

5

LAND USE AND INFRASTRUCTURE

This chapter describes the environmental values associated with existing land uses and infrastructure affected by the construction and operation of the Queensland Curtis LNG (QCLNG) Project's Gas Field Component; the impacts on those land uses and infrastructure; and mitigation measures for those impacts.

5.1

PROJECT ENVIRONMENTAL OBJECTIVES AND VALUES

The Project environmental objectives for land use and infrastructure are to:

- minimise impacts on existing townships and infrastructure
- minimise impacts on agricultural or rural activities and potential long term uses of land.

The sections that follow outline the existing environmental values related to land use and infrastructure.

Land use and infrastructure environmental values are summarised in *Table 3.5.1*.

Table 3.5.1 Environmental Values

General Environmental Values	Specific Environmental Values
Land tenure	Property ownership Protected areas State forests Road reserves and bridges Railway lines Stock routes
Land use	Urban/Rural/Recreational/Residential Zoning Industrial Agricultural – pastoral Agricultural – cropping Good Quality Agricultural Land (GQAL) Intensive animal activities Forestry Mining tenures (e.g. mining lease, mineral development licence) Extractive industries Petroleum tenures (other than Proponent)
Native title	Native title representative bodies (NTRB) boundaries
Resources	Economic mineralisation Petroleum and gas deposits (e.g. oil shale, oil) other than for Proponent Millable timber
Major infrastructure	Gas pipelines Water pipelines Power lines

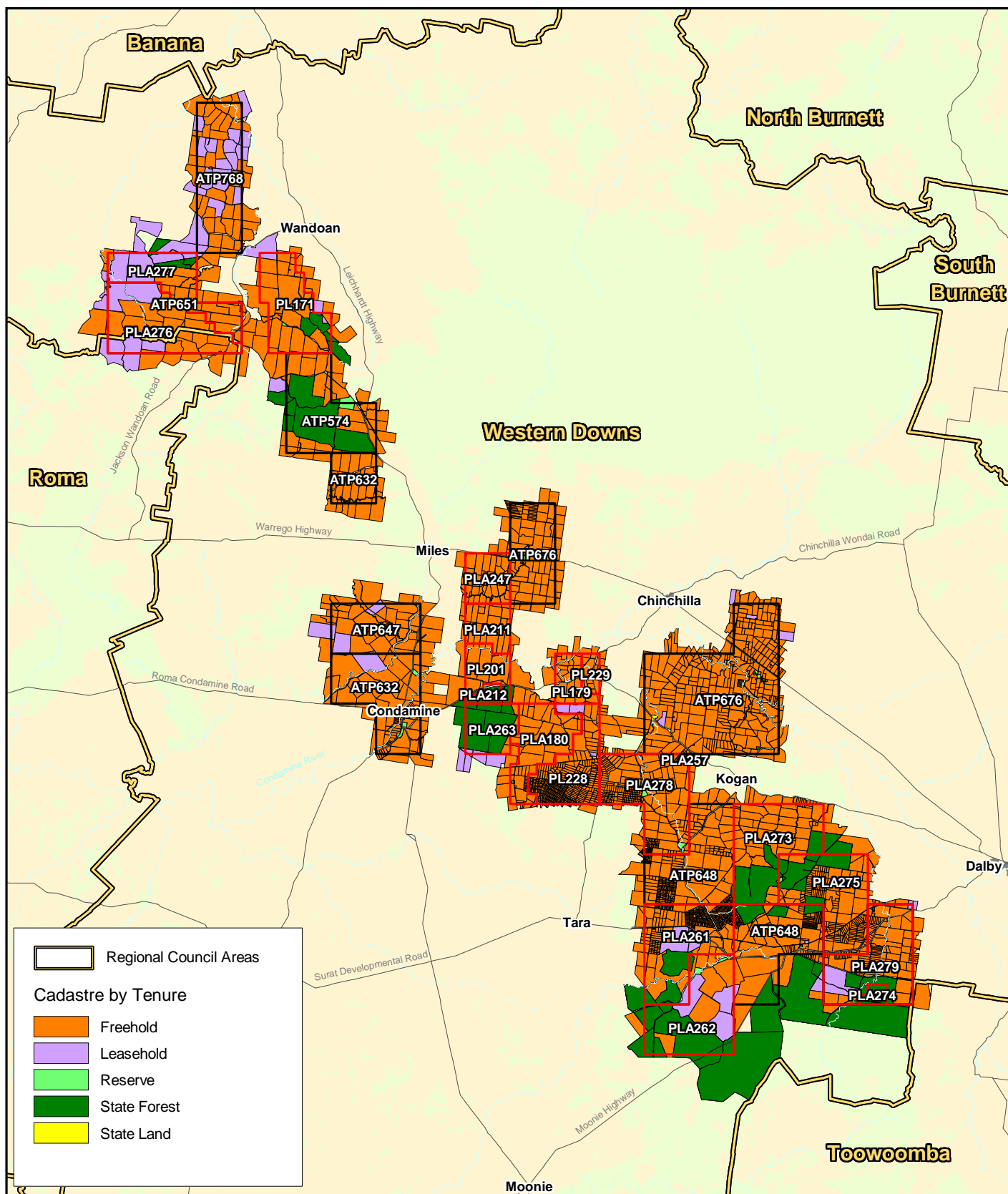
General Environmental Values	Specific Environmental Values
	Interconnector substations Telecommunication lines Airports/airstrips/helipads
Environmentally sensitive areas	Regional Ecosystems – endangered or of concern Wetlands Rivers and lakes Areas zoned as Biodiversity Assessment Planning or Sites of Ecological Significance Groundwater Vulnerability Areas Bushfire hazard zones Wildflower areas Areas of State Significance World Heritage Areas Ramsar Wetlands of International Importance China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) Cultural heritage areas Scientific reserves

5.1.1 Land Tenure

The Gas Field Component covers an area of approximately 468,700 ha and contains predominantly freehold lots. Several leasehold areas and reserves are located within the Gas Field. This number of blocks and the approximate extent of the tenure type are summarised in *Table 3.5.2 below*, and shown in *Figure 3.5.1* and *Figure 3.5.2*.

Table 3.5.2 Land Tenure

Type of Tenure	Number of Blocks	Extent (ha)
Freehold	3,189	359,449
State leasehold	123	124
Lands lease	141	64,941
Crown reserves	111	2,108
State forest	46	56,358
Profit a prendre	1	144
Unallocated state land	0	0
Railway corridors	n/a	2,349
Stock routes	n/a	5,703
Road reserves	n/a	11,970
Total		503,146
Note: The total area of Gas Field (468,700 ha) does not reconcile to the above as some tenures overlap, especially lands lease and state forest; and road reserves and stock routes.		



Legend:



- Gas Fields - Petroleum Lease/Petroleum Lease Application
- Gas Fields - Authority to Prospect

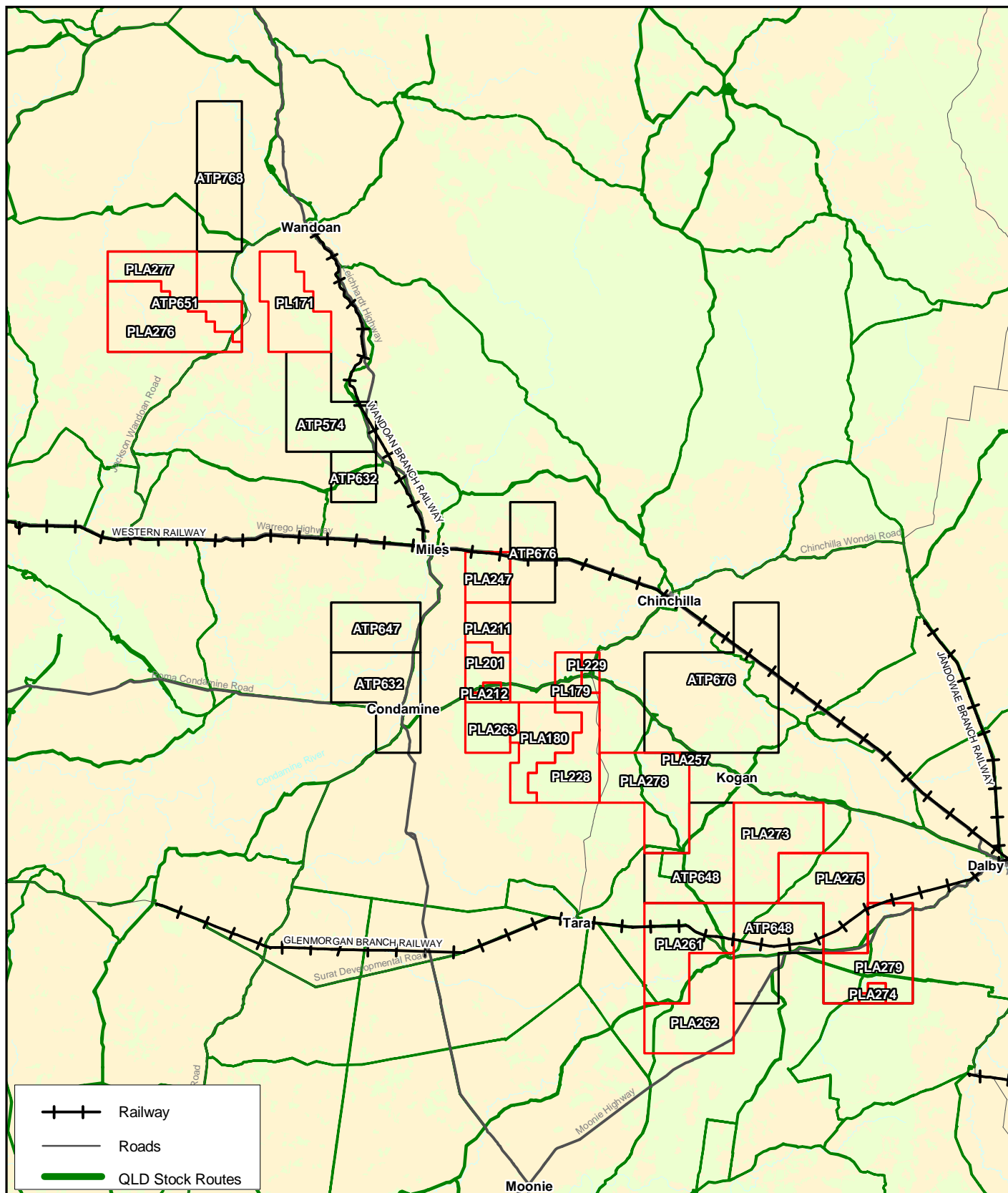
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 <div>QUEENSLAND CURTIS LNG</div> <div>A BG Group business</div>	Project Queensland Curtis LNG Project		Title Land Tenure Cadastre
	Client QGC - A BG Group business		
 <div>ERM</div> <div>Environmental Resources Management Australia Pty Ltd</div>	Drawn Mipela	Volume 3 Figure 3.5.1	Disclaimer: Maps and Figures contained in this Report may be based on Third Party Data, may not be to scale and are intended as Guides only. ERM does not warrant the accuracy of any such Maps and Figures.
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 <p>QUEENSLAND CURTIS LNG</p> <p>A BG Group business</p>	Project Queensland Curtis LNG Project		Title Stock Routes and Railway Lines		
	Client QGC - A BG Group business				
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Table 3.5.3 identifies the chapter of the Environmental Impact Statement (EIS) in which the environmental values of certain land tenures are described, or provides a description of those environmental values.

Table 3.5.3 Environmental Values by Land Tenure

Land Tenure Type	Environmental Values
Protected areas	There are no protected areas declared under federal, state or local legislation within the Gas Field.
State forests	<i>Volume 3, Chapter 7</i>
Road reserves and bridges	<i>Volume 3, Chapter 14.</i>
Railway lines	Three rail lines, mainly providing freight transport, intersect the Gas Fields between: <ul style="list-style-type: none"> • Dalby and Miles • Dalby and Tara • Miles and Wandoan.
Stock routes	Stock routes provide benefits as transport routes and sources of fodder for stock; refuges for biodiversity and potential corridors for faunal movement during long-term events such as drought or as a result of climate change.

5.1.2 Land Use

Satellite imagery, topographic maps and database searches have been used to identify the land uses within the Gas Field. The Gas Field covers a mix of land uses including:

- rural, rural residential and township zones
- land that has been cleared for grazing and cropping, inclusive of Good Quality Agricultural Land (GQAL) as defined in State Planning Policy 1/92: Development and the Conservation of Agricultural Land
- sections of intensive agriculture
- forestry plantations
- mining and petroleum activities
- industrial (planned) areas.

The general land use within the Western Downs Regional Council (WDRC) area is a mix of large-scale grazing, cropping, and mining activity. Well vegetated areas and small and large holdings are dominant features of the landscape. The closest townships to the Gas Fields are Miles, Chinchilla, Condamine, Kogan, Tara and Wandoan. These townships provide the main services for primary production activities in the area and a range of government and community facilities.

5.1.2.1 *Urban/Rural/Recreational/Residential Zoning*

Approximately 99 per cent of the Gas Field is located in the WDRC area, with the remainder in the Roma Regional Council (RRC) area. The area within the boundary of the RRC is included in discussions about general land use in the WDRC, as land use in the RRC is very similar to the WDRC.

WDRC is an amalgamation of Dalby Town and the Shires of Wambo, Chinchilla, Murilla, Tara and Taroom (Division 2). Further details of local council planning scheme, mapping layers and the extent of overlap of the Gas Field with these layers can be found in *Volume 1, Chapter 5*.

Table 3.5.4 shows that almost 100 per cent of the Gas Field lies within zones declared rural or rural residential under local council planning schemes. The only townships that fall within the Gas Field tenures are Brigalow with population of approximately 60 and Condamine with a population of approximately 100. There is minimal industrial, commercial, residential and recreational zoned land all located within township centres.

Table 3.5.4 *Zoning of Land*

Zone	Area of Gas Field in Zone (ha)	Percentage of Gas Field in Zone
Rural	446,830	95%
Rural residential	21,600	5%
Residential/industrial/commercial	85	0%
Recreation	185	0%
Total	468,700	100%

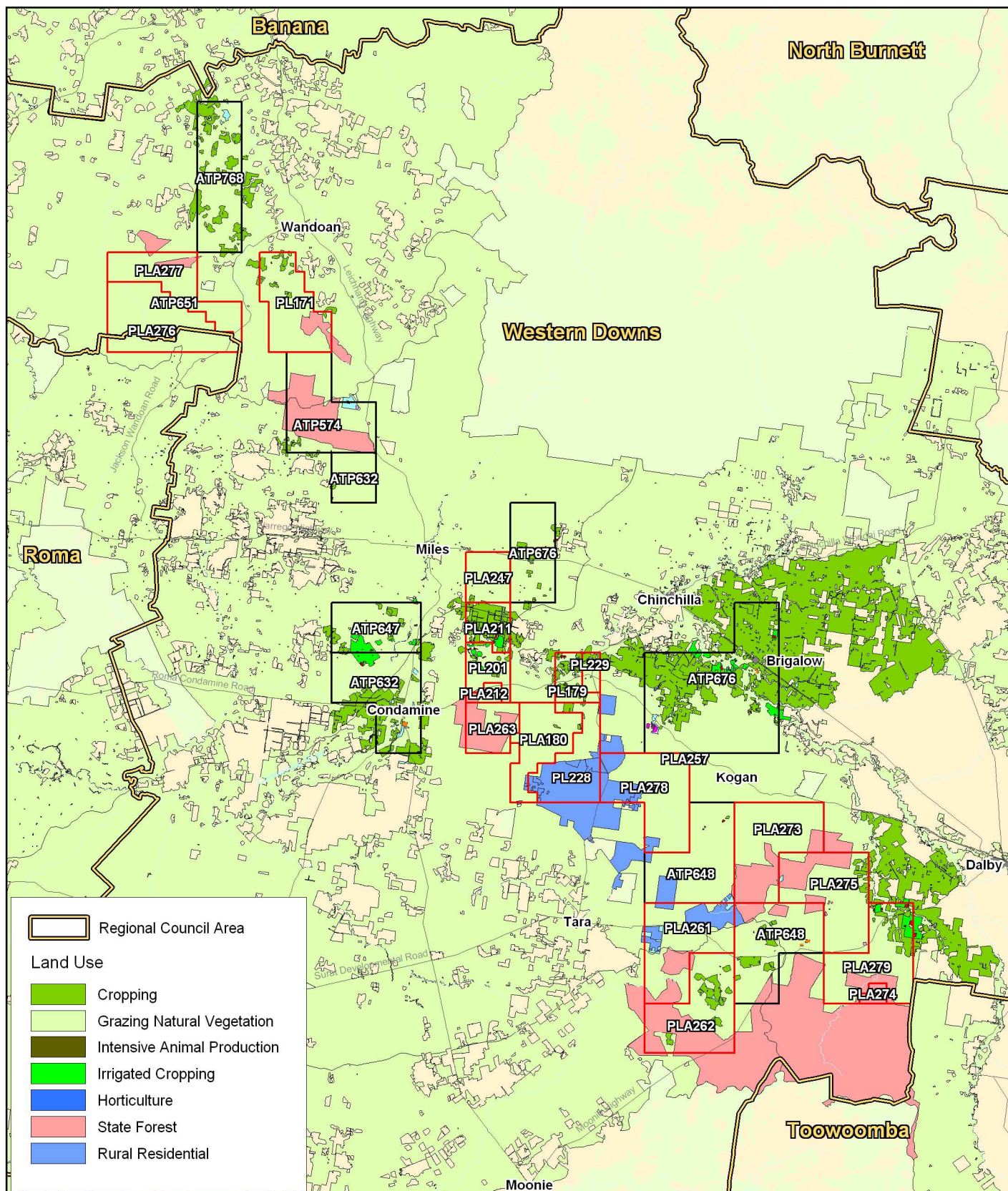
5.1.2.2 *Industrial*



The following power stations are located within or adjacent to the Gas Field:

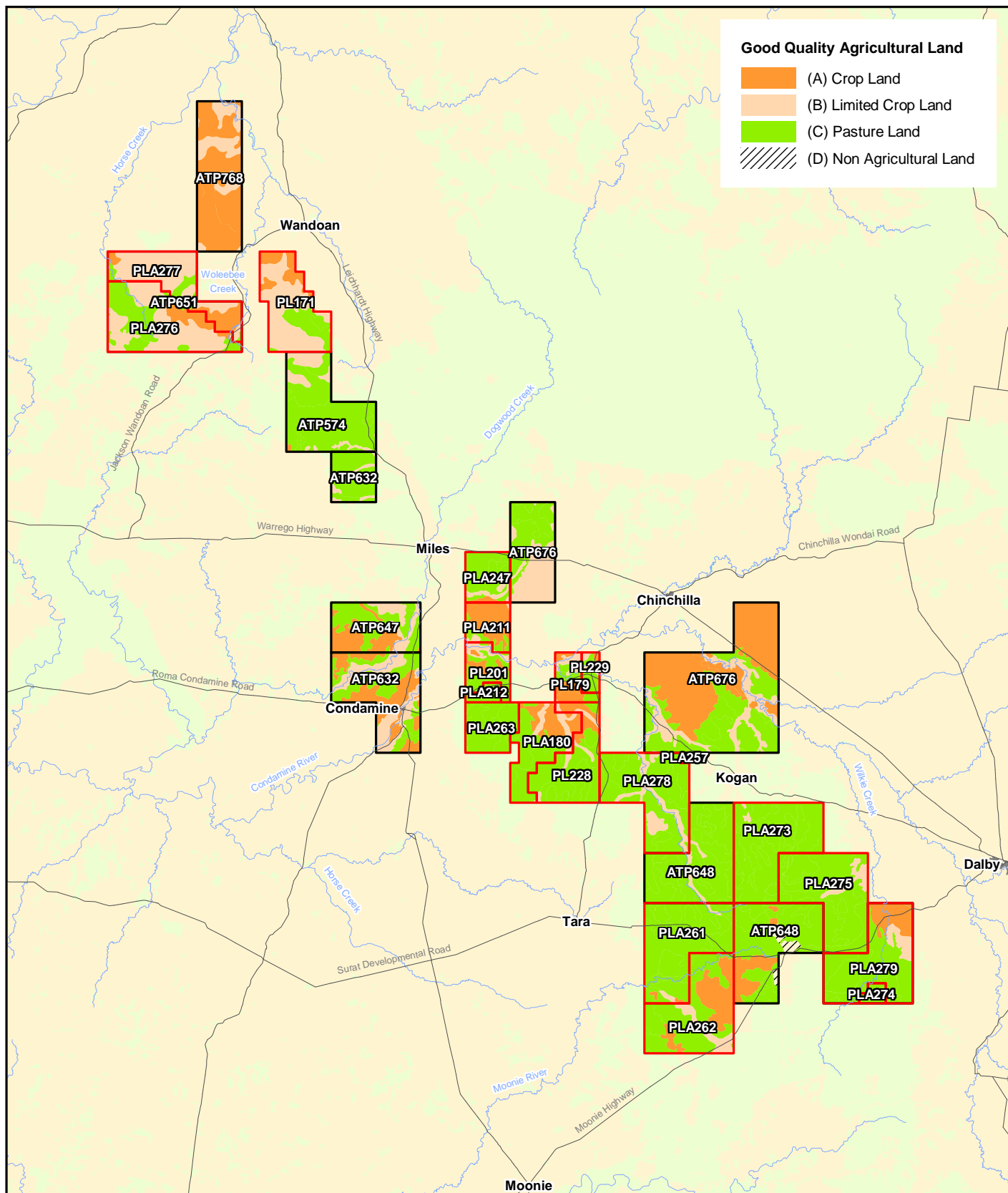
- Kogan Power Station (CS Energy)
- Braemar Power Station (Braemar Power Project)
- Braemar Power Station 2 (ERM Power – commissioned)
- Condamine Power Station (operated by QGC Sales Queensland Pty Ltd, owned by Condamine Power Station Pty Ltd)
- Darling Downs Power Station (Origin Energy – under construction)
- Daandine Power Station (Arrow Energy).

5.1.2.3 *Agricultural, Rural and Forestry Land Uses*

- Land uses including types of agricultural, rural residential and state forest are shown in *Figure 3.5.3*. GQAL is shown in *Figure 3.5.4*.



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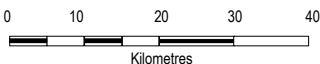
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- Gas Fields - Authority to Prospect

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
 <div>QUEENSLAND CURTIS LNG</div> <div>A BG Group business</div>	Project Queensland Curtis LNG Project		Title Good Quality Agricultural Land
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Table 3.5.5 shows the area and percentage of the Gas Field used for different agricultural, rural and forestry purposes.

Table 3.5.5 Land Use – Gas Field

Land Use	Area within the Gas Field (ha)	Percentage of Gas Field by Land Use
Cropping	51,388	11%
Grazing natural vegetation	332,362	71%
Intensive animal production ¹	31	<1%
Irrigated cropping	5,097	1%
Horticulture	309	<1%
Rural residential	21,679	5%
State Forest ²	53,289	11%
Other (rivers, wetlands, dams, urban)	4,545	1%
Total	468,700	100%

Note 1: Intensive animal activities (i.e. feedlots) occur within the Gas Field area for piggeries and cattle.

Note 2: The only large-scale forestry conducted within the Gas Field is in state forest.

Table 3.5.6 shows the area and percentage of GQAL, by category, in the Gas Field. The classification of land as GQAL (Class A and B) does not necessarily imply that the land is used for cropping. GQAL is a reflection of agricultural potential rather than current agriculture use of the land. Alternatively, land that is classified as Class C, pasture land, may be used for cropping.

Table 3.5.6 Good Quality Agricultural Land – Gas Field

GQAL category	Area (ha) within the Gas Field	Percentage of Gas Field by GQAL category
Cropping land – Class A	96,965	20.7%
Limited cropping land – Class B	86,945	18.5%
Pasture land – Class C	283,485	60.5%
Non-agricultural land – Class D	1,285	0.3%
Total	468,680	100.0%

5.1.2.4 Mining Tenures and Economic Mineralisation

Almost the entire Gas Field is overlain by different types of mining tenure. Table 3.5.7 shows the mining tenure type and the approximate percentage and hectares of land within the Gas Field overlain by that tenure type. This is illustrated in Figure 3.5.5.

Table 3.5.7 Mining Tenures by Tenure Type

Tenure Type	Hectares of Gas Field	Percentage of Gas Field
Exploration Permit Coal (EPC)	419,150	83%
Exploration Permit Mineral (EPM)	11,690	2%
Mineral Development Licence (MDL)	43,490	9%
Mining Lease (ML)	24,520	5%
No Mining tenure	6,123	1%
Total	504,973	100%

Note: The total area of CSG Field (approximately 468,700 ha) does not reconcile to the above as some tenures overlap, especially EPCs and MDL / MLs.

Mining leases, covering areas in the Gas Field, have been granted/pending grant to the following companies:

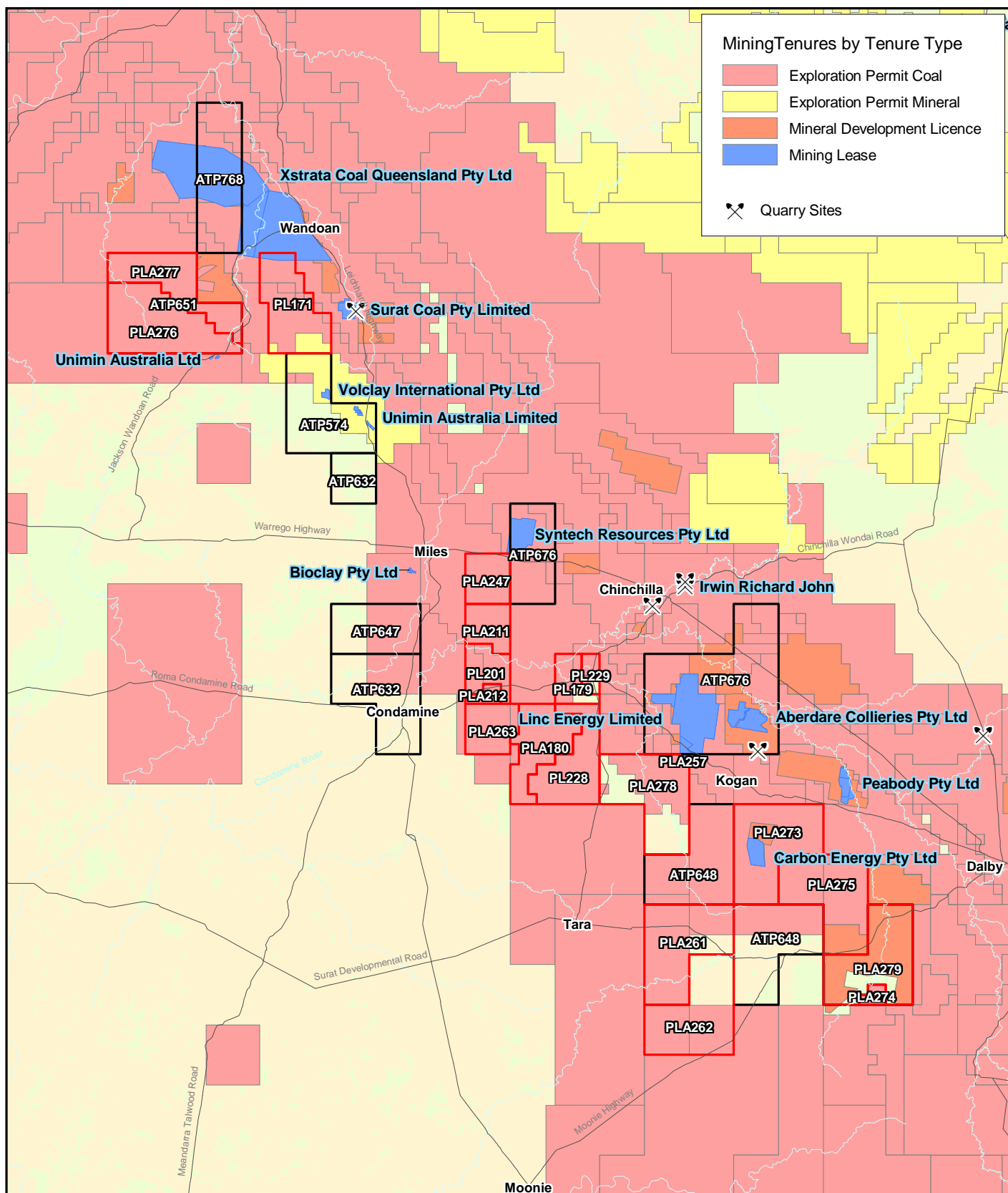
- Xstrata Coal Queensland Pty Ltd (Wandoan Coal Project)
- Syntech Resources Pty Ltd (coal)
- Volclay International Pty Ltd (sodium bentonite)
- Unimin Australia Ltd (raw materials including bentonite)
- Linc Energy Ltd (Underground Coal Gasification Project)
- Carbon Energy Ltd (Underground Coal Gasification Project)
- Aberdare Collieries Pty Ltd (coal).

5.1.2.5 *Extractive Industries*

There are no state-declared Key Resource Areas in the Gas Field. Quarries in the vicinity of the Gas Field are shown in *Figure 3.5.5*.

5.1.2.6 *Petroleum Tenures and Petroleum and Gas Deposits*

All petroleum tenures within the Gas Field are all held by QGC solely or in joint venture with another party.



<p>Legend:</p> <ul style="list-style-type: none"> Gas Fields - Petroleum Lease/Petroleum Lease Application Gas Fields - Authority to Prospect 	<p>Source Note: 1:250,000 Topographic vector copyright Geoscience Australia Mining Tenement Information copyright State of Queensland (Dept. Mines and Energy)</p>	<p>Projection UTM MGA Zone 56 Datum GDA 94</p> <p>Scale: 0 10 20 30 40 Kilometres</p> <p>North Arrow: N</p>
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5.1.3 *Native Title*

Native title claimant areas associated with the Gas Field are shown in

Figure 3.5.6.

QGC has entered into negotiations to develop Indigenous Land Use Agreements (ILUA) with native title interests across the entire Project area, including the Gas Fields.

ILUA negotiations are being undertaken in areas covered by the following registered native title claims:

- Wakka Wakka
- Iman.

QGC is also discussing the Project with other parties who have expressed native title interests or previously held native title over the Gas Field for the purposes of developing an ILUA. These interests include:

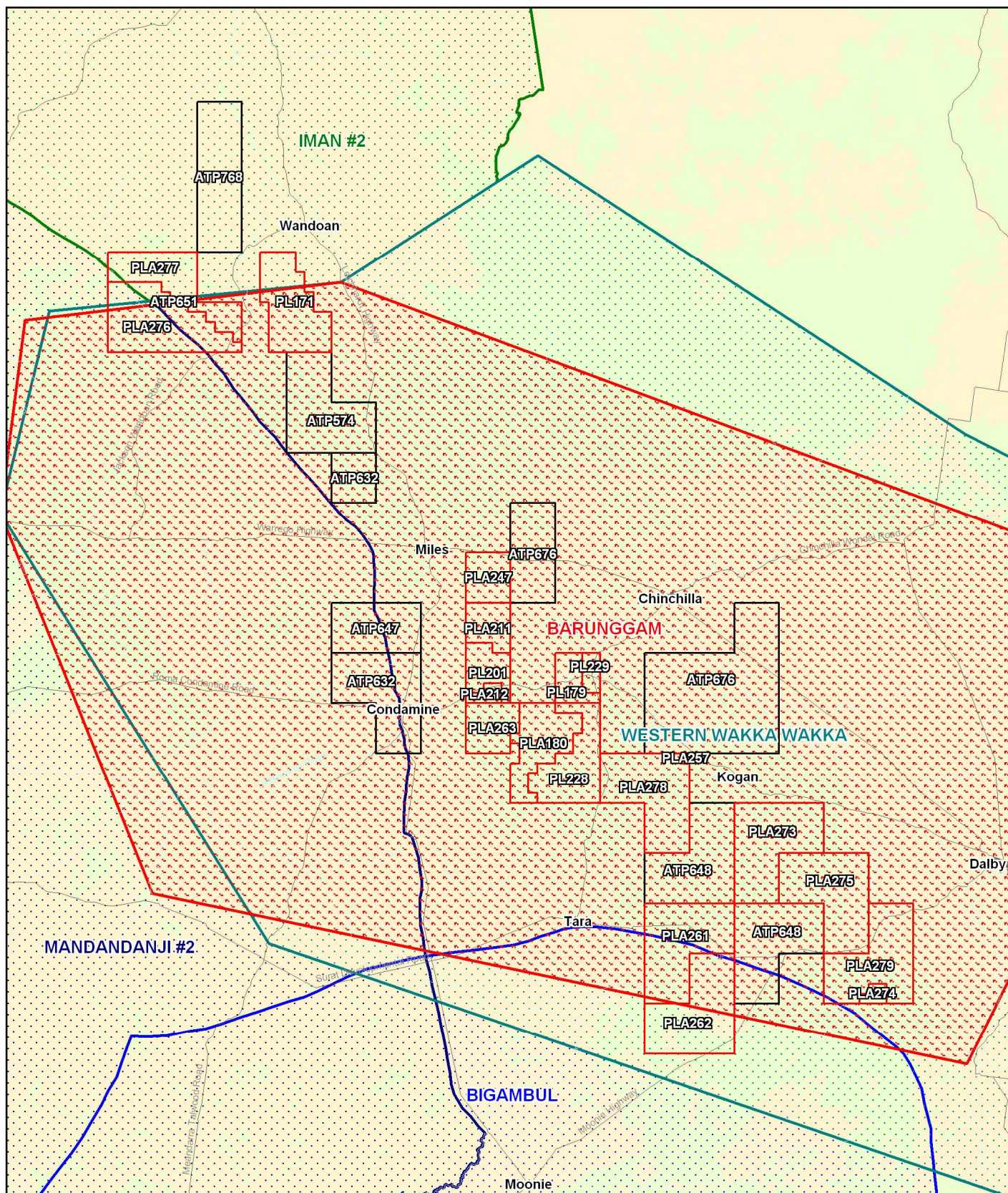
- Mandandanji
- Western Wakka Wakka
- Barunggam
- Bigambul.

QGC has taken the view that it needs to consult with all groups, both because of the open and frank way it wishes to conduct its consultations and because of the ILUA provisions of the *Native Title Act 1993*.

5.1.4 *Resources – Millable Timber*

Within the Gas Field, millable timber is principally held in State Forests. Potential impacts on millable timber will be identified. The Department of Environment and Resource Management (DERM) Forestry Products will be consulted to develop a strategy to mitigate impacts on any millable timber affected by the Gas Field.

Vegetation cleared by QGC for the development of the Gas Field may be millable (refer to *Section 5.3.15.2* for mitigation measures).



Legend:



- Gas Fields - Petroleum Lease/Petroleum Lease Application
- Gas Fields - Authority to Prospect

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0 10 20 30 40
Kilometres



 A BG Group business	Project Queensland Curtis LNG Project		Title Native Title Claimants	
	Client QGC - A BG Group Business			
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5.1.5 *Major Infrastructure*

The Gas Field is crossed by major private and public infrastructure.

Figure 3.5.7 shows the following infrastructure for which information was available, including:

- major gas pipelines
- high-voltage power lines
- major water pipelines (i.e. for state projects)
- aircraft facilities.

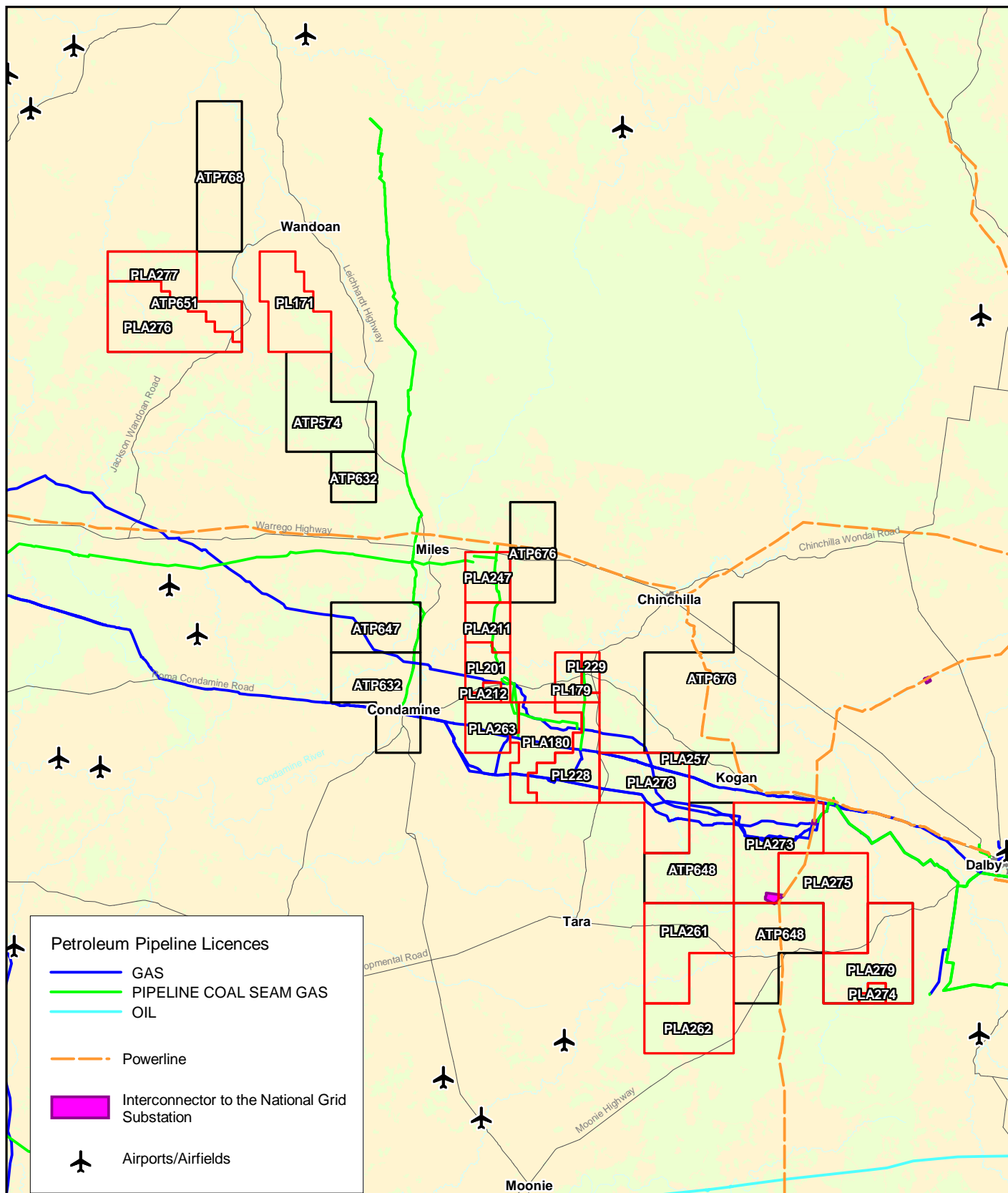
The major gas pipelines that currently intersect the Gas Field include:

- the Roma to Brisbane Pipeline (petroleum pipeline licence (PPL) 2)
- QSN (Queensland - South Australia - New South Wales) Berwyndale to Wallumbilla Link (PPL 125)
- the Braemar Linepack Connection (PPL 102, 103 and 132).

Within the former Wambo Shire, approximately 3 per cent of the Gas Field is located in the interconnector substation zone (as defined in Regional Council Planning Schemes).

Only one airport, airstrip or helipad is located in the Gas Field, being the Miles Landing Ground. The nearest commercial air facilities are at Chinchilla, Dalby and Miles.

It is intended that where information is not currently available on the location of major infrastructure, such as telecommunication lines, information would be gathered through consultation with the relevant owners, operators and/or "Dial Before You Dig" services.



Legend:



- Gas Fields - Petroleum Lease/Petroleum Lease Application
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 0 10 20 30 40
 Kilometres



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Environmentally Sensitive Areas

The environmental values of environmentally sensitive areas are discussed in various chapters of the EIS. *Table 3.5.8* identifies the chapter of the EIS in which the environmental value is described or describes the environmental value.

Table 3.5.8 *Environmental Values of Environmentally Sensitive Areas*

Environmentally Sensitive Area	Environmental Values
Endangered regional ecosystems	<i>Volume 3, Chapter 7</i>
Wetlands	<i>Volume 3, Chapter 7 and 8</i>
Rivers and lakes	<i>Volume 3, Chapter 7 and 8</i>
Areas zoned as biodiversity planning assessment and sites of ecological significance	Within the former Chinchilla and Murilla Shires, approximately 10% and 30% of Gas Field is located in biodiversity assessment planning zones, respectively. Within the former Tara Shire, approximately 70% of the Gas Field is located in sites of ecological significance zones. Further details are provided in <i>Volume 3, Chapter 7</i> .
Groundwater vulnerability areas	Within the former Chinchilla and Murilla Shires, approximately 60% and 10% of the Gas Field lies within groundwater vulnerability areas respectively. Further details on groundwater values are provided in <i>Volume 3, Chapter 10</i> .
Bushfire hazard zones	Within the WDRC, approximately 60% of the Gas Field lies within the low-hazard bushfire zone and 40% lies within a medium bushfire zone.
Wildflower areas	Within the former Murilla Shire, approximately 10% of the Gas Field lies within wildflower areas. Further details are provided in <i>Volume 3, Chapter 7</i> .
Wilderness areas	There are no wilderness areas in the Gas Field.
Areas of state significance	<i>Volume 3, Chapter 7</i>
World Heritage Areas	The Gas Field area is not within a World Heritage Area.
Wetlands of International Importance - Ramsar Sites,	The Gas Field area is not within a Ramsar site
Cultural heritage areas	<i>Volume 8, Part B.</i>
Scientific reserves	The Gas Field area is not within any scientific reserves.

5.2 IMPACTS ON LAND USES AND INFRASTRUCTURE

5.2.1 Gas Field Infrastructure

Operational and construction activities within the Gas Field will impact on land use and infrastructure. These activities are described in *Volume 2, Chapter 7* and *Volume 2, Chapter 11*, respectively. The majority of construction activity is

estimated to take approximately 18 months between 2011 and 2013, with operations and further development to continue for at least 20 years from 2013. The following activities fall within both the construction and operational periods, and disturbances created by these activities have been apportioned accordingly in *Table 3.5.9*:

- well site preparation, drilling and well establishment
- access road establishment
- gathering system establishment.

Table 3.5.9 describes the estimated area of disturbance from construction and operations of the Gas Field, and the remaining area of disturbance following progressive rehabilitation. Progressive rehabilitation does not include final rehabilitation which follows full decommissioning of the areas of disturbance. Progressive rehabilitation aims to mitigate ongoing impacts as soon as possible after the disturbance has occurred.

Table 3.5.9 Construction and Operation – Areas of Disturbance

Activity	Area of disturbance during construction (ha)	Additional area of disturbance during operations (ha)	Area of disturbance after progressive rehabilitation (ha)
Well site preparation, drilling and well establishment	2,000	4,000	3,000
Gathering lines (gas and water)	2,000	4,000	1,200
Compression infrastructure	200	0	200
Water treatment	10	15	25
Water storage	550	0	550
Access roads	400	400	720
Accommodation camps	50	15	15
Total	5,210	8,430	5,710

The total area of Gas Field tenements is approximately 468,000 ha. Following progressive rehabilitation, the total area directly impacted will represent approximately 1.2 per cent of the total tenement area.

5.2.2 Impacts on Environmental Values

Table 3.5.10 identifies the potential impacts on the specific environmental values listed in *Table 3.5.1*. Note that some “impacts” are beneficial, such as beneficial use of treated Associated Water.

Table 3.5.10 Potential Impacts on Land Use and Infrastructure Environmental Values

Environmental Values	Potential Impacts
Land tenure	The Gas Field will not impose any long-term restrictions or changes to the identified land tenures. Easements and access agreements will be created over land, thereby restricting use for existing landholder and allowing access for QGC.
Protected areas	There are no protected areas within the Gas Field. <i>Addressed in Volume 3, Chapter 7</i>
State forests	Loss of flora and fauna through tree clearing and elevated activity levels Disruption to surface water and groundwater flows Interruption of harvesting regimes Beneficial fire break management Benefits through beneficial use of Associated Water <i>Addressed in Volume 3, Chapter 7</i>
Road reserves and bridges	<i>Addressed in Volume 3, Chapter 14</i>
Railway lines	Damage to existing railway lines Temporary disruption during construction Electrical interference
Stock routes	Decline in productivity of stock routes for stock movements Loss of biodiversity Benefits through beneficial use of Associated Water
Urban/rural/recreational/ residential	Change in rural nature of land use Loss of visual amenity in rural zones Increased noise within rural zones Loss of areas available for recreation
Industrial	There are no industrial activities affected by Gas Field development.
Agricultural – pastoral	Stock loss or injury Temporary or permanent restrictions on stock movements Stock security Land contamination Introduction of weeds Soil erosion Soil salinisation Damage to farm infrastructure Benefits through beneficial use of Associated Water
Agricultural – cropping and GQAL	Soil erosion Soil salinisation Land contamination Introduction of weeds Biosecurity for organic (non-GM) crops Fragmentation of cropping practices resulting in approximately 1% – 10% loss of cropping area Damage to farm infrastructure Benefits through beneficial use of Associated Water
Intensive animal activities	Disturbance to animals
Forestry	Clearing of production forests (the majority of forestry occurs

Environmental Values	Potential Impacts
	within state forests)
Mining tenures	Sterilisation of mining resources due to resource removal or alteration Delays in accessing mining resources, in particular, coal seams, and ore bodies
Extractive industries	Sterilisation of extractive resources Delays in accessing resources Increased demand for resources
Petroleum tenures (other than Proponent)	There are no overlapping petroleum production tenures (i.e. excluding PPLs) Sterilisation of other petroleum and gas deposits
Native title representative bodies (NTRB) boundaries	Negotiation rights for access to land subject to native title
Economic mineralisation	There are no known potential resources over which a mining or petroleum tenure has not yet been lodged.
Petroleum and gas deposits (e.g. oil shale, oil) other than for Proponent	Overlapping petroleum production tenements are not permitted under P&G Act (excluding PPLs)
Millable timber	Timber from vegetation clearing not fully utilised for rehabilitation or milling
Gas pipelines	Damage to existing gas pipelines and resultant safety risks and supply disruption Temporary disruption during construction
Water pipelines	Damage to the existing pipeline and resultant safety risks and supply disruption Temporary disruption during construction
Power lines	Electrical interference Damage to existing power lines and resultant safety risks and supply disruption Temporary disruption during construction
Interconnector substation	Electrical interference Temporary disruption during construction
Telecommunication lines	Damage to telecommunications infrastructure and resultant safety risks and supply disruption Temporary disruption during construction
Airports/airstrips/helipads	Possible safety risks for aircraft from placement or operation of infrastructure
Endangered regional ecosystems	Addressed in <i>Volume 3, Chapter 7</i> Benefits through beneficial use of Associated Water
Wetlands	Addressed in <i>Volume 3, Chapter 7 and 8</i>
Rivers/lakes	Addressed in <i>Volume 3, Chapter 7 and 9</i>
Groundwater vulnerability	Addressed in <i>Volume 3, Chapter 10 and 11</i>
Biodiversity planning assessment and sites of ecological significance	Addressed in <i>Volume 3, Chapter 7 and 8</i>
Bushfire hazard	Bushfires caused by Gas Field activities Addressed in <i>Volume 3, Chapter 17</i>
Wildflower areas	Loss or fragmentation of wildflower habitat Addressed in <i>Volume 3, Chapter 7</i>
Areas of state significance	Addressed in <i>Volume 3, Chapter 7</i>
Wilderness areas	None designated in Gas Field

Environmental Values	Potential Impacts
World Heritage Areas	None designated in Gas Field
Ramsar sites	None in Gas Field
Cultural heritage areas	Disturbance/damage to cultural heritage artefacts and areas Addressed in <i>Volume 8</i>
Scientific reserves	None designated in Gas Field

5.3 **MITIGATION MEASURES**

Mitigation measures for each of the impacted environmental values identified in *Table 3.5.10* are described below. Where the impact and mitigation measures are described elsewhere in this EIS, the relevant chapter is referenced.

5.3.1 **Land Tenure**

5.3.1.1 *Creation of Easements/Access Rights over Land*

Individual access and entry protocols will be agreed and documented through close consultation with all landholders. Care will be taken to minimise disruption to existing lifestyles of landholders.

Temporary vehicle restrictions may be required to allow for construction activities. These will be publicly notified and traffic controlled. Where vehicle restrictions occur on private land, landholders will be consulted on the most convenient timing of restrictions.

5.3.2 **Protected Areas**

No Gas Field infrastructure will be located in land designated as protected under Commonwealth or Queensland or local legislation at the time of this EIS.

5.3.3 **State Forests**

Mitigation measures for activities within state forests are discussed in *Volume 3, Chapter 7*. It is expected that restrictive and specific requirements will need to be agreed for access rights to state forests. The relevant forestry managers will be consulted about tree clearing prior to well development. This should ensure that timber is harvested for maximum benefit. Compensation or offsets may be negotiated for lost timber value.

5.3.4 **Road Reserves and Bridges**

Mitigation measures are addressed in *Volume 3, Chapter 14*.

5.3.5 *Railway Lines*

5.3.5.1 *Electrical Interference*

Where steel pipes are used for gas transmission, pipelines cannot be safely co-located within easements for electric rail lines due to the potential for electrical interference with cathodic protection systems and transmission of electric currents along the pipeline. This could result in unacceptable safety issues. To mitigate any potential adverse affects, a separation buffer of at least 500 m will be maintained between any steel pipelines and electrified rail lines. Pipeline crossings will be designed to incorporate the additional protection measures.

5.3.5.2 *Damage to Infrastructure or Disruption of Services*

QGC will liaise with the relevant railway authorities whenever Gas Field activities have the potential to interfere with railway operations. Where gathering systems or trunk lines cross railway lines these will be bored under the railway lines. Gas Field infrastructure will be located to minimise potential interaction between Gas Field activities and railway operations.

5.3.6 *Stock Routes*

QGC will minimise disturbance to stock routes through appropriate siting of Gas Field infrastructure. Where vegetation clearing occurs within a stock route, progressive rehabilitation will aim to return the stock route to pre -disturbance standards as soon as practicable. The integrity of biodiversity in stock routes is likely to be at various levels prior to any disturbance by QGC.

There is potential for treated Associated Water to be utilised to enhance stock route rehabilitation.

Mitigation measures to reduce impacts on areas of biodiversity are addressed in *Volume 3, Chapter 7*.

5.3.7 *Urban/Rural/Recreational/Residential Zones*

Gas Field development will not be conducted in existing urban, residential and recreational areas, as defined under local planning schemes. Proximity to such areas will be determined by safety and separation distances nominated in these planning schemes.

5.3.7.1 *Change in Rural Nature of Land Use*

QGC will aim to minimise the impact on rural lifestyle values through:

- appropriate siting of Gas Field infrastructure
- use of technology that creates the least disturbance
- direct liaison with potentially affected stakeholders.

5.3.7.2 *Loss of Visual Amenity in Rural Zones*

Mitigation of loss of visual amenity is addressed in *Volume 3, Chapter 15*.

5.3.7.3 *Increased Noise in Rural Zones*

Mitigation of noise from Gas Field infrastructure is addressed in *Volume 3, Chapter 13*.

5.3.8 ***Industrial***

Gas Field development planning will not be conducted in areas zoned as industrial.

5.3.9 ***Agricultural – Pastoral***

5.3.9.1 *Stock Loss or Injury*

Stock loss or injury could be caused through stock interacting with Gas Field infrastructure during construction or operation. Possible areas of interaction include open trenches during gathering line placement, drilling pads, construction sites and storage ponds. Temporary fences will be erected around potential areas of interaction to protect livestock from harm. These fences will be erected in consultation with the landholders and using risk and hazard identification processes.

5.3.9.2 *Temporary or Permanent Restrictions on Stock Movements*

Any restrictions on stock movements are likely to be temporary in nature. Where restrictions may occur, individual agreements will be reached with stock owners/operators.

5.3.9.3 *Stock Security*

All QGC staff will be trained to understand how stock is managed and to ensure that QGC activities do not result in a decrease to existing stock security levels.

All gates will be left as requested by the landholder. Any damage to fences will be immediately repaired or alternative arrangements made to ensure the security of stock.

5.3.9.4 *Soil Salinisation*

QGC will introduce an Associated Water management system, as described in *Volume 3, Chapter 11*. One of the objectives of managing Associated Water will be to prevent the release of saline water to land or watercourses. Management of saline residue from water treatment facilities and water storage ponds is addressed in *Volume 3, Chapter 11*.

5.3.9.5 *Land Contamination*

No oil-based drilling fluids will be used in drilling operations and only minimal quantities of potassium chloride will be used. Any resulting bentonite clays and rock chips from the drilling operations will not pose a threat to groundwater quality.

Cement used in casings will encapsulate cement additives and minimise leaching from cement over time. Once the wellheads are cement-plugged and abandoned post extraction, the iron piping may be encased to minimise iron pipe rust contaminating groundwater. The gas and water holding characteristic of the coal also means it is likely that any minor contaminants would be readily readsorbed.

All ponds will be decommissioned and rehabilitated at the conclusion of the Project.

Mitigation measures to minimise land contamination are addressed in *Volume 3, Chapter 6*.

5.3.9.6 *Land Fragmentation*

It is estimated that wells will be sited at approximately 750 m spacing across all tenements. Progressive rehabilitation of well sites, gathering systems and access tracks will reduce the impact on farming practices.

However, some infrastructure, in particular well sites and gathering lines, will be permanently established on grazing land, thereby fragmenting land or access to land.

The selection of locations for well sites and gathering lines will be conducted in consultation with the relevant landholders. This should result, as far as is reasonably practical, in the siting of wells and gathering systems within individual paddocks to minimise disruption to farming practices and the total area impacted for individual landholders.

5.3.9.7 *Spread of Weeds*

Specific management measures for the control of weeds will be part of the Draft EMP for the Gas Field. Strict weed management protocols will be implemented, including washing down of all potentially contaminated vehicles and these are detailed in *Volume 3, Chapter 7* and *Volume 9*.

5.3.9.8 *Soil Erosion*

Some areas have very shallow topsoil overlaying highly dispersive subsoil which can be adversely impacted as a result of clearing activities. These areas will require specific mitigation and management measures as outlined in *Volume 3, Chapter 4*. A Sediment and Erosion Control Plan will be developed as part of the Gas Field Draft EMP based on the recommendations of *Volume 3, Chapter 4*.

Topsoil will be correctly stockpiled and used to progressively rehabilitate areas of disturbance.

5.3.9.9 *Damage to Farm Infrastructure*

All precautions will be taken to minimise damage to farm infrastructure. Landholders will be consulted on the location of farm infrastructure that may be impacted by Gas Field infrastructure.

Where it is necessary, farm infrastructure will be relocated following consultation with the landholder. Compensation will be paid should farm infrastructure be damaged by QGC's construction or operational activities. Workforce access to landholder properties will be controlled under site security arrangements.

5.3.9.10 *Benefits from Beneficial Use of Associated Water*

Potential beneficial uses of treated Associated Water for cropping are discussed in *Volume 3, Chapter 11*.

5.3.10 ***Agricultural – Cropping and GQAL***

Potential impacts on cropping land and GQAL and mitigation measures for those impacts are addressed below and in *Volume 3, Chapter 4*.

5.3.10.1 *Land Fragmentation*

Based on a wellhead density of one every 750 m and wellhead clearing of 100 m x 100 m, it is calculated that during drilling wellheads within cropping land will create an obstruction of between 1 ha in size every 18 ha and 1ha in size every 196 ha. This variability is dependent on the location of wells relative to property boundaries and the size and shape of individual properties.

These well densities do not consider mitigation measures to reduce well densities on cropping land, such as appropriate siting of wells and multiple wells drilled from a single drill pad. If partial restoration reduces the hardstand area to 80 m x 60 m for wellhead operation, an obstruction will be created during production of between 1ha in size for every 72 ha and 1 ha in size for every 784 ha of cropping land. In addition, gravelled access tracks of around 4 m width will be formed between existing property access tracks and wells. Table drains of approximately 1m width, on either side of the access tracks, will also be unusable for cropping. If wells are installed on a fixed 750 m grid, access tracks plus 1 m-wide table drains could cover 1 ha of land for every five wells.

The size of individual cultivation paddocks varies within the study area but many are 70 to 100 ha. Under the proposal, each of these paddocks will, on average, contain two to three wellheads plus around 0.5 ha of gravel tracks. The approximate area of crop production directly impacted will be around 2.5 to 3.5 ha during drilling, representing 2 to 5 per cent of the paddock. During the gas production phase, the total area removed from crop production in an individual paddock is expected to be approximately 1 per cent or less, as partial restoration is performed.

The location of well sites may reduce the ability of the farmer to conduct cropping activities by an area that is larger than the footprint of the well site after progressive rehabilitation (2,500 m²). The area of cropping land indirectly impacted by wells and associated infrastructure is dependent on many factors including farming methods, property shape and size and crop type. It is estimated that there is potential for approximately 10 per cent of a paddock to be indirectly removed from production through well-site location.

Infrastructure will be sited in close consultation with the landholder to minimise impacts on cropping practices, i.e. along access tracks or farm boundaries. Potential well-drilling techniques, such as multiple wells drilled from a single well site will be investigated by QGC as this will assist in minimising disturbance to cropping land.

The choice of location for well sites and gathering lines will be done in consultation with the relevant landholder. This should result, as far as reasonably practicable in the siting of wells and gathering systems within individual paddocks to minimise disruption to cropping practices.

Where loss of cropping land occurs, compensation agreements will be negotiated with affected landholders on a case-by-base basis.

5.3.10.2 *Biosecurity for Organic (non-GM) Crops*

Farmers certified for organic produce will be identified and individually consulted as to the best practices to avoid contamination of organically grown crops. This will include measures to minimise the spread of genetically modified seeds.

Specific management measures will include seed transfer control and strict

entry management protocols will be implemented, including washing down of all potentially contaminated vehicles.

5.3.10.3 *Other Impacts – Cropping and GQAL*

Soil erosion, soil salinisation, land contamination, introduction of weeds, damage to farm infrastructure and benefits from beneficial use of Associated Water will be managed as per *Section 5.3.9, Agricultural – Pastoral* above.

Properties which are part of flood plain cropping practices, drainage changes will be designed in consultation with the landholder.

5.3.11 *Intensive Animal Activities*

5.3.11.1 *Disturbance to Animals*

Gas Field operations will not be conducted within areas that cause disturbance to animals at intensive animal-rearing operations. Temporary (less than one week) disturbance may occur during construction activities, but impacts are likely to be minimal. QGC will not enter any intensive animal-rearing properties, without prior consultation.

5.3.12 *Forestry*

There are no known timber plantations, other than state forests. However, timber plantations may be identified through consultation with landholders. Agreements will be reached with plantation owners and operators prior to any Gas Field infrastructure being constructed and operated. Compensation or offsets will be negotiated with landholders should Gas Field activities result in reduced returns from timber harvesting.

QGC has the potential, through the use of treated Associated Water, to assist forestry plantations in establishing new trees.

5.3.13 *Mining Tenures and Economic Mineralisation*

Land overlain by mining permits, claims and leases is subject to the provisions of the *Minerals Resources Act 1989 (Qld) (MR Act)*. QGC has considered the relevant provisions of the *MR Act* in determining the current proposed Gas Field petroleum tenures and will consult with mining and exploration companies to determine the preferred strategy to meet current and future needs.

5.3.13.1 *Sterilisation of Mining Resources*

The predominant mineral resource located in the Gas Field area is coal, with small areas of bentonite. It is not expected that extraction of

CSG will permanently sterilise other mineral resources.

5.3.13.2 *Delays in Accessing Mining Resources*

CSG extraction is not compatible with other forms of mining in the same area and may cause a delay in accessing other mining resources until the termination of the Project. QGC will consult with potentially impacted parties prior to establishing any Gas Field infrastructure in areas where current mining activities already exist.

5.3.14 ***Petroleum Tenures and Petroleum and Gas Deposits***

All petroleum tenures within the Gas Field are held by QGC. There are no known economically viable petroleum and gas deposits other than CSG within the Gas Field.

5.3.15 ***Extractive Industries***

5.3.15.1 *Quarries*

It is not expected that extraction of CSG will permanently sterilise quarry resources. CSG extraction is not compatible with quarrying in the same area and may cause a delay in accessing quarry resources until the termination of the Project. QGC will not attempt to establish Gas Field infrastructure, without prior consultation with potentially impacted parties, in areas where quarrying activities are occurring.

5.3.15.2 *Millable Timber*

Where commercially viable quantities of millable timber are identified with DERM, QGC will provide sufficient lead time for DERM to arrange for salvage of this timber. The use of timber cleared from state forests is described in *Section 5.3.3* and *Chapter 7*.

5.3.16 ***Native Title Representative Bodies (NTRB) Boundaries***

QGC is attempting to coordinate meetings to minimise the impact on the community and the native title claims process.

The aim of the negotiations is to seek broad consent for all current and future acts required to develop and operate the Gas Field, Pipeline and LNG Components for the life of the Project in return for benefits.

Queensland South Native Title Service has been approached to enter a service agreement with QGC to assist in certifying, where possible, the ILUAs for those claims for which they are the registered legal representative.

5.3.17 *Major Infrastructure*

Major public and private infrastructure includes gas pipelines, water pipelines, telecommunication lines, power lines, interconnector substations and aircraft facilities.

5.3.17.1 *Damage to Existing Infrastructure*

QGC will identify all infrastructure within the Gas Field, through such services as “Dial Before You Dig”. Infrastructure owners and operators will be consulted to ensure that all details regarding infrastructure locations are complete and accurate.

Gas Field activities will be conducted, where practical, to avoid known infrastructure. There may be instances where Gas Field infrastructure, such as gathering lines, may intersect other infrastructure. Parties affected will be consulted to determine the optimal method for avoiding damage, such as appropriate construction techniques.

5.3.17.2 *Temporary Disruption During Construction*

It may be necessary to temporarily cease operation of infrastructure, for safety reasons, when Gas Field infrastructure construction or maintenance intersects other infrastructure. This will be done in consultation with the relevant infrastructure owners or operators. Compensation agreements may be reached for lost income.

5.3.17.3 *Electrical interference*

High-voltage power lines have the potential to create unacceptable electrical interference with the steel gas-gathering pipelines if followed for long distances. To mitigate any potential adverse affects, at least 500 m separation will be maintained between any steel pipelines and power lines.

5.3.17.4 *Interconnector Substations*

Gas Field activities will not be conducted in interconnector substation zones. The relevant owners/operators will be consulted should Gas Field activities have the potential to interact with interconnector substations.

5.3.17.5 *Airports/Airstrips/Helipads*

There are no known commercial aircraft facilities within the Gas Field. All private aircraft facilities will be identified through consultation with landholders. All Gas Field infrastructure will be located to comply with all aviation safety requirements.

5.3.18 *Environmentally Sensitive Areas*

Measures to mitigate impacts on environmentally sensitive areas are discussed in various chapters of the EIS. *Table 3.5.11* identifies the chapter of the EIS in which the mitigation measure is described or describes the mitigation measure.

Table 3.5.11 *Environmental Values of Environmentally Sensitive Areas*

Environmentally Sensitive Area	Mitigation Measures
Endangered regional ecosystems	<i>Volume 3, Chapter 7</i>
Wetlands	<i>Volume 3, Chapter 7 and 8</i>
Rivers and lakes	<i>Volume 3, Chapter 7 and 9</i>
Areas zoned as biodiversity planning assessment or sites of ecological significance	Local councils will be consulted regarding development in areas zoned as Biodiversity Assessment Planning or Sites of Ecological Significance. Mitigation measures for impacts to biodiversity and ecologically important areas are discussed in <i>Volume 3, Chapter 7 and 8</i> .
Groundwater vulnerability areas	<i>Volume 3, Chapter 10 and 11</i>
Bushfire hazard zones	QGC will adhere to all local council mitigation measures to prevent bushfires. The Proponent has a strong incentive, from an internal risk perspective, to prevent bushfires. QGC will maintain fire breaks around infrastructure such as compressors and accommodation camps. In addition, there is the potential for treated Associated Water to be used to fight bushfires. A comprehensive Fire Management Plan will be developed. Mitigation measures for potential hazards are discussed in <i>Volume 3, Chapter 17</i>
Wildflower areas	Local councils will be consulted regarding development in areas zoned as Wildflower Habitat. Mitigation measures for impacts to wildflower habitats are further discussed in <i>Volume 3, Chapter 7</i> .
Wilderness areas	There are no Wilderness Areas that will be affected by the Gas Field.
Areas of state significance	<i>Volume 3, Chapter 7</i>
World Heritage Areas	There are no World Heritage Areas that will be affected by the Gas Field.
Wetlands of International Importance – Ramsar Sites,	There are no Ramsar, sites affected by the Gas Field.
Cultural heritage areas	<i>Volume 8</i> . Comprehensive Cultural Heritage Management Plan(s) will be developed.
Scientific reserves	There are no scientific reserves that will be affected by the Gas Field.

5.4 *GENERAL MITIGATION MEASURES*

Agreements with relevant parties will be reached to control any temporary impacts from operations. In most cases progressive rehabilitation will minimise the spatial footprint and land impacts of Gas Field activities.

Certain infrastructure, such as roads, pipelines and communications may be required by either administrative authorities or landholders. Agreements will be reached with these parties on whether QGC decommissions or passes ownership of long-term infrastructure to the respective stakeholders.

Mitigation measures to be implemented in association with land use and infrastructure include:

- ensuring appropriate buffers are maintained between Gas Field infrastructure and existing and planned development, or where this is not practicable, ensuring Gas Field infrastructure design meets the safety requirements for developed areas
- ensuring appropriate consultation with landholders and occupants in relation to the provision of access for Gas Field construction and ongoing maintenance during operation
- liaison with mining permit, claim or lease holders to consider overlapping tenure issues and ensure that existing legislation has been considered
- minimising impacts on GQAL through appropriate construction techniques and/or minimising construction and camps in areas designated as GQAL
- ensuring that the construction footprint and associated work areas are minimised in environmentally sensitive areas such as state forests and watercourse crossings and approaches
- ensuring that all gathering lines are appropriately signposted
- ensuring appropriate notification and management of noisy and dusty activities particularly in proximity to residential areas, roads and schools.

Volume 2, Chapter 15 of the EIS discusses rehabilitation and decommissioning post-depletion of CSG reservoirs and discusses the expected land use impacts.

5.5

CONCLUSION

The direct footprint of Gas Field Component infrastructure will be approximately one per cent of the total land area of the Gas Field tenements. Where Gas Field infrastructure impacts land users and other infrastructure, proposed mitigation measures will minimise those impacts.

When well sites and associated infrastructure are defined, a hazard and risk assessment can be undertaken to ensure that any impacts on land use or infrastructure are determined and negotiated with relevant parties. A summary of the impacts outlined in this chapter is provided in *Table 3.5.12* below.

Table 3.5.12 *Summary of Impacts for Land Use and Infrastructure*

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct and indirect
Impact duration	Short and long term
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: minor.