURS 1/2
VICTORIA MEGAN SCHUURS 1/2

AS TENANTS IN COMMON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
Deed of Grant No. 12093205 (POR 52)

2. MORTGAGE No 719305748 13/03/2019 at 12:20
VICTORIA MEGAN SCHUURS TRUSTEE
UNDER INSTRUMENT 719305748
INTEREST OF MARK DAVID SCHUURS

3. MORTGAGE No 720737921 21/04/2021 at 11:21
NATIONAL AUSTRALIA BANK LIMITED A.C.N. 004 044 937

4. PRIORITY OF MORTGAGE No 720737922 21/04/2021 at 11:21
MORTGAGE: 720737921
is given priority over
MORTGAGE: 719305748

ADMINISTRATIVE ADVICES

NIL

UNREGISTERED DEALINGS

NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested by: D-ENQ CITEC CONFIRM

Queensland Government

TITLES REGISTRY

Current Title Search

Department of Resources
ABN 59 020 847 551

Title Reference:	**17030104**	**Search Date:**	14/06/2021 11:32
Date Title Created:	03/06/1987	**Request No:**	37534138
Previous Title:	13522202		

ESTATE AND LAND

Estate in Fee Simple

LOT 2 REGISTERED PLAN 210387
Local Government: WESTERN DOWNS

REGISTERED OWNER — INTEREST

Dealing No: 712631859 30/07/2009

CLIFFORD LESTER WEIER 1/2
SHARRON LOUISE HENRY 1/2

AS TENANTS IN COMMON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
Deed of Grant No. 13486036 (POR 88)
Deed of Grant No. 13486037 (POR 88)

2. MORTGAGE No 717088514 23/02/2016 at 15:53
COMMONWEALTH BANK OF AUSTRALIA A.B.N. 48 123 123 124

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
717889476	CON COM AGMT MINERAL AND ENERGY RESOURCES (COMMON PROVISIONS) ACT 2014	10/03/2017 09:38	CURRENT

UNREGISTERED DEALINGS

NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested by: D-ENQ CITEC CONFIRM

Queensland Government

TITLES REGISTRY

Current Title Search

Department of Resources
ABN 59 020 847 551

Title Reference:	**18338246**	**Search Date:**	14/06/2021 11:32
Date Title Created:	27/08/1992	**Request No:**	37534142
Creating Dealing:			

ESTATE AND LAND

Estate in Fee Simple

LOT 46 CROWN PLAN DER34223
Local Government: WESTERN DOWNS

REGISTERED OWNER

JACK MERVYN KLEMM

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
Deed of Grant No. 18338246 (Lot 46 on CP DER34223)

ADMINISTRATIVE ADVICES

NIL

UNREGISTERED DEALINGS

NIL

** End of Current Title Search **

Requested by: D-ENQ CITEC CONFIRM

Queensland Government

TITLES REGISTRY

Current Title Search

Department of Resources
ABN 59 020 847 551

Title Reference:	**50410881**	**Search Date:**	14/06/2021 11:32
Date Title Created:	14/10/2002	**Request No:**	37534141
Previous Title:	16569247, 16569248		

ESTATE AND LAND

Estate in Fee Simple

LOT 49 CROWN PLAN DER34223
Local Government: WESTERN DOWNS

REGISTERED OWNER — INTEREST

Dealing No: 720238226 31/08/2020

MARK DAVID SCHUURS 1/2
VICTORIA MEGAN SCHUURS 1/2

AS TENANTS IN COMMON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
Deed of Grant No. 12205196 (POR 49)

2. MORTGAGE No 720360248 29/10/2020 at 13:04
VICTORIA MEGAN SCHUURS TRUSTEE
UNDER INSTRUMENT 720360248
IN THE INTEREST OF MARK DAVID SCHUURS ONLY

3. MORTGAGE No 720639707 09/03/2021 at 13:32
REGIONAL INVESTMENT CORPORATION

ADMINISTRATIVE ADVICES

NIL

UNREGISTERED DEALINGS

NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested by: D-ENQ CITEC CONFIRM

Queensland Government

TITLES REGISTRY

Current Title Search

Department of Resources
ABN 59 020 847 551

Title Reference:	**50410890**	**Search Date:**	14/06/2021 11:32
Date Title Created:	14/10/2002	**Request No:**	37534139
Previous Title:	13562011, 13562012, 13562015		

ESTATE AND LAND

Estate in Fee Simple

LOT 50 CROWN PLAN DY39
Local Government: WESTERN DOWNS

For exclusions / reservations for public purposes refer to Plan CP DY39

REGISTERED OWNER — INTEREST

Dealing No: 719041074 12/10/2018

MARK DAVID SCHUURS — 1/2
VICTORIA MEGAN SCHUURS — 1/2

AS TENANTS IN COMMON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
Deed of Grant No. 11860205 (POR 50)

2. MORTGAGE No 719305748 13/03/2019 at 12:20
VICTORIA MEGAN SCHUURS TRUSTEE
UNDER INSTRUMENT 719305748
INTEREST OF MARK DAVID SCHUURS

3. MORTGAGE No 720639707 09/03/2021 at 13:32
REGIONAL INVESTMENT CORPORATION

ADMINISTRATIVE ADVICES

NIL

UNREGISTERED DEALINGS

NIL

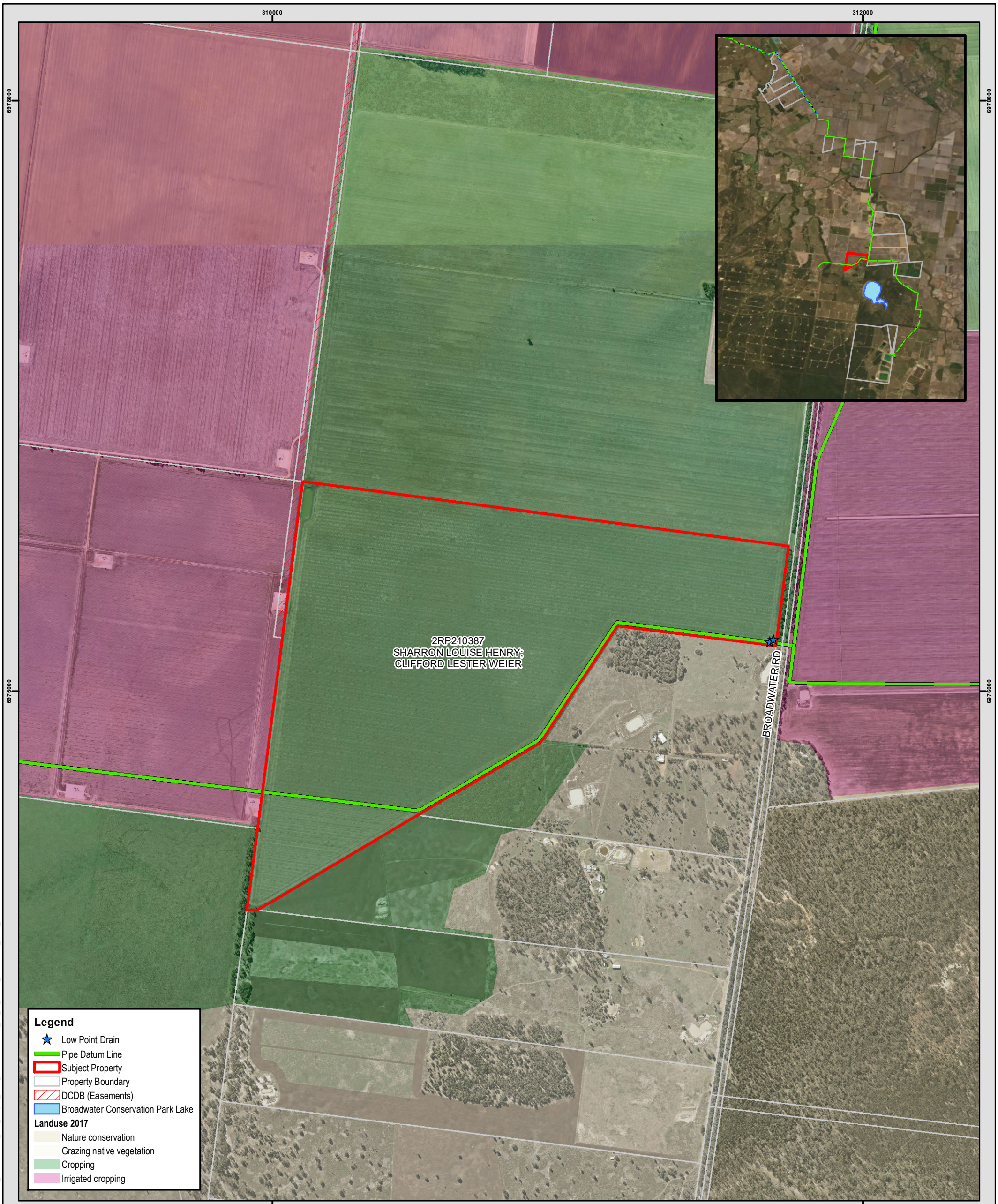
Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested by: D-ENQ CITEC CONFIRM

Appendix 2: Land Parcel Details

I



LPH - RIDA Application

Lotplan 2RP210387

Source: Arrow Energy Pty Ltd
Geoscience Australia
DNRME

Date: 20/04/2021
Issued To: A Hall
Author: jluke

Metres
0 250 500 1,000

Scale 1:12,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

arrow energy
go further

Note: The dimensions, areas, number of lots, size and location of corridor information are approximate only and may vary.

NOT FOR CONSTRUCTION

Document: V:\Products\Australia\Queensland\Surat_Basin\General\210414_RITM0293633_Lots_Subject_RIDA_AH\RITM0293633_SB_A3_11LPH_2RP210387_Weier_1.mxd

Parcel: 2RP210387

Property Details

- This parcel is utilised for cropping dryland cereals and pulses. A farm access track is located on the perimeter of the cropped area.
- Surrounding land use to the north is generally cropping, while to the south is native vegetation/grazing.
- CSG production wells and associated infrastructure are located to the west.

Alignment Summary

- The majority of the alignment has been located on the southern boundary of the property and will utilise the existing farm access track as well as part of the cropped area.
- The alignment does cross through cropped area in the southern portion of the parcel, where the alignment heads west onto 130DY762, to the north of existing gas wells.
- Extra work area will be required to facilitate construction of the Broadwater Road crossing.
- The alignment needs to pass through cropped area rather than following property boundary to select the shortest length and therefore have less overall impact on the cropping land. The alignment also reduces the need to remove vegetation on the neighbouring property and takes advantage of placing the alignment with the neighbouring QGC property.
- Cropping will be able to re-start following the construction period of the LPH. There will be some impacts immediately outside of the disturbance area for a temporary period which will reduce efficiencies.

From Broadwater Road, looking west along alignment

Infrastructure summary

- The length of LPH on this parcel is 1,497 m.
- LPH buried infrastructure on this parcel will consist of two pipelines and fibre optic cable.
- Surface infrastructure will include two low point drains located on the south eastern property boundary, immediately adjacent to Broadwater Road.

Document: V:\Products\Australia\Queensland\Surat_Basin\General\210414_RITM0293633_Lots_Subject_RIDA_AH\RITM0293633_SB_A3_8LPH_46DER34223_Klemm_1.mxd

LPH - RIDA Application

Lotplan 46DER34223

Source: Arrow Energy Pty Ltd
Geoscience Australia
DNRME

Date: 20/04/2021
Issued To: A Hall
Author: jluke

0 300 600 1,200 Metres

Scale 1:14,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

arrow energy
go further

Note: The dimensions, areas, number of lots, size and location of corridor information are approximate only and may vary.

NOT FOR CONSTRUCTION

Parcel: 46DER34223

Property Details

- This property is utilised for dryland cropping of cereals and pulses, consistent with the surrounding land use.
- No on farm tracks are impacted.
- No irrigation channels are located on this property.

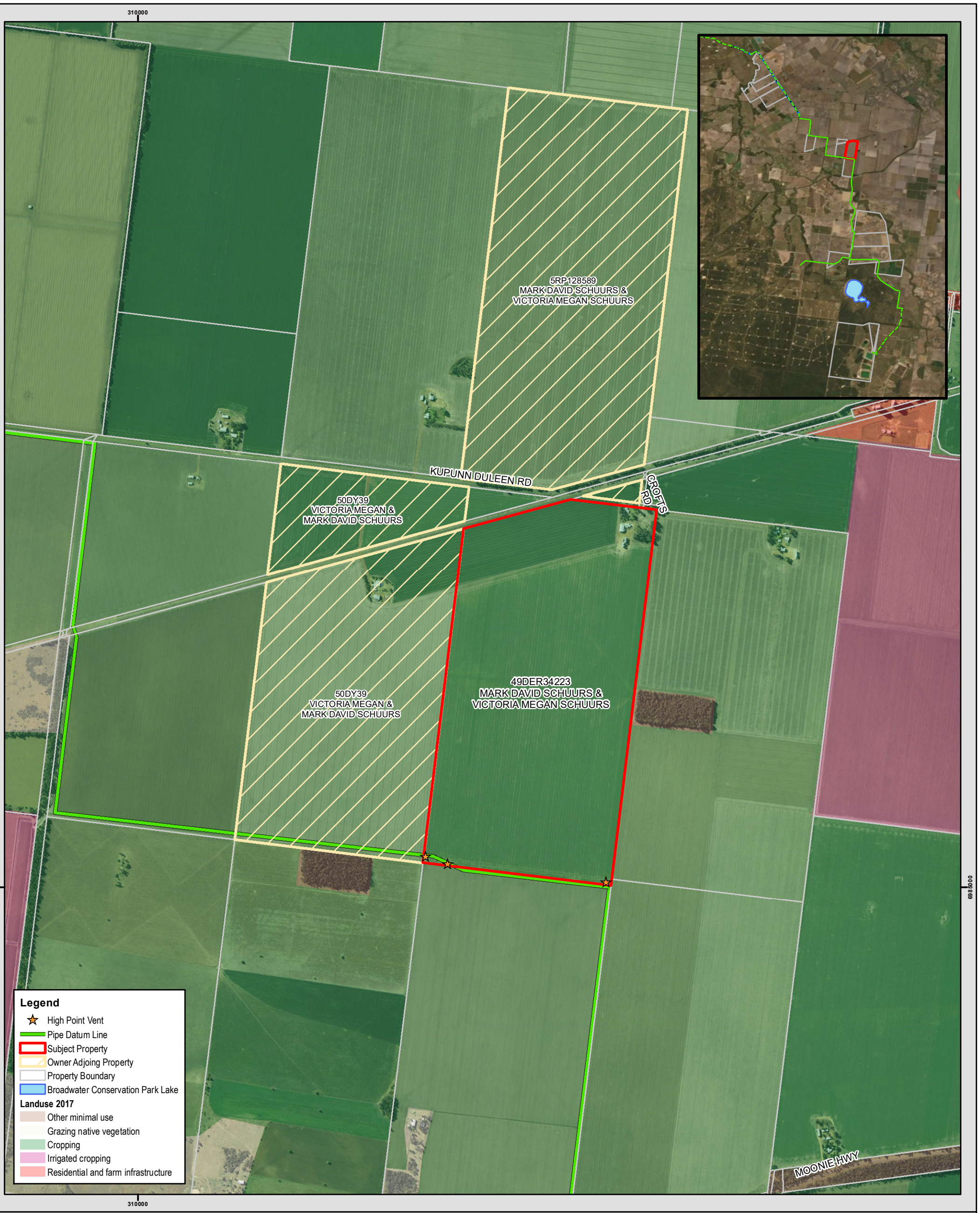
Alignment Summary

- The alignment has been located adjacent the eastern and northern boundary of the property to minimise impacts to the cropping activities.
- The property is accessed from the Moonie Highway on the southern boundary, and it is proposed that this access is utilised during construction and an access track. constructed from the access point east to the ROW to facilitate construction activities and also for ongoing operational access for light vehicle access only.
- Extra work area will be required on the southern boundary of the property to assist with the construction of the Moonie Highway crossing.

From Moonie Highway – looking north along alignment

Infrastructure summary

- The length of LPH on this parcel is 2,277 m.
- LPH buried infrastructure on this parcel will consist of three pipelines, an electrical cable and fibre optic cable.
- Surface infrastructure will include two high point vents located on the northern and southern boundary.



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LPH - RIDA Application

Lotplan 49DER34223

Source: Arrow Energy Pty Ltd, Geoscience Australia, DNRME
Date: 20/04/2021
Issued To: A Hall
Author: jluke

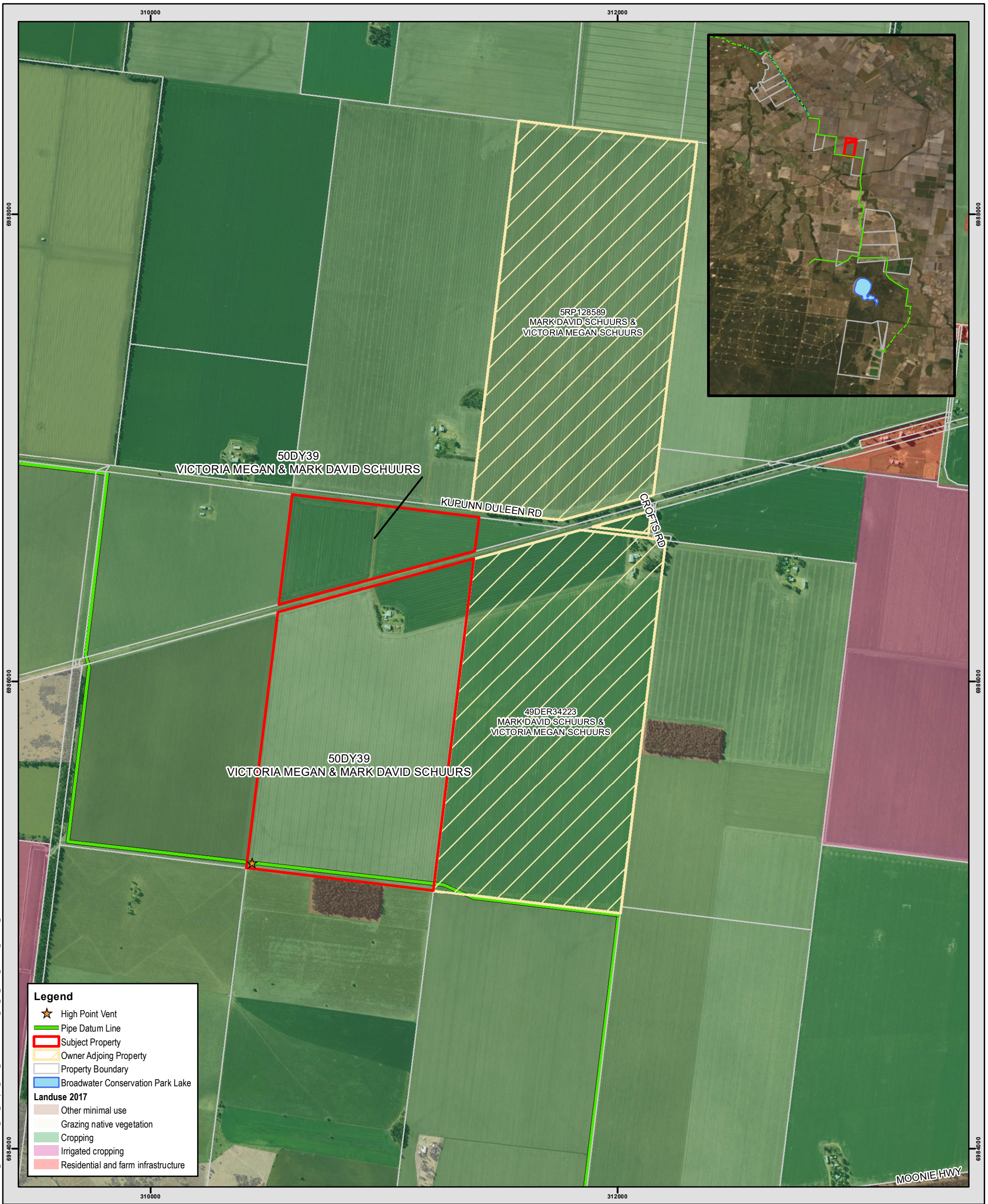
0 350 700 1,400 Metres

Scale 1:15,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

arrow energy go further

Note: The dimensions, areas, number of lots, size and location of corridor information are approximate only and may vary.



Document: V:\Products\Australia\Queensland\Surat_Basin\General\210414_RITM0293633_Lots_Subject_RIDA_AH\RITM0293633_SB_A3_6LPH_50DY39_Schuurs_1.mxd

LPH - RIDA Application

Lotplan 50DY39

Source: Arrow Energy Pty Ltd
Geoscience Australia
DNRME

Date: 20/04/2021
Issued To: A Hall
Author: jluke

0 300 600 1,200 Metres

Scale 1:15,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

arrow energy
go further

Note: The dimensions, areas, number of lots, size and location of corridor information are approximate only and may vary.

NOT FOR CONSTRUCTION

Parcels: 49DER34223 and 50DY39

Property Details

- 49DER34223 and 50DY3 are owned and operated by the same owner in conjunction with 5RP128589 (adjoining north 49DER34223, but not impacted by the alignment).
- The parcels are utilised for dryland cropping of cotton, cereals and pulses.
- Land uses surrounding these parcels also involves cropping.
- A narrow track situated next to the southern boundary will be impacted temporarily during construction but will be reinstated.

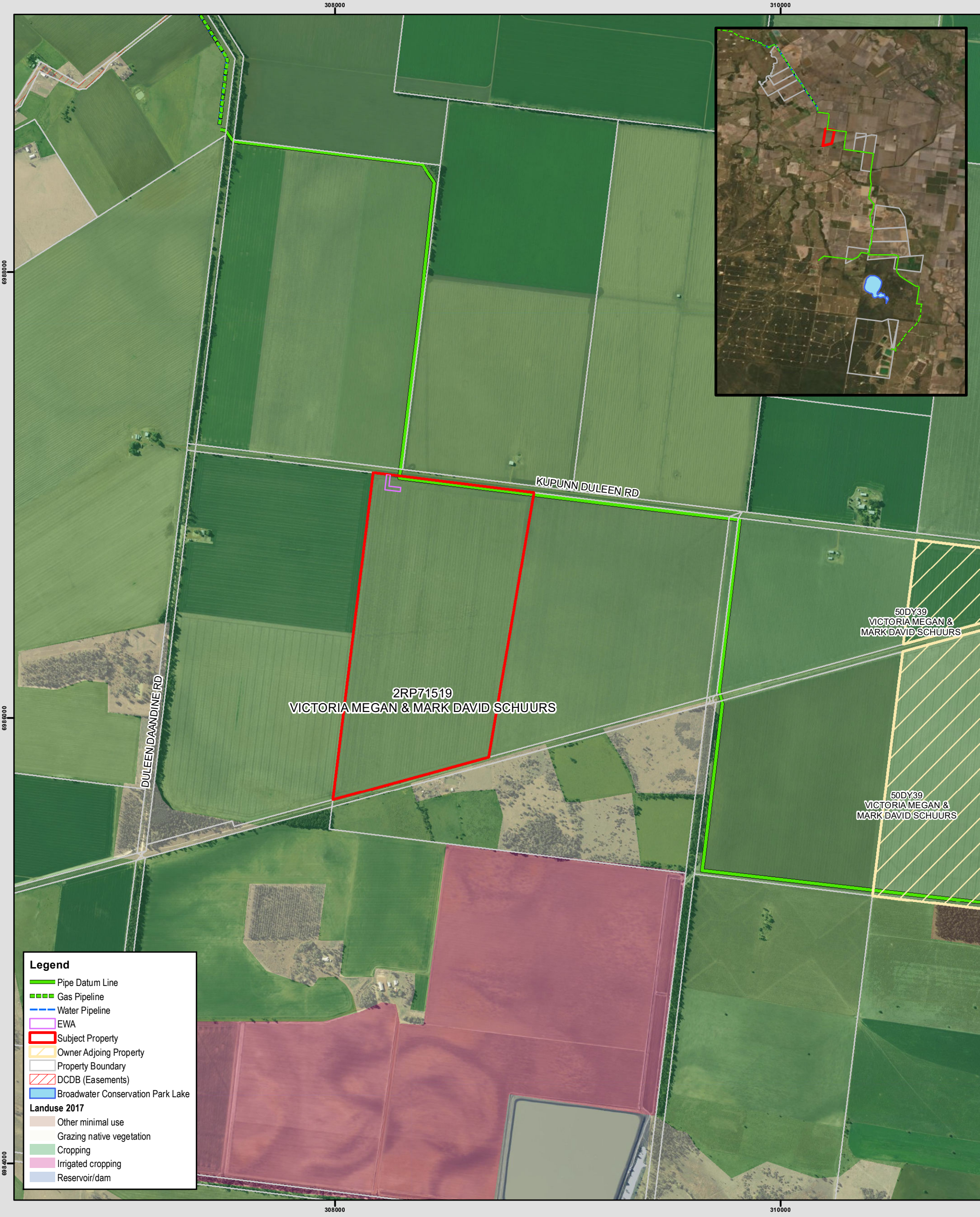
Alignment Summary

- The alignment has been located along the southern boundary of the properties (where impacted by the alignment). In consultation with the landholder the alignment was designed for future development and has been moved slightly north, to avoid a proposed irrigation channel to be constructed along the southern boundary.
- No additional area of impact outside of the ROW is expected.

Looking east along alignment

Infrastructure summary

- The length of LPH on the parcels is 921 m (115 m on 49DER34223 and 806 m on 50DY39).
- LPH buried infrastructure on these parcels will consist of three pipelines, an electrical cable (50DY39 only) and fibre optic cable.
- Surface infrastructure will include one high point vent located on 50DY39 and three high point vents on 49DER34223.



Document: V:\Products\Australia\Queensland\Surat_Basin\General\210414_RITM0293633_Lots_Subject_RIDA_AHIRITM0293633_SB_A3_5LPH_2RP71519_Schuurs_1.mxd

LPH - RIDA Application

Lotplan 2RP71519

Source: Arrow Energy Pty Ltd
Geoscience Australia
DNRME

Date: 20/04/2021
Issued To: A Hall
Author: jluke

0 300 600 1,200 Metres

Scale 1:16,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

arrow energy
go further

Note: The dimensions, areas, number of lots, size and location of corridor information are approximate only and may vary.

Parcel: 2RP71519

Property Details

- This parcel is owned and operated by the same landholder as 49DER34223 & 50DY3, however the land parcel is not immediately adjacent (refer to Figure).
- The parcel is utilised for dryland cropping of cotton, cereals and pulses.
- Land uses surrounding these parcels also involves cropping.

Alignment Summary

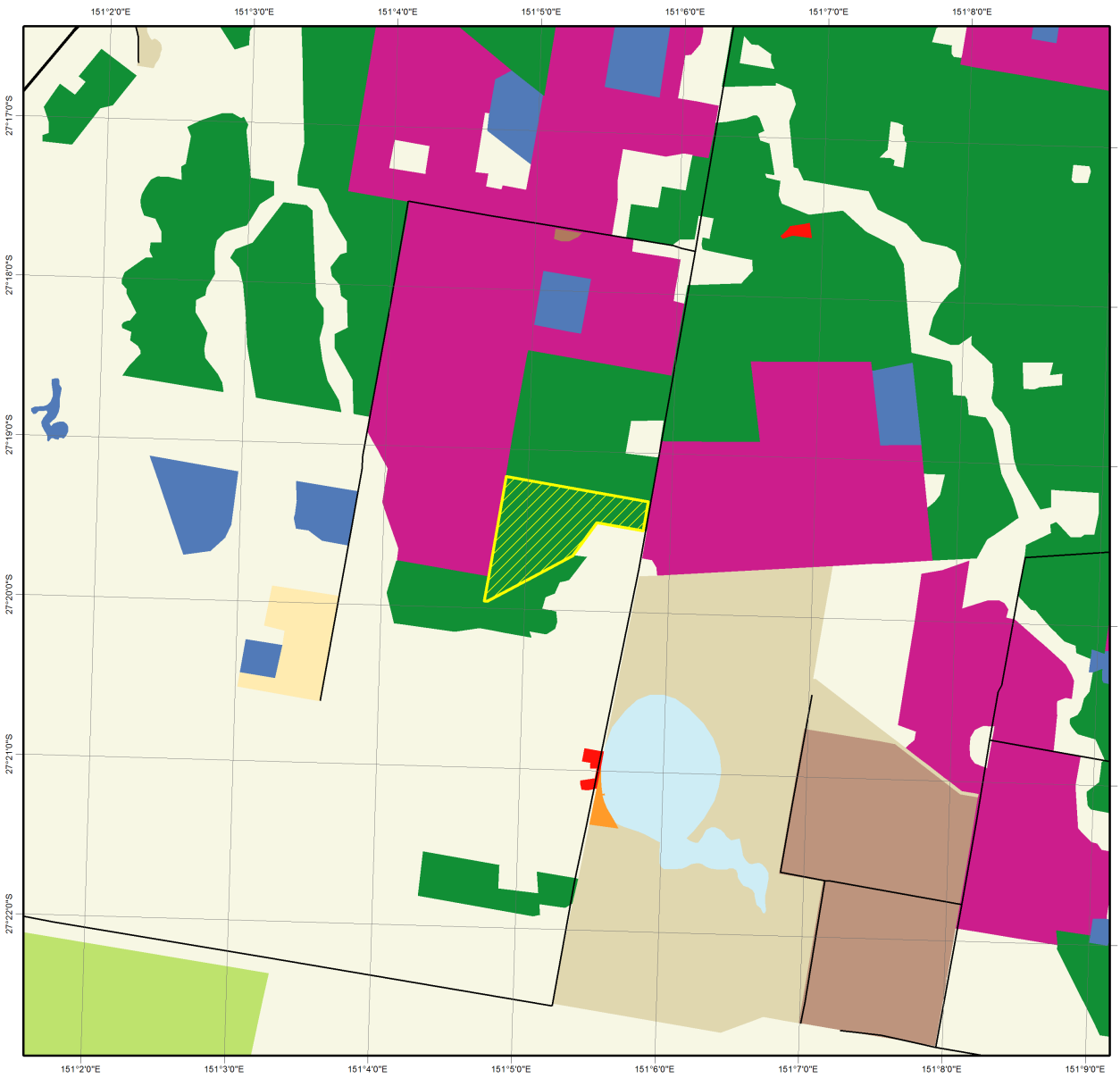
- LPH alignment is located adjacent the northern boundary of the parcel.
- Extra work area is required to facilitate the LPH crossing of the Kupunn Duleen Road.

Looking west along northern boundary– Kupunn Duleen Road on right of image

Infrastructure summary

- The length of LPH on the parcels is 616 m.
- LPH buried infrastructure on this parcel will consist of three pipelines and fibre optic cable.
- There is no surface infrastructure planned to be constructed on this parcel.

Appendix 3: Queensland Land Use Mapping Program (QLUMP)



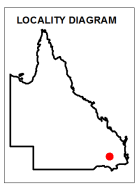
Land Use

Queensland Land Use Mapping Program

Legend

ALUM v8 Secondary level

- Selected Lot and Plan
- Nature conservation
- Managed resource protection
- Other minimal use
- Grazing native vegetation
- Production native forests
- Cropping
- Irrigated cropping
- Residential and farm infrastructure
- Services
- Utilities
- Lake
- Reservoir/dam
- Freeways / motorways; Highways
- Secondary roads; Streets



N

0 680 1360 2040 2720 3400 m

This product is projected into GDA 1994 Queensland Albers

The land use dataset is a product of the Queensland Land use Mapping Program (QLUMP), at a nominal scale of 1:50,000. The layer is a polygon dataset with each feature having attributes describing land use . It presents the most current land use information available in Queensland.

Land use is classified according to the Australian Land Use and Management Classification (ALUMC) Version 8, October 2016. Primary and secondary levels relate to land use (i.e. the principal use of the land in terms of the objectives of the land manager), the tertiary level further discriminate land use, eg. commodity/intensity. Where required and possible, attribution is performed to tertiary level. QLUMP maps the land use classes of sugar and cotton consistently to tertiary level. The minimum attribution level for land use mapping in Queensland is secondary land use, as presented in this map.

Refer to the contact position for additional information regarding source data. Further information relating to land use mapping can be found at http://www.qld.gov.au/environment/land/vegetation/mapping/qlump/ and http://www.agriculture.gov.au/abares/aclump/land-use/

While every care is taken to ensure the accuracy of this information, 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 might be incurred as a result of the information being inaccurate or incomplete in any way and for any reason.

Land Use

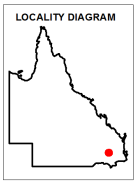
Queensland Land Use Mapping Program

Legend

ALUM v8 Secondary level

- Selected Lot and Plan
- Nature conservation
- Other minimal use
- Grazing native vegetation
- Cropping
- Irrigated cropping
- Residential and farm infrastructure
- Reservoir/dam
- Freeways / motorways; Highways
- Secondary roads; Streets

LOCALITY DIAGRAM



N

0 680 1360 2040 2720 3400 m

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Land Use

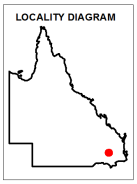
Queensland Land Use Mapping Program

Legend

ALUM v8 Secondary level

- Selected Lot and Plan
- Nature conservation
- Other minimal use
- Grazing native vegetation
- Cropping
- Irrigated cropping
- Residential and farm infrastructure
- Reservoir/dam
- Freeways / motorways; Highways
- Secondary roads; Streets

LOCALITY DIAGRAM



N

0 680 1360 2040 2720 3400 m

This product is projected into GDA 1994 Queensland Albers

The land use dataset is a product of the Queensland Land use Mapping Program (QLUMP), at a nominal scale of 1:50,000. The layer is a polygon dataset with each feature having attributes describing land use . It presents the most current land use information available in Queensland.

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Land Use

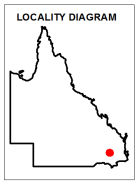
Queensland Land Use Mapping Program

Legend

ALUM v8 Secondary level

- Selected Lot and Plan
- Nature conservation
- Other minimal use
- Grazing native vegetation
- Cropping
- Irrigated cropping
- Residential and farm infrastructure
- Reservoir/dam
- Freeways / motorways; Highways
- Secondary roads; Streets

LOCALITY DIAGRAM



N

0 680 1360 2040 2720 3400 m

This product is projected into GDA 1994 Queensland Albers

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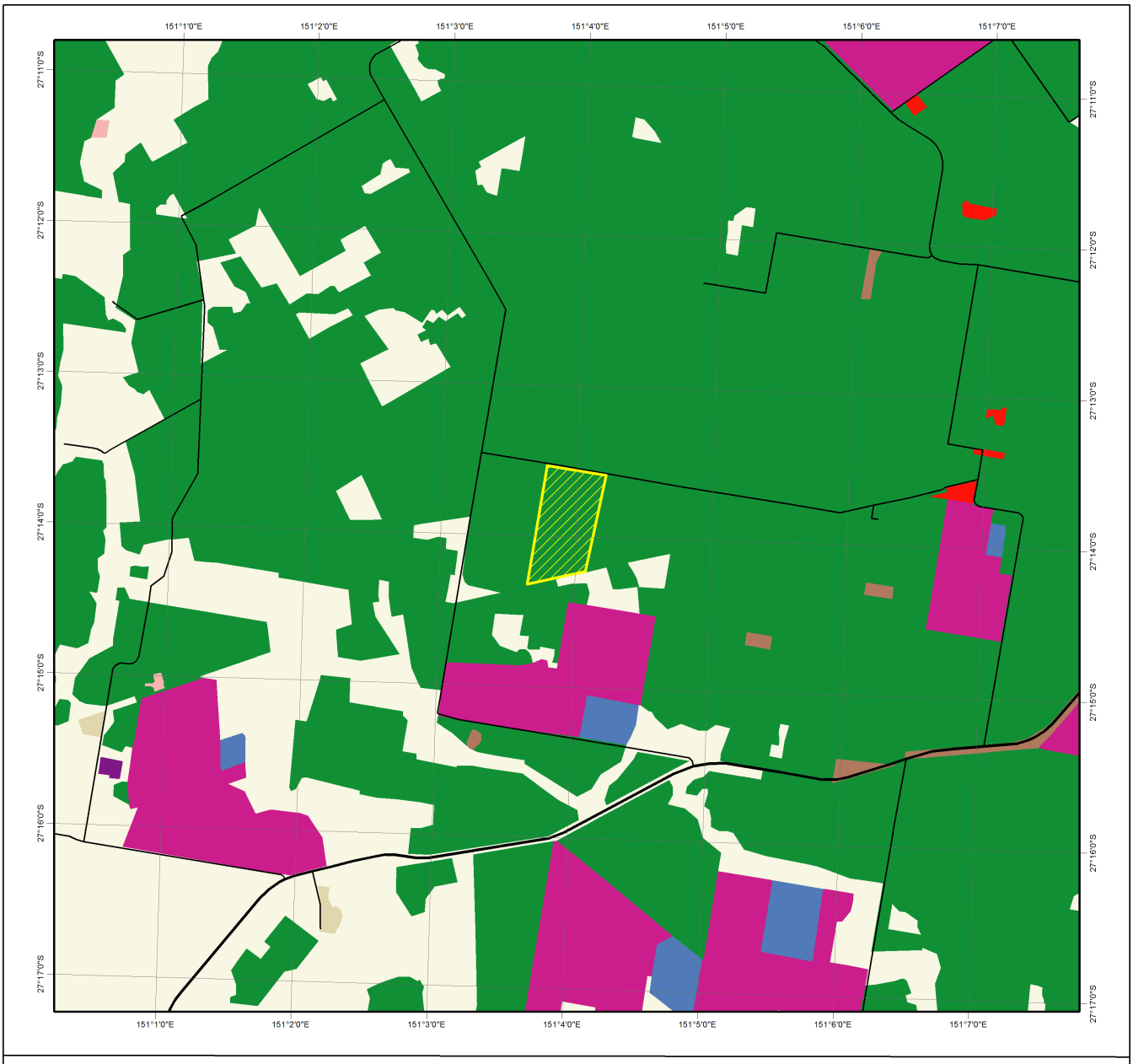


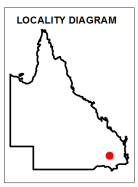
Land Use

Queensland Land Use Mapping Program

Legend

ALUM v8 Secondary level

- Selected Lot and Plan
- Nature conservation
- Other minimal use
- Grazing native vegetation
- Cropping
- Irrigated cropping
- Irrigated perennial horticulture
- Intensive animal production
- Residential and farm infrastructure
- Reservoir/dam
- Freeways / motorways; Highways
- Secondary roads; Streets



N

0 680 1360 2040 2720 3400 m

This product is projected into GDA 1994 Queensland Albers

The land use dataset is a product of the Queensland Land use Mapping Program (QLUMP), at a nominal scale of 1:50,000. The layer is a polygon dataset with each feature having attributes describing land use . It presents the most current land use information available in Queensland.

Land use is classified according to the Australian Land Use and Management Classification (ALUMC) Version 8, October 2016. Primary and secondary levels relate to land use (i.e. the principal use of the land in terms of the objectives of the land manager), the tertiary level further discriminate land use, eg. commodity/intensity. Where required and possible, attribution is performed to tertiary level. QLUMP maps the land use classes of sugar and cotton consistently to tertiary level. The minimum attribution level for land use mapping in Queensland is secondary land use, as presented in this map.

Refer to the contact position for additional information regarding source data. Further information relating to land use mapping can be found at http://www.qld.gov.au/environment/land/vegetation/mapping/qlump/ and http://www.agriculture.gov.au/abares/aclump/land-use/

While every care is taken to ensure the accuracy of this information, 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 might be incurred as a result of the information being inaccurate or incomplete in any way and for any reason.

Appendix 4: Forage Crop Frequency Data for the years 2011 – 2020

arrow energy
go further

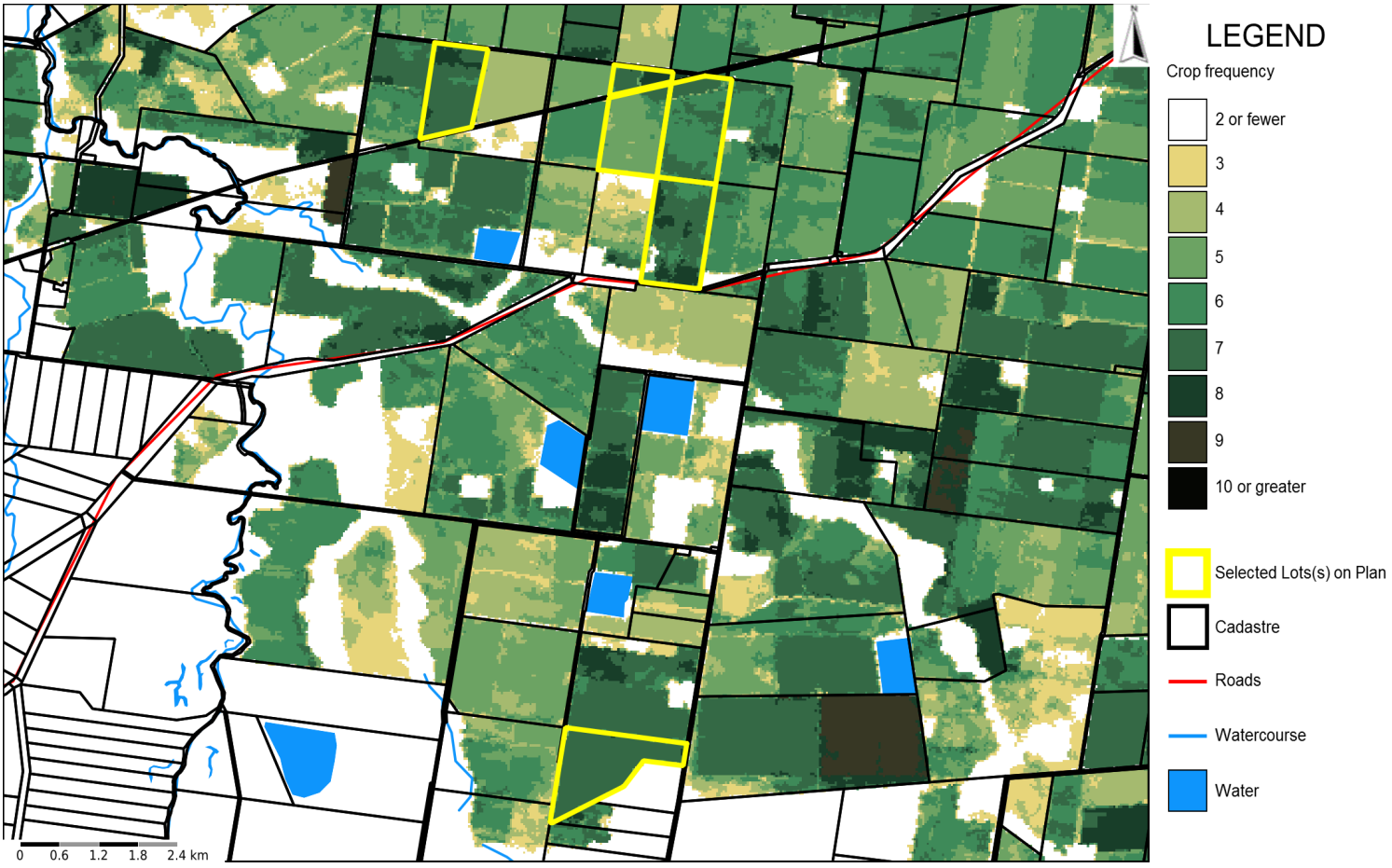
FORAGE REPORT: CROP FREQUENCY

Queensland Government

Introduction

This report presents maps of crop frequency for your chosen area, and chosen time period. Maps are based on time-series analysis of satellite imagery (30-m spatial resolution), for both the summer and winter growing seasons, aimed at detecting cycles of greenness in vegetation. Composite satellite images that display the maximum greenness within a summer or winter growing season for each year are also provided, as a visual reference. For further information refer to the FORAGE User Guide (https://data.longpaddock.qld.gov.au/static/forage_user_guide.pdf) .

Estimated total crop frequency map (2011 - 2020)



How to interpret the information

Crop-frequency mapping: Coloured areas on the maps indicate locations where active crops have been detected three or more times in the summer or winter growing seasons, for the time period specified. The map on this page shows "Total Frequency" which is a count of the number of times that an active crop was detected. The maps on the following page show the summer and winter crop frequency, respectively. Analysis of satellite imagery can result in some misclassification, so it is recommended to view the composite imagery (see below) to help confirm the presence of a crop in a given season.

Mapping of broad groups of crops: Crop frequency is also separated into estimates of the broad crop groups within the area. This estimation is based on an automated classification approach (see https://www.qld.gov.au/environment/land/management/mapping/statewide-monitoring/crops for more detail).

In the winter season the classification differentiates between the groups:

- Cereal crops (e.g. wheat, barley, oats);
- Pulse crops (e.g. chickpea).

In the summer season the classification differentiates between the groups:

- Coarse-grain and pulse (e.g. sorghum, maize, mungbean);
- Cotton crop.

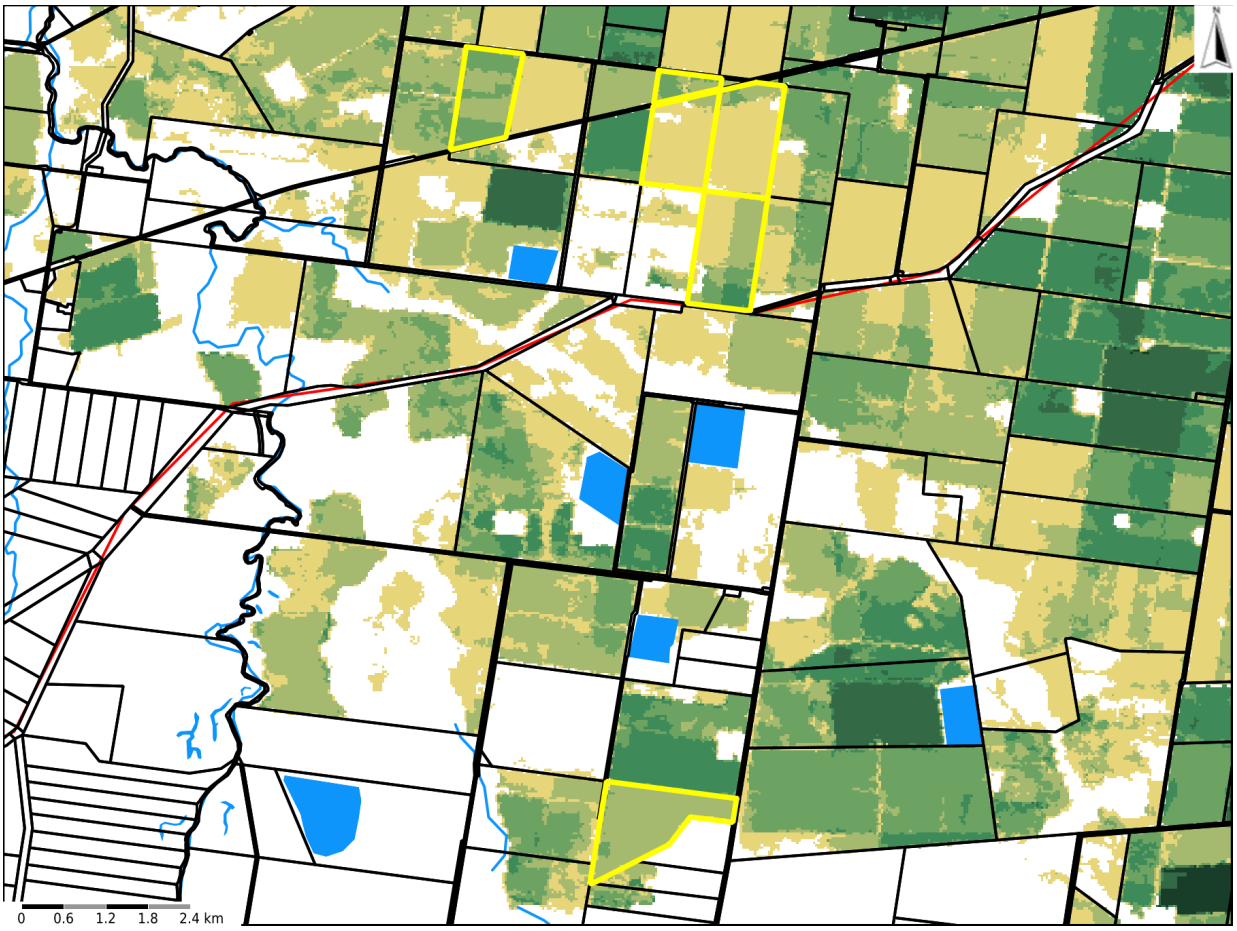
Composite satellite imagery: Due to the limitations of the automated method used to detect active cropping, it is recommended to view the seasonal composite images (pages 5 onward), compiled to represent the maximum greenness (per pixel) within a growing season. Cropped areas will generally appear bright green in the imagery compared with the surrounding landscape. Even if the crop-frequency mapping does not indicate cropping in an area, it is important to check each composite image to confirm that cropping has not been undertaken. Sometimes it will not be possible to clearly identify cropped areas in the imagery, e.g in some wetter seasons the entire landscape might appear green. In this case, it is recommended to undertake further investigation using other information sources. Note: the composite images are only used to confirm the presence or absence of cropping activity; it is not possible to visually differentiate between the crop groups.

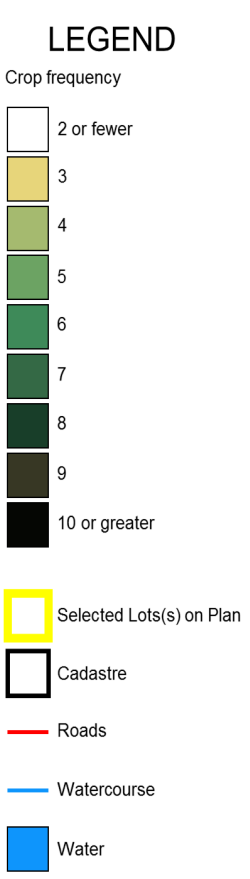
FORAGE REPORT: CROP FREQUENCY

http://www.longpaddock.qld.gov.au/forage *June 14, 2021* *Lot on Plan: 2RP210387,46DER34223,49DER34223, etc.* *Label: lphforagecroppinghistory*

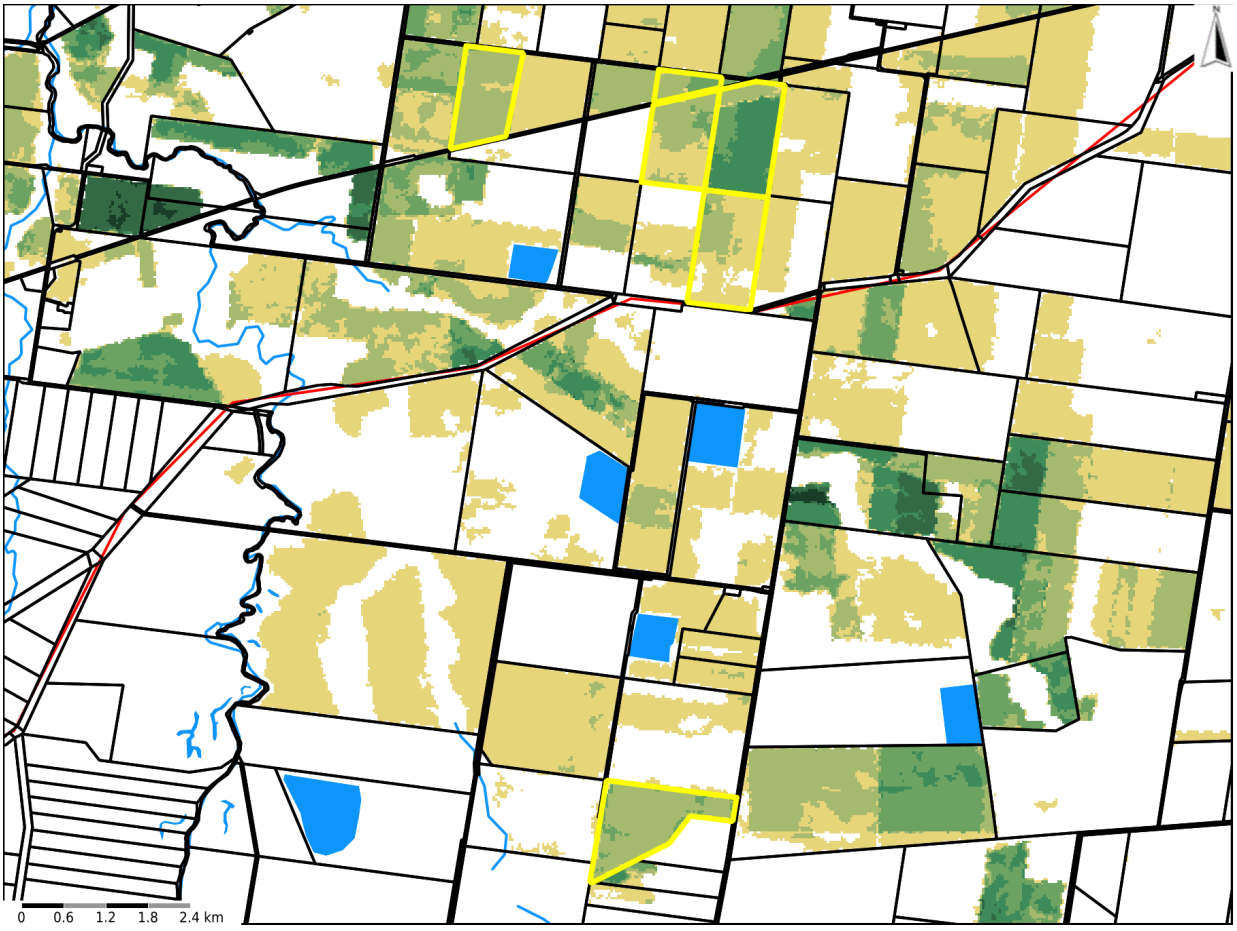
Queensland Government

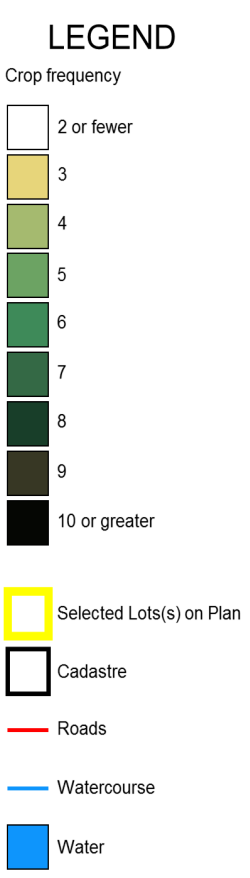
Estimated frequency map for summer (February) crops (2011 - 2020)





Estimated frequency map for winter (September) crops (2011 - 2020)



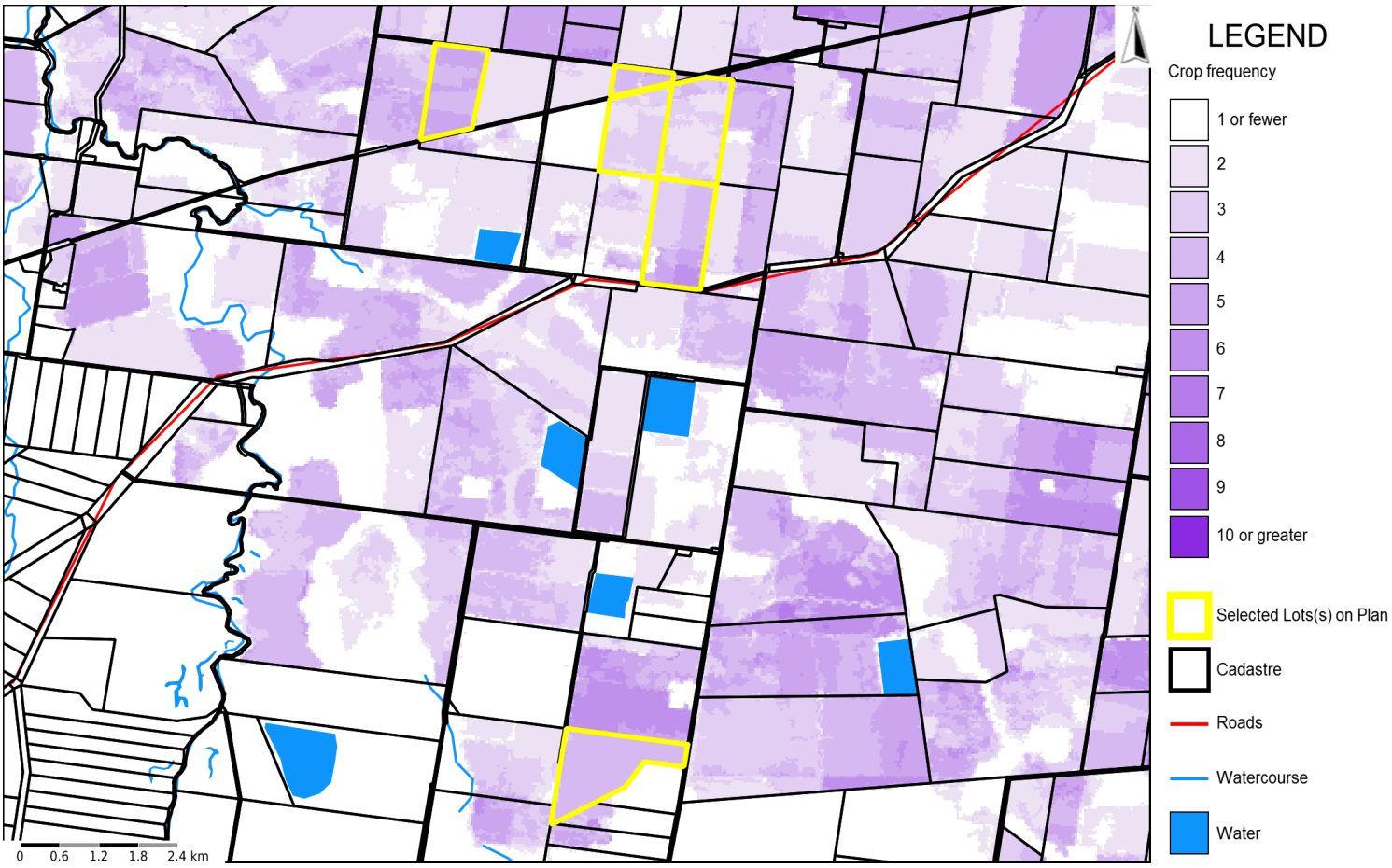


FORAGE REPORT: CROP FREQUENCY

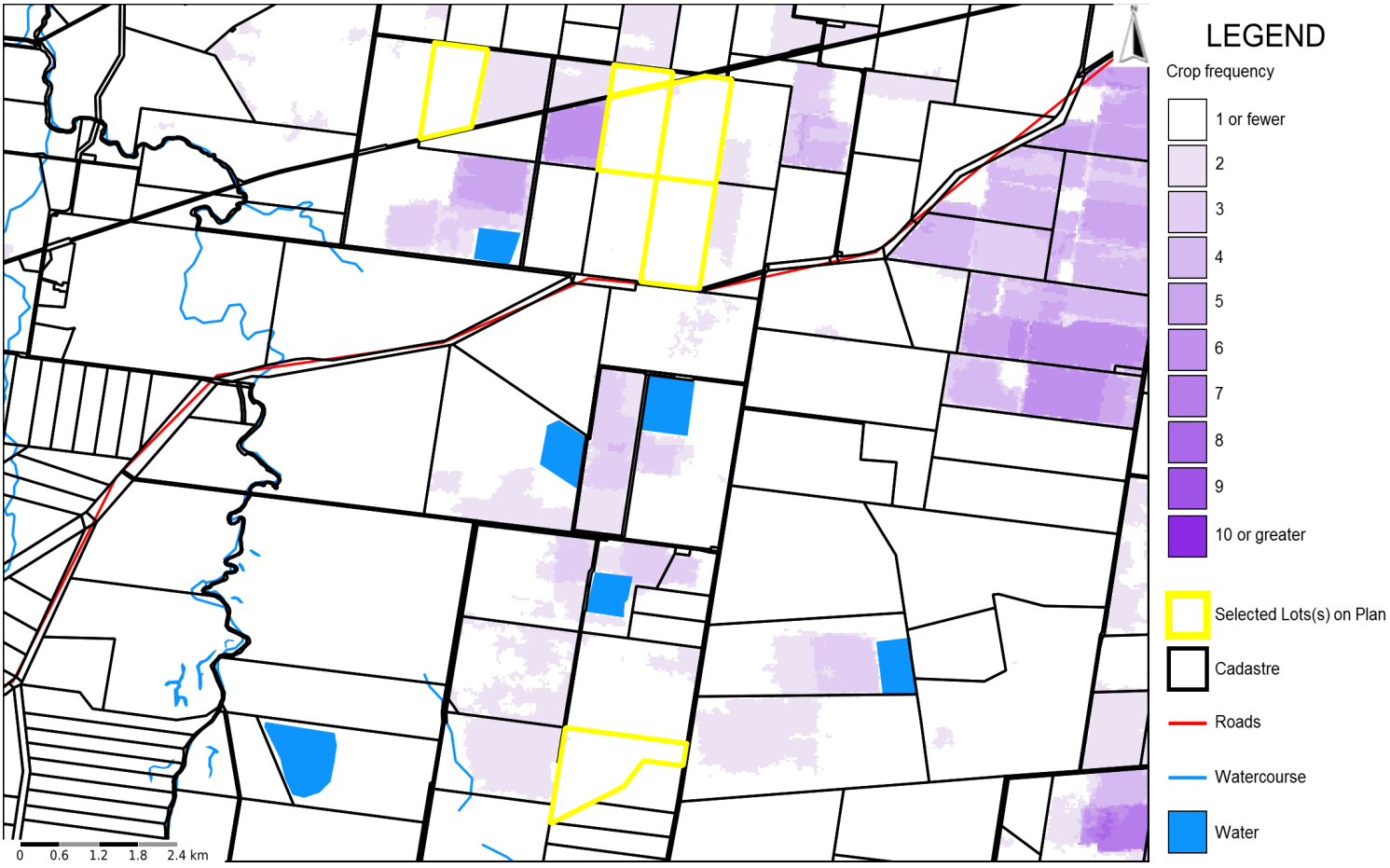
http://www.longpaddock.qld.gov.au/forage *June 14, 2021* *Lot on Plan: 2RP210387,46DER34223,49DER34223, etc.* *Label: lphforagecroppinghistory*

Queensland Government

Estimated frequency map for summer (February) coarse grain and pulse crops (2011 - 2020)



Estimated frequency map for summer (February) cotton crops (2011 - 2020)

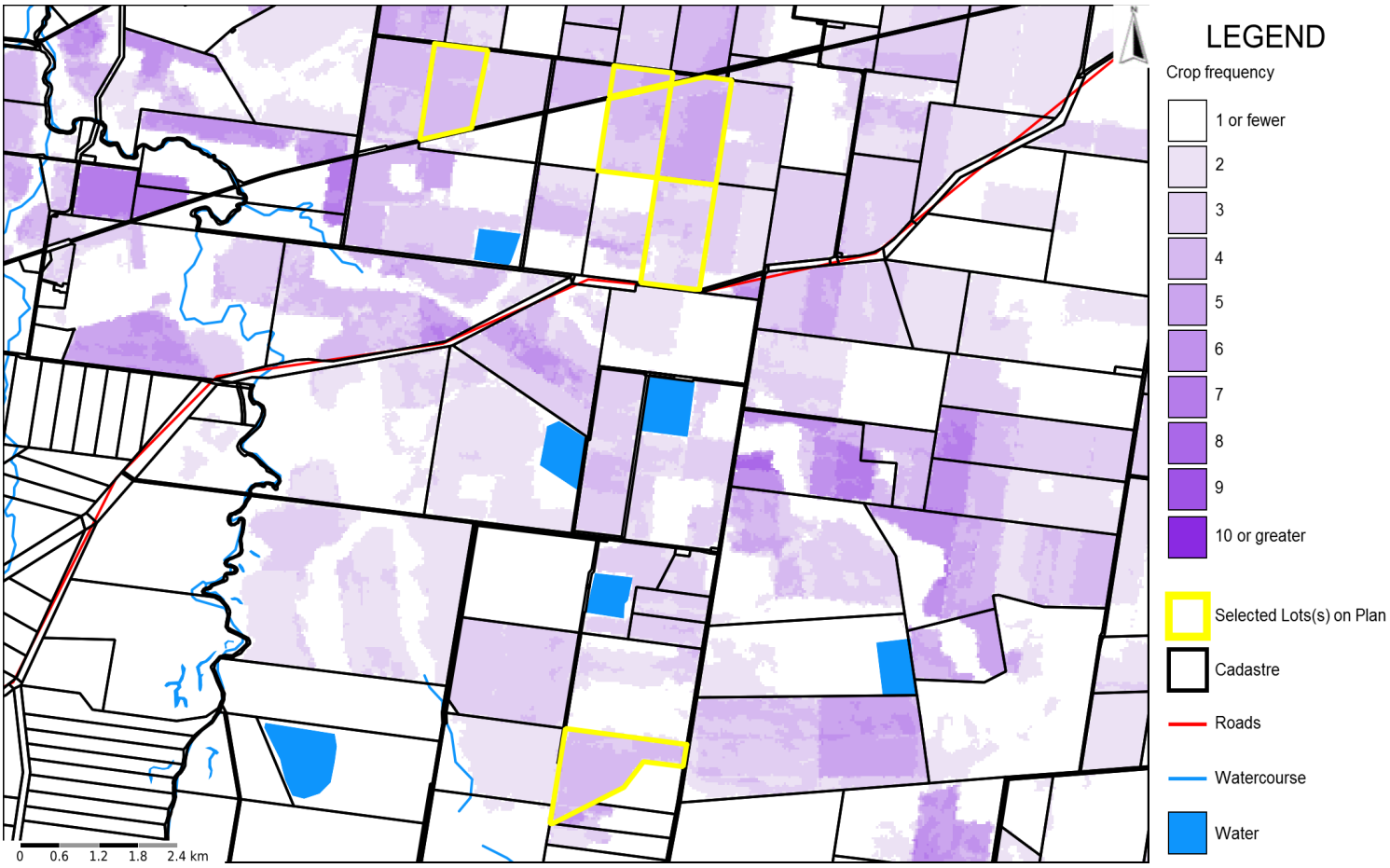


FORAGE REPORT: CROP FREQUENCY

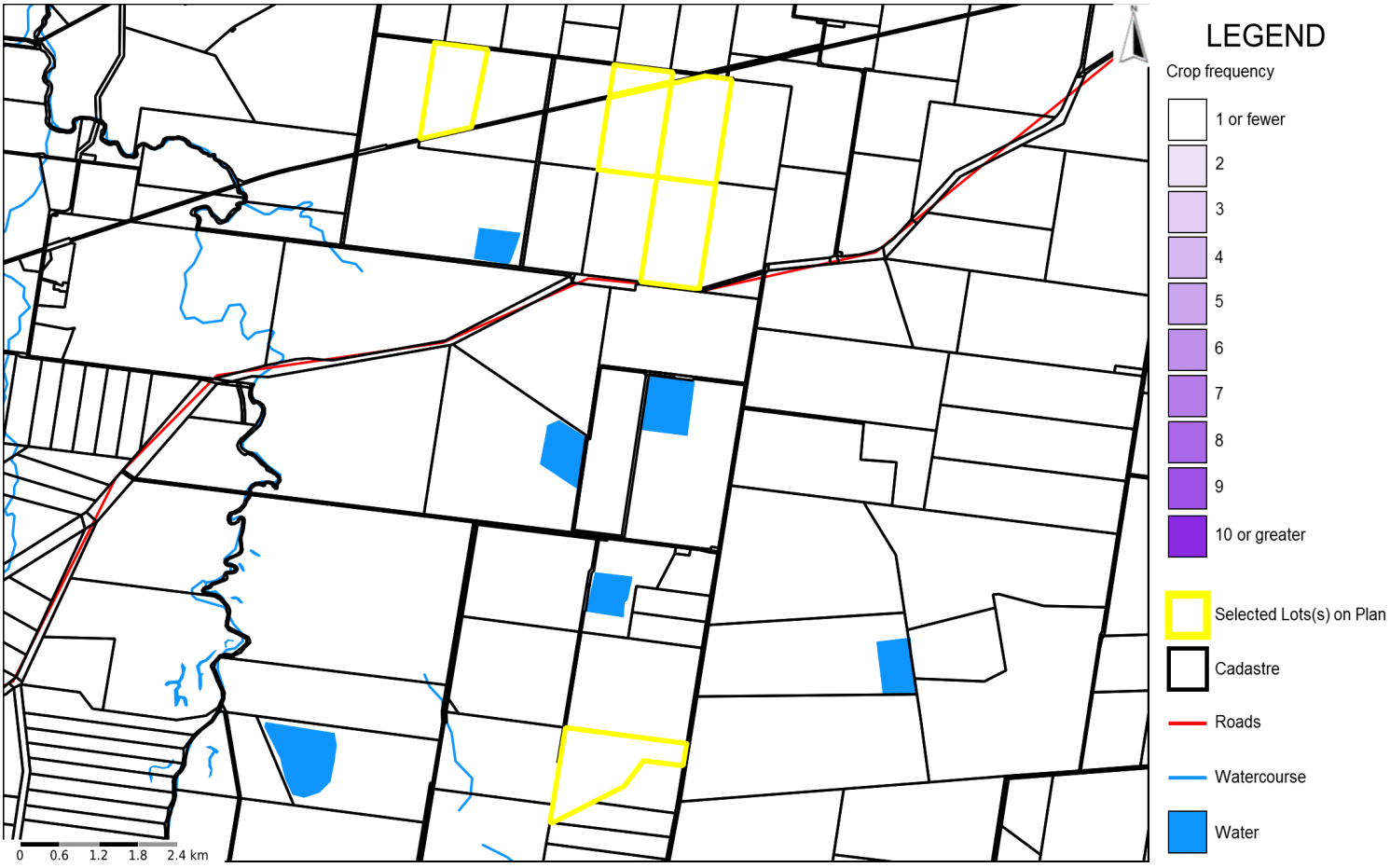
http://www.longpaddock.qld.gov.au/forage *June 14, 2021* *Lot on Plan: 2RP210387,46DER34223,49DER34223, etc.* *Label: lphforagecroppinghistory*

Queensland Government

Estimated frequency map for winter (September) cereal crops (2011 - 2020)



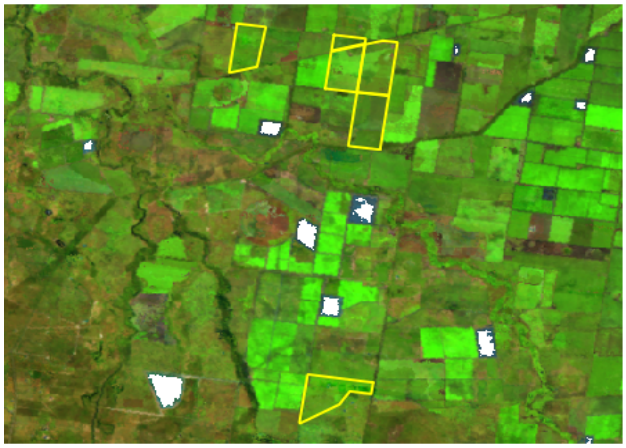
Estimated frequency map for winter (September) pulse crops (2011 - 2020)

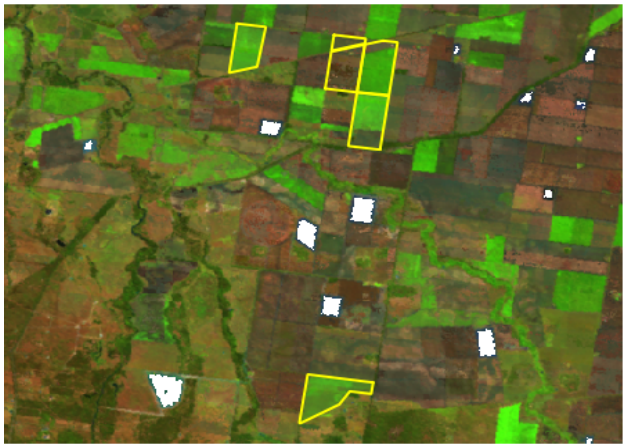


FORAGE REPORT: CROP FREQUENCY

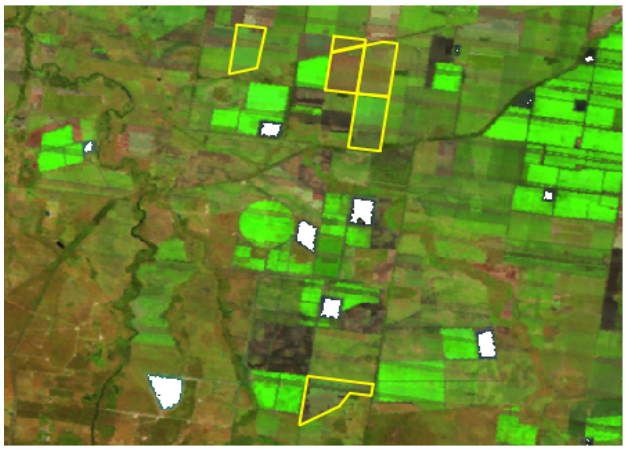
Queensland Government

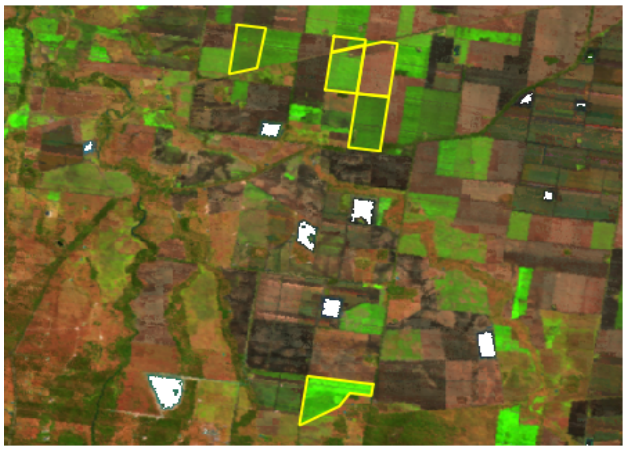
February (left) and September (right) images for 2011



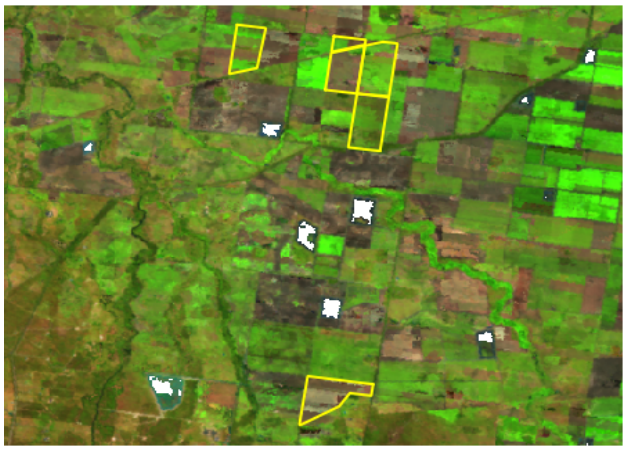


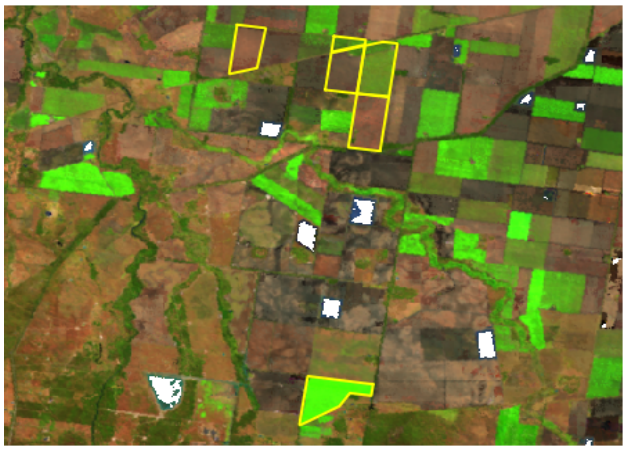
February (left) and September (right) images for 2012





February (left) and September (right) images for 2013

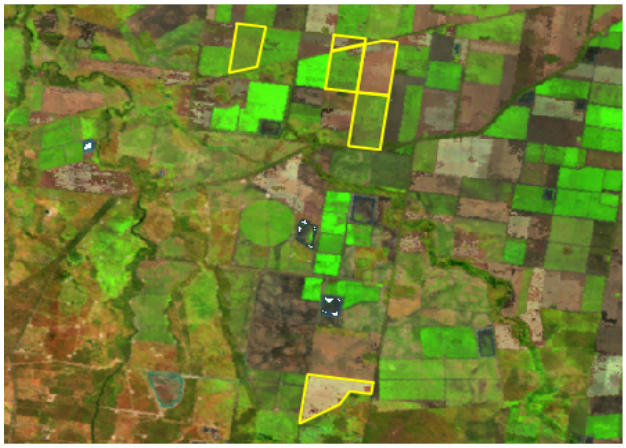


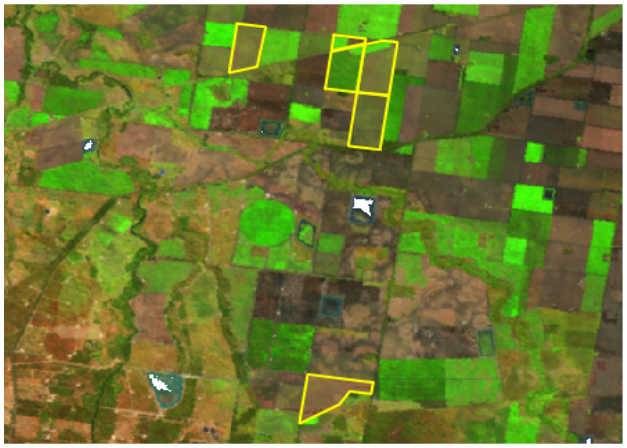


FORAGE REPORT: CROP FREQUENCY

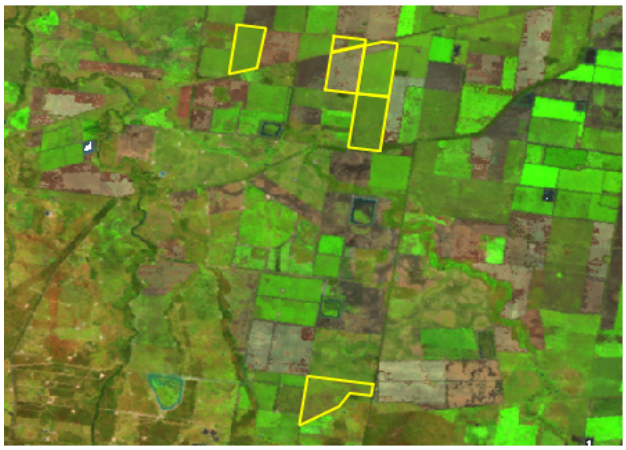
Queensland Government

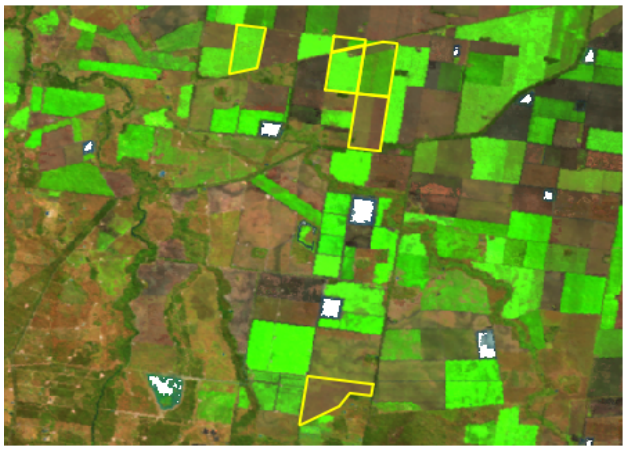
February (left) and September (right) images for 2014



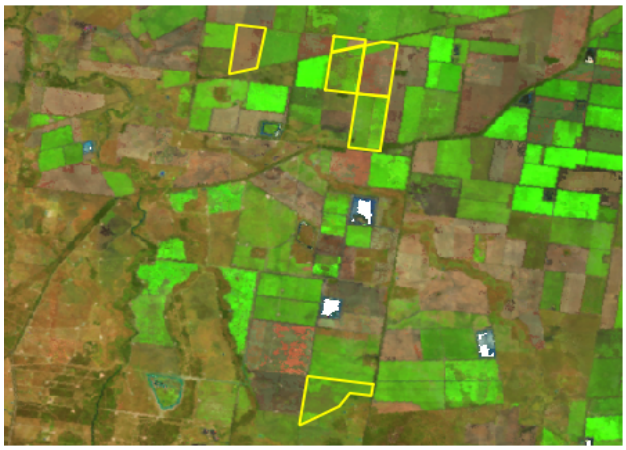


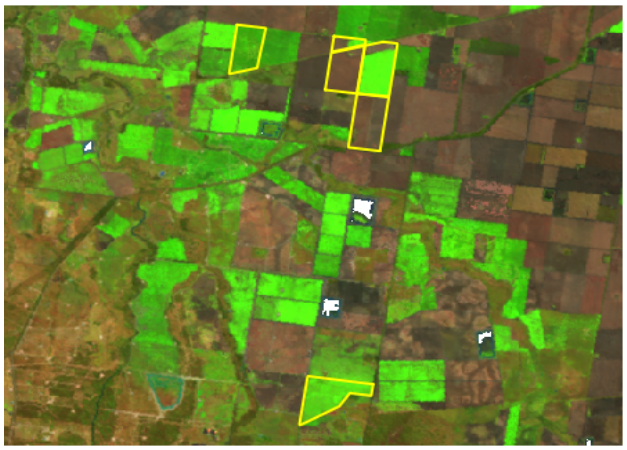
February (left) and September (right) images for 2015





February (left) and September (right) images for 2016

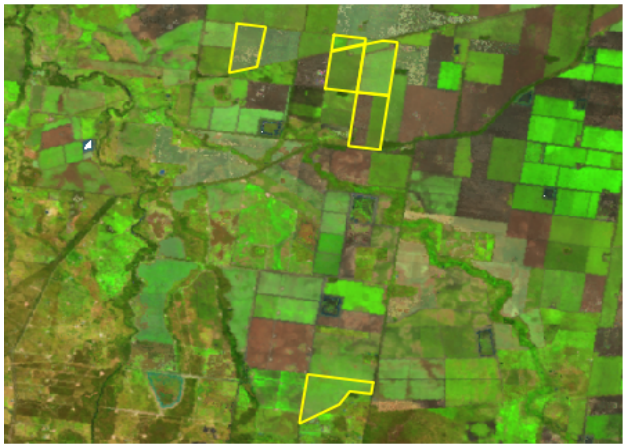


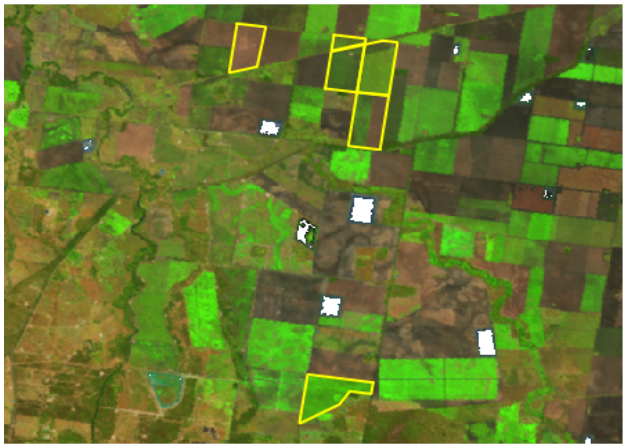


FORAGE REPORT: CROP FREQUENCY

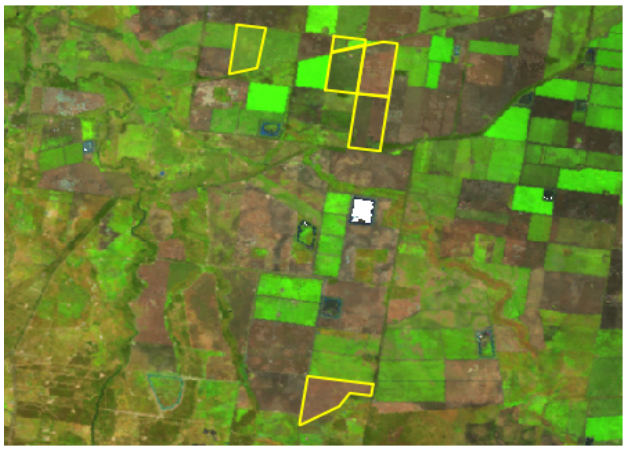
Queensland Government

February (left) and September (right) images for 2017

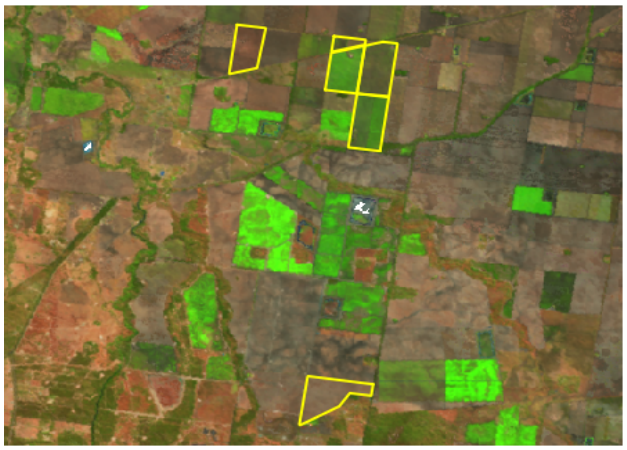




February (left) and September (right) images for 2018



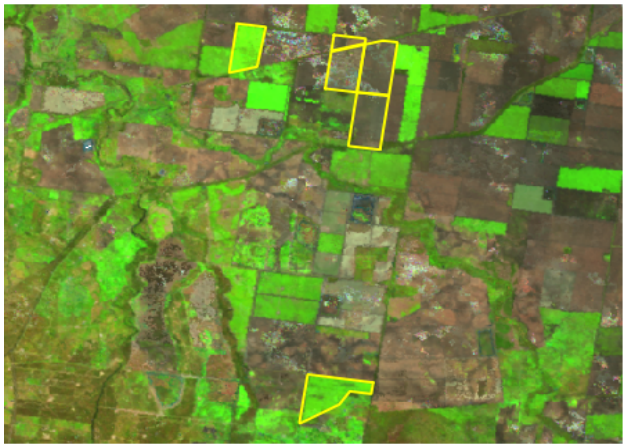
February (left) and September (right) images for 2019

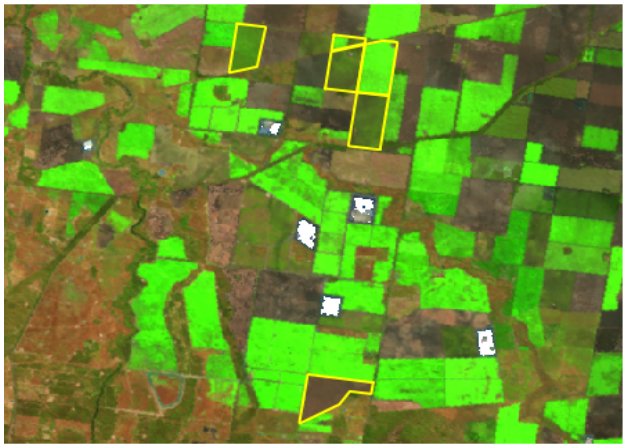


FORAGE REPORT: CROP FREQUENCY

Queensland Government

February (left) and September (right) images for 2020





Disclaimer

Appendix 5: Aerial photography / satellite imagery for the years 2011 – 2020 for 27SP253612 & 2DER3455

This appendix has been removed as it is no longer of relevance to any of the remaining land parcels within the application report.

Appendix 6: Topography Map Series

arrow energy
go further

292000 294000 296000 298000 300000

7000000 6998000 6996000 6994000 6992000

DALBY KOGAN ROAD

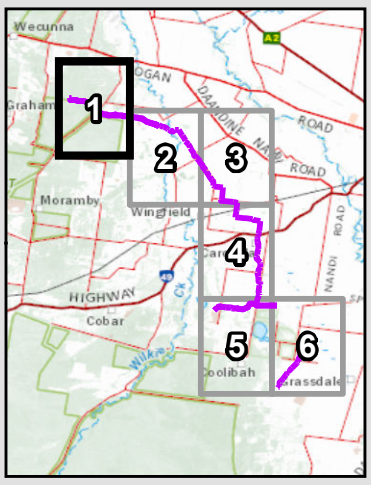
David IPF

KUMBARILLA LANE

Legend

- Low Pressure Header David IPF to Tipton CGPF
- Contour - 1m interval
- Waterway Drainage
- Property Boundary
- Arrow Facility

Location Diagram



Scale @ A3: 1:30,000 **Coordinate System:** GDA 1994 MGA Zone 56

0 500 1,000 1,500 2,000 Metres

N

Contour interval: 1 Metre

Rev	Date	Revision Description	Org	Chkd	Eng	QA	App
6	09/06/2021	Update properties of interest	SL	AH			AH
5	28/04/2021	Update properties of interest	MS	AH			AH
4	08/04/2021	Update facility name	SL	AH			AH
3	18/03/2021	Add property owner labels	SL	AH	_	_	AH
2	18/03/2021	Add cadastre, properties of interest and road labels	SL	AH	_	_	AH
1	23/02/2021	Initial issue.	PD	AH	_	_	AH

Source:
Arrow Energy Limited, Geoscience Australia, Queensland Government

Status: IFU
Issued to: A Hall
Author: sliyanage

arrow energy
go further

Surat Basin
David IPF to Tipton Low Pressure Header
- Topography

Sheet 1 of 6

Document: V:\Products\Australia\Queensland\Surat_Basin\Land_Access\210222_RITM0277076_DavidIPF_to_Tipton_AH\RITM0277076_DavidIPF_to_Tipton_Contour_DDP_5.mxd

NOT FOR CONSTRUCTION

Print Date: 9/06/2021

300000 302000 304000 306000

6996000 6994000 6992000 6990000 6988000

THETEN ROAD

Wilkie Creek

WATTLE DRIVE

MILLERS EASEMENT ROAD

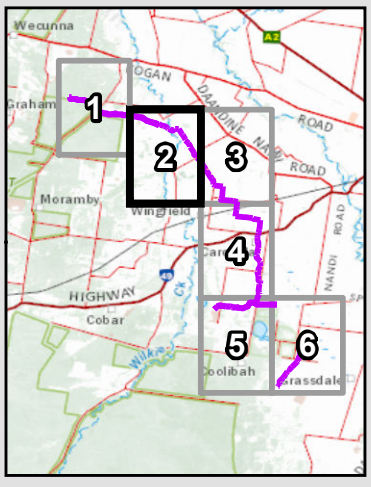
DUCKLO SCHOOL ROAD

WILSONS ROAD

Legend

- Low Pressure Header David IPF to Tipton CGPF
- Rail (Dme)
- Contour - 1m interval
- Waterway Drainage
- Property Boundary

Location Diagram



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Contour interval: 1 Metre

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5	28/04/2021	Update properties of interest	MS	AH			AH
4	08/04/2021	Update facility name	SL	AH			AH
3	18/03/2021	Add property owner labels	SL	AH	_	_	AH
2	18/03/2021	Add cadastre, properties of interest and road labels	SL	AH	_	_	AH
1	23/02/2021	Initial issue.	PD	AH	_	_	AH

Source:
Arrow Energy Limited, Geoscience Australia, Queensland Government

Status: IFU
Issued to: A Hall
Author: sliyanage

arrow energy go further

Surat Basin
David IPF to Tipton Low Pressure Header
- Topography

Sheet 2 of 6

Document: V:\Products\Australia\Queensland\Surat_Basin\Land_Access\210222_RITM0277076_DavidIPF_to_Tipton_AH\RITM0277076_DavidIPF_to_Tipton_Contour_DDP_5.mxd

NOT FOR CONSTRUCTION

Print Date: 9/06/2021

306000 308000 310000 312000

6996000 6994000 6992000 6990000 6988000

LEAHYS ROAD

Condamine River

DAANDINE NANDI ROAD

GREENBANK ACCESS

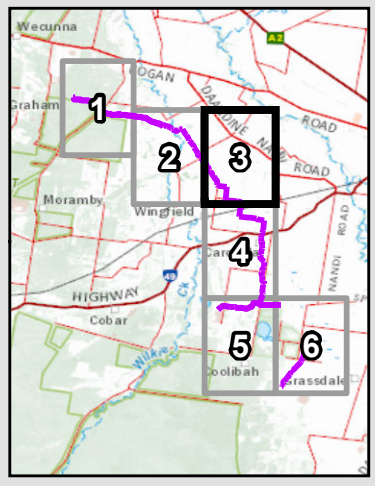
HOADLEYS ROAD

DULEEN DAANDINE ROAD

Legend

- Low Pressure Header David IPF to Tipton CGPF
- Rail (Dme)
- Contour - 1m interval
- Subject to RIDA
- Property Boundary

Location Diagram



Scale @ A3: 1:30,000 **Coordinate System:** GDA 1994 MGA Zone 56

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Contour interval: 1 Metre

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5	28/04/2021	Update properties of interest	MS	AH			AH
4	08/04/2021	Update facility name	SL	AH			AH
3	18/03/2021	Add property owner labels	SL	AH	–	–	AH
2	18/03/2021	Add cadastre, properties of interest and road labels	SL	AH	–	–	AH
1	23/02/2021	Initial issue.	PD	AH	–	–	AH

Source:
Arrow Energy Limited, Geoscience Australia, Queensland Government

Status: IFU
Issued to: A Hall
Author: sliyanage

arrow energy
go further

Surat Basin
David IPF to Tipton
Low Pressure Header

- Topography

Sheet 3 of 6

Document: V:\Products\Australia\Queensland\Surat_Basin\Land_Access\210222_RITM0277076_DavidIPF_to_Tipton_AH\RITM0277076_DavidIPF_to_Tipton_Contour_DDP_5.mxd

NOT FOR CONSTRUCTION

Print Date: 9/06/2021

306000 308000 310000 312000

6986000 6984000 6982000 6980000 6978000

2RP71519
VICTORIA MEGAN &
MARK DAVID SCHUURS

50DY39
VICTORIA MEGAN &
MARK DAVID SCHUURS

49DER34223
MARK DAVID
SCHUURS &
VICTORIA
MEGAN SCHUURS

46DER34223
JACK MERVYN
KLEMM

MOONIE HIGHWAY

Wilkie Creek

1RP181072
NOEL VICTOR
ROCKLIFF

SCHULTZS ROAD

BROADWATER ROAD

2RP181072
NOEL VICTOR
ROCKLIFF

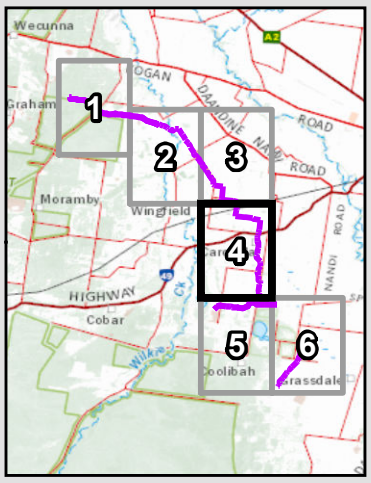
3RP181072
SUZANNE MAREE & NOEL
VICTOR ROCKLIFF

3RP181072

Legend

- Low Pressure Header David IPF to Tipton CGPF
- Rail (Dme)
- Contour - 1m interval
- Subject to RIDA
- Property Boundary

Location Diagram



Scale @ A3: 1:30,000 **Coordinate System:** GDA 1994 MGA Zone 56

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Contour interval: 1 Metre

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5	28/04/2021	Update properties of interest	MS	AH			AH
4	08/04/2021	Update facility name	SL	AH			AH
3	18/03/2021	Add property owner labels	SL	AH	–	–	AH
2	18/03/2021	Add cadastre, properties of interest and road labels	SL	AH	–	–	AH
1	23/02/2021	Initial issue.	PD	AH	–	–	AH

Source:
Arrow Energy Limited, Geoscience Australia, Queensland Government

Status: IFU
Issued to: A Hall
Author: sliyanage

arrow energy
go further

Surat Basin
David IPF to Tipton
Low Pressure Header

- Topography

Sheet 4 of 6

Document: V:\Products\Australia\Queensland\Surat_Basin\Land_Access\210222_RITM0277076_DavidIPF_to_Tipton_AH\RITM0277076_DavidIPF_to_Tipton_Contour_DDP_5.mxd

NOT FOR CONSTRUCTION

Print Date: 9/06/2021

306000 308000 310000 312000 314000

6976000 6974000 6972000 6970000 6968000

2RP210387
SHARRON LOUISE HENRY;
CLIFFORD LESTER WEIER

3RP181072
SUZANNE MAREE & NOEL
VICTOR ROCKLIFF

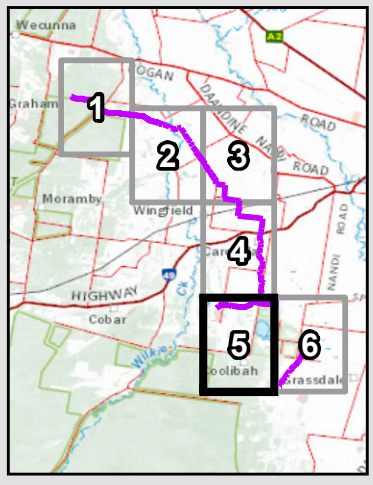
27SP253612
ROBERT ALLAN & DONALD
WILLIAM & COLIN
DAVID & ALFRED
JOHN MCCONNELL

Tipton CGPF

Legend

- Low Pressure Header David IPF to Tipton CGPF
- Contour - 1m interval
- Subject to RIDA
- Property Boundary
- Arrow Facility

Location Diagram



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0 500 1,000 1,500 2,000 Metres

N

Contour interval: 1 Metre

Rev	Date	Revision Description	Org	Chkd	Eng	QA	App
6	09/06/2021	Update properties of interest	SL	AH			AH
5	28/04/2021	Update properties of interest	MS	AH			AH
4	08/04/2021	Update facility name	SL	AH			AH
3	18/03/2021	Add property owner labels	SL	AH	_	_	AH
2	18/03/2021	Add cadastre, properties of interest and road labels	SL	AH	_	_	AH
1	23/02/2021	Initial issue.	PD	AH	_	_	AH

Source:
Arrow Energy Limited, Geoscience Australia, Queensland Government

Status: IFU
Issued to: A Hall
Author: sliyanage

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Surat Basin
David IPF to Tipton
Low Pressure Header

- Topography

Sheet 5 of 6

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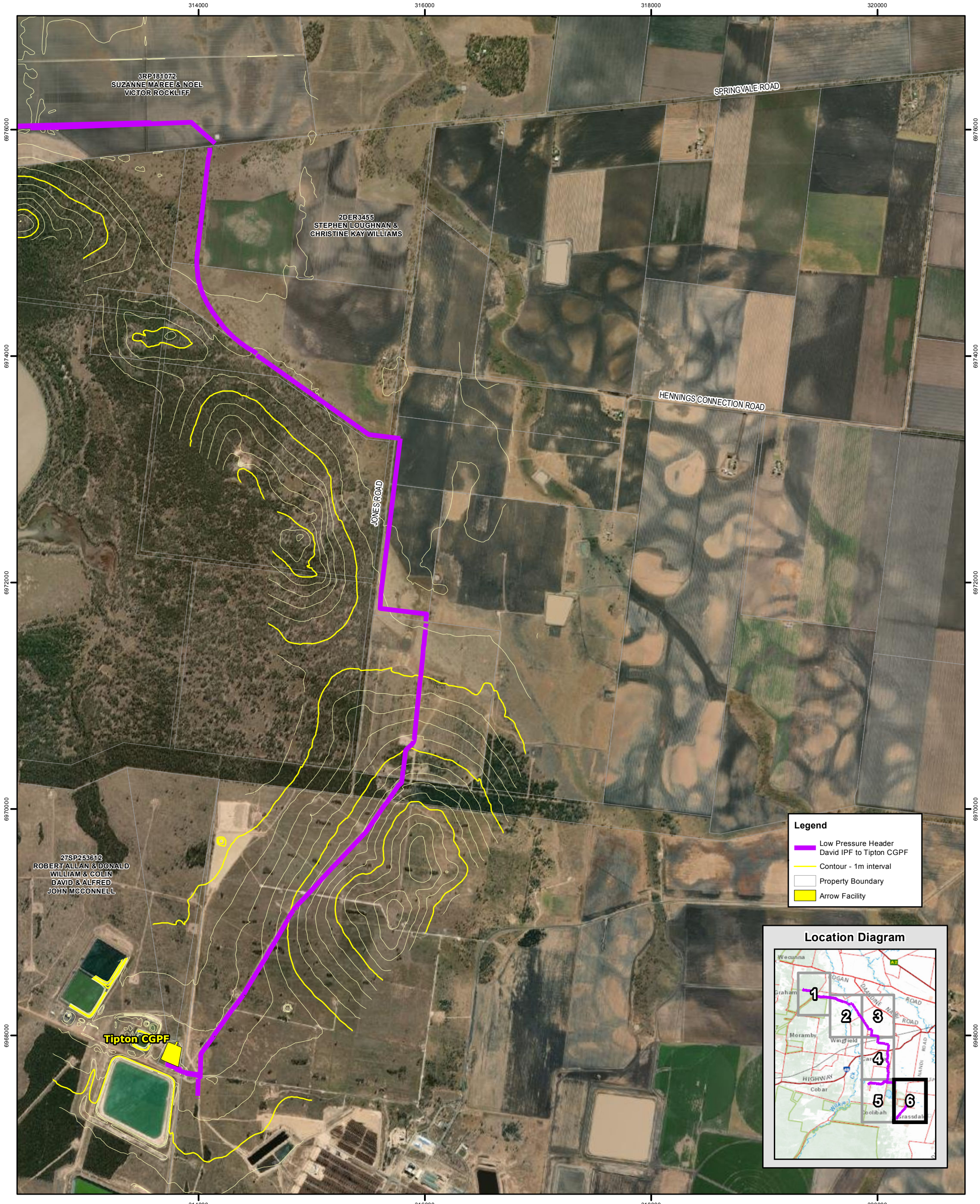
Print Date: 9/06/2021



Scale @ A3: 1:30,000 **Coordinate System:** GDA 1994 MGA Zone 56

0 500 1,000 1,500 2,000 Metres

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Contour interval: 1 Metre

Rev	Date	Revision Description	Org	Chkd	Eng	QA	App
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Sheet 6 of 6

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Appendix 7: Soils Report

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Arrow Energy Pty Ltd
25-Mar-2021

Surat Low Pressure Header (LPH) Pipeline Soil Assessment

Phase 1 - Desktop Assessment

Surat Low Pressure Header (LPH) Pipeline Soil Assessment

Phase 1 - Desktop Assessment

Client: Arrow Energy Pty Ltd

ABN: 73078521936

Prepared by

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25-Mar-2021

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Quality Information

Document Surat Low Pressure Header (LPH) Pipeline Soil Assessment

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Date 25-Mar-2021

Prepared by Max Setchfield/Navjot Kaur

Reviewed by Simon Muniandy

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
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Appendix A
Curriculum Vitae A

1.0 Introduction

1.1 General

AECOM Australia Pty Ltd (AECOM) was appointed by Arrow Energy Pty Ltd (Arrow) to undertake a desktop soil assessment along the proposed pipeline for the Surat Low Pressure Header (Surat LPH) between the David Inlet Processing Facility (located in Daandine area) and the Tipton Facility, to support Arrow's application under the *Regional Planning Interests Act 2014* (RPI Act).

1.2 Objective

The key objectives of the desktop soil assessment along the Surat LPH pipeline were to:

- Assess various soil types along the Surat LPH;
- Assess key issues including soil degradation, loss of productivity and subsidence related to the identified soil types; and
- Provide strategies to manage these identified soil issues during construction.

2.0 Project Description

2.1 Site Identification

The proposed Surat LPH (herein referred to as "the alignment") is approximately 44 km in length, located between the David Inlet Processing Facility (IPF), Harry IPF and the Tipton Central Gas Processing Facility (CGPF), shown in **Figure 1**. The function of the proposed Surat LPH is to:

1. Convey gas from the well systems gathering to compression infrastructure.
2. Convey produced water to the water treatment system.

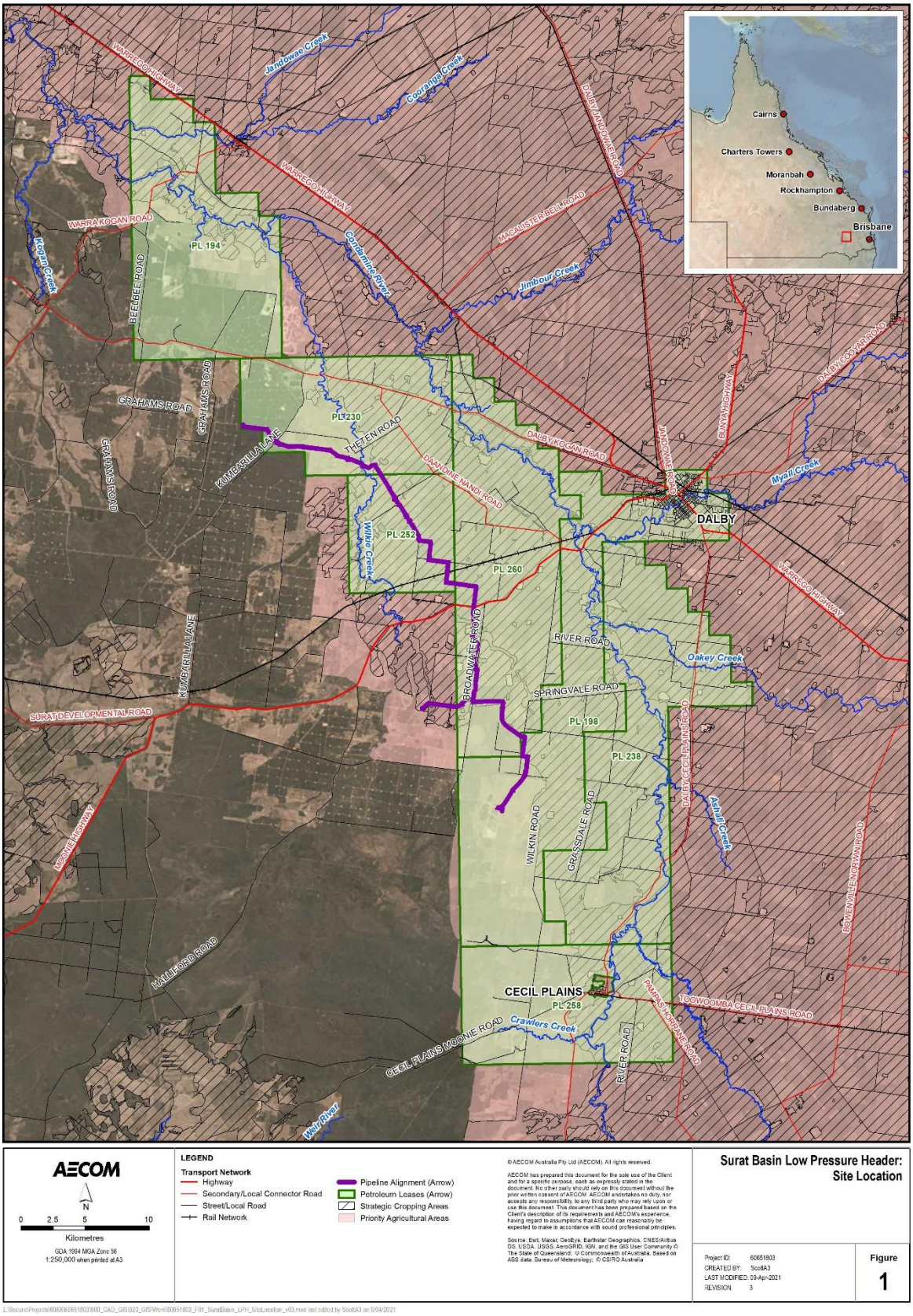
2.2 Right of Way (ROW) Layout

The alignment will be a common easement, containing water/gas pipelines and fibre optic/power cables within a right of way (ROW). The dimensions of a the ROW will be approximately 50 metres (m) wide, with dedicated areas for storage, workspaces, traffic and the pipeline trench (**Plate 1**).

As per information provided by Arrow, the pipelines will be installed by conventional trenching with a trenching machine. Conventional trenching involves an open trench between 1-2 m wide and approximately 2.0 m deep to install, inspect or maintain piping, conduits or cables. After installation, the trench is backfilled with the original material and the surface is restored.

Where the pipelines are required to be installed below existing roads or infrastructure, other trenchless technologies such as thrustbore may be used.

Figure 1 Surat Basin Low Pressure Header: Site Location



The key steps in the pipeline construction are given below, and a generic pipeline ROW layout is provided in **Plate 1**:

- Detailed survey of the ROW and construction areas.
- Establishing temporary access tracks if necessary.
- Installing temporary gates and fences as required.
- Clearing vegetation, where required, and grading the ROW to prepare a safe construction working area (on average the ROW will be 50 m in width).
- Separating and stockpiling topsoil and subsoil to protect and preserve topsoil.
- Crossing watercourses, roads and existing buried pipelines by open cut, boring or alternate trenchless technology (e.g. Horizontal Directional Drilling [HDD] methods) depending upon the type and nature of the crossing.
- Delivering pipe sections along the ROW.
- Welding the low-pressure high-density polyethylene (HDPE) pipe sections together to form ‘a string’.
- Creating a trench in which to lay the pipeline. The trench is excavated by a trenching machine and may include the use of rock saws, excavators, rock hammers or blasting in hard rock terrain.
- Lowering the pipeline strings into the trench and placing padding (e.g. screened trench subsoil) around the pipe to protect the pipe from external damage.
- Returning the subsoil and topsoil to their original horizons.
- Testing the integrity of the pipeline by pneumatic testing or filling it with water and pressurising it to above the maximum allowable operating pressure (i.e. hydrostatic pressure testing).
- Cleaning up, restoring and progressively rehabilitating the construction ROW and all temporary and permanent tracks, gates and fences.
- Installation of multiple pipelines in a single ROW is sequential. The first pipeline is installed, and the trench backfilled before the next pipeline installation commences.

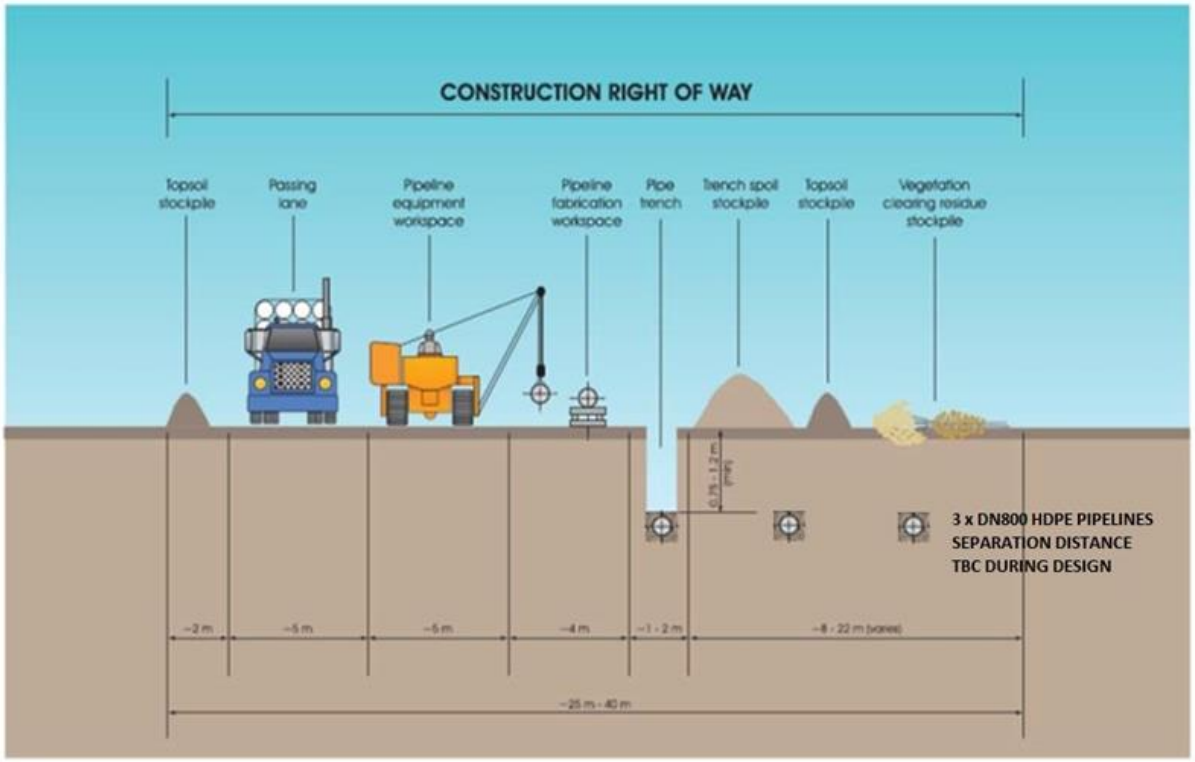


Plate 1 Typical Pipeline ROW Layout

3.0 Scope of Works

The scope of works for undertaking the desktop soil assessment includes:

- Desktop review encompassing:
  - Review of available mapping and publications sourced from the Queensland Government Open Data Portal and Queensland Spatial Catalogue.
  - Review of available data provided by Arrow relevant to the Surat LPH.
- Preparation of this desktop soil assessment report, including recommendations for each soil type including soil stripping, stockpile storage, returning topsoil and subsoil to trench, addition of ameliorants and/or fertilizers (if needed), compaction strategies, erosion controls, post-construction inspection and maintenance regimes.

4.0 Methodology

The methodology for the desktop soil assessment is summarised in this section.

4.1 Relevant Legislation and Guidelines

The key legislation applicable to the works undertaken as part of this desktop soil assessment is the RPI Act, administered by the Department of Infrastructure, Local Government and Planning (DILGP). The Act restricts the carrying out of resource of regulated activities where the activity is not exempt from the provisions of the RPI Act, or a RIDA has not been granted.

The Act identifies four ARIs, including: a priority agricultural area (PAA); a priority living area (PLA); the strategic cropping area (SCA); and a strategic environmental area (SEA). The alignment (the resource activity) intersects PPA and SCA.

- PAA: an area which includes one or more areas used for a priority agricultural land uses (PALU), identified in the relevant regional plan. PALUs may include certain types of agriculture, plantations, and/or intensive horticulture. In the case of the alignment, the PALUs are identified in the Darling Downs Regional Plan.
- SCA: defined as an area mapped as potential Strategic Cropping Land (SCL) on the Department of Natural Resources, Mines and Energy (DNRME) trigger map. The SCL is likely to be highly suitable for cropping due to a combination of the soil, climate, and landscape features.

This desktop soil assessment has been prepared in accordance with Australian legislations, Standards and Guidelines and Arrow's Standard Operating Procedures (SOP) for Surat and Bowen Basins including:

- *RPI Act, Statutory Guideline 02/14, Carrying out resource activities in a Priority Agricultural Area, State of Queensland, Department of State Development, Manufacturing, Infrastructure and Planning, August 2019*
- *RPI Act, Statutory Guideline 03/14 Carrying out resource activities in a Strategic Cropping Area, State of Queensland, Department of State Development, Manufacturing, Infrastructure and Planning, August 2019*
- *Environmental Authority EA0002659 Non-Scheduled Petroleum Activity Petroleum Pipeline Licence -PPL2052, dated 5 February 2021*
- *Environmental Authority EPPG00972513, dated 14 January 2021*
- *Guidelines for Soil Survey along Linear Features, Soil Science Australia, 2015*
- *Arrow Land Disturbance Procedures (ORG-ARW-HSM-PRO-00146)*
- *Scope of Work (SoW), Soil Assessment Report – Surat Low Pressure Header (LPH) pipeline dated 21 December 2020.*

4.2 Desktop Review

The purpose of the desktop review was to obtain background information on potential soil types and landscapes likely to occur within the alignment, information on the underlying geology and topography of the project site and understand potential PAA and SCA limitations.

The Surat LPH study area of the desktop assessment is represented by a 1 km buffer applied to the proposed pipeline route and is presented in the desktop mapping and interpretations.

4.2.1 Publicly available data

The desktop review involved a search of publicly available soil data, sourced from the Queensland Government Open Data Portal and Queensland Spatial Catalogue, including:

- Priority Agricultural Area mapping (DSDMIP, 2013).
- Strategic Cropping Land trigger map (DNRME, 2020).
- Central Darling Downs Land Management Manual (Harris *et al.*, 1999).

- Australian Soil Resource Information System (ASRIS) Atlas of Australian Soils (Northcote *et al.*, 1960-1968).

This information was used to develop a map of soils and physical limitations along the alignment.

4.2.2 Arrow provided data

Arrow provided the following data to assist in validating the potential soil types and landscapes likely to occur within the Surat LPH study area, including:

- Existing and/or historical soil field and laboratory data.
- Master crossing list.
- Standard pipeline construction, rehabilitation requirements and procedures.
- Typical Construction Erosion and Sediment Control Plans.
- Relevant Environmental Authorities (EA).

4.3 Suitably Qualified Person

AECOM confirms that the desktop review and interpretation of available data, has been undertaken directly or under the supervision of a suitably qualified person (SQP). Copies of curriculum vitae have been provided in **Appendix A**.

5.0 Desktop Review

5.1 Topography and geomorphology

5.1.1 Regional physiography

The Surat LPH study area is located wholly within the Condamine Central Lowlands physiographic region (**Figure 2**). The region is described as a low-lying area of undulating siltstone hills with alluvial sediments on the floodplains of the Condamine River and highly weather bedrock on the slopes (CSIRO, 2011).

5.1.2 Topography

Regionally, there is a north-south topographic high of the Taroom Hills and an east-west topographic high of the Great Dividing Range. Two major drainage systems separate these topographic highs: the Condamine River and Wilkie Creek, both draining towards the north-west.

Based on the Queensland Globe relative elevation mapping, the surface elevation across the Surat LPH study area ranges between approximately 330 m Australian Height Datum (mAHD) and 370m AHD. Majority of the LPH alignment [kilometre point (KP) 14 to KP44] in the central area is relatively flat at approximately 330 m AHD. The highest elevation of 370m AHD is observed in north near David IPF. The area in south (from KP0 to KP14) has relative elevation of approximately 350m AHD, with 340m AHD near Harry IPF lateral line. The relative elevations are consistent with the area being located on the Condamine Lowlands and floodplains of the Condamine River (**Figure 2**).

The surface slope occurring throughout the LPH study area is presented in **Figure 3**. The digital elevation model (DEM) for the LPH study area was sourced from the 1 second Shuttle Radar Topographic Mission (SRTM) DEM-S (smoothed) v1.0 (coverage of Queensland, supplied by Geoscience Australia). The DEM-S is supplied in generic GRID format, so no further conversion was necessary. The DEM-S was also used to create the Hillshade Terrain used as a background detail.

The Slope DEM was created from the DEM-S GRID and the Slope calculation tool from the Spatial Analysis toolset, available in ArcGIS. Output measurement was set to PERCENT_RISE, also referred to as percent slope. Based on the calculations, the slope within majority of the LPH study area range from near level (<1%) to 3%, with only minor patches of land with slope >3%.

5.2 Surface geology

The surface geology (presented in **Figure 4**) beneath the Surat LPH study area is a part of the extensive Surat and Clarence Moreton Basins. Based on the Queensland detailed surface geology mapping (DNRME, 2018), the sequency of sedimentary rocks (Kumbarilla Beds [JKk] and Springbok Sandstone [Jis]) within the Basins are overlain by surficial Cenozoic sediments (undifferentiated alluvium and the Condamine Alluvium). These alluvium units are described as unconsolidated [Qs], poorly consolidated [TQ] and semi-consolidated [Qa] sediments typically comprised of sand, silt and clay (DNRME, 2019).

The alignment is primarily underlain by the Condamine Alluvium. The Condamine Alluvium is an extensive accumulation of Tertiary to Quaternary age alluvial sediments, forming a broad (greater than 20 km wide) alluvial plain, extending from Millmerran to Chinchilla. The thickness ranges from less than 10 m to more than 120 m in the floodplain near Dalby (DNRME, 2019). The sediments are dominated by coarse grained gravels and sands, interbedded with clays. The coarse-grained alluvium is associated with higher transmissibility and are the primary source of groundwater.

Figure 2 Regional Physiography- Central Lowlands Province

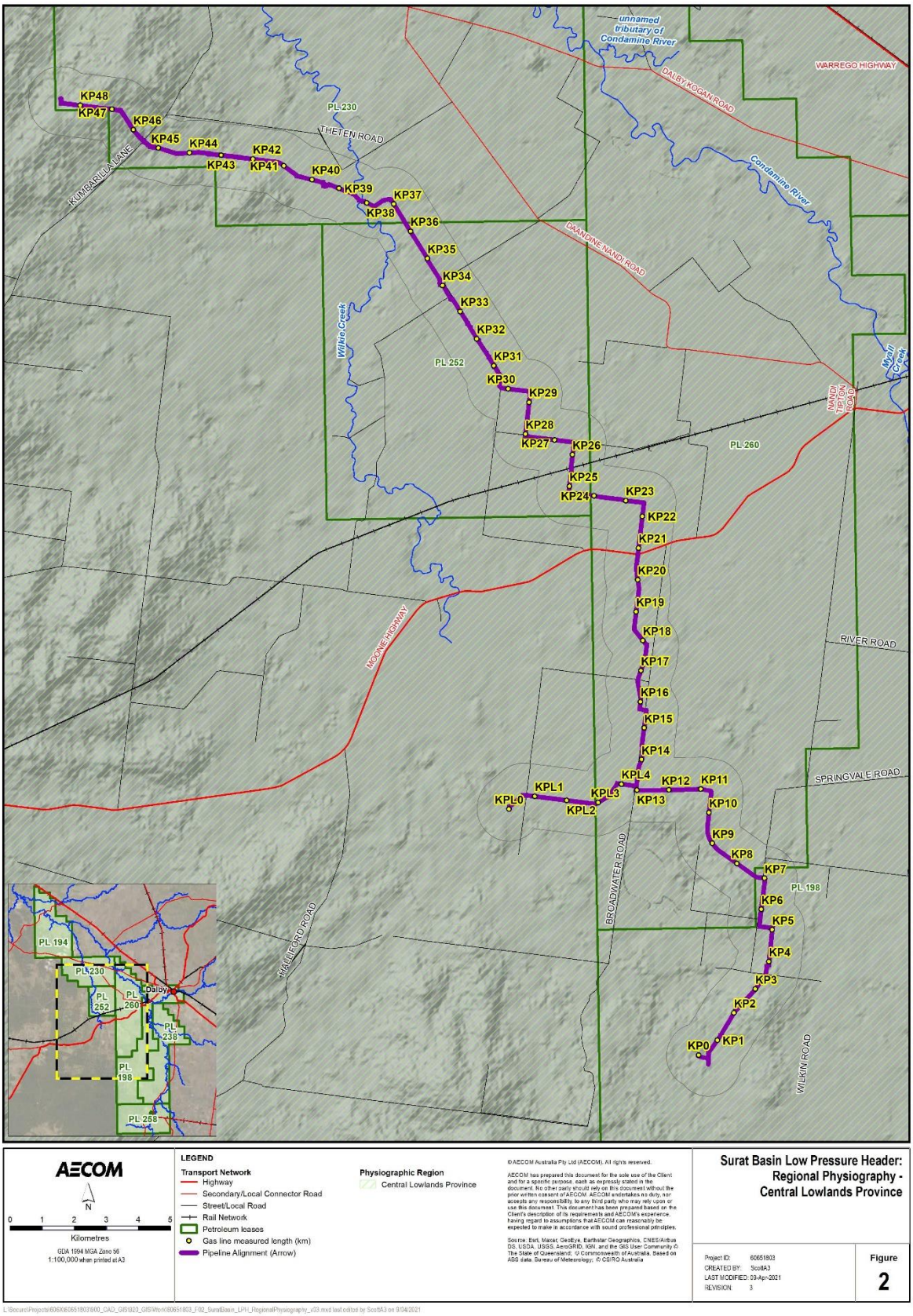


Figure 3 Slope Class and Slope Range (%)

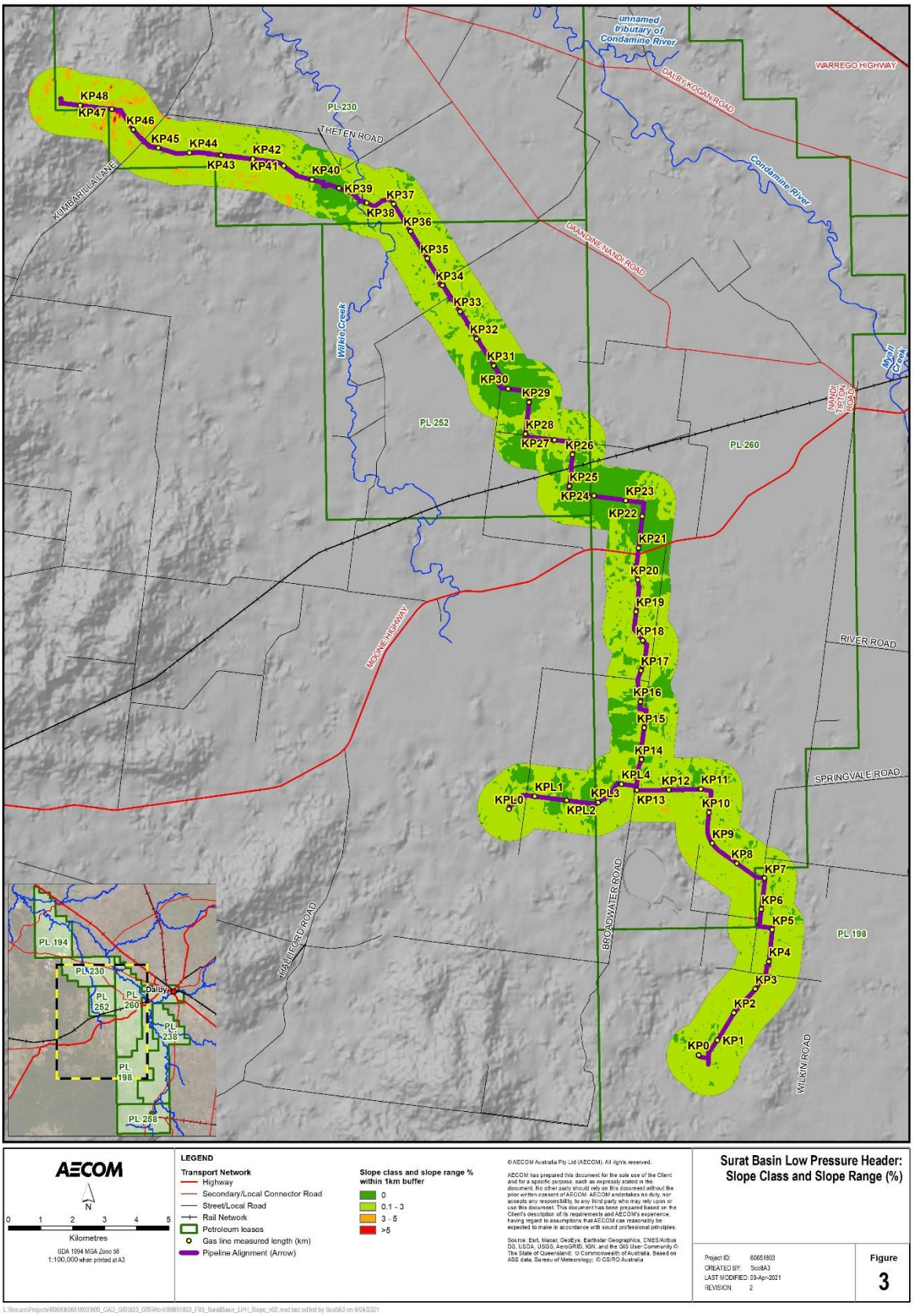
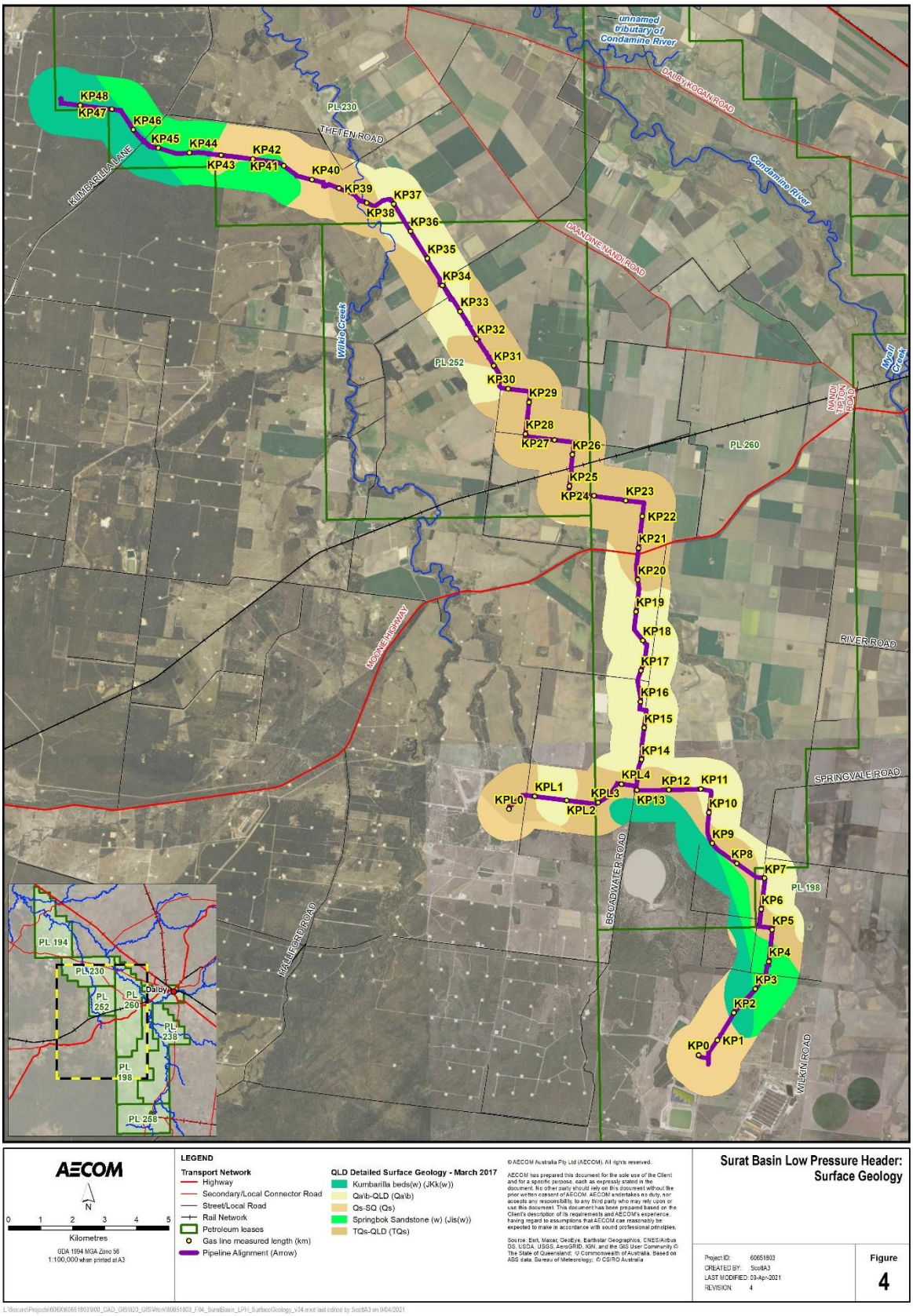


Figure 4 Surface Geology



5.3 Atlas Soil Landscape Units

The relevant soil landscape units have been sourced from the ASRIS Atlas of Australia Soil (Northcote *et al.*, 1960-1968) (herein referred to as 'the Atlas'), which was compiled by CSIRO to provide a nationally consistent description of Australian soils. Mapped units are published at a scale of 1:2,000,000, but the original 10 map compilation was at scales from 1:250,000 to 1:500,000. This scale mapping is commonly used for desktop studies.

The soil landscape units identified in the Atlas provide a description of the physical environmental, displaying the occurrence and distribution of geological regimes, landscape units and associated soil types within 1 km of the alignment. Soil landscape units are reoccurring soil mapping units with shared geology, landform, soil and vegetation associations. More than one soil type can occur within a landscape unit, represented with a dominate and several subdominant types.

The Atlas indicates six (6) soil landscape units[1] intersect the alignment, which are summarised in **Table 1**, and presented graphically in **Figure 5**.

The dominant soil type of each landscape unit is presented alongside the corresponding Australian Soil Classicisation (ASC) soil order and Principle Profile Form (PPF), to aid in the interpretation of the soil encountered along the alignment and based on Ashton & Mackenzie (2001). The ASC is the relevant national classification descriptor achieved using the Isbell (2002) system. The hierarchical scheme allows soils to be named and communicated in an orderly manner.

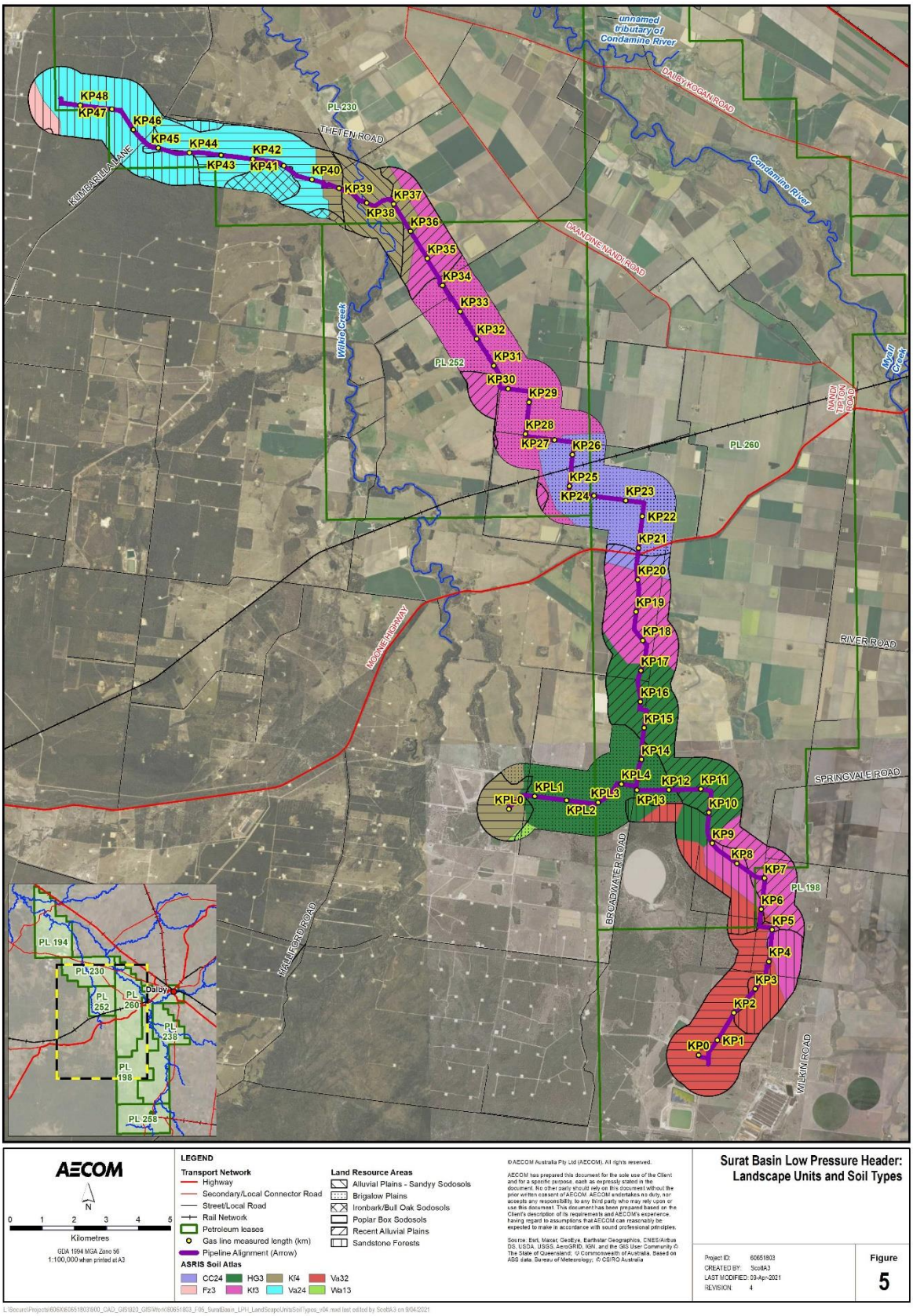
Table 1 Soil Landscapes which intersect the Surat LPH alignment

Soil landscape units	Landform description	Dominant soil type[1]	Dominant Principle Profile Form[2]	Dominant ASC Group[3]
CC24	Plain	Dominant soils are grey cracking clays with some dark cracking clays	Ug5.24, Ug5.28, Ug5.16	Vertosol
HG3	Plain associated with old riverine terrace formation	Hard alkaline dark soils	Dd1.33, Dd1.43	Sodosol
Kf3	Plain with very low sandy rises and banks separated by flats and depressions	Dominant soils are dark cracking clays	Ug5.16	Vertosol
Kf4	River terraces and adjoining plains	Dominant soils are dark cracking clays	Ug5.16	Vertosol
Va24	Gently undulating plains	Hard alkaline and neutral yellow mottled soils	Dy3.43, Dy3.42, Dy2.43, Dy2.42	Sodosol
Va32	Low convex hills with some mounds of lateritised rock	Dominant soils are hard alkaline yellow mottled soils	Dy3.43	Sodosol

Notes:
1. ASRIS Atlas of Australian Soils (Northcote et al., 1960-1968)
2. Principal Profile Form (Northcote, 1974)
3. Dominant Australian Soil Classification (Isbell, 2002)

[1] Two additional soil landscape units (Wa13 and Fz3) were located within the 1 km buffer of the Surat LPH; however, as these do not intersect the pipeline alignment, they have not been included in this soil assessment.

Figure 5 Soil Landscape Units



5.4 Land Resource Areas: Central Darling Downs

Due to the broad scale of the Atlas (1:2,000,000), a review of the Land Resource Areas (LRA) mapping was used to further assess the soil types across the alignment.

LRAs have been determined from the Central Darling Downs Land Management Manual (Harris *et al.*, 1999), and are based on the combination of geology, landscape features (slope/relief), vegetation and groups of soils. LRA maps are not designed to strictly identify soils in a particular map unit but predict their probable occurrence.

LRA identified to intersect the Surat LPH alignment are presented in **Table 2.**

Land suitability for each LRA was also provided by Harris *et al.* (1999), which restricts limited cropping land to the sandy Sodosols of the alluvial plains. The remaining LRAs units have agricultural potential as cropping land (broadacre and horticulture) and pasture (sown and native pastures).

Typical soil characteristics should a generally good correlation with the soil landscape units mapped in the Atlas (Northcote *et al.*, 1960-1968), with the alignment likely to encounter cracking clays as well as bleached sands over cracking clays.

The typical soil types likely to be encountered in each LRA, along with generic soil properties, are detailed in the following subsections.

Table 2 Identified LRAs in the Central Darling Downs (Harris *et al.*, 1999)

LRA	Landform description	Major soils	Estimated ASC	Agricultural land classification	Typical vegetations	Generic physical and chemical soil properties				
						Soil (m)	pH	Dispersion[1]	Sodicity[2]	Salinity[3]
Recent alluvial plains (1a): Condamine	Board level plains of mixed basaltic and sandstone alluvium	Black and grey cracking clays with bleached sands or loams over brown or black clays	Vertosol	A1 – crop land: broadacre and horticulture	Poplar box or Queensland blue gum open woodlands, or grasslands	Surface soil: 0-0.15	8.7	Low	Non-sodic	Very low
						Upper subsoil: 0.15-0.6	9.1	Medium	Sodic	Medium
						Lower subsoil: 0.6-1.4	8.1	Medium	Strongly sodic	High to Very high
Alluvial plains – sandy Sodosols (4a): Leyburn	Level alluvial plains and stream terraces	Bleached sands over brown or black clays	Sodosol	B – limited crop land	Poplar box and Moreton Bay ash woodland with wilga	Surface soil: 0-0.20	7.0	Medium	Non-sodic	Very low
						Upper subsoil: 0.2-0.6	6.1	Medium	Sodic	Very low
						Lower subsoil: 0.6-1.1	7.7	High	Strongly sodic	High to medium
Brigalow plains (5a/5b): Kupunn	Flat plains, with gently undulating clays plains with shallow to deep gilgai	Grey self-mulching cracking clays	Vertosol	A1 – crop land: broadacre and horticulture	Brigalow, belah forest with wilga with some black tea tree	Surface soil: 0-0.05	8.5	Low	Non-sodic	Low
						Upper subsoil: 0.05-1.2	9.0	Low to medium	Sodic	Low
						Lower subsoil: 1.2-1.5	4.3	High	Strongly sodic	High
Poplar box Sodosols (9a): Downfall	Gently undulating plains on sandstone	Bleached sands and loams over brown and grey clays	Sodosol	C1 – pasture land: sown pastures	Poplar box and gum topped box open woodland	Surface soil: 0-0.15	6.5	Medium	Non-sodic	Low
						Upper subsoil: 0.15-0.5	7.4	Medium	Sodic	Very low

LRA	Landform description	Major soils	Estimated ASC	Agricultural land classification	Typical vegetations	Generic physical and chemical soil properties				
						Soil (m)	pH	Dispersion[1]	Sodicity[2]	Salinity[3]
						Lower subsoil: 0.5-0.14	9.0	High	Strongly sodic	High
Ironbark bulloak sodosols (10a): Braemar	Gently undulating plains on sandstone	Bleached sands to loams over mottled, grey or yellow clays	Sodosol	C2 – pasture land: native pastures	Narrow-leaved ironbark, bull oak, cypress pine, rusty gum and poplar box open forest	Surface soil: 0-0.30	5.6	Low	Sodic	Low
						Upper subsoil: 0.3-0.6	6.6	High	Strongly sodic	High
						Lower subsoil: 0.6-1.2	5.0	High	Strongly sodic	Very high to extreme
Sandstone forests (12a): Weranga	Rises and undulating plains on sandstone; often lateritised	Bleached sands to loams over mottled, grey, or yellow clays	Sodosol	C2 – pasture land: native pastures	Narrow-leaved ironbark, bull oak, cypress pine, rusty gum and poplar box open forest	Surface soil: 0-0.06	6.3	Low	Non-sodic	Very low
						Upper subsoil: 0.06-0.4	6.4	Low	Strongly sodic	Medium
						Lower subsoil: 0.4+	7.1	High	Strongly sodic	High

Notes:

1. Clay dispersion is measured as a dispersion ratio (Baker and Eldershaw, 1993)
2. Sodicity is calculated as the percentage of exchangeable sodium (ESP) (Baker and Eldershaw, 1993)
3. Salinity is estimated from the measurement of the electrical conductivity in a 1:5 suspension of soil to water (Shaw, 1988)

5.4.1 Recent alluvial plains (1a)

Common soils within this LRA are deep to very deep (0.8 to 1.8 m) coarse, self-mulching cracking clays on recent alluvial plains on mixed basalt/sandstone alluvia. Soil are distributed along the active floodplain of the Condamine River and tributaries, including river terraces, streambanks, old river channels and plains.

Generic soil features include a medium to heavy clay, self-mulching surface soils, which are moderate to coarse and granular. The surface is often non-sodic and can sometimes be lightly crusted. The subsoil is commonly sodic to strongly sodic with medium to very high salinity. The profiles have an alkaline trend, consistent with depth.

The land is suitable for dryland/irrigated cropping and grazing of native pastures, depending on the risk presented by inundation and erosion.

Native vegetation has mostly been cleared but contains fringing woodland to open forests of river gum, Queensland blue gum and some acacia species.

5.4.2 Alluvial plains – sandy Sodosols (4a)

Soils within this LRA are typically deep texture contrast soils with a shallow, hard setting, bleached loamy sand to clay loam surface, over yellowish brown and brown clay subsoils. Soils are located on flat plains and very gentle slopes (<1%) valley floors of mixed sandstone and traprock alluvium.

Generally, surface soils are thin with a sharp change between the surface and subsurface. The hard-setting, loamy sands to clay loams are underlain by a bleached upper profile with occasional gravels. The subsoil is commonly comprised of blocky or columnar structured clays, which are strongly sodic from 0.05 m and highly saline from 0.05 to 0.9 m. Deeper soils are strongly sodic and have moderate to high salinity. The profiles have a slight alkaline trend with depth.

The land use is best suited to grazing natives and is not considered suitable for cropping, due to its low plant available water capacity (PAWC) (0.05 mm), strong sodicity, high salinity and relatively impermeable subsoils. The soils are susceptible to wind and water erosion if the surface is left unprotected.

Native vegetation has mostly been cleared but contains poplar box grassy woodlands with wilga, or poplar box, gum topped box within open forests.

5.4.3 Brigalow plains (5a/5b)

Typical soils associated with this LRA are deep to very deep (0.1-0.16 m), self-mulching grey cracking clays with shallow gilgai on the brigalow claysheet. Soils are located on flat to very gently sloping undulating brigalow clay plains north of Warra and around Kupunn, west of Dalby.

Generic soil features include an angular blocky surface structure, which is strongly alkaline. The subsoil is often a structured clay, with mild alkalinity in the upper subsoils, tending to strongly acidic deeper in the profile. The subsoil is both strongly sodic and saline.

The land is suitable for continual grain and cotton cropping, only limited by strongly sodic and saline subsoils. The soils are susceptible to erosive flooding.

Native vegetation has mostly been cleared but contains brigalow, belah, wilgas scrub and black tea tree in low lying areas.

5.4.4 Poplar box Sodosols (9a)

The texture contrast soils within this LRA typically have a hard setting surface over clay subsoil. Soils are located on flat plains and very gently sloping (<1%) valley floors of mixed sandstone and basaltic alluvium.

Surface soils are generally described as a sandy loam to clay loam, hard setting with a bleached subsurface layer. The clay subsoil is commonly comprised of coarse blocky or prismatic structure clays, which are sodic to strongly sodic and moderately saline. The profiles have a slight alkaline trend with depth.

The land use is best suited to grazing natives, governed by moderate PAWC (0.1-0.15 mm), surface deterioration following continuous cultivation and potential for hard surface crust formation. Potentially susceptible to overland flooding and wind erosion if under intensive cultivation and dry.

Native vegetation has mostly been cleared but contains poplar box grassy woodlands with wilga, occasional bull oak and grey box. Rough-barked apple and Moreton Bay Ash also occur where the surface soils are sandier.

5.4.5 Ironbark bulloak sodosols (10a)

The texture contrast soils within this LRA typically have a bleached surface overlying mottled clay subsoil. Soils are located on gently undulating sandstone plains, mainly west of the Condamine River on the Kumbarilla Ridge.

Generic soil features include a sharp texture change between the surface and subsoil. The surface is often a massive sandy loam to clay loam, with a thin layer of bleaching occurring above the impermeable subsoil. The subsoil is commonly formed of strongly columnar clays, with varying degrees of mottling. Subsoils are also strongly sodic and have highly saline deep subsoil. The profiles have a slightly alkaline trend, consistent with depth.

The land use is best left in the native state for the purpose of timber production and nature conservation due to several limitations, including low fertility, low PAWC, impermeable subsoil and being extremely susceptible to both erosion and waterlogging.

Native vegetation has been partially cleared and contains shrubby woodland of poplar box with bull oak and narrow-leaved ironbark.

5.4.6 Sandstone forests (12a)

Common soils within this LRA are texture contrast soils with a bleached sandy surface over a mottled subsoil. Soil are distributed along the gently undulating sandstone plains, mainly to the west of the Condamine River on the Kumbarilla Ridge.

Generic soil features include sharp contrast between the surface and subsurface. The surface is often described as a bleached, hard setting loam to sandy loam. The clay subsoil is often mottle and impermeable, as well as being strongly sodic and highly saline. The profiles have an alkaline trend, consistent with depth.

The land use is best left in the native state for the purpose of timber production and nature conservation due to several limitations, including low fertility, low PAWC, impermeable subsoil and being extremely susceptible to both erosion and waterlogging.

Native vegetation has been partially cleared and contains open forest of bull oak or bull oak and cypress pine with associated narrow-leaved ironbark, rusty gum and occasional paperbark tea tree.

Summary

Based on available chemical and physical data from the Central Darling Downs Land Management Manual (Harris *et al.*, 1999) (**Table 2**), most soils along the alignment are expected to have an alkaline upper subsoil (pH 8.0 to 10.0) over acidic lower subsoil (4.0 to 6.0), as a result of developing over clay sheets or sedimentary rocks.

The soils along the alignment are sodic or strongly sodic and have medium to very high levels of salinity in the subsoil. Levels of salinity were generally low in the surface soils, increasing to medium to extreme in the subsoil.

A summary of identified LRA within the Central Darling Downs Land Management Manual (Harris *et al.*, 1999), cross-referenced with the Atlas soil landscape units and associated ASC soil classification is presented in **Table 3**.

Based on the available Atlas and LRA mapping, the study area is dominated by the following two soil types:

- Self-mulching cracking clays, such as Vertosols – 54%; and
- Texture contrast soils, such as Sodosols – 46%.

Table 3 Summary of the Surat LPH soil units and resource areas

LRA	Soil landscape units (ASRIS)	Dominant ASC	Approximate LPH reference points	Total length (km)	Mapped LPH
Recent alluvial plains (1a)	Kf3	Vertosol	KP6 to KP7 KP17 to KP20 KP34 to KP36	6	11%
	HG3	Sodosol	KP10 to KP12 KP15 to KP17	4	7%
	CC24	Vertosol	KP20 to KP21	1	2%
	Kf4	Vertosol	KP36 to KP37	1	2%
Alluvial plains – sandy Sodosols (4a)	Kf4	Vertosol	KP37 to KP39	2	4%
Brigalow plains (5a/5b)	HG3	Sodosol	KPL1 to KPL4 KP12 to KP15	7	13%
	CC24	Vertosol	KP 21 to KP27	6	11%
	Kf3	Vertosol	KP27 to KP34	7	13%
Poplar box Sodosols (9a)	Va32	Sodosol	KP0 to KP2	2	4%
	Kf4	Vertosol	KP39 to KP40	1	2%
	Va24	Sodosol	KP40 to KP45	5	9%
Sandstone forests (12a)	Va32	Sodosol	KP2 to KP4 KP5 to KP6	3	6%
	Kf3	Vertosol	KP4 to KP5 KP7 to KP10	4	7%
	Va24	Sodosol	KP45 to KP49	4	7%
Ironbark bulloak sodosols (10a)	Kf4	Vertosol	KP40 to KP41	1	2%

6.0 Disturbance Management

The major limiting factors for the soils encountered along the Surat LPH alignment are soil structure and texture, along with subsoil salinity and sodicity issues. The proposed management options for these issues are presented in these sections.

6.1 Topsoil suitability and management

The generic soil properties from Harris *et al.* (1999), were reviewed against the criteria set out in the *Selection of Topdressing Material for Rehabilitation of Disturbed Areas in the Hunter Valley* (Elliott and Veness, 1981) to determine the suitability of available soil material for reuse as topsoil. The estimated depth of primary growth media was estimated using the plant available water capacity. These estimates should be reviewed following a detailed pre-characterisation assessment of soils along the alignment to assist in identifying rooting depth and nutrient deficiencies.

The major limiting factors for the soils encountered along the alignment are soil structure and texture, along with subsoil salinity and sodicity issues, as detailed in **Table 4**.

Table 4 Guide to estimated stripping depths

LRA	Estimated primary growth media (m)	Limiting factors
Recent Alluvial Plains (1a)	0.15-0.2	Soils have a narrow moisture range for effective workability, which can be improved by adding a sandier textured material.
Alluvial Plains – Sandy Sodosols (4a)	0.05	Sodic and relatively impermeable subsoils susceptible to gully and tunnel erosion if exposed. Gypsum can be added to improve the subsoil material and limit dispersion and erosion.
Brigalow Plains (5a/5b)	0.2-0.25	Gypsum can be incorporated into the subsoil material to limit dispersion and erosion.
Poplar box Sodosols (9a)	0.1-0.15	Addition of a clayey material and gypsum can improve soil structure and reduce sodicity issues.
Ironbark Bull Oak Sodosols (10a)	<0.05	Sodic and relatively impermeable subsoils susceptible to gully and tunnel erosion if exposed. Gypsum can be added to improve the subsoil material and limit dispersion and erosion.
Sandstone Forests (12a)	<0.05	

6.2 Soil stripping and stockpiling/storage

The Surat LPH alignment largely crosses existing agricultural land, with only a small portion which is timbered (approximately 4.9 km) located within the Braemar State Forest on the northern side of Kumbarilla Road. Where clearing is required, timber should be cleared and retained for chipping or habitat recreation. Chipping can provide a useful soil amendment to improve the physical properties of sandy material and limit weed growth.

Suitable topsoil should be stripped for the width of the pipeline trench and access track plus (nominally) 1 m each side of the trench. The estimated primary growth media depths provided in **Table 4** can be used as a guide.

Topsoil and subsoil (which may have dispersive or sodic subsoil horizons) should be stockpiled separately to avoid mixing. Topsoil management should be undertaken in line with the requirements listed in Arrow's *Land Disturbance Procedure* (ORG-ARW-HSM-PRO-000146).

Stockpiles are not recommended to exceed 3 m in height, to minimise degradation through physical, biological and chemical processes. Based on the typical ROW construction, stockpiling is expected to be undertaken in section along the length of the trench to maintain access/egress. The stockpile should not be compacted to minimise surface runoff and facilitate infiltration.

Stockpiles should be in place for the minimum duration practicable to safely install the infrastructure, which is understood to be typically less than three months. Where practicable work will be staged to not extend over a wet season. In situations where this is unavoidable, quick vegetation such as pasture species and mulches should be used to minimise surface erosion.

Consideration should be made for drainage flow direction and diversions in place to prevent stockpile erosion. Appropriate erosion and sediment control measures should be documented prior to works commencing.

6.3 Returning topsoil/spoil to the trench

Excavated soils should be returned to the trench in the soil pre-disturbance soil profile. Topsoil that has been stripped can be re-spread as part of stabilisation and rehabilitation activities.

Sodic soils are expected to be encountered along the alignment and should be blended with appropriate soil ameliorants (gypsum and organic matter) during the rehabilitation process to reduce the potential for soil dispersion. Sampling and analysis of soil prior to reuse is recommended to assist in identifying nutrient deficiencies and ameliorant requirements. The use of such ameliorants should also be discussed with landholders prior to application.

The disturbance area should be re-shaped into a stable landform with consideration for surface drainage lines.

6.3.1 Compaction Strategies

The backfilling and compaction of the trench is also dependant on the use of appropriate equipment suited for compacting soil in trenches, ensuring the soil is moisture conditioned (i.e. if the soil is too wet or dry to compact) adding moisture based on the inherent moisture content. The soils are generally placed in thin layers (maybe 300 to 400 mm), adding moisture conditioning, if needed, followed by thorough tampering with the bucket (or a roller attachment for the excavator). The site specific compaction strategies are informed by the geotechnical assessment and pipeline construction design.

Compaction of surface layers within the ROW disturbance areas should be undertaken in a way to improve the water infiltration capacity and aeration along the contour, prior to the re-shaping and re-spreading of topsoil and revegetation.

6.4 Reinstatement and erosion controls

The different soil types traversed by the alignment have variable erodibility characteristics, determined primarily by soil structure, texture and sodicity. An overview of the erodibility ratings associated with each soil type is provided in **Table 5**, based on typical Queensland soils described in the DTMR Road Drainage Manual (DTMR, 2019).

An estimate of the long-term soil loss from both sheet and rill erosion can be calculated using the Revised Universal Soil Loss Equation (RUSLE) (IECA, 2008). This issue is less of a concern in the LPH project area due to the flat terrain, including many lasers levelled paddocks.

Erosion and sediment controls should be identified, documented and implemented as part of soil preparation works. These documents should remain in place until stabilisation of the disturbance area is achieved.

Table 5 Typical Erodibility Ratings

Soil type and ASC	Description of erodibility characteristics	Erodibility rating
Uniform sands and sandy loams – *Rudosols and Tenosols*	Incoherent sand, loamy and sand and clayey sand and coherent sandy loam with single grained massive structure.	Moderate (3)

Soil type and ASC	Description of erodibility characteristics	Erodibility rating
Uniform loams and clay loams – Massive – *Kandosol* Structured – Rudosols, *Tenosols and Dermosols*	Coherent loams, sandy clay loams and clay loams with massive to strong structure.	Very Low (1)
Uniform non-cracking clays - *Dermosols*	Light to heavy clays with strong structure: • fine aggregates • coarse aggregates	Very Low (1) Low (2) to Moderate (3)
Uniform cracking clays – *Vertosols*	Light medium to heavy clays that shrink and crack open when dry and swell when wet, gilgai micro relief common.	Low (2) to moderate (3)
Sandy gradational soils – *Kandosols*	Texture gradually increases from a sandy surface to sandy clay loam or sandy light clay with depth; single grain to massive structure.	Moderate (3)
Loamy gradational soils – *Dermosols and Kandosols*	Texture gradually increases from a loamy surface to sandy clay loam or clay with depth; massive to strong structure.	Low (2)
Texture contrast soils (non-dispersive) – *Chromosols*	Sandy or loamy surface abruptly overlaying non-dispersive and generally friable clay subsoil.	Moderate (3)
Texture contrast soils (dispersive) – *Chromosols and Sodosols*	Sandy or loamy surface abruptly overlying a hard, dispersive clay subsoil with: • ESP ≥6 and/or Ca:Mg <15 • ESP ≥15 and/or Ca:Mg <0.1	High (4) Very High (5)

6.5 Construction inspection and maintenance regimes

The disturbance area should continue to be visually monitored until such time that the site is considered effectively stabilised or rehabilitated, in line with Arrow's rehabilitation criteria. To help in adequate rehabilitation, the quantity of ameliorants needed (if any) for topsoil and subsoil based on pre-construction land use are generally calculated based on site specific laboratory analysis.

After completion of pipeline installation, cropped areas should be stabilised to combat erodible / dispersive surface soils (below topsoil) and then topped with a topsoil dressing to match the thickness and quality of the surrounding topsoils of undisturbed areas, as a minimum. Ideally, topsoils stripped during pipeline installation would have been stockpiled and reused in the same location and to the same thicknesses to match the original soil profile as closely as was practical. Inspection and maintenance should include assessment of surface stabilisation (e.g. – lack of erosion of the topsoil / crop-supporting layer and the health of surface vegetation) in accordance with Arrow's rehabilitation criteria.

Waterway crossings might require specific inspection and maintenance regimes, which should be considered at the time of conceptualising and designing each crossing.

7.0 Conclusions

The proposed Surat LPH alignment intersects two ARIs namely PALU and SCA and as such require a RIDA application to be submitted under the RPI Act.

Based on the desktop review of the geology, landscape features, vegetation and groups of soils, a total of eight landscape units (with only six units intercepting the LPH route) and six land resource areas were identified within the 1 km study area of the Surat LPH.

The alignment is located between the Condamine River and Wilkie Creek, described as the Condamine Lowlands. The area contains low-lying siltstone hills with alluvial sediments on the floodplains of the Condamine River and highly weather bedrocks on the slopes. The low-lying area has an elevation ranging from 330 to 370 m AHD. Based on the data, the slope within the majority of the LPH study area range from near level <1% to 3%, with only minor patches of land with slope >3%.

The surface geology is a part of the Surat and Clarence Moreton Basins, dominated by alluvial sediments overlying sedimentary rocks. The Condamine Alluvial sediments are extensive and can range in thickness from 10 m to more than 120 m in the floodplain near Dalby.

Based on the existing mapping (a scale of 1:2,000,000), the soils within the study area were dominated by self-mulching cracking clays (i.e Vertosol) and texture contrast soils (i.e. Sodosol). The available mapping reviewed as part of the desktop review are not designed to strictly identify soils in a particular map unit but predict their probable occurrence.

Based on available chemical and physical data from the Central Darling Downs Land Management Manual (Harris *et al.*, 1999), most soils along the alignment are expected to have alkaline upper subsoil (pH 8.0 to 10.0) over acidic lower subsoil (4.0 to 6.0), as a result of developing over clay sheets or sedimentary rocks. The soils along the alignment are sodic or strongly sodic and have medium to very high levels of salinity in the subsoil. Levels of salinity were generally low in the surface soils, increasing to medium to extreme in the subsoil.

The major limiting factors for the soils encountered along the alignment are soil structure and texture, along with subsoil salinity and sodicity issues. Most issues are likely able to be controlled by suitable soil handling, construction management practices and application of appropriate spoil ameliorants (gypsum and organic matter).

8.0 Recommendations

It is recommended that a detailed soil investigation be undertaken to refine the assessment of soils identified along the alignment, with the objective of ensuring that the adopted control measures are reflective of site-specific soil conditions.

Further soil investigations are recommended to be completed prior to any earth works commencing within the ROW and be detailed within a Sampling Analysis and Quality Plan (SAQP), developed by an SQP.

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10.0 Limitations

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Any estimates of potential costs which have been provided are presented as estimates only as at the date of the report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

Appendix A

Curriculum Vitae

Appendix A Curriculum Vitae

Simon Muniandy
ANZ Upstream Oil and Gas Market Sector Lead

Qualifications
Bachelor of Science (Hons, Geology)

Career History

Areas of Experience
- Conventional and Unconventional Oil and Gas
- Programme and Project Management
- Contamination Assessment and Remediation
- Geology, hydrogeology, & geochemistry
- Operations Management

Career Summary
Simon is the ANZ Upstream Oil and Gas Market Sector Lead and Technical Director with more than 20 years' experience in the geoscience/environmental industry, with projects across Australia, Pacific Islands, Papua New Guinea and S.E. Asia. Simon has a leading role the Oil and Gas market sector responsible for the delivery of AECOM projects to the onshore upstream oil and gas industry across ANZ.

Simon has extensive experience in the oil and gas and mining industry specifically in the risk management of environmental liabilities related to the acquisition, operation, decommissioning and demolition of facilities associated with all aspects of these industries.

Simon has managed the design, implementation and execution of a range of environmental projects including decommissioning and remediation of fuel terminals, marine, aviation and retail facilities. Simon also has extensive experience in upstream unconventional oil and gas, including development approvals and associated environmental assessments, baseline monitoring, water/brine management related to treatment and storage infrastructure, surface water discharge and aquifer storage. Simon has also been responsible for the design, management and execution of a $20M (Office of Groundwater Impact Assessment) groundwater monitoring bore program for Santos.

Due to his achievements associated with the OGIA drilling project, Simon was awarded the URS Pyramid Award for project management in 2014.

Simon has been able to apply his oil and gas industry experience to work collaboratively to achieve his Client's objectives and develop business for AECOM across technical disciplines and geographies.

Detailed Experience

ANZ Upstream Oil and Gas Market Sector Lead
Queensland Office, AECOM Australia Pty Ltd
Simon is responsible for the delivery of upstream oil and gas projects across ANZ. His responsibilities include; health and safety, cost control, contract management, scheduling and resourcing to enable the flawless execution of AECOM projects for our oil and gas clients. Whilst Simon's remit is across all AECOM technical services, he reports to Asia Pacfic Environment Managing Director

Work Group Manager Geoscience and Remediation Services, Queensland
Queensland Office, AECOM Australia Pty Ltd
As Work Group Manager, Simon is responsible for the leadership and management of the Geoscience and Remediation Services group consisting of approximately 30 staff. Simon is accountable for the group's financial performance, technical direction, business development and the technical delivery of a wide range services including:

- Contaminated land assessments and remediation
- Hydrogeological assessments and modelling
- Geochemistry
- Soil Science
- Geophysics
- Geology

Client Management
Santos & Caltex - National Client Account Manager, AECOM Australia Pty Ltd
Simon was AECOM's national client account manager for Santos & Caltex, responsible for the successful delivery of all AECOM projects nationally and throughout the Pacific. Simon provides Santos & Caltex with a single point of contact for contract or issues critical to project delivery. Simon also is Principal in Charge for a range of Coal Seam Gas (Coal Bed Methane) groundwater and environmental projects including; the management of associated water, infrastructure decommissioning, remediation and environmental assessments. His responsibilities as the National Client Account Manager include:

- Contracts negotiation and reporting;
- Financial management;
- Project support and technical review;
- Stakeholder management;
- Strategy Planning, Budgeting and Forecasting;
- Health and Safety Management and Leadership.

Project Management
Project Manager, ExxonMobil Environmental Services - Major Projects, Mobil Oil Australia, Australia, PNG, Indonesia
Simon was the Project Manager responsible for the management of ExxonMobil's environmental liabilities associated with the operation and/or decommissioning of major facilities in Australia. Critical to the successful execution of projects was the ability to evaluate risk and prioritise a large number of sites across the portfolio, then effectively manage the environmental risk and commercial objectives for each site.

Simon has successfully completed multi-million dollar site assessment and remediation projects across Australia with a number of projects receiving recognition for flawless execution across health and safety (zero recordable incidents), on schedule and under budget. Simon was responsible for the following portfolios:

- Non-Operating Distribution Terminals and Pipelines (National);
- Aviation Terminals (National);
- Marine Fuel Terminals (Queensland);
- PNG LNG Office and Housing;
- Oil Field Divestment – Aceh, Indonesia

His responsibilities as a project manager with ExxonMobil Environmental Services included:

Duties:

- Management of environmental risks and liabilities;
- Management of consultants and contractors on major projects (>$15M AUD).
- Technical review and stewardship of environmental assessment and remediation.

Skills:

- Contractor Management;
- Cost and budget controls;
- Health and safety stewardship;
- Technical expertise including soil and groundwater remediation, and risk assessment;
- Risk management;

- Communication of project risks and analysis to stakeholders including senior management.

Oil and Gas

Project Director, Shallow Groundwater Assessment, QGC

Design and construction of 44 groundwater monitoring bores in the Surat Basin Aquifers targeted: Springbok Sandstone and Walloon Coal Measures. The groundwater monitoring program to assess CGS impacts on groundwater and potential groundwater dependant ecosystems. A small mobile drill rig to install shallow groundwater well, compliant with the Code of Practice and API specifications. The project received an QGC Wells team award for excellence.

Project Manager, Spring Gully and Taloona Evaporation Pond Assessment and Remediation

Assessment of an 83ha and 10ha brine storage and evaporation ponds, and development and design of a remedial strategy to protect nearby sensitive receptors. The multidisciplinary delivery team has produced the first remediation and approvals plan of this type in the CGS industry in QLD.

Principal in Charge, Water Facilities Upgrade Project Scotia – Design Phase, Brisbane Team, Queensland

In 2012 URS designed and subcontracted the construction and supervised the filed assembly and oversaw commissioning of a managed aquifer recharge (MAR) water injection system. URS was commissioned to design and oversee construction of the injection equipment and manage the design of the reverse osmosis plant. URS had previously successfully installed the injection bore and had performed hydrogeological testing to ensure that the aquifer had the capacity to accept the required injection volume and rate.

Principal in Charge, Deep Monitoring Program, Queensland

URS engaged a combination of large oil and gas service providers (Halliburton, Weatherford, GE Oil & Gas) and smaller scale drilling and services companies to design a turnkey approach for developing, managing and executing large scale groundwater drilling projects for Coal Seam Gas (CSG) operators.

The 16-well campaign based in Roma, targeted zones of the Springbok and Hutton sandstones to depths of up to 1,150 mBGL. In order to manage potential influxes from gas bearing units (Walloon Coal Measures), a full BOP stack (annular, double rams) was been employed, and all auxiliary gear on site (mud systems, generators, pumps) were intrinsic safety rated.

URS was responsible for the planning, procurement, management and delivery of a groundwater well installation campaign targeting aquifers in close proximity to, and underlying economics CSG reserves. Our technical team, comprising experienced project managers, field hydrogeologists, site supervisors, drilling and completions engineers enable the delivery of reliable groundwater monitoring infrastructure which is designed, drilled and completed to CSG standards.

Principal in Charge, Old Bogandilla, Emu Park Wells, Queensland

URS was commissioned to design, procure and manage the installation of a 1500m deep monitoring well at Old Bogandilla site and a 1600m deep brine injection monitoring well at Emu Park site, located near Roma QLD. The project was completed on budget without any recordable health and safety incidents.

Principal in Charge, Roma MAR Pumping Tests, Queensland

During the construction phase of the Roma Managed Aquifer Recharge Project (MAR), URS was commissioned to perform pumping tests on the Roma MAR injection bores. The objective to gain a better understanding of the hydraulic parameters of target aquifers and to determine the bore efficiency of each injection bore.

Principal in Charge, MAR Numerical Model, Queensland

The project included, update of the numerical model for injection which URS had previously designed, review baseline assessments of all private bores within the Roma MAR injection impact zone, provide recommendations on remedial actions which may be required due to injection.

Principal in Charge, Regional Bore Inventory- Data Review, Queensland

In order to comply with the Queensland Department of Environment Resource Management, Baseline Assessment Guidelines for Roma Regional Bore Inventory, the Client required data collected by their field staff to be reviewed by a third party. URS attended 10% of the baseline assessments being conducted by the Client RBI team and reviewed all information presented in the baseline assessment reports completed by the Client RBI team, enabling sign off by the regulator.

Principal in Charge, Landholder Bore Investigations, Queensland

The Client was required to conduct down-hole surveys of landholder bores in the Fairview field. The surveys will be used to establish which formation the well is screened in, review the construction of the bore and the integrity of the casing, and to determine their suitability for use as ongoing groundwater monitoring points. URS was commissioned to manage the down-hole survey of the bores and perform the data analysis of the survey data. Use of existing bores for monitoring purposes gave a large cost saving to the client.

Project Manager, Regional Bore Inventory - Roma Fairview Arcadia Valley, Queensland
The aim of the project was to collect accurate, verifiable and representative information on the private bores within and surrounding the clients' petroleum leases or Authorities to Prospect (ATPs). The baseline assessments were required to assist with any potential make good agreements with landholders and the assessment was a requirement of the Queensland Water Act 2000. The baseline assessment included all water bores within and potentially surrounding coal seam gas tenures, including water bores not formally registered or notified to the Department of Environment and Resource Management.

Project Manager, Narrabri Surface Water Monitoring, New South Wales
Development and completion of a baseline surface water monitoring program for the Clients Narrabri operations. Scope of work incudes; site familiarisation and orientation, desktop analysis and site selection, map preparation, detailed catchment characterisation, monthly field visits, sampling, preparation of post monitoring memorandums, tracking and review of laboratory data, reporting and data analysis.

Project Manager, Narrabri Environmental Monitoring, New South Wales
Field groundwater and environmental monitoring for the Narrabri operations team including, collection of 22 groundwater samples, collection of 16 raw CSG groundwater samples and collection of 5 surface water samples, and tracking and review of lab data.

Project Manager, Screening Study – Hydraulic Connectivity Studies
Assessment of telemetry bores for suitability of aquifer hydraulic assessment. There were 70 private bores that have been equipped with telemetry to monitor groundwater levels within the bores. During the regular operation of these bores by the landholder, water level data is collected on the drawdown and recovery within the wells. This information alongside flow rates and information available through various sources can be used to determine localised aquifer hydraulics. The desktop assessment through interrogation of all available information was to identify which of the approximate 70 bores have the suitability for further analysis for hydraulic assessment, based on; Groundwater level pumping and recovery data, pumping rate is constant, and availability of well flow rate or volume of water extracted.

Project Manager, Scotia MAR – Injection Equipment Modification and Implementation, Queensland
URS was commissioned to investigate the modification of existing Managed Aquifer Recharge equipment used for permanent use in a separate scheme. The study lead to a full redesign of the existing system and project management of the design of a separate reverse osmosis plant.

Environmental Studies
Principal in Charge GE Project Eldridge - Due Diligence Assessment
URS was commissioned by GE to perform Due Diligence assessment for the sale of 5 chemical sites across eastern Australia. The project required that URS complete the entire project; desk top, intrusive assessment and reporting) within two weeks. GE were able to successfully complete the transaction based on the timeliness and quality of the URS reports.

Principal in Charge – Santos Moonie to Brisbane Pipeline Assessment and Decommissioning Plans
URS were appointed as the environmental consultants to assess and manage the environmental impacts and decommission planning for the entire 300km Moonie Brisbane crude oil pipeline. Through an extensive review of operational records, URS were able to rank each section of the pipeline for the risk of impacts and tailored an assessment process for each risk level (high, medium low,). On the basis of the assessment URS identified a limited number of impacted site requiring remediation or further risk assessment, ensuring management of Santos risk into the future.

In preparation for the potential decommissioning of the pipeline URS prepared an abandonment plan recommending the most cost effective and safest options for decommissioning the pipeline along its entire length including; agricultural regions, urban residential regions, road and rail crossings, and creek crossings. On the basis of the plan Santos were able to select the best decommission techniques for all section of the pipeline.

Team Leader/Principal in Charge, Various environmental projects, Mobil/Shell/Caltex/BP, Australia, Pacific Islands, S.E. Asia
Simon has successfully filled a number of key roles (project manager, technical reviewer, Principal in Charge) on contaminated site assessment and remediation projects for the oil majors. Simon has acted as a team leader for URS contaminated site projects in Victoria, Northern Territory and Queensland where his tasks included the management and technical review of multiple projects to ensure the technical delivery of project for our Clients.

Project Manager, Department of Planning and Infrastructure, Northern Territory
Simon was the project manager for the remediation and ongoing assessment of the Darwin Waterfront Redevelopment. The project management included the development and completion of remedial work plans for each of the construction areas, independent environmental consultant supervision of construction and remedial works, ongoing groundwater monitoring of the site, assessment of former navy fuel storage tanks,

bio-remediation of hydrocarbon contaminated soil, groundwater modelling of the site, trial installation of groundwater interception drains and assessment of 800,000m^3 of imported fill.

Project Manager, Soil and groundwater contamination assessment Leederville Pty Ltd, Cranbourne South, Victoria
Soil and groundwater contamination assessment of former pastoral grazing land rezoned for residential development. Simon had involvement in the planning and conduct of the field component, project management, reporting and also remediation and validation of impacted areas. Following the final assessment report the auditor was able to provide the client with a Certificate of Statutory Environmental Audit for the site.

Project Manager, Confidential Client, Ansett Facilities, Tullamarine, Victoria
A potential purchaser of the Ansett maintenance facilities at Tullamarine required a due diligence environmental site assessment performed prior to purchase. Involvement included managing field activities on two sites simultaneously, three drill rigs and three field staff. Installation of eight groundwater wells to depths of up to 50 m and approximately 60 soil boreholes. Simon was also involved in the groundwater modelling and production of detailed lithological cross-sections and reporting.

Project Manager, Groundwater Assessment, Orica Engineering Pty Ltd, Yarraville, Victoria
A large chemical plant adjacent to the Yarra River required a detailed groundwater assessment prior to the divestment of part of the site. Simon's involvement included installing aquifer specific wells across the three significant aquifers at the site, utilising sophisticated drilling and well installation techniques. Simon also project managed the groundwater monitoring component, involving analysis of non-standard, organic, analytes.

Project Manager, Mirvac Victoria Pty Ltd, The Heath, Heatherton, Victoria
The project involved a groundwater nitrate investigation, assessment of extent and rate of migration of groundwater nitrate plume extending beneath former market garden area. This included the review of possible remediation technologies for groundwater nitrate.

Project Manager, Auspine Pty Ltd, Kalangadoo, Tarpeena, SA and Scotsdale, Tasmania
Simon was the project manager for timber processing and treatment plants, requiring on-going monitoring of groundwater to assess for potential site use impacts on groundwater. Involvement also included groundwater sampling, reporting and peer review.

Project Manager, Australand Apartments Pty Ltd, Abbotsford, Victoria
Australand were developing a former textile mill on the banks of the Yarra River in Abbotsford, Melbourne. The site requires a statement or certificate of environmental audit prior to the completion of the residential development. Involvement included project management of field staff for the installation of 11 groundwater bores, groundwater flow modelling, conceptual geological and groundwater modelling and reporting. Issues in completing to fieldwork included, drilling on an asbestos contaminated site, liaison with CFMEU representatives, OH&S consultants, local council and residents.

Project Manager, Beverford Pty Ltd, Sheep Dip Assessment, Swan Hill, New South Wales
Two former sheep dips are located in a proposed residential subdivision area. Simon's involvement included project management, initial site inspections, sampling and cement stabilisation trials for remediation and disposal of arsenic contaminated soil.

Geotechnical Investigations
Project Manager, Henty Goldmine West Coast, Tasmania
Henty was developing a major extension to the underground workings involving a long drive requiring two vent shaft for ventilation and emergency exists. Involvement included geotechnical logging the pilot hole for Vent Shaft 2, consisting of over 600 m of diamond core. Simons' involvement also extended to point load testing of core samples, organising mine geologists and field staff.

Project Manager, Temco Pty Ltd, Bell Bay, Tasmania
An additional wastewater storage dam was required by a major industry. Simon's involvement included geotechnical investigations of soil and installations of groundwater wells providing information for the dam design.

Project Manager, Comalco Pty Ltd, Bell Bay, Tasmania
A major erosion gully had developed below a historical landfill on the Tamar River causing and increase risk of a landslip occurring. Simon's involvement included soil and groundwater sampling, groundwater and landfill leachate modelling, land slip modelling using SLIP software, reporting, risk assessment and further investigation recommendations.

Project Manager, Leightons Pty Ltd, Melbourne, Victoria
A major petroleum company proposed to develop a large tank farm adjacent to West Swanson Dock. The initial assessment involved geotechnical and environmental components. Simon's involvement included geotechnical logging of 30 - 40 m deep, cored boreholes.

Project Manager, Hydro Tasmania Pty Ltd, Meander Dam, Meander, Tasmania
Soil mapping and sampling to locate sufficient quality and quantity of clay to construct an earth dam wall. Issues included working in remote areas and logistics.

Project Manager, Eastern Treatment Plant, Tertiary Treatment Plant Investigation, Melbourne, Victoria
Excavation of approximately 20 testpits and the construction of three groundwater piezometers to provided geotechnical information for the design of the tertiary treatment plant. Testpits were excavated to a depth of 4 m and bag and bulk samples were collected, in-situ consistency was measured and lithologies logged. Bulk samples were used for standard compaction tests and bag samples were used for particle size analysis and Atterburg limits. Three deeper boreholes were advanced with SPTs performed and U63 collected during drilling. Piezometers were then installed to investigate groundwater levels in the area. Simon's involvement included the reporting of this project which establishing background geology and hydrogeology, summarising field results, laboratory results and allowable soil bearing pressures.

Project Manager, John Mullen Partners, Aldi Food Stores, Melbourne, Victoria
The project involved a joint geotechnical and environmental investigation of numerous proposed Aldi Food stores in Melbourne. Simon's involvement in these projects ranged from fieldwork to project management. The geotechnical component consisted of a limited number of testpits, usually one at each corner of the proposed building and one or two in the vicinity of the proposed car park and CBR testing and limited reporting on allowable bearing pressures for footings and reporting CBR results for pavement design.

Project Manager, Melbourne Water, Mains Water Supply Pipeline, Melton, Victoria
The project involved the geotechnical investigation of a small section of a proposed mains water supply pipeline, where the proposed route went beneath a railway. Simon's involvement included drilling two auger and cored bores on either side of the railway, the installation of piezometers in each bore and surveying the borehole levels. The core was logged, specifically weathering, fracture density and hardness. This information was reported and supplied to the contractor for excavation design.

Project Manager, Melbourne Water, Bridge Investigation, Koo wee rup, Victoria
A geotechnical investigation of a small bridge crossing was required for this project. Simon's involvement included drilling two boreholes, conducting SPTs and collection U63 tubes during drilling and the installation of piezometers. Reporting consisted of regional and local geological and hydrogeological conditions, field and laboratory results and discussion of soil bearing capacities.

Project Manager, Nillumbik City Council, Bridge Investigation, Diamond Creek, Melbourne, Victoria
The project involved a geotechnical investigation of a small foot bridge. Simon's involvement included drilling two boreholes, conducting SPTs and collection U63 tubes during drilling, the installation of piezometers and performing DCPs. Reporting consisted of regional and local geological and hydrogeological conditions, field and laboratory results and discussion of soil bearing capacities. In addition, the project involved liaison with anthropologists and representatives of the local aboriginal tribe.

Project Manager, Radfords Abattoir Pty Ltd, Effluent Lagoon Liner Investigation, Warragul
As a part of a wastewater irrigation project a geotechnical investigation of a proposed effluent storage lagoon site was performed. Simon's involvement ranged from project management to fieldwork. A number of testpits were excavated and bulk samples collected for compaction and tri-axial permeability testing at a range of compaction and moisture conditions. Based on the results of the fieldwork and laboratory results, recommendations were made as to the suitability of the material for uses as a lagoon liner and the required compaction and moisture conditions for the construction of the liner.

Mining
Exploration Geologist Duketon, Western Australia
Exploration geology experience involved a broad range of field, office and managerial tasks. Simon was involved in fieldwork including design and implementation soil sampling program, regional and local scale geological mapping, regolith mapping and geomorphology mapping, groundwater level mapping and supervision of test bore installation for dewatering, supervision and logging of RC, RAB, and diamond core drilling. Office work consisted of database management, GIS management including plan and section production, ore body modelling and wire-framing and geological interpretation and drilling program design. Managerial work consisted of logistical organisation, coordinating drill-rigs and other associated heavy machinery, field technicians, and surveyors.

Wastewater Projects
Exploration Geologist Kraft Foods Ltd, Mil Lel, Mt Gambier, South Australia
The project involved wastewater irrigation assessment and monitoring. High strength, industrial wastewater has been irrigated onto pasture for a number of years. Environmental Protection Act (EPA) required as a part of the licence agreement, the annual monitoring of soils

and biennial monitoring of groundwater, to be reported annually. Simon's involvement included project management, fieldwork and reporting. The report summarises the data, interpolates trends and makes recommendations for reducing adverse environmental impacts. The report is reviewed by an independent reviewer for South Australian EPA.

Exploration Geologist, Starwood Pty Ltd, Bell Bay, Tasmania
Wastewater irrigation assessment for a wood processing plant proposing to reuse the wastewater generated from the plant. The Department of Primary Industries, Water and Environment (DPIWE) required a detailed assessment of the soil and groundwater characteristics of the proposed irrigation site before irrigation could commence. The assessment included soil mapping and sampling, groundwater well installation and sampling, infiltration, permeability and water holding capacity testing. Simon was involved in project manager, fieldwork and reporting.

Exploration Geologist, North West Rendering Pty Ltd, Devonport, Tasmania
Wastewater irrigation and effluent lagoon assessment for a proposed rendering plant site in northern Tasmania. The assessment consisted of soil mapping, soil sampling, infiltration and permeability testing and a lagoon condition assessment. Simon had involvement in project management, soil sampling, permeability and infiltration tests, and reporting.

Exploration Geologist, Sandhurst Development Joint Venture Pty Ltd, Carrum Downs, Victoria
A large residential and golf-course development is utilising treated effluent from the Eastern Treatment Plant for irrigation purposes. Prior to irrigating the effluent EPA require baseline groundwater quality data. The project consisted of the installation and sampling of groundwater monitoring wells and the decommissioning of old irrigation wells. Simon was involved in project management and reporting.

Exploration Geologist, Melbourne Water, Werribee Golf Course and Equestrian Centre, Werribee, Victoria
Western Treatment Plant is providing the Werribee golf course and equestrian centre with treated effluent for irrigation. Prior to irrigating the effluent *EPA* require baseline groundwater quality data. The project consisted of the installation and sampling of groundwater monitoring wells. Simon was involved in project management and reporting.

Exploration Geologist, Coliban Water, Envirosafe 2001, Victoria
Conducting site selection and site assessment for wastewater treatment projects in seven regional Victorian towns, involving GIS assessment, detailed soil and groundwater assessments, permeability testing, salinity susceptibility and agronomic recommendations. The work was performed in conjunction with geotechnical and anthropological assessments.

Exploration Geologist, Wagga Wagga City Council, Wagga Wagga, Victoria
A new industrial area located to the north of Wagga Wagga required a new large effluent treatment system. Simon's involvement included geophysical interpretation and field soil mapping to determine the suitability of proposed effluent irrigation sites.

Exploration Geologist, Oztek Rendering Plant Wadonga, Victoria
As a part of a works approval application for the rendering plant, Oztek required the installation of a groundwater monitoring network surrounding the effluent treatment lagoons and irrigation area. Simon's involvement included, project management and data interpretation and reporting of results to EPA for the works approval.

Exploration Geologist, Epsom Racecourse Redevelopment, Cheltenham, Victoria
The project required the redevelopment of the Epsom racecourse required the relocation of a significant remnant wetland, requiring a detailed soil and groundwater assessment of the existing wetland and the proposed relocation position. This included analysis of bulk density, permeability and major chemical constituents of the soil.

Training
Santos Eastern Queensland, NSW and Cooper Basin Level 1 & 2 inductions

URS Project Manager Certification - 2012

First Aid International Training - 2012

ExxonMobil Stakeholder Engagement Training - 2011

ExxonMobil LPS Training 2007 (annually updated through 2012)

40hr URS Health and Safety Training - 2004

URS Project Management Training (2 days) - 2004

ExxonMobil Incident Investigation Training - 2005

Fundamentals of Groundwater Science, Technology and Management - 2002

Defensive driving and FWD course - 1999

Mining and Resource Contractors Safety and Training Association (MARCSTA) - 3 day training course - 1999

Remote Area Survival Course - 1999

Professional History

2012 - Present
AECOM Services Pty Ltd (formerly URS Australia Pty

Ltd), Brisbane
Principal Geologist

2008 - 2011
Mobil Oil Australia
Contractor

2004 - 2008
URS Australia Pty Ltd, Melbourne
Associate Environmental Scientist

2003 - 2004
Coffey Geosciences Pty Ltd, Victoria
Victorian Environmental Manager

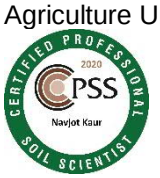
2001 - 2003
Coffey Geosciences Pty Ltd
Environmental Scientist

2000
Van de Graaff and Associates Pty Ltd
Soil Scientist

1999
Johnson’s Well Mining
Exploration Geologist

Navjot Kaur
Technical Lead - Acid Sulfate Soils, Principal Soil Scientist

Qualifications
Certified Professional Soil Scientist (CPSS) 2016 to present
MSc (Hons) Agronomy, Punjab Agriculture University, Punjab, India
BSc (Hons) Agriculture Science, Punjab Agriculture University, Punjab, India



Affiliations
Member of Australian Society of Soil Science
Member of Australian Land and Groundwater Association

Awards
URS International Pyramid Award of Excellence - Health and Safety 2011

URS International Pyramid Award of Excellence - Health and Safety 2009

URS 4sight Health and Safety Excellence Award - 2008

University Merit scholarship and awarded merit certificate in Both BSc and MSc

Career History
Navjot Kaur is an Environmental professional with technical background and competent knowledge of soil science and more than 17 years' experience in working with natural resource sector with respect to environmental management. At AECOM she is placed as Principal Soil Scientist with the Geoscience and Remediation Services team.

Her project experience includes environmental impact statement (EIS) assessments from soils perspective including land and soil classification as per Australian Soil Classification (ASC) system; Land Suitability, Land Use, Good Quality Agriculture Land (GQAL) and Strategic Cropping Land (SCL) assessment; Identification and management of acid sulfate soils (ASS); Land Rehabilitation including assessment of potential impacts of problem soils and mitigation measures, erosion and sediment control, topsoil reuse and management

She was also involved in various contaminated site assessments involving Phase I and Phase II site investigations including soil and groundwater sampling, Quantitative and Qualitative Risk Assessment for human health and environmental receptors and Remediation works including development of sampling and analysis plans (SAP), remedial action plans (RAP) and site management plans (SMP).

Her project management experience includes scope development, cost estimation, project administration, budget management, cost control, project completion sub-contractor administration, bid/tender evaluation, procurement and invoicing. She was also involved in supervision of junior staff and sub-contractors

She also has extensive experience with various data management software (gINT, ESDAT, EQUIS) and MS office for graphs, logs, presentations, statistics and report preparation.

Detailed Experience
Navjot's range of experience includes conducting environmental management works on oil & gas, mining, commercial and industrial sites undertaking the following:

- Environmental Impact Assessment
  - Soil and Land Classification based on Australian Soil Classification System
  - Land Suitability, Strategic Cropping Land (SCL) and Topsoil assessment
  - Identification and management of Acid Sulfate Soils (ASS)
  - Site reinstatement and rehabilitation
- Environmental Sites Assessment and Remediation:
  - Environment and Human health risk assessment and mitigation
  - Soil, soil gas, surface water and groundwater investigations
  - Remediation of hydrocarbon, metals, salts and solvent impacted sites
- Environmental Compliance:
  - Environmental Management Plans (EMP) development and implementation
  - Environmental audits (internal and 3rd party) and approvals/ license documents
  - Incident response, monitoring, sampling, mitigation, and reporting
- Water Management:
  - Dewatering programs and groundwater treatment systems
  - Bore drilling and well installation; compliance monitoring and sampling
- Waste Management:
  - Contaminated/ hazardous and non-hazardous waste management and transport
  - Drilling waste management including drilling muds disposal
- Health, Safety & Environment:
  - Development and implementation of project specific health and safety plans
  - Conduct inductions, risk assessments, incident investigation, auditing
- Data management, Interpretation and Report Writing
  - Data management software (gINT, ESDAT, EQUIS) and MS office for graphs, logs, statistics and report preparation
- Project Management:
  - scope development, cost estimation, project administration, budget management, cost control and project completion
  - Contractor administration, bid/tender evaluation, procurement and invoicing
  - Supervision of junior staff and contractors

Key Projects at AECOM:

- Acid Sulfate Soils intrusive investigation and development of ASSMP for Cross River Rail – Rail Integration System (RIS) – Lead Acid Sulfate Soils Specialist - Co-ordination of fieldwork, data analysis, interpretation and Reporting
- Frac Ponds Decommissioning and Rehabilitation, QGC, Technical Lead and Project Manager. Co-ordination of fieldwork, data analysis, interpretation and Reporting
- Acid Sulfate Soil assessment for road upgrade works at Walkerston Bypass, Mackay, Project – Desktop assessment, data analysis and reporting as per Qld Guidelines
- Contaminated land and Acid Sulfate Soil assessment for underground rail tunnel in Brisbane – Desktop assessment
- Acid Sulfate Soil assessment for road upgrade works at Port Alma Road, Bajool, Project – Desktop assessment, data analysis and reporting as per Qld Guidelines
- Stage 1 and Stage 2 Contamination Investigation across the whole RAAF Base Amberley – Desktop, fieldwork, data analysis and reporting
- Stage 1 and Stage 2 Contamination Investigation across the whole Gallipoli Barracks Enoggera – Desktop, fieldwork, data analysis and reporting
- Stage 2 Contamination Investigation across the whole Jennings Defence Base – Desktop, fieldwork, data analysis and reporting
- Soil Assessment for PFAS and other Contaminants for Growler Project, RAAF

Amberley - Desktop assessment, data analysis and reporting

- Coastal Acid Sulfate Soil assessment (CASS) for North East Link (NELA) Project – Desktop assessment, data analysis and reporting as per Victorian Guidelines
- Land Capability Assessment for onsite Effluent Disposal at a site in Melbourne. It included assessment of topsoil and subsoil and water balance calculations.
- Coastal Acid Sulfate Soil assessment (CASS) for Melbourne Metro Project – Desktop assessment, data analysis and reporting as per Victorian Guidelines
- Stage C Groundwater Assessment – AACO Base, Oakey – Reporting
- Groundwater Radioactive Assessment - Defence Science and Technology Group, Fishermans' bend – Fieldwork and reporting
- Exxon Mobil Altona Refinery Sediment Assessment - project management and reporting
- Coastal Acid Sulfate Soil assessment (CASS) for Edithvale and Bonbeach Level Crossing Removal (LXRA) Projects - Desktop assessment, data analysis and reporting as per Victorian Guidelines
- Project manager, Soil sampling at Oakey Base for PFC assessment in Soils for disposal
- Project manager, Soil sampling at Oakey Civil Terminal for PFC assessment in Soils for disposal
- Santos Remediation Project at Roma – Project team, fieldwork and reporting
- Oakey Groundwater Investigation, AACO base Oakey – Project team, fieldwork and reporting
- Growler Project, RAAF Base Amberley Additional Soil Characterization including assessing soils for PFC contamination
- C-17 Project RAAF Base Amberley Additional Soil Characterization including assessing soils for PFC contamination
- Contamination Investigation for Acid storage dam, Incitec Pivot, Phosphate Hill
- Origin Energy, Deep Drilling for groundwater monitoring wells at Ironbark.
- LendLease – RNA Showgrounds Development Project – Contaminated land and ASS investigation and management – Team member
- Part of the Team for Origin Energy CSG Dams Remediation Project SELECT Phase
- Defence – RAAF Base Amberley, Phase 1 and site contamination Investigation, C17, Growler, Battlefield airlifter etc. – fieldwork and reporting
- Caltex Gold Coast Airport, JUHI and PRA Remediation including ASS management
- UPSS Inspections at various sites for Goodman Pty Ltd – Project Team, fieldwork and reporting
- Deputy Project manager (DPM) for BP contaminated land investigation at Charters Towers.
- Caltex Sites Groundwater Investigation at North Queensland - DPM
- Origin Energy former gasworks sites Bundaberg, QLD Project Team, fieldwork and reporting.
- Origin Energy former gasworks sites, Maryborough, QLD Project Team, fieldwork and reporting.
- Remediation Plans for Origin Energy former gasworks sites at Warwick and Bundaberg, QLD Team lead.
- Part of the Team for Origin Energy CSG Dams Remediation Project Phase 2.
- Origin Energy Asbestos Investigation Project – Project Team, fieldwork and reporting.
- Caltex UPSS 2014, reporting for select sites.
- Phase I Environmental Investigation at different sites for Goodyear Pty Ltd – Project Team, fieldwork and reporting
- Soils and topography as part of the EIS for a major underground combined Bus and Train (BAT) tunnel project in Brisbane – Team lead.

Historical Projects:

- Groundwater monitoring sampling and report writing for key Shell retail and distribution sites in and across Brisbane – Project team
- Groundwater investigation including halogenated compounds for an Industrial site

(BOC), fieldwork and report preparation – Project team

- Environmental Site assessment (Phase I and Phase II) – Project Manager/Site Supervisor.
- Posted on secondment for an year with a major CSG project (Santos), Data manager for Quality control and assurance of environmental data
- CSG Pipeline Construction (Origin Energy via East Coast Pipeline) – Project Manager, SCL and Topsoil Assessment.
- Disposal Options for Drilling Muds for CSG industry (Origin energy) – Project Team, Desktop review, field trials.
- CSG Gas fields EIS – Project Team, Soil survey and land assessment.
- Major underground tunnel project – Team lead, ASS investigation and management.
- Site closure for Box cut mine – Team Lead, Dewatering, Soil treatment and re-interment.
- Soils and groundwater remediation including ASS soils management at a major fuel distribution centre (ExxonMobil) – Project Team
- ASS soils investigation for various projects at Brisbane Airport including fieldwork – Project team
- Marine sediment sampling program associated with the proposed LNG (Liquefied Natural Gas) plant in the Port of Gladstone (Santos)
- Marine Sediment analysis involving a proposed dredge area for the removal of the subsea section of a decommissioned pipeline bundle (Caltex Refineries Pty Ltd)

Conferences
Soil Science Conference, Canberra, 2018

Mine Closure, Brisbane 2012

Training
- AECOM Certified Project Manager
- Acid Sulfate Soils; Identification, Assessment and Management, Three day short Course
- Nature and Distribution of Queensland Soils as per Australian System of Classification, Two Day Training
- Software Training gINT, Three day training
- Software Training ESDAT, one day training
- How to Write Effective Reports, one day training at Australian Institute of Management (AIM)
- 40 Hour Health and Safety Training (HAZWOPER)
- 30215 QLD Construction Industry Safety Induction (Blue Card)
- PMASUP236A Operate Vehicle in the Field 4WD,
- Santos Environment Health and Safety Induction Rev 7.3 including gas Certificate
- Senior First Aid and CPR training
- Australian Institute of Petroleum Permit System
- MOBIL Loss Prevention System Training
- Shell Coles Express Online Induction A and B
- Shell Approved Retail and Distribution Permit Holder Training
- Working in Electrified Territory (WET), Safely Accessing the Rail Corridor (SARC), Fatigue Management, Category 3 Medical
- Rail Industry Worker (RIW) card

Other Languages
Punjabi, Hindi

Professional History

2020 - Present
AECOM
Principal Soil Scientist – Technical Lead Acid Sulfate Soils

2016 - 2020
AECOM
Senior Soil Scientist - RCE

2014 - 2016
AECOM
Professional Environmental Scientist - RCE

2008 - 2013
URS Australia Pvt Ltd
Soil Scientist

2005 - 2008
Simmonds and Bristow Pvt Ltd
Scientist

2003 - 2004
Sydney Environmental & Soil Laboratory Pvt Ltd
Analyst

Appendix 8: EWAs associated with the LPH on subject lots

arrow energy
go further

151°3'48"E 151°3'51"E 151°3'54"E

27°13'30"S 27°13'33"S 27°13'36"S 27°13'39"S

2240 m2

2RP71519
VICTORIA MEGAN & MARK DAVID SCHUURS

Legend
- LPH Pipe Datum Line
- Extra Work Area
- Subject Property
- Property Boundary

Scale @ A3: 1:1,000 **Coordinate System:** GDA 1994 MGA Zone 56

0 10 20 40 60 80 Metres

N

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Rev	Date	Revision Description	Org	Cknd	Eng	QA	Appr
4	09/06/2021	Update title block	SL	XX	XX	XX	AH
3	22/04/2021	Remove survey corridor	JL	XX	XX	XX	AH
2	15/04/2021	Clip survey corridor, EWA, LPH, tracks to RIDA properties	JL	XX	XX	XX	AH
1	17/03/2021	Add LPH	SL	XX	XX	XX	AH
0	16/03/2021	Show access tracks and EWA	SL	XX	XX	XX	AH

Source:
Arrow Energy Limited, Geosciences Australia
Qld Gov.

Status: IFI
Issued To: A Hall
Author: sliyanage

arrow energy
go further

DK West - LPH

Map 1 of 2

Uncontrolled 4

Document: V:\Products\Australia\Queensland\Surat_Basin\General\210415_RITM0294107_RIDAAPP_AH\RITM0294107_Map3_4.mxd

NOT FOR CONSTRUCTION

Print Date: 9/06/2021

151°5'54"E
151°5'57"E
27°15'30"S
27°15'33"S
27°15'36"S

46DER34223
JACK MERVYN KLEMM

550 m2

PL260

Legend
- LPH Pipe Datum Line
- Extra Work Area
- Subject Property
- PL (Arrow)
- Property Boundary

N

Scale @ A3: 1:725 **Coordinate System:** GDA 1994 MGA Zone 56

Metres
0 5 10 20 30 40

Confidential: For Internal Use Only

Rev	Date	Revision Description	Orig	Checkd	Eng	QA	Appr
4	09/06/2021	Update title block	JL	XX	XX	XX	AH
3	22/04/2021	Remove survey corridor	JL	XX	XX	XX	AH
2	15/04/2021	Clip survey corridor, EWA, LPH, tracks to RIDA properties	JL	XX	XX	XX	AH
1	17/03/2021	Add LPH	SL	XX	XX	XX	AH
0	16/03/2021	Show access tracks and EWA	SL	XX	XX	XX	AH

Source:
Arrow Energy Limited, Geosciences Australia
Qld Gov.

Status: IFU
Issued To: A Hall
Author: sliyanage

arrow energy
go further

DK West - LPH

Map 2 of 2

Uncontrolled 4

Document: V:\Products\Australia\Queensland\Surat_Basin\General\210415_RITM0294107_RIDAAPP_AH\RITM0294107_Map4_4.mxd

NOT FOR CONSTRUCTION

Print Date: 9/06/2021

Appendix 9: Summary of Progress of Consultation (Confidential – Not for Public Release)

arrow energy
go further