

Australian Pacific LNG Project

Volume 2: Gas Fields

Chapter 23: Matters of National Environmental Significance

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23 Matters of National Environmental Significance

23.1 Introduction

This chapter assesses the potential impacts on Matters of National Environmental Significance (MNES) associated with the proposed development of the Walloons coal seam gas fields (the gas fields) and associated infrastructure as part of the Australia Pacific LNG Project (the Project). The chapter has been prepared to facilitate the Australian Government's assessment of gas pipeline impacts on MNES under Chapter 4 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The EPBC Act provides for the identification and management of MNES including threatened flora and fauna species, ecological communities and migratory species protected under international treaties, internationally recognised significant wetlands and critical habitat areas.

The proposed development of the gas fields and associated infrastructure was determined on 3 August 2009 to be a controlled action requiring assessment and approval by the Commonwealth Minister for the Environment, Heritage and the Arts. This decision was on the basis of the referral (number: EPBC 2009/4974) received under the EPBC Act on 6 July 2009. The relevant controlling provisions under the EPBC Act were determined as being:

- Wetlands (Ramsar) (Sections 16 and 17B)
- Listed threatened species and communities (Sections 18 and 18A)
- Listed migratory species (Sections 20 and 20A).

Australia Pacific LNG lodged two other EPBC referrals with DEWHA relating to the Project as follows:

- EPBC 2009/4976 – Gas transmission pipeline
- EPBC 2009/4977 – LNG plant and associated facilities.

These matters are addressed in Volume 3 and Volume 4 respectively. Section 8 of the terms of reference (TOR) prepared by the Queensland Coordinator-General and Commonwealth Government for the Project's environment impact statement (EIS) requires that this chapter '*should bring together assessments of impacts on MNES in other chapters and produce a stand-alone assessment in a format suited for assessment under the EPBC Act*'. The format for this chapter is specified in Section 8.5 of the TOR and, as a result, the chapter is structured as follows:

- The balance of this section describes the proposed action (i.e. the construction and operation of the Australia Pacific LNG Project and associated infrastructure) and identifies the relevant technical and supporting studies
- Section 23.2 outlines the assessment methodology applied to ensure impacts on MNES are addressed
- Section 23.3 provides an overview of the affected environment, key impact mechanisms and values relevant to the controlling provisions
- Section 23.4 details the assessment of potential impacts on listed threatened ecological communities
- Section 23.5 details the assessment of potential impacts on threatened species

- Section 23.6 details the assessment of potential impacts on listed migratory species
- Section 23.7 details the assessment of potential impacts on Ramsar Wetlands
- Section 23.9 provides an outline of the environmental management plan (EM Plan) consisting of the key mitigation and management strategies detailed in Sections 23.3 to 23.4 and those relating to other approvals and conditions. This section also contains the required outline of the environmental record of the proponent (i.e. person proposing to take the action)
- Section 23.11 provides summary conclusions relating to impacts on MNES.

There are no listed heritage sites of global, national or state heritage significance within the gas fields' area and as such, no further discussion of these controlling provisions are provided in this chapter.

23.1.1 Project description

Overview

Australia Pacific LNG proposes to develop a world scale 18 million tonnes per annum (Mtpa) long-term coal seam gas (CSG) to liquefied natural gas (LNG) project in Queensland. The Project is significant by world standards. It is an exciting opportunity for the project proponents, the communities hosting project elements, and the interested local and global communities.

To supply the required quantity of CSG to support the Project at Gladstone, a series of CSG fields will need to be developed, along with the associated processing plant. While this infrastructure is not technically complex, it will be spread across a large region. The 30-year project being assessed by this EIS will involve:

- Developing the Walloons gas fields, including up to 10,000 CSG wells, in the Surat Basins in Queensland's Western Downs region
- Constructing and operating an LNG facility adjacent to Laird Point, Curtis Island near Gladstone for exporting up to 18 million tonnes of LNG each year
- Constructing and operating a 450km main gas pipeline to connect the Walloons gas fields with the LNG facility.

The project will also require associated infrastructure including gas compression, power generation and water treatment facilities, as well as networks of low pressure gas and water pipelines, high pressure gas pipelines, road and access tracks and communications. Warehousing, temporary and permanent accommodation facilities, road upgrades and logistics-related infrastructure will also be needed.

Project planning is underpinned by key sustainability principles and a risk management approach. Australia Pacific LNG will continue to openly engage with the community to ensure that their interests are identified and incorporated into the project planning and delivery stages to the greatest degree possible.

Location

The Australia Pacific LNG gas fields are located in Queensland's Surat Basin on the Western Darling Downs. They cover an area of approximately 570,000 hectares. The nearest townships are Wandoan, Miles, Condamine, Chinchilla, Kogan and Millmerran. An overview of the Project's location is provided in Figure 23.1 .

23.1.2 Key components of gas fields' development

This section describes the key components of developing a CSG field and how these work together; from initial exploration and drilling of the wells through to the point where the gas is delivered from the gas fields' gathering and processing pipeline system to the main gas transmission pipeline (gas pipeline) for delivery to the Project's LNG facility on Curtis Island.

Overview

Coal seam gas development differs significantly from developing conventional natural gas. To produce gas from a coal seam, normally the water must first be withdrawn using artificial lift (pump) installed in the well at the depth of the coal seam being targeted. This reduces the pressure within the coal seam and liberates the adsorbed gas from the coal.

An individual CSG well generally produces less gas than conventional natural gas wells, irrespective of the extent of dewatering. More wells must be drilled per area to make a project viable, compared to an equivalent natural gas development. Wells may be located as close as 500m apart once an area is fully developed. This project development is based on a 750m well spacing, while actual well spacing may be greater or less depending on reservoir characteristics or location constraints.

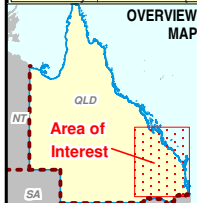
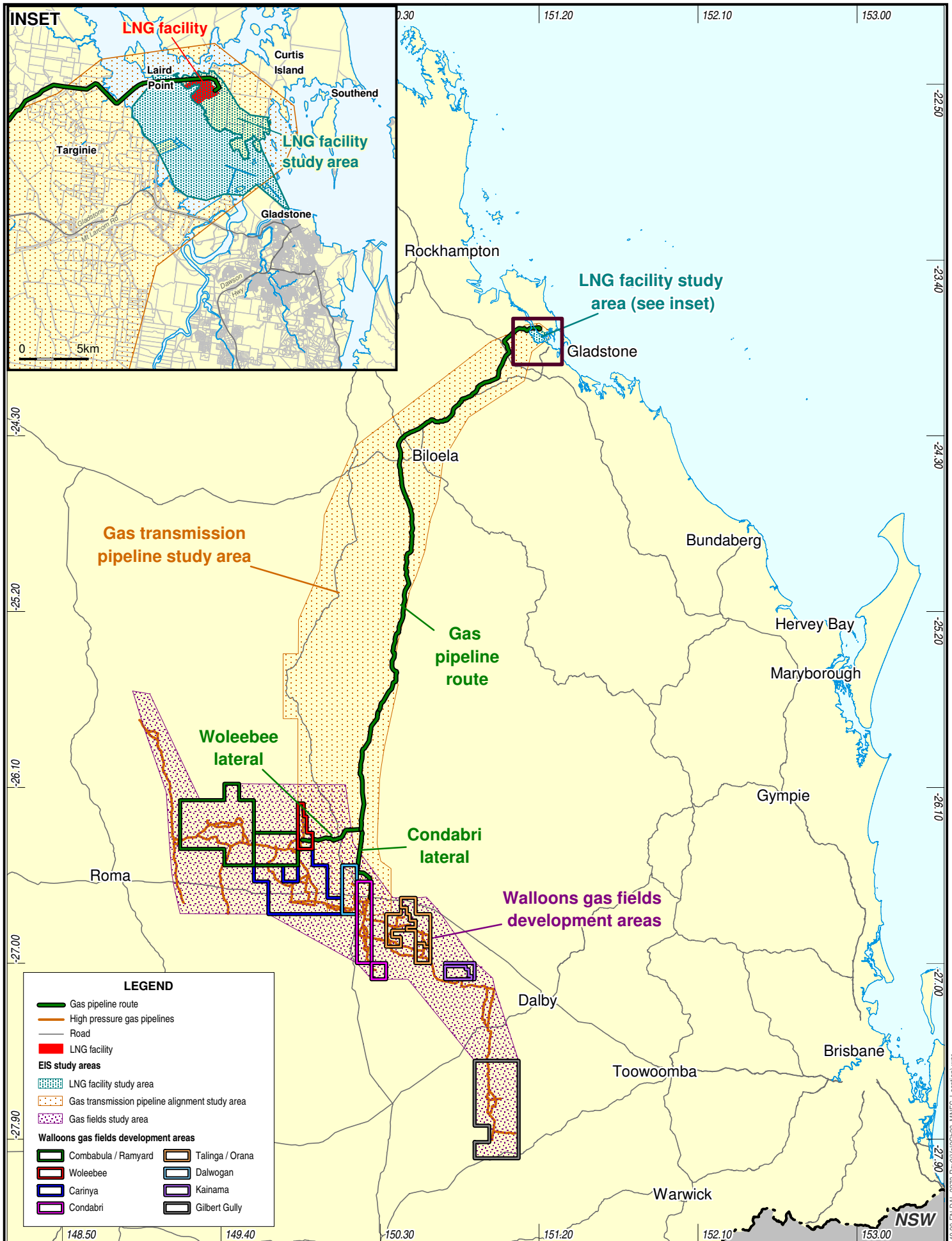
Associated water production declines during the life of the well as gas production increases. Once sufficient water has been removed, or 'dewatered', the gas will begin to release. Over time, as the amount of water being pumped declines, the gas flow increases until it reaches a maximum or 'peak' flow. It then tapers off to a long period of almost constant low flow or 'post-peak' flow.

Water continues to be produced throughout the life of the well, but in reducing quantities. This, combined with new wells brought on line to maintain gas production, means that water treatment infrastructure is required throughout the life of the Project.

The period between initial dewatering, peak gas production and minimum constant flow from a well, varies across the different CSG fields, as well as between individual wells in the same field. A single well could 'peak' at any time, from under one year to almost three years.

Field planning

From the information obtained during the exploration and pilot studies the field development is planned. The actual location of wells, gas and water gathering system, and access tracks is designed using constraints mapping giving consideration to topography, vegetation, cultural heritage and impact on landowners. Where possible, previously disturbed areas are utilised for petroleum infrastructure, and gathering network and access tracks are co-located. Selected locations are refined during site inspections, in consultation with landholders and other associated stakeholders.



SOURCE INFORMATION

Roads
Department of Main Roads 2009

Towns
Department of Main Roads 2009

Digital cadastral database
Department of Natural Resources and Water 2009

0 50 100km

SCALE - 1 : 2,750,000 (at A4)

Latitude/Longitude

Geocentric Datum of Australia 1994

N

AUSTRALIA PACIFIC LNG PROJECT

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Figure 23.1 - Overview of project location

Drilling

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

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

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

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

Figure 23.2 shows a layout of a typical drilling lease. The drilling rig first drills the surface section of the hole which takes around one day. A casing is then cemented in place, by pumping cement into the wellbore and circulating back through the casing/well ring. This cement isolates any shallow surface aquifers and prevents cross contamination.

The second stage is to drill the production section of the hole, which is cased with perforated casing across the coal seams to allow CSG and associated water to flow into the well. Above the coal seams the casing is cemented back to surface to prevent any contamination of aquifer sands. It will usually take around two to three days to drill the wells to a depth of 600m to 1,000m. The drilling rig is then packed up and moved to the next well.

Australia Pacific LNG is intending to use a new drilling rig technology which has the opportunity to significantly reduce the lease size required as well as reduce the time required to drill wells and improve safety for the rig workers. Figure 23.3 shows a typical drilling rig used by Australia Pacific LNG.

Completions

Following the drilling program, a completions rig is mobilised to site, assembled and then drills through the cement barriers left by the drilling and installs the equipment required to operate the gas well. The completions rig has the same equipment as the main drilling rig.

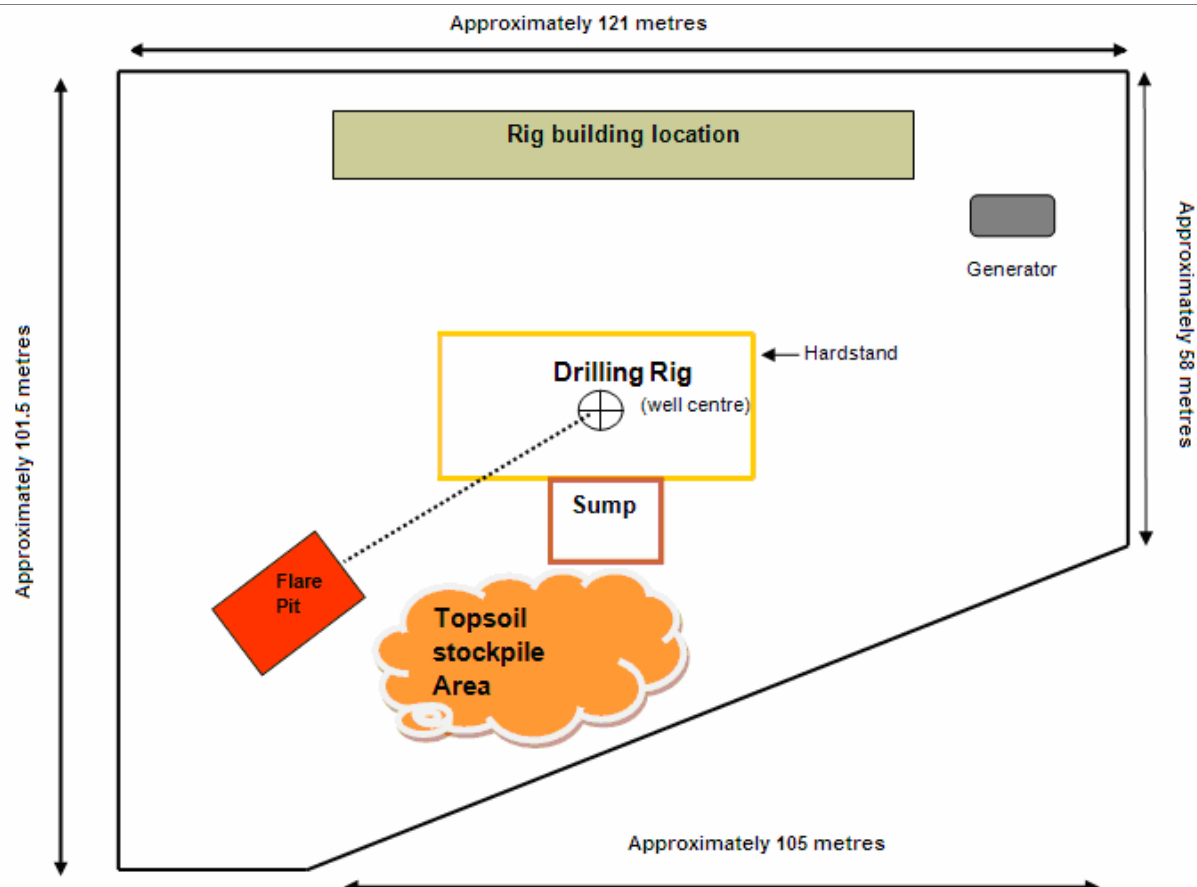


Figure 23.2 Layout of a typical drilling lease



Figure 23.3 A typical drilling rig used by Australia Pacific LNG

Well production

Wellhead and separation equipment is installed to separate the well flow into two streams – gas and associated water. The lease sites are progressively rehabilitated at this point. Wells are typically operational for 30 years.

The typical surface facilities associated with a CSG well are:

- A wellhead through which the gas and associated water is brought to the surface
- A pump that lifts the associated water to the surface
- A micro turbine or other power supply to drive the pump
- A wellhead separator with associated control devices.

All these facilities will be appropriately fenced. Australia Pacific LNG proposes to primarily use gas fired micro-turbines for power generation. These are totally enclosed highly reliable systems that run on CSG. However in flood prone areas, alternative gas-fired power supply packages may be used.

In the early life of field areas, before produced gas is available, liquefied petroleum gas (LPG) may be used as a fuel for power generation.

As the well pressure declines, a small compressor may be required at the wellhead to ensure that maximum recovery of available gas is achieved. At this time, a pump may also be required to maintain water transfer. Alternatively, 'nodal' compression, which are small compressors used in field to support naturally declining well and pipeline operating pressure may be installed and this would serve a number of wells.

Gas and water gathering network

Flow from the well is separated into water and gas in a small vessel called a wellhead separator. Some gas will be entrained in the water and some water will be present with the gas. After separation occurs at the wellhead, the low pressure CSG from each of the wellhead separators flows into a network of low pressure buried pipelines. These interconnect all wells operating in a specific area to form the gas gathering network. The entire gas gathering system up to the gas processing facility (GPF) may operate at pressures of up to 830 kilopascal gauge (kPag), and will be constructed from high density polyethylene pipe.

The gas flows through several subsystems which direct the gas to the central GPF. Each GPF is typically served by wells in an area covering an approximate nine kilometre radius or 'drainage circle'. However, judicious design of the gas gathering network may allow a larger drainage circle, and thereby minimise the number of gas processing facilities required.

After separation at the wellhead, the associated water flows into a similarly buried high density polyethylene pipeline network. This forms the water gathering network which channels the water to the nearest water treatment facility (WTF). The system up to the WTF operates at pressures between 210 and 1,230kPag, depending on the terrain.

Where topographical constraints are unavoidable, water transfer stations are established. The transfer stations are predominately comprised of a holding pond and pumping station constructed on a concrete pad.

Gas processing facilities

Coal seam gas is compressed and dehydrated at the GPF to remove any remaining water. It is then sent to the high pressure gas pipeline network for transmission to the LNG facility.

Figure 23.4 shows the existing Spring Gully GPF. The gas processing and compression area is in the background, behind the offices and workshop area. The new facilities for the Australia Pacific LNG project may be somewhat larger than the Spring Gully facility, and would use a different compression configuration, but the facility layout would be similar.

Based on a conservative nine kilometre drainage circle radius, Australia Pacific LNG's CSG development could have a maximum of 23 gas processing facilities across the entire development area, over the 30-year life of the Project. The final design will aim to minimise the number of installed facilities. Each facility would handle 75, 150 or 225 terajoules per day (TJ/d) of gas production, and would be based on 75TJ/d modules.

Environmental, hazard and risk, social and cultural heritage values were part of the decision making process for the GPF locations, utilising multi-constraints criteria analysis.

The development timing for these facilities will be staged to coincide with drilling program progress. Facility sizes will vary from location to location based on the predicted production rates from each gas field.



Figure 23.4 Spring Gully gas processing facility

Water treatment facilities

Associated water from the low pressure gathering network is delivered to the WTF's feed pond. At this location the associated water is treated using a variety of processes, potentially including desalination via reverse osmosis technology.

Water treatment options create two streams; permeate (freshwater), and brine (highly saline). A range of disposal options are currently being developed for both streams, according to regulatory policy.

Proposed disposal options are likely to include associated infrastructure, such as transmission pipelines for permeate and lined storage ponds for brine. The associated facilities will vary in size depending on the production of associated water.

The treated water could be suitable for a number of uses. This might include commercial use, such as;

- For mining, power stations or feedlots.
- Irrigation water for local agriculture or appropriate plantations.
- Supplement community water supplies and environmental flows,
- To recharge aquifers like the Great Artesian Basin.
- For CSG industry aggregation of associated water for beneficial re-use.

Associated water typically contains between 0.5 and 30 grams of salt per litre, which refers to sodium chloride or 'common salt'. While the associated water may contain over 4g/l of salts, the sodium chloride content may be less than 0.5g/l of salt, with the remainder being primarily sodium carbonate and sodium bi-carbonate. Australia Pacific LNG has an existing WTF that uses reverse osmosis technology and operating successfully at the Spring Gully field (Figure 23.5). Up to 85% of the associated water can be recovered using reverse osmosis as treated water with a salt content of less than 0.15g/l. Fresh water is typically less than 0.5 grams of salt per litre so post-treatment may be required to ensure compatibility, depending on the final use of the treated water. Regardless of the type of salts present, this water has limited uses in its untreated form, so needs to be treated to produce a clean water product.



Figure 23.5 Spring Gully water treatment facility

Water from gathering networks flows into the feed pond at the WTF. The pond is mainly an inlet collection system for the facilities and provides buffer storage capacity, some cooling, and separation of coarse suspended solids. Reverse osmosis is a specialised filtration process often used for water treatment, where pressure forces a solution through a membrane that traps most of the dissolved components. The result is 'permeate', while the dissolved salts are kept aside as a concentrated solution. This process reverses normal osmosis where clean water naturally moves from an area of

low solute concentration, through a membrane, to an area of high solute concentration. No external pressure is applied.

The treated water or 'permeate' leaves the reverse osmosis unit and may need to be further treated before being disposed of in an approved manner. Meanwhile, the brine stream from the reverse osmosis unit is routed to the lined storage pond, where evaporation will cause further concentration. Final salt disposal options, which are still under investigation, include:

- Producing potentially saleable salt products
- Implementing salt crystallisation and burying salts in approved waste management facilities
- injecting high concentration brines into deep, hydraulically isolated geological reservoirs.

Apart from brine, waste from the WTF primarily consists of filtered solids and other chemical cleaning solutions. This waste would be biodegraded and recycled via feed ponds where technically practicable. Any remaining streams would be combined into the brine waste stream.

Filtration solids collected prior to reverse osmosis treatment will be dewatered and appropriately managed via soil treatment. Beneficial use of this material is subject to the sludge composition which may form part of the brine re-use options that are subject to Department of Environment and Resource Management (DERM) approvals.

It is expected that each WTF will have oily wastewater in very small volumes of less than 20m³/yr per facility. This will be directed to the nearest GPF oily water treatment system and appropriately managed as discussed in the EM Plan. Grey and black water will be managed on a site-by-site basis, according to current regulations.

Stormwater will be managed by firstly diverting it around the facility. Stormwater collected on the facility site will be captured through a conventional stormwater system. This usually includes a trench network, valves, sumps and sedimentation ponds. Stormwater is tested in the sedimentation ponds and released when discharge criteria is achieved.

All associated water, plant wash down water and other wastes will be segregated from stormwater systems. All process area wash down wastes will be captured and returned to facility feed ponds for reprocessing. Chemicals commonly used in the water treatment facilities are included in Table 23.1 .

The typical facilities associated with a WTF are lined water feed ponds, reverse osmosis feed pumps, reverse osmosis facilities, lined storage ponds for high salinity brine water, and power generation. The estimated footprint of the components of a 40ML/d WTF is:

- Reverse Osmosis (RO) Facility – 4ha
- Feed pond – 5-20ha
- Brine storage pond – 140-210ha.

Strategically the associated water treatment facilities have been located centrally to several gas development fields. The centrally located sites have been determined through multi-criteria analysis. This ensures environmental, hazard and risk, social and cultural heritage values are identified and are part of the decision making process.

The facilities are modular and responsive to actual development sequence and produced water flow rates. For the scale of development being considered, a modular 20ML/d facility has demonstrated to be the most efficient. These facilities can be further optimised by adopting incremental increases of 5ML/d, as required.

Table 23.1 Chemicals used in water treatment facilities

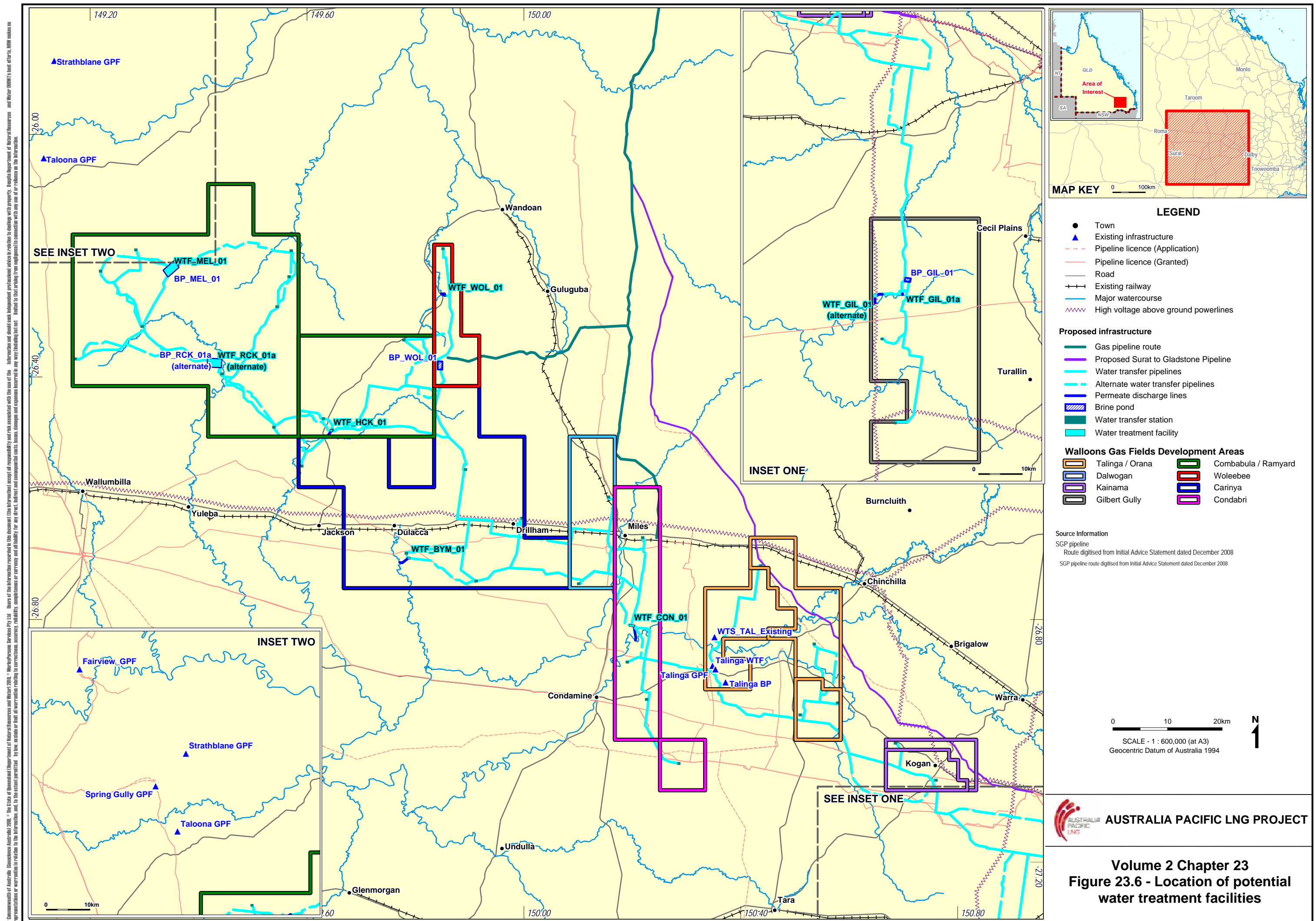
Chemical	Packaging type	Estimated storage for max. 80 ml/d facility (m3)	Notes
Anti-scalant	Bulk	48	Non-dangerous good
Biocides	Bulk	8	Class 6, packaging group III
Citric acid	Bulk	33	Non-dangerous good
Diesel	Bulk	6	Emergency generator, Non-dangerous good, combustible liquid
Hydrochloric acid	Bulk	150	Class 8 packaging group II (33%) if ion exchange is part of design.
Anhydrous Ammonia	Bulk	2	Class 2.3 Toxic Gas
Chlorine	Bulk	5	Class 2.3 Toxic Gas
Lubrication oil	Bulk	7	Non-dangerous goods, combustible liquid, self-bunded tanks
Sodium bisulphate	Bulk	70	Class 8 dangerous goods, packaging group III
Sodium hydroxide	Bulk	58	Class 8 dangerous goods, packaging group II
Sodium hypochlorite solution	Bulk	45	Class 8 dangerous goods, packaging group III
Wet waste oil tank	Bulk	7	Non dangerous goods, combustible liquid, self-bunded tanks

Note: Around 30 miscellaneous chemicals and blends of chemicals (reagents) in small quantities will also be used.

The development timing for these facilities will be staged to coincide with the progression of the drilling program. Associated water is produced from the wells in relatively large volumes before significant gas production, so all associated water handling infrastructure must be in place before the wells go on line. The plant sizes will vary from location to location, based on forecasts for collective well performance in each gas field.

Eight possible locations for water treatment facilities have been identified across the entire development area. These are shown in Figure 23.6, along with the map references, capacities, and notional development timing. Only six locations are likely to be required to support the entire gas fields' development, so two of these are considered to be 'alternative locations'.

These water treatment facilities would only be provided as and when the respective gas fields were developed. Each would be expected to have a capacity of between 20 and 80ML/d of associated water, depending on water production at the time.



Brine ponds

The salts removed from the associated water during reverse osmosis treatment are concentrated into a low volume reject or 'brine' stream. This has a salt content of around 60 grams of salts per litre. This brine will be stored in fully engineered, purpose-built, lined ponds to further concentrate the stream by evaporation.

Prior to transport to the ponds, small amounts of brine may be blended for reprocessing through the reverse osmosis plant. The majority of the effluent stream will be piped to the identified pond location.

At this stage it is anticipated that only one of the potential six water treatment facilities would include brine ponds as part of the WTF itself. Remote brine ponds would be provided for the remaining five facilities with consolidation to minimise locations.

Water transfer stations and water transfer network

Associated water will be collected at water transfer stations, usually located at low elevations. From there it will be pumped to higher elevations for reintegration into the collection system and treatment at the water treatment facilities.

High pressure gas pipelines

To enable delivery of the CSG to the LNG facility at Gladstone, a network of in-field high pressure pipelines will be developed which will collect gas from a number of gas processing facilities in the gas fields and deliver it to the gas pipeline. The high pressure pipeline network also joins the gas processing facilities to the existing transmission pipelines in the region. The in-field high pressure gas pipeline network consists of the following:

- Fairview to Spring Gully pipeline
- Spring Gully to Wallumbilla loop
- Combabula Lateral, including the:
 - Pine Hills spur line
 - Reedy Creek spur line
 - Combabula 2 spur line
 - Combabula 1 spur line
 - Ramyard spur line
- Condabri south lateral, including the:
 - Condabri south nodal spur line
 - Condabri south spur line
 - Condabri central spur line
- DDPS Pipeline related supply, including:
 - DDPS Condabri link
 - Talinga spur line (existing)

-
- Orana spur line
 - Kainama spur line.
 - Associated pig launchers and receivers (scraper stations):
 - Connections for future gas processing facilities
 - Mainline valve facilities.

Where practicable, it is planned that the high pressure gas pipeline network (Figure 23.7) will be collocated with other infrastructure like the low pressure system, roads, tracks and fibre optic cable. The high pressure gas pipeline network operates in free flow mode as the gas processing facilities include adequate discharge compression capacity.

Additional booster compression at the Talinga Metering Station may be required to flow gas from the spur lines feeding the eastern section of the existing Darling Downs Power Station Pipeline into the western section of the existing Darling Downs Power Station Pipeline before delivery to the Darling Downs Power Station Condabri Link.

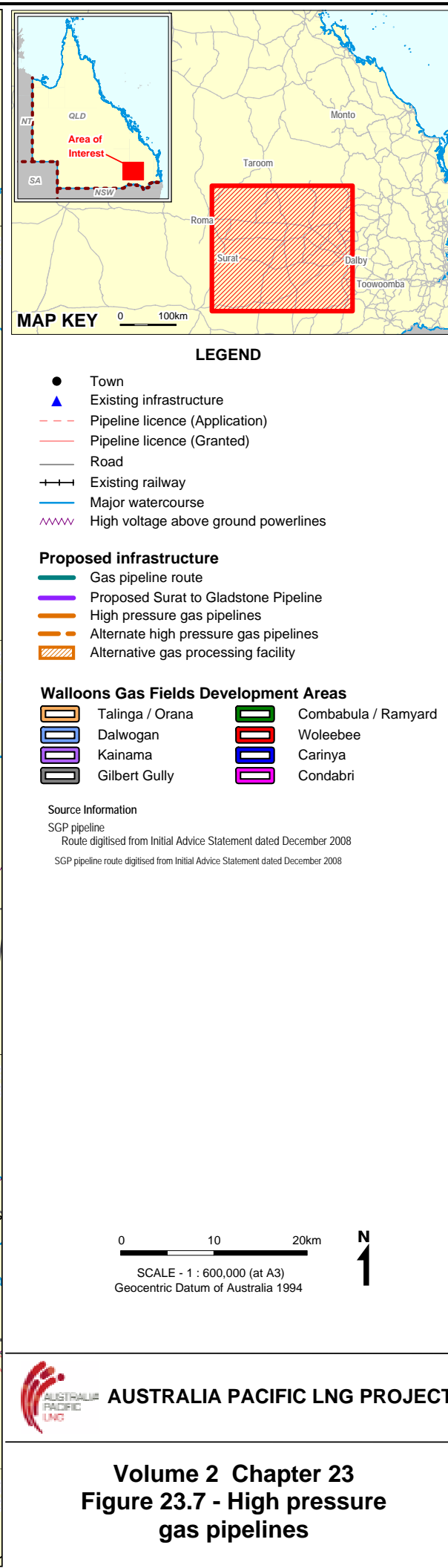
The design, construction, operation and rehabilitation of all pipelines will be in accordance with Australian Standard 2885.

Rehabilitation and decommissioning

Once infrastructure is no longer in use, it is removed and re-used, recycled, or disposed of. The disturbed area is then rehabilitated to the original land use.

The DERM requires a financial assurance to be lodged as part of the application for an environmental authority, which is a necessary approval for the field development. This financial assurance is updated throughout the life of the environment authority in accordance with the approval conditions of the project.

An effective decommissioning and rehabilitation plan will also include a timely and well-constructed stakeholder engagement program to inform the community of the facility's closure.



Decommissioning and rehabilitating the gas processing facilities, water treatment facilities, well sites and connecting pipelines will involve:

- Stakeholder consultation
- Environmental assessment
- Preparatory works
- Cessation of production
- Pipeline decommissioning
- Peripheral equipment decommissioning
- Process equipment decommissioning
- Electrical and control systems decommissioning
- Buildings decommissioning
- Tanks and ponds decommissioning
- Material and equipment removal and disposal
- Hazardous material treatment
- Site clearance, such as removal of roads, drains, fences and other project related infrastructure and/or components
- Site rehabilitation.

While these activities are listed in their typical order of occurrence, they would not always occur in this sequence.

Supporting infrastructure

Telecommunications

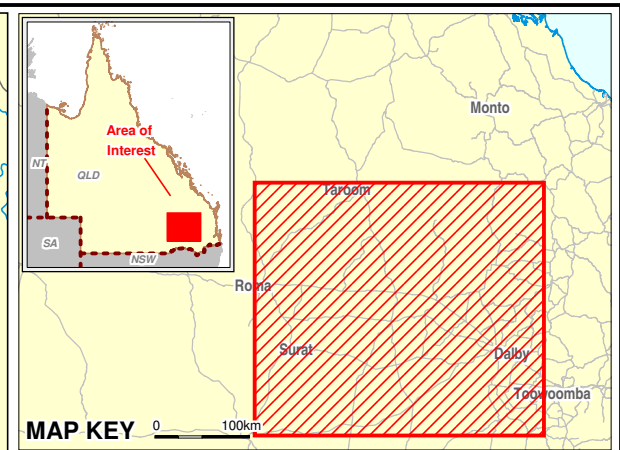
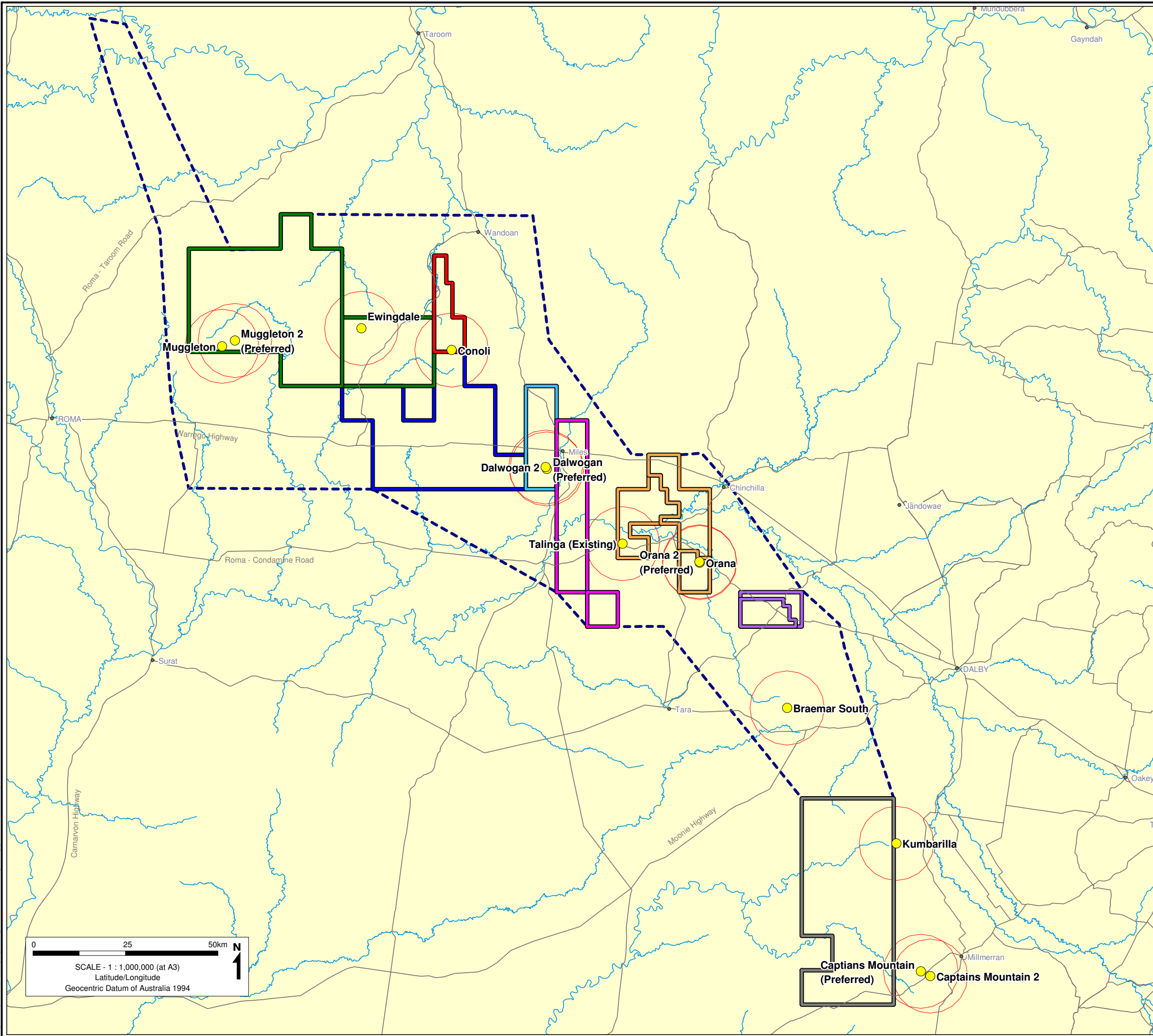
Telecommunication equipment will be installed early in the construction phase. Telecommunications is essential during construction and to ensure the health and safety of employees and contractors.

Data and voice communications will be used on construction sites via the proposed microwave backbone infrastructure which will interface with the telecommunication carriers' service positioned at designated centres. The disturbance area should not exceed 70m by 70m, with the tower as a central point.

This area will be a fenced compound to maintain security and safety requirements, as it includes the anchor points used to stabilise the tower. Locations for the telecommunication towers are shown in Figure 23.8 , and an example of a telecommunication tower is shown in Figure 23.9.

During the post construction phase, the microwave infrastructure will remain. Telecommunications towers will also be used for wireless communication applications such as two way radio and wireless data. To mitigate potential disturbance, access tracks to the microwave tower sites will be provided by direct route from main project roads, where the terrain will allow it.

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MAP KEY

- Major towns
- Road
- Major watercourse
- Gas field study area

Walloons Gas Fields Development Areas

Talinga / Orana	Combabula / Ramyard
Dalwogan	Woleebee
Kainama	Carinya
Gilbert Gully	Condabri

Communication Towers

- Communication tower locations
- Communications tower 10km buffer

Source Information

Roads
Towns
Queensland Department of Main Roads 2009
Communication tower locations
Supplied by Origin Energy on 07/10/2009



Figure 23.9 Example of a telecommunications tower

For operations, fibre optic cable will also be used for communication between control centres (administration buildings) and the respective facilities. Where possible, the fibre optic cable will be co-located in a trench with gas or associated water pipelines. The overall telecommunications infrastructure including fibre optic cable, microwave towers, radio repeater stations and wireless are required to support:

- Business data and voice network services, for access to all corporate data applications and telecommunications services, Australia Pacific LNG's internet protocol (IP) telephony based system, and all communications outlets at each in-field facility. Wireless local area network (LAN) access to network services may be provided in future
- Radio services for mobile two-way radio devices, and coverage for all in-field operational areas including well sites and along the high pressure gas pipelines
- Control network services, for network connectivity for control and telemetry equipment at all sites and pipeline valve stations. All control/telemetry traffic is to be segregated from business systems traffic using physically separate network equipment and cabling.
- Security systems, as use of the telecommunication infrastructure for network communications between closed-circuit television equipment and other security equipment may be required in future.

Transport

The transportation of workers and materials for construction and operations for the entire project will utilise a number of methods. These methods will include road traffic, rail traffic, air traffic and shipping traffic. The Project supply chain for the gas fields will extend from Brisbane to regional hubs along the Warrego Highway such as Dalby, Roma and Miles. From these centres construction materials, equipment, products, wastes and personnel will move to and from the gas fields.

Peak construction activities may employ up to 2,100 workers directly and numerous support industries delivering goods and services to the Project, all of which will utilise the transportation network.

Numerous upgrades to road networks are anticipated in the gas fields from the Project's activities. Each of the intersections and road networks which have been identified as potentially requiring upgrades are detailed in Volume 2 Chapter 17. Australia Pacific LNG is currently in discussions with Queensland Rail for the use of rail in the Project and to identify if upgrades would be required to the rail network.

The air transportation network was also identified as potentially requiring upgrades to meet the demands of the gas fields' developments, specifically the Miles Aerodrome and the Dalby Airport. Airport upgrades will be further assessed once a further understanding of movements of non resident workers to and from the gas fields is understood.

The Gladstone and Brisbane Ports are not expected to require additional expansion resulting from the Projects activities. Australia Pacific LNG will work with the responsible authorities for the movement of materials through the Ports. It is not anticipated that Port upgrades will be required for the Project.

During the construction and operations phases of the project, non resident workers will travel to and from their places of work in Brisbane, Roma, Miles, Dalby using both air and road networks. On a daily basis, workers will travel from their homes or temporary and permanent accommodation facilities (50 to 800 workers per facility) using buses and small capacity working vehicles (e.g. welding trucks, drilling trucks, heavy trucks) and personnel automobiles.

The supply chain of construction and operations materials may be transported using any combination of the following:

- From overseas to Australia via shipping
- From the port of Gladstone and the port of Brisbane to the operational areas via truck and rail
- Overseas and domestic via air.

Peak traffic volumes will occur during the construction phase of the project in both gas fields and access areas along the high pressure pipeline right of way. These activities should be localised and short term, as the construction and development is completed and these workforces are relocated.

Heavy trucks will be utilised to move earth moving equipment, drilling rigs, modular gas plant and WTF components. These loads will be delivered where practicable between 6:30am and 6:30pm to laydown areas, construction sites and well sites. It is anticipated that peak daily traffic for all activities across the gas fields' development area may be greater than 500 vehicles per day.

It is anticipated that during the operational phase of the project traffic movements will plateau to an average daily volume of 450 to 500 vehicles across the entire gas fields' area.

Workforce and accommodation

Construction

During construction activities the workforce, including contractors, is expected to live in onsite temporary accommodation facilities. Temporary accommodation facilities will be required to house between 50 and 800 personnel, and be constructed near the proposed project infrastructure locations.

Peak construction workforce numbers for the entire gas fields are likely to be up to 2,100 people. These temporary accommodation facilities will move as new areas are developed. There will be a requirement for temporary accommodation facilities to house construction workers over the life of the Project although the peak need will be during the first five years.

Temporary accommodation facilities will require relevant statutory approval for their construction and will be operated in a manner that does not adversely affect the nearby community. The facilities will include individual units, mess halls, recreational facilities, utilities, car parking, sewage treatment plants, administration facilities and waste management areas (Figure 23.10).

Sewage from small temporary accommodation facilities such as drilling rigs and advance accommodation facilities will be disposed of on-site in an appropriate manner.



Figure 23.10 Indicative layout of a temporary workforce accommodation facility

Operation

The operation of the gas fields will be a major development in the region, requiring an operational workforce of around 520 people in 2016 (increasing to 824 people around 2027). It is expected that initially most of the operational workers will be housed in permanent accommodation facilities that will be set up by Australia Pacific LNG in the vicinity of key infrastructure within the fields. It is also expected that some of these workers will be housed in Roma (50 people in 2016), Miles (50 people in 2016) and Brisbane (50 people in 2016), as they will act as logistics hubs.

Operational workforce requirements for Australia Pacific LNG will consist of approximately 520 people in 2016 and increasing to 824 people around 2027.

Australia Pacific LNG intends, where possible, to recruit locally for its operational workforce but expects a large proportion of staff will work on a fly in fly out and drive in drive out basis.

An integrated workforce and logistics strategy is being developed to address, among other elements, detailed health and safety and environmental planning.

23.1.3 Relevant technical and supporting studies

The description of potential MNES impacts associated with the gas pipeline contained in this chapter includes information derived from the following technical and supporting studies commissioned for the Project's EIS:

- Terrestrial Ecology and Impact Assessment Report: Gas Fields Component – Australia Pacific LNG Project EIS, undertaken by Biodiversity Assessment and Management (BAAM) for Worley Parsons on behalf of Australia Pacific LNG, December 2009
- This report is included as Volume 5 Attachment 14. It comprised a desktop review of existing data followed by field investigations of the gas fields' study area. The report discussed the potential impacts and recommended mitigation measures for the threatened and endangered communities and species, including those listed under the EPBC Act
- Aquatic Ecology, Water Quality and Geomorphology Impact Assessment – Gas Fields, undertaken by Hydrobiology for Australia Pacific LNG Project (Upstream), December 2009
- This report is included as Volume 5 Attachment 14. It described the existing environment and provided an assessment of potential impacts associated with the gas fields' element of the Australia Pacific LNG Project on aquatic ecology, water quality and geomorphology. This included consideration of potential MNES impacts.

23.2 Methodology

The assessment of potential MNES impacts relating to the gas fields involved the key activities outlined in this section.

Desktop reviews of relevant literature and existing data was undertaken, along with field reconnaissance surveys to identify locations within the study area likely to contain important ecological values of relevance to MNES and to locate suitable sampling points for collection of additional data needed to assess potential impacts. Desktop research included searches utilising the EPBC Protected Matters Search Report, the QLD Herbarium HERBRECS Flora Collection Records, Department of DERM Wildlife Online Database, Birds Australia database and Queensland Museum Fauna Collection Records.

In order to identify vegetation patterns and key investigation areas and gain an appreciation of the proximity of the proposed project area to sensitive areas, the desktop assessments included reviews of recently acquired satellite imagery, the DERM Regional Ecosystem RE mapping (Version 5.0 during the mapping process and Version 6.0 during the impact assessment process when it became available) and Regulated Regrowth Vegetation mapping (Version 1.0) and the RE description database (Version 6.0 November 2009). In addition, the DERM Essential Habitat, Queensland Wetland and Environmentally Sensitive Area mapping and Directory of Important Wetlands database were reviewed to identify important environmental values including any nationally important wetlands within the wider study area.

Sampling of established water bodies was undertaken during field deployments from April to October 2009. Sampling sites were selected based on a desktop review of information followed by a helicopter assisted reconnaissance survey. The reconnaissance survey enabled rapid assessment of suitable water bodies to be sampled according to habitat features, accessibility and availability of water.

Final sampling sites were selected to provide representative examples of stream types, habitats and ecological features and to adequately assess the range of potential impacts throughout the gas fields.

Details of the sampling program and methods are provided in Volume 5 Attachment 17.

Terrestrial field surveys were conducted, particularly between 22 April and 8 May 2009 and between 27 July and 28 September 2009. This included an investigation of the presence/absence or likely presence/absence of EPBC-listed flora and fauna species and communities identified from the desktop assessment.

Terrestrial flora and fauna ground surveys were undertaken, involving a combination of targeted species searches, general habitat assessments and verification of current DERM-certified RE mapping. The primary aims of these surveys were to produce project-specific vegetation/habitat mapping and enable the prioritisation of terrestrial ecological values to inform the subsequent terrestrial ecology sensitivity analysis and impact assessment for the Project.

Sites surveyed were selected based on their RE status under the Queensland Vegetation Management Act 1999 (VMA), size of the RE patch, size of the tract of remnant within which the patch is located, connectivity with other remnant vegetation and presence of riparian corridors. A representative sample of RE types was also targeted, regardless of status, to gather information on species that characterise these vegetation communities and factors affecting their general condition.

Preliminary surveys were targeted towards locating significant flora and reptile species during suitable seasonal conditions, with incidental data collected for other terrestrial vertebrate species. All subsequent surveys involved RE verification/mapping conducted concurrently with general assessments of fauna structural habitat and fauna species-specific habitat assessments. Flora and/or fauna surveys were also carried out opportunistically at sites deemed suitable when in the field, typically within State Forests, road reserves and stock reserves

Interpretation and integration of existing scientific knowledge (e.g. contained in databases and published research), field survey outcomes and habitat preference analysis to identify and document likely impacts on MNES matters such as EPBC Act-listed species and communities. This involved documenting analysis in terms of the significant impact criteria (provided in DEWHA's Significant Impact Guidelines) relevant to potential MNES impacts of the Project. Species for which potential habitat was found to be present were analysed based upon the known ecology of each species.

The assessment activities are explained in detail in Volume 5 Attachment 14 and Volume 5 Attachment 17.

23.3 Overview of the affected environment, impacts and values

This section outlines the affected environment, impact mechanisms and values relevant to the controlling provisions.

23.3.1 Terrestrial environment

The gas fields are entirely located within the Brigalow Belt South bioregion. The Brigalow Belt spans inland and eastern Queensland from Townsville in the north to northern New South Wales, covering an area of about six million hectares. Only about 2% of the Brigalow Belt is protected in conservation reserves.

Most of this bioregion is used for agriculture, particularly cattle grazing in the rangelands. Endangered ecological communities representing Brigalow, semi-evergreen vine thicket and weeping regional ecosystems (REs) open woodland are present within the study area. Although included with the results of the EPBC Act online protected matters search tool, no occurrences of the remaining three endangered ecological communities have been confirmed or are considered likely for the gas fields' study area. These are 'natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland', 'the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin', and 'white box-yellow box-Blakely's red gum grassy woodland and derived native grassland'.

The study area is part of a highly modified landscape, within which some large remnant tracts of vegetation persist. Such remnants are primarily on less fertile lands at higher altitudes and support ecosystems which are well-represented regionally and are mostly incorporated within the State Forest network. The more fertile, lower altitude lands are intensively grazed, and generally have only small, more isolated patches of remnant vegetation remaining.

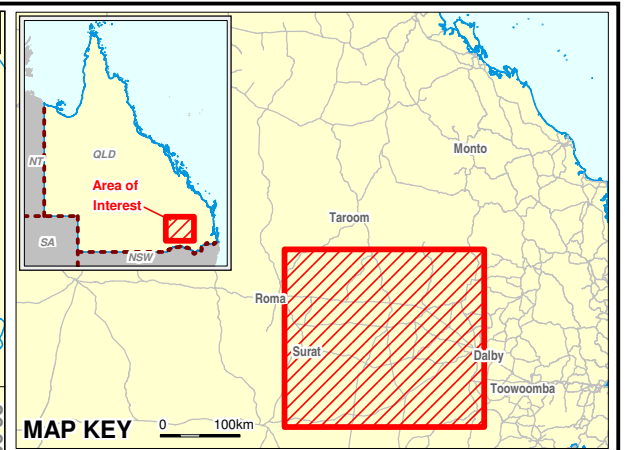
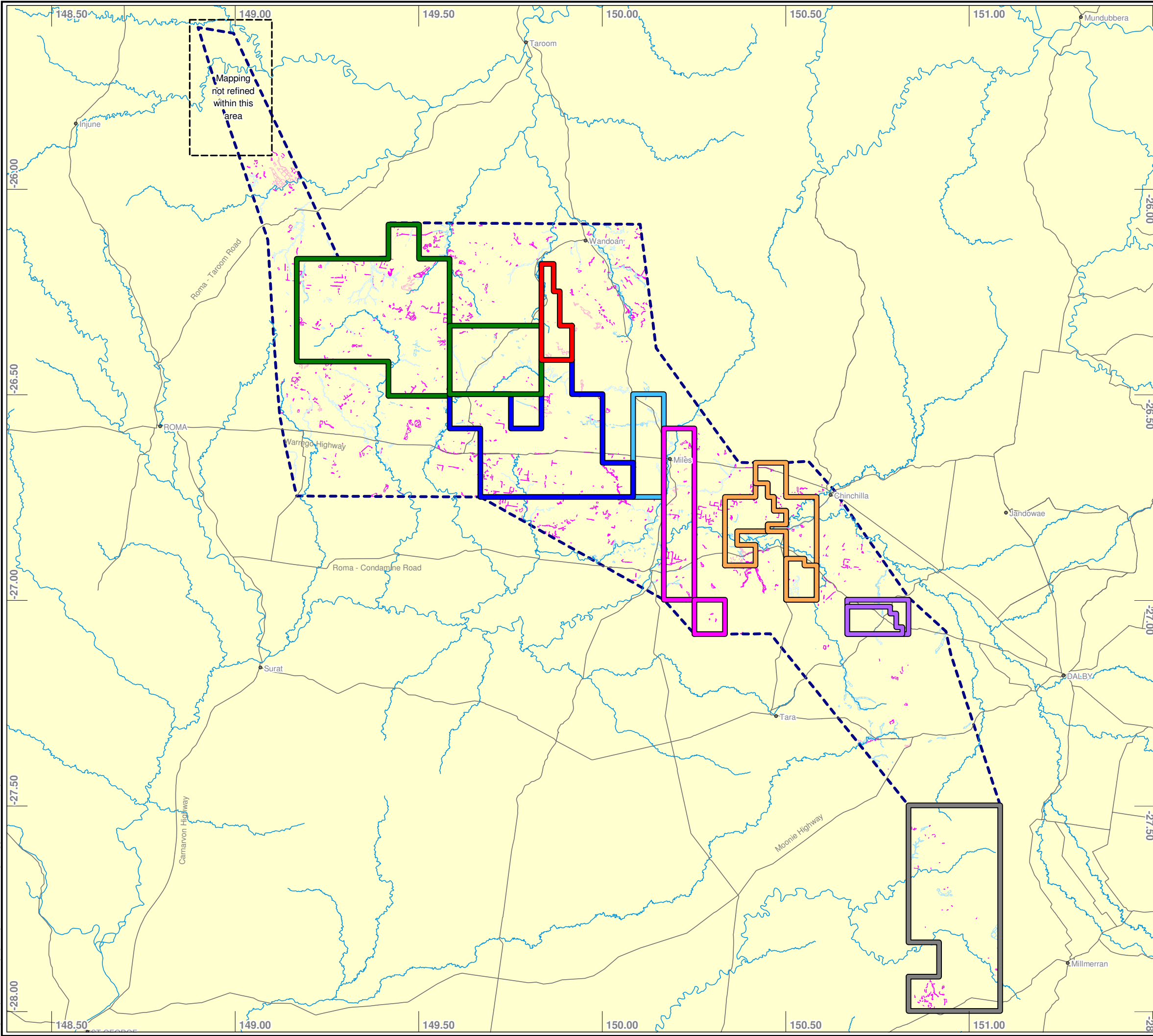
The now endangered Brigalow communities were once widespread before much of this land was cleared for grazing. Flora and fauna species that are strongly associated with these ecosystems are also affected by their fragmentation, as well as by cattle damage and altered fire regimes. As a result, many of these species share the threatened status of the vegetation communities.

Threatened ecological communities within the study area as represented by regional ecosystems are shown on Figure 23.11.

Terrestrial ecology sensitivity mapping has been undertaken for the Project, categorising the significance and sensitivity of ecosystems (using RE mapping as a base unit). Figure 23.12 provides a visual representation of the results the sensitivity analysis, showing the relative terrestrial ecological importance assessment for the entire study area. The fundamental assessment criteria that contributed to the sensitivity of the mapped vegetation included:

- The conservation status of regional ecosystems (REs) under the VMA and EPBC Act
- The suitability of each RE as habitat for significant terrestrial flora and fauna
- The conservation status of significant terrestrial flora and fauna species (known or considered likely to occur within the mapped REs within the study area) under the EPBC Act or NC Act
- The importance of the study area to the significant terrestrial flora and fauna species (that is, in terms of known distributions)
- Contribution of vegetation (both remnant and regrowth) to significant corridors, as identified under the BPA
- The tract size of each vegetation polygon, as identified under the BPA
- Occurrence of vegetation within areas protected under the NC Act.

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LEGEND

- Town
- Road
- Major watercourse
- - - Gas field study area

Walloons Gas Fields Development Areas

Talinga / Orana	Combabula / Ramyard
Dalwogan	Woleebee
Kainama	Carinya
Gilbert Gully	Condabri

Environmentally Sensitive Areas

- Dominant Endangered RE
- Sub-dominant endangered RE
- Dominant of concern RE
- Sub-dominant of concern RE

Source Information

Roads, Towns
Queensland Department of Main Roads 2009
Communication tower locations
Supplied by Origin Energy on 07/10/2009

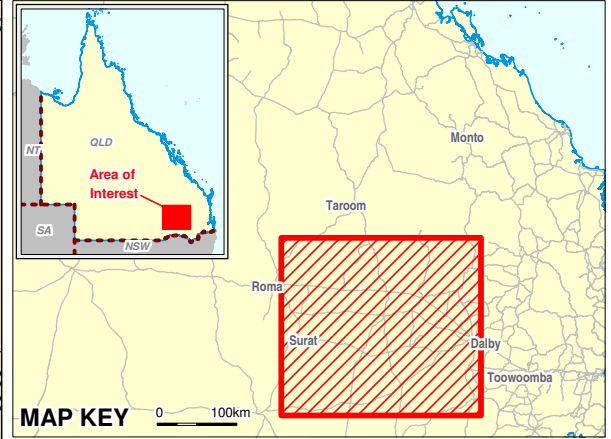
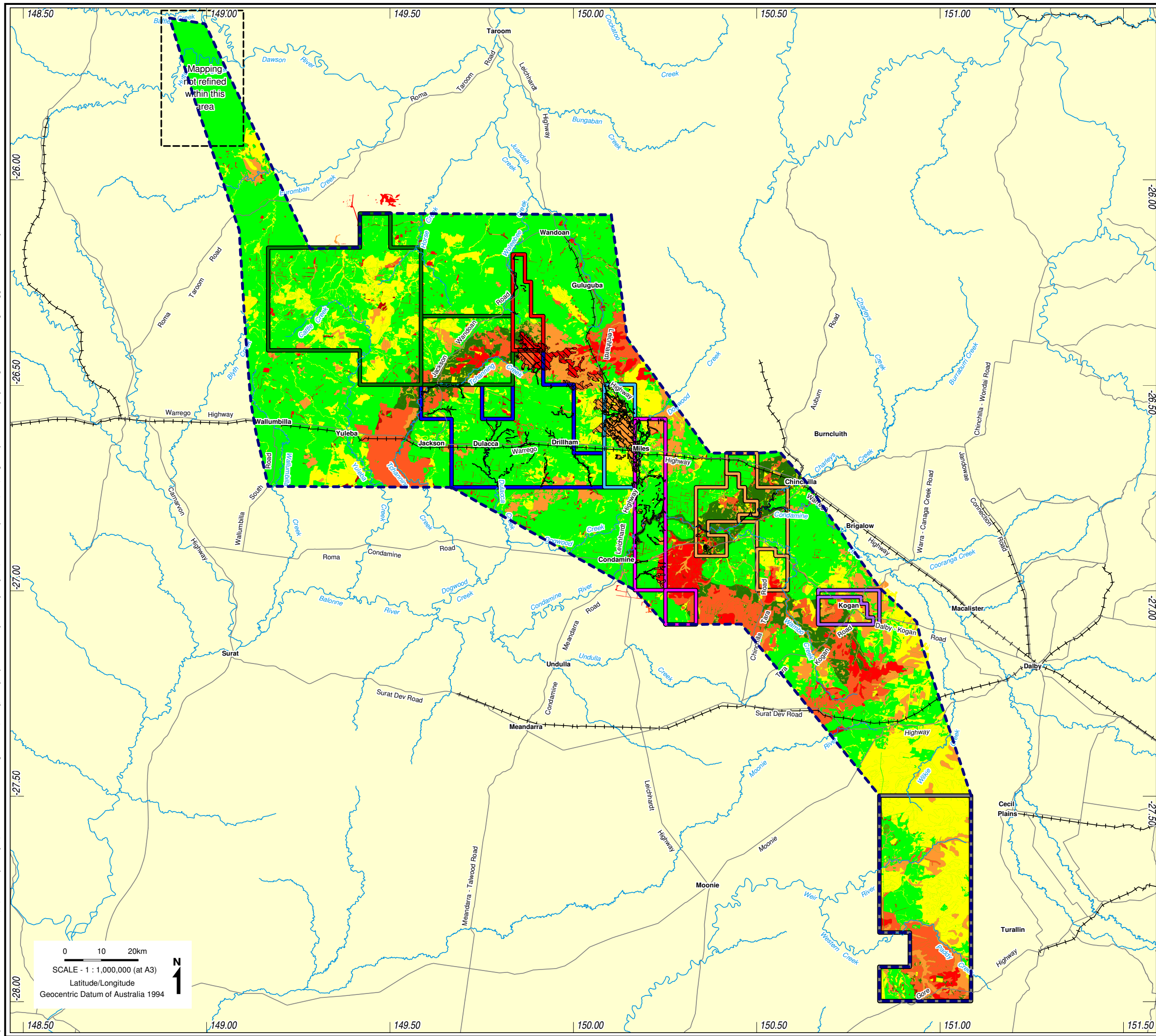
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Latitude/Longitude
Geocentric Datum of Australia 1994

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AUSTRALIA PACIFIC LNG PROJECT

Volume 2 Chapter 23
Figure 23.11 - Threatened ecological communities

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LEGEND

Major drainage
Gas field study area
Road
Railway

Walloons Gas Fields Development Areas

Talinga / Orana	Combabula / Ramyard
Dalwogan	Woleebee
Kainama	Carinya
Gilbert Gully	Condabri

Environmentally Sensitive Areas

Endemic threatened species
Confirmed population of Weeping Myall
Predicted critical habitat for BL 12
Predicted critical habitat for BL 13
Known significant ecological features
11.3.16 Eucalyptus Largiflorens
Confirmed population of Yakka Skink

Sensitivity Ranking

1 Extremely
2 Highly
3 Sensitive
4 Neutral
5 Robust
6 Clearing within corridors
7 Cleared

Source Information

Environmentally sensitive areas
Biodiversity Assessment and Management Pty Ltd 2009

Additional layers of sensitivity are also applied to the mapping, regardless of the sensitivity category of any relevant polygons, as follows:

- Areas known, or having high potential, to support one flora species and Gurulmundi fringe myrtle (*Calytrix gurulmundensis*), and two undescribed snail species, Brigalow Woodland Snail and Dulacca Woodland Snail
- Areas within the Talinga tenement known to support populations of Yakka Skink or Painted Diuris (both vulnerable under the EPBC Act), or which contain habitat features such as caves and overhangs that are important to a number of conservation significant species
- Water bodies, due to their very high resource value, and certain areas of cleared land within floodplains that are subject to inundation during or subsequent to rainfall events and may provide valuable resources for conservation significant fauna species such as Rough frog and Grey snake when flooded
- The area of RE 11.3.16, confirmed by the Queensland Herbarium as the northernmost known population of this community in Australia.

Figure 23.12 shows that the most sensitive areas are associated with remnant Brigalow communities which are scattered throughout the study area, and also highly sensitive remnant vegetation occurring within Bioregional corridors.

Management measures to mitigate landscape-scale ecological impacts for each of the ecological sensitivity categories are as follows:

- Category 1: Extremely sensitive: Siting of infrastructure within these areas will be avoided.
- Category 2: Highly Sensitive: Infrastructure will only be located within or in proximity to existing cleared and disturbed areas to reduce fragmentation. , Limited clearing (if necessary for incremental expansion of existing disturbance) for construction to be rehabilitated prior to operation.
- Category 3: Sensitive: Clearing only for linear infrastructure and well leases. Non-linear infrastructure to be located within or in proximity to existing cleared and disturbed areas. Disturbed areas not required for ongoing operation to be rehabilitated prior to operation.
- Category 4: Neutral: Clearing for linear and non-linear infrastructure is to minimise edge effects where possible.
- Category 5: Robust: Clearing for infrastructure, although hollow-bearing trees and habitat connectivity, particularly along watercourses, to be retained.
- Category 6 and 7: Cleared: Siting of infrastructure >100m from edges of categories 2-5 and >200m from category 1.

Figure 23.13 shows proposed management areas derived from the impact assessment process. This includes indicating the locations of REs (and their analogous communities of national conservation significance) recommended to be maintained, areas where further field investigations are required to accurately locate specific, highly restricted habitats and species and areas where offset actions will be most beneficial.

This sensitivity mapping has been used for preliminary siting of infrastructure, in particular gas well locations, and will be used to refine gas well, gas and water gathering networks and access road locations during the life of the Project. The intention of the mapping is to protect the integrity of large tracts of vegetation and associated polygons of significant vegetation, particularly where they occur within bioregional corridors.

Table 23.2 shows that, not including RE 11.3.2 which is listed only where weeping myall is present, there are 143,027ha of Endangered Ecological Communities occurring within the relevant subregions. Of these, 20,542ha occur within the study area. Proposed clearing for the Project within these communities totals approximately 83ha, which is not exceeding 0.15% of the provincial extent of any of the subject communities. These areas proposed for clearing are generally those isolated from adjoining vegetation and/or occurring adjacent to currently disturbed vegetation and/or cleared areas.

Based on the assessment of existing terrestrial ecological values, the following terrestrial species listed as endangered under the EPBC Act are currently recognised as occurring or possibly occurring within the study area:

- Herbaceous xerothermella (*Xerothermella herbacea*)
- Slender tylophora (*Tylophora linearis*)
- Microcarpaea (*Microcarpaea agonis*)
- Swift parrot (*Lathamus discolor*).

In addition, the following two undescribed species of land snail are known to occur within the study area from current and previous surveys and. These are currently being processed by DEWHA for listing under the EPBC Act, they are also considered as part of this assessment:

- Brigalow Woodland Snail (Camaenidae BL13), a description will be published in 2010 in Stanisic et al. (in preparation) – currently under submission to DEWHA for listing under the EPBC Act as Critically Endangered
- Dulacca Woodland Snail (Camaenidae BL12), a description will be published in 2010 in Stanisic et al. (in preparation) – currently under submission to DEWHA for listing under the EPBC Act as Endangered.

Table 23.2 Endangered ecological communities and proposed clearing

Provincial and study area distribution of EPBC Act endangered ecological communities and proposed clearing.

Regional ecosystem	Management status ¹			Total current extent (ha)		Extent to be disturbed			
	EPBC Act	VMA	EP Act	Relevant provinces ^{2,3}	Study area ⁴	Total area (ha)	% of relevant provinces extent	% of study area extent	% of tenements extent ⁵
11.3.1	E	E	E	3111	792	4.51	0.15	0.57	1.68
11.3.2	E ⁶	OC	OC	167893	14729	129.13	0.08	0.88	2.12
11.4.3	E	E	E	32277	4759	18.86	0.06	0.40	1.08
11.4.7	E	E	E	3063	292	0.43	0.01	0.15	0.65
11.4.10	E	E	E	1589	64	0.90	0.06	1.40	2.15
11.8.3	E	OC	OC	11033	8	0.00	0	0	n/a ⁹
11.9.1	E	E	E	3893	7	0.00	0	0	n/a ⁹
11.9.4	E	OC	E	11043	3605	13.27	0.12	0.37	1.09
11.9.5	E	E	E	76647	10897	45.21	0.06	0.41	0.97
11.9.6	E	E	E	371	118	0.00	0	0	n/a ⁷

1 Where: E = endangered, OC = of concern, LC = least concern, NC = no concern at present. 'EP Act' status is based on the 'biodiversity status' prescribed on DERM's regional ecosystem description database v6.

2 'Relevant provinces' includes provinces 25, 26, 27, 28, 30, 31, and 32 of the BBS bioregion, except for REs 11.10.3, 11.10.7, and 11.10.13 (for which the relevant province is province 24).

3 Based on data from Environmental Protection Agency (EPA) (2008). Data is only available for each RE as a whole, not for individual subsets (for example, for 11.10.13, not for 11.10.13a).

4 Based on GIS analysis of refined vegetation mapping (Volume 5 Attachment 14, Appendix I)

5 Note: certain REs may be under represented within the tenements, thereby resulting in a large percentage based on overall study area disturbance.

6 Only where weeping Myall *Acacia pendula* occurs.

7 REs that do not occur within the gas fields tenements

The following terrestrial species listed as Vulnerable under the EPBC Act are currently recognised as occurring or possibly occurring within the study area:

- Dunmore mint-bush (*Prostanthera* sp. Dunmore)
- Chinchilla wattle (*Acacia chinchillensis*)
- Curly-barked wattle (*Acacia curranii*)
- Tara Wattle (*Acacia lauta*)
- Thomby Range wattle (*Acacia wardellii*)
- Gurulmundi fringe myrtle (*Calytrix gurulmundensis*)
- Shiny-leaved ironbark (*Eucalyptus virens*)
- Pink donkey-orchid (*Diuris tricolor*)
- Cobar greenhood orchid (*Pterostylis cobarensis*)
- Belson's panic grass (*Homopholis belsonii*)
- The waxflower (*Philotheca sporadica*)
- Ooline (*Cadellia pentastylis*)
- Central Queensland zamia palm (*Macrozamia fearnsidei*)
- Adorned (Collared) delma (*Delma torquatus*)
- Brigalow scaly-foot (*Paradelma orientalis*)
- Yakka skink (*Egernia rugosa*)
- Dunmall's Snake (*Furina dunmalli*)
- Squatter pigeon (southern subspecies) (*Geophaps scripta scripta*)
- Red goshawk (*Erythrorhynchus radiatus*)
- Plains-wanderer (*Pedionomus torquatus*)
- Australian painted snipe (*Rostratula australis*)
- Black-breasted button-quail (*Turnix melanogaster*)
- Grey-headed flying-fox (*Pteropus poliocephalus*)
- Large-eared pied Bat (*Chalinolobus dwyeri*)
- South-eastern (Greater) long-eared bat (*Nyctophilus corbeni*) (formerly *timoriensis*).

The following migratory species under the EPBC Act are known to occur, or potentially occur, within the study area:

- Australian cotton pygmy-goose (*Nettapus coromandelianus albipennis*)
- White-throated needletail (*Hirundapus caudacutus*)
- Fork-tailed swift (*Apus pacificus*)
- Great egret (*Ardea alba*) (also known as Eastern Great Egret *A. modesta*)

- Cattle egret (*Bubulcus ibis*) (also known as *Ardea ibis*)
- Glossy Ibis (*Plegadis falcinellus*)
- Osprey (*Pandion haliaetus*) (also known as Eastern Osprey *P. cristatus*)
- White-bellied sea-eagle (*Haliaeetus leucogaster*);
- Pacific golden plover (*Pluvialis fulva*);
- Australian painted snipe (*Rostratula australis*)**;
- Latham's snipe (*Gallinago hardwickii*);
- Black-tailed godwit (*Limosa limosa*);
- Bar-tailed godwit (*Limosa lapponica*);
- Whimbrel (*Numenius phaeopus*);
- Common greenshank (*Tringa nebularia*);
- Marsh sandpiper (*Tringa stagnatilis*);
- Wood sandpiper (*Tringa glareola*);
- Common sandpiper (*Actitis hypoleucos*);
- Red-necked stint (*Calidris ruficollis*);
- Sharp-tailed sandpiper (*Calidris acuminata*);
- Curlew sandpiper (*Calidris ferruginea*);
- Ruff (*Philomachus pugnax*);
- Caspian tern (*Sterna caspia*) (also known as *Hydroprogne caspia*);
- Rainbow bee-eater (*Merops ornatus*);
- Black-faced monarch (*Monarcha melanopsis*);
- Rufous fantail (*Rhipidura rufifrons*);
- Satin flycatcher (*Myiagra cyanoleuca*); and
- Australian reed-warbler (*Acrocephalus australis*) (formerly known as Clamorous Reed-Warbler *A. stentoreus*).

Potential impacts of the gas fields element of the Project on threatened ecological communities and terrestrial flora and fauna are primarily associated with the physical clearing of vegetation required to prepare sites for the construction of a range of infrastructure within the study area, and associated habitat loss, degradation, fragmentation, isolation, and loss of connectivity.

Removal of vegetation results in direct loss of plant species, and potentially can result in the mortality of fauna present at the time of clearing. Potential secondary impacts are soil disturbance/exposure, altered water flow patterns, and subsequent erosion and sedimentation, salinisation of areas downslope, and increases in desiccation, light penetration, wind-throw, herbivory, weed invasion, nest predation, and parasitism for adjacent flora and fauna. In particular, introduced weeds can change vegetation community composition and in some cases increase the intensity of fire.

The construction, operation and decommissioning phases also have the potential to result in ongoing habitat disturbance through noise, dust, and night lighting, while fauna mortality could result from an increase in traffic and animal/vehicle collisions, and certain fauna becoming trapped in trenches or other excavations that remain open for any period of time.

Increased human presence has the potential to increase the frequency of accidental fires within vegetated areas, adversely affecting habitat structure and therefore habitat value for a range of significant species.

The operation of the proposed gas fields' development could further disrupt natural ecological processes such as limiting the natural movement and dispersal of fauna and the natural spread and regeneration of native flora that rely on such fauna for seed dispersal, altering the local surface and groundwater environment due to landform modification, and creating long-term edge effects along the borders of active areas and adjacent habitat as well as isolated habitat patches between disturbed areas.

23.3.2 Aquatic environment including Ramsar wetlands

The gas fields' infrastructure could potentially impact aquatic environments within the Condamine-Balonne, Dawson and Border Rivers catchments.

The main impact mechanism with the potential to affect the aquatic environment during the construction phase is sediment mobilisation through the clearing of vegetation adjacent to waterways and bank or bed excavation. However, other impacts may also present a risk to aquatic biota, such as accidental chemical spillages, effluent generated from temporary accommodation facilities and the direct removal of aquatic flora and fauna from excavation.

The potential impact mechanisms related to operation and decommissioning phases include:

- Alteration of flow regimes from permeate discharge
- Alteration of low flow hydrology / hydraulics associated with infrastructure placed within waterways (e.g. road crossings)
- Low calcium concentration and /or elevated contaminant concentrations in permeate water discharge
- Hydrocarbon, chemical or wastewater contamination from accidental spills
- Disturbance to threatened artesian spring communities associated with aquifer draw down from well water extraction
- Contamination of watercourses resulting from brine pond overflows.

The assessment detailed in Section 23.2 indicates that there is only one EPBC Act-listed fish or macroinvertebrate species in the water bodies or waterways that may be impacted by the development of the gas fields – the Murray Cod *Maccullochella peelii*. Murray Cod is regularly stocked into the Condamine River by the Chinchilla Amateur Fishing Club due to their recreational fishing value and in support of the Native Fish Strategy for the Murray-Darling Basin 2003-2013.

The only wetlands occurring in the vicinity of the gas fields' development area with potential relevance to the controlling provisions are the Balonne River Floodplain complex, including the Ramsar listed Narran Lakes.

Narran Lakes Nature Reserve has an area of 5,531ha and forms part of a large terminal wetland of the Narran River (at the end of the Balonne River) in NSW. It is located approximately 500km

downstream of the Project Area. Narran Lakes Nature Reserve is listed as a wetland of international importance under the RAMSAR Convention, and is internationally significant for waterbird breeding and as habitat for species including a number listed under the Japan-Australia and China-Australia Migratory Bird Agreements (JAMBA and CAMBA).

Narran Lakes Nature Reserve is also listed as a wetland of national importance as a major breeding site for waterbirds and contains a variety of flora associations considered to be threatened in NSW (Ramsar Information Sheet, NSW National Parks and Wildlife Service (NSW NPWS) 2000). Waterbird breeding is stimulated by inundation of the wetlands and successful breeding is influenced by a number of factors, including inundation area, duration, frequency, timing and depth.

One of the objectives of the Narran Lakes Nature Reserve Plan of Management (NSW NPWS 2000) is 'maintenance of diverse, healthy and productive wetland habitat and the value of the reserve as a major waterbird breeding area'.

Section 40 of the Water Resource (Condamine and Balonne) Plan 2004 (WRP) provides rules for managing Narran Lakes filling flow events in order to improved water availability for bird breeding.

Great Artesian Basin spring wetlands occur on the outer edge of the GAB in Queensland, NSW and South Australia. The GAB springs are characterised into twelve 'Supergroups'. Each Supergroup comprises smaller spring groups and spring complexes.

One GAB Spring community is known to occur within the vicinity of the study area and is located 25km north of Roma. The communities of native species dependent on the natural discharge of groundwater from the GAB are listed as an endangered community under the EPBC Act 1999. Of these, two species of plant – artesian milfoil *Myriophyllum artesium* and salt pipewort *Eriocaulon carsonii* – are known to occur within the Springsure Supergroup (DEWHA 2009).

23.4 EPBC Act significant impact criteria assessment

Brigalow (Acacia harpophylla dominant and co-dominant) community

The Brigalow ecological community, Brigalow (*Acacia harpophylla* dominant and co-dominant) community', was listed as a threatened (endangered) ecological community under the EPBC Act on 4 April 2001. This community has received federal protection as it has declined to 10% of its pre-clearing extent (90% removed).

Within the study area this community is analogous to areas mapped as REs 11.3.1, 11.4.3, 11.4.7, 11.4.10, 11.9.1, 11.9.5 and 11.9.6. These REs cover an area of approximately 17,000ha of the study area, representing approximately 14% of that mapped as present in the relevant provinces of the Brigalow Belt South (BBS) bioregion. There is a potential loss of up to approximately 70ha of this ecological community, which equates to 0.4% of study area extent and 0.06% of the relevant provincial extent.

With the possible exception of a very limited number of patches located within state forest, it was found that much of the Brigalow within the study area has been highly disturbed and is in poor condition due primarily to invasion by buffel grass (Section 2.3.2).

Significant impact criteria – Brigalow community

An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:

1. *Reduce the extent of an ecological community.*

Disturbance to this ecological community will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of this ecological community will be developed.

In addition, Project areas that are located within areas currently supporting Brigalow, or in buffers to those areas, will be managed to control the extent of buffel grass and other weed species to ensure the Project activities do not adversely affect the presence or spread of weeds in this ecological community. No significant impact is predicted.

Given the fragmented and degraded nature of Brigalow communities within the study area, and the fact that minimal clearing within the analogous REs is proposed at the project scale, it is unlikely that the proposed action will result in a significant increase in fragmentation of this ecological community. Offsets will be designed to increase overall connectivity of remnant vegetation communities across the local landscape. No significant impact is predicted.

Disturbance to this ecological community will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of this ecological community will be developed. No habitat critical to the survival of this community will be adversely affected.

2. *Modify, destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions within the EM Plan. No significant impact is predicted.

3. *Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting.*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions set out in the EM Plan.

Activities associated with this Project will not cause a substantial change in species composition of this vegetation community.

4. *Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:*

- *Assisting invasive species, that are harmful to the listed ecological community, to become established; or*
- *Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions within the EM Plan.

Activities associated with the Project will not cause a substantial reduction in the quality of this vegetation community.

5. *Interfere with the recovery of an ecological community.*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions provided in the EM Plan.

The offsets will be designed to increase overall connectivity of remnant vegetation communities across the local landscape. The proposed actions will not interfere with the recovery of this ecological community.

Weeping myall woodlands

Weeping myall woodlands occur in a range from open woodlands to woodlands, generally 4-12m high, in which weeping myall (*Acacia pendula*) trees are the sole or dominant overstorey species. Other common names for weeping myall include myall, boree, balaar, nilyah, bastard gidgee, and silver leaf boree.

As this TEC occurs on arable land, much of its former range has been cleared for dryland /irrigated cropping or has been significantly modified by heavy grazing. Most areas remaining in good condition are in little-grazed, uncropped sites such as road reserves and stock routes and reserves. These areas of structurally intact woodland tend to be relatively small and exist in a matrix of agricultural development with poor landscape connectivity.

Within the study area, this ecological community potentially occurs within RE 11.3.2. Recent field surveys have found 30ha of this ecological community within the study area. The majority of this ecological community has been mapped within road reserves.

There is a potential loss of up to approximately 129ha of habitat suitable for this ecological community, which equates to 0.9% of study area extent and 0.1% of the relevant provincial extent.

Significant impact criteria – Weeping myall woodlands

An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:

1. *Reduce the extent of an ecological community*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

In addition, Project areas that are located within areas currently supporting weeping myall Open Woodland or in buffers to those areas, will be managed to control the extent of buffel grass and other weed species to ensure the Project activities do not adversely affect the presence or spread of weeds in this ecological community. No significant impact is predicted.

2. *Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*

Given the fragmented and degraded nature of weeping myall open woodland communities within the study area, and the fact that minimal clearing within these REs is proposed at the Project scale, it is unlikely that the proposed action will result in a significant increase in fragmentation of this ecological community. The offsets will be designed to increase overall connectivity of remnant vegetation communities across the local landscape. No significant impact is predicted.

3. *Adversely affect habitat critical to the survival of an ecological community*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed. No significant impact is predicted.

4. *Modify, destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions set out in the EM Plan. No significant impact is predicted.

5. *Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions set out in the EM Plan.

Activities associated with this Project will not cause a substantial change in species composition of this vegetation community.

6. *Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:*
- *Assisting invasive species, that are harmful to the listed ecological community, to become established; or*
 - *Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions set out in the EM Plan.

Activities associated with this Project will not cause a substantial in the quality of this vegetation community.

7. *Interfere with the recovery of an ecological community*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions set out in the EM Plan.

The offsets will be designed to increase overall connectivity of remnant vegetation communities across the local landscape. The proposed actions will not interfere with the recovery of this ecological community.

Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions

Semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions are listed as endangered under the EPBC Act. This community has been substantially reduced in size with nine to 30% of the original area remaining. As a result of this clearing, this community generally occurs as fragmented patch sizes of less than 100ha. As a result of their small size, these patches are subject to further degradation and decline from such threatening processes as clearing, inappropriate fire regimes, grazing and weed invasion.

This ecological community is analogous to areas mapped as REs 11.8.3 and 11.9.4 within the study area. These REs cover an area of approximately 3,600ha of the study area, representing approximately 16% of that mapped as present in the relevant provinces. There is a potential loss of up to approximately 13ha of this ecological community, which equates to 0.4% of study area extent and 0.06% of the relevant provincial extent.

The general condition of this ecological community within the study area varies from patch to patch with some examples in the Gurulmundi area being in comparatively good condition. In general, this ecological community is degraded in the understorey by trampling and cattle grazing, partially preventing regrowth. Invasion by exotic pasture grasses is prevalent especially along exposed edges.

Significant impact criteria – Semi-evergreen vine thickets

An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:

1. *Reduce the extent of an ecological community*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

In addition, Project areas that are located within areas currently supporting SEVT or in buffers to those areas, will be managed to control the extent of buffel grass and other weed species to ensure the Project activities do not adversely affect the presence or spread of weeds in this ecological community. No significant impact is predicted.

2. *Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*

Given the fragmented and degraded nature of SEVT communities within the study area, and the fact that minimal clearing within these REs is proposed at the Project scale, it is unlikely that the proposed action will result in a significant increase in fragmentation of this ecological community. Offsets will be designed to increase overall connectivity of remnant vegetation communities across the local landscape. No significant impact is predicted.

3. *Adversely affect habitat critical to the survival of an ecological community*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed. No habitat critical to the survival of this community will be adversely affected.

4. *Modify, destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be

monitored and mitigated as appropriate according to prescriptions set out in the EM Plan. No significant impact is predicted.

5. *Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed. Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions provided in the EM Plan.

Activities associated with this Project will not cause a substantial change in species composition of this vegetation community. No significant impact is predicted.

6. *Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:*

- *Assisting invasive species, that are harmful to the listed ecological community, to become established; or*
- *Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed.

Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions set out in the EM Plan. Activities associated with this Project will not cause a substantial reduction in the quality of this vegetation community. No significant impact is predicted.

7. *Interfere with the recovery of an ecological community*

Disturbance to these regional ecosystems will be avoided or offset. Restrictions will also apply to any clearing outside of already disturbed areas within these ecological communities. Habitat management guidelines for works within 200m of these areas will be developed. Habitat management for works within the 200m buffer will include actions to prevent impacts upon this threatened community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. These factors will be monitored and mitigated as appropriate according to prescriptions set out in the EM Plan.

Offsets will be designed to increase overall connectivity of remnant vegetation communities across the local landscape.

The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin

Great Artesian Spring wetlands occur on the outer edge of the GAB in Queensland, NSW and South Australia. The GAB springs are characterised into 12 'supergroups'. Each supergroup comprises smaller spring groups and spring complexes. The Project's area is located within the Springsure Supergroup, Brigalow Belt Complex (EPA 2005; Fairfax et al. 2007; Fensham et al. 2004).

The community of native species dependent on the natural discharge of groundwater from the Great Artesian Basins is listed as an endangered community under the EPBC Act (1999). No springs that qualify as this TEC occur within the gas fields. The one GAB Spring community known to occur within the vicinity of the study area is located 25km north of Roma. These communities may include salt pipewort (*Eriocaulon carsonii*), listed as endangered under the EPBC Act.

There is a low risk of impact to artesian spring communities associated with construction or operation activities. The main activities that could affect artesian spring communities during construction are direct excavation and/or sediment delivery from road and pipeline construction.

There are currently no pipeline or road crossings located in the immediate vicinity of known springs. If a pipeline crossing over a spring-fed stream is required, the boring method will be undertaken if the crossing is within 2km of the spring.

Potential impacts associated with groundwater drawdown from well watering were assessed to be low. However, further investigation of the spring complex located 25km north of the gas fields will occur to verify that there are no 'discharge' springs in this area and assess existing condition of known recharge springs. The residual risk of impact to GAB spring communities associated with construction activities is assessed to be low.

Significant impact criteria – GAB Spring communities

An action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:

1. *Reduce the extent of an ecological community*

The project works will avoid any known community of native species dependent on natural discharge of groundwater from the Great Artesian Basin.

Although extremely unlikely, any unforeseen disturbance will be offset. It is proposed that vegetation offsets be provided following consultation with DEWHA and DERM as part of the mitigation against any loss of this community. No significant impact is predicted.

Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

The project works will avoid any known community of native species dependent on natural discharge of groundwater from the Great Artesian Basin. These communities generally occupy a small area and no springs that satisfy the DEWHA criteria for this community were observed. In addition, any unforeseen disturbance will be offset.

It is proposed that vegetation offsets be provided following consultation with DEWHA and DERM as part of the mitigation against any loss of this community. The construction and operation of the gas fields will not fragment or increase fragmentation of an ecological community. No significant impact is predicted.

2. *Adversely affect habitat critical to the survival of an ecological community*

This community is not listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

The project works will avoid any known community of native species dependent on natural discharge of groundwater from the Great Artesian Basin. These communities generally occupy a small area and no springs that satisfy the DEWHA criteria for this community were observed.

It is not considered that habitat critical to the survival of the community will be adversely impacted.

3. *Modify, destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*

For a period of time post-production (during the groundwater level recovery phase), the drawdown cones in the affected Great Artesian Basin aquifers, whilst reducing in magnitude, are projected to broaden beyond the boundaries of the CSG development areas. According to the preliminary cumulative case projections, there is a very low risk that groundwater levels (and potentially the rate of vertical groundwater movement) will be affected (post-CSG operation) at the following key locations:

- In proximity to the high-value discharge spring complexes and their associated groundwater dependant ecosystems east of the Injune township
- In proximity to the various spring complexes and their associated groundwater dependant ecosystems 100km west of the Roma township.

Other spring complexes and accompanying ground dependant ecosystems are known to exist within the study area are not expected to be at risk. The preliminary cumulative case model projections also indicate that groundwater levels within the shallow Cainozoic Units may be affected, in localised areas, by groundwater level drawdown from CSG development. As the level of groundwater dependency of ecosystems in these areas is likely to be low, species dependent upon groundwater in the shallow watertable aquifers associated with drainage lines are considered to be at very low risk of impact.

A review of the impacts on groundwater drawdown on this community is discussed in Volume 2 Chapter 10.

No other abiotic factors necessary for this community's survival are likely to be impacted. It is not considered that the proposed (including groundwater drawdown) works will substantially modify or destroy abiotic factors necessary for the survival of this community.

Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting. The project works will avoid any known community of native species dependent on natural discharge of groundwater from the Great Artesian Basin.

In addition habitat management for works within and adjacent to this community will include actions to prevent impacts upon this community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire.

In addition, the implementation of a biosecurity management plan is a requirement of the TOR to control and prevent the establishment of invasive species (and associated diseases) as a result of the Project.

4. *Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:*
- *Assisting invasive species, that are harmful to the listed ecological community, to become established; or*
 - *Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.*

The project works will avoid any known community of native species dependent on natural discharge of groundwater from the Great Artesian Basin.

In addition habitat management for works within and adjacent to this community will include actions to prevent impacts upon this community including: management of surface and ground waters, weeds infestations, feral animal species, light, wind, temperature and fire. In addition, the implementation of a biosecurity management plan is a requirement of the TOR to control and prevent the establishment of invasive species (and associated diseases) as a result of the Project.

5. *Interfere with the recovery of an ecological community*

The project works will avoid any known community of native species dependent on natural discharge of groundwater from the Great Artesian Basin. This ensures that no disturbance occurs to the recovery of this community. Any unforeseen disturbance will be offset. It is proposed that vegetation offsets be provided following consultation with DEWHA and DERM as part of the mitigation against any loss of this community.

23.5 Threatened species

23.5.1 Terrestrial flora

The assessment detailed in Table 23.3 identified 16 threatened flora species known from or potentially present within the study area, including three species listed as endangered under the EPBC Act and 13 species listed as vulnerable under the Act. This table also identifies each species' habitat preference and likelihood of occurrence within the project area.

The assessment is based on database searches, literature reviews, analysis of habitat preferences and fields surveys. Five of the species were recorded during the recent ground surveys, while the remaining 11 species are either known from previous records or are considered possible occurrences based on the presence of suitable habitat within the gas fields' study area.

In summary, three endangered terrestrial flora species listed under the EPBC Act are predicted or have been found to occur in the study area. These species are:

- Herbaceous xerothermella
- Slender tylophora
- Microcarpaea.

Table 23.3 Likely occurrence of threatened flora species within the study area

Family	Species name	Common name	EPBC Act status	Habitat preference	Known distribution and likelihood of occurrence
Acanthaceae	<i>Xerothamnella herbacea</i>	Herbaceous xerothamnella	Endangered	Found in Brigalow dominated communities in shaded situations, often in leaf litter and in association with gilgais, on heavy, grey to dark brown clay soils.	Restricted to the Chinchilla – Goondiwindi region of southern Queensland. Possibly occurs within study area.
Apocynaceae	<i>Tylophora linearis</i>	Slender tylophora	Endangered	Found in dry scrublands, open forests and woodlands in association with broombush <i>Melaleuca uncinata</i> , broad-leaved ironbark, red ironbark <i>Eucalyptus sideroxylon</i> , white box <i>E. albens</i> , black cypress pine <i>Callitris endlicheri</i> , white cypress pine, bullock <i>Allocasuarina luehmannii</i> , hakea wattle <i>Acacia hakeoides</i> , striped wattle <i>A. lineata</i> , myoporums (<i>Myoporum</i> spp.) and she-oaks (<i>Casuarina</i> spp.) at low altitudes and on sedimentary flats.	Restricted to northern and central western slopes of New South Wales and near Glenmorgan in the western Darling Downs district in Queensland. Possibly occurs within study area.
Asteraceae	<i>Rhaponticum australe</i>	Austral cornflower	Vulnerable	Found in eucalypt open forests with grassy understorey in association with narrow-leaved red ironbark, mountain coolibah <i>Eucalyptus orgadophila</i> , poplar box, forest red gum, silver-leaved ironbark, broad-leaved apple Angophora subvelutina, rough-barked apple, spear thistle <i>Cirsium vulgare</i> , Rhodes grass <i>Chloris gayana</i> , Queensland bluegrass <i>Dichanthium sericeum</i> and kangaroo grass <i>Themeda triandra</i> , in black clay soils, on roadsides and road reserves and up to 480m altitude.	Restricted from Mount Moffatt to Gatton in southern Queensland and historically known to extend through New South Wales and Victoria. Not likely to occur within study area.
Byttneriaceae	<i>Commersonia argentea</i>	Commersonia	Vulnerable	Eucalypt forests on stony ridges.	Restricted to central and southern Queensland from near Injune west to Tambo. Not likely to occur within study area.

Family	Species name	Common name	EPBC Act status	Habitat preference	Known distribution and likelihood of occurrence
Celastraceae	<i>Denhamia parvifolia</i>	Small-leaved denhamia	Vulnerable	Found in semi-evergreen vine thickets, vine scrubs and Brigalow scrub communities in association with shrub persimmon <i>Diospyros humilis</i> , crow's ash <i>Flindersia australis</i> , wilga <i>Geijera parviflora</i> , crow's apple <i>Owenia venosa</i> and python tree <i>Austromyrtus bidwillii</i> in fertile, red-brown, sandy, clay loams on hillslopes and crests of variable aspect and at 160 – 560m altitude. Also recorded in narrow-leaved red ironbark forests.	Restricted to the greater Chinchilla area in south-eastern Queensland. Known to occur in vine thicket at Allies Creek Area (Craig Eddie pers. comm.). Not likely to occur within study area.
Eriocaulaceae	<i>Eriocaulon carsonii</i>	Salt pipewort	Endangered	Found in active or flowing artesian mound springs or the margins of the Great Artesian Basin and on fen soils.	Restricted to Queensland, north-western NSW and north-eastern South Australia. Not likely to occur within study area.
Fabaceae	<i>Swainsona murrayana</i>	Slender darling-pea	Vulnerable	Found in a variety of vegetation communities from saltbush to eucalypt communities in depressions on heavy soils. Collection site in Queensland is bluegrass/mitchell grass grassland.	Restricted to Queensland and New South Wales. Only record in Queensland is from Surat region. Not likely to occur within study area.
Haloragaceae	<i>Haloragis exalata</i> ssp. <i>velutina</i>	Tall velvet sea-berry	Vulnerable	Found in rainforests and rainforest margins and adjacent grasslands and open grassy woodlands in association with broad-leaved apple, forest red gum, green wattle <i>Acacia irrorata</i> and dwarf scullcap <i>Scutellaria humilis</i> , in damp places near watercourses and on steep rocky slopes, above 500m altitude.	Restricted to coastal regions of south-eastern Queensland and north-eastern New South Wales, although known from the Carnarvon Range. Not likely to occur within study area.
Lamiaceae	<i>Prostanthera</i> sp. <i>Dunmore</i>	Dunmore mint-bush	Vulnerable	Found in Eucalyptus - Callitris woodlands in shallow sandy soils and eucalypt woodlands on hard sandstone ridge tops	Restricted to near Millmerran in south-east Queensland. Possibly occurs within study area.

Family	Species name	Common name	EPBC Act status	Habitat preference	Known distribution and likelihood of occurrence
Lamiaceae	<i>Westringia parvifolia</i>	Small-leaved westringia	Vulnerable	Found in mallee woodlands and forests in association with Baker's mallee <i>Eucalyptus bakeri</i> , green mallee <i>E. viridis</i> and spinifexes, in sandy and stony soils.	Restricted to a small area near Yelarbon and Inglewood in south-eastern Queensland. Not likely to occur within study area.
Mimosaceae	<i>Acacia chinchillensis</i>	Chinchilla wattle	Vulnerable	Found in open forests dominated by narrow-leaved red ironbark, smooth-barked apple and narrow-leaved box and in association with bullock, black cypress pine, white cypress pine, white feather honey-myrtle <i>Melaleuca decora</i> , the wattle - <i>Acacia crassa</i> , crowded-leaf wattle <i>A. conferta</i> , Mueller's wattle <i>A. muelleriana</i> , urn-heath <i>Melichrus urceolatus</i> and prickly mirbelia <i>Mirbelia pungens</i> , in deep loamy to sandy loam soils often with poor drainage and low nutrient levels, on gently undulating flat plains at 340 –380m altitude. Also recorded in silver-leaved ironbark – coastal cypress pine <i>C. columellaris</i> – She-oak (<i>Casuarina</i> spp.) woodlands.	Restricted to the Chinchilla region in the Darling Downs, southern Queensland. Known to occur within Talinga/Orana tenement (Craig Eddie pers. comm.) and one record within Orana tenement during the recent ground surveys (Volume 5 Attachment 14). Known to occur within study area.
Mimosaceae	<i>Acacia curranii</i>	Curly-barked wattle	Vulnerable	Found in dry sclerophyll forests and semi-arid woodlands on rocky outcrops of isolated hills and ranges on skeletal soils. Gurulmundi populations are just to the immediate east of the study area (Craig Eddie pers. comm.).	Restricted to Gurulmundi, Darling Downs District in Queensland and Shepherds Hill and Kilparney, South Western Plains, New South Wales. Possibly occurs within study area.
Mimosaceae	<i>Acacia grandifolia</i>	Large-leaved wattle	Vulnerable	The species grows on hilly terrain of varying aspects and slope, on hillcrests, in gullies on plains. It occurs in ironbark gum and lemon-scented spotted gum forests and woodlands. The most frequently recorded associated tree species are narrow-leaved red ironbark,	This species is endemic to south-east Queensland and is restricted to a small area around Gayndah, Mundubbera, Coulston Lakes and Proston in the Burnett District. Restricted distribution outside of

Family	Species name	Common name	EPBC Act status	Habitat preference	Known distribution and likelihood of occurrence
				lemon-scented spotted gum, brown bloodwood and Queensland peppermint.	study area. Not likely to occur within study area.
Mimosaceae	<i>Acacia handonis</i>	Hando's wattle	Vulnerable	Found in open forests and woodlands dominated by tall dusky-leaved ironbark, Watson's large-fruited yellow jacket <i>Corymbia watsoniana</i> , budgeroo <i>Lysicarpus angustifolius</i> and woolly she-oak <i>Allocasuarina inophloia</i> , in lateritic soils on gently undulating slopes and stony ridges and in association with crowded-leaf wattle, catkin wattle <i>Acacia julifera</i> , rush-leaved wattle <i>A. juncifolia</i> , thread-leaf hopbush <i>Dodonaea falcata</i> , bipinnate boronia <i>Boronia bipinnata</i> , glabrous boronia <i>B. glabra</i> , sandstone panic <i>Cleistochloa subjuncea</i> , wiry panic <i>Entolasia stricta</i> , Kenny's bog-rush <i>Schoenus kennyi</i> , the porcupine grass, <i>Triodia scariosa</i> ssp. <i>yelarbonensis</i> , and many-flowered matrush <i>Lomandra multiflora</i> .	Restricted to the greater Barakula State Forest area, NNE of Chinchilla in southern Queensland. Not likely to occur within study area.
Mimosaceae	<i>Acacia lauta</i>	Tara wattle	Vulnerable	Found in open woodlands in sandy soils. Shrubby woodlands with red ironbark, tumble-down ironbark Eucalyptus panda, broombush and other Acacia species and Triodia species (Craig Eddie pers. comm.)	Restricted to the Inglewood – Tara region in the Darling Downs district of southern Queensland. Known to occur within study area
Mimosaceae	<i>Acacia wardellii</i>	Thomby Range wattle	Vulnerable	Found in eucalypt woodland in gravelly soils on shallow weathered sandstone. Occurs on ridge crests and slopes with loamy and gravelly soil along the edges of woodlands or in clearings: occurs with dusky-leaved Ironbark, narrow-leaved red ironbark, Queensland peppermint, brown bloodwood, white cypress pine, smooth-barked apple, native quinine <i>Alstonia constricta</i>	Restricted to south of Roma, south-west of Chinchilla and the Thomby Range, near Surat, south-eastern Queensland. Known to occur within Talinga/Orana tenement (Craig Eddie pers. comm.) and one record approximately 2.3km west of Condabri tenement during the recent ground

Family	Species name	Common name	EPBC Act status	Habitat preference	Known distribution and likelihood of occurrence
				and bullock and various wattles (Eddie 2007).	surveys (Volume 5 Attachment 14). Known to occur within study area.
Myrtaceae	<i>Calytrix gurlmundensis</i>	Gurulmundi fringe myrtle	Vulnerable	Open scrublands with sparse stunted Eucalyptus, Acacia and Casuarina species on ridge tops and spinifex hummock grasslands with scattered shrubs in yellow lateritic sandy clay, shallow red gravelly soils on sandstone. Associated with catkin wattle, thready-bark oak <i>Allocasuarina inophloia</i> , brown bloodwood.	Restricted to the Gurulmundi, Guluguba and Barakula area in south-eastern Queensland. Eleven records from within Wooleebee tenement during the recent ground surveys (Volume 5 Attachment 14). Known to occur within study area.
Myrtaceae	<i>Eucalyptus argophloia</i>	Queensland white gum	Vulnerable	Found in open forests dominated by Brigalow, belah or Inland grey box in brown to black clay to clay-loam soils on flat terrain.	Restricted to the Chinchilla area, in southern Queensland. Not likely to occur within study area.
Myrtaceae	<i>Eucalyptus beaniana</i>	Bean's ironbark	Vulnerable	Found in woodlands in association with lemon-scented spotted gum, Gympie messmate <i>Eucalyptus cloeziana</i> , the ironbark <i>E. suffulgens</i> , large-fruited yellow jacket, brown bloodwood and narrow-leaved white mahogany, in shallow, sandy soils on quartzose sandstone ridges.	Restricted to two localities at Isla Gorge and north-east of Baroondah Station in central Queensland. Not likely to occur within study area.
Myrtaceae	<i>Eucalyptus virens</i>	Shiny-leaved ironbark	Vulnerable	Found in woodlands dominated by Queensland peppermint, the apple <i>Angophora costata</i> , Tom Russell's mahogany <i>Lysicarpus ternifolius</i> and woolly she-oak, in coarse sandy, skeletal soils on outcropping sandstone escarpments; forests dominated by bullock and red ironbark in shallow, grey sandy soils on flat lands; and woodlands dominated by bendo, the smooth-barked apple and woolly she-oak, in coarse white sandy soils over sandstone on undulating lands.	Restricted to four disjunct localities near Mt Moffatt in the Carnarvon area, Brovinia area south of Mundubbera, Tara area west of Dalby and Coolmunda Dam east of Inglewood in southern Queensland. Possibly occurs within study area.

Family	Species name	Common name	EPBC Act status	Habitat preference	Known distribution and likelihood of occurrence
Myrtaceae	<i>Homoranthus decumbens</i>	Decumbent homoranthus	Vulnerable	Found in tall shrublands and heathlands in association with the shrub <i>Goodenia racemosa</i> , cone bushes (<i>Petrophile spp.</i>), grasstrees (<i>Xanthorrhoea spp.</i>) and dwarf banksia <i>Banksia oblongifolia</i> , in shallow sandy soils containing lateritic pebbles and on sandstone cliff edges and at 0 – 800m altitude.	Restricted to the Barakula Forestry Area near Chinchilla and the Blackdown Tableland National Park in southern and central Queensland. Not likely to occur within study area.
Orchidaceae	<i>Diuris tricolor</i>	Pink donkey-orchid	Vulnerable	Found in sclerophyll forests and ironbark-acacia shrublands in association with white cypress pine, poplar box, gum coolibah <i>Eucalyptus intertexta</i> and often with a grassy to herbaceous understorey, in sandy soils on flats and small rises and sometimes red earths.	Restricted to coastal ranges eastern Australia, from south-east Queensland to the New South Wales - Victoria border. Known to occur within study area.
Orchidaceae	<i>Pterostylis cobarensis</i>	Cobar greenhood orchid	Vulnerable	Found in eucalypt woodlands, open mallee and cypress pine shrubland in skeletal sandy loam soils on low stony ridges and slopes and in association with Morris' grey mallee <i>Eucalyptus morrisii</i> , green mallee, gum coolibah, Manara Hills red gum <i>E. vicina</i> , white cypress pine, wilga, belah, spearwood <i>Acacia doratoxylon</i> , cassias (<i>Senna spp.</i>) and emu bushes (<i>Eremophila spp.</i>).	Restricted to the central eastern Australia from Darling Downs in southern Queensland south to Nyngan-Cobar-Bourke region in New South Wales and west to eastern South Australia. Known to occur within study area.
Poaceae	<i>Bothriochloa biloba</i>	Lobed blue-grass	Vulnerable	Found in cleared eucalypt forests and relict grasslands dominated by purple wiregrass <i>Aristida ramosa</i> , red-leg grass <i>Bothriochloa macra</i> , pitted bluegrass <i>B. decipiens</i> and windmill grass <i>Chloris truncata</i> , in heavier-textured soils including brown or black clays.	Restricted to the Darling Downs region of southern Queensland and tablelands and western slopes of the Great Dividing Range in northern New South Wales. Not likely to occur within study area.

Family	Species name	Common name	EPBC Act status	Habitat preference	Known distribution and likelihood of occurrence
Poaceae	<i>Dichanthium queenslandicum</i>	King blue-grass	Vulnerable	Found in black clay soils.	Restricted to Emerald and, rarely, the Darling Downs in Queensland. Not likely to occur within study area.
Poaceae	<i>Digitaria porrecta</i>	Finger panic grass	Endangered	Found in grasslands on extensive basaltic plains in association with Queensland bluegrass.	Restricted to coastal regions of south Queensland and in northern NSW. Not likely to occur within study area.
Poaceae	<i>Homopholis belsonii</i>	Belson's panic grass	Vulnerable	Found in white box communities and wilga woodlands on rocky hills; belah forests in alluvial soils on flat to undulating lands; poplar box woodlands; and dry woodlands on poor soils derived from basalt at 200 – 520m altitude. Also recorded in Brigalow, myall and weeping myall communities; mountain coolibah communities; and on roadsides.	Restricted to Darling Downs region in southern Queensland to north-west slopes of northern New South Wales. Two records from within Carinya tenement during the recent ground surveys (Volume 5 Attachment 14). Known to occur within study area.
Rutaceae	<i>Philotheca sporadica</i>	Waxflower	Vulnerable	Found in low open acacia and eucalypt forest in shallow uniform sandy loams to clay loams on residual hills of laterised Cretaceous sandstones.	Restricted to north of Tara, approximately 12km east of Kogan in the Darling Downs District, in south-eastern Queensland. Known to occur within study area.
Rutaceae	<i>Zieria verrucosa</i>	Warty zieria	Vulnerable	Found in semi-evergreen vine thickets in red soils and in Red Ironbark woodland in red clay soils, on gently inclined hillslopes at 360 – 500m altitude.	Restricted to a small area near Mundubbera in south-eastern Queensland. Not likely to occur within study area.
Santalaceae	<i>Thesium australe</i>	Austral toadflax	Vulnerable	Found in damp sites in association with kangaroo grass in grasslands and grassy woodlands.	Restricted to the coastal regions of eastern Australia. Not likely to occur within study area.

Family	Species name	Common name	EPBC Act status	Habitat preference	Known distribution and likelihood of occurrence
Scrophulariaceae	<i>Microcarpaea agonis</i>	Microcarpaea	Endangered	A wetland species found on the margins of <i>Eleocharis</i> – <i>Cyperus</i> spp. dominated seasonal swamplands.	Restricted to Goondiwindi – Millmerran area in southern Queensland. Possibly occurs within study area.
Surianaceae	<i>Cadellia pentastylis</i>	Ooline	Vulnerable	Found in semi-evergreen vine thickets in association with native quinine, hard alectryon <i>Alectryon subdentatus</i> , leopard ash <i>Flindersia collina</i> , wilga and narrow-leaved bottle tree <i>Brachychiton rupestris</i> on sandstone and basalt slopes and currawong, Brigalow and belah communities on undulating clay plains and low hills at altitudes 200 – 500m.	Known to occur within Woleebee tenement, between Jackson-Wandoan Road and Gurulmundi State Forest. Nine records from within Wooleebee tenement during the recent ground surveys (Volume 5 Attachment 14). Known to occur within study area.
Zamiaceae	<i>Macrozamia fearnsidei</i>	Central Queensland zamia palm	Vulnerable	Occurs in open woodlands of large-fruited yellow jacket, lemon-scented gum and budgeroo.	Known from sandstone escarpments of the Great Dividing Range north of Injune and Taroom, in central Queensland. Recorded from within 2.3km of the study area boundary at the extreme north-western end (Beilba/Kentucky area) (QLD Herbarium records). Possibly occurs within study area.

In addition, based on the surveys and/or habitat preference analysis, the study area is considered to support suitable habitat for an additional 13 species namely:

- Dunmore mint-bush
- Chinchilla wattle
- Curly-barked wattle
- Tara wattle
- Thomby Range wattle
- Gurulmundi fringe myrtle
- Shiny-leaved ironbark
- Pink donkey-orchid
- Cobar greenhood orchid
- Belson's panic grass
- Waxflower
- Ooline
- Central Queensland zamia palm

These species are described in the context of the significant impact guidelines, below.

Chinchilla wattle

The Chinchilla wattle is listed as vulnerable under the EPBC Act and is endemic to the Chinchilla region of Queensland. The species is recorded from more than 29 locations in Queensland, covering a range of 200km from just north of Chinchilla, as far east to Cecil Plains, and as far west as Tara, with a further outlying population recently discovered to the south, near Karara, west of Warwick (Queensland Herbarium 2007).

Chinchilla wattle occurs on gently undulating flat plains at 340 to 380m above sea level and flourishes in deep loamy sands to sandy loam soils with sandy clay subsoils, often with poor drainage and low nutrient levels (Halford 1995). It occurs in a mid to dense shrub layer in open forest with narrow-leaved red ironbark (*Eucalyptus crebra*), smooth-barked apple (*Angophora leiocarpa*) and narrow-leaved box (*E. pilligaensis*), often associated with bullock (Allocasuarina leuhmannii), black cypress pine (*Callitris endlicheri*), white cypress pine (*C. glaucophylla*), and white feather honey-myrtle *Melaleuca decora*.

There is currently no recovery plan established under the EPBC Act for the management of the Chinchilla wattle, but main threatening processes have been identified and include destruction of habitat by clearing, and inappropriate fire regimes (Barker 1995). Populations occurring in areas of remnant vegetation, as defined under the VMA, are currently protected from broad scale clearing including all populations occurring in State Forests.

Populations occurring in the Tara and Millmerran shires are spread over crown land (road reserve) or freehold tenure. Anecdotal evidence suggests loss of habitat at two of the sites due to road development and some clearing for cultivation (Halford 1995), although Johnson (2003) observed for

one population that clearing on its own, without land use change, did not adversely affect population numbers or available habitat for the species.

Within the gas fields' study area Chinchilla wattle is known to occur within the Talinga/Orana tenement (Craig Eddie pers. comm.) and one record was obtained from this area during the recent ground surveys (Volume 5 Attachment 14). Potential habitat includes REs 11.5.1, 11.5.4, 11.5.21, 11.7.4, 11.7.5, 11.7.6, 11.3.18, 11.5.5.

Assessment of impact significance – Chinchilla wattle

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If species is found, implementing avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If species is found, implementing avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If species is found, implementing avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM.

DEWHA would be required to confirm the appropriateness of this approach. The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1–N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 3,840ha of potential habitat (following mitigation), which equates to 1.1% of the extent within the study area and 0.3% of the extent within the relevant provinces¹.

It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 – N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of

¹ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

It is unlikely that the loss of potential habitat, equivalent to 1.1% of the extent within the study area and 0.3% of the extent within the relevant provinces, will prevent the recovery of this species.

Curly-barked wattle

The curly-barked wattle is endemic to New South Wales and Queensland and is listed as vulnerable under the EPBC Act. The species is known from three separate areas: Lake Cargelligo and Gunderbooka Range near Bourke in New South Wales and Gurulmundi in Queensland. The preferred habitat of this species consists of dry sclerophyll forests and semi-arid woodlands on rocky outcrops of isolated hills and ranges.

There is currently no recovery plan established under the EPBC Act for the management of this species, but main threatening processes have been identified and include habitat erosion; grazing, browsing and horning of adult and seedling plants by feral goats, grazing by stock, rabbits and macropods; clearing of vegetation for fire trail widening, quarrying activities at the Shephards Hill and Gurulmundi sites, predation of seeds by insects causing a large number of seeds to be non-viable and lack of suitable fire disturbance for seedling establishment (Department of Environment and Climate Change (DECC) 2005a).

Populations of curly-barked wattle are known from Gurulmundi to the immediate east of the study area (Craig Eddie pers. comm.), and the species distribution suggests the study area is of high importance. Potential habitat within the study area includes REs 11.7.5, 11.3.18, and 11.7.2 within the Gurulmundi area (Volume 5 Attachment 14).

Assessment of impact significance – Curly-barked wattle

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have not confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If species is found, implementing avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have not confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If species is found, implementing avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14).

If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If species is found, implementing avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

4. *Adversely affect habitat critical to the survival of a species*

If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If species is found, implementing avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 37ha of potential habitat representing 2.5% of the habitat available within the Gurulmundi region. It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

The species is only predicted to occur within the study area, and no important populations have been detected during recent surveys. It is unlikely that the loss of potential habitat, equivalent to representing 2.5% of the habitat available within the Gurulmundi region will prevent the recovery of this species.²

Tara wattle

Tara wattle is found in open woodlands in sandy soils, particularly shrubby woodlands with red ironbark (*Eucalyptus sideroxylon*), tumble-down ironbark (*Eucalyptus panda*), broombush (*Melaleuca uncinata*) and other *Acacia* species and *Triodia* species (Craig Eddie pers. comm.).

² Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

The species is restricted to the Inglewood – Tara region in the Darling Downs district of southern Queensland and there are a total of eight database records for this species from an area encompassing the study area. Potential habitat within the study area includes REs 11.7.4, 11.7.5, 11.7.7, 11.3.3, 11.3.17, 11.3.18, 11.4.12, and 11.9.1.

Assessment of impact significance – Tara wattle

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

This species is known to occur within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. If avoidance is not possible, consultation with DEWHA for disturbance conditions is recommended. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DEWHA and DERM.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health has been advised in the prescriptions for threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 1,679ha of potential habitat (following mitigation), which equates to 0.9% extent within the study area and 0.4% of the extent within the relevant provinces³. It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5

³ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread. No significant impact predicted.

Interfere substantially with the recovery of the species

It is unlikely that the loss of potential habitat, equivalent to 0.9% of the extent within the study area and 0.4% of the extent within the relevant provinces, will prevent the recovery of this species.

Thomby Range wattle

Thomby Range wattle is found in eucalypt woodland in gravelly soils on shallow weathered sandstone on ridge crests and slopes along the edges of woodlands or in clearings. It occurs with dusky-leaved ironbark (*Eucalyptus fibrosa* subsp. *Nubila*), narrow-leaved red ironbark, Queensland peppermint (*E. exserta*), brown bloodwood (*Corymbia trachyphloia*), white cypress pine, smooth-barked apple, native quinine (*Alstonia constricta*) and bullock and various wattles (Eddie 2007).

Thomby Range wattle is restricted to south of Roma, south-west of Chinchilla and the Thomby Range, near Surat, in south-eastern Queensland, and is known to occur within the Talinga/Orana tenement (Craig Eddie pers. comm.) and from one record approximately 2.3km west of the Condabri tenement during the recent ground surveys (Volume 5 Attachment 14).

Potential habitat within the study area includes REs 1.9.9, 11.5.21, 11.7.6, 11.7.2, 11.7.7, 11.7.4, 11.10.1, 11.10.9, 11.10.11, and 11.7.5.

Assessment of impact significance – Thomby Range wattle

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline. There is a proposed loss of approximately 2,113ha of potential habitat

(following mitigation), which equates to 0.8% extent within the study area and 0.2% of the extent within the relevant provinces⁴.

It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread. No significant impact is predicted.

9. *Interfere substantially with the recovery of the species*

It is unlikely that the loss of potential habitat, equivalent to 0.8% of the extent within the study area and 0.2% of the extent within the relevant provinces, will prevent the recovery of this species.

Ooline

Ooline is listed as vulnerable under the EPBC Act and is restricted to central New South Wales and Central Queensland, between Narrabri in the south to Rannes in the North. Ooline is found in semi-evergreen vine thickets in association with native quinine, hard alectryon (*Alectryon subdentatus*), leopard ash (*Flindersia collina*), wilga (*Geijera parviflora*) and narrow-leaved bottle tree (*Brachychiton rupestris*) on sandstone and basalt slopes and currawong (*Acacia sparsiflora*), Brigalow and belah communities on undulating clay plains and low hills at altitudes 200–500 metres.

There is currently no recovery plan established under the EPBC Act for the management of ooline however the main identified threats are localised extinction due to small and scattered populations; inbreeding which threatens genetic diversity in small populations; low seed viability which threatens breeding success; clearing for agriculture; grazing and soil compaction by domestic stock, feral goats and pigs; invasion of habitat by weeds, such as tiger pear (*Opuntia aurantiaca*), frequent fires, tunnel and sheet erosion, damage to roadside populations during roadworks and severe insect attack (Fletcher 2002; DECC 2005b).

⁴ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

Ooline is known to occur within the Wooleebee tenement, including a number of records between Jackson – Wandoan Road and Gurulmundi State Forest during the recent ground surveys. Potential habitat within the gas fields' study area includes REs 11.9.4, 11.9.5, 11.7.2, 11.9.10, and 11.9.1.

Assessment of impact significance – Ooline

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 703ha of potential habitat (following mitigation), which equates to 0.8% of the extent within the study area and 0.2% of the extent within the relevant provinces⁵.

It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of

⁵ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

It is unlikely that the loss of potential habitat, equivalent to 0.8% of the extent within the study area and 0.2% of the extent within the relevant provinces, will prevent the recovery of this species.

Gurulmundi fringe myrtle

The Gurulmundi fringe myrtle is endemic to Queensland and is listed as vulnerable under the EPBC Act. The species is known from the Gurulmundi, Guluguba and Barakula areas of Queensland. This species occurs on ridge tops in open scrubland with sparse stunted *Eucalyptus* spp., *Acacia* spp., and *Casuarina* in *Triodia*-hummock grassland with scattered shrubs, and growing on yellow lateritic sandy clay, shallow red gravelly soil and sandstone (Craven 1987).

There is currently no recovery plan established under the EPBC Act for the management of the Gurulmundi fringe myrtle however main threatening processes have been identified and include vegetation clearing, increasing fragmentation and loss of remnants, changed fire regimes, quarrying and inappropriate timber harvesting (Australian Natural Resource Atlas (ANRA) 2007).

Eleven records of this species were obtained from within the Wooleebee tenement during recent ground surveys. Potential habitat within the study area includes REs 11.7.6, 11.7.2, 11.7.5, 11.7.4, and 11.7.7 within the Gurulmundi area.

Assessment of impact significance – Gurulmundi fringe myrtle

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained.

Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline. There is a proposed loss of approximately 37ha of potential habitat (following mitigation), which equates to 2.5% of the extent within the Gurulmundi region).

It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 -

N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

It is unlikely that the loss of potential habitat, equivalent to 2.5% of the extent of habitat within the Gurulmundi region will prevent the recovery of this species.⁶

Pink donkey-orchid

The Pink Donkey-orchid is listed as vulnerable under the EPBC Act and occurs from Toowoomba in Queensland to Victoria where a single plant has been recorded (Jones 2006). It is sporadically distributed along the western slopes in New South Wales and in Queensland it occurs on the Darling Downs (Clements 2008).

Although population figures are unavailable, the species is widespread and may be locally common (Jones 2006). Pink Donkey-orchid grows in dry sclerophyll woodland and sclerophyll forest among grass, often with *Callitris*. Soils are often sandy or lateritic and landform ranges from flat to low laterite hills (Jones 2006).

There is no recovery plan established under the EPBC Act for the management of the tricolour diuris however main threatening processes have been identified and include clearing of vegetation (small-scale residential associated, through to broad-scale open-cut coal mining associated); weed invasion; grazing by domestic stock; feral pigs disturbing or eating orchid tubers; and illegal collection (NSW NPWS 2003; NSW Scientific Committee 2007). Invasive weeds include rhodes grass (*Chloris gayana*) and African lovegrass (*Eragrostis curvula*).

⁶ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

Pink Donkey-orchid is known to occur within the study area and potential habitat includes REs 11.10.9, 11.3.39, 11.9.7, 11.7.2, 11.7.5, 11.7.4, 11.3.4, 11.3.19, 11.5.20, 11.7.7, 11.3.2, 11.3.14, 11.5.1, 11.5.4, 11.7.6, 11.3.25, 11.5.5, 11.10.1, 11.10.11, 11.9.10, 11.10.9, and 11.3.18.

Assessment of impact significance – Pink donkey-orchid

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 5,728ha of potential habitat (following mitigation), which equates to 1.1% of the extent within the study area and 0.3% of the extent within the relevant provinces⁷.

It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The implementation of these measures is considered sufficient to prevent a decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

⁷ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, it is unlikely that the loss of potential habitat, equivalent to 1.1% of the extent within the study area and 0.3% of the extent within the relevant provinces, will prevent the recovery of this species.

Shiny-leaved ironbark

Shiny-leaved ironbark is endemic to south-east Queensland and is listed as vulnerable under the EPBC Act. There are five recorded sites, as far south as Inglewood and as far west as Mt Moffatt (Queensland Herbarium 2008). The total population size is currently unknown. It inhabits plateaux, sandstone escarpments or sandy soils on low rises (Queensland Herbarium 2008).

There is currently no recovery plan established under the EPBC Act for the management of this species however main threatening processes have been identified and include timber harvesting of the species, disturbance of habitat during timber harvesting operations, and loss of habitat due to vegetation clearing (Halford 1998).

Assessment of impact significance – Shiny-leaved ironbark

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have not confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have not confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 1,679ha of potential habitat (following mitigation), which equates to 0.9% of the extent within the study area and 0.2% of the extent within the relevant provinces⁸. It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this

⁸ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, it is unlikely that the loss of potential habitat, equivalent to 0.9% of the extent within the study area and 0.2% within the relevant provinces⁹, will prevent the recovery of this species.

Belson's Panic Grass

Belson's Panic Grass is listed as vulnerable under the EPBC Act and occurs within the Brigalow Belt South bioregion of Queensland and on the north-western slopes and plains of New South Wales (Trémont and Whalley 1993; Menkins 1998). In Queensland, the species has been recorded in the Darling Downs area, near Oakey, Jondaryan, Bowenville, Dalby, Acland, Sabine, Quinalow, Goombungee, Gurulmundi and Millmerran, and further west between Miles and Roma (Queensland Herbarium 2008).

Belson's Panic Grass occurs at elevations ranging from 200m to 520m above sea level (Trémont and Whalley 1993; Menkins 1998). It is known to occur in dry woodland habitats on poor soils, such as those derived from basalt. It occurs on rocky hills supporting white box and in wilga woodland, flat to gently undulating alluvial areas supporting belah forest (Trémont and Whalley 1993; DECC 2005c) and soils and plant communities of poplar box woodlands (Leigh et al. 1984; Menkins 1998).

⁹ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

It may also be associated with shadier areas of Brigalow, myall and weeping myall communities. It is generally found among fallen timber at the base of trees or shrubs, among branches and leaves of trees hanging to ground level or along the bottom of netting fences (Trémont and Whalley 1993).

There is currently no recovery plan established under the EPBC Act for the management of Belson's Panic Grass however main threatening processes have been identified and include clearing of habitat for agriculture, development or pasture improvement; overgrazing of habitat by domestic stock; invasion of habitat by introduced weeds (Leigh et al. 1984; Menkins 1998; DECC 2005c) and clearing of habitat for mining (New Hope Coal Australia 2007).

Two records of the species were obtained from the Carinya tenement during recent ground surveys, and potential habitat is provided by REs 113.17, 11.9.6, 11.3.1, 11.4.3, 11.4.7, 11.9.5, 11.3.2.

Assessment of impact significance – Belson's panic grass

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be

incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is no proposed loss of potential habitat for this species, following mitigation. It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14).

If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

It is unlikely that any unforeseen loss of potential habitat will prevent the recovery of this species.¹⁰

Central Queensland *zamia* palm

The Central Queensland *zamia* palm is known from sandstone escarpments of the Great Dividing Range north of Injune and Taroona, in central Queensland, including Queensland Herbarium records from within 2.3km of the study area boundary at the extreme north-western end (Beilba/Kentucky area). It occurs in open woodlands of large-fruited yellow jacket, lemon-scented spotted gum and budgeroo.

The presence of this species within the study area has not been confirmed, although it is considered a possible occurrence, particularly within REs 11.10.13, 11.10.1, 11.10.4, 11.10.3, 11.10.7, 11.10.9, and 11.10.11.

Assessment of impact significance – Central Queensland *zamia* palm

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have not confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have not confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found

¹⁰ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. With the provision of appropriate habitat offsets and translocation plans where necessary any reduction in the area of occupancy will be minor, whether or not any such population would be considered an important population.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

Adversely affect habitat critical to the survival of a species

No habitat critical to the survival of this species will be disturbed.

4. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained.

Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

5. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 574ha of potential habitat (following mitigation), which equates to 1% of the extent within the study area and 0.1% of the extent within the

relevant provinces¹¹. It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained.

Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

6. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

7. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

8. *Interfere substantially with the recovery of the species*

As the species is only predicted to occur within the study area, and no important population has been detected during recent surveys, it is unlikely that the loss of potential habitat, equivalent to 1% of the extent within the study area and 0.1% of the extent within the relevant provinces, will prevent the recovery of this species.

Microcarpaea

Microcarpaea is a wetland herb species found on the margins of *Eleocharis* – *Cyperus* spp. dominated seasonal swamplands. It is restricted to the Goondiwindi – Millmerran area in southern Queensland and possibly occurs within the gas fields' study area, even though it is known only from the type locality totalling 10 individuals (DEWHA 2008a).

Threatening processes include grazing, roadworks and trampling by livestock (DEWHA 2008a). Potential habitat for this species within the study area includes the majority of REs on alluvial soils, totalling approximately 60,000ha.

¹¹ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

Assessment of impact significance – Microcarpaea

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of a population*

Searches for this species have failed to confirm its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14) for application under the relevant EM Plan for each phase of the Project.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14).

If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, this native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of the species*

Searches for this species have failed to confirm its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If located avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14) for application under the relevant EM Plan for each phase of the Project.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, a reduction of occupancy of an important population is not considered likely provided the proposed mitigation measures are implemented.

3. *Fragment an existing population into two or more populations*

If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14) for application under the relevant EM Plan for each phase of the Project.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in

Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of a population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 478ha of potential habitat (following mitigation), which equates to 0.8% of the extent within the study area and 0.12% of the extent within the relevant provinces¹². It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained.

Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

¹² Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

9. *Interfere with the recovery of the species*

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, it is unlikely that the loss of 478ha of potential habitat, equivalent to 0.8% extent within the study area and 0.12% of the extent within the relevant provinces, will prevent the recovery of this species.

Waxflower

Waxflower is restricted to north of Tara approximately 12km east of Kogan in the Darling Downs District of south-eastern Queensland. It is found in low open acacia and eucalypt forest in shallow uniform sandy loams to clay loams on residual hills of laterised Cretaceous sandstones.

The presence of this species within the study area has been confirmed and distribution records suggest that the study area is of high importance to this species. Potential habitat includes REs 11.4.10, 11.5.1, 11.5.4, 11.7.6, 11.7.2, 11.7.7, 11.7.5, 11.7.4, 11.5.21, and 11.3.18.

Assessment of impact significance – Waxflower

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14).

If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Volume 5 Attachment 14 Section 3.5.1).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 37ha of potential habitat representing 2.5% of the total available habitat within the Gurulmundi region. It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

It is unlikely that the loss of potential habitat, equivalent to 2.5% of the total available habitat within the Gurulmundi region will prevent the recovery of this species.

Dunmore mint-bush

Dunmore mint-bush is restricted to near Millmerran in south-east Queensland. It is found in *Eucalyptus* - *Callitris* woodlands in shallow sandy soils and eucalypt woodlands on hard sandstone ridge tops.

Presence of this species has not been confirmed during present surveys, although the known distribution of this species suggests that the study area is potentially of high importance to this species. Potential habitat includes RE 11.10.11.

Assessment of impact significance – Dunmore mint-bush

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have failed to confirm its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If located avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14).

If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, this native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have failed to confirm its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If located avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, a reduction of occupancy of an important population is not considered likely provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If located avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14). If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline. There is a proposed loss of approximately 126ha of potential habitat (following mitigation), which equates to 1.7% of the extent within the study area and 0.1% of the extent within the relevant provinces¹³.

It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a

¹³ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, it is unlikely that the loss of 126ha of potential habitat, equivalent to 1.7% of the extent within the study area and 0.1% of the extent within the relevant provinces, will prevent the recovery of this species.

Cobar greenhood orchid

The Cobar greenhood orchid is listed as vulnerable under the EPBC Act. This species is known chiefly from the Nyngan–Cobar–Bourke district in the far western plains of New South Wales but is also known from the Central West, Namoi, Western (New South Wales) Border Rivers Maranoa–Balonne, Condamine (Queensland), and South Australia Arid Lands Natural Resource Management Regions.

The Cobar greenhood orchid inhabits eucalypt woodland, open mallee, or *Callitris* shrubland on low stony ridges and slopes with skeletal sandy-loam soils (DECC 2008).

There is currently no recovery plan established under the EPBC Act for the management of the Cobar greenhood orchid however the main threatening processes have been identified and include damage caused by feral goats, broad-scale vegetation clearing, grazing pressure, altered hydrology, increasing salinity, fragmentation and loss of remnants (ANRA 2007).

This species has a confirmed present within the study area and potential habitat includes REs 11.7.6, 11.7.2, 11.7.7, 11.7.5, 11.7.4, 11.10.9, 11.5.2, 11.5.4, 11.5.21, 11.5.5, and 11.10.1.

Assessment of impact significance – Cobar greenhood orchid

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of an important population*

Searches for this species have confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health has been advised in the guidelines for threatened species management (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing important population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach. The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of an important population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 4,944ha of potential habitat (following mitigation), which equates to 1.1% extent within the study area and 0.3% of the extent within the relevant provinces¹⁴. It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

¹⁴ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

It is unlikely that the loss of potential habitat, equivalent to 1.1% of the extent within the study area and 0.3% of the extent within the relevant provinces, will prevent the recovery of this species.

Slender tylophora

Slender tylophora is endemic to Queensland and New South Wales and is listed as endangered under the EPBC Act. This species is known from eight localities in the Dubbo area and Mt Crow near Barraba in NSW, and 'Regional Ecosystems Park' near Glenmorgan in Queensland.

Tylophora linearis grows in dry scrub, open forest and woodlands associated with broombush, red ironbark, white box *E. albens*, black cypress pine, white cypress pine, bulloak, hakea wattle *Acacia hakeoides*, striped wattle *A. lineata*, Myoporums (*Myoporum* spp.) and she-oaks (*Casuarina* spp.) at low altitudes and on sedimentary flats (DECC 2005d, Forster 1992).

There is currently no recovery plan established under the EPBC Act for the management of this species however main threatening processes have been identified and include forestry activities; disturbances such as grazing and fire; and invasion of habitat by introduced weeds, such as lantana *Lantana camara*.

Although widely distributed outside of, and not confirmed to be present within, the gas fields' study area, there is one database record for this species from an area encompassing the study area and it is considered a possible occurrence, particularly within RE 11.7.5 of which there is currently approximately 20,000ha.

Assessment of impact significance – Slender tylophora

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of a population*

Searches for this species have failed to confirm its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur, avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14) for application under the relevant EM Plan for each phase of the Project.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, this native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of the species*

Searches for this species have failed to confirm its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If located avoidance, buffering and monitoring for long-term health will be incorporated into the

threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14) for application under the relevant EM Plan for each phase of the Project.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, a reduction of occupancy of an important population is not considered likely provided the proposed mitigation measures are implemented.

3. *Fragment an existing population into two or more populations*

If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14) for application under the relevant EM Plan for each phase of the Project.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of a population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

There is a proposed loss of approximately 126ha of potential habitat (following mitigation), which equates to 0.6% of the extent within the study area and 0.2% of the extent within the relevant provinces¹⁵.

It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 -

¹⁵ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere with the recovery of the species*

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys, it is unlikely that the loss of 126ha of potential habitat, equivalent to 0.6% extent within the study area and 0.2% of the extent within the relevant provinces, will prevent the recovery of this species.

Herbaceous xerothamnella

Herbaceous xerothamnella is found in Brigalow dominated communities in shaded situations, often in leaf litter and in association with gilgais, on heavy, grey to dark brown clay soils. It is restricted to the Chinchilla –Goondiwindi region of southern Queensland, with two populations recorded near Theodore and near Yelarbon. Total population size and area are currently unknown.

Threatening processes include competition from invasive plants, inappropriate fire regimes, road widening and maintenance activities, surface erosion and grazing and trampling by cattle (Briggs and Leigh 1995; DEWHA 2008b). The presence of this species within the study area has not been confirmed by recent ground surveys, although there are nine database records from an area encompassing the study area and distribution of this species suggests that the study area is of high importance. Potential habitat for this species within the study area includes REs 11.4.10, 11.9.1, 11.3.3, 11.4.3, 11.7.6, 11.4.7, 11.9.5, 11.3.1, 11.3.17 and 11.9.10, totally approximately 45,000ha.

Assessment of impact significance – Herbaceous xerothamnella

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of a population*

Searches for this species have not confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found

to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

2. *Reduce the area of occupancy of the species*

Searches for this species have not confirmed its presence within the study area. Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With the provision of appropriate habitat offsets and translocation plans where necessary, native habitat loss is not considered significant provided the proposed mitigation measures are implemented.

3. *Fragment an existing population into two or more populations*

Site specific searches will be conducted for this species in suitable habitat proposed to be disturbed. If found to occur avoidance, buffering and monitoring for long-term health will be incorporated into the threatened species management guidelines (Section 3.5.1 of Volume 5 Attachment 14).

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of the measures prescribed above will mitigate or avoid fragmentation of existing important populations.

4. *Adversely affect habitat critical to the survival of a species*

No habitat critical to the survival of this species will be disturbed.

5. *Disrupt the breeding cycle of a population*

It is expected that any disruption to any possible local population of the species would be minor and temporary.

If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area could be considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline. There is a proposed loss of approximately 83ha of potential habitat (following mitigation), which equates to 0.4% of the extent within the study area and 0.05% of the extent within the relevant provinces¹⁶.

It is intended to search for the presence of this species and avoid populations where found on a site-by-site basis. If disturbance to a known population of this species is unavoidable relevant permits and disturbance conditions from DERM will be obtained. Design and implement a translocation plan according to Australian Network for Plant Conservation (2004) (Tables N1 - N4 of Appendix N in Volume 5 Attachment 14). If offsets are necessary they will be made by agreement with DERM. DEWHA would be required to confirm the appropriateness of this approach.

The combination of avoidance where possible, translocation and/or habitat offset is considered sufficient to mitigate any possible decline in this species.

7. *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 of Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the weed management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 of Volume 5 Attachment 14) will assist in the prevention of the introduction of plant diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere with the recovery of the species*

As the species is only predicted to occur within the study area, and no important populations have been detected during recent surveys. It is unlikely that the loss of potential habitat, equivalent to 0.4% of the extent within the study area and 0.05% of the extent within the relevant provinces, will prevent the recovery of this species.

¹⁶ Relevant provinces include provinces 25, 26, 27, 28, 30, 31 and 32 of the BBS bioregion (Section 2.3.1 of Volume 5 Attachment 14).

23.5.2 Terrestrial fauna

Based on the assessment of existing terrestrial ecological values (Volume 5 Attachment 14), 14 terrestrial fauna species listed (or with a pending listing) as threatened under the EPBC Act are known or considered possible occurrences within the gas fields' study area Table 23.4. This includes one species pending listing as critically endangered, two species listed (or pending listing) as endangered and 11 species listed as vulnerable.

Four of these species were recorded during the recent ground surveys, while the remaining 10 species are either known from previous records or are considered possible occurrences based on the presence of suitable habitat within the gas fields' study area.

The table also list those 10 species identified from the desktop review that are not considered likely to occur in the gas fields' study area, based on a lack of known or reliable records and habitat preference.

In summary, it is considered that, based on habitat preference, the gas fields' study area may support suitable habitat for a total of 14 terrestrial fauna species (excluding migratory birds) listed under the EPBC Act, including three endangered species and 13 vulnerable terrestrial fauna species.

The relevant endangered species are as follows:

- Dulacca woodland snail Camaenidae BL12
- Brigalow woodland snail Camaenidae BL13
- Swift parrot.

The relevant vulnerable species are as follows:

- Adorned (collared) delma
- Brigalow scaly-foot
- Yakka skink
- Dunmall's snake
- Squatter pigeon
- Red goshawk
- Australian painted snipe
- Black-breasted button-quail
- Grey-headed flying-fox
- Large-eared pied bat
- South-eastern long-eared bat.

Table 23.4 Likely occurrence of threatened terrestrial fauna species within the study area

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/ relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
Gastropoda Camaenidae	In preparation ¹	Dulacca woodland snail Camaenidae BL12 ²	Endangered ³	Eight records. One Queensland Museum record and seven BAAM survey records (2009), all in Carinya tenement. Known only from study area.	Recorded from REs 11.4.3, 11.5.1/11.7.6, 11.7.7/11.7.4/11.5.1 and 11.9.5/11.9.10 but not normally expected to occur in REs 11.4.3 and 11.9.5.
Gastropoda Camaenidae	In preparation ¹	Brigalow woodland snail Camaenidae BL13 ²	Critically Endangered ⁴	Five BAAM survey records (2009), three in Talinga and Orana tenements with another just west of the Condabri tenement.	Known from REs 11.3.1, 11.3.3/11.3.4/11.3.25 and 11.3.25/11.3.4/11.3.3.
Reptilia Chelidae	<i>Rheodytes leukops</i>	Fitzroy turtle	Vulnerable	No actual database records, EPBC search only. Known to the north of the study area (McFarland et al. 1999a, b). Not expected to occur.	
Reptilia Pygopodidae	<i>Delma torquata</i>	Adorned (collared) delma	Vulnerable	One published record for Gilbert Gully (Hines et al. 2000). No database records, known to the east of the study area (McFarland et al. 1999a, b). Cryptic species that may occur elsewhere in the study area in suitable habitat.	Open eucalypt forest with a shrub and tussock grass understorey. Soil type is usually shallow and deep-cracking or stony (Ehmann 1992; Wilson and Swan 2008). RE 11.3.2 could be an important habitat for the species but most typical habitat is Land Zone 10 in REs 11.10.1 and 11.10.1d.
Reptilia Pygopodidae	<i>Paradelma orientalis</i>	Brigalow scaly-foot	Vulnerable	16 WildNet records. Two Queensland Museum records. One BAAM survey record (2009) in Combabula tenement.	Brigalow and other Acacia species woodlands, sparse tussock grass vegetation on grey cracking soils, poplar box open

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/ relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
				Database records from Talinga, Kainama, Gilbert Gully, Condabri, Woleebee and Carinya tenements. Could occur throughout the study area.	woodland, sandstone rises in dry sclerophyll forests, Ironbark dominated forest and mixed open woodland with spinifex (Shea 1987; Schulz and Eyre 1997; Kutt et al. 2003). Many different REs on Land Zones 3, 4, 5, 7, 9 and 10. Most important habitats are REs 11.9.5, 11.10.1, 11.10.1d, and 11.10.4.
Reptilia Scincidae	<i>Anomalopus mackayi</i>	Five-clawed worm-skink	Vulnerable	No database records, EPBC search only. Known to the east and north of the study area (McFarland et al. 1999a, b). Not expected to occur.	
Reptilia Scincidae	<i>Egernia rugosa</i>	Yakka skink	Vulnerable	Two WildNet records. Two Queensland Museum records, including one from Talinga tenement. Colony currently known from Talinga (Eddie 2008; Golder Associates 2008). Two pre-1975 records listed in McFarland et al. (1999a, b) are likely to be the WildNet records. Secretive species that occurs in a variety of habitats and which may be widespread in the study area. Probably under-recorded.	Variety of drier forests and woodlands (usually on well drained, coarse gritty soils) including poplar box on alluvial soils, low ridges, Callitris on sands, belah (Ehmann 1992; Cogger 2000; Drury 2001; Wilson 2005). Also occur in highly degraded sites and where there are log piles and rabbit warrens (EPA 2003). Important habitat for the species includes RE 11.3.2, 11.3.3, 11.3.14, 11.4.4 and 11.9.3. Also occurs in Land Zone 5.

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/ relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
Reptilia Agamidae	<i>Tympanocryptis pinguicolla</i>	Grassland earless dragon	Endangered	No actual database records, EPBC search only. Known to the east of the study area (McFarland et al. 1999a, b). Not expected to occur, but possible in croplands on suitable substrates in eastern portion of study area.	
Reptilia Elapidae	<i>Denisonia maculata</i>	Ornamental snake	Vulnerable	No database records, EPBC search only. Known to the north of the study area (McFarland et al. 1999a, b). Not expected to occur.	
Reptilia Elapidae	<i>Furina dunmalli</i>	Dunmall's snake	Vulnerable	Four WildNet records, one pre-1975, three 2009. Two Queensland Museum (QM) records, 1978 and 2000. One record 1975-1999 (McFarland et al. 1999a, b), possibly the 1978 QM record. Little known species whose habitats requirements and distribution are poorly understood. Could be widespread at low densities throughout the study area.	Poorly known but most recorded in open forests and woodlands, particularly Brigalow and woodlands growing on cracking black clay and clay loams (Cogger et al. 1993). Also recorded from dry eucalypt forests and may occur in vine thickets. Occurs in Land Zones 3, 4, 5, 7, 9 and 10 but insufficiently known to identify most important REs.
Aves Columbidae	<i>Geophaps scripta scripta</i>	Squatter pigeon (southern subspecies)	Vulnerable	Three Queensland Museum records, two from the 1800s and one from 1936. Two Birds Australia records, one outside the study area and the other within the area	Dry grassy eucalypt woodlands and open forests, also Callitris and acacia woodlands. Most birds live in sandy sites near permanent water (Frith 1982; Blakers et al.

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/ relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
				but not within a tenement. One BAAM survey record (2009) in Ramyard tenement. 'Observed occasionally' in database search area (URS 2009). Very sparse in the study area.	1984; Crome and Shields 1992). Occurs in land zones 3, 4, 5, 7, 9 and 10.
Aves Accipitridae	<i>Erythrotriorchis radiatus</i>	Red goshawk	Vulnerable	Two WildNet records, 1978 and pre 1975 (McFarland et al. 1999a, b). Recorded from Talinga tenement. Very occasional visitor, probably largely absent from the study area.	Woodlands and forests, ideally with a mosaic of vegetation types and permanent water, particularly riverine forests. The species avoids both very dense and very open habitats (Marchant and Higgins 1993).
Aves Pedionomidae	<i>Pedionomus torquatus</i>	Plains-wanderer	Vulnerable	Four WildNet records, all of unknown date and location. One pre-1975 record for study area (McFarland et al. 1999a, b), included in WildNet. Vagrant to the study area. Most likely in non-remnant vegetation.	Sparse, natural grasslands with short grass and a few taller shrubby plants (Geering et al. 2007).
Aves Rostratulidae	<i>Rostratula australis</i>	Australian painted snipe ⁵	Vulnerable, Migratory	One WildNet record, pre 1975 (McFarland et al. 1999a, b). One Birds Australia record from outside the study area. '[S]een most years' in Talinga tenement (Eddie 2008). Cryptic species that could occur in any suitable habitat including drainage ditches, farm dams, and flooded paddocks. Probably under-recorded in study area.	Terrestrial shallow wetlands, ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains (Marchant and Higgins 1993). Most likely in REs 11.3.2, 11.3.25 and 11.3.27b but could also occur in gilgaied areas.

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/ relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
Aves Turnicidae	<i>Turnix melanogaster</i>	Black-breasted button-quail	Vulnerable	One WildNet record, no location or date details available. Known to the north and east of study area (McFarland et al. 1999a, b). Possibly occurs in softwood scrubs in the study area. However status in the study area not confirmed and it may not be present.	Semi-evergreen vine thicket, low microphyll vine forest and dry rainforest of Brigalow, belah and bottletree (Marchant and Higgins 1993). Most likely to occur in REs 11.8.3, 11.9.4a and 11.9.4b in the study area.
Aves Psittacidae	<i>Polytelis swainsonii</i>	Superb parrot	Vulnerable	No actual database records, EPBC search only. Not expected to occur.	
Aves Psittacidae	<i>Lathamus discolor</i>	Swift parrot	Endangered	Three WildNet records, including Broadbent's 1885 record, a pre-1975 record whose location is uncertain and one 1964 record from Rockwood Station in Talinga tenement. Also seen three or four times in recent decades at Rockwood Station where it is considered a 'rare visitor' (Eddie 2008). Non-breeding winter migrant which is a very occasional visitor to the study area.	Mainly dry open eucalypt forest and woodland, including those with grey box or river red gum (Higgins 1999). Most likely to be recorded in REs 11.3.25, 11.3.26 and 11.3.27b in the study area.
Aves Meliphagidae	<i>Anthochaera phrygia</i>	Regent honeyeater ⁶	Endangered, Migratory	One record, Broadbent (1885), also recorded in Queensland Museum database. Not expected to occur.	
Aves	<i>Poephila cincta</i>	Black-throated finch	Endangered	One record, Broadbent (1885), also	

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/ relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
Estrilidae	<i>cincta</i>	(southern subspecies)		recorded in WildNet and Queensland Museum databases. Not expected to occur.	
Aves Estrilidae	<i>Neochmia ruficauda ruficauda</i>	Star finch (eastern subspecies)	Endangered	No actual database records, EPBC search only. Not expected to occur.	
Mammalia Dasyuridae	<i>Dasyurus hallucatus</i>	Northern quoll	Endangered	No actual database records, EPBC search only. Not expected to occur.	
Mammalia Dasyuridae	<i>Dasyurus maculatus</i>	Spot-tailed quoll	Endangered	One WildNet record of unknown date (pre-1975) and location. May be from outside the study area. Known to the north and east (McFarland et al. 1999a, b). Not expected to occur.	
Mammalia Vombatidae	<i>Lasiiorhinus krefftii</i>	Northern hairy-nosed wombat	Endangered	One WildNet record, 1927, from outside the study area. Not expected to occur.	
Mammalia Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed flying-fox	Vulnerable	One WildNet record of unknown date and location (pre-1975), known to the east and north of the Study Area (McFarland et al. 1999a, b). Also known from the Taroom area (Craig Eddie pers. comm.). Known from the Chinchilla area (no details) (Hando and Hando 1997). The species is considered marginal within the study area.	In the study area grey-headed flying-fox is most likely to occur in areas of profusely flowering eucalypts, particularly on more fertile alluvial soils. The establishment of a camp is only likely within riparian vegetation.

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/ relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
Mammalia Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared pied bat	Vulnerable	One WildNet record (1997) in Gilbert Gully tenement. Roosting sites most likely to be associated with Gurulmundi State Forest and surrounding areas. Possibly occurs in vegetation on sandstone in the study area.	Little known, but may depend heavily on sandstone outcrops. It has been found roosting in disused mine shafts, caves, overhangs and disused fairy martin <i>Petrochelidon ariel</i> nests (Hoye and Schulz 2008). It also possibly roosts in the hollows of trees (Duncan et al. 1999). Possibly occurs in REs on sandstone, such as 11.10.1 and in areas of <i>Callitris</i> such as REs 11.3.14 and 11.3.18.
Mammalia Vespertilionidae	<i>Nyctophilus sp. formerly timoriensis</i> ⁷	South-eastern long-eared bat	Vulnerable	Six WildNet records, all 2001 or 2002 with records from Talinga and Condabri tenements. One Queensland Museum record. One survey record near Condamine (Unidel Energy and Infrastructure 2009). Very sparse in the study area.	Dry forest habitats including river red gum, open woodland, mallee, Brigalow and other arid and semi-arid habitats. It appears to be more common in box, ironbark and cypress-pine forests on sandy soils in southern Queensland (Churchill 2008; Turbill et al. 2008). May occur in all Land Zones.

1 Undescribed species, description will be published in 2010 in Stanisic et al. (in preparation).

2 Undescribed species, alpha-numeric code is as cited in Queensland Museum database.

3 Currently under submission to DEWHA for listing under the EPBC Act as Endangered.

4 Currently under submission to DEWHA for listing under the EPBC Act as Critically Endangered.

5 Listed as Migratory under the EPBC Act as Painted Snipe *Rostratula benghalensis s. lat.*

6 Listed as Migratory under the EPBC Act as *Xanthomyza phrygia*.

7 Very recently described as *Nyctophilus corbeni* (Parnaby 2009).

Each species is discussed in detail below in relation to relevant significant impact criteria.

As the Australian painted snipe is a listed migratory species as well as a vulnerable species, it is also discussed in the migratory species section of this chapter.

Potential impacts of the Project on terrestrial fauna are likely to be primarily associated with habitat loss, degradation, fragmentation and loss of connectivity due the physical clearing of vegetation for infrastructure development. This may include:

- The potential for increase in accidental fire which causes direct mortality, alters the structure and therefore the suitability of habitats for fauna species, and facilitates weed invasion which may increase fire intensity
- Ongoing edge effects, for example, through increased solar radiation, increase wind effects, desiccation and vegetation dieback
- The construction of access tracks through remnant vegetation causing increased access for feral predators such as foxes, cats and cane toads
- The construction of access tracks causing increased access for competitors such as cane toads and common myna and aggressive native species (such as noisy miner and rainbow lorikeet) which may exclude other native species
- Increased access for native predators such as laughing kookaburra and pied butcherbird which may increase predation on native species, particularly small reptiles
- Construction of access tracks and artificial water bodies leading to an increase of, or colonisation by, cane toads and subsequent increased potential mortality due to attempted predation of cane toads by native frog-eating species, particularly reptiles
- Increased weed invasion - particularly exotic grasses which outcompete native species and increase fire frequency and intensity
- Changes to hydrological conditions that may affect habitat for frogs
- The creation of artificial water bodies which may provide suitable resources for a variety of native fauna
- More local effects of increased noise and night time lighting.

Dulacca woodland snail Camaenidae BL12

Dulacca woodland snail (Camaenidae BL12) is an undescribed species of land snail to be submitted for listing under the EPBC Act as 'endangered'. Its name will be formally published in early 2010 after which the official submission will be made.

This species was previously known from a single population from a rocky peak, east of Dulacca, and it is now known to encompass the Miles-Dulacca area, wholly within the Carinya tenement. As a result of the surveys undertaken for this project, seven new records of the species have now been documented from within the tenements in a variety of REs and non-remnant vegetation.

Soil types where specimens were found include clay plains (land zone 4), sandy and loamy soils (land zone 5), duricrust (land zone 7) and fine-grained sedimentary rocks (land zone 9). The species is threatened by land clearing, fire, trampling by livestock and feral predators.

Significant impact criteria – Dulacca woodland snail

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of a population*

Some potential habitat for this species may be lost as a result of the proposed action.

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would prevent any long-term decrease in the size of the population.

2. *Reduce the area of occupancy of the species*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would prevent any reduction in the area of occupancy of the population.

3. *Fragment an existing population into two or more populations*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would prevent any long-term decrease in the size of the population.

4. *Adversely affect habitat critical to the survival of a species*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines (Section 3.5 in Volume 5 Attachment 14) through the EM Plan for each phase of the Project would prevent any adverse effects on habitat critical to the survival of the species.

5. *Disrupt the breeding cycle of a population*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would prevent any disruption to the breeding cycle of the population.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

Some potential habitat for this species would be lost as a result of the proposed action
Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would result in any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species to not be of an extent that is likely to cause the species to decline.

7. *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the feral species management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 in Volume 5 Attachment 14) will assist preventing the introduction of animal diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere with the recovery of the species*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would result in any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species to not be of an extent that is likely to interfere with the recovery of the species.

Brigalow woodland snail Camaenidae BL13

The Brigalow woodland snail (Camaenidae BL13) is an undescribed species of land snail to be submitted for listing under the EPBC Act as critically endangered. Its name will be formally published in early 2010 after which the official submission will be made. This species is previously known from the Chinchilla area from scattered populations in remnant Brigalow/woodland vegetation.

All recent records from the Talinga/Orana tenement have been collected from Brigalow habitat on alluvial black soils. Within the study area, four new records of the species were documented from remnant Brigalow vegetation, all occurring in Land Zone 3 (alluvial soils); while a single record was collected in a non-remnant vegetation patch.

The distribution of the Brigalow woodland snail encompasses the Talinga-Orana tenement and extends east to near Lake Broadwater. The species is threatened by clearing of Brigalow for agriculture and grazing, fire, trampling by livestock and feral predators.

Significant impact criteria – Brigalow woodland snail

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of a population*

Some potential habitat for this species may be lost as a result of the proposed action.

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would prevent any long-term decrease in the size of the population.

2. *Reduce the area of occupancy of the species*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would prevent any reduction in the area of occupancy of the population.

3. *Fragment an existing population into two or more populations*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would prevent any long-term decrease in the size of the population.

4. *Adversely affect habitat critical to the survival of a species*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would prevent any adverse effects on habitat critical to the survival of the species.

5. *Disrupt the breeding cycle of a population*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would prevent any disruption to the breeding cycle of the population.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

Some potential habitat for this species would be lost as a result of the proposed action. Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would result in any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species to not be of an extent that is likely to cause the species to decline.

7. *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the feral species management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 in Volume 5 Attachment 14) will assist in preventing the introduction of animal diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project, to include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere with the recovery of the species*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines (Section 3.5.1 in Volume 5 Attachment 14) and implementation of the habitat management guidelines through the EM Plan for each phase of the Project would result in any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species to not be of an extent that is likely to interfere with the recovery of the species.

Swift parrot

This species breeds in Tasmania during spring and summer, dispersing widely across south-eastern Australia during winter (NSW NPWS 2003). Movements on the mainland are little understood and the species is considered nomadic and irruptive, moving in response to food resources (Higgins 1999). It is infrequently, though possibly annually, recorded in south-eastern Queensland. The species feeds mainly on nectar, mostly from eucalypts. Swift parrots occur in woodlands, riparian vegetation and remnant patches of mature eucalypts in agricultural areas, though they prefer dry sclerophyll forest (Higgins 1999; NSW NPWS 2003).

The swift parrot is threatened by clearing of suitable habitat, loss of nest hollows due to forestry practices, competition for nest hollows with introduced common starlings *Sturnus vulgaris*, land degradation that leads to dieback of eucalypts, and lack of regeneration of food tree species (Garnett and Crowley 2000; NSW NPWS 2003).

Significant impact criteria – Swift parrot

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of a population*

A portion of potential habitat for this species would be lost as a result of the proposed action. Although mitigation is not recommended specifically for this species due to its very occasional visitor status in the study area the relevant habitats will be mitigated for under State listed species such as square-tailed kite (*Lophoictinia isura*).

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would lead to the long-term decrease of an important population of the species.

2. *Reduce the area of occupancy of the species*

There are less than 10 known records of the species in the study area and its surrounds since 1885 and no important population is known for the study area.

3. *Fragment an existing population into two or more populations*

If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur.

4. *Adversely affect habitat critical to the survival of a species*

A paucity of historical records indicates that there is no habitat present that is critical to the survival of the species.

5. *Disrupt the breeding cycle of a population*

This species breeds in Tasmania during spring and summer, dispersing widely across south-eastern Australia during winter. A paucity of records indicates that there is no habitat present that is critical to the breeding cycle of an important population.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

7. *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project.

The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the feral species management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of animal diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere with the recovery of the species*

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would interfere with the recovery of the species.

Adorned (collared) delma

The adorned delma is a small, secretive species that shelters in soil cracks, leaf litter and under rocks in open eucalypt forest with a shrub and tussock grass understorey. Soil type is usually shallow and deep-cracking or stony (Ehmann 1992; Wilson and Swan 2008). The species generally occurs on rocky hillsides and is patchily distributed from the western edges of Brisbane north to Blackdown Tableland and inland to the Bunya Mountains and Expedition Range (Wilson 2005; Wilson and Swan 2008).

Significant impact criteria – Adorned delma

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Some potential habitat for this species would be lost as a result of the proposed action. Mitigation is not recommended for this species due to its apparent marginal distribution within the study area.

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would lead to the long-term decrease of an important population of the species.

2. *Reduce the area of occupancy of an important population*

There is a single record from the study area and its surrounds and no important population is known for the study area.

3. *Fragment an existing important population into two or more populations*

If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur.

4. *Adversely affect habitat critical to the survival of a species*

A paucity of historical records indicates that there is no habitat present that is critical to the survival of the species.

5. *Disrupt the breeding cycle of an important population*

A paucity of records indicates that there is no habitat present that is critical to the breeding cycle of an important population.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would interfere with the recovery of the species.

Brigalow scaly-foot

The Brigalow scaly-foot was once thought to be confined to remnant Brigalow or sparse tussock grass vegetation on grey cracking soils (Shea 1987). Recent records, however, have found the species in additional habitats including broad-leaved hickory *Acacia falciformis* woodland, gidgee *A. cambagei* woodland, poplar box *Eucalyptus populnea* open woodland, sandstone rises in dry sclerophyll forests, spotted gum and ironbark dominated forest and mixed open woodland with spinifex (Schulz and Eyre 1997; Kutt et al. 2003).

Most records are from relatively undisturbed habitats but the species can also occur in young regrowth (two-three years old) (Kutt et al. 2003). However, it is also suggested that the species needs litter on the ground and so never occurs in disturbed habitats (EPA 2003). Fragments of invertebrates such as spiders and crickets have been recorded from scats. However, sap, particularly from *Acacia* species, constitutes a significant proportion of this species diet (Tremul 2000).

Most records are from the Brigalow Belt bioregion. However, records occur from 200km south-west of Charters Towers south to Bendidee National Park and Eena State Forest (35km north-west of Goondiwindi) (Schulz and Eyre 1997; Kutt et al. 2003). The species occurs east to Gladstone (Boyne Island) and west to around Morven (Eyre et al. 1997; Schulz and Eyre 1997; Tremul 2000).

Significant impact criteria – Brigalow scaly-foot

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Some potential habitat for this species would be lost as a result of the proposed action.

It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located. If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM. DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, the result of the proposed action would not significantly reduce the local extent of these habitats. It is expected that any possible decrease in any possible local population, whether or not that population is considered an important population, would be minor and temporary.

2. *Reduce the area of occupancy of an important population*

With mitigation through offsetting the result of the proposed action would not significantly reduce the local area of occupancy. It is expected that any possible decrease in any possible local population, whether or not that population is considered an important population, would be minor and temporary.

3. *Fragment an existing important population into two or more populations*

Offsets will be designed to replace any potential habitat within bioregional corridors and to link remnant patches through replanting currently cleared lands with relevant pre-clearing REs. Should an existing important population be fragmented as a result of the proposed action such fragmentation would be minor and temporary.

4. *Adversely affect habitat critical to the survival of a species*

Some potential habitat for this species would be lost as a result of the proposed action. It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located. If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM. DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, the result of the proposed action would not adversely affect habitat critical to the survival of the species.

5. *Disrupt the breeding cycle of an important population*

Some potential habitat for this species would be lost as a result of the proposed action. It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located. If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM. DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, any disruption of the breeding cycle of a local population, regardless of whether or not it is considered an important population, as a result of the proposed action would be minor and temporary.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

Some potential habitat for this species would be lost as a result of the proposed action. It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located. If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM.

DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species would not be to an extent that is likely to cause the species to decline.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

With mitigation through offsetting any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species would not be to an extent that is likely to interfere with the recovery of the species.

Yakka skink

Yakka skinks live in colonies, occupying communal burrows, often under dead timber or deep rock crevices. They eat invertebrates and soft plant material, particularly fruit. They are found in a variety of drier forests and woodlands (usually on well drained, coarse gritty soils) including poplar box on alluvial soils, low ridges, *Callitris* on sands, belah and mulga *Acacia aneura* (Ehmann 1992; Cogger 2000; Drury 2001; Wilson 2005). They can also occur in highly degraded sites and where there are log piles and rabbit warrens. It has been suggested the species may be more common than previously thought (EPA 2003).

The yakka skink is endemic to Queensland, occurring from Cape York Peninsula to the St. George area in the Southern Brigalow Belt (Drury 2001; Wilson 2005). The species is threatened by loss of habitat, loss of shelter sites through agricultural practices, too-frequent fire, trampling of burrows by livestock and predation by foxes *Vulpes vulpes* and cats *Felis catus* (Drury 2001)

Significant impact criteria – Yakka skink

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Some potential habitat for this species would be lost as a result of the proposed action.

It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located. It is proposed that log piles in paddocks and large, hollow logs be retained and that livestock is excluded from known colonies. Feral Animal, Weed and Ecological Fire management measures will be implemented (Section 3.5 in Volume 5 Attachment 14).

If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM. DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, the result of the proposed action would not significantly reduce the local extent of these habitats. It is expected that any possible decrease in any possible local population, whether or not that population is considered an important population, would be minor and temporary.

2. *Reduce the area of occupancy of an important population*

With mitigation through offsetting, the result of the proposed action would not significantly reduce the local area of occupancy. It is expected that any possible decrease in any possible local population, whether or not that population is considered an important population, would be minor and temporary.

3. *Fragment an existing important population into two or more populations*

Offsets will be designed to replace any potential habitat within bioregional corridors and to link remnant patches through replanting currently cleared lands with relevant pre-clearing REs.

Should an existing important population be fragmented as a result of the proposed action such fragmentation would be minor and temporary.

4. *Adversely affect habitat critical to the survival of a species*

Some potential habitat for this species would be lost as a result of the proposed action. It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located.

If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM. DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, the result of the proposed action would not adversely affect habitat critical to the survival of the species.

5. *Disrupt the breeding cycle of an important population*

Some potential habitat for this species would be lost as a result of the proposed action. It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located. If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM. DEWHA would be required to confirm the appropriateness of this approach.

With mitigation through offsetting, any disruption of the breeding cycle of a local population, regardless of whether or not it is considered an important population, as a result of the proposed action would be minor and temporary.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

Some potential habitat for this species would be lost as a result of the proposed action. It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located. If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM. DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species would not be to an extent that is likely to cause the species to decline.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

With mitigation through offsetting, any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species would not be to an extent that is likely to interfere with the recovery of the species.

Dunmall's snake

This species is highly cryptic and extremely secretive. Only a handful of records occur within any given decade. Consequently, the biology of the snake is virtually unknown. Most records appear in open forests and woodlands, particularly Brigalow and woodlands growing on cracking black clay and clay loams (Cogger et al. 1993). However, the species has also been recorded from dry eucalypt forests and anecdotal evidence suggests it may occur in vine thickets.

Cogger et al. (1993) describes its distribution as occurring from Yeppoon to Oakey and Glenmorgan in the south. The species has also been recorded from around Emerald in central Queensland and in northern New South Wales (Wilson 2005).

Threats are not well understood. The paucity of records does not even allow the estimation of population trends. They are likely to be affected by altered land practices, particularly land clearing, but the impacts of other activities such as weed invasion and cattle grazing cannot be estimated without further knowledge of the species.

Significant impact criteria – Dunmall's snake

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Some potential habitat for this species would be lost as a result of the proposed action.

It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located.

If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM.

DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, the result of the proposed action would not significantly reduce the local extent of these habitats. It is expected that any possible decrease in any possible local population, whether or not that population is considered an important population, would be minor and temporary.

2. *Reduce the area of occupancy of an important population*

With mitigation through offsetting, the result of the proposed action would not significantly reduce the local area of occupancy. It is expected that any possible decrease in any possible local population, whether or not that population is considered an important population, would be minor and temporary.

3. *Fragment an existing important population into two or more populations*

Offsets will be designed to replace any potential habitat within bioregional corridors and to link remnant patches through replanting currently cleared lands with relevant pre-clearing REs.

Should an existing important population be fragmented as a result of the proposed action such fragmentation would be minor and temporary.

4. *Adversely affect habitat critical to the survival of a species*

Some potential habitat for this species would be lost as a result of the proposed action. It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located. If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM. DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, the result of the proposed action would not adversely affect habitat critical to the survival of the species.

5. *Disrupt the breeding cycle of an important population*

Some potential habitat for this species would be lost as a result of the proposed action. It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located. If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM. DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, any disruption of the breeding cycle of a local population, regardless of whether or not it is considered an important population, as a result of the proposed action would be minor and temporary.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

Some potential habitat for this species would be lost as a result of the proposed action. It is proposed to survey within a 200m buffer of proposed infrastructure and prepare threatened species management measures if the species is located.

If disturbance to known habitat for this species is unavoidable, it is proposed to offset affected habitat following consultation with DERM. DEWHA would be required to confirm the appropriateness of this approach. With mitigation through offsetting, any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species would not be to an extent that is likely to cause the species to decline.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

With mitigation through offsetting, any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species would not be to an extent that is likely to interfere with the recovery of the species.

Squatter pigeon (southern subspecies)

Squatter pigeons are terrestrial, foraging and breeding on the ground. The species occurs in open dry sclerophyll woodland with a grassy understorey, nearly always near permanent water. Birds may occasionally feed in sown grasslands and pastures. Squatter pigeons eat mainly seeds, including those of exotic pasture plants, and some insects (Crome and Shields 1992; Higgins and Davies 1996).

This species was historically found from Cape York Peninsula in Queensland south to the Dubbo region in New South Wales. There have been no official records in New South Wales since the 1970s and the species has declined greatly in southern Queensland (Higgins and Davies 1996; NSW NPWS 2003).

Breeding is poorly known but does appear to be greatly influenced by rainfall. The nest is a shallow depression on the ground (Frith 1982; Higgins and Davies 1996).

Much of the original habitat in Queensland has been replaced with pasture for livestock (Higgins and Davies 1996). Threats to existing populations include clearing and fragmentation of habitat, overgrazing by livestock and feral herbivores, trampling of nests by livestock and feral animals, predation by cats and foxes, and illegal shooting (NSW NPWS 2003).

Significant impact criteria – Squatter pigeon

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Some potential habitat for this species would be lost as a result of the proposed action.

Mitigation is not recommended for this species due to its now marginal distribution within the study area. The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would lead to the long-term decrease of an important population of the species.

2. *Reduce the area of occupancy of an important population*

There is a paucity of records from the study area and its surrounds and no important population is known for the study area.

3. *Fragment an existing important population into two or more populations*

Any population within the study area is unlikely to be of a sufficient size for fragmentation to occur.

4. *Adversely affect habitat critical to the survival of a species*

A paucity of records indicates that there is no habitat present that is critical to the survival of the species.

5. *Disrupt the breeding cycle of an important population*

A paucity of records indicates that there is no habitat present that is critical to the breeding cycle of an important population.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project.

It is understood that a biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

Any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species in the study area would not be to an extent that is likely to interfere with the recovery of the species.

Red goshawk

The red goshawk occurs in woodlands and forests, ideally with a mosaic of vegetation types and permanent water, particularly riverine forests. The species avoids both very dense and very open habitats.

The red goshawk is endemic to Australia and is found in north-western, northern and eastern Australia in coastal and subcoastal areas. The species is sparsely distributed, with home ranges of 120km² and 20km² for females and males, respectively (Marchant and Higgins 1993). Nests are restricted to trees taller than 20m and within one km of a watercourse or wetland (Garnett and Crowley 2000).

The species is threatened by loss and fragmentation of habitat, fire, egg-collecting, shooting, loss of prey species, and possibly secondary poisoning (Marchant and Higgins 1993; Garnett and Crowley 2000).

Significant impact criteria – Red goshawk

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Some potential habitat for this species would be lost as a result of the proposed action.

Mitigation is not recommended for this species due to its marginal occurrence within the study area. The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would lead to the long-term decrease of an important population of the species.

2. *Reduce the area of occupancy of an important population*

There is a paucity of records from the study area and its surrounds and no important population is known for the study area.

3. *Fragment an existing important population into two or more populations*

Any population within the study area is unlikely to be of a sufficient size for fragmentation to occur. May adversely affect habitat critical to the survival of a species. A paucity of records indicates that there is no habitat present that is critical to the survival of the species.

4. *Disrupt the breeding cycle of an important population*

A paucity of records indicates there is no habitat present that is critical to the breeding cycle of an important population.

5. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

6. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project.

The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

7. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project. It is understood that a biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

8. *Interfere substantially with the recovery of the species*

Any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species in the study area would not be to an extent that is likely to interfere with the recovery of the species.

Plains-wanderer

Plains-wanderers occur in open sparse native grasslands and do not occur in dense improved pasture or woodlands and other treed habitats even with a suitable ground layer. They are also recorded from lightly grazed broad-acre agricultural areas with ephemeral and perennial grasses and herbs. Overgrazing, cultivation, pasture improvement and burning causes local extinctions (Marchant and Higgins 1993).

The plains-wanderer occurs at scattered sites in Queensland, New South Wales, Victoria and South Australia (Barrett et al. 2003). In Queensland, most records are from the channel country in the far west (Bennett 1983; Baker-Gabb 1990, 2002) but there have been scattered records in native grasslands extending east from this region (Bennett 1983; Baker-Gabb 1990).

There are four regions that support the species and habitat that is critical for its survival. The most important of these is the Riverina region in New South Wales. Central-western Queensland is considered of secondary importance (Baker-Gabb 2002).

Significant impact criteria – Plains-wanderer

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Mitigation is not recommended for this species due to its vagrant status within the study area and the absence of natural habitat. The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would lead to the long-term decrease of an important population of the species.

2. *Reduce the area of occupancy of an important population*

No important population is known for the study area.

3. *Fragment an existing important population into two or more populations*

If this species is present, any population is unlikely to be of a sufficient size for fragmentation to occur.

4. *Adversely affect habitat critical to the survival of a species*

A paucity of historical records indicates that there is no habitat present that is critical to the survival of the species.

5. *Disrupt the breeding cycle of an important population*

A paucity of records indicates that there is no habitat present that is critical to the breeding cycle of an important population.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

Any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species in the study area would not be to an extent that is likely to interfere with the recovery of the species.

Australian painted snipe

The Australian painted snipe is a secretive, cryptic, crepuscular species that occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains. The species feeds on vegetation, seeds and invertebrates, including crustaceans and molluscs (Marchant and Higgins 1993).

Painted snipes in Australia have previously been considered a subspecies of *Rostratula benghalensis*, a species found in sub-Saharan Africa and Asia (Marchant and Higgins 1993). Australian birds are now considered to be an endemic species, *R. australis*, in which case *R. benghalensis* does not occur in Australia (Garnett and Crowley 2000; Geering et al. 2007). They are patchily distributed throughout Australia, with most records being in the south-east. Records are erratic, with the species being absent from areas in some years and common in others.

Breeding occurs mainly in the Murray-Darling region, though is also recorded in other parts of Queensland, New South Wales and South Australia. Breeding habitat requirements appear to be specific including shallow wetlands with patches of bare mud, dense low cover and sometimes tall dense cover (Rogers et al. 2005).

Breeding has been recorded all year round and may be a response to wetland conditions rather than season (Marchant and Higgins 1993). The Australian painted snipe is threatened by drainage of wetlands, diversion of water from rivers, clearance of wetland vegetation, and overgrazing (Garnett and Crowley 2000).

Significant impact criteria – Australian painted snipe

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would lead to the long-term decrease of an important population of the species.

2. *Reduce the area of occupancy of an important population*

No important population is known for the study area.

3. *Fragment an existing important population into two or more populations*

No population of this highly mobile species will be fragmented due to the proposed action.

4. *Adversely affect habitat critical to the survival of a species*

No population of this highly mobile species will be fragmented due to the proposed action.

5. *Disrupt the breeding cycle of an important population*

No habitat considered critical to the breeding cycle of a population, whether or not that population is considered an important population, is present in the study area.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

No habitat to be modified, destroyed, removed, isolated or decreased in availability or quality by the Project would result in decline of the species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

Any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species in the study area would not be to an extent that is likely to interfere with the recovery of the species.

Black-breasted button-quail

The species is predominantly recorded from closed dry rainforest and vine thickets with abundant leaf litter, although they can also be occasionally recorded from scrubs including Brigalow, belah, bottletree thickets and in dry eucalypt forests where there is a dense understorey such as lantana and grass groundcover (Marchant and Higgins 1993). Black-breasted button-quails have specific habitat requirements based on soil fertility, leaf litter and structural attributes which determine food availability and protection from predation (Mathieson and Smith 2009).

The species is known from Byfield in central Queensland south to northeast New South Wales. The habitat and the sub-populations are highly fragmented. The two main population centres in south-eastern Queensland are in SEVT in the Yarraman-Jimna and region and in coastal dune scrubs in the Great Sandy region (Mathieson and Smith 2009).

Their movements are not fully understood. They are often recorded intermittently or occasionally, before disappearing for extended periods (Marchant and Higgins 1993). Radio-tracking studies by Smith et al. (1998) suggest that the birds do not occupy exclusive territories. Home ranges appear to range in size from 2.2 to 6.1ha.

At least 90% of black-breasted button-quail habitat has been cleared and the continued loss of habitat remains the greatest threat to this species. Within areas of remaining habitat, pressures such as grazing and other disturbances by cattle and pigs *Sus scrofa* can be locally severe. In addition, the abundant leaf litter and dry vegetation in which the species occurs is prone to fire, often rendering an area unsuitable for the species (Garnett and Crowley 2000).

Significant impact criteria – Black-breasted button quail

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Mitigation is not recommended for this species due to a lack of confirmation of its presence within the study area. The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would lead to the long-term decrease of an important population of the species.

2. *Reduce the area of occupancy of an important population*

No population is known for the study area.

3. *Fragment an existing important population into two or more populations*

Any population within the study area is unlikely to be of a sufficient size for fragmentation to occur.

4. *Adversely affect habitat critical to the survival of a species*

The lack of records indicates that there is no habitat present that is critical to the survival of the species.

5. *Disrupt the breeding cycle of an important population*

The lack of records indicates that there is no habitat present that is critical to the breeding cycle of an important population.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

No habitat to be modified, destroyed, removed, isolated or decreased in availability or quality by the Project would result in decline of the species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

Any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species in the study area would not be to an extent that is likely to interfere with the recovery of the species.

Grey-headed flying-fox

Two habitat characteristics are important for grey-headed flying-foxes - foraging resources and roosting sites. As the species is a canopy-feeding frugivore and nectarivore, they utilise vegetation including rainforests, open eucalypt forests, woodlands, melaleuca swamps and banksia woodlands. Roosts are commonly within dense vegetation close to water, primarily rainforest patches, stands of melaleuca, mangroves or riparian vegetation (Nelson 1965), but colonies may use exotic vegetation in urban areas (Birt et al. 1998).

The species congregates in large camps of up to 200,000 individuals from early until late summer, with the number of bats within a camp being influenced by the availability of blossom in the surrounding area. Adults normally disperse during the winter and can migrate up to 750km as individuals or small groups, with the young forming winter camps (Churchill 2008).

The species is generally recorded between the coast and the western slopes of the Great Dividing Range. Regular or frequently used camps have been located between Gladstone in Queensland south to around Mallacoota in East Gippsland, Victoria. Less consistent records extend the south range of the species to Warrnambool, Victoria (Duncan et al. 1999) and recent surveys have located camps of this species as far north as the Mackay region (Roberts et al. 2008).

Significant impact criteria – Grey-headed flying-fox

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Mitigation is not recommended for this species due to a lack of confirmation of its presence within the study area.

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would lead to the long-term decrease of an important population of the species.

2. *Reduce the area of occupancy of an important population*

No population is known for the study area.

3. *Fragment an existing important population into two or more populations*

Any population within the study area is unlikely to be of a sufficient size for fragmentation to occur.

4. *Adversely affect habitat critical to the survival of a species*

The lack of records indicates that there is no habitat present that is critical to the survival of the species.

5. *Disrupt the breeding cycle of an important population*

The lack of records indicates that there is no habitat present that is critical to the breeding cycle of an important population.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

No habitat to be modified, destroyed, removed, isolated or decreased in availability or quality by the Project would result in decline of the species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project.

A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

Any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species in the study area would not be to an extent that is likely to interfere with the recovery of the species.

Large-eared pied bat

The large-eared pied bat has been recorded roosting in disused mine tunnels, rock overhangs, caves and fairy martin (*Petrochelidon ariel*) nests (Dwyer 1966; Eyre et al. 1997; Schulz 1998; Thompson 2002). In south-eastern Queensland, the species seems to be more associated with higher altitude moist forests and adjacent rainforest (Eyre et al. 1997). The species occurs south from the Blackdown Tableland in Queensland to near Wollongong, New South Wales and extends inland to Carnarvon National Park, Queensland (Menkhorst and Knight 2004). Recent surveys suggest that the species is only found in the sandstone belt (EPA 2003).

Due to poor ecological knowledge of this species, an assessment of threats is difficult. Several roosts have been destroyed, including the type locality at Copeton (Dwyer 1966) by flooding from the Copeton Dam (Hall and Richards 1998). Other possible threats include the loss and fragmentation of habitat, too-frequent burning of foraging habitat, damage to roost and maternity sites by mining operations, disturbance of roost and maternity sites by recreational caving, use of pesticides, and predation by feral animals (Duncan et al. 1999; NSW NPWS 2003).

Significant impact criteria – Large-eared pied bat

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Some potential foraging habitat for this species would be lost as a result of the proposed action. Wherever possible, a 200m buffer will be maintained between any proposed actions and caves, tunnels and mines that may provide roosting habitat.

Work within the buffer area would be completed in accordance with the relevant threatened species management guidelines. Mitigation is not recommended for this species due to its marginal occurrence within the study area. The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would lead to the long-term decrease of an important population of the species.

2. *Reduce the area of occupancy of an important population*

There is a paucity of records from the study area and its surrounds and no important population is known for the study area.

3. *Fragment an existing important population into two or more populations*

Any population within the study area is unlikely to be of a sufficient size for fragmentation to occur.

4. *Adversely affect habitat critical to the survival of a species*

A paucity of records indicates that there is no habitat present that is critical to the survival of the species.

5. *Disrupt the breeding cycle of an important population*

A paucity of records indicates that there is no habitat present that is critical to the breeding cycle of an important population.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

No habitat to be modified, destroyed, removed, isolated or decreased in availability or quality by the Project would result in decline of the species.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project.

The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project.

A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

Any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species in the study area would not be to an extent that is likely to interfere with the recovery of the species.

South-eastern (greater) long-eared bat

Nyctophilus timoriensis is no longer considered to occur in Australia. For some time the *Nyctophilus* species relevant to the study area was undescribed and referred to as *Nyctophilus* species 2 (Churchill 2008). The genus in Australia was revised very recently and the species found in southeast Queensland is now known as *Nyctophilus corbeni* (Parnaby 2009).

The biology of the greater long-eared bat is little known. They are known to roost in tree crevices and under bark (Churchill 2008). Larger tree hollows are used as maternity colonies in spring and summer (Turbill et al. 2008). The species occurs in a variety of forest/woodland types including SEVT, but prefers areas where the vegetation has a distinct canopy with a dense understorey. It is largely confined to the Murray-Darling basin, being most abundant in woodlands on sandy soils along the western slopes and plains of southern Queensland and New South Wales. Surveys suggest that larger remnants are needed to support high population densities (Turbill et al. 2008).

Significant impact criteria – South-eastern (greater) long-eared bat

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of an important population of a species*

Some potential habitat for this species would be lost as a result of the proposed action.

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would lead to the long-term decrease of an important population of the species.

2. *Reduce the area of occupancy of an important population*

There is a paucity of records from the study area and its surrounds and no important population is known for the study area.

3. *Fragment an existing important population into two or more populations*

Any population within the study area is unlikely to be of a sufficient size for fragmentation to occur.

4. *Adversely affect habitat critical to the survival of a species*

A paucity of records indicates that there is no habitat present that is critical to the survival of the species.

5. *Disrupt the breeding cycle of an important population*

A paucity of records indicates that there is no habitat present that is critical to the breeding cycle of an important population.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The study area is not considered to contain habitat important enough for the species such that its modification, destruction, removal or isolation, or a decrease in its availability or quality would result in overall species decline.

7. *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*

The application of feral animal management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.4 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of feral animal management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.4 in Volume 5 Attachment 14) will assist in the prevention of the introduction of pest animals (and associated diseases) as a result of the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere substantially with the recovery of the species*

Any modification, destruction, removal, isolation or decrease in availability or quality of habitat for this species in the study area would not be to an extent that is likely to interfere with the recovery of the species.

23.5.3 Threatened aquatic fauna

Murray Cod is the only freshwater aquatic fauna or flora species listed under the EPBC Act that was identified in database and literature reviews as being present or likely to be present in waterways crossed by the gas fields' study area.

In describing the existing environmental values and assessing the potential impacts of the gas fields element of the Project, an aquatic ecology, water quality and geomorphology assessments of the study area was undertaken (Volume 5 Attachment 14).

This assessment concludes that there is a low risk of impact to Murray Cod during construction or operation. The main impact during the construction phase is increased sediment delivery. Murray Cod are unlikely to be affected by short-term increases in sediment delivery as they are adapted to high levels of TSS and turbidity and populations are artificially maintained in the Condamine-Balonne River, through stocking.

There may be some localised effects associated with damming of perennial watercourses during road and crossing construction. However, impacts are likely to be short-term and rapid species recolonisation / recovery is expected. With suitably designed road crossings constructed (i.e. clear span bridges or large box culverts), impacts to fish passage should be minimal.

Increased baseflows resulting from permeate discharge are unlikely to directly impact Murray Cod populations as spawning requires a combination of elevated temperature (>15 °C) and flow. Their main food resources are frogs, small fish and crayfish, which are unlikely to be directly impacted by increased flows.

Significant impact criteria – Aquatic fauna

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

1. *Lead to a long-term decrease in the size of a population*

No potential habitat for this species will be lost as a result of the proposed action.

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines through the EM Plan for each phase of the Project would prevent any long-term decrease in the size of the population.

This will include effective erosion and sediment control measures to mitigate disturbance to Murray Cod associated with any increased turbidity.

2. *Reduce the area of occupancy of the species*

No potential habitat for this species will be lost as a result of the proposed action.

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines through the EM Plan for each phase of the Project would prevent any long-term decrease in the size of the population.

3. *Fragment an existing population into two or more populations*

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines through the EM Plan for each phase of the Project would prevent any long-term decrease in the size of the population.

Should a population be fragmented as a result of the proposed action such fragmentation would be minor and temporary.

4. *Adversely affect habitat critical to the survival of a species*

No critical habitat will be affected by the Project. Implementation of specific site surveys will identify any unexpected critical habitat. Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines through the EM Plan for each phase of the Project will ensure that existing habitat conditions are suitably maintained. This will include effective erosion and sediment control measures to mitigate disturbance to Murray Cod associated with any increased turbidity.

5. *Disrupt the breeding cycle of a population*

No potential habitat for this species will be lost as a result of the proposed action. Impacts on flow conditions associated with breeding will be negligible to positive depending on the extent, if any, of permeate discharge released to the Condamine River.

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines through the EM Plan for each phase of the Project would also prevent any disruption to breeding. This will include effective erosion and sediment control measures to mitigate disturbance to Murray Cod associated with any increased turbidity.

6. *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

No potential habitat for this species will be lost as a result of the proposed action.

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines through the EM Plan for each phase of the Project would prevent any decrease in the availability or quality of available habitat.

7. *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

The application of weed management guidelines has been recommended for the clearing, construction, operation and decommissioning phases of this Project. The requirements for measures to be included within the guidelines as described in Section 3.5.3 in Volume 5 Attachment 14 are considered sufficient to prevent negative impacts of invasive species as a result of the Project.

8. *Introduce disease that may cause the species to decline*

The implementation of the feral species management guidelines within the relevant EM Plan for each phase of the Project (Section 3.5.3 in Volume 5 Attachment 14) will assist in the prevention of the introduction of animal diseases as a result from the Project. A biosecurity management plan will also be prepared for the Project which will include procedures for the prevention of pest and disease introduction and spread.

9. *Interfere with the recovery of the species*

No potential habitat for this species will be lost as a result of the proposed action.

Implementation of specific site surveys and maintenance of buffers and/or application of threatened species management guidelines through the EM Plan for each phase of the Project will ensure that the Project activities are consistent with the Recovery Plan for the species.

23.6 Listed migratory species

23.6.1 Migratory birds

Measures undertaken by Volume 5 Attachment 14 to assess the actual or potential presence of listed migratory terrestrial fauna species within the gas fields' study area included:

- A review of the results of public database searches, including the EPBC Act Online Protected Matters Search Tool, DERM's WildNet database, fauna collection records from the Queensland Museum, and records from the Birds Australia Atlas database (Appendix G of Volume 5 Attachment 14)
- A comprehensive review of available literature relevant to the terrestrial flora and fauna of the gas fields' study area (Appendix H of Volume 5 Attachment 14)
- A review of additional, unpublished data available for the gas fields' study area
- Project-specific ground surveys, including preliminary, targeted searches for significant terrestrial fauna species undertaken between 22 April and 8 May 2009, and subsequent surveys undertaken between 27 July to 28 September 2009 for the verification of existing vegetation mapping and associated habitat values
- The identification of available habitat for significant fauna species based on associated vegetation communities and determined via consultation with an expert panel convened specifically for the project.

Based on the assessment of existing terrestrial ecological values undertaken by Volume 5 Attachment 14, 28 terrestrial fauna species listed as migratory under the EPBC Act are known or considered possible occurrences within the gas fields' study area, as detailed in Table 23.5.

Two of these species were recorded during the recent ground surveys, while the remaining 26 species are either known from previous records or are considered possible occurrences based on the presence of suitable habitat within the gas fields' study area.

The table also lists those two species identified from the desktop review that are not considered likely to occur in the gas fields' study area, based on a lack of known or reliable records and habitat preference.

Table 23.5 Likely occurrence of migratory terrestrial species within the study area

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
Aves Anatidae	<i>Nettapus coromandelianus</i>	Cotton pygmy-goose	Migratory	One WildNet record, of unknown location and date (pre-1975) McFarland et al. (1999a, b). Seven Birds Australia records (all outside the study area). Marginal occurrence in the study area, more frequent to north and east (McFarland et al. 1999a, b), but could occur on water bodies with aquatic vegetation.	Terrestrial wetlands, preferring freshwater with abundant floating and submerged aquatic vegetation, interspersed with patches of open water (Marchant and Higgins 1990).
Aves Apodidae	<i>Hirundapus caudacutus</i>	White-throated needletail	Migratory	Eight WildNet records. One Queensland Museum record. 19 Birds Australia records. Widespread and common non-breeding visitor to the study area.	An aerial species, may occur over any habitat type, including cleared land and infrastructure.
Aves Apodidae	<i>Apus pacificus</i>	Fork-tailed swift	Migratory	Six WildNet records. One Birds Australia record. Widespread but infrequent non-breeding visitor to the study area.	An aerial species may occur over any habitat type, including cleared land and infrastructure.
Aves Fregatidae	<i>Fregata ariel</i>	Lesser frigatebird	Migratory	One WildNet record. Marine species, vagrant to study area. There is no suitable habitat and the species is not expected to occur again.	
Aves Ardeidae	<i>Ardea modesta (alba)</i>	Eastern great egret	Migratory	10 WildNet records. 74 Birds Australia records. Four BAAM survey records	Shallow wetland habitats, including man-made dams and ponds and moist

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
				(2009) in Carinya, Condabri, Ramyard and Talinga tenements. Common and widespread species that could occur throughout the study area.	grasslands (Marchant and Higgins 1990).
Aves Ardeidae	<i>Ardea (Bubulcus) ibis</i>	Cattle egret	Migratory	Six WildNet records. Nine Birds Australia records. Most likely in paddocks and non-remnant vegetation. Could occur in any open habitats within study area, particularly with livestock.	Grasslands, wetlands, pasture and crops. Strongly associated with grazing animals (Pringle 1985; Marchant and Higgins 1990).
Aves Threskiornithidae	<i>Plegadis falcinellus</i>	Glossy ibis	Migratory	Four WildNet records. One Queensland Museum record. 11 Birds Australia records. Could occur on any suitable waterbody throughout the study area.	Terrestrial wetlands, preferring inland freshwater wetlands with abundant aquatic flora (Pringle 1985; Marchant and Higgins 1990).
Aves Accipitridae	<i>Pandion cristatus</i>	Eastern osprey	Migratory	One WildNet record. Vagrant to the study area. Few suitably large water bodies in the study area.	Mainly coastal habitats but can occur on inland rivers and lakes (Debus 1998).
Aves Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle	Migratory	Seven WildNet records. 22 Birds Australia records. One BAAM survey record (2009) in Talinga tenement. Few suitably large water bodies in the study area.	Terrestrial wetlands, including large rivers, freshwater swamps, lakes, reservoirs and billabongs (Marchant and Higgins 1993).
Aves Charadriidae	<i>Pluvialis fulva</i>	Pacific golden plover	Migratory	Two WildNet records. Very occasional visitor to the study area.	Usually intertidal sandflats and mudflats and salt marshes but also short grass in

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
					paddocks and crops (Geering et al. 2007). Most likely on artificial water bodies and in fringing non-remnant vegetation.
Aves Rostratulidae	<i>Rostratula australis</i>	Australian painted snipe ²	Vulnerable, Migratory	One WildNet record, pre 1975 (McFarland et al. 1999a, b). One Birds Australia record from outside the study area. '[S]een most years' in Talinga tenement (Eddie 2008). Cryptic species that could occur in any suitable habitat including drainage ditches, flooded paddocks and farm dams. Probably under-recorded in the study area.	Terrestrial shallow wetlands, ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains (Marchant and Higgins 1993). Most likely in REs 11.3.2, 11.3.25 and 11.3.27b but could also occur in gilgaied areas.
Aves Scolopacidae	<i>Gallinago hardwickii</i>	Latham's snipe	Migratory	Six WildNet records. One Queensland Museum record. 13 Birds Australia records. Uncommon visitor to study area.	Swamp and marsh margins and in wet pasture (Pringle 1987).
Aves Scolopacidae	<i>Limosa limosa</i>	Black-tailed godwit	Migratory	One WildNet record. One Birds Australia record (Lake Broadwater ¹). Very occasional visitor to the study area.	Fresh and brackish wetlands and intertidal mudflats (Geering et al. 2007).
Aves Scolopacidae	<i>Limosa lapponica</i>	Bar-tailed godwit	Migratory	One WildNet record. Rarely found away from coast. Possibly misidentified Black-tailed Godwit. Either absent or very occasional visitor to study area.	Coastal areas with intertidal mudflats (Geering et al. 2007).

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
Aves Scolopacidae	<i>Numenius phaeopus</i>	Whimbrel	Migratory	One WildNet record. Rarely found away from coast. Record possibly a mis-identified Little Curlew <i>Numenius minutus</i> which does occur inland. Either absent or very occasional visitor to study area.	Coastal areas with intertidal mudflats (Geering et al. 2007).
Aves Scolopacidae	<i>Actitis hypoleucos</i>	Common sandpiper	Migratory	One WildNet record. Very occasional visitor to the study area.	Mangrove inlets, rocky shores and creeks, channels and dams (Geering et al. 2007).
Aves Scolopacidae	<i>Tringa nebularia</i>	Common greenshank	Migratory	Three WildNet records. One Queensland Museum record. Three Birds Australia records. Occasional visitor to study area.	Saltwater and freshwater wetlands and intertidal mudflats (Geering et al. 2007).
Aves Scolopacidae	<i>Tringa stagnatilis</i>	Marsh sandpiper	Migratory	One WildNet record. Nine Birds Australia records. Occasional visitor to study area.	Brackish and freshwater wetlands (Geering et al. 2007).
Aves Scolopacidae	<i>Tringa glareola</i>	Wood sandpiper	Migratory	One WildNet record. Two Birds Australia records (Lake Broadwater ¹ and Roma). Very occasional visitor to study area.	Well vegetated, shallow, freshwater wetlands (Geering et al. 2007).
Aves Scolopacidae	<i>Calidris ruficollis</i>	Red-necked stint	Migratory	One WildNet record. Very occasional visitor to the study area.	Wide range of freshwater and saltwater habitats (Geering et al. 2007).
Aves Scolopacidae	<i>Calidris acuminata</i>	Sharp-tailed sandpiper	Migratory	Three WildNet records. One Queensland Museum record. 13 Birds Australia records. Most commonly recorded sandpiper in the study area.	Coastal and inland areas, preferring non-tidal fresh or brackish wetlands (Geering et al. 2007).

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
Aves Scolopacidae	<i>Calidris ferruginea</i>	Curlew sandpiper	Migratory	One WildNet record. One Birds Australia record (Lake Broadwater ¹). Very occasional visitor to study area.	Intertidal mudflats and freshwater wetlands (Geering et al. 2007).
Aves Scolopacidae	<i>Philomachus pugnax</i>	Ruff	Migratory	One WildNet record. Seldom recorded in Queensland. Very occasional visitor to the study area.	Wide range of freshwater and saltwater habitats (Geering et al. 2007).
Aves Laridae	<i>Hydroprogne caspia</i>	Caspian tern	Migratory	Two WildNet records. Very occasional visitor to the study area. Few suitably large water bodies in the study area.	Mostly coastal habitats but also inland terrestrial wetlands including lakes, reservoirs, large rivers (Higgins and Davies 1996).
Aves Meropidae	<i>Merops ornatus</i>	Rainbow bee-eater	Migratory	12 WildNet records. Four Queensland Museum records. 74 Birds Australia records. Common and widespread in the study area.	Open or lightly timbered areas, shrublands, farmland, cleared land, mangroves and rainforest edges. Also disturbed areas that have exposed bare soil in bank for breeding (Higgins 1999).
Aves Meliphagidae	<i>Anthochaera phrygia</i>	Regent honeyeater ³	Endangered, Migratory	One record, Broadbent (1885), also recorded in Queensland Museum database. Not expected to occur.	
Aves Rhipiduridae	<i>Rhipidura rufifrons</i>	Rufous fantail	Migratory	Four WildNet records. One Queensland Museum record. Seven Birds Australia records. Though patchy, this species is well established within the study area	Moist habitats, including closed forests, coastal scrubs, mangroves and along watercourses and gullies, and urban/rural areas during mid-year migration (Pizzey

Class/family	Species name	Common name	EPBC Act status	Likely occurrence/relevant study area component(s)	Key RE/habitat preference (for species known or considered possible occurrences within the study area)
				(Craig Eddie pers. comm.).	and Knight 2003; Higgins et al. 2006a). Most likely in REs 11.8.3, 11.9.4a and 11.9.4b.
Aves Monarchidae	<i>Myiagra cyanoleuca</i>	Satin flycatcher	Migratory	Two WildNet records. One Queensland Museum record, 1970. One Birds Australia record. Very occasional visitor to the study area.	Eucalypt forest, especially wet sclerophyll. Often in gullies and along watercourses (Higgins et al. 2006a).
Aves Monarchidae	<i>Monarcha melanopsis</i>	Black-faced monarch	Migratory	One WildNet record. One Queensland Museum record, 1977. Very occasional visitor to the study area.	Mainly rainforests, also wet sclerophyll forest and open forest near rainforest (Higgins et al. 2006a).
Aves Acrocephalidae	<i>Acrocephalus australis</i>	Australian reed-warbler	Migratory	Seven WildNet records. 21 Birds Australia records. One Queensland Museum record. Uncommon in the study area due to a lack of water bodies with suitable fringing vegetation.	Reeds, rushes, sedges and similar vegetation in and adjacent to most wetland types (Higgins et al. 2006b). Other than around artificial water bodies is most likely in RE 11.3.27b.

1 Lake Broadwater is outside the study area but within the database search area.

2 Listed as Migratory under the EPBC Act as Painted Snipe *Rostratula benghalensis s. lat.*

3 Listed as Migratory under the EPBC Act as *Xanthomyza phrygia*.

There is little evidence to suggest that the study area supports 'important habitat' for migratory species. Given their migratory habits, the ephemeral nature of food and habitat resources, and the extent of habitat across their range, it is likely that the existing resources within the study area would be utilised infrequently and on a transitory basis only with the exception of a few species as discussed below. Migratory species recorded from, or predicted to occur in, the study area are:

- Australian cotton pygmy-goose
- White-throated needletail
- Fork-tailed swift
- Great egret
- Cattle egret
- Glossy ibis
- Osprey
- White-bellied sea-eagle
- Pacific golden plover
- Australian painted snipe
- Latham's snipe
- Black-tailed godwit
- Bar-tailed godwit
- Whimbrel
- Common greenshank
- Marsh sandpiper
- Wood sandpiper
- Common sandpiper
- Red-necked stint
- Sharp-tailed sandpiper
- Curlew sandpiper
- Ruff
- Caspian tern
- Rainbow bee-eater
- Black-faced monarch
- Rufous fantail
- Satin flycatcher
- Australian reed-warbler (*Acrocephalus australis*) – formerly known and listed as clamorous reed-warbler *A. stentoreus*.

Twenty of the species recorded for the study area (of a total of 28) are strongly associated with water bodies, though white-bellied sea-eagle is considered a terrestrial rather than wetland species under the EPBC Act. Natural water bodies are not a significant component of the study area, as indicated by the small number of records for most of these species.

Most of the species are more likely to occur on the artificial water bodies present or, in some cases, in temporary water bodies, including flooded paddocks, created by heavy rain events.

Osprey, Pacific golden plover, black-tailed godwit, bar-tailed godwit, whimbrel, wood sandpiper, red-necked stint, curlew sandpiper, ruff and Caspian tern are all known from only one or two records from the study area and are not discussed. However, their habitat requirements are covered under the considerations of the remaining wetland species.

Cotton pygmy-goose

The cotton pygmy-goose occurs in terrestrial wetlands. It is almost entirely aquatic, preferring freshwater with abundant floating and submerged aquatic vegetation, interspersed with patches of open water (Marchant and Higgins 1990).

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

1. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

Although this species is known in the study area from only one record, it has been recorded more frequently in the general region. Its particular habitat requirements would not be adequately dealt with in discussion of other species and as such is included here.

The species occurs on terrestrial wetlands, preferring freshwater with abundant floating and submerged aquatic vegetation, interspersed with patches of open water (Marchant and Higgins 1990). It will use artificial water bodies if they provide suitable resources. A 200m buffer will be maintained between Project activities and any wetland community that may support this species.

Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. The proposed action would have minimal effects on any local population of this species and no important habitat will be modified, destroyed or isolated.

2. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

Although this species is known in the study area from only one record, it has been recorded more frequently in the general region. Its particular habitat requirements would not be adequately dealt with in discussion of other species and as such is included here.

The species occurs on terrestrial wetlands, preferring freshwater with abundant floating and submerged aquatic vegetation, interspersed with patches of open water (Marchant and Higgins 1990). It will use artificial water bodies if they provide suitable resources. A 200m buffer will be maintained between Project activities and any wetland community that may support this

species. Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. The proposed action would have minimal effects on any local population of this species and no important habitat will be modified, destroyed or isolated.

3. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

Although this species is known in the study area from only one record, it has been recorded more frequently in the general region. Its particular habitat requirements would not be adequately dealt with in discussion of other species and as such is included here.

The species occurs on terrestrial wetlands, preferring freshwater with abundant floating and submerged aquatic vegetation, interspersed with patches of open water (Marchant and Higgins 1990). It will use artificial water bodies if they provide suitable resources. A 200m buffer will be maintained between Project activities and any wetland community that may support this species.

Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. The proposed action would have minimal effects on any local population of this species and no important habitat will be modified, destroyed or isolated.

4. *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species*

The study area is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or terrestrial species. The local area has a history of forest clearing and habitat modification, which has benefited a number of feral and invasive flora and fauna species.

The proponent proposes the implementation of weed and feral animal control guidelines for the Project in accordance with any local and/or state government pest or weed management guidelines.

5. *Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species*

The species occurs on terrestrial wetlands and breeds from late spring to mid-autumn, nesting high in hollow trees near water (Marchant and Higgins 1990). Although known from only one record there is potential for breeding by this species within the study area. A 200m buffer will be maintained between Project activities and any mapped wetland community that may support this species.

Any minor project activities within the buffer zone will be in accordance with threatened species management guidelines. This buffer or the implementation of threatened species management guidelines for minor Project activities within the buffer zone, means that the proposed action would have minimal effects on this species and that there would be no serious disruption to the lifecycle of any local population, regardless of whether or not the population is considered to be an ecological significant proportion of the species' population.

White-throated needletail and fork-tailed swift

White-throated needletail and fork-tailed swift are non-breeding aerial foragers. These species may potentially forage in air space over the study area and may forage over all habitats including cleared

land, open ocean and infrastructure (Higgins 1999). It is considered unlikely that these species will be impacted by the proposed development.

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

1. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

These non-breeding species have been recorded within the study area and are predicted to occur on an annual basis. Both are aerial species for which the study area does not represent 'important habitat' and no impacts are expected due to the proposed action as these species forage over a wide variety of land use, including human infrastructure and large water bodies.

2. *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species*

The study area is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or terrestrial species. The local area has a history of forest clearing and habitat modification, which has benefited a number of feral and invasive flora and fauna species.

The proponent proposes the implementation of weed and feral animal control programs for the Project in accordance with any local and/or state government pest or weed management guidelines that will contribute to the overall enhancement of habitat for migratory species.

3. *Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species*

No impacts are expected for these non-breeding aerial species (they do not breed in Australia) as a result of the proposed action regardless of whether or not the study area is considered to support an 'ecologically significant proportion of a population'.

Eastern great egret and cattle egret

Great egret and cattle egret may be found in a wide variety of habitats, though cattle egret is largely associated with livestock when foraging and typically breeds in dense vegetation near or within water bodies. Glossy ibis will be restricted to open freshwater habitats such as swamps and lakes (Marchant and Higgins 1990).

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

1. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

These species are known to occur in the study area with eastern great egret being common and widespread in a variety of habitats and cattle egret being less common and associated with

paddocks and livestock, but requiring wetlands for breeding. A 200m buffer will be maintained between Project activities and any mapped wetland community.

Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. The proposed action would have minimal effects on any local population of these species and no important habitat will be modified, destroyed or isolated.

2. *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species*

The study area is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or terrestrial species. The local area has a history of forest clearing and habitat modification, which has benefited a number of feral and invasive flora and fauna species. The proponent proposes the implementation of weed and feral animal control programs for the Project in accordance with any local and/or state government pest or weed management guidelines that will contribute to the overall enhancement of habitat for migratory species.

3. *Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species*

A 200m buffer will be maintained between Project activities and any mapped wetland community. Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. This proposed action would have minimal effects on these species and that there would be no serious disruption to the lifecycle of any local population, regardless of whether or not the population is considered to be an ecological significant proportion of the species' population.

White-bellied sea-eagle

White-bellied sea-eagle is a large raptor associated with coastal environments and large inland water bodies such as lakes, dams and large rivers (Marchant and Higgins 1993). In the study area it is most likely on artificial water bodies.

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

1. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

This species is recorded only sparsely in the study area but could occur on any suitable waterbody. The species occurs on terrestrial wetlands, preferring inland freshwater wetlands with abundant aquatic flora (Pringle 1985; Marchant and Higgins 1990). A 200m buffer will be maintained between Project activities and any mapped wetland community.

Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. The proposed action would have minimal effects on any local population of these species and no important habitat will be modified, destroyed or isolated.

2. *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species*

The study area is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or terrestrial species. The local area has a history of forest clearing and habitat modification, which has benefited a number of feral and invasive flora and fauna species. The proponent proposes the implementation of weed and feral animal control programs for the Project in accordance with any local and/or state government pest or weed management guidelines that will contribute to the overall enhancement of habitat for migratory species.

3. *Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species*

A 200m buffer will be maintained between Project activities and any mapped wetland community. Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. The proposed action would have minimal effects on these species and that there would be no serious disruption to the lifecycle of any local population, regardless of whether or not the population is considered to be an ecological significant proportion of the species' population.

Australian painted snipe and Latham's snipe

Australian painted snipe will be largely restricted to freshwater habitats, typically with fringing vegetation and including flooded paddocks and vegetated drainage lines (Marchant and Higgins 1993).

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

1. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

These species are uncommon visitors to the study area but probably occur annually. The Australian painted snipe occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish. They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains (Marchant and Higgins 1993). Latham's snipe has similar habitat use, occurring in swamp and marsh margins and in wet pasture (Pringle 1987).

A 200m buffer will be maintained between Project activities and any mapped wetland community. Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. Some pasture subject to inundation may be modified by the Project but such habitat is not considered an 'important habitat' for the two species.

The proposed action would have minimal effects on any local population of these species and no important habitat will be modified, destroyed or isolated.

2. *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species*

The study area is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or terrestrial species. The local area has a history of forest clearing and

habitat modification, which has benefited a number of feral and invasive flora and fauna species.

The proponent proposes the implementation of weed and feral animal control programs for the Project in accordance with any local and/or state government pest or weed management guidelines that will contribute to the overall enhancement of habitat for migratory species.

3. *Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species*

These species are uncommon visitors to the study area but probably occur annually. The Australian painted snipe occurs in terrestrial shallow wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish.

They also use inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains (Marchant and Higgins 1993). Latham's snipe has similar habitat use, occurring in swamp and marsh margins and in wet pasture (Pringle 1987).

A 200m buffer will be maintained between Project activities and any mapped wetland community. Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. Some pasture subject to inundation may be modified by the Project but such habitat is not considered an 'important habitat' for the two species.

The proposed action would have minimal effects on any local population of these species and no important habitat will be modified, destroyed or isolated.

Common greenshank, marsh sandpiper and sharp-tailed sandpiper

There are four sandpipers considered hereunder; Latham's snipe, common greenshank, marsh sandpiper and sharp-tailed sandpiper. These species may occur in natural freshwater wetlands but will also use artificial water bodies that provide suitable substrate and foraging opportunities (Higgins and Davies 1996; Geering et al. 2007).

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

1. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

These species are occasional visitors to the study area. They occur on a variety of wetlands, including freshwater wetlands (Geering et al. 2007) and in the case of sharp-tailed sandpiper, in flooded paddocks (Higgins and Davies 1996). A 200m buffer will be maintained between Project activities and any mapped wetland community.

Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. Some pasture subject to inundation may be modified by the Project but such habitat is not considered an 'important habitat'.

The proposed action would have minimal effects on any local population of these species and no important habitat will be modified, destroyed or isolated.

2. *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species*

The study area is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or terrestrial species. The local area has a history of forest clearing and habitat modification, which has benefited a number of feral and invasive flora and fauna species.

The proponent proposes the implementation of weed and feral animal control programs for the Project in accordance with any local and/or state government pest or weed management guidelines that will contribute to the overall enhancement of habitat for migratory species.

3. *Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species*

These species are occasional visitors to the study area that breed in the northern hemisphere. A 200m buffer will be maintained between Project activities and any mapped wetland community. Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. Some pasture subject to inundation may be modified by the Project but such habitat is not considered an 'important habitat'. There would be no serious disruption to the lifecycle of any local population, regardless of whether or not the population is considered to be an ecological significant proportion of the species' population.

Rainbow bee-eater

Rainbow bee-eater is a widespread species that may be readily observed over a variety of habitats including highly modified lands such as golf courses. They nest by digging burrows in loose soil in exposed banks (Higgins 1999).

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

1. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

Rainbow bee-eater is a common, widespread species in the study area. It occurs in open or lightly timbered areas, shrublands, farmland, cleared land, mangroves, rainforest edges and in disturbed areas that have exposed soil or sand banks for breeding (Higgins 1999). The proposed action would have minimal effects on any local population of these species and no important habitat will be modified, destroyed or isolated.

2. *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species*

The study area is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or terrestrial species. The local area has a history of forest clearing and habitat modification, which has benefited a number of feral and invasive flora and fauna species.

The proponent proposes the implementation of weed and feral animal control programs for the Project in accordance with any local and/or state government pest or weed management guidelines that will contribute to the overall enhancement of habitat for migratory species.

3. *Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species*

Rainbow bee-eater is a common, widespread species and the study area would not support an 'ecologically significant proportion of a population' and any potential impacts associated with the proposed action would be negligible.

Black-faced monarch, rufous fantail and satin flycatcher

Black-faced monarch, satin flycatcher and rufous fantail are all species that tend to prefer habitats with a dense understorey and canopy. Black-faced monarchs are summer breeding migrants to south-east Australia occurring in coastal rainforests and other dense habitats, although the species will occur in more open woodlands.

Satin flycatcher occurs in coastal woodlands, mangroves and gardens during its summer migration to south-east Australia. Rufous fantail undergo both latitudinal (summer migrant to southern Australia) and altitudinal migrations (winter migrant from mountain rainforests) and may occur a considerable distance inland in suitable habitat (Higgins et al. 2006a).

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

1. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

These three species are occasional or very occasional visitors to the study area. Within the study area they would occur in the more moist habitats, including closed forests and along watercourses and gullies. Semi-evergreen vine thicket is the habitat most likely to provide suitable resources for black-faced monarch and rufous fantail.

The proposed action would have minimal effects on any local population of these species and no important habitat will be modified, destroyed or isolated.

2. *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species*

The study area is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or terrestrial species. The local area has a history of forest clearing and habitat modification, which has benefited a number of feral and invasive flora and fauna species.

The proponent proposes the implementation of weed and feral animal control programs for the Project in accordance with any local and/or state government pest or weed management guidelines that will contribute to the overall enhancement of habitat for migratory species.

3. *Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species*

In the study area the habitat most important to black-faced monarch and rufous fantail is semi-evergreen vine thicket. Satin flycatcher is most likely in moist gullies. There would be no serious disruption to the lifecycle of any local population, regardless of whether or not the population is considered to be an ecological significant proportion of the species' population.

Australian reed-warbler

Australian reed-warbler occurs in dense, low aquatic or riparian vegetation in or around nearly any type of fresh, brackish or saline wetland (Higgins et al. 2006b).

Significant impact criteria

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

1. *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

The Australian reed-warbler is uncommon in the study area, probably due to a lack of suitable fringing vegetation around water bodies. It occurs in reeds, rushes, sedges and similar vegetation in and adjacent to most wetland types (Higgins et al. 2006). A 200m buffer will be maintained between Project activities and any mapped wetland community. Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. The proposed action would have minimal effects on any local population of these species and no important habitat will be modified, destroyed or isolated.

2. *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species*

The study area is not considered to be an area of 'important habitat' for migratory birds, whether they are wetland or terrestrial species.

The local area has a history of forest clearing and habitat modification, which has benefited a number of feral and invasive flora and fauna species. The proponent proposes the implementation of weed and feral animal control programs for the Project in accordance with any local and/or state government pest or weed management guidelines that will contribute to the overall enhancement of habitat for migratory species.

3. *Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species*

The Australian reed-warbler occurs in reeds, rushes, sedges and similar vegetation in and adjacent to most wetland types. A 200m buffer will be maintained between Project activities and any mapped wetland community. Any minor Project activities within the buffer zone will be in accordance with threatened species management guidelines. There would be no serious disruption to the lifecycle of any local population, regardless or whether or not the population is considered to be an ecological significant proportion of the species' population.

23.7 Wetlands of international importance

23.7.1 Narran Lakes

There is a low risk of impact to Narran Lakes during operations. Narran Lakes is located approximately 500km downstream of the proposed discharge locations and it is unlikely that significant flows would reach Beardmore Dam, due to transmission losses and agricultural use.

Any water that did reach Beardmore Dam would be used to supplement the St George Water Supply Scheme and potentially be available as compensation flows to the Narran Lakes. As a result, any project-related flow contributions into the Condamine River would provide positive benefit. Additional modelling will be completed as part of detailed design of any discharges which will confirm these findings.

Significant Impact Criteria

An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in wetland if there is a real chance or possibility that it will result in:

1. *areas of the wetland being destroyed or substantially modified*

Narran Lakes is located approximately 500km downstream of the proposed discharge locations and it is unlikely that significant flows would reach Beardmore Dam, due to transmission losses and agricultural use. It is considered unlikely that areas of the wetland will be destroyed or substantially modified.

2. *a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland*

Narran Lakes is located approximately 500km downstream of the proposed discharge locations and it is unlikely that significant flows would reach Beardmore Dam, due to transmission losses and agricultural use. Although there will be groundwater drawdown and increases to flows upstream associated with the development in the gasfields these impacts are not likely to be felt at the wetlands themselves.

3. *the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependant upon the wetland being seriously affected*

Narran Lakes is located approximately 500km downstream of the proposed discharge locations and it is unlikely that significant flows would reach Beardmore Dam, due to transmission losses and agricultural use. Even if flows associated with the gasfields were observed at Narran Lakes it is unlikely these flows would impact the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependant upon the wetland.

4. *a substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or*

Narran Lakes is located approximately 500km downstream of the proposed discharge locations and it is unlikely that significant flows would reach Beardmore Dam, due to transmission losses

and agricultural use. Even if flows associated with the gasfields were observed at Narran Lakes it is unlikely these flows would create a measurable change in the water quality of the wetland

5. *an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.*

Narran Lakes is located approximately 500km downstream of the proposed discharge locations and it is unlikely that significant flows would reach Beardmore Dam, due to transmission losses and agricultural use. Even if flows associated with the gasfields were observed at Narran Lakes it is unlikely these flows would facilitate an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

23.8 Cumulative Impacts

23.8.1 The Australia Pacific LNG Project

Each of the three main elements of the Project – the gas fields, the gas pipeline and the LNG facility – have been subject to separate assessments for matters of national environmental significance. The assessments have been conducted separately due to the very different nature of the types of disturbance that are proposed for each project element, and due to the bioregional variation between the locations of each of the Project elements.

Assessment of the matters of national environmental significance for each of the Project elements have determined that no action will have a significant impact on the elements subject to the relevant controlling provisions with the implementation of proposed mitigation, and where necessary, offset actions.

23.8.2 The gas fields

Within the bioregional provinces relevant to the gas fields' element of the Project, the quantification of proposed impacts of projects other than the Australia Pacific LNG Project has been constrained by the lack of information available in relation to other gas field development projects. Existing reporting for these projects provides limited quantification of how much habitat will be lost, which habitat types will be affected, the severity of impacts, and mitigation and offset measures.

To compensate for a lack of information on which to base cumulative impact assessment, the other gas field tenements known to be subject to development applications have been mapped in conjunction with the Australia Pacific LNG tenements.

Sites of other projects in the approval or early development stage have also been mapped, if they occur within the bioregional provinces affected by the gas fields' element of the Australia Pacific LNG project.

Figure 23.14 shows the areas of known proposed development projects over the biodiversity status remnant vegetation. A total of approximately 2,000,000ha of remnant vegetation falls within the boundaries of these project areas. Of this, 235,000ha falls within the Australia Pacific LNG tenures and Australia Pacific LNG proposes to clear 6000ha or less than 0.5% of that area.

Clearing for the Australia Pacific LNG project will not reduce the extent of any vegetation communities within the Brigalow belt bioregion such that their remnant status will be altered. In fact, clearing represents a very small extent (no greater than 0.5%) of the pre-clearing extent of any REs within the relevant provinces. Similar analysis is not available for the other relevant projects.

Figure 23.15 shows the estimated project impact areas in relation to the bioregional corridors identified by the Biodiversity Planning Assessment process. Maintenance and enhancement of these corridors have been identified as key recommended mitigation actions for the Australia Pacific LNG Project, particularly to offset actions that will affect a number of EPBC listed fauna species.

An agreed approach for the consistent treatment of these corridors in all developments will maximise the benefits through maintaining and improving landscape connectivity for these species.

The total amount of clearing by all proponents for gas field development is relatively small compared with the overall tenement sizes. However, the need to establish gas wells in a grid format, connected by access tracks and pipelines, has the capacity to fragment remnant vegetation.

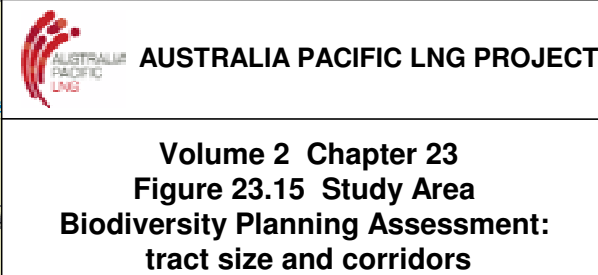
Regardless of the conservation status of that vegetation, the activities must be carefully managed to avoid severing landscape linkages for flora and fauna.

Fragmentation also has the capacity to degrade the quality of significant areas of adjacent habitat over time. Vigilance in weed and pest animal species control for the duration of these projects is vital for the protection of the significant number of 'endangered, vulnerable, or rare' (EVR) or near threatened species present within both remnant and non-remnant vegetation in the region.

With diligent and cooperative management of terrestrial ecological impacts in all developments (actively involving regional community organisations) and a broad-scale and integrated planning approach to rehabilitation and offset locations, the combined development projects currently proposed for the relevant provinces could minimise the impact on habitats for a number of conservation significant flora and fauna species.

Those species most at risk are those which are endemic to the region and rely specifically on connected, large tracts of intact, remnant vegetation.

Concentration of rehabilitation efforts within the bioregional corridors recommended for the Australia Pacific LNG project will have positive local ecological benefits. However, coordination of habitat rehabilitation efforts for all of the proposed gas field projects is outside of the authority of any of the individual proponents and will require government input.



23.9 Environmental management plan

A stand-alone environmental management plan (EM Plan) for the gas fields has been developed in accordance with the TOR issued for the Project, and is included at Volume 2 Chapter 24. The EM Plan provides measures for the management of impact to MNES for the construction, operation and decommissioning of the gas fields. It has been designed to:

- Be a comprehensive document which identifies all of the environmental values, potential impacts and management strategies for the gas fields
- Ensure the environmental impacts are minimised through proposed performance criteria and implementation strategies for each element
- Provide the government authorities and stakeholders with evidence that the environmental management of the project is acceptable.

The EM Plan for the Project will include detailed guidelines to be developed as part of the application for an environmental authority under Chapter 5A of the *Environmental Protection Act 1994*. The plan will include proposed environmental authority conditions which will be considered by the administering authority when determining the conditions of approval for the Project.

The EM Plan consists of the construction, operation, decommissioning and rehabilitation of the gas fields. It provides a summary of the environmental values and potential impacts for the following elements:

- Land
- Terrestrial ecology
- Aquatic ecology
- Marine ecology
- Water resources
- Coastal environment
- Air quality
- Greenhouse gases
- Noise and vibration
- Waste management
- Traffic and transport
- Indigenous cultural heritage
- Shared cultural heritage
- Social
- Hazard and risk.

Each relevant part of the EM Plan involves performance criteria, implementation strategies, monitoring, auditing, reporting and corrective actions as outlined in Table 23.6.

Table 23.6 Environmental management plan structure

Element/issue:	Aspect of construction or operation to be managed (as it affects environmental values)
Operational policy:	The operational policy or management objective that applies to the element
Performance criteria:	Measurable performance criteria (outcomes) for each element of the operation
Implementation strategy:	The strategies, tasks or action program (to nominated operational design standards) that would be implemented to achieve the performance criteria
Monitoring:	The monitoring requirements to measure actual performance (i.e. specified limits to pre-selected indicators of change)
Auditing:	The auditing requirements to demonstrate implementation of agreed construction and operation environmental management strategies and compliance with agreed performance criteria
Reporting:	Format, timing and responsibility for reporting and auditing of monitoring results
Corrective action:	The action (options) to be implemented in case a performance requirement is not reached and the person(s) responsible for action (including staff authority and responsibility management structure)

The EM Plan in Volume 2 Chapter 24 provides a summary of the environmental values and potential impacts for the MNES-related issues discussed in this section.

Mitigation and management measures have been developed with the aim of avoiding impacts where practicable with the relocation of certain facilities to avoid impacts on MNES undertaken prior to and during the field surveys. Areas identified as containing threatened ecological communities or habitat for EPBC-listed flora and fauna species and riparian vegetation have been avoided as far as possible. It is recognised that further refinement of the location of facilities at a local scale may be required for constructability and to further mitigate impacts.

The EM Plan specifies relevant performance criteria and mitigation strategies in relation to MNES issues. The mitigation measures are also discussed in the assessment sections of this chapter.

23.10 Project and field planning

23.10.1 Field development plan

Further to the EM Plan, ongoing environmental planning will continue, using over-arching field development plans which identify known environmental sensitivities. This part of the planning process usually commences 18 months to two years out from works on larger facilities commencing. For initial exploration works, where environmental impacts are minimal, project planning may commence six to 12 months from the first construction commencing.

Once the engineering disciplines have defined the field development plan, environmental constraints analysis from this EIS is used to assess the various environmental and social values of the particular area. This part of the planning process identifies any aspects which require additional, more detailed assessment via field studies, monitoring or modelling.

A review of the additional studies and consultation with external stakeholders, such as landholders, will inform any final changes to the field development plan. Documents are updated with the revised information, and updates of any external approvals (e.g. EA amendments) are completed.

An action plan is then developed. This summarises the commitments made in documents such as the EM Plan, as well as any conditions of approval. The action plan also provides a method of assessing overall project compliance with these commitments, and details how each commitment will be implemented at a site level. Implementation can include:

- Procedures, guidelines or checklists required
- Monitoring
- Training
- Resources
- Responsibility.

23.10.2 Detailed field planning and internal approval process

The next stage of environmental assessment involves more detailed field planning, which examines individual construction zones or work areas and assesses the site specific impacts of that work area. A number of steps are involved, including a risk-based constraints analysis, and producing an internal approval document for each disturbance. Before construction can commence, environment personnel prepare the internal approval document, which must be signed off by the Senior Manager for the CSG asset

The risk based constraints analysis provides a way of identifying key risks at a site level, and ensuring sufficient controls measures are incorporated into any environmental documentation for that work area (e.g. internal disturbance approval, design documentation or tender specifications).

The internal approval process starts with a desktop review of existing constraints mapping, such as imagery, ecological constraints mapping, and erosion risk. This identifies the level of environmental risk from the operation, as well as potential locations of any protected flora, fauna and sensitive receptors.

A review of initial studies and monitoring relevant to this specific site will also be carried out in the desktop review. During any site inspections, field teams will use a summary of EPBC information for matters of national environmental significance from this EIS. The desktop review will include a review of the Environmental Authority and EM Plan commitments.

The desktop review will be summarised with a package of environmental information and risk review for the specific worksite. This is sent to the field environmental team for the next stage of the internal approvals process.

High and medium risk sites may require more detailed studies, which include further field assessments. These will be initiated well before construction begins, and will ensure that any environmental risks are mitigated and adequate controls are in place. Mitigation measures might include, for example, relocation of works, using innovative drilling methods, designing infrastructure to include additional controls, or negotiating agreements with landholders.

Lower risk sites (i.e. where the desktop review assesses environmental impacts as being low risk) will not require a more rigorous review. Instead, an internal approval document detailing standard conditions for construction compliance, combined with the desktop review summary, will form the basis of the internal approval.

Prior to construction commencing on any site (high, medium and low risk), a site inspection will be carried out to identify key issues, such as weeds and erosion risk from construction activities. This

environmental inspection will require an environmental team member to complete a checklist and sign off on it before any construction commences.

Major infrastructure sites (e.g. gas processing, water treatment or temporary accommodation facilities) will require more detailed assessment and potentially background monitoring at this stage. A document detailing environmental controls for the construction process will be produced.

During construction, environmental presence at each site is again assessed by risk. Field environmental team members can attend site at various phases during the construction process, including:

- Initial kick-off meeting
- Toolbox meetings, which are held regularly before each shift
- Site inspections or audits
- In response to a request from site personnel
- In response to an incident, observation or community concern.

As above, larger developments or major infrastructure sites will generally have a higher presence during construction. For example, the Spring Gully and Talinga projects presently have dedicated environmental team members available at each site.

23.10.3 Terrestrial ecology habitat management guidelines

The proposed mitigation measures for threatened ecological communities and terrestrial flora and fauna species are designed to ensure impacts are reduced to 'negligible' or at most 'minor' levels via the application of terrestrial ecology sensitivity mapping infrastructure restrictions (Section 23.3.1) and habitat management guidelines, and where this cannot be achieved, through offsets described in Section 23.6.4. The successful mitigation of potential impacts will rely on the quality and implementation of the habitat management guidelines. It is proposed that the guidelines be prepared and referred / addressed in environmental management plans, including the preparation of individual threatened species management guidelines that can be applied to works that may affect specific species of significance likely to be encountered during the life of the gas fields.

The habitat management guidelines will be developed as the overarching terrestrial ecology management document, setting out the relationship of the individual ecological management guidelines to the overall goal of minimising, mitigating, and offsetting ecological impacts arising from the construction, operation, and decommissioning of the Project. The following individual management guidelines will be prepared and incorporated in the EM Plan for the Project:

- Threatened species management guidelines (plus individual guidelines for specific species where required)
- Clearing management guidelines
- Weed management guidelines
- Feral animal management guidelines
- Rehabilitation and revegetation management guidelines
- Ecological fire management guidelines.

Management of erosion and sedimentation, soil and water contamination, and noise, dust and vibration, are standard components of the Project's EM Plan. However, suppression of dust for habitat quality reasons will be expressly dealt with in the habitat management guidelines, especially over the term of operational practices.

Habitat loss and fragmentation has the potential to impact on overall biodiversity through loss per se and through interference with processes and ecological functioning. Strategies to minimise, mitigate and offset these impacts will be outlined in the rehabilitation and revegetation management guidelines and the threatened species management guidelines.

The introduction and/or spread of weeds have the potential to degrade habitat over time. The management of extant weed populations, the minimisation of the spread of weeds throughout the study area and the eradication and control of new infestations will be detailed within the weed management guidelines.

Construction and operational traffic may come into contact with native fauna, particularly during dawn, dusk, and night time hours. Impacts of this type will be dealt with in the habitat and threatened species management guidelines.

Siting of stockpile areas, camps, offices, spoil dumps, refuse areas, vehicle parking areas, and so forth, must, where possible, be within areas already cleared, or are proposed to be cleared. Management of these areas for weed and feral animals will be achieved through the weed and feral animal management guidelines.

Native vegetation, agricultural lands, and rehabilitation areas within the study area will require ongoing management of grazing activities, fire, and pest species. Livestock, particularly cattle, and feral fauna, cause damage to vegetation and substrate over large areas, compete with native herbivores and trample some native fauna species. Other feral species such as foxes and cats kill native fauna and compete with native carnivores. Weeds, especially exotic grasses and mother of millions, degrade habitat condition, as does inappropriate fire regimes. Management will be required in operational and access areas and in areas undergoing current or future rehabilitation or acting as buffers.

Vehicular strike causes death of many native fauna species crossing between habitat patches and gaps in native habitat may require devices to facilitate fauna movement and these would need to be constructed, maintained, and monitored. Speed limits will apply to construction and access roads, signage alerting drivers to the potential presence of fauna on roads will be erected in areas where the roads intersect vegetation significant patches, and driver education programmes will be implemented.

The preparation and implementation of habitat management guidelines will include monitoring of associated management guidelines (weed management, feral animal, rehabilitation, and revegetation, and ecological fire) that will allow assessment of the accuracy of predicted impacts, the effectiveness of mitigation measures and adaptive control and mitigation measures.

23.10.4 Environmental offsets

Environmental offsets may be considered for compensation of impacts which can not be adequately reduced through avoidance and mitigation. The regulatory and policy framework for environmental offsets that may be relevant to this Project includes Commonwealth and Queensland government policy and requirements.

Use of environmental offsets under the EPBC Act

The Commonwealth Government has developed a policy relevant to the use of environmental offsets; 'Draft Policy Statement: Use of environmental offsets under the Environment Protection and Biodiversity Conservation Act 1999'. The policy indicates that:

Environmental offsets can be used under the EPBC Act to maintain or enhance the health, diversity and productivity of the environment as it relates to matters protected by the EPBC Act (i.e. MNES). Environmental offsets can be applied as an approval condition under the EPBC Act for developments that have undergone assessment. They may be used when a development will result in impacts on a matter protected by the EPBC Act.

The draft policy indicates that eight principles for the use of environmental offsets under the EPBC Act have been identified. These eight principles are to be used to assess any proposed environmental offsets to ensure consistency, transparency and equity under the EPBC Act. The Australian Government's position as per the draft policy is that:

- Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted
- A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents
- Environmental offsets should deliver a real conservation outcome
- Environmental offsets should be developed as a package of actions - which may include both direct and indirect offsets
- Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'
- Environmental offsets should be located within the same general area as the development activity
- Environmental offsets should be delivered in a timely manner and be long lasting
- Environmental offsets should be enforceable, monitored and audited.

Use of offsets under the Queensland Government framework

The Queensland Government Environmental Offsets Policy establishes a framework for using environmental offsets in Queensland. The policy is based on the premise that offsets should only be considered after all environmental impacts have been avoided and minimised.

The policy is based on seven policy principles that direct the way offsets must be used to contribute to Ecologically Sustainable Development:

- Environmental offsets will not replace or undermine existing environmental standards or regulatory requirements, or be used to allow development in areas otherwise prohibited through legislation or policy
- Environmental impacts must first be avoided, then minimised, before considering the use of offsets for any remaining impact
- Environmental offsets must achieve an equivalent or better environmental outcome

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- Environmental offsets must provide environmental values as similar as possible to those being lost
 - Environmental offset provision should minimise the time-lag between the impact and delivery of the offset
 - Environmental offsets must provide additional protection to environmental values at risk, or additional management actions to improve environmental values
 - Environmental offsets must be legally secured for the duration of the offset requirement.

The Queensland Government has several specific-issue offsets policies that indicate where environmental offsets are needed, and what form they should take. The specific-issue offsets policies, and their regulating agencies are for:

- Vegetation Management (Policy for Vegetation Management Offsets, September 2007, Department of Natural Resources and Water)
- Marine Fish Habitat (Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss, 2002, Department of Primary Industries and Fisheries)
- Koala Habitat (Offsets for Net Benefit to Koalas and Koala Habitat, 2006, Environmental Protection Agency)

Specific-issue policies are currently in development to address impacts on waste water quality and biodiversity.

Use of offsets

Biodiversity offsets

The objectives of the Queensland Government draft Policy for Biodiversity Offsets (EPA 2008b) are to improve the long-term protection and viability of the State's biodiversity, to increase the area of habitat restored and enhanced and to ensure development in Queensland is ecologically sustainable. It provides criteria for identifying and utilising biodiversity offsets to counterbalance an impact that causes a loss of biodiversity values.

Under the draft policy, biodiversity offsets must achieve an equivalent or better environmental outcome for the biodiversity values impacted and may include direct offsets (such as acquiring lands to be included in a protected estate or rehabilitation and protection of regrowth vegetation), or indirect offsets including removing threats to biodiversity values, providing fauna assisted crossings and implementing actions of a recovery plan, biodiversity action plan or management plan.

The draft Policy for Biodiversity Offsets may provide a useful guide to calculate potential offsets based on the conservation status of the values impacted. However, the policy in its present form is a consultation draft and is subject to considerable change. Therefore, it is not considered further here.

23.11 Conclusions

23.11.1 Threatened ecological communities

Potential impacts of the Project's gas fields on threatened ecological communities are primarily associated with the physical clearing of vegetation (required to prepare sites for the construction), and associated degradation, fragmentation, isolation and loss of connectivity.

Endangered ecological communities representing Brigalow, semi-evergreen vine thicket and weeping myall open woodland are present within the study area. Although included with the results of the EPBC Act online protected matters search tool, no occurrences of the remaining three endangered ecological communities have been confirmed or are considered likely for the gas fields' study area. These three communities are"

- Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland
- The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin
- White box-yellow box-Blakely's red gum grassy woodland and derived native grassland.

Not including Regional Ecosystem (RE) 11.3.2, which is listed only where weeping myall is present, there are 143,027ha of endangered ecological communities occurring within the relevant subregions. Of these, 20,542ha occur within the study area. Proposed clearing for the Project within these communities totals approximately 83ha, which will not exceed 0.15% of the provincial extent of any of the subject communities. Those areas proposed for clearing are generally isolated from adjoining vegetation and/or occur adjacent to currently disturbed vegetation and/or cleared areas.

Where these communities cannot be avoided, they will be offset as a matter of preference within bioregional corridors to improve landscape-scale habitat connectivity.

Works within 200m of threatened ecological communities will be subject to habitat management guidelines designed to protect the integrity of these communities.

Sensitivity mapping has been developed for preliminary siting of infrastructure, in particular gas wells, and will be used to refine locations during the life of the Project (see Section 23.10– Field planning). The intention of the mapping is to protect the integrity of large tracts of vegetation and associated polygons of significant vegetation, particularly where they occur within bioregional corridors.

Assessment of the proposed action against the significant impact criteria has determined that there are no significant impacts predicted for threatened ecological communities.

23.11.2 Threatened terrestrial flora and fauna

Sixteen threatened flora species are known from, or are potentially present, within the study area. This includes three species listed as endangered under the EPBC Act and 13 species listed as vulnerable under the Act. The assessment is based on database searches, literature reviews, analysis of habitat preferences and fields surveys. Five of the species were recorded during the recent ground surveys, while the remaining 11 species are either known from previous records or are considered to possibly occur based on the presence of suitable habitat within the study area

Based on the assessment of existing terrestrial ecological values (Volume 5 Attachment 14), 14 terrestrial fauna species listed (or pending listing) as threatened under the EPBC Act are known or

considered to possibly occur within the study area. This includes one species pending listing as critically endangered, two species listed (or pending listing) as endangered, and 11 species listed as vulnerable. Four of these species were recorded during the recent ground surveys, while the remaining 10 species are either known from previous records or are considered to possibly occur based on the presence of suitable habitat within the study area.

Impact mitigation measures include pre-development surveys, sensitive infrastructure siting, and applying specific threatened species management guidelines within 200m of known populations of listed species. This reduces potential impacts on most of these species, and no significant impacts are predicted (see Section 23.10.1).

In some cases, threatened species may not be able to be avoided and management measures may not be available to adequately mitigate impacts. If this occurs, permits will be obtained that will provide conditions for the disturbance of threatened flora species. In such cases, translocation plans will need to be prepared for some fauna species or offset measures proposed. With relocation or offsets implemented where necessary, no significant impacts on these species are predicted.

23.11.3 Threatened aquatic fauna

One threatened aquatic fauna species, the Murray Cod, is known from the study area and is predicted to occur in the Condamine and Balonne Rivers and their tributaries. Mitigation measures are proposed which prevent degradation of waterways by invasive weed species, and construction and operational activities. No significant impacts from the Project are predicted for this species.

23.11.4 Listed migratory birds

There is no evidence to suggest that the gas fields' area supports important habitat for any migratory species. Given their migratory habits, the ephemeral nature of food and habitat resources, and the extent of habitat across their range, it is likely that the existing resources within the area would be used infrequently and on a transitory basis. The suitable habitat for the remaining species within the gas fields' area is not considered important habitat. It is considered that no important habitat for these species will be modified, destroyed or isolated by the Project.

23.11.5 Ramsar wetlands

The Narran Lakes Nature Reserve is located in central northern New South Wales, in the Condamine Balonne catchment. It is the closest Ramsar listed wetland to the gas fields.

Given that the Narran Lakes Ramsar site is located approximately 500km downstream from the gas field and pipeline areas, the risk of adverse impacts is assessed to be minimal.

Operational discharges are unlikely to impact the Narran Lakes wetland. Any discharge water will be suitably treated before release, and released water would also be thoroughly mixed with natural flows by the time it reaches Beardmore Dam, upstream of the wetland. It is also considered highly unlikely that groundwater drawdown in the gas fields would result in reduced flows reaching the wetlands.

On the contrary, preliminary hydrological modelling indicates that there is potential to provide additional flows, consistent with natural flow patterns, which could be beneficial to the wetland. To confirm these initial findings, additional modelling will be completed as part of detailed design for any discharges.

23.11.6 Heritage areas

There are no listed heritage sites of global, national or State heritage significance within the gas fields' area.

23.12 Commitments to protection of MNES

To manage potential impacts from activities within the gas fields on MNES, Australia Pacific LNG has committed to a range of strategies. The key commitments and their relevant EIS references are detailed in the following sections. Further details and mitigation measures are also incorporated in the relevant chapters in this EIS volume.

23.12.1 Terrestrial ecology

Australia Pacific LNG commits to utilising sensitivity mapping and landscape management guidelines to plan the location of infrastructure, taking into account the landscape biodiversity values with the aim of minimising habitat fragmentation.

Australia Pacific LNG will limit clearing in areas of high biodiversity value, particularly for:

- Category 1 areas – these areas will be avoided and protected with 'no go' zones and a buffer area established in accordance with the approved habitat management guidelines
- Categories 2 and 3 areas –, unless otherwise approved, all activity on undisturbed land in these areas will follow the approved habitat management guidelines, infrastructure will be positioned along existing disturbed areas, and active rehabilitation will be implemented.

Australia Pacific LNG will establish a vegetation offset program that includes:

- Developing offsets for each hectare of conservation significant vegetation removed for the Project
- Considering ecological values at a regional scale when identifying locations for compensatory offset
- Targeting offsets to enhance biodiversity corridors where practical
- Using a third party provider to manage delivery of the regional program, supplemented with contributions to an administered fund
- Developing and providing offsets to respond to a disturbance inventory.

Australia Pacific LNG will engage with government and the community to develop sustainable regional land use strategies that combine the interests of gas production, agriculture and biodiversity values.

Australia Pacific LNG will undertake the following weed management measures:

- Develop a weed management guideline to minimise the spread of weeds throughout the study area and eradicate and control new weed infestations
- Work with regional councils in weed control
- Construct weed wash down facilities near Miles to support gas field construction and operations.

23.12.2 Aquatic ecology

To manage the potential impacts on water quality, aquatic ecology and habitat, as well as fluvial geomorphology associated with the construction, operation and decommissioning of the proposed gas fields' infrastructure, Australia Pacific LNG will:

- Develop and implement water quality, aquatic ecology and geomorphology monitoring programs for treated water discharge
- Locate discharge points within geomorphologically stable reaches of watercourses
- Design and implement erosion and sediment control devices according to regulatory requirements (Queensland 'Guidelines for Erosion and Sediment Control')
- Develop and implement mosquito monitoring and mitigation in accordance with the Mosquito Management Code of Practice for Queensland, for ponded waters associated with petroleum development.
- Design discharges to watercourses to mimic the variability of natural flows to the best extent practicable, and meet regulatory requirements. (Recognising the practicalities and timing of establishing beneficial use)
- Design watercourse crossings so flows and aquatic fauna passage are not impeded.

23.12.3 Geology and soils

For the construction, operation, and decommissioning of the Project within the gas fields, Australia Pacific LNG will:

- Avoid areas of severe erosion potential, where practicable
- Minimise erosion risk by refining both construction techniques and erosion and sediment control methods
- Creek rehabilitation will be consistent with surrounding environment and contours of the channel at the time of construction
- Point discharges will be directed to stable waterways and/or drainage lines, with appropriate engineering controls in place, such as scour protection and flow velocity limits
- Develop and implement procedures and monitoring programs to identify, investigate and conduct necessary remedial works for potential site contamination to retain environmental values.

23.12.4 Air quality

To manage the potential impacts of air emissions associated with the construction, operation and decommissioning of the gas fields and to meet air quality objectives, Australia Pacific LNG will minimise dust emissions by implementing measures incorporated in the EM Plan.

These include, as far as practicable, minimising the area and duration of land disturbance activities, scheduling such activities to avoid adverse weather conditions, suppressing dust, and rehabilitating disturbed areas as soon as possible.

23.12.5 Stakeholder engagement and consultation

Australia Pacific LNG will:

- Continue consultation and engagement programs with stakeholders to ensure their views are understood and considered throughout the life of the Project
- Continue to participate with government in local and regional planning processes, and provide timely information about the Project to inform discussion and decision making.

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