EnergyAustralia

Delta electricity

Appendix F
Gas Pipeline Environmental Assessment (Western and Eastern Routes)

MARULAN GAS TURBINE FACILITIES

SUBMISSIONS RESPONSE & PREFERRED PROJECT REPORT

VOLUME 2 | APPENDICES | May 2009

URS

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Energy Australia

Report for Marulan Gas Pipeline

Environmental Assessment of Pipeline Options

March 2009

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Background

Delta Electricity (Delta) and EnergyAustralia are seeking project approval to construct two separate gas turbine facilities, side by side on a site adjacent to the existing TransGrid Marulan 330/132kV Switchyard site, near Brayton.

The gas turbine facility proposed by Delta, would be developed in two stages. Stage 1 consists of two open cycle gas turbines. Stage 2 is the conversion of the open cycle facility to a combined cycle facility to generate electricity for intermediate/base load electricity demand.

The facility proposed by EnergyAustralia would consist of two open cycle gas turbines.

The proposed facilities are subject to Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Environmental assessments for the facilities have been prepared in accordance with Part 3A. The environmental assessments have been presented as a group of three documents for the various approvals required. The three documents are:

1. Marulan Gas Turbine Facilities – Joint concept application seeking:
   - Concept approval for all components of the two gas turbine facilities proposed and addressing the cumulative impact of the two facilities; and
   - Project approval for the common shared works. These are bulk earthworks on the site noting that works may be staged; an access road from Canyonleigh Road noting that the portion along the current access into the adjacent property will be under an existing easement; a formed road; and a transmission line connection to the nearby TransGrid switchyard.
2. Delta Marulan Gas Turbine Facility – Project application seeking approval for Stage 1 of its facility and a concept plan for Stage 2.
3. EnergyAustralia Marulan Gas Turbine Facility – Project application seeking approval for its facility.

The environmental assessments prepared by Delta and EnergyAustralia have addressed the environmental aspects of each gas turbine facility (referred to as 'the facilities' for the purpose of this report) individually, as well as their cumulative impacts.

The environmental assessments were publicly exhibited from 10 September 2008 to 13 October 2008.

The primary fuel for the facilities will be natural gas. Construction of a pipeline for the transmission of natural gas fuel from the existing Moomba to Sydney gas pipeline to the gas turbine facilities is required.

Other than in a general sense, the construction of a pipeline to connect the facilities to the Moomba to Sydney gas pipeline was not addressed in the environmental assessments.

1.2 Purpose of this report

This report has been prepared as part of a preferred project report for the facilities. It provides an environmental assessment of the key impacts of the proposed gas pipeline route options, which are briefly described below.

The gas would be transferred to the facilities by a common lateral pipeline and the gas flow into each plant would be metered separately. The main physical portions of the pipeline system are:

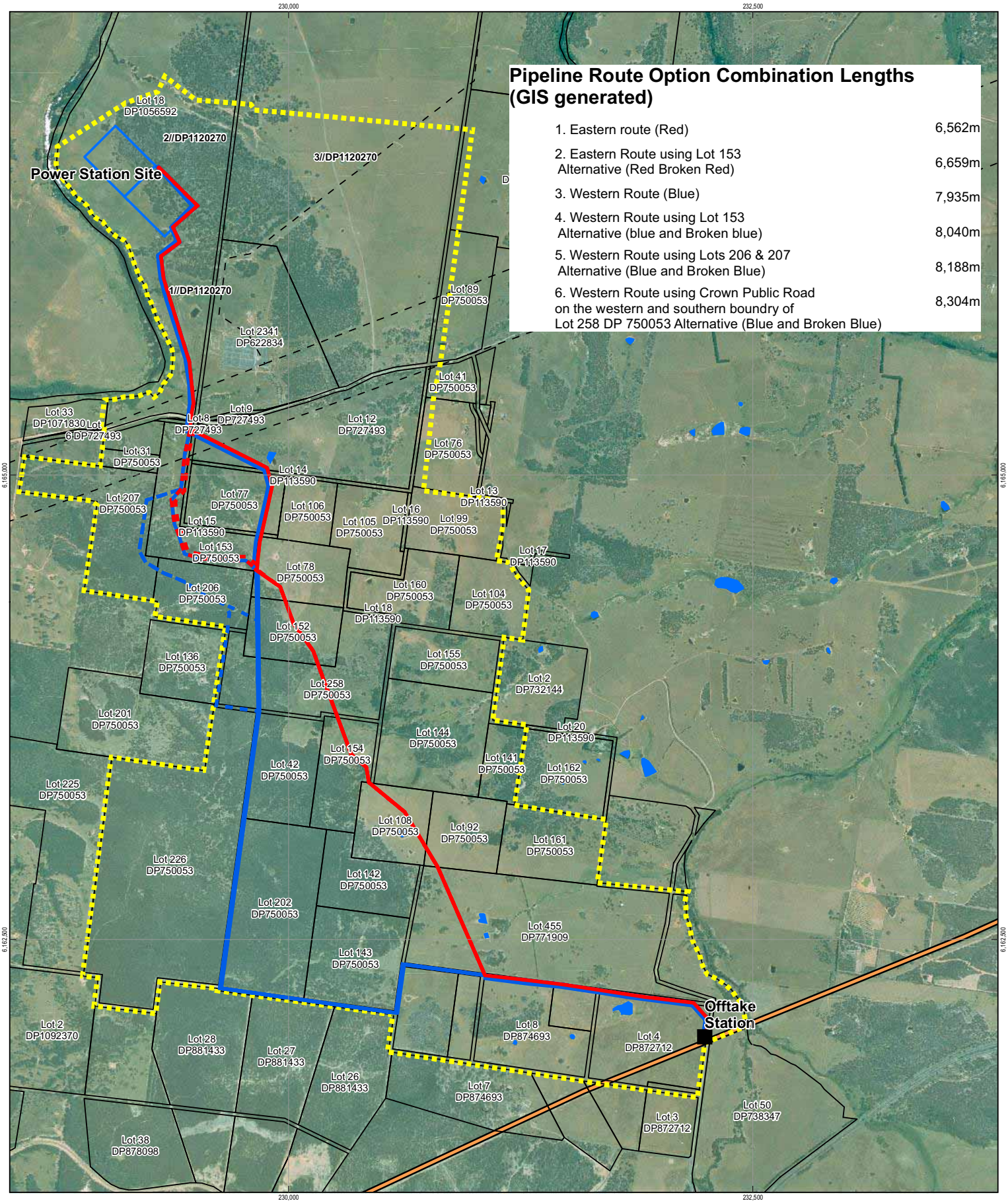
- An off-take facility from the Moomba to Sydney gas pipeline;
- The lateral pipeline approximately 6.5 kilometres to 8.3 kilometres in length; and
- The gas delivery facility on the gas turbine facilities site.

There are two main route options for the proposed gas pipeline – an eastern route and a western route. EnergyAustralia and Delta (the proponent) is also considering three alternatives to these main options. The alternative to the eastern route involves a deviation using lot 153. The alternatives to the western route involve a deviation using lot 153 or a deviation using lots 206 and 207.

Project approval under Part 3A of the EP&A Act is being sought from the Minister for Planning for all of these route options as described below and shown in Figure 1.1.

Pipeline route options	Alternative
Eastern route	1. Alternative eastern route using lot 153
Western route	1. Alternative western route using lot 153 2. Alternative western route using lots 206 and 207 3. Alternate western route using Crown Public Road on southern boundary of Lot 258.

Further information on the pipeline and the routes is provided in Section 2.



Pipeline Route Option Combination Lengths (GIS generated)

1. Eastern route (Red)	6,562m
2. Eastern Route using Lot 153 Alternative (Red Broken Red)	6,659m
3. Western Route (Blue)	7,935m
4. Western Route using Lot 153 Alternative (blue and Broken blue)	8,040m
5. Western Route using Lots 206 & 207 Alternative (Blue and Broken Blue)	8,188m
6. Western Route using Crown Public Road on the western and southern boundry of Lot 258 DP 750053 Alternative (Blue and Broken Blue)	8,304m

Legend

- Offtake Station
- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative
- Gas Pipeline Corridor
- Cadastre
- Powerlines
- Moomba Sydney Gas Pipeline
- Plant Foot print

1:19,000 (at A3)
0 87.5 175 350 525 700
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

Delta Electricity and EnergyAustralia
Marulan Gas Pipeline

Job Number 21-17633
Revision F
Date 23 February 2009

Pipeline Corridor - Route Options

Figure 1.1

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10 Bond Street Sydney NSW 2000 Australia 61 2 9239 7000 61 2 9239 7199 sydmail@ghd.com.au www.ghd.com.au

1.3 Scope of assessment

The environmental assessment provides:

- Information on the pipeline and the main route options;
- An assessment of the potential environmental impacts of the pipeline with a focus on the key environmental issues, including recommended mitigation measures to minimise the potential impacts identified;
- Measures proposed to manage other environmental issues (mainly issues relating to construction of the pipeline); and
- Recommended mitigation measures for each main route option detailing the proponent's commitments to minimising and managing the potential impacts identified.

Key potential environmental issues relating to construction of the pipeline are considered to be ecology and heritage.

An ecological assessment of the pipeline options has been undertaken by GHD, and a cultural heritage assessment has been undertaken by Navin Officer.

A summary of the results of these assessments is provided in Sections 3.1, 3.2, 4.1 and 4.2 of this report. The full assessments are included in Appendices A to D.

The report also considers potential land use and infrastructure issues associated with the pipeline options. It:

- Reviews zoning;
- Reviews current land uses; and
- Identifies any land uses issues/conflicts associated with the pipeline.

Other potential environmental issues, relating to construction of the pipeline, include:

- Water quality;
- Noise;
- Air quality; and
- Traffic.

The report considers the nature of these potential issues (including identification of any sensitive receivers) and how these issues will be managed during construction, providing a framework for mitigation, management and monitoring.

2. Description of the proposed pipeline

2.1 Pipeline concept design

2.1.1 Pipeline function and objectives

The main function and objectives of the pipeline are to:

- Transmit natural gas fuel from the Moomba to Sydney gas pipeline to the facilities;
- Condition the delivered gas to the required characteristics of pressure, temperature, particulate filtration and condensate content to suit the gas turbine's fuel specification;
- Meter the gas flow to each of the EnergyAustralia and the Delta Electricity facilities;
- Provide compliant physical protection and integrity for gas containment under operational loads and resistance to fracture, corrosion and external impact; and
- Allow for use of intelligent pigging devices for periodic internal inspections.

2.1.2 Design standard

The pipeline and ancillaries will be designed to AS 2885 'Pipelines – Gas and Liquid Petroleum' and other standards as referenced and applicable therein.

The design pressure is 6,900 kPag to match the maximum allowable operating pressure for Moomba to Sydney gas pipeline.

2.1.3 Pipeline and facilities configuration

The pipeline consists of an off-take facility, lateral pipeline and delivery facility for transmission of gas from the Moomba Sydney gas pipeline to the gas power facilities. The following forms the basis for configuring the pipeline and ancillaries from the off-take point to the power plant battery limits:

- An off-take tee and isolation valve would be installed on the Moomba - Sydney Pipeline upstream of the Uringalla Line Valve Station MWMS 1217 by hot-tap connection method;
- The gas turbines at the EnergyAustralia and Delta facilities are similar and require the same gas delivery conditions of pressure, temperature and filtration;
- Custody transfer metering for the gas supplied would be located at the facilities' site (or the delivery end of the new lateral pipeline);
- Common pipeline and gas ancillaries would be used to service both power facilities, except that separate gas metering to each section is required; and
- The pipeline would have provision for internal treatment or inspections using conventional and intelligent pigging devices.

A schematic process block diagram for the gas pipeline and associated facilities is shown in Figure 2.1. Further information is provided in the following sections.

2.1.4 Off-take station

The off-take station includes an isolation valve assembly (which may also serve as an emergency shutdown valve for the lateral pipeline system) and a scraper launcher assembly.

Pipeline blowdown provisions would be provided at either this site or alternatively at the facilities' site.

The isolation valve assembly would be housed within the existing Uringalla Mainline Valve Station compound on the Moomba – Sydney Pipeline. The scraper launcher assembly would require an additional plot area adjacent to the existing plot.

The existing mainline valve facility and the new gas off-take facility plots may be contained within one extended compound or two separate adjacent compounds depending on the ownership and operations status of the new lateral gas pipeline system.

The additional new plot area is estimated to be about 50 metres x 20 metres.

2.1.5 Pipeline

The pipeline would be approximately 6.5 kilometres to 8.3 kilometres in length.

The estimated nominal pipeline size is DN 450 millimetres to DN 600 millimetres (457 millimetres or 610 millimetres outside diameter).

The pipeline would be made of high strength carbon steel pipe manufactured to American Petroleum Institute specification API 5L.

The pipe wall thickness would be in the range of 6.4 millimetres to 12.7 millimetres and the actual thickness would be determined during detail design. The lower thickness is sufficient for pressure containment using high steel grade (specified minimum yield strength 358 MPa or higher). The thicker pipe is likely depending on the selected steel grade, risk assessment evaluation outcome, fracture control plan and also commercial availability considerations for this relatively small pipe order.

The pipeline would be buried except at entry and exit ancillaries. The pipeline would be laid across rural land, bushland and within Crown Public Roads with minimum soil cover between 0.75 metres and 0.90 metres except for locations where special design and risk considerations require greater cover such as road crossings, creeks, buried services or where the landowner proposes to undertake deep ploughing.

Protection from corrosion would be provided by a combination of pipeline coating and cathodic protection. The pipeline coating may be either a fusion bonded epoxy system or a tri-laminate coating system (thin epoxy coating protected with polyethylene coat).

The pipeline would be constructed within a 20 metre wide easement (also referred to as a 'right of way').

2.1.6 Gas delivery station

The receipt and conditioning of the gas to match the facilities' fuel supply conditions, and also the custody transfer metering to each of the facilities, occurs in the gas delivery station. The main equipment in the process train includes:

- Pipeline blow-down;
- Scraper receiver;
- Facility inlet isolation valve;
- Gas filtration;
- Gas fired water bath heater (unless alternatively heating is provided within the gas turbine fuel conditioning package);
- Pressure regulation and over-pressure protection;
- Liquids coalescence and separation (if required);
- Gas Specification Chromatography (unless available from upstream facilities);
- Metering for EnergyAustralia facility;
- Metering for Delta facility;
- Isolation or emergency shutdown valves for EnergyAustralia power facility;
- Isolation or emergency shutdown valves for Delta Electricity power facility;

The gas delivery facility plot area is estimated to be about 60 metres x 40 metres.

2.1.7 Operation concept

The pipeline and ancillaries operation, monitoring and control would be automated and/or performed remotely from either of the facilities' control rooms or alternatively from a remote gas pipeline control centre.

The pipeline would require periodic inspection, maintenance and patrol activities by the pipeline operator crew.

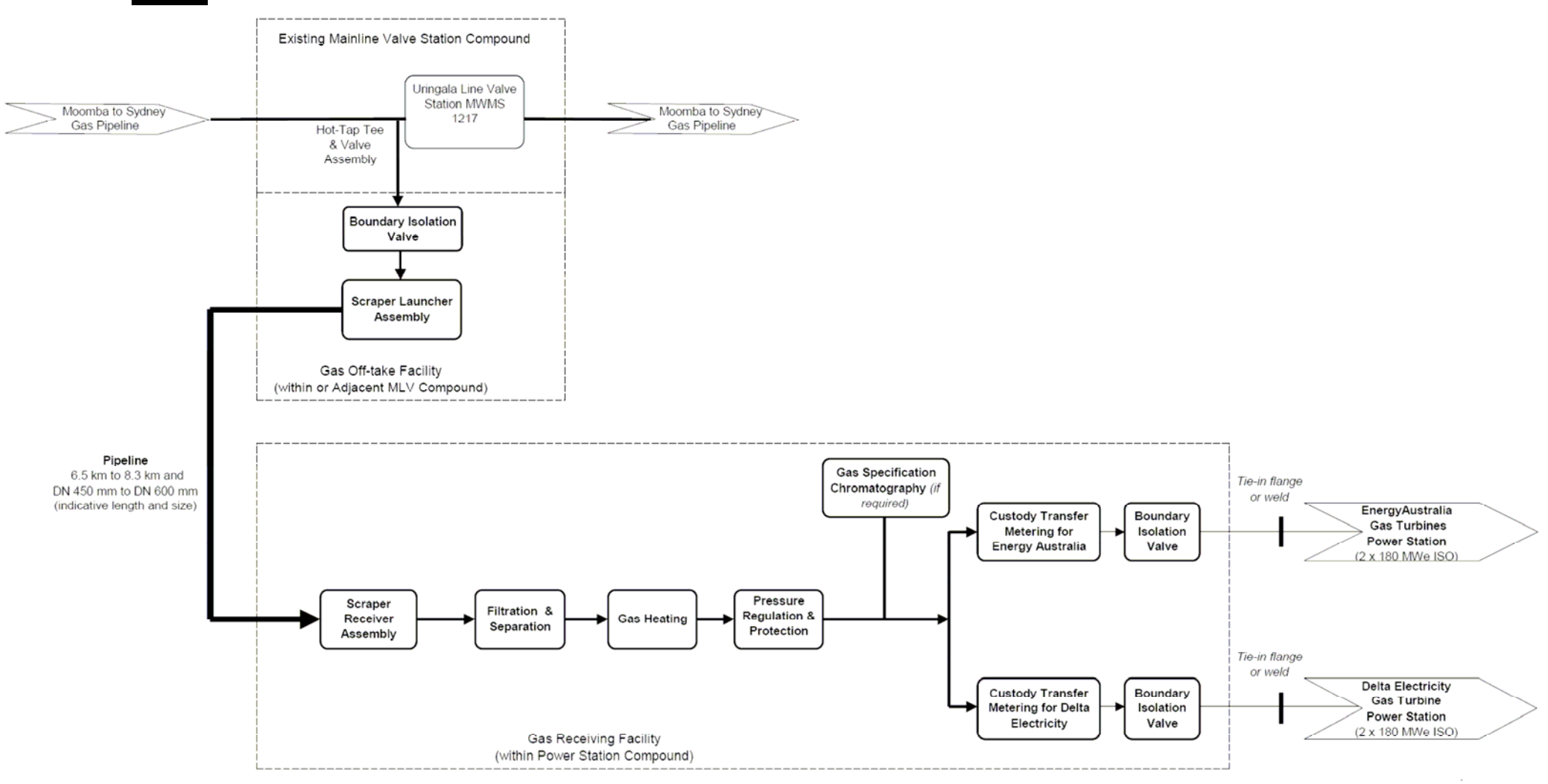


Figure 2.1 Schematic process block diagram for Marulan Gas Pipeline and facilities

2.2 Pipeline size and capacity

2.2.1 Gas demand

The estimated total fuel gas design demand for the facilities is 8.16 TJ/hour.

The estimated gas demand for each of the four 180 MW gas turbine units is 2.04 TJ/hour. This was based on the operating condition of peak fuel consumption being at the lowest ambient temperature of (minus) -8.5^{O}C and with anti-icing OFF. The design value was calculated as 1.05 times the specified preliminary peak fuel consumption for this condition (a 5% design contingency).

There would be no significant variation in fuel demand when the Delta Electricity plant section operates in combined cycle mode given that the additional power output is derived from steam generated by recovery of heat from the exhaust of the gas turbine units.

2.2.2 Pipeline sizing

The estimated nominal pipeline size of DN 450 millimetres to DN 600 millimetres and the relevant assumptions are described in this section.

The gas delivery pressure is specified in the range of 2,500 kPa (abs) to 2,700 kPa (abs). This concept design brief is conservatively based on the upper value of 2,700 kPa (abs).

The following gas pressure drop allowances are included:

- 50 kPa for pressures drop across the gas off-take facility;
- 400 kPa pressure drop across the gas delivery facility (metering, pressure regulation and other ancillaries including piping through to the gas turbines battery limit) for frictional losses within the facility piping and equipment and also for incremental settings within the pressure regulation system; and
- 250 kPa limit for pipeline frictional loss at maximum throughput flow rate (the calculated value for a DN 500 mm pipeline was 220 kPa, using a conservative gas specific gravity and a *conservative pipeline length of 8.3 kilometres compared to a 6.5 kilometre to 8.3 kilometre route length range*).

Given the above pressure parameters, the minimum flowing pressure in the Moomba to Sydney pipeline at the tapping point should be 3,400 kPa (abs) and this value is subject to negotiation with the gas provider. Flexibility in specification of the pipeline size should be considered for the regulatory approvals submissions and a size range of DN 450 millimetres to DN 600 millimetres is suggested until confirmation of gas supply pressure is obtained from the gas provider.

2.3 Site services

Limited site services would be required to support the normal operation of the pipeline and ancillaries and these would be considered in more detail during the design stage. The concept design in relation to site services provision is described in Table 2.1.

Table 2.1 Services provision

Service	Provision
Communications	◗ Remote transmission for system control and data acquisition (SCADA).
Water	◗ Potable water could be provided from the nearby power station. ◗ No process water is required.
Sewer	◗ Sewage would not be required and amenities could be provided from the nearby power station.
Firewater	◗ Firewater would not be provided as such would not be practical for high-pressure natural gas application. Fire extinguishers may be provided in control huts for general fire fighting applications.
Power	◗ Provided for on-site general purpose in control huts, process control, security, lighting and similar low power applications.
Drainage	◗ The surface of the site for the ancillary stations would be predominantly grass or gravel and allow for infiltration. There would be no potential oil or trade waste leak or spill sources contamination in the run-off water quality. Therefore, the design would allow natural stormwater run-off while the design would not affect the overall natural drainage of the surrounding rural terrain.

2.4 Fugitive emissions

2.4.1 Fuel combustion

The flowing gas pressure from the Moomba to Sydney pipeline would be sufficient for transmission and delivery of the gas to the facilities at the required pressure, therefore the pipeline system would not include any compression facility.

The gas delivery station would include a water bath heater. The heater would contain gas burners, which would operate using fuel gas from the gas piping within the station. The actual fuel consumption would depend on the ratio of the received gas pressure to the regulated pressure as required for the power station. The received pressure would be generally expected to be a small margin above the regulated pressure and this would minimise the heater fuel consumption and exhaust emissions.

Exhaust emission would be quantified during the design stage.

2.4.2 Gas venting

Occasional venting of limited gas volumes would be necessary for maintenance activities such as venting filter vessel for element change over and venting of scraper traps for pig launch and retrieval.

Blowdown of the full pipeline content would not be permitted except in the unlikely event of an extreme emergency (typically outside the control of the pipeline operator).

2.4.3 Gas leaks

The pipeline and facilities would be designed and tested to ensure there are no leaks during normal operation. Any identified leak or potential for leaks would be mitigated promptly.

2.5 Trade waste or discharge

Normal operation of the pipeline and ancillaries would not involve generation of wastewater, process effluent, oils, chemicals and solvents generation.

The generation of minor amounts of lubricants or waste may occur during maintenance activities and such would be collected in trays, drums or bins as appropriate for off-site disposal in accordance with approved procedures.

2.6 Buildings

Buildings would be limited to a small control hut in each of the off-take facility and the gas delivery facility. The huts would be light weight transportable type structures and of plot size in the order of 2 x 3 metres.

2.7 Site access

Access to the off take facility station would be from the Hume Highway along part of Redhill Road and the Crown Public Road (known as Wollumbi Road) then along the existing Moomba-Sydney Pipeline easement.

Access to the gas delivery station would be from Canyonleigh Road along the same roadway to be constructed to the facilities' site and during construction of the pipeline along the cleared right of way from Canyonleigh Road to the facilities' site. During construction access from the southern end of the pipeline would be from the Hume Highway, along part of Redhill Road, the Crown Public Road (known as Wollumbi Road) and then generally along the cleared right of way. From the northern end of the pipeline construction access would be from Canyonleigh Road then along the cleared right of way.

Temporary access to the pipeline right-of-way for construction purposes at other locations may be required which would be identified during construction planning and would generally utilise existing roadways and farm tracks that cross the pipeline route.

2.8 Site security

The pipeline ancillary stations would be surrounded with cyclone type fenced with lockable gates. The sites would be monitored by regular patrols. The sites may also be monitored remotely by electronic systems if considered necessary during the design stage.

2.9 Pipeline construction

2.9.1 Construction overview

The pipeline construction would involve clearing, grading, trenching, pipe welding, pipe laying, backfill, hydrostatic testing and finally restoration of the right-of-way.

The proposed construction width and pipeline right of way/easement is 20 metres wide.

The eastern route consists predominantly of open rural land. The western route consists of a mix of bushland areas, cleared road corridors and open rural land. Both route options cross several small watercourses and gullies and these would require established pipeline construction techniques and erosion and sediment control.

An electrical transmission sub-station and high-voltage power transmission lines are present in the vicinity of the proposed facilities' site. The selected gas pipeline route would cross or pass close to these electrical ancillaries and due consideration would be given during the design phase to the cathodic protection and electrical safety special requirements.

All construction and operation works would be carried out by appropriately qualified personnel and in compliance with approved specifications, procedures and environmental management plans.

2.9.2 Construction rate and schedule

Construction of the pipeline and ancillaries is expected to commence at the same time as the facilities with practical completion within a period in the order of six months.

The construction crew would involve about 20 personnel. The construction spread should be no more than a few hundred metres along the easement.

Construction activities would typically be undertaken from 7 am to 6 pm and each day of the week as per the convention for cross-country pipelines in rural or remote locations.

2.9.3 Pre-construction activities

Pre-construction activities include:

- Access to the proposed gas pipeline route for detailed engineering, cadastral, topographic heritage, and ecological surveys and engineering inspections;
- Marking the pipeline construction right-of-way with survey pegs;
- Marking of hollow bearing trees and other environmentally sensitive identified for preservation within the pipeline right of way;
- Marking and possibly fencing areas or features determined to be subject to environmental or heritage protection adjacent to the pipeline right of way;
- Access to specific locations along the proposed gas pipeline route for geotechnical investigations may include bore logs drilling and pit excavation; and
- Provision of a temporary construction depot and storage yard located in approved areas outside the pipeline right-of-way.

2.9.4 Construction activities

Construction activities include:

- Erection of temporary construction gates on existing fence lines and the temporary fencing off of paddocks from the construction area as may be required along the pipeline right of way;
- Progressive clearing of vegetation (within the 20 metre wide easement) followed by stripping and conservation of top-soil (also refer to Section 2.9.6);
- Installation of erosion and sediment control measures;
- Grading of the construction strip alongside the pipeline trench alignment;
- Trenching along the pipeline centreline except for any major road crossing which could be installed by boring;
- Pipe stringing and pipe bending alongside the trench line;
- Pipe welding and weld non-destructive inspection;
- Pipe joint coating;
- Padding of the trench bottom with sand as required;
- Testing of the pipe coating for defects and repair if necessary prior to lowering of the pipe into the trench;
- Trench back filling; and
- Hydrostatic pressure testing to assure pipe strength and that there are no leaks and disposal of testing water.

A civil construction crew would prepare the approved construction right-of-way for construction of the pipeline. All construction activities along the proposed gas pipeline route would be limited to within the nominal right-of-way width of 20 metres.

Vegetation and trees would be cleared, chipped/mulched and stockpiled on the side of the right-of-way. Substantial trees suitable for fence posts could be kept to one side for the landowners use.

Clearing would be followed by stripping and stockpiling of the topsoil separately on the side of the easement. A construction width would then be graded to facilitate a working surface profile for trench excavation and pipeline, stringing, welding and laying. The excavated trench material stockpiled along the side of the trench would be returned later as backfill material.

The chipped/mulched vegetation, topsoil and backfill would be maintained in separate stockpiles.

Clearing width may be increased at watercourse crossing to allow stockpiling of materials outside the zone of water. The clearing width may also require increasing at road crossings to allow stockpiling of materials and storing of construction equipment outside the zone of traffic flow.

Hydrostatic test water will be sourced in consultation with landowners and the relevant regulatory authorities and trucked in if it cannot be soured locally. A temporary holding dam

with a membrane liner may be constructed alongside the pipeline right of way within a cleared area to facilitate the reuse of the test water along sections of the pipeline.

Hydrostatic test water will be disposed of in accordance with the requirements of the relative authorities. Water quality analysis would be undertaken to determine the method and location of the disposal of the test water

2.9.5 Post construction activities

Post construction activities include:

- Restoration of the pipeline right-of-way and disturbed area's (refer following section);
- Warning sign posting; and
- Restoration of permanent fencing.

2.9.6 Restoration and rehabilitation

The right-of-way would be restored and rehabilitated upon completion of construction and testing of the pipeline. The contours would be restored to blend in with the surrounding ground and the original topsoil would be spread in uniform thickness to cover the areas stripped during construction. Landforms and drainage contours would be re-established. The finished grounds would be stabilised by seeding and revegetation compatible with original environment including the spreading of chipped and mulched vegetation.

On watercourses and areas prone to soil erosion, check banks and sediment traps would be constructed to assist in stabilising the soil until revegetation of the disturbed area has been established.

During construction activities all waste materials would be collected for approved off-site disposal.

Construction and restoration activities as described above would be performed in accordance with the pipeline specification and the construction environmental management plan (CEMP), which would be prepared and approved during the design and prior to the construction of the pipeline.

2.10 Description of the eastern route

This route is shown in red in Figure 1.1.

The eastern route starts at the proposed off-take station on the downstream side of the Moomba to Sydney gas pipeline at the Uringalla main line valve. The route heads in a north westerly direction through a pasture improved paddock for approximately 200 metres before travelling along a Crown Public Road (known as Wollumbi Road). Within this road corridor, the route heads west on the southern side of the gravel road formation for approximately 1,100 metres (1,300 metres from the off-take station). The route then leaves the road corridor and heads in a north westerly direction across undulating land occupied by improved pasture, used for open cattle grazing, for approximately 1,250 metres, then continues in a north westerly direction through unimproved undulating open sheep grazing country consisting of predominately native grasses and trefoils for approximately 2,500 metres. It then crosses

Canyonleigh Road and continues in a northerly direction within the site for the gas turbine facilities over undulating native grassland with basalt rock outcrops for 1,500 metres, before reaching the gas turbine facility.

Approximate length: 6,562 metres

Private landowners: 3

This route is the shortest most direct route.

2.10.1 Alternative eastern route using lot 153

The alternative section is shown in shown by a red dotted line in Figure 1.1.

The proponent owns Lot 153 of DP750053.

To avoid impacting private property this route offers an alternative for both the eastern and western route through a property purchased by the proponent.

The route heads west from the 4,000 metre point on the eastern and western route for 400 metres and then north for 750 metres where it rejoins the eastern and western route prior to the Canyonleigh Road crossing. The pipeline alignment through the property has been selected to avoid sensitive native vegetation.

Length of alternative section: 1,150 metres

Total length of eastern route using this alternative: 6,659 metres

Private landowners (along alternate section): Nil

2.11 Description of the western route

This route is shown in blue in Figure 1.1.

This route is the same as the eastern route for the first 1,300 metres, at which point it continues in a westerly direction within Wollumbi Road for 1,650 metres, then a right angle bend to head directly north within an unmade Crown Public Road through bushland areas for 2,520 metres where it rejoins the eastern route described above for 2,450 metres through to the gas turbine site.

This route avoids the improved cattle grazing country to the east and uses more government owned land (Crown Public Road) than privately owned land.

Length: 7,935 metres

Private landowners: 3

2.11.1 Alternative western route using Lot 153

The alternative section is shown by a blue dotted line in Figure 1.1.

This route alternative is the same as the eastern route alternative described above.

The route heads west from the 5,500 metre point on the western route for 400 metres and then north for 750 metres where it rejoins the eastern and western route prior to the Canyonleigh

Road crossing. The pipeline alignment through the property has been selected to avoid sensitive native vegetation and possible archaeological sites.

Length of alternative section: 1,150 metres

Total length of western route using this alternative: 8,040 metres

Private landowners (along alternative section): Nil

2.11.2 Alternative western route using Lots 206 & 207

The alternative section is shown by a blue dotted line in Figure 1.1.

This route offers an alternative to the western route, leaving the western route at the 5,000 metre point and heading westerly through Lot 206 DP750053 for 600 metres. It then turns north through Lot 207 DP750053 and then in a north easterly direction into Lot 153 DP 750053 owned by the proponent rejoining the route through Lot 153 described in 2.11.1 above.

Length of alternative section: 1,700 metres

Total length of western route using this alternative: 8,188 metres

Private landowners (along alternative section): 2

2.11.3 Alternative western route "L" shaped Crown Public Road

This alternative is shown by a blue broken line in Figure 1.1

This route leaves the western route at approximately the 4,500 metre point heading directly west for approximately 200 metres, then north for 500 metres remaining predominately within an unmade Crown Public Road, rejoining the alternative route within Lots 206 & 207 described above in 2.11.2

Remaining predominately within Crown Public Road corridor and minimises impact on the adjacent privately owned land.

Length of alternative section: 700 metres

Total length of western route using this alternative: 8,304 metres

Private landowners (along alternative section): 1

2.11.4 Summary of routes and alternatives

Table 2.2 summarises the routes and the alternatives considered.

Table 2.2 Pipeline routes and alternatives

Route Description	Approximate Length (Metres)	Total Length (Metres)	Variance (Metres)	Easement Area (20 metre wide easement)	Number of Private Landowners on route
Eastern route	6,562	6,562		13.12 ha	3
Eastern route alternate using Lot 153	1,150	6,659	+97	13.31 ha	2
Western route	7,935	7,935	+1,373	15.87 ha	3
Western route alternative using Lot 153	1,150	8,040	+1,478	16.08 ha	2
Western route alternative using Lots 206 & 207	1,700	8,188	+1,626	16.37 ha	3
Western route alternative using “L” shaped Crown Public Road	700	8,304	+1,742	16.60 ha	3

3. Environmental assessment of eastern route

3.1 Ecology

3.1.1 Existing environment

Flora

Approximately 170 plant species were recorded during the field surveys undertaken for the ecological assessment (refer Appendix A).

The following vegetation communities were identified within the study area (as shown in Figure 3.1).

- Riverbank Forest;
- Eastern Tablelands Dry Forest;
- Frost Hollow Grassy Woodland;
- Tablelands Grassy Box Gum Woodland;
- Native Pasture;
- Modified or Disturbed Land; and
- Acacia Scrub.

Threatened species

The desktop literature review indicated that 24 threatened plant species (listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) have been previously recorded or are predicted to occur in the study area. None of these species were identified during field surveys. However, the study area contains suitable habitat for a number of threatened plants including:

- Buttercup Doubletail (*Diuris aequalis*);
- Camden Woollybutt (*Eucalyptus macarthurii*);
- Hoary Sunray (*Leuchochyrsum albicans var tricolour*);
- Tallong Midge Orchid (*Genoplesium plumosum*);
- Delicate Pomaderris (*Pomaderris delicata*);
- Button Wrinklewort (*Rutidosis leptorrhynchoides*); and
- Dwarf Kerrawang (*Rulingia prostrata*).

Generally these species are most likely to occur within in existing remnant vegetation, which would not be directly impacted by the route. However, it is possible some may occur within the area of impact, as both Buttercup Doubletail and Button Wrinklewort have both been known to occur in secondary grassland and may occur along the route. However, neither of these species has been previously recorded in the study area and neither was identified during targeted surveys during known flowering times. Threatened species locations are shown in Figure 3.2.

Endangered ecological communities

Tablelands Grassy Box Gum Woodland qualifies as the endangered ecological community (EEC) White Box, Yellow Box, Blakely's Red Gum Grassy Woodland (Box-Gum Woodland) EEC. This EEC is listed under both the TSC Act and the EPBC Act however is defined based on slightly different criteria. An area of scattered Yellow Box trees exists along the proposed eastern route which constitutes TSC Act listed Box-Gum Woodland, however does not meet the criteria for EPBC Act listed Box-Gum Woodland. Another area on Lot 153 contained a stand of Yellow Box which meets the majority of the criteria for EPBC Act listed Box-Gum Woodland, and in light of the precautionary principle, has been assessed under EPBC Act Significant Impact Criteria.

Fauna

During the field surveys, 24 mammals, 95 species of bird, seven frogs and two reptiles were recorded.

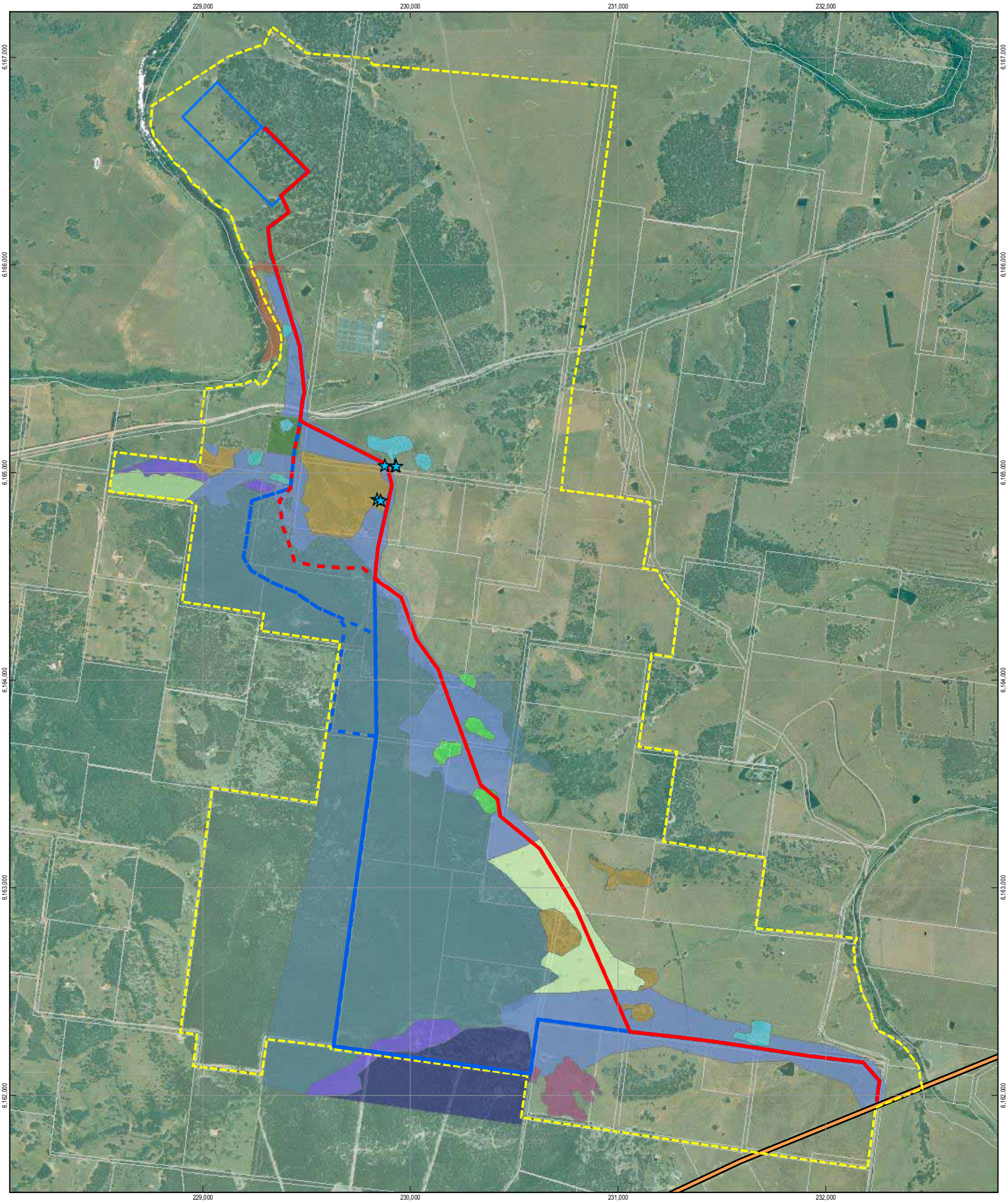
The habitat assessment identified the following key habitat types across the study area:

- Forest and woodland;
- Forest hollow woodland;
- Acacia scrub;
- Native pasture;
- Exotic pasture;
- Aquatic and wetland habitat; and
- Other habitat resources – included hollow-bearing trees and stags, reasonable amounts of standing and fallen dead timber and rock outcrops.

The predatory red fox, the feral dog and wild pig were sighted within the study area. It is expected that the cat (*Felis catus*) would also occupy the study area.

The majority of the study area is stocked with sheep and domestic cattle and moderate numbers of rabbits were noted. These species may compete with native herbivores and may suppress growth of palatable native herbs and grasses.

Overall, habitat within the study area is relatively continuous with a large patch of intact woodland and forest to the west. This connectivity would allow the movement of native birds, some reptiles, arboreal mammals and potentially small terrestrial mammals. Land to the north and east features a matrix of patchy open woodland and grassland. These areas have similar habitat value to the study area and would combine to form a large area of habitat suitable for open country and woodland species. Connectivity is good to the south for approximately 2 kilometres but then is limited by the Hume Highway. Species such as Speckled Warbler are dependent on large areas of relatively intact vegetation.



Legend

- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative
- Plant Foot print
- Gas Pipeline Corridor
- Moomba Sydney Gas Pipeline
- Modified Grassland
- Riverbank Forest
- River She-oak Forest
- Frost Hollow Grassy Woodland
- Snow Gum / Apple Box Woodland
- Unclassified
- Acacia Scrub
- Argyle Apple Forest
- Box- Gum Woodland EEC
- Cabbage Gum / Stringybark Forest
- Candlebark gully Forest
- Garden
- Native Grassland
- Red Gum Woodland
- Red Stringy Bark Forest
- Scribbly Gum woodland
- Snow Gum/Candlebark/Applebox Woodland
- Stringybark/ Black Sheoak forest
- Tableland Hills Grassy Woodland

1:17,000 (at A3)

0 60 120 240 360 480

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Marulan Gas Turbines Facilities

Job Number 21-17633
Revision A
Date 9 December 2008

Figure 3.1

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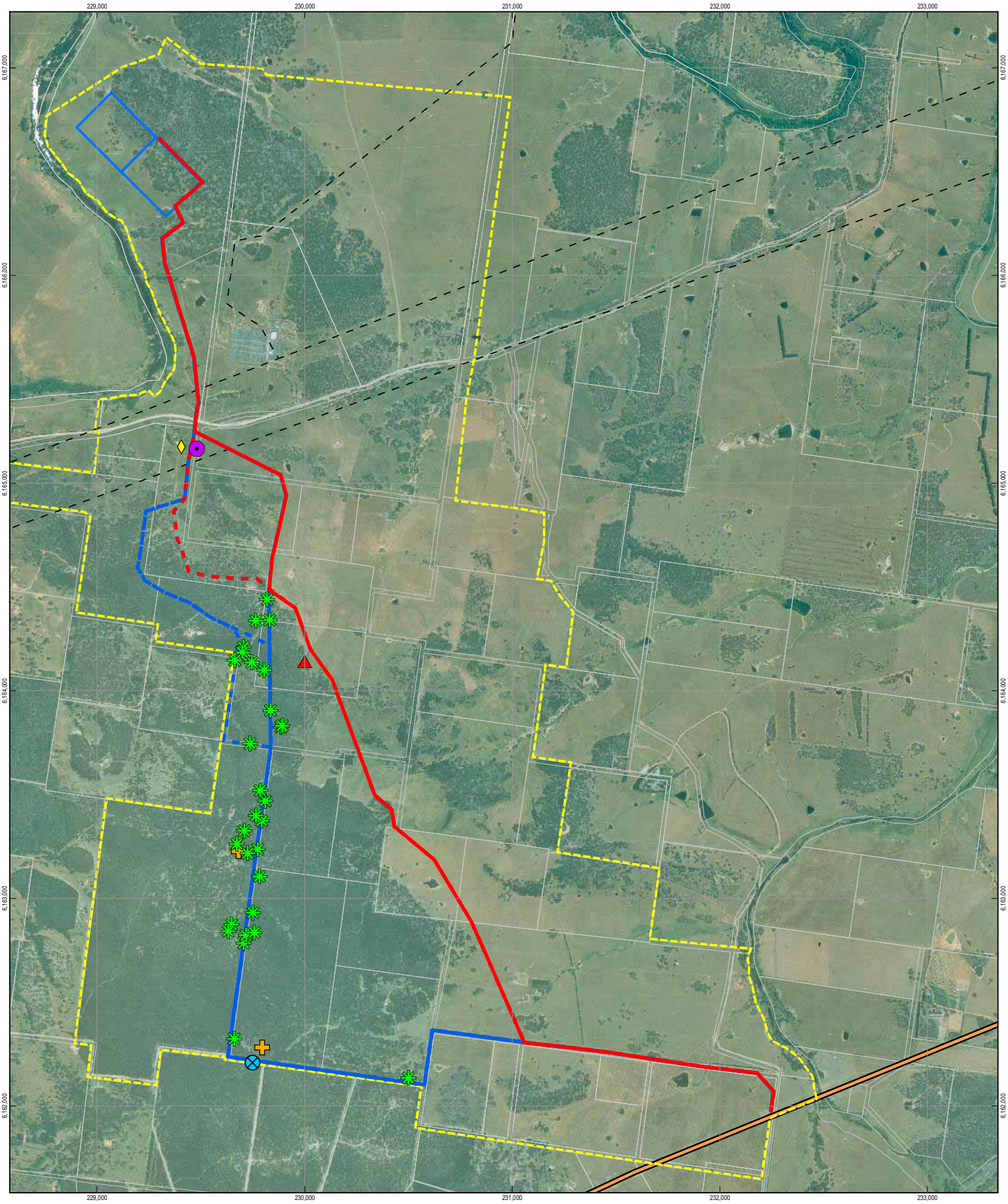
10 Bond Street Sydney NSW 2000 Australia 61 2 9239 7000 61 2 9239 7199 sydmail@ghd.com.au www.ghd.com.au



Legend

- Large- footed Myots (tentaive record)
- Eastern Bent Wing Bat
- Speckled Warbler
- Glossy Black Cockatoo, Preferred feed Tree
- Powerful owl
- Gang-gang Cockatoo
- Plant Foot print
- Gas Pipeline Corridor
- Sydney Moomba Gas Main
- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative

1:17,000 (at A3)

0 87.5 175 350 525 700

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number	21-17633
Revision	A
Date	30 October 2008

Thereatened Species Figure 3.2

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10 Bond Street Sydney NSW 2000 Australia 61 2 9239 7000 61 2 9239 7199 sydmail@ghd.com.au www.ghd.com.au

The Wollondilly River is less than 200 metres from the northern portion of the study area. The riparian corridor features stretches of intact riparian forest alternating with willow (*Salix* sp.) infestations and cleared agricultural land. The riparian zone provides a near-continuous habitat corridor for aquatic species, waterfowl and semi-aquatic, frogs, reptiles and mammals.

Threatened fauna species

Four threatened bird species were observed during the surveys:

- Gang-gang Cockatoo *(Callocephalon fimbriatum)*;
- Glossy Black-cockatoo *(Calyptorhynchus lathami)*;
- Speckled Warbler (*Pyrrholaemus saggitatus)*;
- Powerful Owl (*Ninox strenua*).

Two microchiropteran bats listed as vulnerable under the TSC act were tentatively detected by Anabat recordings:

- Eastern bentwing-bat *(Miniopterus schreibersii oceanensis*); and
- Large-footed Myotis *(Myotis macropus).*

A number of gliders (*Petaurus sp.*) were observed during spotlight surveys. This genus is difficult to identify to species level by spotlight. Several individuals were positively identified by call as Sugar Glider, however some individuals may have been the Squirrel Glider, which is listed as vulnerable under the TSC Act.

The desktop review indicates the potential presence of a further 33 threatened fauna species listed under the TSC Act as Wildlife Atlas records in the locality, and/or the EPBC Act and predicted to occur in the local area.

A total of eight species were considered to have a high likelihood of occurrence within the study area based on the presence of suitable foraging and roosting habitat and recent records in the local area:

- Masked Owl *(Tyto novaehollandiae*);
- Squirrel Glider *(Petaurus norfolcensis);*
- Diamond Firetail *(Stagonopleura guttata*);
- Hooded Robin *(Melanodryas cucullate*);
- Eastern False Pipistrelle *(Falsistrellus tasmaniensis*);
- Eastern Bentwing-bat *(Miniopterus schreibersii oceanensis*);
- Little Bentwing-bat *(Miniopterus australis);*
- Greater Broadnosed Bat *(Scoteanax ruepellii);* and

A further five species may utilise habitats within the study area on an occasional or opportunistic basis:

- Large-eared Pied Bat *(Chalinolobus dwyeri);*
- Brown Treecreeper *(Climacteris picumnus);*
- Swift Parrot *(Lathamus discolour);*

- Barking Owl *(Ninox connivens);* and
- Spotted-tailed Quoll *(Dasyurus maculatus).*

3.1.2 Impact assessment – main eastern route

The route is located almost entirely within agricultural land devoid of canopy trees and shrubs. It passes through small patches of Acacia Scrub and along the edge of Eastern Tablelands Dry Forest. A total of 13 hectares of clearing would be required including approximately one ha of remnant vegetation.

Threatened flora species

The route would not directly impact any known populations of threatened flora species, although habitat for Buttercup Doubletail and Button Wrinklewort may be removed. An assessment of impacts on threatened flora was undertaken. The assessment determined that the route is unlikely to significantly adversely affect potential habitat for these two species within the study area.

Threatened fauna species

Construction of the pipeline would result in the temporary removal of foraging habitat for the Diamond Firetail, and marginal sheltering habitat for the Striped Legless Lizard. It would also affect habitat adjacent to the forest used by the Glossy-black Cockatoo, Gang-gang Cockatoo, Speckled Warbler and Powerful Owl. An assessment of impacts on threatened fauna was conducted. The assessment determined that the route is unlikely to significantly adversely affect potential habitat for threatened birds, the Striped Legless Lizard or microchiropteran bats. Construction of the pipeline would not result in the removal of significant habitat for any of these species, as the majority of the route would be located within cleared land, and significant areas of habitat for these species exists within the study area.

Endangered Ecological Communities

Construction of the pipeline would involve clearing of Derived Native Grassland associated with the TSC Act listed EEC (White Box, Yellow Box, Blakely's Red Gum Woodland endangered ecological communities). An assessment of impacts on EECs was undertaken. The assessment determined that if no canopy trees associated with this community are removed and if native grassland areas are appropriately re-established, then a significant impact on these communities is unlikely.

Vegetation clearing and construction impacts

Flora

The route would impact on native or introduced pasture, and some small patches of edge vegetation, predominately Acacia Scrub. No vegetation would be fragmented or isolated from other vegetation.

Fauna

A considerable abundance and diversity of native bird species occupy the study area, with the potential for impacts as a result of the removal of native vegetation and other habitat resources. However, the majority of these species are mobile, widespread and common. In addition, there

are large quantities of equivalent habitat and resources in the study area and so it is likely that any impact on local populations of native birds would be minor.

Arboreal mammals occur in areas of Eastern Tablelands Dry Forest. The route would not impact these areas. A number of microchiropteran bats were recorded within the study area; however, it is considered that the route would be unlikely to substantially affect relevant habitat for any of these species.

The pipeline may directly impact active wombat burrows, which would need to be identified and any resident wombats carefully relocated.

A moderate diversity and abundance of native frogs and reptiles are considered likely to occupy the study area. Species recorded during field surveys were widespread and common (Cogger, 1996). It is likely that individuals would be killed or displaced during clearing, particularly species that burrow or shelter beneath woody debris. The loss of habitat is likely to have a minor impact on local populations of these species given the large areas of native vegetation and other resources in the vicinity of the study area.

There would be moderate, ongoing impacts on fauna using adjacent areas of habitat during construction associated with noise and other disturbances. Impacts are likely to be minor as construction would only occur during daylight hours and would be temporary. There are already disruptive human activities in the vicinity of the study area associated with agriculture. Larger, more mobile fauna currently occupying the study area are likely to be adapted to these disturbances. There would be impacts upon smaller, less mobile fauna in the immediate vicinity of the route.

EPBC Act

EPBC Act listed threatened species with the potential to occur within the study area include:

- Striped Legless Lizard (*Delma impar*);
- Button Wrinklewort (*Rutidosis leptorrhynchoides*); and
- Buttercup Doubletail (*Diuris aequalis*).

These species were assessed using relevant Significant Impact Criteria. The assessment concluded that the route is unlikely to have a significant impact on these species.

Offsets

The route avoids impacts on important stands of native vegetation. Any areas of native and introduced pasture would be re-instated once construction works are complete. As such, construction of the pipeline is unlikely to result in any significant long-term impact on native flora and fauna and an offset is not considered to be required.

3.1.3 Impact assessment - eastern route with alternative section using lot 153

The alternative route through Lot 153 may impact on some remnant vegetation including approximately 2 ha Eastern Tablelands Dry Forest and Acacia Scrub, however, the majority of the route is located almost entirely within agricultural land devoid of canopy trees and shrubs. A total of 13 hectares of clearing would be required including approximately two ha of remnant vegetation. Impacts to remnant vegetation would be rehabilitated.

Threatened flora species

The route would not directly impact any known populations of threatened flora species, although habitat for Buttercup Doubletail and Button Wrinklewort may be removed. An assessment of impacts on threatened flora was undertaken. The assessment determined that the route is unlikely to significantly adversely affect potential habitat for these two species within the study area.

Threatened fauna species

Construction of the pipeline would result in the temporary removal of foraging habitat for the Diamond Firetail, and marginal sheltering habitat for the Striped Legless Lizard. It would also affect habitat adjacent to the forest used by the Glossy-black Cockatoo, Gang-gang Cockatoo, Speckled Warbler and Powerful Owl. An assessment of impacts on threatened fauna was conducted. The assessment determined that the route is unlikely to significantly adversely affect potential habitat for threatened birds, the Striped Legless Lizard or microchiropteran bats. Construction of the pipeline would not result in the removal of significant habitat for any of these species, as the majority of the route would be located within cleared land, and significant areas of habitat for these species exists within the study area.

Endangered Ecological Communities

Construction of the pipeline would involve clearing of Derived Native Grassland associated with the EPBC Act listed EEC (White Box, Yellow Box, Blakely's Red Gum Woodland endangered ecological communities). An assessment of impacts on EECs was undertaken. The assessment determined that if no canopy trees associated with this community are removed and if native grassland areas are appropriately re-established, then a significant impact on these communities is unlikely.

Vegetation clearing and construction impacts

Flora

The route would impact on native or introduced pasture, and some small patches of native vegetation, predominately Acacia Scrub and Eastern Tablelands Dry Forest. No vegetation would be fragmented or isolated from other vegetation. Remnant vegetation would be rehabilitated back to existing condition, with a modified vegetation layer of shrubs and grasses above the pipeline route where it traverses Eastern Tablelands Dry Forest on Lot 153.

Fauna

Fauna habitat impacts are as for the main eastern route, discussed above (3.1.2).

EPBC Act

EPBC Act listed threatened species with the potential to occur within the study area include:

- Striped Legless Lizard (*Delma impar*);
- Button Wrinklewort (*Rutidosis leptorrhynchoides*); and
- Buttercup Doubletail (*Diuris aequalis*).

These species were assessed using relevant Significant Impact Criteria. The assessment concluded that the route is unlikely to have a significant impact on these species.

was also assessed. The assessment determined that if no canopy trees associated with this community are removed and if native grassland areas are appropriately re-established, then a significant impact on these communities is unlikely.

An assessment of impacts associated with the proposed development on EPBC Act Box-Gum Woodland was undertaken. The assessment determined that if mitigation measures ensuring that no canopy trees associated with this community were removed, and appropriate re-establishment of native grassland areas conducted, then the proposed pipeline would be unlikely to result in a significant impact on this community.

Offsets

The route avoids impacts on important stands of native vegetation. Any areas of native and introduced pasture would be re-instated once construction works are complete. As such, construction of the pipeline is unlikely to result in any significant long-term impact on native flora and fauna and an offset is not considered to be required.

3.2 Cultural Heritage

3.2.1 Existing environment

A search of the DECC Aboriginal Heritage Information Management System (AHIMS) database indicated that no Aboriginal sites have been previously recorded in the study area. There are no heritage listed historic items within the study area.

Two Aboriginal sites comprising an isolated artefact (BH1) and an artefact scatter (BH3) were identified in the study area by Biosis Research in 2008.

Three Aboriginal sites comprising one artefact scatter with associated potential archaeological deposit (MGPS1&PAD) and two isolated finds (MGPS 2 and MGPS3) were identified within the study area during the field survey undertaken for the cultural heritage assessment. A potential archaeological deposit (MGP1) was also identified in the study area.

No historical heritage sites were identified.

Sites BH1, BH3, MGPS2 and MGPS3 are located in the vicinity of the main eastern route. MGPS1&PAD and MGP1 are located in the vicinity of the alternative route using lot 153.

Site and PAD locations are shown on Figure 3.3. Sites are described below.

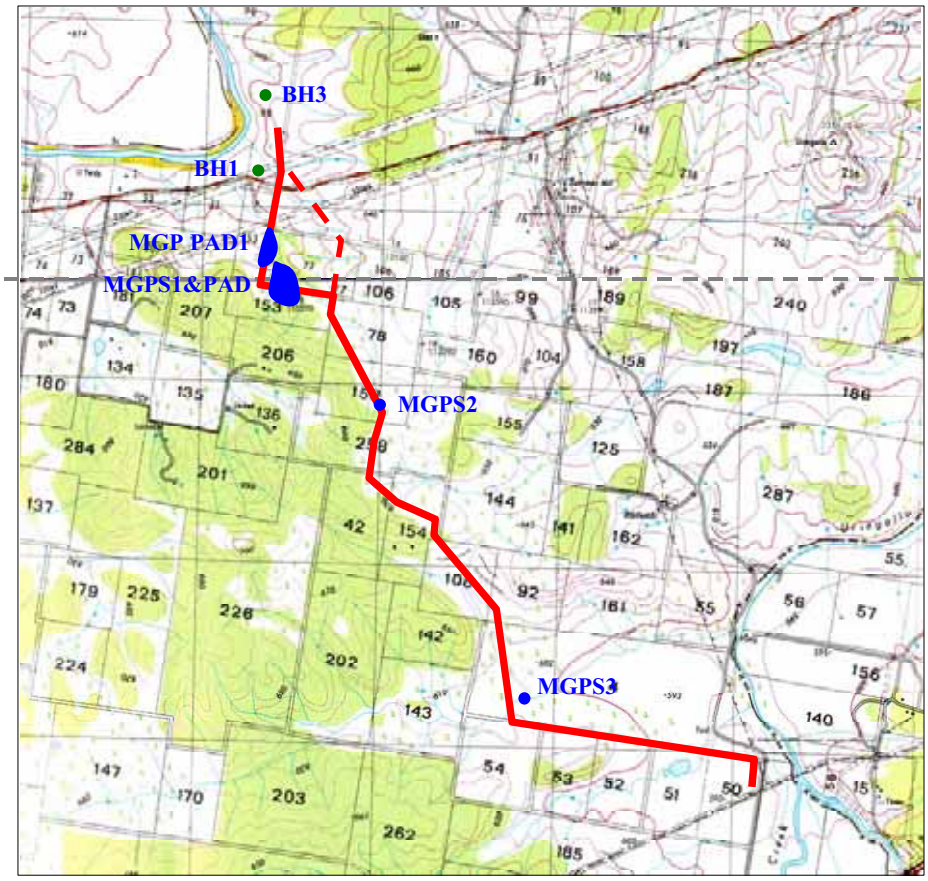

Figure 3.3 Location of Aboriginal sites along the eastern route

Site BH1 consisted of an isolated artefact situated at the base of an existing overhead power line tower. The site comprises only a single quartz artefact on the southern side of a small drainage line.

Site BH3 consisted of a small scatter of four stone artefacts situated on the upper eastern bank of the Wollondilly River. The stone artefacts comprised three quartz flakes with a quartzite core trimming flake. A number of other quartz fragments were also noted along the vehicle track.

The site described as Marulan Gas Pipeline Site 1 and PAD (MGPS1&PAD) consisted of a scatter of eleven artefacts located on the crest and slopes of a spur line between a drainage line and a creek line. Artefacts were visible over an area approximately 250 x 150 metres. The artefacts were identified in six locations with the wider site area. The potential for the site to contain more artefacts and to be associated with subsurface archaeological deposit is considered to be moderate. The significance of site/deposit cannot be determined based on the present available data

Site MGPS2 is an isolated find located on the top of a high ridgecrest on the edge of the tree line. There is low potential for this site to be larger or to contain subsurface Aboriginal objects.

Site MGPS3 is an isolated find located on the edge of a drainage line at the base of a spur side slope at the end of a dam wall. There is low potential for this site to be larger and to contain subsurface Aboriginal objects.

The visible artefacts at these two sites are common artefact types and common raw materials. The sites have low potential to be associated with undisturbed archaeological deposit. The sites are therefore assessed as having low archaeological significance.

The PAD described as Marulan Gas Pipeline PAD (MGP PAD1) is an area of potential archaeological deposit located on a low spurline between the confluence of two small creek/drainage lines. The PAD is approximately 200 x 75 metres. It is assessed as having moderate archaeological potential.

3.2.2 Impact assessment

Main eastern route

Four Aboriginal sites, BH1, BH3, MGPS2 and MGPS3, are located within the vicinity of the route and may be impacted by construction of the pipeline.

Eastern route with alternative section using lot 153

Five Aboriginal sites, BH1, BH3, MGPS1&PAD, MGPS2 and MGPS3, and one area of potential archaeological deposit, MGP PAD1, are located within the vicinity of the route and may be impacted by construction of the pipeline.

If the BH1 isolated find is located in close proximity to an existing transmission line tower, then it is unlikely that this find would be impacted by the works, given the requirement for an adequate construction buffer around such structures. The exact location of this isolated find could not be confirmed during the present investigation.

3.3 Land use and infrastructure issues

3.3.1 Zoning

The majority of the pipeline (to the south of Canyonleigh Road) would be located within the Goulburn Mulwaree local government area (LGA). The portion of the pipeline to the north of Canyonleigh Road would be located in the Upper Lachlan Shire LGA.

The relevant local environmental plan for the pipeline as a whole is the *Mulwaree Shire Local Environmental Plan 1995*. The route is located within Zone No. 1(a) (General Rural). Pipelines are permissible within this zone with development consent.

Goulburn Mulwaree Shire Council has prepared the *Draft Goulburn Mulwaree Local Environmental Plan 2007*. The draft LEP has been sent to the Department of Planning for Ministerial approval.

Pursuant to the Draft Goulburn Mulwaree LEP, the route of the gas pipeline to the south of Canyonleigh Road is located within Zone RU2 Rural Landscape. Pipelines are permissible within this zone with development consent.

3.3.2 Existing environment

Land use

The area surrounding the route is rural in nature. Much of the land in the immediate vicinity of the route has been cleared and the pasture improved for cattle grazing, although land to the west of the route is relatively densely vegetated and patches of trees remain to the east along drainage lines and ridgelines. There is also some cropping in the southern section of the route.

The majority of the land that the pipeline would pass through is privately owned. Rural residential dwellings and agricultural buildings associated with these rural properties are located in the study area. The nearest dwellings are located more than one kilometre east and west of the route.

Infrastructure

Infrastructure in the vicinity of the route includes a Crown Public Road (known as Wollumbi Road) to the south and Canyonleigh Road (to the north). Several unformed Crown Public Road reserves ('paper roads') are marked on plans. These road reserves are not formed on the ground.

Wollumbi Road and Canyonleigh Road are both unsealed gravel roads that provide access to rural properties. Canyonleigh Road also provides access to the TransGrid switchyard.

Approximately 1.1 kilometres of the route runs along Wollumbi Road. The pipeline would also cross Canyonleigh Road and a 330kV and 66kV transmission line easement. The transmission line easement incorporates lattice towers and enters the TransGrid switchyard located adjacent to the route on the northern side of Canyonleigh Road.

Due to the rural nature of the locality it is considered that there would be minimal other services located along the route. Nonetheless, there may be underground infrastructure such as Telstra/ Optus cables, electric power conduits/cables and water mains located within Wollumbi Road and Canyonleigh Road. The proposed gas pipeline route may also traverse private irrigation/water pipes associated with the rural properties. All underground infrastructure would be identified during the detailed design of the pipeline.

3.3.3 Impact assessment

Rural uses

As mentioned above, a large portion of the proposed gas pipeline route would pass through land used for grazing. The construction of the pipeline could potentially impact on the use of land for grazing and agriculture. Pasture within the pipeline easement would be cleared as a result of topsoil stripping during construction. Construction of the trench may temporarily restrict access for livestock and farming activities to parts of the properties.

Once constructed, it is anticipated that there would be no impacts on agricultural activities during operation of the pipeline. The pipeline would be laid at a sufficient depth so as not to affect cultivation, grazing of livestock and normal farming activities over the pipeline easement.

Residential

The proposed gas pipeline route is located in a rural area and its construction would not require the demolition or removal of any houses. Environmental management measures would be implemented during construction as outlined in the CEMP (refer Section 3.5) to minimise the potential for impacts on the environment (including the nearest dwelling) with respect to air quality, noise and traffic impacts.

Once operational, the presence of the gas pipeline may result in restrictions being imposed on the future construction of residential premises in the immediate vicinity for safety reasons. It is noted that a six lot subdivision was approved by Goulburn Mulwaree Council on 6 July 2007, which affects Lots 240, 176, 172 and 191 on DP 750053. However, this subdivision would not be impacted by the pipeline.

Furthermore, it is considered that applications for residential subdivision in the area surrounding the pipeline would become less common once the Draft Goulburn Mulwaree Local Environmental Plan 2007 is adopted. The Draft Goulburn Mulwaree Local Environmental Plan 2007 would change the zoning around the route from Zone No. 1(a) (General Rural) to RU2 Rural Landscape and would increase the minimum lot size for subdivisions from 40 ha to 100 ha in order to maintain the rural character. The Upper Lachlan Shire Council has indicated that it would also increase the minimum lot size for subdivisions in the area surrounding the northern most section of the proposed gas pipeline route (north of Canyonleigh Road) to 100 ha.

Infrastructure

The route runs along a section of the Wollumbi Road reserve and would cross Canyonleigh Road.

The construction of the pipeline would require the excavation along the road verge of a section of Wollumbi Road approximately 1,100 metres in length. Excavation along Wollumbi Road verge has the potential to impact upon local traffic and access. Detours would be provided to ensure that access is maintained.

The crossing of Canyonleigh Road would be carried out in consultation with Council. It would be undertaken either by boring, without direct impact on the usage of the road, or by trenching involving the construction a side track and/or use of steel plates and traffic control.

There are also underground services located within, and in close proximity to, the Canyonleigh Road reserve. Excavation for the proposed gas pipeline could impact on these underground services.

The route would cross two electricity easements. One of the easements contains a 330 kV transmission line and associated towers, whilst the other contains a 66 kV transmission line and associated towers.

3.4 Other environmental issues

Construction activities, particularly excavation, have the potential to lead to other environmental issues and impacts, including:

- Impacts to water quality mainly as a result of erosion, sedimentation and disturbance of drainage lines;
- Noise generation during construction;
- Impacts to air quality mainly as a result of dust generation; and
- Traffic impacts, particularly as a result of the disturbance of local roads.

These issues are described below. Potential impacts would be managed mainly through the implementation of standard construction environmental management methods as outlined by a CEMP. Management measures are described in Section 3.5.

In terms of sensitive receivers, it is noted that the nearest residential property is within Lot 153 DP750053 approximately 60 metres west of the pipeline route. The proponent has purchased this property and the use of the dwelling as a residence is being reviewed. The other nearest dwellings are located more than 1.2 kilometres east of the route.

3.4.1 Water quality

The route would cross a number of drainage lines. These are characterised as ephemeral, channel confined streams, which would form a chain of shallow ponds after heavy rainfall. All of the drainage lines are tributaries of Wollondilly River, Paddys River or Uringalla Creek.

The southern section of the route would pass within approximately 200 metres of Uringalla Creek, whilst to the north of Canyonleigh Road the pipeline would come to within approximately 200 metres of Wollondilly River. All of the abovementioned waterways are within the Wollondilly River sub-catchment of the Hawkesbury catchment.

There are also several farm dams located in close proximity to the proposed pipeline route. These dams are located in areas of cleared grassland and contain near-permanent water.

It is unknown whether groundwater occurs in the area of the gas pipeline.

Construction would result in the disturbance of soils, as shallow excavations would be required to form the trench for the pipeline. This disturbance to surface stability could lead to erosion, sediment transportation, siltation and contamination of offsite waters, especially during high rainfall events.

During trenching for the construction of the pipeline, any rainfall that does not readily absorb into the ground surface would drain across the surface of the ground as runoff, potentially eroding and transporting sediment loads from the construction areas into adjoining drainage lines and contaminating the creeks and waterways of the catchment area. It is also possible that sediment from trenching could contaminate groundwater if there is groundwater present and the trenches intersect the water table.

Another potential minor risk would be the spillage of hydrocarbons from construction vehicles, which could contaminate the surface water and local waterways.

Typical construction activities and sources of potential impacts include:

- Earthworks undertaken immediately prior to rainfall periods;
- Work areas that have not been stabilised;
- Stripping of topsoil, particularly in advance of construction works;
- Works within drainage paths;
- Stockpiling of excavated materials;
- Storage and transfer of construction oils, fuels and chemicals; and
- Maintenance of plant and equipment.

3.4.2 Noise

The proposed gas pipeline route passes through a sparsely populated rural area consisting predominantly of large rural properties and pasture. Roads in the immediate vicinity of the proposed gas pipeline route are generally minor dirt tracks that provide access to rural properties. The Hume Highway is located approximately 900 metres from the southern most extreme of the route. Noise in the vicinity of the route is generated by traffic, farm machinery and equipment, livestock, and the switchyard.

Several activities would be undertaken during construction of the pipeline that would result in an increase in noise levels in the area. Construction activities are described in Section 2.

However, construction of the pipeline would be undertaken progressively, in stages. This would ensure that any noise impacts would be of short duration at any one location. Furthermore, the area surrounding the proposed gas pipeline route is rural in nature and is sparsely populated with a number of properties used only as 'weekenders'. There are no schools or hospitals in the vicinity of the proposed gas pipeline route and the only sensitive noise receivers are residential dwellings associated with rural properties. It is anticipated that noise impacts would be minimal.

3.4.3 Air quality

The main potential air quality issue in relation to construction of the pipeline would be dust during excavation of the pipeline trench. The following activities have the potential to generate dust:

- Removal of vegetation;
- Excavation works;
- Stockpiling of soil for replacement; and
- Erosion of bare soil prior to re-establishment of vegetation.

As only short sections of trench would be excavated at any one time, the affects of any dust generated would be localised and would be managed through the implementation of standard environmental management practices during construction.

Occasional venting of limited gas volumes would be necessary for maintenance activities. Such maintenance venting is not expected to have a significant impact on air quality in the locality, as only a small amount of gas would be released and this would be quickly dispersed.

Blowdown of the full pipeline content would not be permitted except in the unlikely event of an extreme emergency, which is typically outside the control of the pipeline operator.

3.4.4 Traffic and access

As noted by the environmental assessment for the Marulan Gas Turbine Facilities (prepared for EnergyAustralia and Delta by URS) the regional road network is dominated by the Hume Highway, which runs between Sydney and Melbourne. The Hume Highway runs to the south of the eastern route for the pipeline. The connection with the Moomba Sydney gas pipeline is located approximately 900 metres north of the highway. Wollumbi Road provides access to the connection point. In this location, Wollumbi Road is a narrow gravel road that provides access to properties to the north.

Canyonleigh Road is located in the north of the study area. The proposed gas pipeline route crosses this road. Canyonleigh Road connects with Brayton Road to the west. Brayton Road provides access to the town of Marulan, and the Hume Highway.

Brayton Road is a 6.5 metre wide sealed road from Marulan to the junction with Canyonleigh Road. Initially Canyonleigh Road is a 5.5 metre wide sealed road but as the distance away from Brayton Road increases the road changes to a gravel surface. In the vicinity of the pipeline route, Canyonleigh Road provides access to the facilities' site and the TransGrid Switchyard. It also provides access to rural properties.

Potential impacts on the road infrastructure have been considered in Section 3.3 above.

Access arrangements for construction are described in Section 2.7.

Excavation to cross local roads is not expected to have a significant impact on local traffic. The roads currently experience low traffic volumes, with the main issue being access for local property owners and residents. Detours would be set up at these locations to ensure that access is maintained.

If any property fences need to be removed for construction, temporary fences/gates would be installed, and the fences would be reinstated to their original condition at the conclusion of construction.

The long term operating workforce would generate very little traffic activity in the local area. There would be only occasional traffic accessing the pipeline as required for maintenance purposes. Generally, maintenance crews would consult with landowners to use internal property tracks and roads to access any areas of the pipeline that require maintenance.

3.5 Recommended mitigation measures

To ameliorate the potential environmental impacts identified in Section 3.4, a number of mitigation measures are recommended. These measures would form part of the proponent's Statement of Commitment for the project.

3.5.1 Ecology

Construction techniques

Through ecologically sensitive sections of the route low-impact construction techniques would be used. This would involve the use of smaller excavators and stockpiling of materials and fill away from the immediate excavation area. Low-impact construction techniques would restrict direct construction impacts to a corridor of 10 metres. This would reduce the overall extent of native vegetation and habitat resources removed.

Pre-clearance survey

A detailed pre-clearance survey by a qualified ecologist would be required prior to construction. This would involve:

- Diurnal searches for birds, nests and roosts;
- Active searches for reptiles, including checking of woody debris and rocks/outcrops within the construction footprint,
- Active searches for micro bats, including checking under exfoliating bark; and
- Nocturnal surveys, including stag-watching of identified habitat trees, specifically focusing on observing use of trees by micro bats.

This survey would focus on locating individuals, and especially roosts of threatened species.

If nests or nestlings of threatened species are observed within, or close to, the route then construction would be postponed until the nestlings have hatched and fully-fledged. If construction constraints mean that this delay is not practicable then DECC would be consulted to determine if relocating the species is acceptable.

Tree fauna management

The CEMP would detail procedures for fauna management including the following:

- Trees would be monitored for fauna before and during clearing operations;
- Trees with resident fauna would be avoided as far as is practicable;
- Hollow-bearing trunks and branches would be carefully sawn and placed intact in adjacent areas of native vegetation; and
- Replacement habitat, such as nest boxes, would be provided where habitat trees are to be removed.

Ground-dwelling fauna management

The CEMP would include the following:

- Engage a suitably qualified ecologist to identify active wombat burrows that may be impacted by the route;
- Advise on suitable precautions to be exercised during excavation in and around wombat burrows; and
- Engage a suitably qualified ecologist to identify and re-locate any reptiles sheltering in rocky areas outcrops that would be directly impacted by the route.

Groundcover clearance protocol

A groundcover clearance protocol would be incorporated into the CEMP including the following:

- Remove large woody debris and rock fragments using excavator grabs or manual handling if practicable;
- Place intact large woody debris and rock fragments within adjacent areas of intact vegetation;
- Scrape and stockpile leaf litter and topsoil separately from deeper fill material; and
- Reuse leaf litter and topsoil in remediation works.

Timing of construction works

The ideal time for construction would be during December/February. Most species that reproduce in spring would have finished breeding at this stage. This period would also avoid the breeding period of large forest owls such as Powerful Owl which typically breed in Autumn/ Winter.

Site management

The following mitigation measures are recommended in order to minimise operational impacts:

- Setting maximum speed limits during construction within the study area to reduce the risk of fauna road fatalities; and
- Limit vehicular and personnel entry into adjacent remnant vegetation during construction through appropriate marking of operational areas.

Phytophthora management

Hygiene measures to prevent the introduction or spread of the pathogen would be incorporated into the CEMP.

Remediation

The original topsoil would be retained and stockpiled to assist in remediation of land along the route. All supplementary plantings would use indigenous native species of local provenance. It is recommended that fallen timber within the route be relocated to areas of intact vegetation adjacent to the study area.

The health of revegetated areas would be monitored closely and supplementary watering supplied as appropriate. Revegetated areas would be monitored for weed infestation and any infestations actively managed to minimise further weed spread.

Weed and pest management

To limit the spread of weeds into adjoining remnant vegetation all construction areas would be temporarily fenced. Stockpiles of fill or vegetation would not be placed in areas of adjoining remnant vegetation but instead within existing cleared areas.

It is recommended that the following measures be incorporated into the CEMP:

- Perform a baseline weed survey to assess the extent and severity of weed infestation in extant native vegetation within the study area pre and post construction;

- Incorporate control measures to limit the spread of weed propagules downstream of the study area;
- During construction undertake maintenance of silt fences and other mitigation measures to isolate runoff; and immediately rehabilitate disturbed vegetation to limit the potential for colonisation by weeds;
- During construction areas of vegetation that would not be cleared would be fenced, restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill would not be placed in areas of remnant vegetation but instead in adjacent cleared areas;
- Following construction, cleared areas would be revegetated with indigenous native vegetation to limit the potential for colonisation by weeds;
- During operations monitor and control noxious weed species in line with legislative obligations;
- Ensure refuse is adequately disposed of to avoid attracting vermin and other pest species;
- Perform ongoing monitoring of weed infestation on and adjoining the study area using the baseline weed survey.

3.5.2 Cultural heritage

Where possible, disturbance to archaeological sites BH1, BH3, MGPS1&PAD, MGPS2, MGPS3 and area of potential archaeological deposit MGP PAD would be avoided.

If impact to Aboriginal sites BH1, BH3, MGPS2, and MGPS3 cannot be avoided then the artefacts would be collected or relocated away from the area of impact.

If disturbance is unavoidable in the vicinity of MGPS1&PAD and MGP PAD1, then a program of archaeological subsurface investigation would be conducted to determine the nature, extent and integrity of any potential archaeological deposits that may be present in these areas.

The timing of the subsurface testing may occur after consent is granted and would be included in the conditions of consent for the project.

Should the subsurface testing program determine the presence of high significance sites then archaeological salvage may be required. Alternatively, a redesign/re-routing of the proposed pipeline in that area may be required.

3.5.3 Land use and infrastructure

Rural uses

The pipeline would be laid in stages to ensure that only small sections of the right of way/ easement are disturbed at anyone time. The topsoil would be replaced as soon as possible at the conclusion of each section. The topsoil would contain the original seed bank and rootstock of the pasture and, as such, the pasture may regrow unaided in many instances. However, as required, pasture seed and fertiliser compatible with the surrounding pasture would be re-sown to rehabilitate the area over the pipeline.

Once it has been rehabilitated, the land above the pipeline route would be able to be returned to grazing and normal agricultural activities without the need for any further mitigation measures.

Residential

Potential impacts of the pipeline generally relate to construction issues such as noise, air quality, traffic and access. Mitigation measures in relation to these issues are described in section 3.5.4.

Infrastructure

Access to the pipeline route and the suitability of local roads would be considered during the further assessments that would be undertaken to confirm the traffic and access arrangements to the facilities' site.

Measures relating to construction traffic management are described in the following section.

Detailed services searches would be undertaken during detailed design to identify and locate underground services located in the road reserve. The pipeline design would aim to ensure that services are not impacted. Should impacts to underground services be unavoidable, consultation with the service provider would be undertaken and the services would be relocated prior to construction.

Prior to any construction taking place within the electricity easements the relevant electricity provider would be consulted to establish clearances required from the transmission lines and any restrictions on construction machinery. The pipeline would be cathodically protected to ensure that the electricity transmission lines do not induce currents on the pipeline once it is operational.

3.5.4 Environmental management

Water quality

Construction phase impacts would generally be managed by the implementation of standard environmental management measures as defined in the CEMP. Such measures would significantly decrease the likelihood of adverse environmental impacts.

The CEMP would include a construction soil and water management plan detailing construction phase stormwater management strategies in accordance with *Landcom Soil and Construction, Managing Urban Stormwater* (Landcom, 4th edition, 2004). These would include amongst others:

- General site practices and responsibilities;
- Material management practices;
- Stockpile practises;
- Topsoil practices; and
- Erosion control practices (earth sediment basins, straw bales, sediment fences, turbidity barriers, stabilised site accesses, diversions and catch drains).

The trenching would be undertaken progressively, in stages, to minimise the time that disturbed land is exposed and ensure that spoil stockpiling is kept to a minimum. The stockpiles would be

established in an appropriate manner and sediment fencing would be installed to ensure that no sediment is able to enter receiving waters through rainwater runoff.

In the case where a trench would have to intersect the water table, a groundwater management plan would be prepared. The water table would be intercepted and water extracted from the site in accordance with the groundwater management plan. It is expected that construction areas would be rehabilitated and proposed stormwater controls would provide best practice management of potential erosion scour and sediment transport from the site during wet weather events.

Noise

A CEMP would be prepared. This would include the following mitigation measures:

- Where practical, machines would be switched off when not in use;
- Machines found to produce excessive noise compared to normal industry expectations would be removed from the site or stood down until repairs or modifications can be made;
- Haulage and delivery trucks would be fitted with appropriate mufflers and be in good working order;
- Construction hours would be limited to DECC guidelines; and
- A community liaison person would be appointed to communicate with potentially affected residents and to actively respond in the event complaints are received.

Air quality

A dust control plan detailing measures to control the potential for dust generation would form part of the CEMP. Measures would target dust generation by vehicle movements and excavation works. Typical mitigation measures would include:

- Ensuring exposure time of uncovered surfaces is minimised;
- Covering stockpiles and loads; and
- Site management controls.

Traffic

A construction traffic management plan would be prepared as part of the CEMP. It would be prepared in consultation with road authorities to minimise the potential for construction traffic impact on the surrounding road network and disruptions within roads and road reserves. The plan would include measures to ensure public safety and access is maintained, and that disruptions are minimised as far as possible.

The plan would include measures such as the use of one-way traffic and appropriate fencing, provision of detour routes, signs and traffic control measures that would be installed.

4. Environmental assessment of western route

4.1 Ecology

4.1.1 Existing environment

Flora

Approximately 170 plant species were recorded during the field surveys undertaken for the ecological assessment (refer Appendix B).

The following vegetation communities were identified within the study area (as shown in Figure 3.1):

- Riverbank Forest;
- Eastern Tablelands Dry Forest;
- Frost Hollow Grassy Woodland;
- Tablelands Grassy Box Gum Woodland;
- Scribbly Gum Woodland;
- Argyle Apple Woodland;
- Candlebark Gully Forest;
- Native Pasture;
- Modified and Disturbed land; and
- Acacia Scrub.

Threatened species

The desktop literature review indicated 24 threatened plant species (listed under the TSC Act and the EPBC Act) have been previously recorded or are predicted to occur in the study area. None of these species were identified during field surveys. However, the study area contains suitable habitat for a number of threatened plants including:

- Buttercup Doubletail (*Diuris aequalis*);
- Camden Woollybutt (*Eucalyptus macarthurii*);
- Hoary Sunray (*Leuchochyrsum albicans* var *tricolour*);
- Tallong Midge orchid (*Genoplesium plumosum*);
- Delicate Pomaderris (*Pomaderris delicata*);
- Button Wrinklewort (*Rutidosis leptorrhynchoides*); and
- Dwarf Kerrawang (*Rulingia prostrata*).

Targeted surveys throughout winter and spring did not detect any of these species. As most are either large or easily identifiable in the field, or were surveyed for during their known flowering times, it is considered unlikely that any of these species occur within the study area.

EECs

Two small patches of Tablelands Grassy Box Gum Woodland exist within the study area in the vicinity of the pipeline route. This community qualifies as EEC - White Box, Yellow Box, Blakely's Red Gum Grassy Woodland (Box-Gum Woodland). This EEC is listed under both the TSC Act and the EPBC Act however is defined based on slightly different criteria. One of these stands is considered to meet criteria under the TSC Act, while the other (on Lot 153) meets criteria under both TSC Act and EPBC Act.

Fauna

During the field surveys, 24 mammals, 95 species of bird, seven frogs and two reptiles were recorded.

The habitat assessment identified the following key habitat types across the study area:

- Forest and woodland; and
- Other habitat resources – included hollow-bearing trees and stags, reasonable amounts of standing and fallen dead timber and rock outcrops.

The predatory red fox, the feral dog (*Canis lupus*) and wild pig (*Sus scrofa*) were sighted within the study area. It is expected that the cat (*Felis catus*) would also occupy the study area. The presence of these predators reduces the likelihood of some native animals occurring.

The main patch of stringybark/black sheoak forest in the study area is large and has excellent connectivity with native vegetation to the west and south. It supports healthy local populations of a range of native birds, mammals and reptiles including patch-size dependant species such as the threatened speckled warbler. This connectivity will also facilitate the movement of native birds, some reptiles, arboreal mammals and potentially small terrestrial mammals.

Smaller patches isolated by surrounding pasture and farm structures will support open country bird species and a more limited suite of native reptiles and mammals. Land to the north and east features a matrix of patchy open woodland and grassland. These areas have similar habitat value to the study area and will combine to form a large area of habitat suitable for open country and woodland species. Connectivity is good to the south for approximately two km but then is limited by the Hume Highway.

The Wollondilly River is less than 200 metres from the northern portion of the study area. The riparian corridor features stretches of intact riparian forest alternating with willow (*Salix* spp.) infestations and cleared agricultural land. The riparian zone provides a near-continuous habitat corridor for aquatic species, waterfowl and semi-aquatic, frogs, reptiles and mammals.

Threatened fauna species

Four threatened bird species were observed during the surveys:

- Gang-gang Cockatoo *(Callocephalon fimbriatum);*
- Glossy Black-cockatoo *(Calyptorhynchus lathami);*
- Speckled Warbler (*Pyrrholaemus saggitatus);* and
- Powerful Owl (*Ninox strenua*).

Two microchiropteran bats listed as vulnerable under the TSC act were tentatively detected by Anabat recordings:

- Eastern Bentwing-bat *(Miniopterus schreibersii oceanensis*); and
- Large-footed Myotis *(Myotis macropus).*

A number of gliders (*Petaurus* spp.) were observed during spotlight surveys. This genus is difficult to identify to species level by spotlight. Several individuals were positively identified by call as sugar glider, however some individuals may have been the squirrel glider, which is listed as vulnerable under the TSC Act.

The desktop review indicates the potential presence of a further 33 threatened fauna species listed under the TSC Act as Wildlife Atlas records in the locality, and/or the EPBC Act and predicted to occur in the local area.

A total of six species were considered to have a high likelihood of occurrence within the study area based on the presence of suitable foraging and roosting habitat and recent records in the local area:

- Diamond Firetail *(Stagonopleura guttata*);
- Hooded Robin *(Melanodryas cucullate*);
- Eastern False Pipistrelle *(Falsistrellus tasmaniensis*);
- Eastern Freetail Bat (*Mormopterus norfolkensis*);
- Little Bentwing-bat *(Miniopterus australis);* and
- Greater Broadnosed Bat *(Scoteanax ruepellii).*

Another five species are considered to have the potential to occur:

- Black-chinned Honeyeater (*Melithreptus gularis gularis*);
- Turquoise Parrot (*Neophema pulchella*);
- Yellow-bellied Glider (*Petaurus australis*);
- Squirrel Glider *(Petaurus norfolcensis);*
- Striped Legless Lizard (*Delma impar*)

A further seven species may utilise habitats within the study area on an occasional or opportunistic basis:

- Large-eared pied Bat *(Chalinolobus dwyeri);*
- Brown Treecreeper *(Climacteris picumnus);*
- Swift Parrot *(Lathamus discolour);*
- Regent Honeyeater *(Xanthomyza phrygia);*
- Barking Owl *(Ninox connivens);*
- Masked Owl *(Tyto novaehollandiae*); and
- Spotted-tailed Quoll *(Dasyurus maculatus).*

4.1.2 Impact assessment – main western route

Approximately half the proposed gas pipeline route falls within already cleared agricultural land. The main western route would remove/modify between eight and 10 hectares of intact forest

and woodland habitat as well as approximately nine hectares of cleared native pasture. The majority of the route would be rehabilitated.

Initial clearing may disrupt connectivity for a distance of over two kilometres and bisect a large intact patch of remnant forest that occurs within an already fragmented landscape. Linear clearings are known to favour pest species such as foxes, increase weed invasion and edge effects, and may impact on intact patch dependent species such as the speckled warbler. However, allowing native vegetation to re-colonise in these areas to a six metre shrub and grass corridor would reduce these impacts and maintain connectivity once construction and rehabilitation is complete. Furthermore, canopy trees including hollow-bearing trees and stands of *Allocasuarina* would be avoided wherever possible, minimising impacts as a result of fragmentation. Clearing would also be conducted in a way that avoids the proposed pipeline route remaining cleared for long periods of time (see Section 7) with remediation beginning as soon as is feasible after construction

General fauna impacts

A considerable abundance and diversity of native bird species occupy the study area, with the potential for impacts as a result of the removal of native vegetation and other resources. However, the majority of these species are mobile, widespread and common. In addition, there are large quantities of equivalent habitat and resources in the study area and so it is likely that any impact in local populations of native birds would be minor.

Arboreal mammals occur in areas of forest. The route would not impact these areas. A number of microchiropteran bats were recorded within the study area, however, the impacts associated with the pipeline would be unlikely to substantially affect habitat for any of these species.

The pipeline may directly impact active wombat burrows which would need to be identified and any resident wombats carefully relocated.

A moderate diversity and abundance of native frogs and reptiles are considered likely to occupy the study area. Species recorded during field surveys were widespread and common. It is likely that individuals would be killed or displaced during clearing, particularly species which burrow or shelter beneath woody debris. The loss of habitat is likely to have a minor impact on local populations of these species given the large areas of native vegetation and other resources in the vicinity of the study area.

There would be moderate, ongoing impacts on fauna utilising adjacent areas of habitat during construction associated with noise and other disturbances. Impacts are likely to be minor as construction would only occur during daylight hours and would be temporary. There are already disruptive human activities in the vicinity of the study area associated with agriculture. Larger, more mobile fauna currently occupying the study area are likely to be adapted to these disturbances. There would be impacts upon smaller, less mobile fauna in the immediate vicinity of the route.

Threatened flora species

Although the study area contains habitat for a number of potential threatened flora species, targeted surveying during the known flowering times of these species was conducted and these species were not detected. It is consequently considered unlikely that any of these threatened flora occur within the study area.

Threatened fauna species

Construction of the pipeline would impact on habitat for threatened species. An assessment of impacts on threatened fauna was conducted. The assessment determined that the route is unlikely to significantly adversely affect potential habitat for threatened birds, mammals, reptiles and amphibians in light of detailed mitigation measures.

EECs

Construction of the proposed gas pipeline would involve clearing of derived native grassland associated with the EEC White Box, Yellow Box, Blakely's Red Gum Woodland. An assessment of impacts on EECs was undertaken. The assessment determined that if mitigation measures were followed ensuring that no canopy trees associated with this community are removed, and that appropriate re-establishment of native grassland areas was conducted, then the proposed pipeline route would be unlikely to result in a significant impact on these communities.

Matters of National Environmental Significance

Two EPBC Act listed threatened species have the potential to occur in the study area or may use habitat in the study area:

- Spotted-tail Quoll; and
- Striped Legless Lizard.

The assessment concluded that the proposed gas pipeline would be unlikely to significantly impact on these species.

One EPBC Act listed EEC, White Box, Yellow Box, Blakely's Red gum and Derived Native Grassland critically EEC (Box-Gum Woodland), was tentatively recorded in the study area. The assessment concluded that this community would not be significantly impacted by the proposal.

4.1.3 Impact assessment - western route alternatives

A summary of the potential impacts in terms of clearing, hollow trees and Glossy Black cockatoo feeds trees for each alternative is provided in Table 4.1 and Table 4.2.

Table 4.1 Route alternatives - summary of vegetation clearance, hollow-bearing trees and Glossy Black-cockatoo feed trees, and the area of modified habitat after rehabilitation

Route alternative	Vegetation clearance	Consequent modified corridor above pipeline route after rehabilitation	Number of hollow-bearing trees identified along each route*	Number of Glossy Black-cockatoo feed trees identified along each route*
Western route (3)	15.3 ha (incl 9 ha native pasture)	1.55 ha	39	16
Western route (4)	20.7 ha (incl 9 ha native pasture)	2.15 ha	39	16
Western route (5)	19.8 (incl 9 ha native pasture)	1.7 ha	45	16
Western route (6)	17 ha (incl 9 ha native pasture)	1.25 ha	39	19

* Numbers are for trees identified within 30 m of the pipeline route. Note that many trees would be avoided during construction as detailed in mitigations section.

Table 4.2 Approximate clearance of each vegetation type for each alternative route

Proposed western pipeline route alternative	Vegetation type	Approximate area of initial clearance of 20 metres	Rehabilitated modified 6 metre corridor (m^2)
Western pipeline route Along Wollombi Road, through crown road reserve, Lot 152, Lot 78, Lot 77, Lot 12, Lot 8, across Canyonleigh Road through Lot 1 to Facilities site. Total distance: 7935 metres	Native pasture	90,000	NA – entire area of impact rehabilitated to existing grassland
	Native pasture associated with Box-Gum Woodland EEC (scattered Yellow Box trees)	2,000	NA – entire area of impact rehabilitated to existing grassland
	Stringybark / Black Sheoak Forest	50,000	15,000
	Candlebark Gully Forest (excluding 6m existing clearance along Wollombi Road)	7,476	534
	Scribbly Gum Woodland (excluding 6m existing clearance along Wollombi Road)	35,000	NA (existing 6 metre corridor would be maintained above proposed pipeline)
TOTAL for western pipeline route (3)		**15,2976 (15 ha)**	**15,534 m^2 (1.55 ha)**
Western pipeline route using Lot 153 Along Wollombi Road, through crown road reserve, Lot 152, Lot 78, through Lot 153 to Lot 8, across Canyonleigh Road through Lot 1 to Facilities site. Total Distance: 8040 metres	Native pasture	90,000	NA – entire area of impact rehabilitated to existing grassland
	Native pasture associated with Box-Gum Woodland EEC (on Lot 153)	5,000	NA – entire area of impact rehabilitated to existing grassland
	Stringybark / Black Sheoak Forest	70,000	21,000
	Candlebark Gully Forest (excluding 6m existing clearance along Wollombi Road)	7,476	534
	Scribbly Gum Woodland (excluding 6m existing clearance along Wollombi Road)	35,000	NA (existing 6 metre corridor would be maintained above proposed pipeline)
TOTAL for western pipeline route (4)		**207,476 (20.7 ha)**	**21,534 (2.15 ha)**

Proposed western pipeline route alternative	Vegetation type	Approximate area of initial clearance of 20 metres	Rehabilitated modified 6 metre corridor (m^2)
Western pipeline route using Lots 206 & 207 Along Wollombi Road, through crown road reserve, Lots 206 & 207 joining Lot 153 to Lot 8, across Canyonleigh Road through Lot 1 to Facilities site. Total Distance: 8188 metres	Native pasture	90,000	NA (assumes complete rehabilitation to existing state)
	Stringybark / Black Sheoak Forest	40,000	12,000
	Stringybark / Black Sheoak Forest where existing 3 metre path would be utilised	25,500	4,500 (assumes a 3 metres corridor either side of existing 3 metres track to be maintained as trees and shrubs)
	Candlebark Gully Forest (excluding 6m existing clearance along Wollombi Road)	7,476	534
	Scribbly Gum Woodland (excluding 6m existing clearance along Wollombi Road)	35,000	NA (existing 6 metres corridor would be maintained above proposed pipeline)
TOTAL for western pipeline route (5)		**197,976 (19.8 ha)**	**17,034 (1.7 ha)**
Western pipeline route using Crown Public Road on the western & southern boundary of Lot 258 Along Wollombi Road, through crown road reserve until Lot 152 where it joins Lots 206 & 207 joining Lot 153 to Lot 8, across Canyonleigh Road through Lot 1 to facilities site. Total Distance: 8304 metres	Native pasture	90,000	NA (assumes complete rehabilitation to existing state)
	Stringybark / Black Sheoak Forest	50,000	7,500
	Stringybark / Black Sheoak Forest where existing 3 metre path would be utilised	25,500	4500 (assumes a 3 metre corridor either side of existing 3 metre track to be maintained as trees and shrubs)
	Candlebark Gully Forest	7,476	534
	Scribbly Gum Woodland	35,000	NA (existing 6m corridor will be maintained above proposed pipeline)
TOTAL for western pipeline route (6)		**176,476 (17 ha)**	**12,534 (1.25 ha)**

4.2 Cultural heritage

4.2.1 Existing environment

Sites identified

A search of the DECC Aboriginal Heritage Information Management System (AHIMS) database indicated that no Aboriginal sites have been previously recorded in the study area. There are no heritage listed historic items within the study area.

Two Aboriginal sites comprising an isolated artefact (BH1) and an artefact scatter (BH3) were identified in the study area by Biosis Research in 2008.

Two Aboriginal sites comprising one artefact scatter with associated potential archaeological deposit (MGPS1&PAD) and a low density surface scatter of Aboriginal stone artefacts with an associated area of potential archaeological deposit (MGPS4) were identified within the study area during the field survey undertaken for the cultural heritage assessment. A potential archaeological deposit (MGP1) was also identified in the study area.

Three historical heritage recordings were made within the study area:

- Remnant two rail fence line consisting of isolated standing and fallen wooden posts (MGPHS1),
- Stone alignment marking a cadastral boundary (MGPHS2), and
- Collection of four items of disused forestry and farm machinery (MGPHS3).

In addition, the location of a modern chapel building labelled 'The Little Bush Chapel of Burnt Hills' is noted.

Sites BH1, BH3, MGPHS1 and MGPHS2 are located in the vicinity of the main western route.

MGPS1&PAD and MGP1 are located in the vicinity of the alternative section using lot 153.

MGPHS3 and MGPS4 are located in the vicinity of the alternative section using lots 206 and 207.

Site and PAD locations are shown on Figure 4.1. Sites are described below.

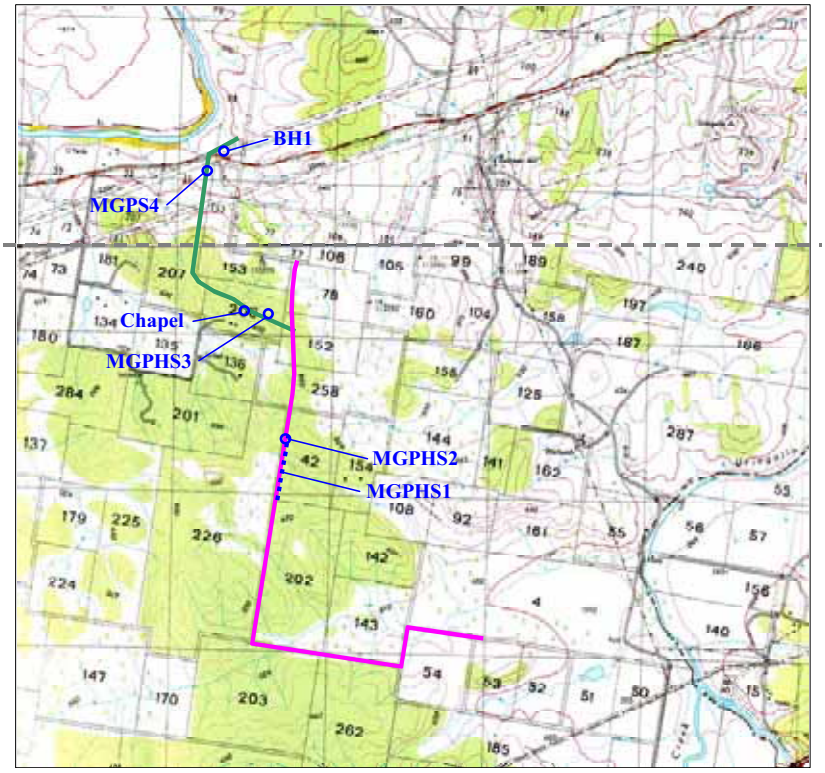

Figure 4.1 Location of Aboriginal sites along the western route

Site descriptions and significance - Aboriginal

Site BH1 consisted of an isolated artefact situated at the base of an existing overhead power line tower. The site comprises only a single quartz artefact on the southern side of a small drainage line.

Site BH3 consisted of a small scatter of four stone artefacts situated on the upper eastern bank of the Wollondilly River. The stone artefacts comprised three quartz flakes with a quartzite core trimming flake. A number of other quartz fragments were also noted along the vehicle track.

The site described as Marulan Gas Pipeline Site 1 and PAD (MGPS1&PAD) consisted of a scatter of eleven artefacts located on the crest and slopes of a spur line between a drainage line and a creek line. Artefacts were visible over an area approximately 250 x 150 metres. The artefacts were identified in six locations within the wider site area.

The potential for the site to contain more artefacts and to be associated with subsurface archaeological deposit is considered to be moderate.

The significance of site/deposit cannot be determined based on the present available data.

The PAD described as Marulan Gas Pipeline PAD (MGP PAD1) is an area of potential archaeological deposit located on a low spur line between the confluence of two small creek/drainage lines. The PAD is approximately 200 x 75 metres. It is assessed as having moderate archaeological potential.

The site MGPS4 consisted of a low density surface scatter of three stone artefacts and an associated area of potential archaeological deposit. All of the artefacts are exposed in or near gully embankments which are approximately 1 metre high and situated in valley floor deposits along an unnamed tributary creek.

One artefact was exposed apparently in situ, 30 centimetres below the top of the bank section. The surface artefacts occur within an area of 25 x 15 metres. The formation of multiple gullies on either side of the floor of this valley has caused the majority of the floor deposit to be bounded by gully scarps and to have the appearance of an elevated island. This remaining block of sediment is recorded as a potential archaeological deposit (PAD). The basal slopes on either side of the gullies may also include deposits containing artefacts and the PAD should be considered to extend at least 20 metres upslope from the gullies. The total area of the PAD is around 50 x 75 metres.

There is moderate potential for the site to be larger and high potential to contain subsurface Aboriginal objects. The potential for in situ archaeological material is considered to be moderate. The PAD is assessed in general as having moderate archaeological potential.

Based on the limited surface evidence and the assessed archaeological potential of the associated potential archaeological deposit, this site is tentatively assessed as having low to moderate archaeological significance within a local context. This assessment is subject to confirmation following the conduct of test archaeological excavations within the associated deposits.

The two Aboriginal community representatives who participated in the field survey indicated that the Aboriginal cultural values of this site warranted its conservation, where and if feasible.

Site descriptions and significance – historic heritage

Marulan Gas Pipeline Historical Site 1 (MGPHS1)

This recording consists of a remnant wooden 2 rail fence line. It is incomplete, discontinuous and in a poor and remnant condition. The fence line does not display features which are technologically distinctive or unusual for the local area, and there are no demonstrable historical links with significant persons or events.

This recording is not considered to fulfil criteria for local or State listing.

Marulan Gas Pipeline Historical Site 2 (MGPHS2)

This recording comprises a stone alignment that marks a shared boundary between a freehold portion and a Crown Road. The alignment has some value as a representative example of its type, but in other respects does not present rare, unusual or interpretive features of note.

This recording is not considered to fulfil criteria for local or State listing.

Marulan Gas Pipeline Historical Site 3 (MGPHS3)

This site comprises a collection of movable disused agricultural and/or forestry machinery. It is likely that these items form part of a deliberate placed and reserved, privately owned collection, and possibly includes locally sourced items of known provenance and history. If the latter possibilities could be confirmed, then these items could be considered to have a degree of local significance under criterion (g), and possibly also criteria (b) and (d) depending on provenance.

This assessment must remain tentative subject to confirmation from further research and liaison with the owner of the items.

4.2.2 Impact assessment

Main western route

Two Aboriginal sites, BH1, BH3 and two historical recordings MGPHS1 and MGPHS2 are located in the vicinity of the route and may be impacted by construction of the pipeline.

Western route with alternative section using lot 153

Three Aboriginal sites, BH1, BH3 and MGPS1&PAD, one area of potential archaeological deposit, MGP PAD1, and two historical recordings MGPHS1 and MGPHS2 are located within the vicinity of the route and may be impacted by construction of the pipeline.

Western route with alternative section using lots 206 and 207

Three Aboriginal sites, BH1, BH3 and MGPS4 and three historical recordings MGPHS1, MGPHS2 and MGPHS3 are located in the vicinity of the route and may be impacted by construction of the pipeline.

If the BH1 isolated find is located in close proximity to an existing transmission line tower, then it is unlikely that this find would be impacted by the works, given the requirement for an adequate construction buffer around such structures. The exact location of this isolated find could not be confirmed during the present investigation.

In order to avoid impact to archaeological site and PAD MGPS4, a deviation of the currently proposed pipeline alternative route 2 would be required. A feasible amendment to the route may be a deflection to the north west, to connect with the Marulan to Canyonleigh road west of the tributary crossing. If avoiding impact to this site is not feasible, then the conduct of an archaeological test excavation would be required within that part of the site and PAD subject to direct impact. This would test the indicative significance assessment made in the archaeology report and determine the management requirements of the deposit.

Recording MGPHS3 consists of a collection of movable heritage items which do not need to be maintained in their current location to effectively manage their heritage values. Consequently, impact to these items could be effectively avoided by temporarily or permanently moving them to a new or interim location.

Alternative western route "L" shaped Crown Public Road

No Aboriginal or historical objects, sites or places were identified within this section.

4.3 Land use and infrastructure issues

4.3.1 Zoning

The majority of the proposed gas pipeline route (to the south of Canyonleigh Road) would be located within the Goulburn Mulwaree local government area (LGA). The portion of the pipeline to the north of Canyonleigh Road would be located in the Upper Lachlan Shire LGA.

The relevant local environmental plan for the pipeline as a whole is the *Mulwaree Shire Local Environmental Plan 1995*. The route is located within Zone No. 1(a) (General Rural). Pipelines are permissible within this zone with development consent.

Goulburn Mulwaree Shire Council has prepared the *Draft Goulburn Mulwaree Local Environmental Plan 2007*. The draft LEP has been sent to the Department of Planning for Ministerial approval.

Pursuant to the Draft Goulburn Mulwaree LEP, the route of the gas pipeline to the south of Canyonleigh Road is located within Zone RU2 Rural Landscape. Pipelines are permissible within this zone with development consent.

4.3.2 Existing environment

Land use

The area surrounding the route is rural in nature. The middle section of the route passes through bushland. Sections to the north and south have been cleared and the pasture improved for sheep and cattle grazing. There is also some cropping in the southern section of the route.

The majority of the land that the proposed gas pipeline route would pass through is publicly owned, with approximately half the route located within a Crown Public Road. Few rural residential dwellings and agricultural buildings associated with rural properties are located in the study area. The other nearest dwellings are located more than one kilometre east and west of the route.

Infrastructure

Infrastructure in the vicinity of the proposed gas pipeline route includes a Crown Public Road (known as Wollumbi Road) to the south and Canyonleigh Road (to the north). Several unformed Crown Public Road reserves ('paper roads') are marked on plans.

Approximately 2,700 metres of the route runs along Wollumbi Road. The pipeline would also cross Canyonleigh Road and a 330kV and 66kV transmission line easement. The transmission line easement incorporate lattice towers and enter the TransGrid switchyard located adjacent to the route on the northern side of Canyonleigh Road.

Due to the rural nature of the locality it is considered that there would be minimal other services located along the route. Nonetheless, there may be underground infrastructure such as Telstra/ Optus cables, electric power conduits/cables and water mains located within Wollumbi Road and Canyonleigh Road. The proposed gas pipeline route may also traverse private irrigation/water pipes associated with the rural properties. All underground infrastructure would be identified during the detailed design of the pipeline.

Wollumbi Road and Canyonleigh Road are both unsealed gravel roads that provide access to rural properties. Canyonleigh Road is a Council Road from Brayton through to Canyonleigh and also provides access to the TransGrid switchyard. Wollumbi Road is a no-through Crown Public Road maintained by the landowners for access to their properties.

4.3.3 Impact Assessment

Rural uses

A large portion of the proposed gas pipeline route would pass through land used for grazing. The construction of the pipeline could potentially impact on the use of land for grazing and agriculture. Pasture within the pipeline easement would be cleared as a result of topsoil stripping during construction. Construction of the trench may temporarily restrict access for livestock and farming activities to parts of the properties.

The trench may temporarily restrict access to some land during construction. Once constructed it is anticipated that there would be no impacts on agricultural activities during operation of the pipeline. The pipeline would be laid at a sufficient depth so as not to affect cultivation, grazing of livestock and normal farming activities over the pipeline easement.

Residential

The proposed gas pipeline route is located in a rural area and its construction would not require the demolition or removal of any houses. Environmental management measures would be implemented during construction as outlined in the CEMP (refer Section 4.5) to minimise the potential for impacts on the environment (including the nearest dwelling) with respect to air quality, noise and traffic impacts.

Once operational, the presence of the gas pipeline may result in restrictions being imposed on the future construction of residential premises in the immediate vicinity for safety reasons. It is noted that a six lot subdivision was approved by Goulburn Mulwaree Council on 6 July 2007, which affects Lots 240, 176, 172 and 191 on DP 750053. However, this subdivision would not be impacted by the operation of the pipeline.

Furthermore, it is considered that applications for residential subdivision in the area surrounding the pipeline would become less common once the Draft Goulburn Mulwaree Local Environmental Plan 2007 is adopted. The Draft Goulburn Mulwaree Local Environmental Plan 2007 would change the zoning around the route from Zone No. 1(a) (General Rural) to RU2 Rural Landscape and would increase the minimum lot size for subdivisions from 40 ha to 100 ha in order to maintain the rural character. The Upper Lachlan Shire Council has indicated that it would also increase the minimum lot size for subdivisions in the area surrounding the northern most section of the proposed gas pipeline route (north of Canyonleigh Road) to 100 ha.

The route location has been selected to pass along lot boundaries rather than bisect lots.

Infrastructure

The route runs along a section of the Crown Public Road (Wollumbi Road) and would cross Canyonleigh Road.

The construction of the pipeline would require the excavation of a section of Wollumbi Road approximately 2.7 kilometres in length. The excavation of Wollumbi Road has the potential to impact upon local traffic and access. Detours would be provided to ensure that access is maintained.

There are also underground services located within, and in close proximity to, the Canyonleigh Road reserve. Excavation for the proposed gas pipeline could also impact on these

underground services. Detailed services searches would be undertaken during detailed design to ensure that underground services are not impacted.

The proposed gas pipeline would cross two electricity easements. One of the easements contains a 330 kV transmission line and associated towers, whilst the other contains a 66 kV transmission line and associated towers.

4.4 Other environmental issues

Construction activities, particularly excavation, have the potential to lead to other environmental issues and impacts, including:

- Impacts to water quality mainly as a result of erosion, sedimentation and disturbance of drainage lines;
- Noise generation during construction;
- Impacts to air quality mainly as a result of dust generation; and
- Traffic impacts, particularly as a result of the disturbance of local roads.

These issues are described below. Potential impacts would be managed mainly through the implementation of standard construction environmental management methods as outlined by a CEMP. Management measures are described in Section 4.5.

In terms of sensitive receivers, the nearest dwellings are located more than one kilometres east of the route.

4.4.1 Water quality

The route would cross a number of drainage lines. These are characterised as ephemeral, channel confined streams, which would form a chain of shallow ponds after heavy rainfall. All of the drainage lines are tributaries of Wollondilly River, Paddys River or Uringalla Creek.

The southern section of the route would pass within approximately 200 m of Uringalla Creek, whilst to the north of Canyonleigh Road the proposed gas pipeline would come to within approximately 200 metres of Wollondilly River. All of the abovementioned waterways are within the Wollondilly River sub-catchment of the Hawkesbury catchment.

There are also several farm dams located in close proximity to the proposed gas pipeline route. These dams are located in areas of cleared grassland and contain near-permanent water.

It is unknown whether groundwater occurs in the area of the gas pipeline.

Construction would result in the disturbance of soils, as shallow excavations would be required to form the trench for the pipeline. This disturbance to surface stability could lead to erosion, sediment transportation, siltation and contamination of offsite waters, especially during high rainfall events.

During trenching for the construction of the pipeline, any rainfall that does not readily absorb into the ground surface would drain across the surface of the ground as runoff, potentially eroding and transporting sediment loads from the construction areas into adjoining drainage lines and contaminating the creeks and waterways of the catchment area. It is also possible

that sediment from trenching could contaminate groundwater if there is groundwater present and the trenches intersect the water table.

Another potential minor risk would be the spillage of hydrocarbons from construction vehicles, which could contaminate the surface water and local waterways.

Typical construction activities and sources of potential impacts include:

- Earthworks undertaken immediately prior to rainfall periods;
- Work areas that have not been stabilised;
- Stripping of topsoil, particularly in advance of construction works;
- Works within drainage paths;
- Stockpiling of excavated materials;
- Storage and transfer of construction oils, fuels and chemicals; and
- Maintenance of plant and equipment.

4.4.2 Noise

The route passes through a sparsely populated rural area consisting predominantly of large rural properties, pasture and bushland. Roads in the immediate vicinity of the proposed gas pipeline route are generally minor dirt tracks that provide access to rural properties. The Hume Highway is located approximately 900 metres from the southern most extreme of the route. Noise in the vicinity of the route is generated by traffic, farm machinery and equipment, livestock, and the switchyard.

Several activities would be undertaken during construction of the pipeline that would result in an increase in noise levels in the area. Construction activities are described in Section 2.

However, construction of the pipeline would be undertaken progressively, in stages. This would ensure that any noise impacts would be of short duration at any one location. Furthermore, the area surrounding the proposed gas pipeline route is rural in nature and is sparsely populated. There are no schools or hospitals in the vicinity of the proposed gas pipeline route and the only sensitive noise receivers are residential dwellings associated with rural properties. It is anticipated that noise impacts would be minimal.

4.4.3 Air quality

The main potential air quality issue in relation to construction of the pipeline would be dust during excavation of the pipeline trench. The following activities have the potential to generate dust:

- Removal of vegetation;
- Excavation works;
- Stockpiling of soil for replacement; and
- Erosion of bare soil prior to re-establishment of vegetation.

As only short sections of trench would be excavated at any one time, the affects of any dust generated would be localised and would be managed through the implementation of standard environmental management practices during construction.

Occasional venting of limited gas volumes would be necessary for maintenance activities. Such maintenance venting is not expected to have a significant impact on air quality in the locality, as only a small amount of gas would be released and this would be quickly dispersed.

Blowdown of the full pipeline content would not be permitted except in the unlikely event of an extreme emergency, which is typically outside the control of the pipeline operator.

4.4.4 Traffic and access

As noted by the environmental assessment for the Marulan Gas Turbine Facilities (prepared for EnergyAustralia and Delta by URS) the regional road network is dominated by the Hume Highway, which runs between Sydney and Melbourne. The Hume Highway runs to the south of the eastern route for the pipeline. The connection with the Moomba Sydney gas pipeline is located approximately 900 metres north of the highway. Wollumbi Road provides access to the connection point. In this location, Wollumbi Road is a narrow gravel road that provides access to properties to the north.

Canyonleigh Road is located in the north of the study area. The proposed gas pipeline route crosses this road. Canyonleigh Road connects with Brayton Road to the west. Brayton Road provides access to the town of Marulan, and the Hume Highway.

Brayton Road is a 6.5 metres wide sealed road from Marulan to the junction with Canyonleigh Road. Initially Canyonleigh Road is a 5.5 metre wide sealed road but as the distance away from Brayton Road increases the road changes to a gravel surface. In the vicinity of the pipeline route, Canyonleigh Road provides access to the facilities' site and the Transgrid Switchyard. It also provides access to rural properties.

Potential impacts on the road infrastructure have been considered in Section 4.3 above.

Access arrangements for construction are described in Section 2.7.

Excavation to cross local roads is not expected to have a significant impact on local traffic. The roads experience low traffic volumes, with the main issue being access for local property owners and residents. Detours would be set up at these locations to ensure that access is maintained.

If any property fences need to be removed for construction, temporary fences/gates would be installed, and the fences would be reinstated to their original condition at the conclusion of construction.

The long term operating workforce would generate very little traffic activity in the local area. There would be only occasional traffic accessing the pipeline as required for maintenance purposes. Generally, maintenance crews would consult with landowners to use internal property tracks and roads to access any areas of the pipeline that require maintenance.

4.5 Recommended mitigation measures

To ameliorate the potential environmental impacts identified in Section 4.4, a number of mitigation measures are recommended. These measures would form part of the proponent's Statement of Commitment for the project.

4.5.1 Ecology

Construction techniques

Through ecologically sensitive sections of the route low-impact construction techniques would be used. This would involve the use of smaller excavators and stockpiling of materials and fill away from the immediate excavation area. Low-impact construction techniques would restrict direct construction impacts to a corridor of 10 metres. This would reduce the overall extent of native vegetation and habitat resources removed.

Pre-clearance survey

A detailed pre-clearance survey by a qualified ecologist would be required prior to construction. This would involve:

- Diurnal searches for birds, nests and roosts;
- Active searches for reptiles, including checking of woody debris and rocks/outcrops within the construction footprint,
- Active searches for micro bats, including checking under exfoliating bark; and
- Nocturnal surveys, including stag-watching of identified habitat trees, specifically focusing on observing use of trees by micro bats.

This survey would focus on locating individuals, and especially roosts of threatened species.

If nests or nestlings of threatened species are observed within, or close to, the route then construction would be postponed until the nestlings have hatched and fully-fledged. If construction constraints mean that this delay is not practicable then DECC would be consulted to determine if relocating the species is acceptable.

Tree fauna management

The CEMP would detail procedures for fauna management including the following:

- Trees would be monitored for fauna before and during clearing operations;
- Trees with resident fauna would be avoided as far as is practicable;
- Hollow-bearing trunks and branches would be carefully sawn and placed intact in adjacent areas of native vegetation; and
- Replacement habitat, such as nest boxes, would be provided where habitat trees are to be removed.

Ground-dwelling fauna management

The CEMP would include the following:

- Engage a suitably qualified ecologist to identify active wombat burrows that may be impacted by the route;
- Advise on suitable precautions to be exercised during excavation in and around wombat burrows; and
- Engage a suitably qualified ecologist to identify and re-locate any reptiles sheltering in rocky areas outcrops that would be directly impacted by the route.

Groundcover clearance protocol

A groundcover clearance protocol would be incorporated into the CEMP including the following:

- Remove large woody debris and rock fragments using excavator grabs or manual handling if practicable;
- Place intact large woody debris and rock fragments within adjacent areas of intact vegetation;
- Scrape and stockpile leaf litter and topsoil separately from deeper fill material; and
- Reuse leaf litter and topsoil in remediation works.

Timing of construction works

The ideal time for construction would be during December/February. Most species that reproduce in spring would have finished breeding at this stage. This period would also avoid the breeding period of large forest owls such as Powerful Owl which typically breed in Autumn/ Winter.

Site management

The following mitigation measures are recommended in order to minimise operational impacts:

- Setting maximum speed limits during construction within the study area to reduce the risk of fauna road fatalities; and
- Limit vehicular and personnel entry into adjacent remnant vegetation during construction through appropriate marking of operational areas.

Phytophthora management

Hygiene measures to prevent the introduction or spread of the pathogen would be incorporated into the CEMP.

Remediation

The original topsoil would be retained and stockpiled to assist in remediation of land along the route. All supplementary plantings would use indigenous native species of local provenance. It is recommended that fallen timber within the route be relocated to areas of intact vegetation adjacent to the study area.

The health of revegetated areas would be monitored closely and supplementary watering supplied as appropriate. Revegetated areas would be monitored for weed infestation and any infestations actively managed to minimise further weed spread.

Weed and pest management

To limit the spread of weeds into adjoining remnant vegetation all construction areas would be temporarily fenced. Stockpiles of fill or vegetation would not be placed in areas of adjoining remnant vegetation but instead within existing cleared areas.

It is recommended that the following measures be incorporated into the CEMP:

- Perform a baseline weed survey to assess the extent and severity of weed infestation in extant native vegetation within the study area pre and post construction;
- Incorporate control measures to limit the spread of weed propagules downstream of the study area;
- During construction undertake maintenance of silt fences and other mitigation measures to isolate runoff; and immediately rehabilitate disturbed vegetation to limit the potential for colonisation by weeds;
- During construction areas of vegetation that would not be cleared would be fenced, restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill would not be placed in areas of remnant vegetation but instead in adjacent cleared areas;
- Following construction, cleared areas would be revegetated with indigenous native vegetation to limit the potential for colonisation by weeds;
- During operations monitor and control noxious weed species in line with legislative obligations;
- Ensure refuse is adequately disposed of to avoid attracting vermin and other pest species;
- Perform ongoing monitoring of weed infestation on and adjoining the study area using the baseline weed survey.

EECs

It is recommended that the following measures be incorporated into the CEMP:

- No canopy trees would be impacted by the proposal;
- The pipeline should be placed to provide as large an area of clearance between EECs and the pipeline as practicable;
- Areas should be fenced to clearly demarcate the vegetation;
- Areas of adjacent grassland should be rehabilitated; and
- Weeds should be managed both within and adjacent to areas of EEC to ensure there is no decline in quality within these communities.

4.5.2 Cultural heritage

Where possible, disturbance to archaeological sites BH1, BH3, MGPS1&PAD, MGPS4 and area of potential archaeological deposit MGP PAD would be avoided.

If impact to Aboriginal sites BH1 and BH3 cannot be avoided then the artefacts would be collected or relocated away from the area of impact.

If disturbance is unavoidable in the vicinity of MGPS1&PAD and MGP PAD1, then a program of archaeological subsurface investigation would be conducted to determine the nature, extent and integrity of any potential archaeological deposits that may be present in these areas.

The timing of the subsurface testing may occur after consent is granted and would be included in the conditions of consent for the project.

Should the subsurface testing program determine the presence of high significance sites then archaeological salvage may be required. Alternatively, a redesign of the project infrastructure in that area may be required.

If impact to Aboriginal site MGPS4 cannot be avoided then an archaeological test excavation program would be conducted within the construction footprint. The objectives of the program would be to determine the nature, extent and integrity of any archaeological deposits present, and to determine management requirements in the context of the pending construction disturbance. Should the testing program determine the presence of significant archaeological deposits, then a further program of salvage excavation may be required. The curation of any recovered Aboriginal objects would be the subject of consultation with the Department of Environment and Climate Change and the Aboriginal stakeholders

No further cultural heritage management actions are required in relation to historical recordings MGPHS1 and MGPHS2. Unnecessary direct impact to these recordings would be avoided where feasible.

If it is anticipated that direct impact would occur to the movable heritage items in recording MGPHS3, then these items would be moved, in consultation with the owners of the items, to a location where there is no potential for construction impact.

4.5.3 Land use and infrastructure

Rural uses

The pipeline would be laid in stages to ensure that only small sections of the easement are disturbed at anyone time. The topsoil would be replaced as soon as possible at the conclusion of each section. The topsoil would contain the original seed bank and rootstock of the pasture and, as such, the pasture may regrow unaided in many instances. However, as required, pasture seed and fertiliser compatible with the surrounding pasture would be re-sown to rehabilitate the area over the pipeline.

Once it has been rehabilitated the land above the pipeline route would be able to be returned to grazing and normal agricultural activities without the need for any further mitigation measures.

Residential

Potential impacts of the pipeline generally relate to construction issues such as noise, air quality, traffic and access. These issues are described in the following section.

Infrastructure

Access to the proposed gas pipeline route and the suitability of local roads would be considered during the further assessments that would be undertaken to confirm the traffic and access arrangements to the facilities' site.

Measures relating to construction traffic management are described in the following section.

Detailed services searches would be undertaken during detailed design to identify and locate underground services located in the road reserve. The pipeline design would aim to ensure that services are not impacted. Should impacts to underground services be unavoidable, consultation with the service provider would be undertaken and the services would be relocated prior to construction.

Prior to any construction taking place within the electricity easements the relevant electricity provider would be consulted to establish clearances required from the transmission lines and any restrictions on construction machinery. The pipeline would be cathodically protected to ensure that the electricity transmission lines do not induce currents on the pipeline once it is operational.

4.5.4 Environmental management

Water quality

Construction phase impacts would generally be managed by the implementation of standard environmental management measures as defined in the CEMP. Such measures would significantly decrease the likelihood of adverse environmental impacts.

The CEMP would include a construction soil and water management plan detailing construction phase stormwater management strategies in accordance with *Landcom Soil and Construction, Managing Urban Stormwater* (Landcom, 4th edition, 2004). These would include amongst others:

- General site practices and responsibilities;
- Material management practices;
- Stockpile practises;
- Topsoil practices; and
- Erosion control practices (earth sediment basins, straw bales, sediment fences, turbidity barriers, stabilised site accesses, diversions and catch drains).

The trenching would be undertaken progressively, in stages, to minimise the time that disturbed land is exposed and ensure that spoil stockpiling is kept to a minimum. The stockpiles would be established in an appropriate manner and sediment fencing would be installed to ensure that no sediment is able to enter receiving waters through rainwater runoff.

In the case where a trench would have to intersect the water table, a groundwater management plan would be prepared. The water table would be intercepted and water extracted from the site in accordance with the groundwater management plan. It is expected that construction areas would be rehabilitated and proposed stormwater controls would provide best practice management of potential erosion scour and sediment transport from the site during wet weather events.

Noise

A construction noise management plan would be prepared. This would include the following mitigation measures:

- Where practical, machines would be switched off when not in use;
- Machines found to produce excessive noise compared to normal industry expectations would be removed from the site or stood down until repairs or modifications can be made;
- Haulage and delivery trucks would be fitted with appropriate mufflers and be in good working order;
- Construction hours would be limited to DECC guidelines; and
- A community liaison person would be appointed to communicate with potentially affected residents and to actively respond in the event complaints are received.

Air quality

A dust control plan detailing measures to control the potential for dust generation would form part of the CEMP. Measures would target dust generation by vehicle movements and excavation works. Typical mitigation measures would include:

- Ensuring exposure time of uncovered surfaces is minimised;
- Covering stockpiles and loads; and
- Site management controls.

Traffic

A construction traffic management plan would be prepared as part of the CEMP. It would be prepared in consultation with road authorities to minimise the potential for construction traffic impact on the surrounding road network and disruptions within roads and road reserves. The plan would include measures to ensure public safety and access is maintained, and that disruptions are minimised as far as possible.

The plan would include measures such as the use of one-way traffic and appropriate fencing, provision of detour routes, signs and traffic control measures that would be installed.

Appendix A

Ecological assessment - eastern route

Ecological impact assessment of the proposed eastern pipeline route (December, 2008), GHD

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Energy Australia

Report for Marulan Gas Pipeline

Ecological Impact Assessment for Proposed Eastern Pipeline Route Option

December 2008

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Proposed Development

EnergyAustralia and Delta Electricity (the Proponent) aim to construct and operate a pipeline in the order of DN450, which would traverse a distance of approximately seven and a half kilometres, including associated ancillaries, for the transmission of natural gas from the Moomba - Sydney Gas Pipeline east of Marulan NSW to fuel the proposed two separate gas turbine facilities (the "Facilities") at Brayton.

Currently, two pipeline routes are being considered ("Eastern" and "Western"), with the affected landowners on both route options being consulted. Easement agreements would be negotiated on the preferred route with the affected landowners. The easement would nominally be a 20 metre corridor. This report focuses on the proposed "eastern" pipeline route.

The pipeline would be owned jointly by EnergyAustrala and Delta Electricity to supply natural gas metered separately to individual gas turbine Facilities, one to be owned by EnergyAustralia and the other to be owned by Delta Electricity. The EnergyAustralia facility is planned to operate on peak load basis and would consist of two 175 MW_e gas turbines units. The Delta Electricity facility is planned to operate initially on peak load basis and would consist of two 175 MW_e gas turbine units. At a later stage, the Delta Electricity facility would be upgraded for base load operation as a combined cycle power plant by adding a 100 MW_e steam turbine to boost the power rating to 450 MW_e.

Together with the Facilities, the environmental approval for the pipeline is currently being undertaken via a Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as *a* "Major Project", the consent authority being the Minister for Planning. The Facilities have also been offered "Critical Infrastructure" status under Section 75C of the EP&A Act.

1.2 Description of the eastern route

Two pipeline alternatives are considered for the proposed eastern route:

Main Eastern Route

The main eastern route starts at the proposed off-take station on the downstream side of the Moomba to Sydney gas pipeline at the Uringalla main line valve. The route heads in a north westerly direction through a pasture improved paddock for approximately 200 metres before travelling along a Crown Public Road (known as Wollumbi Road). Within this road corridor, the route heads west on the southern side of the gravel road formation for approximately 1,100 metres (1,300 metres from the off-take station). The route then leaves the road corridor and heads in a north westerly direction across undulating land occupied by improved pasture, used for open cattle grazing, for approximately 1,250 metres, then continues in a north westerly direction through unimproved undulating open sheep grazing country consisting of predominately native grasses and trefoils for approximately 2,500 metres. It then crosses Canyonleigh Road and continues in a northerly direction within the site for the gas turbine facilities over undulating native grassland with basalt rock outcrops for 1,500 metres, before reaching the gas turbine facility. This route is approximately 6,600 metres long. This route is the shortest most direct route.

Alternative eastern route using lot 153

The proponent owns Lot 153 of DP750053. To avoid impacting private property this route offers an alternative for the eastern route through a property purchased by the proponent.

The route heads west from the 4,000 metre point on the eastern and western route for 400 metres and then north for 750 metres where it rejoins the eastern and western route prior to the Canyonleigh Road crossing. The pipeline alignment through the property has been selected to avoid sensitive native vegetation. This route is approximately 6,750 metres in length.

1.3 Scope of Report

GHD Pty Ltd (GHD) was engaged by the proponent to undertake an Ecological Assessment for the proposed Marulan Gas Pipeline, north of Goulburn, NSW.

The proponent requires assistance to complete the environmental assessment for the gas lateral connection between the proposed Marulan Gas Power facilities to the Moomba-Sydney gas main, a distance of approximately seven km. Once completed, the findings need to be summarised in a Preferred Project Report that includes a Statement of Commitments detailing the safeguards and mitigation measures that would be used.

It is understood that the pipeline is currently the subject of a Concept Approval Environmental Assessment (EA) being undertaken by URS Australia. Due to land access constraints, detailed assessment of the pipeline has not been undertaken. Therefore, in order to gain Project Approval for this component of the project, a detailed ecological assessment is required to support a Preferred Project Report that would be prepared by the proponent.

The proposal is a Major Project pursuant to NSW *State Environmental Planning Policy (Major Projects)*. Accordingly, the proposal is subject to the development and assessment processes and requirements of Part 3A of the NSW *Environmental Planning & Assessment Act 1979* (EP&A Act), with the Minister for Planning as the consent authority. A Project Application must be lodged with the NSW Department of Planning, accompanied by a Preferred Project Report prepared in accordance with the requirements of the Director-General (D-G) of the Department (also know as the Environmental Assessment Requirements, or EARs).

An initial desktop review identifying potential ecological constraints for the proposed gas pipeline was undertaken as part of the URS *Biodiversity Impact Assessment Gas Turbine Facilities Project, Marulan NSW* (2008). This report assessed potential flora and fauna constraints within a broad pipeline corridor. Due to land access constraints a pipeline route was not defined and a detailed assessment of impacts has not been undertaken. In order to prepare a Preferred Project Report and gain project approval, field investigations of the pipeline route are required to more accurately assess any likely impacts on flora and fauna.

This Report has been prepared as a technical document to support the EA, and addresses the EARs, which state that the EA must include a 'flora and fauna impact assessment in accordance with the NSW Department of Environment and Climate Change (DECC) *Guidelines for Threatened Species Assessment* (DEC, 2005). This Report assesses the ecological impacts of the proposed construction and operation of the gas pipeline, with due consideration of relevant Commonwealth and State legislation (see Section 3), as well as relevant guidelines, including:

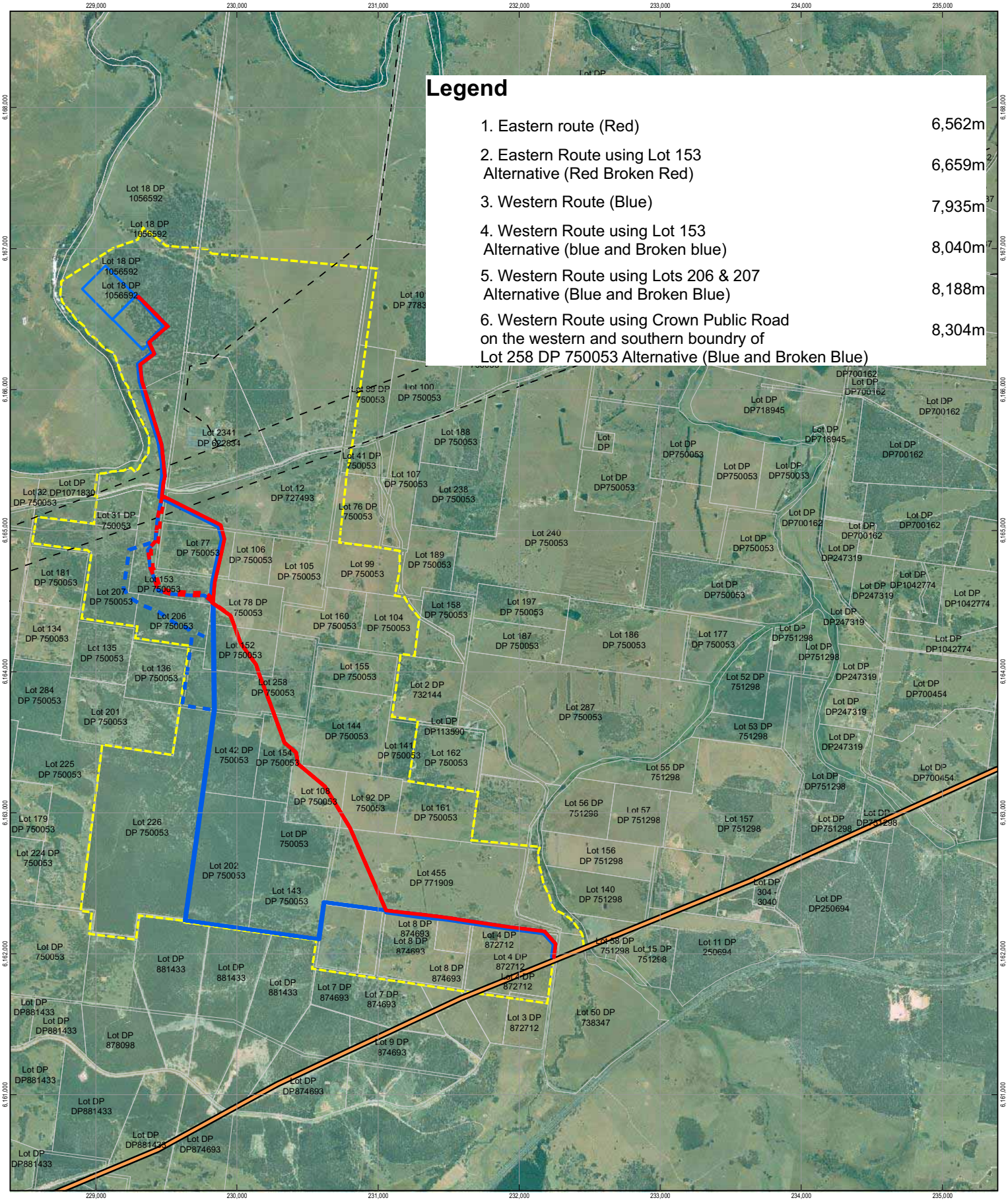
- *Guidelines for Threatened Species Assessment* (DEC, 2005), with regard to the nature and content of this report; and
- *DEC Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (DEC 2004). The field surveys completed for this assessment, as described in Chapter 4, have been designed and implemented to comply with the minimum requirements recommended in these guidelines.

The DEC (2005) guidelines identify important factors and/or heads of consideration that must be considered by proponents and consultants when assessing potential impacts on threatened species, populations, or

ecological communities, or their habitats for development applications assessed under Part 3A. The guiding principles outlined in the guidelines and addressed in the current assessment are as follows:

- 'Maintain or improve' biodiversity values (i.e. there is no net impact on threatened species or native vegetation);
- Conserve biological diversity and promote ecologically sustainable development;
- Protect areas of high conservation value (including areas of critical habitat);
- Prevent the extinction of threatened species;
- Protect the long-term viability of local populations of a species, population or ecological community; and
- Protect aspects of the environment that are matters of national environmental significance.

The assessment is based on the entire length of the proposed pipeline assuming a 20-metre corridor of impact ("the study area"). This assessment is designed to provide information and analysis to demonstrate that feasible alternatives have been considered, that the project has been designed to be consistent with the principles outlined above, and where there are impacts, that adequate mitigation measures and biodiversity offsets are implemented.



Legend

- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
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- Moomba Sydney Gas Pipeline
- Plant Foot print
- Gas Pipeline Corridor
- LandOwnership

1:25,000 (at A3)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Delta electricity

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Delta Energy and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number 21-17633
Revision A
Date 14 Dec 2008

Site Locations

Figure 1

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10 Bond Street Sydney NSW 2000 Australia 61 2 9239 7000 61 2 9239 7199 sydmail@ghd.com.au www.ghd.com.au

2. Study Area Description

2.1 Proposed pipeline route location

The proposed pipeline route runs from the proposed power station site on Canyonleigh Rd, Brayton, south through a number of farms to Wollombi Rd, off the Hume Highway north of the village of Marulan. An indicative site layout is provided in Figure 1.

The study area is within the Southeastern Highlands Bioregion as defined in the *Interim Biogeographic Regionalisation for Australia* (Thackway and Cresswell, 1995). The facilities site area falls within the Upper Lachlan Shire Council LGA, however the pipeline route is within the Goulburn-Mulwaree Council area

For the purposes of this report the 20 m area of impact for the proposed pipeline route option is defined as the 'study area'.

2.2 Geology and Soils and Topography

The 1:250,000 Goulbourn Soil Landscape Series states that the study area is underlain with Marulan Granite resulting in undulating rises and low hills with patches of granite outcrops and boulders. Soils are sandy red podzolics on hillcrests and upper slopes, yellow podzolics on lower slopes and gleyed podsolic soils in drainage depressions.

2.3 Hydrology

The Wollondilly River occurs to the immediate northwest of the proposed pipeline route. The southern extreme of the proposed pipeline would pass within approximately 200 m of Uringalla Creek, and transects Wollombi Rd. The proposed gas pipeline would also cross many drainage lines characterised as ephemeral, channel confined streams, which would form a chain of shallow ponds after heavy rainfall. All of the drainage lines are tributaries of Wollondilly River, Paddys River or Uringalla Creek and are all within the Wollondilly River sub-catchment of the Hawkesbury catchment. There are also several farm dams located in close proximity to the proposed pipeline route. These dams are located in areas of cleared grassland and contain near-permanent water.

2.4 Climate

Weather statistics are taken from the nearest weather station to the study area at Goulburn Airport approximately 30 kilometres south (BOM, 2008). The area has a mean maximum temperature of 27.6^{o} Celsius in January and 11.6^{o} in July. Mean minimum temperatures are 12.6^{o} in summer and 0.3^{o} in winter.

Mean annual rainfall is 514.5 mm with the majority of rain falling in winter.

3. Legislative Framework

3.1 Environmental Planning & Assessment Act 1979

The EP&A Act forms the legal and policy platform for development assessment and approval in NSW and aims to, *inter alia*, 'encourage the proper management, development and conservation of natural and artificial resources'. The proposal is a Major Project according to *State Environmental Planning Policy (Major Projects) 2005* and as such, is to be assessed under the provisions of Part 3A of the EP&A Act, with the Minster for Planning as the Consent Authority for the Project Application.

3.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides legal status for biota of conservation significance in NSW. The Act aims to, *inter alia,* 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

- The listing of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, vulnerable species and communities listed under Schedule 2;
- The listing of 'Key Threatening Processes' (under Schedule 3);
- The preparation and implementation of Recovery Plans and Threat Abatement Plans; and
- Requirements for the preparation of Species Impact Statements (SISs).

The TSC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the study area and hence could occur subject to the habitats present;
- Targeted field surveys for threatened species listed under the Act;
- Development of suitable impact mitigation and environmental management measures for threatened species, where required; and
- Assessment of potential impacts on threatened species.

3.3 Native Vegetation Act 2003

The NSW Government released the regulations for the *Native Vegetation Act 2003* (NV Act) on 14 November 2005, which came into effect on 1 December 2005. The NV Act regulates the clearing of native vegetation on all land in NSW except for land listed in Schedule 1 of the Act. Excluded land under Schedule 1 of the Act includes National Parks and other conservation areas, State forests and reserves, and urban areas. Specifically, urban areas, which are excluded, include areas zoned residential (but not rural residential), village, township, industrial or business.

According to s.75U(e) of the EP&A Act, an authorisation under Section 12 of the NV Act to clear native vegetation is not required for a project approved under Part 3A. Hence, the NV Act does not apply to the current proposal.

3.4 Noxious Weeds Act 1993

Under the *Noxious Weeds Act 1993* (NW Act), Goulburn-Mulwaree Council is responsible for the control of noxious weeds in the LGA. The NW Act provides for the declaration of noxious weeds by the Minister of Agriculture. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land. As such, noxious weeds within the study area have been recorded as part of this assessment.

3.5 Environment Protection and Biodiversity Conservation Act

The purpose of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, would have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Commonwealth Minister for the Environment and Water Resources.

In January 2007 the Commonwealth and NSW governments signed a Bilateral Agreement which accredits the assessment regimes under Part 3A, Part 4 and Part 5 of the EP&A Act for assessment purposes under the EPBC Act. The Bilateral Agreement applies only to proposals that the Commonwealth Environment Minister has determined are controlled actions under the EPBC Act, with the exception of nuclear actions.

The EPBC Act identifies matters of national environmental significance as:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

The Administrative Guidelines for the EPBC Act (Department of the Environment & Heritage 2006) set out criteria intended to assist in determining whether an action is controlled and hence requires approval. In particular, the Guidelines contain criteria for determining whether a proposed action is likely to have a 'significant impact' on a matter of national environmental significance (NES). Would the proponent deem the proposal likely to have a significant impact on a matter of NES, a referral to the Commonwealth Minister for the Environment would be undertaken to obtain a determination as to whether the proposal is a 'controlled action' requiring Commonwealth approval.

The EPBC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species or ecological communities that have been previously recorded within the locality of the study area and hence could occur, subject to the habitats present;
- Targeted field surveys for threatened species listed under the Act;
- Development of suitable impact mitigation and environmental management measures for threatened species, where required; and
- Assessment of potential impacts on threatened species.

4. Methodology

4.1 Literature Review

A desktop literature review was undertaken by GHD to identify the representative spectrum of flora and fauna, threatened species, populations and ecological communities listed under the NSW TSC Act and the Commonwealth EPBC Act that could be expected to occur within the study area, based on habitats present. To this end, the following documentation was reviewed prior to the conduct of the field investigations:

- NSW NPWS Wildlife Atlas database (July 2008– 10 km radius search for TSC Act listed flora and fauna, centred on the study area. The NSW Bungonia and Crookwell CMA sub-regions were searched for Endangered Ecological Communities);
- EPBC online Protected Matters Database (July 2008– to a 10 km radius);
- URS, 2008 *Biodiversity Impact Assessment, Gas Turbine Facilities Project, Marulan, NSW* including the listed of target threatened species provided by DECC in the EARs for that project*;* and
- PB, 2005 *Big Hill Gas Turbine Baseline Ecological Surveys.*

4.2 Field surveys

An initial walkover was performed by a GHD ecologist at and within the vicinity of the proposed route (the study area) on 9 July 2008. A targeted flora and fauna survey was performed by GHD ecologists from 15 to 17 July 2008. A supplementary survey was performed on 18 and 19 September 2008 and surveys targeting an alternative route in adjacent lands were conducted on 8 to 10 October 2008. Survey locations are shown on Figure 2. Survey methodology is described below and survey effort detailed in Table 1.

4.2.1 Flora Survey

Flora surveys were consistent with the DECC guidelines where applicable (DEC 2004). All vascular plants (i.e. not mosses, lichens or fungi) observed were recorded on appropriate pro-forma field data sheets.

Plant specimens not readily identifiable in the field were collected and subsequently identified using standard botanical texts and where required were compared with voucher specimens held in the National Herbarium of New South Wales Online Reference Collection. Structural vegetation communities were described according to classifications made by Specht (1970). Plant identifications were made according to nomenclature in Harden (1990, 1991, 1992, and 1993). Plant specimens which were difficult to identify (either insufficient sample collected or buds/fruiting bodies were not available at the time of the survey) were submitted to the NSW National Herbarium for identification.

On the basis of air photo interpretation, initial walkover and habitat assessment, the study area was divided into stratification units i.e. functionally similar units for the purposes of environmental assessment according to the DECC guidelines (DEC 2004). Surveying included thirteen 20 m x 20 m quadrats. A 'random meander' survey was also performed over the whole route and its immediate vicinity, as prescribed by Cropper (1993) for detecting threatened species.

Plant species were recorded on appropriate pro forma field data sheets. Each data sheet included a detailed biophysical description including vegetation structure, soils, geology and geomorphology, habitat and fire and disturbance history.

The location of field survey quadrats and significant species, habitat and communities were captured with a handheld GPS unit. The location of the vegetation survey quadrats are shown in Figure 2.

4.2.2 Fauna Survey

Targeted fauna surveys were generally consistent with the DECC guidelines (DEC 2004). The survey design was based on the likelihood of threatened species identified in the literature review occurring within the study area and the initial habitat assessment. Methods included diurnal bird counts, Anabat bat detector recording, active searches, nocturnal call playback, spotlighting , litter searches, opportunistic observations and track and scat analysis. All observations were recorded on appropriate pro forma field data sheets.

Weather during the field survey comprised predominately warm, dry weather (BOM, 2008) and there was no light spill from human sources. Traffic along the local roads was very light with less than one vehicle movement per hour. Conditions throughout the survey were suitable for the detection of small nocturnal fauna. No rain fell during the survey period, however, there was standing water in farm dams and wetlands across the study area and frogs were actively calling.

Diurnal Bird Counts

Diurnal bird counts consisted of area searches through habitat within the study area. Searches were conducted at dawn and dusk, for at least 40 minutes over approximately one hectare consistent with the DECC guidelines (DEC 2004. Opportunistic observations of bird species were recorded throughout the duration of all surveys within the study area. Species were identified by visual observation and call and were documented along with numbers of individuals, behaviour, breeding activity and habitat type on pro forma data sheets.

Trees were also scanned for nests, whitewash (guano deposits) and roosts throughout the study area and their locations captured with a handheld GPS unit.

Active Searches

Active searches for frogs and reptiles were performed within and adjacent to the study area focussing on wetlands and suitable substrate. Banks and streamsides were systematically searched and semi-aquatic vegetation was visually scanned. Shelter sites were carefully lifted and replaced, trunks and decorticating bark were scanned, rock crevices were searched, leaf litter was raked and visual scanning of vegetation for active and foraging specimens was undertaken. Frogs were identified by sight and by call.

Microchiropteran Bat Survey

Fixed Anabat recordings were undertaken, recording from half an hour before dusk until the following morning. Two Anabat units were placed for two nights in the initial July 15-17 survey. Further surveys included two Anabats over one night during the supplementary on 18/19September and again over two nights on 8-10 October 2008. Overall five full nights of bat call recordings were taken. Recordings were sent to Ray Wouldiams of Ecotone for identification. Calls were identified to the species level where possible and were reported as ‘definite’, ‘probable’ or ‘possible’ depending on the confidence of the identification. Two harp traps were also placed out during September supplementary surveys near dams and within flyways.

Call Playback

Call playback was performed over five nights targeting the squirrel glider (*Petaurus norfolcensis)*, powerful owl (*Ninox strenua)*, sooty owl (*Tyto tenebricosa), m*asked owl (*Tyto novaehollandiae*) and barking owl (*Ninox connivens)*.

Call playback included at least five minutes broadcasting and ten minutes listening for each species per night plus additional listening and spotlighting at the beginning and end of the call playback period.

Spotlighting

Spotlighting surveys were performed on a total of five evenings and involved walking one km transects for one hour. Approximately two hours of additional, opportunistic spotlighting in areas of interest or of high activity was performed each evening either on foot or from a vehicle through the entire survey period.

Fauna Habitat Assessment

An assessment of the quality of habitats present for native fauna was made across the entire study area. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. Indicative habitat criteria for targeted threatened species (i.e. recorded in the TSC and EPBC Act searches) were identified prior to fieldwork. Criteria were based on information provided in TSC Act species profiles, field notebooks and the knowledge and experience of GHD field ecologists. Habitat assessment assists in the compilation of a comprehensive list of fauna that are predicted within the vicinity of the study area, rather than relying solely on single event surveys that are subject to seasonal limitations and may only represent a snapshot of assemblages present.

The locations and quantitative descriptions of significant habitat features were captured with a handheld GPS unit and photographed where appropriate.

Ground debris searches

Ground debris searches were undertaken incidentally during the entire survey period while traversing the study area. These included active searches for scats, tracks, burrows or other traces.

Opportunistic Observations

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. Survey effort was concentrated on suitable areas of habitat throughout the course of the flora survey, for instance fallen timber was scanned for reptiles and paddock trees and dams were scanned for roosting birds.

4.3 Conservation significance

Conservation status of species and communities recorded across the study area were determined with reference to the following:

- TSC Act for State significance; and
- EPBC Act for National significance.

4.4 Survey limitations

It is possible that some species utilise the study area but were not detected during the survey period. These species are likely to include flora species that flower after rainfall as well as annual, ephemeral or cryptic species that are difficult to detect or identify when not in flower; fauna species which are inactive during cooler months, especially frogs, reptiles and microbats, and migratory or nomadic species that occur on a seasonal basis. Some fauna species are also mobile and transient in their use of resources and it is likely that not all species (resident or transitory) were recorded during the survey period. The habitat assessment conducted for the study area allows for the identification of habitat resources for such species to determine their likely occurrence. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values within the study area in order to predict potential impacts of the proposal.

Table 1 Survey Effort

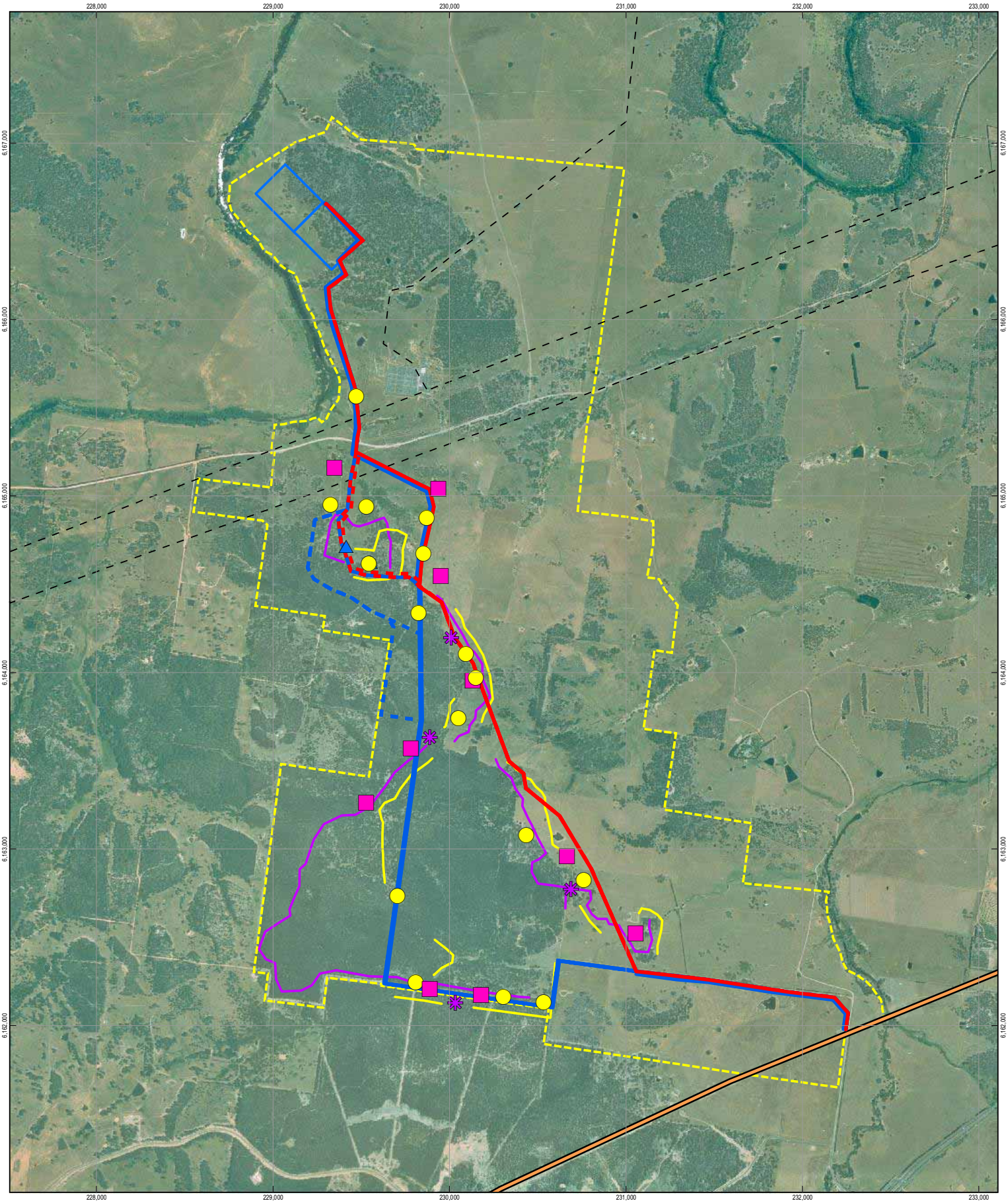
Task	Technique	Person Hours / Number
FLORA		
Flora Inventory	Quadrats	18 quadrat throughout the study area
Targeted Searches for Threatened Flora	Random Meander	5 random meanders along the length of the pipeline route and surrounds
FAUNA		
Bird Survey	Diurnal Bird Counts	Two people conducting two 40 min searches over 6 mornings 16 person hours
Reptiles and Amphibians	Active Searches	Incidentally through out 8 survey days ~ 16 person hours
Bats	Anabat Harp Traps	Two Anabats out each night of surveys 10 Anabat nights
Forest Owls and threatened arboreal fauna	Call Play Back	Conducted each surveys night for approximately 1 hour ~ 5 survey hours
Arboreal and other nocturnal fauna	Spotlighting	Two people spotlighting for approximately 2 hours each survey night ~10 person hours

4.5 Staff Qualifications

Field surveys were undertaken by qualified GHD field ecologists. Staff qualifications and experience are presented in Table 2 below.

Table 2 GHD Ecology Personnel and Qualifications

Name	Position / Project Role	Qualifications	Relevant Experience
Ben Harrington	Fauna Ecologist / field surveys and reporting	Master of Science, Bachelor of Science, Macquarie University	5+ years
Vanessa Keyzer	Flora Ecologist / field surveys and reporting	Bachelor of Social Science, UNE Master of Applied Science (Environmental Conservation) – currently enrolled CSU	6+ years
Brendan Ryan	Fauna Ecologist / field surveys	Master of Environmental Science, Bachelor of Science, Sydney University	10 + years
Natasha Witting	Senior Ecologist / technical review and QA	Bachelor of Science (Environmental Science), Griffith University Bachelor of Science (Environmental Science) Ecology (hons1), Griffith University	10 years + experience



Legend

- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative
- Harp trap
- Anabat
- Quadrats
- Call Play Back
- Bird Survey
- Spotlighting
- Plant Foot print
- Gas Pipeline Corridor
- Powerlines
- Moomba Sydney Gas Pipeline

1:20,000 (at A3)

0 125 250 500 750 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Delta electricity

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Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number	21-17633
Revision	A
Date	29 October 2008

Survey Locations

Figure 2

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10 Bond Street Sydney NSW 2000 Australia 61 2 9239 7000 61 2 9239 7199 sydmail@ghd.com.au www.ghd.com.au

5. Results

5.1 Flora

5.1.1 Flora species

Approximately 170 plant species were recorded during the field survey. No threatened flora was identified during surveys. The total plant species list recorded during the field survey is presented in Appendix A.

5.1.2 Vegetation communities

Vegetation communities described and mapped within the study area are shown on Figure 3 and described below. Where relevant, communities have been defined based on Tindell *et al.* (2004).

Riverbank Forest

This community occurred along the Wollondilly River and was dominated by river sheoak (*Casuarina cunninghamiana*). The understorey was generally very disturbed and included a mix of native and introduced grasses and herbs, with large areas dominated by blackberry (*Rubus fruticosus*) and stands of parramatta green wattle (*Acacia parramattensis*).

Eastern Tablelands Dry Forest

This community included two sub-communities:

Stringybark / Black Sheoak Forest

This was the dominant vegetation community within the study area and occurred on the hill slopes west of the proposed pipeline route.

Dominant species included blue-leaved stringybark (*Eucalyptus agglomerata*) and brown stringybark (*Eucalyptus eugenoides*) as well as included silvertop ash (*Eucalyptus sieberi*), candlebark (*Eucalyptus rubida ssp rubida*), snow gum (*Eucalyptus pauciflora*), apple box *Eucalyptus bridgesiana*), grey gum (*Eucalyptus punctata*), cabbage gum (*Eucalyptus amplifolia*) and Sydney peppermint (*Eucalyptus piperita*). Patches of this forest were also dominated by black sheoak (*Allocasuarina littoralis*), and in areas where grazing occurred contained few understorey or ground layer species. However, areas from which grazing had been excluded showed a diversity of shrub species including urn heath (*Melichrus urceolatus*), kangaroo thorn (*Acacia paradoxa*), Parramatta green wattle, hoary Guinea flower (*Hibbertia obtusifolia*), matt-rush (*Lomandra filiformis*), violet kunzea (*Kunzea parvifolia*) and rusty pomaderris (*Pomaderris ferruginea*). Ground layer species in intact areas included mulga fern (*Cheilathes sieberi*), raspworts (*Gonocarpus teucriiodes, Gonocarpus tetragynus*), and *Pomax umbellata*.

Cabbage Gum / Stringybark Forest

Two areas of this forest occurred within the study area. Lot 77 DP 750053 contained gully vegetation that was dominated by stringybark eucalypts, cabbage gum, snow gum and candlebark with a mid-storey of Parramatta green wattle (see Figure 3). Understorey and groundlayer species were virtually absent form this area except for occasional scattered mulga fern, rasp wort and some native grasses. This community also contained silver banksia (*Banksia marginata*), violet kunzea and urn heath. A second area occurred on Lots 96 and 108 DP 750035 and Lot 455 DP 771909. These areas contained cabbage gums and stringybarks with a modified understorey of weeping meadow grass, sheep sorrel, carrot weed (*Cotula australis*), stinking

pennywort (*Hydrocotyle laxiflora*) and grazed introduced pasture species. Candlebark and Sydney peppermint also occurred in these patches of east of the pipeline route (see Figure 3).

Frost Hollow Grassy Woodland

This community occurred on flats adjacent to hill slopes. It was dominated by snow Ggm (*Eucalyptus pauciflora*), and/or apple box (*Eucalyptus bridgesiana*) and contained a grassy understorey dominated by kangaroo grass (*Themeda australis*) and wire grasses (*Aristida calycina var calycina, Aristida racemosa var speciosa*). Other occasionally occurring species in this community included candlebark, golden moths (*Diuris chryseopsis*), violet kunzea, spear grass (*Austrostipa* sp.) and canary grass (*Phalaris aquatica*)

Individual apple box also occurred in association with yellow box (*Eucalyptus melliodora*) on the edges of other forest types.

Tablelands Grassy Box Gum Woodland

Yellow box occurred in scattered locations adjacent to snow gum Woodland on Lots 77 and 106 DP 750053 and Lot 12 DP 727493 (see Figure 3). A patch of yellow box also occurred in association with cabbage gum and candlebark south of the house study area on Lot 153 DP 750053. One individual also occurred adjacent to cabbage gum forest on Lot 108 DP 750053.

The presence of scattered individuals adjacent to areas of native pasture suggests that box gum woodland occurred in a mosaic with other vegetation types across the landscape, however, this community has been predominately removed to accommodate cattle and sheep grazing. This makes defining boundaries of this community within the study area difficult.

Native Pasture

Native pasture occurred throughout the study area. Aspect and slope affected the species composition with areas on the lower slopes dominated by kangaroo grass, slopes with an easterly aspect were dominated by wire grasses, and slopes with an southerly aspect were dominated by weeping meadow grass (*Microlaena stipoides*). Other grasses present included wallaby grasses (*Austrodanthonia tenuior, Austrodanthonia racamosa var racamosa)*, spear grass (*Austrostipa* sp), plume grass (*Dichlachne micrantha*) and weed grasses such as canary grass (*Phalaris aquatica*) and serrated tussock (*Nasella trichotoma*). Other pasture species included clover (*Trifolium* spp), capeweed (*Arcotheca calendula*), cats ear (*Hypochaeris radicata*), onion grass (*Romulea rosea*), sheep sorrel (*Acetosella vulgaris*), plantain (*Plantago lanceolata*) and bittercress (*Lepidium* sp). These areas would once have supported woodland and have been cleared of canopy trees for agriculture.

Modified or Disturbed Land

This community refers to areas of exotic grassland that occurred primarily within the southern section of the pipeline route in association with woodland and native pasture. These areas were dominated by introduced pasture species such as prairie grass (*Bromus catharticus*), canary grass, plantain (*Plantago lanceolata*), sheep sorrel, and clover. These areas were heavily grazed making identification of species difficult.

Acacia Scrub

Occasional patches of Parramatta green wattle occurred as pure stands or in association with regenerating Eucalypts at a number of locations throughout the study area (see Figure 3).

5.1.3 Threatened species

The desktop literature review indicates twenty-four threatened plant species that have been previously recorded or are predicted to occur in the locality (see Table 7 in Appendix C). None of these species was present within the study area, however, the study area contains suitable habitat for a number threatened plants including:

- buttercup doubletail (*Diuris aequalis*);
- camden woollybutt (*Eucalyptus macarthurii*);
- hoary sunray (*Leuchochyrsum albicans var tricolour*);
- Tallong midge orchid (*Genoplesium plumosum*);
- delicate pomaderris (*Pomaderris delicata*);
- button wrinklewort (*Rutidosis leptorrhynchoides*); and
- dwarf kerrawang (*Rulingia prostrata*).

Generally these species are most likely to occur within in existing remnant vegetation which would not be directly impacted by the proposed pipeline route. However, it is possible some may occur within the area of impact, including cryptic species and species which may not have been flowering during the survey. Buttercup doubletail and button wrinklewort have both been known to occur in secondary grassland and may occur along the pipeline route. However, neither of these species has been previously recorded in the locality i.e. 10 km radius from the study area (DECC 2008a). Targeted surveys also did not identify either of these species.

5.1.4 Endangered ecological communities

Tablelands grassy box gum woodland qualifies as the endangered ecological community (EEC) white box, yellow box, Blakely's red gum grassy woodland (box-gum woodland) EEC. This EEC is listed under both state and federal legislation, however, is defined based on slightly different criteria. Under federal legislation (EPBC Act) the patch must be in "reasonable condition" and support at least 12 native non-grass species in the ground layer, or be greater than two ha in size if otherwise. State legislation (TSC Act) only requires the presence of relevant canopy species (i.e. yellow box, white box or Blakely's red gum). Table 3 and Table 4 detail the criteria for determining TSC Act and EPBC Act box-gum woodland in regards to the study area.

Within the study area, a stand of yellow box occurred in association with a number of other eucalypts as well as shrubs and native grasses south of the house site on Lot 153 DP 750053 (see Figure 3). This contained nine native non-grass species and this total could potentially come up to 12 considering seasonal variations. This patch would also be considered to be in 'reasonable' condition. Based on these criteria, the patch south of the house site on Lot 153 DP 750053 may qualify as an EEC under both the TSC and EPBC Acts.

Scattered individual yellow box trees also occurred in association with other canopy trees either as isolated patches or adjacent to other vegetation types (see Figure 3). Defining community boundaries in areas containing scattered trees is difficult, particularly as this community is likely to have occurred within a mosaic of other vegetation types within the study area and has been mostly cleared to create grazing land. In line with the precautionary principle it has been assumed that areas of native pasture adjacent to yellow box that are unlikely to support other vegetation types (such as stringybark forest which occurs on steeper slopes) historically contained box gum woodland EEC. These areas of scattered individual yellow box trees and associated grassy understorey did not meet the federal criteria for determination of the box woodland EEC listed under the EPBC Act (i.e. at least 12 non-grass understorey species, or greater than two ha in size if otherwise), however do qualify under the TSC Act.

Table 3 NSW TSC Act criteria for the determination of Box Gum Woodland EEC

Criteria	Description	Does woodland in the study area meet the criteria?
1	Does the site fall within the area defined in the NPWS Scientific Determination for Box Gum Woodland EEC?	Yes.
2	Are characteristic trees white box, yellow box or blakely's red gum present (or likely to have been present) at the site?	Yes, yellow box is present at a number of locations (see Figure #).
3	Is the site mainly grassy?	Yes, study areas containing yellow box have a mainly grassy understorey.
4	Do any of the listed characteristic species occur?	Yes. (See NPWS Scientific determination and species list in Appendix 1)
5	If the site is degraded, is there potential for assisted regeneration of the overstorey or understorey?	Yes, there is potential for assisted regeneration in all areas containing yellow box.

The EPBC Act listing of box gum woodland has different criteria for assessing the presence of this community. Under this Act study areas are required to be in reasonable condition to qualify as this EEC. The following table (Table 4) outlines the criteria and if areas of yellow box within the study area meet each criterion.

Table 4 Commonwealth Listing Advice on White Box-Yellow Box-Blakely's Cabbage Gum Grassy Woodland and Derived Native Grassland (2006) criteria for assessing box Gum Woodland

Criteria	Description	Does the study area meet the criteria?
1	Does the site contain or previously have contained white box, yellow box or Blakely's cabbage gum?	Yes, yellow box is present at a number of locations (see Figure 3).
2	Does the site have a predominately native understorey?	Yes. Areas where yellow box occur have a predominately native understorey.
3	Is the patch 0.1 ha or greater in size?	Yes. The patch south of the south of the house study area on Lot 153 DP750053 is greater than 0.1 ha in size.
4	Are there 12 or more native understorey species present (excluding grasses)?	Scattered trees adjacent to native pasture do not meet this criteria however, the patch of box gum woodland south of the house study area on Lot 153 DP750053 contained nine native non-grass species Seasonal surveys may reveal a higher presence of non-grass native species.
5	Is the site in "reasonable" condition? (i.e. at least one of the understorey species would be an important species (e.g. grazing-sensitive, regionally significant or uncommon species; such as kangaroo grass or orchids) in order to indicate a reasonable condition).	Yes. All areas containing yellow box meet this criteria expect the isolated individual on Lot 108 DP 750053.

Criteria	Description	Does the study area meet the criteria?
6	Where the site does not meet criteria 4 and 5, is the patch two ha or greater in size?	No. Areas of scattered yellow box do not meet this criterion.
7	If yes, than does the patch have an average of 20 or more mature trees per hectare or is there natural regeneration of dominant overstorey Eucalypts?	The patch of Box Gum Woodland south of the house site on Lot 153 DP 750053 meets this criterion, however, areas with scattered individual Yellow Box do not.

One other EEC, natural temperate grassland of the southern tablelands (NSW and ACT), is predicted to occur within the study area (DEWHA, 2008), however the guidelines for identifying this community require that an area historically did not contain canopy trees and this is unlikely to be the case within the study area. Open grassland areas within the study area are the result of clearing for agriculture and would have contained woodland vegetation prior to clearance.

5.1.5 Noxious Weeds

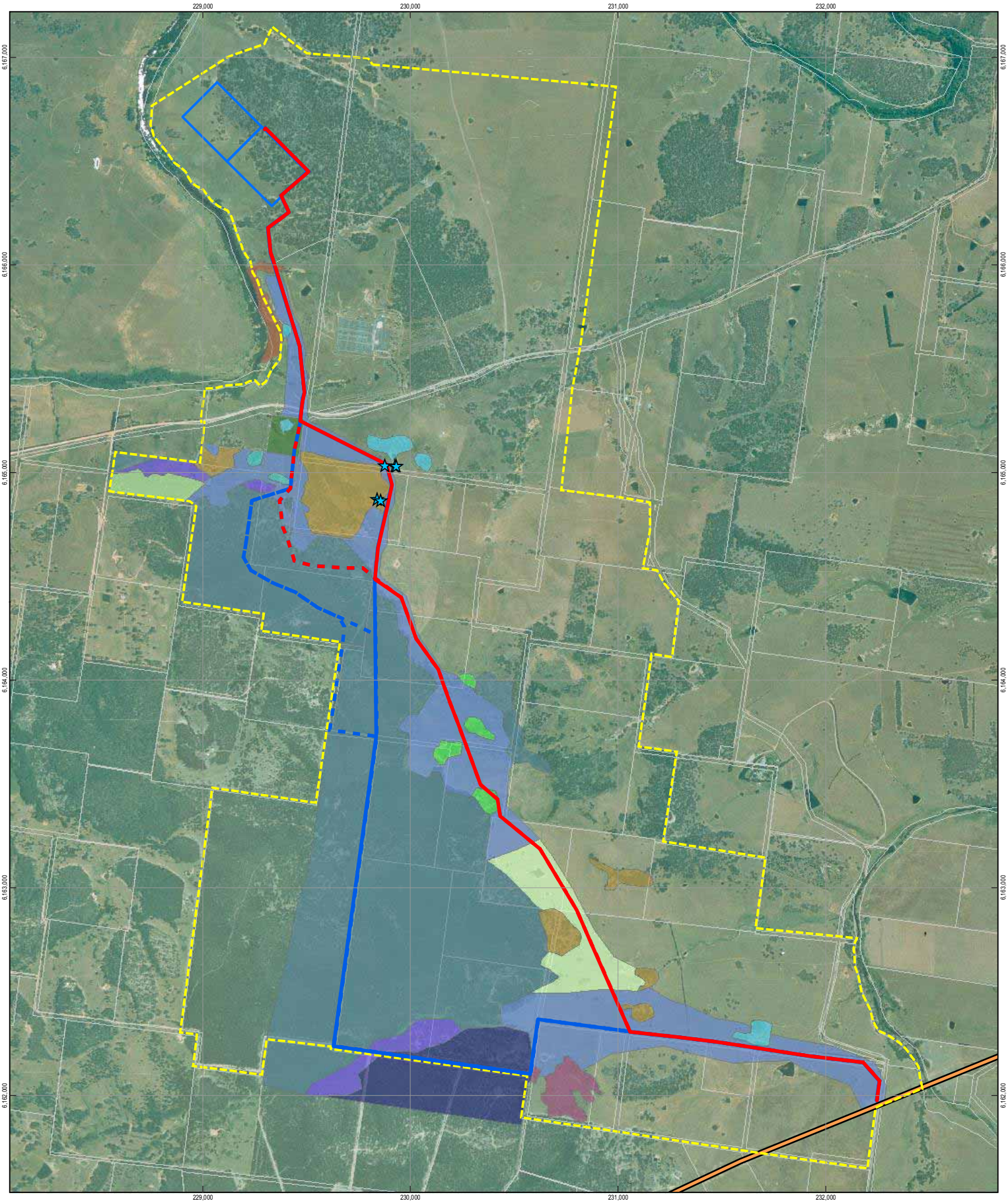
The *Noxious Weeds Act 1993* provides for the declaration of noxious weeds in local government areas. Landowners and occupiers must control noxious weeds according to the control category specified in the Act. Public authorities must control noxious weeds according to the control category to the extent necessary to prevent their spread to adjoining land.

The study area contains nine species declared as noxious weeds in Goulburn-Mulwarree LGA as shown in Table 5 below. These species were scattered throughout the study area. Blackberry was particularly prominent along the Wollondilly River, and lantana occurred as infestations in areas of eastern dry tablelands forest. Other species occurred in areas of pasture.

Table 5 Noxious weeds present in the study area

Common name	Scientific name	Control category
african love grass	*Eragrostis curvula*	4
blackberry	*Rubus fruticosus*	4
fireweed	*Senecio madagascarensis*	4
lantana	*Lantana species*	4
onion grass	*Romulea species*	5
scotch thistle	*Onopordum species*	4
serrated tussock	*Nasella trichotoma*	4
prickly pear	*Opuntia sp*	4
briar rose	*Rosa rubignosa*	4

For Category 4: ‘the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority’. For Category 5: ‘the requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with’.



Legend

- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative
- Plant Foot print
- Gas Pipeline Corridor
- Moomba Sydney Gas Pipeline
- Modified Grassland
- Riverbank Forest
- River She-oak Forest
- Frost Hollow Grassy Woodland
- Snow Gum / Apple Box Woodland
- Unclassified
- Acacia Scrub
- Argyle Apple Forest
- Box- Gum Woodland EEC
- Cabbage Gum / Stringybark Forest
- Candlebark gully Forest
- Garden
- Native Grassland
- Red Gum Woodland
- Red Stringy Bark Forest
- Scribbly Gum woodland
- Snow Gum/Candlebark/Applebox Woodland
- Stringybark/ Black Sheoak forest
- Tableland Hills Grassy Woodland

1:17,000 (at A3)

0 60 120 240 360 480

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Figure 3

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5.2 Fauna

5.2.1 Fauna species

The GHD 2008 field surveys recorded 23 mammals, 79 species of bird, seven frogs and two reptiles as listed in Table 6 of Appendix B.

There was a moderate diversity of native birds within the study area. These included species from a range of guilds (i.e. species with different niches or lifestyles) which suggests the study area and surrounds provides diverse and potentially important habitat for native birds (Keast *et al.*, 1985). These included:

- The threatened gang-gang (*Callocephalon fimbriatum*) and glossy black-cockatoos (*Calyptorhynchus funereus*);
- Open country species such as the Australian magpie (*Gymnorhina tibicen*), Australian raven (*Corvus coronoides*), Australian pipit (*Anthus* australis) yellow-rumped thornbill (*Acanthiza chrysorrhoa*) and scarlet robin (*Petroica boodang*);
- Dry forest and woodland species including the white-throated treecreeper (*Cormobates leucophaea*), striated thornbill (*Acanthiza* lineata), white-browed scrubwren (*Sericornis frontalis*) and red-browed finch (*Neochmia temporalis*) and the threatened speckled warbler (*Pyrrholaemus saggitatus*) identified in stringybark/black she oak forest;
- Waterbirds including Pacific black duck (*Anas superciliosa*), dusky moorhen (*Gallinula tenebrosa*) and Australian wood duck (*Chenonetta jubata*);
- Raptors including the wedge-tailed eagle (*Aquila audax*) and little eagle (*Hieraaetus morphnoides*); and
- Nocturnal, predatory species such as tawny frogmouth (*Podargus strigoides*), and threatened powerful owl (*Ninox strenua*).

Eight gang-gang cockatoos were observed flying over forest to the west of the proposed pipeline route. Two glossy black-cockatoos were observed feeding in *Allocasuarina littoralis* to the east of the pipeline route. Chewed *A. littoralis* cones, diagnostic of the species, were noted in the immediate vicinity of the route (refer Figure 4). The speckled warbler was identified in stringybark/black sheaok forest and the powerful owl responded to call playback along Wollombi Rd.

Native mammals observed included the common and widespread eastern grey kangaroo (*Macropus giganteus*), common wombat (*Vombatus ursinus*), common brushtail possum (*Trichosurus vulpecular*) and common ringtail possum (*Pseudochreirus peregrinus*) in woodland and grassland across the study area. Red-necked wallaby (*Macropus rufogriseus*) were observed in steeper country with intact forest and rock outcrops. Sugar gliders *(Petaurus breviceps*) were noted feeding on eucalyptus blossom and *Acacia parramattensis* sap. Exotic species included the European rabbit (*Oryctolagus cuniculus*) and the fox (*Vulpes vulpes*).

Four species of microbat were identified as 'definite' records within the study area - the southern forest bat (*Vespadelus regulus*), little forest bat (*Vespadelus vulturnus*), Gould's wattle bat (*Chalinobolus gouldii*) and the chocolate wattled bat (*Chalinobolus morio*). A further three species were identified as probable - the large forest bat (*Vespadelus darlingtoni*), a long-eared bat (*Nyctiphilus* sp.) and a freetail bat (*Mormopterus* sp.) Five bats were caught in harp traps over the two-day supplementary survey and were either southern forest bats or little forest bats. The URS 2006 and 2007 field surveys noted large numbers of 11 species of microbats on the Marulan Gas Facility site (URS, 2008). It is likely that these populations of microbats would also occupy habitat along the proposed gas pipeline route.

Diurnal reptiles were relatively sparse, probably reflecting the mild to cold weather during field surveys rather than a paucity of species in the local area. A single sun skink species (*Lampropholis* sp.) was recorded sheltering amongst woody debris and a number of jacky lizards (*Amphibolurus muricatus*) were observed in stringybark/black sheoak forest.

A moderate diversity and abundance of frogs were recorded across the study area. Common eastern froglets (*Crinia signifera*) were abundant and calling in permanent open wetlands and ephemeral drainage lines and ponds across the study area. Whistling tree frogs (*Litoria verreauxii),* spotted marsh frogs (*Limnodynastes tasmaniensis*) and dusky toadlets (*Uperoleia fusca*) were observed sheltering beneath rocks and woody debris in grassland and woodland, with smooth toadlets (*Uperoleia laevigata*), beeping toadlets (*Crinia parainsignifera*) and Perons' tree frog (*Litoria peroni*) heard calling from farm dams.

5.2.2 Fauna habitats

Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species previously recorded in the study area. Important habitat resources are mapped on Figure 4.

The habitat assessment identified the following key habitat types across the study area:

Forest and Woodland

Eastern tablelands dry forest and tablelands grassy box gum woodland within the study area are likely to have equivalent habitat value for native fauna and so are assessed together.

Woodland and forest adjacent to the study area is relatively intact and contains healthy, mature trees. It has good structural diversity with a mix of mature eucalypts and stags and good recruitment of juveniles and seedlings. The study area is likely to support a rich diversity of native birds, micro bats and arboreal mammals. There is a well developed small tree stratum consisting of acacia and allocasuarina species. Acacia is abundant on cleared margins of the forest where it grades into acacia scrub. This stratum would be important for forest bird species, the sugar glider and potentially the squirrel glider, providing shelter, nectar and sap. Black she oak is present in good numbers throughout the eastern tablelands dry forest and forms localised dense stands. Black she oak is an important food resource for the glossy black cockatoo (*Calyptorhynchus lathami)*. The species is known to frequent preferred feed trees which are mature, healthy, in dense stands and bear good quantities of fruit (DEC, 2005). Black she oak within the study area is mature and healthy with abundant fruit. Two individuals were observed directly and chewed cones were noted on study area and so it is highly likely that black she oak at the study area comprise feed trees.

There are few hollow bearing trees and old-aged emergents in the vicinity of the study area, probably reflecting historical ring-barking and a severe bushfire in 1965 (Seiler, W. pers. comm.). Large, important habitat trees are plotted on Figure 4 and discussed in greater detail below. Stringybark species are nectar-bearing and would provide a food resource for native fauna, including birds such as the red wattlebird and yellow-faced honeyeater observed on study area, other nectar feeding birds and arboreal mammals. These stringybark species are autumn and winter-flowering and may provide seasonal nectar resources for the swift parrot and regent honeyeater. Local populations of gang-gang cockatoo feed on stringybark flowers and fruits during their annual winter feeding migrations (URS, 2008).

The understorey was found to be sparse, consisting of occasional shrubs, native grasses and sedges. Understorey growth is suppressed by dense cover of black she oak in many areas and probably as a result of grazing. The combination of extensive intact vegetation, large hollow-bearing trees, diverse structure and drainage lines means that the study area is likely to support foraging large forest owls such as powerful owl (*Ninox strenua*) identified adjacent to the study area and masked owl (*Tyto novaehollandiae)*. Hollow-bearing

trees within the study area and surrounds are large enough to support breeding owls, such as the Powerful Owl (*Ninox strenua*) which has been recorded during current surveys (and previously by PB 2005). The proposed pipeline route would provide foraging habitat for forest owls but does not contain any potential roost trees.

Riverbank forest would provide similar habitat as the other forest communities, however this community was limited to a thin strip of riparian vegetation of low species diversity and would provide poorer quality habitat as a consequence.

Forest Hollow Woodland

This community featured a dense understorey of *Themeda australis*, other native grasses and herbs. This woodland would provide suitable foraging habitat for native herbivorous mammals. This would also provide shelter and foraging habitat for small terrestrial animals including native invertebrates, reptiles and mammals and included potential habitat for the striped legless lizard (*Delma impar*).

Acacia scrub

Acacia scrub is a regrowth community and does not contain mature habitat trees. Structural diversity within the community is limited, however, most patches occur in close proximity to eucalyptus woodland and forest. Collectively they form a structurally diverse vegetation association that is likely to support a diverse range of native birds and arboreal mammals. *Acacia paramattensis* would provide valuable nectar and sap resources for these species. Mature individuals also support large quantities of borers and other invertebrate prey. Acacia scrub would comprise an important food resource for the sugar glider, observed feeding directly, and potentially also the squirrel glider. *Acacia* sap may also support the yellow-bellied glider (*Petaurus australis*) however the species is generally associated with taller, moister, more productive forests (DEC, 2005).

Native pasture

Native grassland present within the study area has the potential to provide important foraging habitat for many native bird species, particularly finches and parrots. Native grasses provide a superior food resource to exotic pasture for many native birds including threatened species such as diamond firetail (*Stagonopleura guttata*) and turquoise parrot (*Neophema pulchella*). This community is in close proximity to intact woodland and is likely to provide foraging habitat for threatened shelter-dependent bird species such as the speckled warbler and brown treecreeper.

Less intensely grazed portions of the study area contain good growth of native tussock grasses. These areas also contain good quantities of fallen timber and rock fragments and may support striped legless lizard (*Delma impar*).

Exotic pasture

Exotic grassland is a secondary, or derived, vegetation community with the original shrub and grass species replaced with pasture grasses (DECC, 2007c). It would support a lower abundance and diversity of native fauna than in its natural state. Cleared grassland provides good quality foraging habitat for larger native mammals and many native bird species, but marginal shelter and foraging habitat for native reptiles and small terrestrial mammals. These areas are likely to be utilised by open country specialists such as the birds eastern rosella, red-rumped parrot, wedge-tailed eagle and Australian magpie and mammals including the eastern grey kangaroo and common wombat. These species are generally widespread and common. Threatened fauna may occasionally forage in grazing land, however, this community does not contain any important resources for these species.

Aquatic and wetland habitat

The study area features moderate quantities of aquatic habitat including ephemeral drainage lines and wetlands and farm dams. Drainage lines across the study area are in moderate condition, with little erosion, few environmental weeds and no upstream pollution. They are ephemeral, channel confined streams which would form a chain of shallow ponds after heavy rain. Dams contain near-permanent water in areas of cleared grassland. These would provide important refuges and breeding habitat for native frogs as well as native fish, crustaceans and aquatic invertebrates. Dams provide nocturnal refuge and foraging habitat for waterfowl including the Pacific black duck and Australian grebe observed during field surveys. They have limited cover of aquatic and semi-aquatic vegetation and are surrounded by cleared grassland. Accordingly they are unlikely to support shelter-dependant wetland birds such as Australian painted snipe (*Rostratula australis*) and Australasian bittern (*Botaurus poiciloptilus*). Wetlands within the study area are also unlikely to support the open water species blue-billed duck (*Oxyura australis*) and freckled duck (*Stictonetta naevosa*) as they prefer large, permanent wetlands with dense fringing vegetation (DEC, 2005).

Dams would provide foraging habitat for microbats potentially including *Myotis macropus* (large-footed myotis) which was recorded as 'probable' via Anabat.

The Wollondilly River flows through the study area to within 200 m of the northern portion of the pipeline route. Two ephemeral drainage lines cross the study area through this section and flow directly to the river. The Wollondilly River is permanent and would support a diverse aquatic ecological community and a diverse range of wetland birds, frogs and reptiles.

Other habitat resources

The DEC (2004) guidelines identify "special habitats" (e.g. water bodies, rocky outcrops and cliffs) that are likely to support specific fauna assemblages. These resources may be significant for threatened species (DECC, 2008b). Tree hollows are important for native fauna as diurnal or nocturnal shelter sites, for rearing young, for feeding, for thermoregulation, and to facilitate ranging behaviour and dispersal. An estimated 15% of all terrestrial vertebrate fauna in Australia are dependent upon tree hollows and for many of these species the relationship is obligate i.e. no other habitat resource represents an adequate substitute (Gibbons and Lindenmayer, 2002). Accordingly, the field survey included a targeted survey of specific habitat resources in addition to the assessment of the communities described above.

Forest and woodland in the study area was mature and contained hollow-bearing trees and stags. There were also few large hollow-bearing paddock trees (refer Figure 4). Ground-based field surveys may underestimate the quantity of important tree hollows present in a vegetation community. Conversely, many hollows visible from the ground may not have the required depth, orientation or other attributes required to constitute suitable shelter (Gibbons and Lindenmayer, 2002). Therefore the above assessment would be considered an estimate of the quality and quantity of tree hollows within the study area. Overall the study area is likely to contain sufficient quantities of these resources to support local populations of hollow-dependant fauna.

Hollow-bearing trees may provide suitable diurnal roost sites for tree-roosting microbats including the threatened eastern freetail bat (*Mormopterus norfolkensis*), little bent-wing bat (*Miniopterus australis*), eastern bent-wing bat (*Miniopterus schreibersii*) greater broad-nosed bat (*Scoteanax rueppellii*) and eastern falsistrelle (*Falsistrellus tasmaniensis*) which have recently been recorded in the locality (URS, 2008; PB, 2005). They are also likely to support native parrots including the sulphur-crested cockatoo (*Cacatua galeritai),* yellow-tailed black-cockatoo (*Calyptorhynchus funereus*) and threatened species such as the gang-gang cockatoo, glossy black-cockatoo and powerful owl (*Ninox strenua)* observed during the field surveys.

The study area contains reasonable amounts of standing and fallen dead timber which would provide important shelter and foraging resources for native invertebrates, reptiles and small terrestrial mammals.

There is a large, significant conglomerate rock outcrop approximately 300 m upslope and to the west of the southern portion of the route. This outcrop forms a continuous cliff line over approximately 300 m with good quantities of cracks and fissures, large boulders and fragments and some caves and overhangs. Caves are used for shelter by red-necked wallabies and eastern grey kangaroos (identified by tracks and scats). A cave also contained a martin (*Petrochelidon* sp.) nest and whitewash from another, larger bird species. Fissures and overhangs may provide diurnal roost sites for microbats however none of the caves are large or sheltered enough to provide suitable sites for maternity colonies. Rocky outcrops were also present within forest areas west of the pipeline route.

There were no other large rock outcrops or substantial amounts of rock fragments in the study area. There were moderate amounts of small conglomerate fragments which would provide good shelter for small native vertebrates. Lower slopes contain small areas of granitic rock outcrops, with moderate quantities of rock fragments. This would provide marginal shelter and foraging habitat for pink-tailed worm lizard (*Aprasia parapulchella*); however, the study area does not contain large amounts of schist or other platey rock fragments that provide optimum habitat for the species (DECC, 2008_b). Large rock outcrops and fragments were identified within stringybark/black sheoak forest adjacent to the stuffy area.

Exotic species

The predatory red fox, the feral dog (*Canis lupus*) and wild pig (*Sus scrofa*) were sighted within the study area. It is expected that the cat (*Felis catus*) would also occupy the study area. The presence of these predators may reduce the likelihood of some native animals occurring along the pipeline route, such as medium sized mammals like the brush-tailed rock wallaby (*Petrogale penicillata*) or ground nesting birds such as bush stone-curlew (*Burhinus grallarius*).

The majority of the study area is stocked with sheep and domestic cattle and moderate numbers of rabbits were noted. These species may compete with native herbivores and may suppress growth of palatable native herbs and grasses.

Patch Sizes and Connectivity

The main patch of eastern tablelands dry forest in the study area is large (see Figure 3) and has excellent connectivity with native vegetation to the west. It would support healthy local populations of a range of native birds, mammals and reptiles including patch-size dependant species such as the speckled warbler. Smaller patches isolated by surrounding pasture and farm structures would support open country bird species and a limited suite of native reptiles and mammals. The development footprint for the pipeline itself is located almost entirely within agricultural land devoid of canopy trees and shrubs. It passes through small patches of acacia scrub and along the edge of eastern tablelands dry forest.

Overall, habitat within the study area is relatively continuous with a large patch of intact woodland and forest to the west. This connectivity would allow the movement of native birds, some reptiles, arboreal mammals and potentially small terrestrial mammals. Land to the north and east features a matrix of patchy open woodland and grassland. These areas have similar habitat value to the study area and would combine to form a large area of habitat suitable for open country and woodland species. Connectivity is good to the south for approximately two km but then is limited by the Hume Highway. Species such as speckled warbler are dependent on large areas of relatively intact vegetation.

The Wollondilly River is less than 200 m from the northern portion of the study area. The riparian corridor features stretches of intact riparian forest alternating with wouldow (*Salix* sp.) infestations and cleared

agricultural land. The riparian zone provides a near-continuous habitat corridor for aquatic species, waterfowl and semi-aquatic, frogs, reptiles and mammals.

5.2.3 Threatened fauna species

Four threatened bird species were observed during GHD (July, September & October 2008) field surveys:

- gang-gang cockatoo *(Callocephalon fimbriatum);*
- glossy black-cockatoo *(Calyptorhynchus lathami);*
- speckled warbler (*Pyrrholaemus saggitatus);*
- powerful owl (*Ninox strenua*).

Two microchiropteran bats listed as vulnerable under the TSC act were tentatively detected by Anabat:

- eastern bentwing-bat *(Miniopterus schreibersii oceanensis*); and
- large-footed myotis *(Myotis macropus).*

Threatened fauna records are shown on Figure 5.

A number of gliders (*Petaurus sp.*) were observed during spotlight surveys. This genus is difficult to identify to species level by spotlight. Several individuals were positively identified by call as sugar glider, however some individuals may have been the squirrel glider which is listed as Vulnerable under the TSC Act.

The desktop review indicates the potential presence of a further 33 threatened fauna species listed under the TSC Act as Wildlife Atlas records in the locality, and/or the EPBC Act and predicted to occur in the local area. The full list of threatened fauna, including their conservation status, habitat requirements, previous records and likelihood of occurrence is presented in Table 7 of Appendix C. A review of the specific habitat requirements of these species, and the habitat present within the study area allowed a number of these species to be eliminated as having low likelihood of occurrence along the proposed pipeline route.

Three threatened bird species (gang-gang cockatoo, diamond firetail and hooded robin) and two threatened microbats (eastern false pipistrelle and eastern bent-wing bat) were recorded near the proposed gas turbine facilities sites during 2007 (URS, 2008). An additional four threatened fauna species (powerful owl, greater broad-nosed bat, eastern bent-wing bat and little bent-wing bat) were recorded less than two km to the northwest in 2005 (PB, 2005). Woodland and forest in the study area provides suitable habitat for these species.

Therefore total of eight species were considered to have a high likelihood of occurrence within the study area based on the presence of suitable foraging and roosting habitat and recent records in the local area:

- masked owl *(Tyto novaehollandiae*);
- squirrel glider *(Petaurus norfolcensis);*
- diamond firetail *(Stagonopleura guttata*);
- hooded robin *(Melanodryas cucullate*);
- eastern false pipistrelle *(Falsistrellus tasmaniensis*);
- eastern bentwing-bat *(Miniopterus schreibersii oceanensis*);
- little bentwing-bat *(Miniopterus australis);* and
- greater broadnosed bat *(Scoteanax ruepellii).*

A further five species may utilise habitats within the study area on an occasional or opportunistic basis and are presented below:

- large-eared pied bat *(Chalinolobus dwyeri);*
- brown treecreeper *(Climacteris picumnus);*
- swift parrot *(Lathamus discolour);*
- barking owl *(Ninox connivens);* and
- spotted-tailed quoll *(Dasyurus maculatus).*

However, the pipeline would not remove significant habitat for any of these species, as the majority of the pipeline would occur within land already cleared of canopy trees and shrub layer, and significant areas of habitat for these species exists within the study area and would not be impacted.

5.3 Threatening processes

A 'key threatening process' (KTP) is defined under the TSC Act as 'a threatening process specified in Schedule 3' of the Act. A 'threatening process' is defined as 'a process that threatens, or may have the capability to threaten the survival or evolutionary development of species, populations or ecological communities'.

The following KTPs are currently operating within the study area:

- Predation by the European red fox;

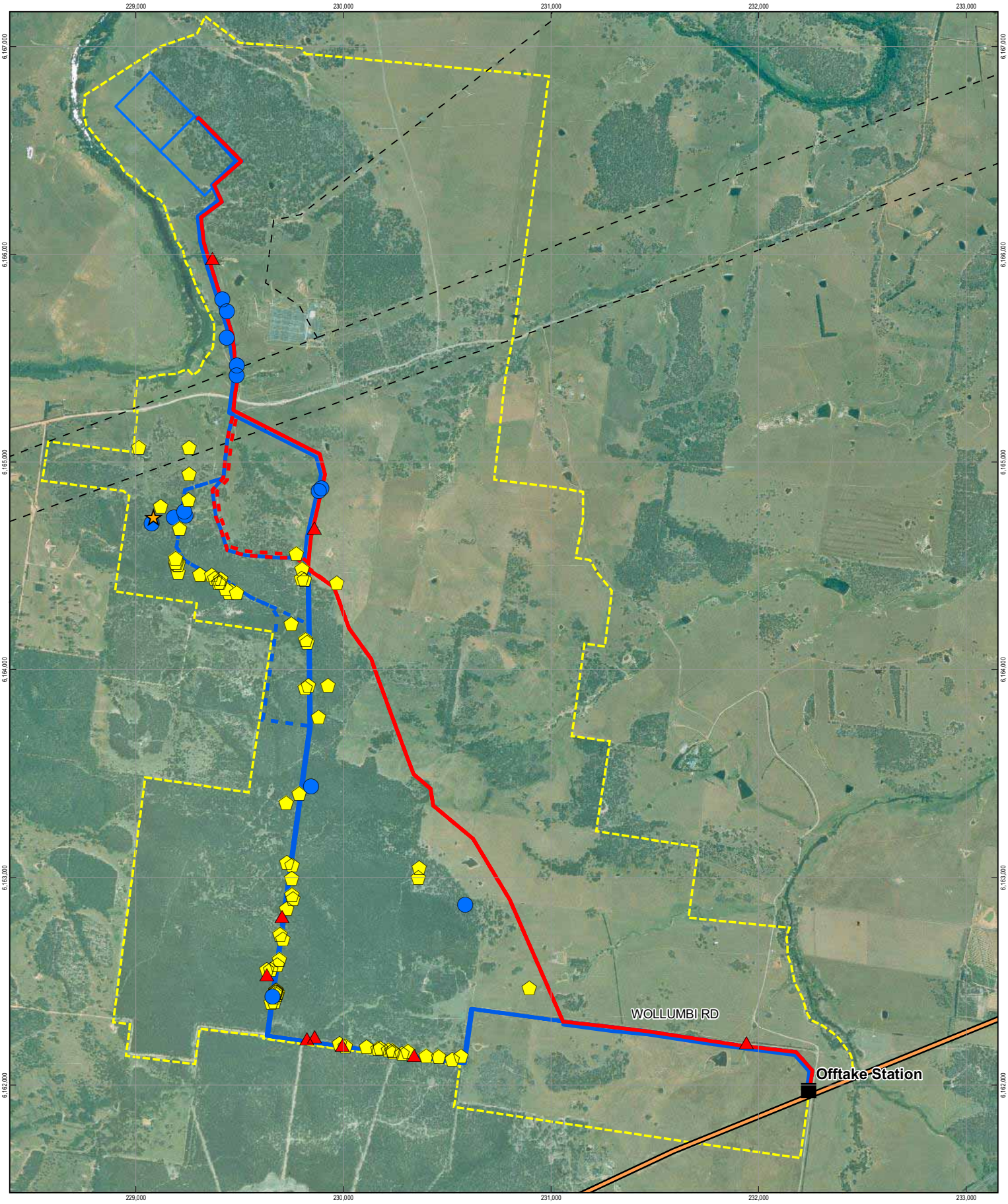
The following KTPs would have operated previously, given the modified vegetation communities present within the study area:

- Clearing of native vegetation;
- Invasion of native plant communities by exotic perennial grasses;
- Loss of hollow-bearing trees; and
- Removal of dead wood and dead trees.

The proposed activity would directly contribute to the operation of two KTPs:

- Clearing of native vegetation; and
- Removal of dead wood and dead trees.

The extent and severity of the operation of these processes is described in Section 6.5.



Legend

- Offtake Station
- Cave
- Rock outcrop
- Habitat tree
- Drainage line
- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative
- Powerlines
- Moomba Sydney Gas Pipeline
- Plant Foot print

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0 125 250 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Figure 4

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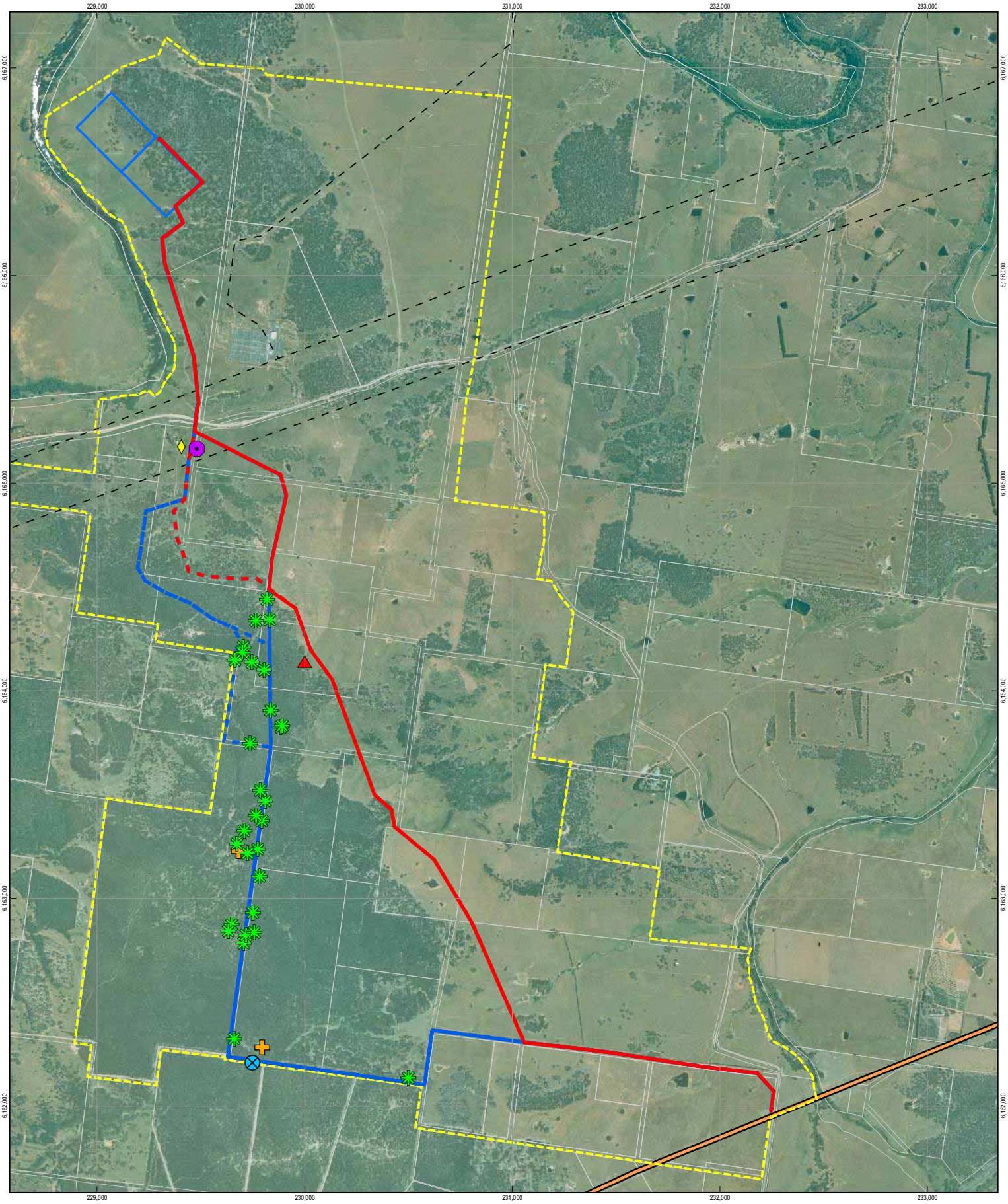

Legend

- Large- footed Myots (tentaive record)
- Eastern Bent Wing Bat
- Speckled Warbler
- Glossy Black Cockatoo, Preferred feed Tree
- Powerful owl
- Gang-gang Cockatoo
- Plant Foot print
- Gas Pipeline Corridor
- Sydney Moomba Gas Main
- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative

1:17,000 (at A3)

0 87.5 175 350 525 700

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Thereatened Species

Figure 5

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6. Impact Evaluation

This section assesses the potential impacts of the proposal during construction and operation on the flora and fauna of the study area.

6.1 Conservation Significance

6.1.1 Threatened Flora Species

The proposed development would not directly impact any known populations of threatened flora species, although may remove habitat for buttercup doubletail and button wrinklewort. Other threatened flora may occur within the study area in association with remnant forest and woodland, but these areas are not expected to be directly impacted by the proposed pipeline.

An assessment of impacts on threatened flora was conducted (see Appendix D). This assessment determined that the proposed development is unlikely to significantly adversely affect potential habitat for these two species within the study area for the following reasons:

- These species have not been previously recorded within the locality (ten km radius);
- Secondary grassland is not preferred habitat for these species, although they may occur in secondary grassland;
- The majority of the study area has undergone long-term grazing and these species would struggle to persist;
- Any potential habitat that may be impacted would be restored using existing topsoil and maintained as grazing land; and
- Significant alternative habitat would be retained at the study area including secondary grassland and preferred habitat in the form of forest and woodland.

6.1.2 Threatened Fauna Species

The proposed development would temporarily remove foraging habitat for the diamond firetail and marginal sheltering habitat for the striped legless lizard. It would also affect habitat adjacent to forest utilised by the glossy-black cockatoo, gang-gang cockatoo, speckled warbler and powerful owl. An assessment of impacts on threatened fauna was conducted (see Appendix D). This assessment determined that the proposed development is unlikely to significantly adversely affect potential habitat for threatened birds within the study area for the following reasons:

- These species are highly mobile;
- Habitat to be removed is marginal and substantial alternative habitat exists within the study area and locality;
- Habitat to be removed would be re-instated; and
- No roosting or breeding habitat would be removed.

The proposed development is unlikely to significantly adversely affect potential habitat for the striped legless lizard within the study area for the following reasons:

- This species was not identified despite targeted searches;

- This species has not been previously recorded within the locality;
- Mitigation measures include pre-clearance surveys when any reptiles identified within areas of impact would be relocated; and
- Habitat features for this species would be retained and re-instated adjacent to the proposed pipeline.

The proposed pipeline is unlikely to significantly adversely affect potential habitat for threatened microchiropteran bats within the study area for the following reasons:

- These species are highly mobile;
- Habitat to be removed is marginal and substantial alternative habitat exists within the study area and locality;
- Habitat to be removed would be re-instated; and
- No roosting or breeding habitat would be removed.

6.1.2 Endangered Ecological Communities

Two endangered ecological communities (EECs) occur within the vicinity of the study area:

- White Box, Yellow Box, Blakely's Red Gum woodland endangered ecological communities (TSC Act); and
- White Box, Yellow Box, Blakely's Red Gum and derived native grassland critically endangered ecological community (EPBC Act)

The proposed main eastern pipeline and the proposed alternative through Lot 153 would involve clearing of derived native grassland associated with this EEC (see Figure 3). An assessment of impacts associated with the proposed development on EECs has been undertaken (see Appendix D). The outcome is that if mitigation measures ensuring that no canopy trees associated with this community are removed and appropriate re-establishment of native grassland areas is conducted then the proposed pipeline is unlikely to result in a significant impact on these communities.

6.2 Vegetation Clearing and Construction Impacts

6.2.1 Flora

The proposed main eastern route is located almost entirely within agricultural land devoid of canopy trees and shrubs. It passes through small patches of Acacia Scrub and along the edge of Eastern Tablelands Dry Forest. A total of 13 hectares of clearing would be required including approximately one ha of remnant vegetation.

The alternative route through Lot 153 may impact on some remnant vegetation including approximately 2 ha Eastern Tablelands Dry Forest and Acacia Scrub, however, the majority of the route is located within agricultural land devoid of canopy trees and shrubs. A total of 13 hectares of clearing would be required including approximately two ha of remnant vegetation. Impacts to remnant vegetation would be rehabilitated.

6.2.2 Fauna

Native vegetation within the proposed pipeline footprint is shown on Figure 3 and threatened fauna and important habitat resources on Figure 4**.** The removal of these resources may impact fauna within the study area. The magnitude of these impacts is assessed below.

A considerable abundance and diversity of native bird species occupy the study area and would be impacted by the removal of native vegetation and other habitat resources, however, the majority of these species are mobile, widespread and common. Further, there are large quantities of equivalent habitat and resources in the locality and so it is likely that the impact on local populations of native birds would be minor.

Arboreal mammals occur in areas of eastern tablelands dry forest and these areas would not be impacted as a result of the proposed pipeline. A number of microchiropteran bats were recorded within the study area, however, the impacts associated with the pipeline would be unlikely to substantially affect habitat of relevance for any of these species. Mitigation measures outlined in Section 7 are likely to ameliorate impacts on these species.

The pipeline may directly impact active wombat burrows which would need to be identified and any resident wombats carefully relocated. Mitigation measures outlined in Section 7 are likely to ameliorate impacts on these species.

A moderate diversity and abundance of native frogs and reptiles are likely to occupy the study area. Species recorded during field surveys were widespread and common (Cogger, 1996). It is likely that individuals would be killed or displaced during clearing, particularly species which burrow or shelter beneath woody debris. Mitigation measures outlined in **Section 7** are likely to ameliorate these impacts. These include: a pre-clearance survey and relocation of individuals where practicable; and careful removal of large woody debris and placement within adjoining areas. The loss of habitat is likely to have a minor impact on local populations of these species given the large areas of native vegetation and other resources in the vicinity of the study area.

There would be moderate, ongoing impacts on fauna utilising adjacent areas of habitat during construction associated with noise and other disturbances. Impacts are likely to be minor as construction would only occur during daylight hours and would be temporary. There are already disruptive human activities in the vicinity of the study area associated with agriculture. Larger, more mobile fauna currently occupying the study area are likely to be adapted to these disturbances. There would be impacts upon smaller, less mobile fauna in the immediate vicinity of the proposed works.

6.3 Indirect and Operational Impacts

Sediments and runoff

The Construction Environmental Management Plan (CEMP) would include safeguards and mitigation measures to minimise potential impacts from additional runoff and associated erosion and transfer of sediments. Assessment of impacts based on soils assessment and residual impacts after mitigation measures would be finalised in the detailed design stage.

Groundwater and hydrology

Detailed design of the proposed gas pipeline and the CEMP would include safeguards and mitigation measures to minimise the impacts on surface and groundwater flow regimes

The study area contains a number of sensitive receptors which could be impacted by changes to surface and groundwater flows, including:

- The Wollondilly River, down slope and approximately 200 m from the northern portion of the pipeline route;
- Three ephemeral drainage lines traversed by the pipeline route;
- Ephemeral wetlands in grassland adjacent to the pipeline route; and
- A number of farm dams across and down slope from the pipeline route.

Assessment of impacts based on hydrological assessment and residual impacts after mitigation measures would be finalised in the detailed design stage.

6.4 Long Term Impacts

The construction phase of the proposed activity would take approximately 3 to 4 months. After construction remediation of the pipeline route would be undertaken as described in Section 7.2.

Long-term impacts on native fauna would include the loss of ecological functions and habitat resources that take a long time to develop. These include:

- Mature hollow-bearing trees;
- Feed trees, since trees must reach full sexual maturity to produce large volumes of blossom and fruit;
- Structurally diverse vegetation, with a number of age classes and mature emergents; and
- A healthy soil seed bank, with sufficient number and diversity of propagules to allow the native vegetation to regenerate following disturbances such as bushfire.

Provided the mitigation measures outlined in **Section 7** are adopted; in particular the remediation of the pipeline route, the project is unlikely to result in permanent or irreversible impacts on native biodiversity

6.5 Threatening processes

The proposal would contribute to the operation of the following KTPs:

- Clearing of native vegetation; and
- Removal of dead wood and dead trees.

The proposal would remove a small number of dead Parramatta green wattle none of which comprised stags or hollow-bearing habitat trees. The proposal would disturb a small amount of fallen dead trees within the construction footprint. In line with the groundcover clearance protocol outlined in Section 7.2.8 this timber would be replaced intact in adjacent areas of native vegetation. Although this would result in short term impacts on resident fauna the habitat value of the timber would be retained and so this measure would mitigate against the operation of the KTP.

The following KTPs may also be of relevance to the proposed activity:

- Invasion and establishment of exotic vines and scramblers;
- Invasion of native plant communities by exotic perennial grasses; and
- Infection of native plants by *Phytophthora cinnamomi.*

Provided the soil and weed management measures outlined in Section 7 are followed, the proposed activity would not result in the operation of, or increase the impact of, any of these KTPs. The likelihood of these KTPs operating is also minimised by the limited extent and duration of the proposed works.

6.6 Matters of NES

A number of EPBC Act listed threatened species have previously been recorded or are predicted to occur in the locality (DEWHA 2008). EPBC Act listed threatened species with the potential to occur within the study area include:

- striped legless lizard (*Delma impar*);
- button wrinklewort (*Rutidosis leptorrhynchoides*); and
- buttercup doubletail (*Diuris aequalis*).

These species were assessed using relevant Significant Impact Criteria (Appendix E). The EEC 'Box-Gum Woodland' was recorded in the study area, and may be impacted by the prposed alternative route through Lot 152, and was also assessed using relevant Significant Impact Criteria (Appendix E).

7. Mitigation

7.1 Avoidance of Impacts

7.1.1 Project location

Where possible, direct impacts on remnant forest and woodland have been avoided by strategic placement of the pipeline route. Only small patches of degraded edge habitat would be impacted by the proposal.

7.2 Mitigation of Impacts

7.2.1 Planning

A CEMP, Operational Environment Management Plan (OEMP) and rehabilitation plan would be developed for the proposed pipeline route in consultation with an appropriately qualified ecologist and would include the mitigation measures outlined in the following sections

7.2.2 Construction techniques

The majority of the proposed pipeline route traverses cleared agricultural landscapes with little conservation value. Accordingly it is appropriate to use the most efficient and cost-effective construction techniques. This would involve using large excavators and other machinery impacting on a construction corridor of 20 metres. Through ecologically sensitive sections of the route low-impact construction techniques would be used. This would involve the use of smaller excavators and stockpiling of materials and fill away from the immediate excavation area. Low-impact construction techniques would restrict direct construction impacts to a corridor of 10 metres. This would reduce the overall extent of native vegetation and habitat resources removed by the proposed activity.

7.2.3 Soil Erosion / Runoff

The CEMP would contain detailed safeguard measures to reduce soil erosion and pollutant run-off during both construction and operation phases.

7.2.4 Dust

Appropriate construction and operational mitigation measures must be incorporated into the final detailed design to minimise the generation of dust and associated impacts on adjacent natural environments. These are likely to include:

- Setting maximum speed limits for construction and operational traffic within the study area to limit dust generation; and
- Use of a water tanker or similar to spray unpaved roads during construction and operation where required.

7.2.5 Pre-clearance Survey

A detailed pre-clearance survey by a qualified ecologist would be required prior to any pipeline construction. This would involve:

- Diurnal searches for birds, nests and roosts;

- Active searches for reptiles, including checking of woody debris and rocks/outcrops within the construction footprint,
- Active searches for micro bats, including checking under exfoliating bark; and
- Nocturnal surveys, including stag-watching of identified habitat trees, specifically focusing on observing use of trees by micro bats.

This survey would focus on locating individuals, and especially roosts of threatened species.

If nests or nestlings of threatened species are observed within, or close to, the development footprint then construction would be postponed until the nestlings have hatched and fully-fledged. If construction constraints mean that this delay is not practicable then DECC would be consulted to determine if relocating the species is acceptable.

7.2.6 Tree Fauna Management

A plan for the management of tree dwelling fauna is required as the proposal involves the removal of a small number of mature trees. No important habitat trees (>40 cm diameter breast height or any trees with hollows) would be removed, however, birds and arboreal mammals may feed or roost in those trees that are to be removed. Further, nesting birds were observed in the development footprint during field surveys and would potentially occupy the study area during construction. Due care during clearing is recommended to reduce direct impacts to any tree dwelling fauna species which may be utilising the area. The CEMP would detail procedures for a pre-clearance survey and fauna management including the following points:

- Trees would be monitored for fauna before and during clearing operations;
- Trees with resident fauna would be avoided as far as is practicable;
- Hollow-bearing trunks and branches would be carefully sawn and placed intact in adjacent areas of native vegetation; and
- Replacement habitat, such as nest boxes, would be provided where habitat trees are to be removed.

7.2.7 Ground-dwelling Fauna Management

A plan for the management of impacts to ground-dwelling fauna – in particular reptiles utilising rocky areas and active wombat burrows - is required as the proposed pipeline is likely to directly impact some active burrows. The CEMP would detail procedures for a pre-clearance survey and fauna management including the following points:

- Engage a suitably qualified ecologist to identify active wombat burrows that may be impacted by the proposal;
- Advise on suitable precautions to be exercised during excavation in and around wombat burrows; and
- Engage a suitably qualified ecologist to identify and re-locate any reptiles sheltering in rocky areas outcrops that would be directly impacted by the pipeline.

7.2.8 Groundcover Clearance Protocol

Groundcover substrate, in particular, large woody debris provides important habitat for native fauna, including threatened species. A groundcover clearance protocol would be incorporated into the CEMP to mitigate the project's impacts. It is recommended that the protocol involve the following steps:

- Remove large woody debris and rock fragments using excavator grabs or manual handling if practicable;

- Place intact large woody debris and rock fragments within adjacent areas of intact vegetation;
- Scrape and stockpile leaf litter and topsoil separately from deeper fill material; and
- Reuse leaf litter and topsoil in remediation works.

7.2.9 Timing of construction works

Where feasible, construction works would aim to be conducted in areas of forest and woodland to avoid the breeding season of threatened species identified at the site. Details of any timing of works would be outlined in the CEMP for the site.

7.2.10 Protection of Endangered Ecological Communities

The proposed alternative eastern pipeline route may impact on derived native grassland associated with the EEC Box-Gum Woodland depending on final route selection. If either of these routes becomes the final route option the following measures are recommended to mitigate potential impacts on these areas:

- No canopy trees should be impacted by the proposal; the pipeline should be placed to provide as large an area of clearance between EECs and the pipeline as possible;
- Areas should be fenced to clearly demarcate the vegetation;
- Areas of adjacent grassland should be rehabilitated as detailed in Section 7.2.11 Remediation below; and
- Weeds should be managed both within and adjacent to areas of EEC to ensure there is no decline in quality within these communities.

If these measures are undertaking it is not expected that any areas of EEC within the study area are likely to be adversely impacted by the proposal.

7.2.11 Site Management

The following mitigation measures are recommended in order to minimise operational impacts of the proposed pipeline:

- Setting maximum speed limits during construction within the study area to reduce the risk of fauna road fatalities; and
- Limit vehicular and personnel entry into adjacent remnant vegetation during construction through appropriate marking of operational areas.

7.2.12 Phytophthora Management

Phytophthora cinnamomi (phytophthora) is a soil borne pathogen that spreads in plant roots in warm, moist conditions. Phytophthora infects a large range of species resulting in a range of symptoms including reduced health or plant death, though some plants show no apparent symptoms. Phytophthora may contribute to plant death when plant health is exacerbated by other stresses (e.g. waterlogging, drought, and wildfire) (DEC 2005).

Hygiene measures to prevent the introduction or spread of the pathogen during the construction and operational phases of the development incorporated into the CEMP.

7.2.13 Remediation

The original topsoil would be retained and stockpiled to assist in remediation of the pipeline route. All supplementary plantings would utilise indigenous native species of local provenance. The proposed pipeline route contains fallen timber that is likely to constitute an important habitat resource for native fauna. It is recommended that timber within the development footprint be carefully replaced in areas of intact vegetation adjacent to the study area.

The health of revegetated areas would be monitored closely and supplementary watering supplied as appropriate. Revegetated areas would be monitored for weed infestation and any infestations actively managed to minimise further weed spread.

7.2.14 Weed and Pest Management

To limit the spread of weeds into adjoining remnant vegetation all operational areas would be temporarily fenced. This would be done prior to construction, restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill or vegetation would not be placed in areas of adjoining remnant vegetation but instead within existing cleared areas.

A Weed And Pest Management Plan would be prepared as part of the Construction Environmental Management Plan and Operation Environmental Management Plan for the study area.

It is recommended that the following measures be adopted to manage environmental weeds during construction and operation of the study area:

- Perform a baseline weed survey to assess the extent and severity of weed infestation in extant native vegetation within the study area pre and post construction;
- Incorporate control measures in the design of the proposed development to limit the spread of weed propagules downstream of the study area;
- During construction undertake maintenance of silt fences and other mitigation measures to isolate runoff; and immediately rehabilitate disturbed vegetation to limit the potential for colonisation by weeds;
- During construction areas of vegetation that would not be cleared would be fenced, restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill would not be placed in areas of remnant vegetation but instead in adjacent cleared areas;
- Post-construction landscape any open areas with indigenous native vegetation to limit the potential for colonisation by weeds;
- During operations monitor and control noxious weed species in line with legislative obligations;
- Ensure refuse is adequately disposed of to avoid attracting vermin and other pest species;
- Perform ongoing monitoring of weed infestation on and adjoining the study area utilising the baseline weed survey of the study area and its surrounds.

7.3 Offsetting of Impacts

The location of the proposed pipeline has been deliberately set to avoid impacts on important stands of native vegetation. Any areas of native and introduced pasture would be re-instated once construction works are complete. The proposal deliberately aims to avoid and mitigate impacts on native flora and fauna. As such, the proposal is unlikely to result in any significant long-term impact on native flora and fauna and an offset is not considered to be required.

8. Conclusion

8.1 Key Thresholds

Pursuant to DEC (2005) assessment guidelines development applications under Part 3A must contain a justification of the preferred option based on the following key thresholds.

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts would maintain or improve biodiversity values.

Specific impact mitigation and environmental management measures have been recommended for implementation to increase the certainty of the long term maintenance of the biodiversity values of the proposed pipeline during construction and operation of the proposal. The proposal specifically aims to avoid direct clearing of vegetation along the majority of the route. Retention and reuse of topsoil would ensure native grassland / pasture is retained along the pipeline route. Weed management measures may improve pasture areas impacted by the proposal.

Whether or not the proposal is likely to reduce the long-term viability of a local population of any threatened species, population or ecological community.

It was determined that the proposal is unlikely to impact significantly on the long-term survival of populations of threatened species recorded or those that could potentially occur along the proposed pipeline route, based on the limited areas being cleared in comparison to the total site and the maintenance of connectivity. Extensive areas of similar potential habitat within the remainder of the study area would be retained. Retained vegetation would remain intact and contiguous with large areas of surrounding native vegetation that contain areas of known and potential habitat for threatened species. These areas would not be significantly impacted.

Whether or not the proposal is likely to accelerate the extinction of any species, population or ecological community or place it at risk of extinction.

The proposed pipeline is considered highly unlikely to accelerate the extinction of threatened species given:

- The limited areas being cleared in comparison to total study area;
- Most valuable habitat within the study area (areas of forest and woodland) would not be directly impacted except the removal of some vegetation from a small portion of edge habitat;
- A large area of retained potential habitat, the maintenance of connectivity within the study area and with extensive areas of similar and suitable habitat in surrounding areas; and
- The proposed development is highly unlikely to inhibit the movement of migratory or nomadic fauna along recognised corridors or linkages in the locality or region; and
- Whether or not the proposal would adversely affect critical habitat.

No listed critical habitat would be removed or adversely affected as a result of this proposal.

8.2 Summary

The proposed eastern pipeline route has been designed to minimise environmental impact to the largest extent possible, and where impacts are unavoidable, mitigation measures have been proposed that are considered likely to be successful in protecting native biota and in particular threatened species and communities. No threatened species are likely to be significantly affected by the proposal. No vegetation or habitat would be isolated or fragmented by the proposal. The proposal successfully meets the required "improve or maintain" test in that vegetation communities and fauna habitats would be maintained at the study area. Mitigation measures would also aim to improve current conditions in that noxious and other weeds would be managed at the study area.

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Appendix A

Flora Species List

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
ADIANTACEAE	*Cheilanthes sp*			x		x	x		x		x				x		x		x		x		x		x
APIACEAE	*Centella asiatica*				x							x		x	x	x	x						x	x	x
APIACEAE	*Hydrocotyle laxiflora*	Stinking Pennywort																			x				
ASTERACEAE	*Arcotheca calendula*	Cape Weed												x											x
ASTERACEAE	*Carthamus lanatus**	Saffron Thistle			x						x			x											
ASTERACEAE	*Cassinia aculeata*																					x			x
ASTERACEAE	*Chrysocephalum apiculatum*	Yellow Buttons							x	x	x														x
ASTERACEAE	*Cirsium sp*	A Thistle					x																		
ASTERACEAE	*Conyza sp**	Fleabane	x					x						x									x		x
ASTERACEAE	*Cotula australis*	Carrot Weed					x				x	x		x											x
ASTERACEAE	*Cymbonotus sp.*	Bear's Ear										x		x		x	x						x		x
ASTERACEAE	*Euchiton*	Cud Weed	x	x	x			x	x	x				x		x							x		x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
AE	*sphaericus*																								
ASTERACEAE	*Gamochaeta americanum**	Cud Weed	x			x																			
ASTERACEAE	*Hypochoeris radicata**	Cat's Ear	x	x						x		x		x	x					x			x	x	
ASTERACEAE	*Olearia microphylla*																							x	
ASTERACEAE	*Olearia viscidula*											x									x		x		
ASTERACEAE	*Onorpordum acanthium**	Scotch Thistle										x		x		x				x				x	
ASTERACEAE	*Ozothamnus diosmifolius*	Dog Wood		x								x				x					x		x	x	
ASTERACEAE	*Sonchus olearaceus*	Milk Thistle																							
ASTERACEAE	*Taraxacum officinale*	Dandelion				x		x	x															x	
ASTERACEAE	*Xerochrysum sp*	Everlasting																						x	
BRASSICAEAE	*Capsella bursa-pastoris*	Shepherd's Purse												x											
BRASSICAEAE	*Lepdium sp*	A Cress												x											
BRASSICA	*Raphaneus*	Wild Radish												x											

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
EAE	*raphanistrum*																								
CACTACEAE	*Opuntia sp*	Prickly Pear															x								
CARYOPHYLLACEAE	*Cerastium glomeratum**	Mouse Ear Chickweed												x									x		
CARYOPHYLLACEAE	*Paronychia brasiliana*	Brazilian Whitlow									x			x											
CARYOPHYLLACEAE	*Polycarpon tetraphylla*	Four-leaf Allseed					x				x														
CARYOPHYLLACEAE	*Scleranthus diander*																			x					
CASUARINACEAE	*Allocasuarina littoralis*	Black Sheoak		x	x	x	x												x			x	x	x	x
CASUARINACEAE	*Casuarina cunninghamiana*	River Sheoak	x											x				x							
CHENOPODACEAE	*Einadia hastata*	A Salt Bush										x													
CHENOPODACEAE	*Einadia nutans ssp nutans*	Climbing Saltbush	x																			x			x
CLUSIACEAE	*Hypericum perforatum**	St Johns Wort									x														
CONVOLVULACEAE	*Dichondra repens*	Kidney Weed				x	x				x										x				

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
CYPERACEAE	*Cyperus congestus**										x														
CYPERACEAE	*Cyperus imbecillis*		x																						
CYPERACEAE	*Lepidosperma gunni*					x																x	x		
DENNSTAEDTIACEAE	*Pteridium esculentum*	Bracken			x	d		d			x									x		x	x		
DILIENIACEAE	*Dampiera purpurea*																					x		x	
DILIENIACEAE	*Hibbertia acicularis*																						x		
DILIENIACEAE	*Hibbertia empetrifolia*										x												x		
DILIENIACEAE	*Hibbertia obtusifolia*	Hoary Guinea Flower		x	x	x					x					x	x		x			x			
DROSERACEAE	*Drosera sp*																						x	x	
DRYOPTERIDACEAE	*Polystichum sp*	Broad Shield Fern									x														
ERIACEAE	*Astroloma humifusum*	Native Cranberry		x	x	x					x				x	x								x	
ERIACEAE	*Brachyloma*																	x					x	x	

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
	daphnoides																								
ERIACEAE	*Epacris pulchella*										x														
ERIACEAE	*Lissanthe strigosa ssp subulata*	Peach Heath																			x				
ERIACEAE	*Melichrysus urceolatus*					x	x				x				x	x	x	x							
FABACEAE	*Aotus ericoides*																								x
FABACEAE	*Bossiaea buxifolia*																					x			
FABACEAE	*Daviesia leptophylla*																								x
FABACEAE	*Dillwynia sericea*																								x
FABACEAE	*Glycine microphylla*																						x		
FABACEAE	*Glycine tabacina*																			x		x	x		
FABACEAE	*Hardenbergia violacea*	Purple Coral Pea																x				x	x		x
FABACEAE	*Hovea heterophylla*														x						x				

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
FABACEAE	*Indigofera autralis*	Austral Indigo																				x		x
FABACEAE	*Jacksonia scoparia*	Jacksonia														x		x						x
FABACEAE	*Mirbelia rubifolia*																							x
FABACEAE	*Mirberlia platylobioides*																							
FABACEAE	*Pultenaea scabra*																						x	
FABACEAE	*Trifolium repens*	White-flowering Clover										x												x
FABACEAE	*Trifolium subbterraneum**	Subterrnean Clover				x				x	x			x										
GENTIANACEAE	*Centaurium erythraea**	Common Centaury		x		x																x		
GERANIACEAE	*Erodium cicutarium**	Common Storksbill												x										
GOODENIACEAE	*Goodenia hederacea*	Ivy-leaved Goodenia		x		x										X			x		x	x		
HALOGORACEAE	*Gonocarpus tetragynus*			x		x				x					x		x		x			x		x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
HALOGORACEAE	*Gonocarpus teucrioides*	Rasp Wort		x							x														
IRIDACEAE	*Romulea rosea*	Onion Grass												x											
JUNCACEAE	*Juncus continuus*					x	x	x		x	x														x
LILIACEAE	*Patersonia sericea*																						x		x
LILIACEAE	*Wahlenbergia gracilis*	Bluebell																			x			x	x
LILIACEAE	*Wahlenbergia sp*	Bluebell		x																		x			
LILIACEAE	*Wahlenbergia stricta*	Bluebell																				x			
LILIACEAE	*Wurmbea dioica*																								x
Loganaceae	*Mitrasacme polymorpha*																								x
LOMANDRACEAE	*Lomandra filiformis*	A Mat-rush		x					x		x				x	x	x		x			x	x		x
LOMANDRACEAE	*Lomandra longifolia*	Spiny-headed Mat-rush																	x					x	
LOMANDR	*Lomandra*	Many-flowering																				x	x		x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
ACEAE	*multiflora*	Mat-rush																							
LOMANDRACEAE	*Lomandra obliqua*																						x	x	
MALVACEAE	*Malva parvifloa*													x											
MALVACEAE	*Modiola caroliana**	Small-flowering Mallow									x			x											
MIMOSOIDEAE	*Acacia brownii*																				x		x	x	
MIMOSOIDEAE	*Acacia implexa*													x											
MIMOSOIDEAE	*Acacia obtusifolia*																							x	
MIMOSOIDEAE	*Acacia paradoxa*	Kangaroo Thorn																x					x		
MIMOSOIDEAE	*Acacia parramattensis*	Parramatta Green Wattle	x		d	d	d								x		x		x			x			x
MIMOSOIDEAE	*Acacia terminalis*	Sunshine wattle																					x		
MYRSINACEAE	*Anagallis arvensis*	Scarlet Pimpernel									x														
MYRTACEAE	*Calytrix tetragona*																				x				

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
MYRTACEAE	*Eucalyptus agglomerata*	Blue-leaved Stringybark		x											d	x			x			x		x	
MYRTACEAE	*Eucalyptus amplifolia*	Cabbage Gum							x			x			d		d						x		x
MYRTACEAE	*Eucalyptus bridgesiana*	Apple Box							x					x				x							
MYRTACEAE	*Eucalyptus cinerea*	Argyle Apple									x			x									x	x	
MYRTACEAE	*Eucalyptus eugenoides*	Brown Stringybark										x			d	x							x	x	
MYRTACEAE	*Eucalyptus mannifera ssp mannifera*	Brittle Gum																					x	x	
MYRTACEAE	*Eucalyptus melliodora*	Yellow Box															d	x							
MYRTACEAE	*Eucalyptus pauciflora*	Snow Gum							d		x			x	d										x
MYRTACEAE	*Eucalyptus piperita*	Sydney Peppermint												x				x							
MYRTACEAE	*Eucalyptus punctata*	Grey Gum																				x		x	x
MYRTACEAE	*Eucalyptus rossi*	Scribbly Gum																	x						x
MYRTACEAE	*Eucalyptus rubida ssp*	Candlebark									x			x			d	x						x	x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
AE	*rubida*																								
MYRTACEAE	*Eucalyptus sieberi*	Silvertop Ash																				x	x	x	
MYRTACEAE	*Kunzea parvifolia*	Violet Kunzea		x		x											x	x						x	
MYRTACEAE	*Leptospermum trinervium*									x													x		
MYRTACEAE	*Leptospermyum myrtifolium*	Grey Tea-tree									x							x					x	x	
ORCHIDACEAE	*Caladenia sp*																	x							
ORCHIDACEAE	*Diuris chryseopsis*	Golden Moths																x							
OXALIACEAE	*Oxalis sp*	Oxalis									x											x		x	
PHORMIACEAE	*Dianella sp*																						x	x	
PHORMIACEAE	*Stypandra glauca*	Nodding Blue Lily																					x		
PHYLLANTHACEAE	*Poranthera microphylla*																							x	
PHYTOLACCEACEAE	*Phytolacca octandra**	Ink Weed			x																				
PITTOSPO	*Billardiera*																				x		x	x	

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
RACEAE	*scandens*																								
PLANTAGINACEAE	*Plantago gaudichaudii*																								
PLANTAGINACEAE	*Plantago lanceolata**	Plantain	x											x			x								x
PLANTAGINACEAE	*Veronica calycina*	Hairy Speedwell													x	X									
PLANTAGINACEAE	*Veronica sp*	Speedwell																				x	x		x
POACEAE	*Anthoxanum ororatum**	Sweet Vernal Grass				x					x														
POACEAE	*Aristida calycina var calycina*	A Wire Grass	d	d	x	x					x				x	x	x								x
POACEAE	*Aristida ramosa var speciosa*	A Wire Grass	d	d	d	d	x		x	d	x				x	x							x		x
POACEAE	*Aristida sp*	A Wire Grass	x			x															x				
POACEAE	*Austrodanthonia racemosa var racemosa*	A Wallaby Grass			x																				x
POACEAE	*Austrodanthonia tenuoir*	A Wallaby Grass	x	x			x					x				x	x						x		x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
POACEAE	*Austrostipa densiflora*	A Spear Grass	x				x	x	d			x		x								x	x		
POACEAE	*Bothriochloa macra*	Red-leg Grass	x		x			x																	
POACEAE	*Bromus catharticus*	Prairie Grass																					x		
POACEAE	*Cynodon dactylon**	Couch	x				x							x											x
POACEAE	*Dichelachne micrantha*	Short-haired Plume Grass	x			x	x	x								x									x
POACEAE	*Echinopogon caesapitosus*	Hedgehog Grass		x											x				x		x				x
POACEAE	*Eleusine indica**	Crab Grass									x	x		x											
POACEAE	*Entolasia stricta*	Right-angle Grass																				x		x	
POACEAE	*Eragrostis elongatus*										x														x
POACEAE	*Eragrostis leptostachya*	Paddock Love Grass	x	x		x	x	x	x	x															x
POACEAE	*Holcus lanatus*																								x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
POACEAE	*Imperata cylindrica*	Blady Grass									x														
POACEAE	*Lachnagrostis aemula*	Blown Grass										x													
POACEAE	*Microlaena stipoides*	Weeping Meadow Grass			d		d	d	x			x		x	x	x			x		x	x	x		x	
POACEAE	*Nassella trichotoma* *	Serrated Tussock	d											x		x	x								x	
POACEAE	*Panicum sp*	Panic Grass	x	x	x		x		x					x		x									x	
POACEAE	*Pennisetum clandestinum**	Kikuyu	x																							
POACEAE	*Phalaris aquatica**	Canary Grass									x			x											x	
POACEAE	*Poa sp*																								x	
POACEAE	*Setaria gracilis**	Pigeon Grass	x																							
POACEAE	*Sporobolus elongatus*	Rat's Tail Grass	d						x	d	x														x	
POACEAE	*Themeda australis*	Kangaroo Grass	x			x		x	d	d						x	x								x	
POLYGONACEAE	*Acetosella vulgaris**	Sheep Sorrel		x			x	x		x	x	x		x			x									

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
POLYGONACEAE	*Rumex sp*	A Dock										x		x											
Polytrichaceae	*Dawsonia superba*	Giant Moss																				x	x		
PROTEACEAE	*Banksia marginata*	Silver Banksia																x					x		
PROTEACEAE	*Persoonia laurina*										x														
PROTEACEAE	*Persoonia linearis*																						x		
PROTEACEAE	*Persoonia mollis ssp livens*																								
RANUNCULACEAE	*Clematis aristata*																						x		
RHAMNACEAE	*Cryptandra amara var amara*														x										
RHAMNACEAE	*Pomaderris betulina ssp betulina*	Rusty Pomaderris									x					x							x		x
ROSACEAE	*Acaena sp probably ovina*								x		x														
ROSACEAE	*Rosa rubignosa**	Briar Rose							x		x														

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
ROSACEAE	*Rubus fruticosus aggregate**	Blackberry	x												x									x
RUBIACEAE	*Galium gaudichaudii*		x																					
RUBIACEAE	*Galium propinquum*																				x			x
RUBIACEAE	*Opercularia aspera*	Coarse Stink Weed																						x
RUBIACEAE	*Pomax umbellata*															x	x						x	x
SANTALACEAE	*Exocarpus cuppressiformis*	Cherry Ballart												x										
SOLANACEAE	*Solanum aviculare*	Kangaroo Apple					x																	
SOLANACEAE	*Solanum chenopodioides**	White-tip Nightshade					x																	
SOLANACEAE	*Solanum nigrum**	Blackberry Nightshade									x													
SOLANACEAE	*Solanum prinophyllum*	Forest Nightshade																			x	x	x	
URTICACEAE	*Urtica incisa*	Stinging Nettle					x																	

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Boltezar Q1	Boltezar Q2	Boltezar Q3	Boltezar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
VERBENACEAE	*Verbena bonariensis**	Purpletop									x														
VIOLACEAE	*Viola sp*																								x
XANTHORRHOECEAE	*Xanthorrhoea australis*	Grass Tree																	x						x

Appendix B

Fauna Species List

Table 6 Fauna species list

Scientific Name	Common Name	Observation type
Frogs		
Limnodynastes tasmaniensis	Spotted Grass Frog	Seen
Crinia parainsignifera	Beeping Toadlet	Heard
Crinia signifera	Common Eastern Froglet	Heard
Litoria peroni	Peron's Tree Frog	Heard
Litoria verreauxii	Whistling Tree Frog	Seen
Uperoleia fusca	Dusky Toadlet	Seen
Uperoleia laeviagata	Smooth Toadlet	Heard
Birds		
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Seen
Acanthiza lineata	Striated Thornbill	Seen
Acanthiza nana	Yellow Thornbill	Seen
Acanthiza pusilla	Brown Thornbill	Seen
Acanthiza reguloides	Buff-rumped Thornbill	Seen
Acanthiza sp.	Unidentified Thornbill	Seen
Acanthorhynchus tenuirostris	Eastern Spinebill	Heard
*Acridotheres tristis**	Common Myna	Seen
Aegotheles cristatus	Australian Owlet-nightjar	Heard
Anas gracilis	Grey Teal	Seen
Anas superciliosa	Pacific Black Duck	Seen
Anthochaera carunculata	Red Wattlebird	Heard
Anthus australis	Australian Pipit	Seen
Aquila audax	Wedge-tailed Eagle	Seen
Cacatua galerita	Sulphur-crested Cockatoo	Heard
Cacatua sanguinea	Little Corella	Heard
Cacomantis flabelliformis	Fan-tailed Cuckoo	Heard
Cacomantis variolosus	Brush Cuckoo	Seen
Callocephalon fimbriatum	**Gang-gang Cockatoo**	**Seen**
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	Seen

Scientific Name	Common Name	Observation type
Calyptorhynchus lathami	**Glossy Black-Cockatoo**	**Seen, chewed cones**
Chenonetta jubata	Australian Wood Duck	Seen
Chthonicola sagittata	**Speckled Warbler**	**Seen**
Chrysococcyx basalis	Horsefields Bronze Cuckoo	Seen
Colluricincla harmonica	Grey Shrike-thrush	Heard
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Seen
Corcorax melanorhamphos	White-winged Chough	Seen
Cormobates leucophaea	White-throated Treecreeper	Seen
Corvus coronoides	Australian Raven	Seen
Corvus mellori	Little Raven	Heard
Cracticus torquatus	Grey Butcherbird	Seen
Cuculus pallidus	Pallid Cuckoo	Heard
Dacelo novaeguineae	Laughing Kookaburra	Seen
Dicaeum hirundinaceum	Mistletoebird	Seen
Egretta novaehollandiar	White-faced Heron	Seen
Eolophus roseicapillus	Galah	Seen
Eopsaltria australis	Eastern Yellow Robin	Seen
Falco longipennis	Australian Hobby	Seen
Gallinula tenebrosa	Dusky Moorhen	Heard
Grallina cyanoleuca	Magpie-lark	Seen
Gymnorhina tibicen	Australian Magpie	Seen
Hieraaetus morphnoides	Little Eagle	Seen
Hirundo ariel	Fairy Martin	Seen
Hirundo neoxena	Welcome Swallow	Seen
Lichenostomus chrysops	Yellow-faced Honeyeater	Seen
Lichenostomus leucotis	White-eared Honeyeater	Seen
Lichenostomus penicillatus	White-plumed Honeyeater	Seen
Malurus cyaneus	Superb Fairy-wren	Seen
Manorina melanocephala	Noisy Miner	Seen
Microeca fascinans	Jacky Winter	Seen
Neochmia temporalis	Red-browed Finch	Seen

Scientific Name	Common Name	Observation type	
Ninox strenua	**Powerful Owl**	**Seen**	
Ocyphaps lophotes	Crested Pigeon	Seen	
Pachycephala pectoralis	Golden Whistler	Seen	
Pardalotus punctatus	Spotted Pardalote	Heard	
Pardalotus striatus	Striated Pardalote	Seen	
*Passer domesticus**	House Sparrow	Seen	
Pelecanus conspicillatus	Pelican	Seen	
Petrochelidon sp.	Martin	Nest	
Petroica boodang	Scarlet Robin	Seen	
Philemon citreogularis	Little Friarbird	Seen	
Philemon corniculatus	Noisy Friarbird	Seen	
Platycercus adscitus eximius	Eastern Rosella	Seen	
Platycercus elegans	Crimson Rosella	Seen	
Podargus strigoides	Tawny Frogmouth	Seen	
Poryphyrio poryphyrio	Purple Swamphen	Seen	
Psephotus haematonotus	Red-rumped Parrot	Seen	
Rhipidura fuliginosa	Grey Fantail	See	
Rhipidura leucophrys	Wouldie Wagtail	Seen	
Sericornis frontalis	White-browed Scrubwren	Seen	
Strepera graculina	Pied Currawong	Heard	
*Sturnus vulgaris**	Common Starling	Seen	
Tachybaptus novaehollandiae	Australasian Grebe	Seen	
Taeniopygia bichenovii	Double-barred Finch	Seen	
Todiramphus sanctus	Sacred Kingfisher	Seen	
*Turdus merula**	Eurasian Blackbird	Seen	
Vanellus miles	Masked Lapwing	Heard	
Zosterops lateralis	Silvereye	Heard	
Mammals			
*Bos taurus**	European cattle	Seen	
*Canis lupus**	Dingo, domestic dog	Scat	
Chalinolobus gouldii	Gould's Wattled Bat	Anabat	Definite record

Scientific Name	Common Name	Observation type	
Chalinolobus morio	Chocolate Wattled Bat	Anabat	Definite record
*Equus caballus**	Horse	Seen	
*Lepus capensis**	Brown Hare	Seen	
Macropus giganteus	Eastern Grey Kangaroo	Seen	
Macropus robusta	Wallaroo	Seen	
Macropus rufogriseus	Red-necked Wallaby	Seen	
Miniopterus schreibersii oceanensis	**Eastern Bentwing-bat**	Anabat	**Possible record**
Myotis macropus	**Large-footed Myotis**	Anabat	**Possible record**
Nyctophilus sp.	A Long-eared Bat	Anabat	**Definite**
*Oryctolagus cuniculus**	Rabbit	Seen	
*Ovis aries**	Sheep	Seen	
Petaurus breviceps	Sugar Glider	Seen, heard	
Pseudocheirus peregrinus	Common Ringtail Possum	Seen	
*Sus scrofa**	Pig	Scat	
Trichosurus vulpecula	Common Brushtail Possum	Seen	
Vespadelus darlingtoni	Large Forest Bat	Anabat	Definite record
Vespadelus regulus	Southern Forest Bat	Harp Trap	
Vespadelus vulturnus	Little Forest Bat	Anabat	Definite record
Vombatus ursinus	Common Wombat	Scat, burrow	
*Vulpes vulpes**	Fox	Dead, scat	
Reptiles			
Amphibolurus muricatus	Jacky Lizard	Seen	
Lampropholis sp.	Sunskink	Seen	

* = *introduced species*

bold = *threatened species*

Appendix C

Threatened Species Table

Table 7 Threatened flora and EECs potentially occurring within the study area and likelihood of occurring

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurrence
Endangered Ecological Communities		Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT	EEC	E	Fertile lower parts of the landscape where water and nutrients are abundant but tree growth is limited by other factors. Altitude between 560 and 1200 metres above sea level.	Unlikely to occur within the study area. This community is typified by being historically treeless and this is unlikely to be the case with grassland within the study area. These areas are treeless due to clearing for agriculture.
		White Box - Yellow Box - Blakely's Cabbage Gum Grassy Woodland and Derived Native Grassland	E	CE	Tablelands and western slopes of NSW, typically on fertile substrates in lower parts of the landscape.	Identified within the study area
Flora	**Botanical Name**	**Common Name**	**TSC Act**	**EPBC Act**	**Habitat Requirements**	**Likelihood of Occurrence**
	Baloskion longipipes		V		Dense Cord-rush is a perennial, grass-like herb. It has been recorded from the Kanangra-Boyd area to the Southern Tablelands but all populations are small. Populations have been recorded in Blue Mountains National Park, Kanangra-Boyd National Park, Penrose State Forest (in Hanging Rock Swamp), Morton National Park (The Vines), the Clyde Mountain area and Ballalaba (south of Braidwood). This species is commonly found in swamps or depressions in sandy alluvium, sometimes growing with sphagnum moss. It also occurs in swales within tall forest, and in Black Gum (Eucalyptus aggregata) Woodland. Threats include damage to plants from roadworks and weed spraying. Pigs rooting for food cause direct damage to the species and to the surrounding habitat.	Unlikely. The study area did not include appropriate habitat such as swamps

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurrence
Fabaceae (Faboideae)	*Bossiaea oligosperma*	Few-seeded Bossiaea	V		Erect shrub to 2m tall. The Few-seeded Bossiaea is known from two disjunct areas - the lower Blue Mountains in the Warragamba area and the Windellama area in Greater Argylle Shire, where it is locally abundant. It occurs on stony slopes or ridges on sandstone in the Yerranderie area, and low woodland on loamy soil in the Windellama area. Nothing is known about its ecology but it probably has hard-coated seeds that respond well to fire and soil disturbance. Frequent fire, clearing and habitat loss are the primary threats t this species (DECC 2008).	Unlikely. May occur on slopes in Stringybark Forest but unlikely.
	Caladenia tesselata	Thick-lipped Spider Orchid	E	V	This species of orchid inhabits grassy sclerophyll woodland on clay loam or sandy soils, and low woodland with stony soil. Flowering generally occurs between September and November, however late flowering in September or early October has been recorded in southern populations. This species is known from Sydney (historic records), Wyong, Ulladulla and Braidwood regions in NSW. Kiama and Queanbeyan populations are presumed extinct. Records from the 1930's occur within the Huskisson area. C. tessellata occurs on the coast of Victoria from east of Melbourne to almost the NSW border. Threats to this species include clearing associated with urban development, pedestrian activity associated with recreational use along coastal areas, long-term absence of fire, and events leading to local population extinctions (DEC 2007).	Unlikely. May occur on slopes in Stringybark Forest and patches of woodland. Not identified during Spring Surveys.
	Dillwynia glaucula	Michelago Parrot-pea		E1	This erect shrubs grows to 2.5m and is recorded from three areas on the NSW Southern Tablelands - near Windellama, where the species is locally abundant, north-east of Michelago and at Numeralla. There is potential habitat between the known study areas. Threats include weed invasion, stock grazing, damage during road maintenance/widening and overspray from chemical weed control (DECC 2008).	Unlikely. May occur on slopes in Stringybark Forest and patches of woodland. Unlikely to occur within any areas of impact as only few shrubs occurred and were easily identified.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurrence
Orchidaceae	*Diuris aequalis*	Buttercup Doubletail		E1	This species is a terrestrial "donkey" orchid, and has been recorded in forest, low open woodland with grassy understorey and secondary grasslands on the higher parts of the central and southern tablelands. Threats include habitat loss, roadwork's, rubbish dumping and rural-residential subdivision (DEC 2007)	Possible. May occur on edges of or within existing woodland.
	Diuris tricolor	Pine Donkey Orchid	V		This species is a tuberous terrestrial species, with a flower stalk 20 to 40 cm high, flowering in September and November with bright yellow to orange flowers speckled with red, purple, or white flecks. It is sporadically distributed along the western slopes of NSW, growing in sclerophyll forests among grass, often with native Cypress Pine (Callitris sp.). It is found on sandy soils, and may appear to favour disturbed soils (DEC 2007).	Unlikely. Known associated overstorey species not present within the study area.
Sapindaceae	*Dodonaea procumbens*	Creeping Hop-bush		V	This species of low-spreading shrub occurs in bare patches on sandy-clay soils on or near shale outcrops in Natural Temperate Grassland or Snow Gum (*Eucalyptus pauciflora)* Woodland in the dry areas of the Monaro. Flowering occurs in early spring with fruits forming late spring and early summer. Threats include habitat loss and degradation from clearing for urban and agricultural development, road construction and upgrading, stock grazing, and weed invasion (DEC 2007).	Unlikely. Potential habitat present within the study area, however this species not identified despite targeted searches.
	Eucalyptus aqautica	Broad-leaved Sally			This species of small tree grows to 7 m and occurs on open, swampy flats as scattered individuals in the Penrose area near Goulburn in NSW. Threats include too frequent and hot fire, and localised events leading to population extinctions (DEC 2007).	Unlikely. Known habitat absent from the study area.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurrence
Myrtaceae	*Eucalyptus macarthurii*	Camden Woollybutt		V	This species of tree grows to 40 m and occurs in grassy woodlands on relatively fertile soils on broad cold flats from the Moss Vale District to Kanangra Boyd National Park, and in the southern highlands in the north west part of the Boyd Plateau (DEC 2007: Royal Botanic Gardens & Domain Trust - PlantNET 2007). Threats include habitat loss and degradation through clearing for agricultural and urban development, stock grazing, weed infestation, and localised extinctions due to random natural and human-induced events.	Possible. May occur on edges of existing woodland.
	Eucalyptus recurva	Mongarlowe Mallee	E1		This species of Mallee grows to 4 m and occurs on shallow soils on gentle slopes in low heathland dominated by Stunted She-oak (*Allocasuarina nana*) and Finger Hakea (*Hakea dactyloides*), and at the margins of adjacent low woodland dominated by Brittle Gum (*Eucalyptus mannifera*) and Snow Gum (*E. pauciflora*). This species is confined to the NSW Southern Tablelands where it is known from only four locations between Mongarlowe and Windellama. Only 5 individuals of this tree are known to exist. They are likely to be relics from a more widespread ancestor and it is unlikely that further extensive populations of the species remain undiscovered (DEC 2005).	Unlikely. Although associated canopy species are present within the study area other undiscovered population are considered unlikely to exist.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurrence
	Genoplesium plumosum	Tallong Midge Orchid		E1	The Tallong Midge Orchid has flower spikes to 20 cm tall, with one to eight flowers on each spike. It was originally collected at Kurnell in 1947; presumably it also occurred south of there, but it is now only known from two areas - the village of Tallong and its immediate environs, and a study area in Morton National Park 8.5 km south-east of the town of Wingello. It occurs exclusively in heathland, generally dominated by Violet Kunzea (*Kunzea parvifolia*), Common Fringe-myrtle (*Calytrix tetragona*) and parrot-peas (*Dillwynia* spp.) and grows on very shallow soils or within mosses on sandstone conglomerate shelves. This species of orchid reproduces by seed and has no mechanism for vegetative reproduction. Individuals exist as a dormant tuber for much of the year, dying back after flowering and fruiting in late summer or early autumn. The Tallong Midge Orchid can be difficult to survey as flowering is highly dependant on seasonal conditions. Threats include loss, degradation and fragmentation of habitat and/or populations for residential developments and road works (DECC 2008).	May occur in association with Kunzea parviflora pacthes, however patches of Kunzea are unlikely to represent heath land so much as regenerating woodland.
	Gentiana wingecarribensis	Wingecarribee Gentian	E	E	Wingecarribee Gentian is an erect annual herb, to 9 cm tall, and is known only from Hanging Rock Swamp and Wingecarribee Swamp on the Southern Highlands. Wingecarribee Gentian grows in bogs, in Sphagnum Moss humps and in sedge communities.	Unlikely. Preferred habitat absent from the study area.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurrence
Proteaceae	*Grevillea molyneuxii*	Wingello Grevillea	V	V	The Wingello Grevillea is a low spreading shrub to 60 cm tall that is restricted to a small area south of Penrose, above Tallowa Gully and Bundanoon Creek, in Morton National Park and on Crown Land. This species has only been recorded in low heathland on sandstone, where it grows in skeletal soil on flat, wet sandstone shelves above dissected valleys. It seems to prefer open areas within heathland patches and is colonising the few tracks that bisect its habitat. Plants are killed by fire but seem to regenerate readily from seed in open spaces. Very young plants have been observed to flower so the species is probably well adapted to fire. Threats include damage by vehicles, digging by animals and frequent fire (DECC 2008).	Unlikely. Preferred habitat absent from the study area.
	Kunzea camgagei	Cambage Kunzea	V	V	Wingecarribee Gentian is an erect annual herb, to 9 cm tall, and is known only from Hanging Rock Swamp and Wingecarribee Swamp on the Southern Highlands. Wingecarribee Gentian grows in bogs, in Sphagnum Moss humps and in sedge communities. Cambage Kunzea is a ground cover. Like other species of Kunzea, it appears to be a relatively long-lived species with older plants having tangled mats of thick, woody stems that grow up to a metre tall. Cambage Kunzea occurs mainly in the Yerranderie / Mt Werong area in the Blue Mountains but has also been collected on the Wanganderry Plateau, and at Medway and along the Wingecarribee River (near Berrima). Cambage Kunzea is restricted to damp, sandy soils in wet heath or mallee open scrub at higher altitudes on sandstone outcrops or Silurian group sediments. Some populations have been recorded on roadsides where road maintenance (e.g. road widening, weed spraying) may be a threat.	Unlikely. Preferred habitat absent from the study area.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurrence
	Leuchochrysum albicans var tricolor	Hoary Sunray		E	A perennial herb with a stout, erect, woody rootstock. This species would have originally occupied *Eucalyptus pauciflora* woodland and tussock grassland, however most of this habitat is now converted to improved pasture or cropland. Little information is known of this species ecology in NSW.	Possible. This species may occur in association with Snow Gum woodland although none were identified during surveys.
	Phyllota humifusa	Dwarf Phyllota	V		Dwarf Phyllota is a prostrate shrub with hairy leaves, at least when they are young that is is known from the southern Blue Mountains (Bimlow Tableland), the Joadja area west of Mittagong and Penrose area near Paddys River. The species occurs in dry sclerophyll forest, sometimes near swamps, in deep sandy soils or gravely loams over a sandstone substrate. Accompanying trees are often Brittle Gum Eucalyptus mannifera, Narrow-leafed Peppermint E. radiata or Sydney Peppermint E. piperita. Plants apparently resprout following fire and threats include sand and sandstone mining, both directly and through changes to hydrology. The species may also be threatened by forestry activities (DECC 2008).	Unlikely. Preferred overstorey species absent.
Rhamnaceae	*Pomaderris cotoneaster*	Cotoneaster Pomaderris		E1	Cotoneaster Pomaderris is a shrub growing to 4 m tall. It has a very disjunct distribution, being known from the Nungatta area, northern Kosciuszko National Park (near Tumut), the Tantawangalo area in South-East Forests National Park and adjoining freehold land, Badgery's Lookout near Tallong, the Yerranderie area, the Canyonleigh area and Ettrema Gorge in Morton National Park. Cotoneaster Pomaderris has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs. Little is known about the ecology of the species. It is probably killed by fire but plants have been observed to re-sprout from the stem following death of the crown from apparent drought. Populations tend to be isolated and range in size from a few individuals to many hundreds. The distribution of this species suggests that catastrophic events have led to its fragmentation, of which fire	Unlikely. May occur in forested areas on slopes but is distinct and easily identified in the field. Not identified despite targeted surveys.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurrence
					is the most likely. Fires at too short an interval may cause local extinction. Some populations are located in areas of high public use and some plants have been damaged along walking tracks (DECC 2008).	
	Pomaderris delicata	Delicate Pomaderris	E1		This species of shrub is known from only two study areas between Goulbourn and Bungonia and south of Windellana, where it occurs in dry open forest dominated by *Eucalyptus sieberi* with a dense she-oak understorey. Soils are shallow and derived from sandstone and siltstone. Threats include habitat disturbance and under-scrubbing (DEC 2007).	Possible. Potential habitat for this species exists in Stringybark forest where both *E sieberi* and *Allocas littoralis* were present. These areas are unlikely to be directly impacted.
	Pomaderris pallida	Pale Pomoderris	V		Pale Pomaderris is a compact rounded shrub to 1.5 m tall. Pale Pomaderris has been recorded from near Kydra Trig, north-west of Nimmitabel, Tinderry Nature Reserve, and the Queanbeyan River. A record from Byadbo in Kosciuszko National Park has not been relocated. The main distribution is along the Murrumbidgee in the ACT. This species usually grows in shrub communities surrounded by Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (E. *macrorhynca*) or Callitris spp. woodland. It is threatened by rural residential development, weed competition, goat browsing (Kydra) and too-frequent fire patterns (DECC 2008).	Unlikely. Occasional Brittle Gum present on Wollombi Rd however this species not identified despite targeted searches.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurrence
	Pultenaea pedunculata	Matted Bush-pea	E1		This species of prostrate shrub grows to 20 cm high. It is found on clay or sandy clay soils on Wianamatta Shale, close to localised patches of tertiary alluvium, or on the shale / sandstone interface. In NSW it is represented by three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn (where it is locally abundant). The species occurs in a range of habitats including woodland vegetation, road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area. Threats include habitat loss and fragmentation due to clearing for urban, rural, and pastural development, powerline, trail, and road maintenance, and poor understanding and management of species populations. Low intensity fires or an absence of fire may also be a threat (DEC 2007).	Unlikely. Targeted searches undertaken during this species flowering period and was not identified.
Sterculiaceae	*Rulingia prostrata*	Dwarf Kerrawang	E	E1	This species is a prostrate shrub that forms mats to more than 1 m across, occurring on sandy, sometimes peaty soils in a wide variety of habitats. Occurs on sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum (*Eucalyptus pauciflora*) Woodland at Rose Lagoon; Blue leaved Stringybark (*E. agglomerata*) Open Forest at Tallong; and in Brittle Gum (*E. mannifera*) Low Open Woodland at Penrose; Scribbly Gum (*Eucalyptus haemostoma*)/ Swamp Mahogany (*E. robusta*) Ecotonal Forest at Tomago. Associated native species may include *Imperata cylindrica*, *Empodisma minus* and *Leptospermum continentale*. This species is threatened by a poor understanding of responses to environmental conditions and management practices which could result in inappropriate management actions or inactions (DEC 2007).	Possible. Suitable overstorey species present within the study area.

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurrence
	Rutidosis leptorhynchoides	Button Wrinklewort	E	E	The Button Wrinklewort is a perennial, multi-stemmed herb. Flower-heads are bright yellow, slightly domed and button-like, to 2 cm wide. Occurs in Box-Gum Woodland, secondary grassland derived from Box-Gum Woodland or in Natural Temperate Grassland; and often in the ecotone between the two communities. Threats include competition with other grassland species, changes in fire regime, road/rail maintenance, grazing and weed invasion.	Possible. Although Box Gum Woodland present within the study area this species was not identified. May occur in secondary grassland areas.
Solanaceae	*Solanum celatum*		E1		This species of shrub grows to 2.5 m and occurs in rainforest clearings, or in wet sclerophyll forests from Wollongong to just south of Nowra, and west to Bungonia in NSW. Flowering occurs from August to October with fruiting following in December/January. Threats include habitat loss and degradation from weed infestation, in particular *Lantana camara*, local extinction due to small population size, and too frequent fire (DECC 2008).	Unlikely. Preferred habitat absent from the study area.
Rutaceae	*Zieria murphyi*	Velvet Zieria	V		Zierias are shrubs or small trees closely related to the boronias; the Velvet Zieria species is found in the Blue Mountains at Mt Tomah and on the southern tablelands where it has been recorded in Morton National Park in the Bundanoon area. It is found in gullies in dry sclerophyll forest with sandy soil. Frequent fire is a potential threat (DECC 2008).	Unlikely. No gullies with intact remnant vegetation exist within the study area.

Table 8 Threatened fauna with the potential to occur in the locality and likelihood of impacting

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Eastern Pipeline Route
Fish					
Macquaria australasica	Macquarie Perch	FV		This species of freshwater fish inhabits river and lake habitats, especially the upper reaches of rivers and their tributaries. Spawning occurs in spring and summer in shallow upland streams or flowing sections of river systems. This species is found in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas.	Potentially present in Wingecaribbee River which would not be impacted by the proposal. Would not occur in the isolated farm dams which may occur near the construction footprint..
Frogs					
Litoria aurea	Green and Golden Bell Frog	E1		This species inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. It prefers study areas containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. They are active by day and breed during the summer months (DEC 2006).	Unlikely. May occur in farm dams with suitable instream vegetation however, no dams would be directly impacted as a result of the proposal.
Birds					
Botaurus poiciloptilus	Australasian Bittern	V		This species favours permanent freshwater wetlands with tall dense reedbeds particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.) with adjacent shallow, open water for foraging. It hides during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Unlikely. Potentially present along Wingecaribbee River which would not be impacted by the proposal. Would not occur in isolated farm dams which lack aquatic vegetation. No farm dams would be directly impacted.

Callocephalon fimbriatum	Gang-gang Cockatoo	V	This species is nomadic, spending summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests and winter at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests (DEC 2007).	Present. However, habitat for this species unlikely to be impacted.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	This species is highly specialised, feeding almost exclusively on the seeds extracted from the wooden cones of Allocasuarina species including Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*Allocasuarina torulosa)* or Drooping She-oak (*Allocasuarina verticilliata*). This species needs suitable hollows in living and dead trees for nesting and breeds between March and August (DEC 2007).	Present. Small areas of habitat for this species to be impacted, however substantial areas of alternative habitat including preferred feed trees would be retained.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	This species inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey within coastal areas. They nest in hollows in standing dead or live trees and tree stumps. Fallen timber is an important habitat component for this species (DEC 2007).	Possible. May occur in adjacent forest and woodland areas which would not be affected by the proposal. Fallen timber to be retained on study area.

Melanodryas cucullata	Hooded Robin	V	The Hooded Robin is a large Australian robin reaching 17 cm in length. The Hooded Robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. (DECC 2007).	Possible. May occur in adjacent forest and woodland areas which would not be affected by the proposal. Fallen timber to be retained on study area.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	This species is the largest of its genus, and is widespread, from the Tablelands of the Great Dividing Range to the northwest and central west plains of the Riverina. It is rarely recorded eat of the Great Dividing Range, although regularly observed from the Richmond River district. It occupies mostly upper levels of drier open forest or woodlands dominated by Box and Ironbark eucalypts, as well as open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. This species usually occurs in pairs or is nomadic. It forages along twigs, branches, and trunks probing for insects. Nectar is taken from flowers and honeydew is gleaned from foliage. The Black-chinned Honeyeater nests high in the crown of a tree in the uppermost lateral branches (DEC 2007).	Possible. May occur in adjacent forest and woodland areas which would not be affected by the proposal.

Neophema pulchella	Turquoise Parrot	V	This species of parrot occurs in open eucalypt woodlands and forests, typically with a grassy understorey. It favours the edges of woodlands adjoining grasslands or timbered creek lines and ridges. A granivorous species, the Turquoise Parrot feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat for this species. This species nests in tree hollows, logs or posts from August to December.	Possible. May occur in adjacent forest and woodland areas which would not be affected by the proposal.
Ninox connivens	Barking Owl	V	Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or in dense clumps of canopy leaves in large eucalypts. The Barking owl feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits important during breeding. This species lives alone or in a pair with territories ranging from 30 to 200 hectares. Nests are built in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camandulensis*), White Box (*Eucalyptus albens*), Red Box (*Eucalyptus polyanthemos*), and Blakely's Red Gum (*Eucalyptus blakelyi*). Breeding occurs during late winter and early spring (DEC 2007).	Present, but unlikely to directly impact habitat for this species. Mitigation measures including avoiding construction during this species breeding time would be implemented.

Ninox strenua	Powerful Owl	V	This species is a nocturnal, solitary and sedentary species. They occur in a number of vegetation types ranging from woodland and open sclerophyll forest to tall open wet forest and rainforest. However, this species does prefer large tracts of vegetation. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old with breeding taking place from late summer to late autumn. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and would defend a large home range of 400 - 1,450 ha. It forages within open and closed woodlands as well as open areas (DEC 2006). This Owl has a variety of vocal calls and is known to 'dawn call' when returning from its night hunting activities to mark the position of its daytime roost (Parks Victoria 2003).	Present, but unlikely to directly impact habitat for this species. Mitigation measures including avoiding construction during this species breeding time would be implemented.
Oxyura australis	Blue-billed Duck	V	It is a partly migratory bird that travels short-distances between breeding swamps and over-wintering lakes, with some long-distance dispersal to breed during spring and early summer. It prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Nesting occurs in Cumbungi over deep water between September and February, as well as in trampled vegetation of Lignum, sedges or Spike-rushes, where a bowl-shaped nest is constructed. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes. The species is completely aquatic, swimming low in the water along the edge of dense cover. They feed on seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies found on the bottom of swamps they inhabit.	Unlikely. Farm dams in study area too small and lacking in aquatic vegetation. No aquatic habitat to be directly affected.

Pachycephala olivacea	Olive Whistler	V		The Olive Whistler inhabits the wet forests on the ranges of the east coast mostly above 500 m. During the winter months they may move to lower altitudes. Favours beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range. It forages in trees and shrubs and on the ground, feeding on berries and insects, making a nest of twigs and grass in low forks of shrubs. (DECC 2007).	Unlikely. May occur in adjacent forest and woodland areas but typically favours moister, higher altitude forests.
Pyrrholaemus sagittatus	Speckled Warbler	V		This species of small wren occurs in a range of Eucalyptus dominated communities that have a grassy understorey with a sparse shrub layer and open canopy, often in gullies or on rocky ridges. The species requires large, relatively undisturbed remnants in order to persist in an area. Its diet consists mainly of seeds and insects. Threats include habitat loss and fragmentation through clearing for firewood and development, grazing, removal of fallen timber and logs, and nest predation by feral animals due to urbanisation and fragmented habitat (DECC 2007).	Present, but unlikely to directly impact habitat for this species. Remnant forest and woodland would not be substantially affected by the proposal.
Rostratula benghalensis	Painted Snipe (was Australian Painted Snipe)	E	V, M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. This cryptic species nests on the ground amongst tall reed-like vegetation near water. It emerges from the dense growth at dusk to feed on mudflats and the water's edge taking insects, worm and seeds (DEC 2007). This species prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Unlikely. Potentially present along Wingecaribbee River which would not be impacted by the proposal. Would not occur in isolated farm dams which lack aquatic vegetation.

Stagonopleura guttata	Diamond Firetail	V	This species is known to occur in grassy eucalypt woodlands, including Box-Gum Woodlands, and Snow Gum (*Eucalyptus pauciflora*) Woodlands, riparian areas (rivers and creeks), and sometimes in lightly wooded farmland (DEC 2007).	Likely. 2007 record of species in similar habitat 1 km to the north of the study area (URS, 2008). Proposal would temporarily impact on foraging habitat for his species
Tyto novaehollandiae	Masked Owl	V	This species occurs in dry eucalypt woodlands at altitudes from sea level to 1100 m and roosts and breeds in hollows and sometime caves in moist eucalypt forested gullies. It hunts along the edges of forests and roadsides and has a home range covering between 500 ha and 1000 ha. Prey for this species are principally terrestrial mammals but arboreal species may also be taken. It has also been recorded on the Nullarbor plain. The southern subspecies occupies a home range of 5 to 10 square km (DEC 2007).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted. Mitigation measures including avoiding construction during this species breeding time would be implemented.
Xanthomyza phrygia	Regent Honeyeater	E1	This species is a semi-nomadic species that inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak where there are significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast (DEC 2007).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted.

Lathamus discolor	Swift Parrot	E	E	The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga *Ironbark E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis* and Swift Parrots would return to some foraging study areas on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum *E. globulus*. (DECC 2005).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted.
Mammals					
Chalinolobus dwyeri	Large-eared Pied Bat	V		This species is distributed between south-eastern QLD to NSW from the coast to the western slopes of the divide. This species roosts in caves and mines and has been most commonly recorded from dry sclerophyll forests and woodlands. *C. dwyeri* is an insectivorous species that flies relatively slowly over the canopy or along creek beds (Churchill 1998). Threats include clearing and isolation of habitat, damage to roosting and maternal study areas from mining operations, and recreational caving activities, and the use of pesticides (DEC 2007).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted.

Dasyurus maculatus	Spotted-tailed Quoll	V	This species of carnivorous marsupial is largely nocturnal but opportunistically hunts prey during the day. It inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den study areas are found in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines. Threats include habitat loss and fragmentation, poisoning through dog-baiting programs, and competition for food with feral animals (DEC 2007).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted. This species is highly mobile with a large home range.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	This species of bat inhabits moist forest generally with trees larger than 20 m and roosts in eucalypt hollows, underneath bark or in buildings. Diet consists of moths, beetles and other insects, which it collects within or just below the tree canopy. This species hibernates during winter and breeding takes place in late spring (DEC 2007).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted.
Miniopterus australis	Little Bentwing-bat	V	This species of bat inhabits moist eucalypt forest, rainforest or dense coastal Banksia scrub. This species primarily roosts in caves, tunnels and sometimes tree hollows. Breeding for this species occurs during winter at maternal roost study areas (DEC 2007).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted.

Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	This species has dark reddish-brown to dark brown fur and is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998, DEC 2006). In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within 6 m of the ground. Moths form the major component of their diet and breeding takes place from October to April (Churchill 1998).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted.
Mormopterus norfolkensis	Eastern Freetail-bat	V	This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range and roosts primarily in tree hollows but also in man-made structures or under bark. This species is solitary and probably insectivorous (DEC 2007).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted.
Myotis adversus	Large-footed Myotis	V	Primarily a coastal species that forages over streams and watercourses feeding on fish and insects which it catches by raking its feet across the water surface, it would occur inland along large river systems. Breeding takes place during November or December, roosting in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. Threats include loss and degradation of roosting and feeding study areas, increased use of pesticides, and the reduction in water quality occurring within waterbodies (DECC 2007).	Likely. This species was tentatively recorded via Anabat on two separate occasions foraging over farm dams. However habitat for this species is unlikely to be directly impacted.

Petaurus australis	Yellow-bellied Glider	V	This species of large arboreal mammal occurs in a variety of forest types though prefers tall mature eucalypt forest with high rainfall and rich soils, along the east coast to the western slopes of the Great Divide. This species relies on hollow-bearing trees for shelter and nesting. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Plant and insect exudates provide the bulk of this gliders diet including nectar, sap, honeydew and manna, whilst protein is obtained from arthropods and some pollen. The Yellow-bellied Gilder incises tree trunks and branches to obtain phloem sap, often leaving a distinctive 'V'-shaped scar. Tree selection and usage is complex and a large number of tree species are used as sap trees throughout the range of this glider. Threats include loss and fragmentation of habitat, and loss of hollow-bearing and feed trees (DEC 2007).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted.
Petaurus norfolcensis	Squirrel Glider	V	This species of glider is spread widely though sparsely distributed throughout eastern Australia. In NSW it inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. This species prefers a diversity of food supplies including acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein, and requires an abundant supply of tree-hollows for nesting and shelter. Threats include loss and fragmentation of habitat, flowering trees and shrubs, and hollow-bearing trees, and barbed wire fences snagging individuals whilst gliding (DEC 2007).	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted.
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	This species of small wallaby occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. (DECC 2008).	Unlikely. May occur within adjacent forest but not in open country.

Phascolarctos cinereus	Koala	V	The Koala is limited to areas of preferred feed trees in eucalypt woodlands and forests. The size of their home range varies depending on the quality of habitat, ranging from less than 2 ha to several hundred hectares in size.	Unlikely. May occur within adjacent forest associated with rocky outcrops but not in open country. Habitat for this species would not be affected.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	It hunts from above rows of trees lining creeks and the edges of woodland in otherwise cleared paddocks, roosting in hollow tree trunks and branches as well as the roofs of old buildings (Churchill 1998). It inhabits a variety of habitats ranging from moist and dry eucalypt forest and rainforest to tall wet forest, however tends to prefers moist gullies in mature coastal forest or rainforest from the Atherton Tablelands in north QLD, along the coastal regions to southern NSW.	Possible. May occur in forest and woodland areas however this habitat unlikely to be directly impacted.
Reptiles				
Delma impar	Striped Legless Lizard	V	Found in natural and secondary temperate grasslands and open Box-Gum Woodland containing tussock forming perennial grasses, and occasionally in areas containing surface rock or high amount of exotic grasses. It feeds on spiders, moth larvae, crickets and cockroaches. This species shelters under logs and rocks, and lays its eggs in early summer.	Possible. Suitable habitat in native grasslands in north of study area, less suitable in heavily grazed improved pasture in south.

Appendix D

Part 3A Threatened Species Assessment

Flora

- Buttercup Doubletail (*Diuris aequalis*)
- Button Wrinklewort (*Rutidosis leptorrhynchoides*)

Buttercup Doubletail

This species is a terrestrial "donkey" orchid, and has been recorded in forest, low open woodland with grassy understorey and secondary grasslands on the higher parts of the central and southern tablelands. Threats include habitat loss, roadworks, rubbish dumping and rural-residential subdivision (DEC 2005).

Button Wrinklewort

A perennial, multi-stemmed herb, sometimes with narrow basal leaves and leafy flower stems to 35 cm. In NSW, populations are found at Goulburn and in the Canberra - Queanbeyan area. Occurs in Box-Gum Woodland, secondary grassland derived from Box-Gum Woodland or in Natural Temperate Grassland; and often in the ecotone between the two communities. Grows on soils that are usually shallow, stony red-brown clay loams; tends to occupy areas where there is relatively less competition from herbaceous species (either due to the shallow nature of the soils, or at some study areas due to the competitive effect of woodland trees). The species exhibits an ability to colonise disturbed areas (e.g. vehicle tracks, bulldozer scrapings and areas of soil erosion). It is apparently susceptible to grazing, being retained in only a small number of populations on roadsides, rail reserves and other un-grazed or very lightly grazed study areas. Threats include the loss, degradation and fragmentation of habitat and/or populations due to: intensification of grazing regimes, invasion of weeds, increased competition from other native grassland species within the habitat because of adverse increases of biomass and the resultant closing up of the inter-tussock spaces that this species requires and also the inherent risk of loss of small populations from natural or un-natural catastrophic events (DECC 2005).

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

a) displaces or disturbs threatened species and/or populations;

The proposal would remove potential habitat for these two species, however this habitat is likely to be marginal as both species are usually associated with forest and woodland. Substantial alternative habitat exists within the study area. Neither of these species has been previously recorded within the locality. Targeted surveys did not reveal either of these species. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Areas of native pasture would be re-established once works are complete restoring this potential habitat. Thus, the proposal is unlikely to displace or disturb any of the listed flora species as a result of the proposal.

b) disrupts breeding cycle;

Targeted surveys did not reveal either species. The proposal is unlikely to disturb pollinators for these species and native pasture would be restored once construction is completed. Substantial alternative habitat exists within the study area. Given the above considerations, it is unlikely that the proposal would disrupt the breeding cycle of any of the listed threatened flora would they occur in surrounding areas of retained vegetation.

c) disturbs the dormancy period

Buttercup Doubletail dies off each year, re-sprouting after flowering. This species was not recorded during surveys and has not been previously recorded within the locality. The proposal would remove potential habitat for this species however, this habitat would be re-established once construction works are complete. Substantial alternative habitat exists within the study area. As such, the proposal is unlikely to disrupt the dormancy period of Buttercup Doubletail.

d) disrupts roosting behaviour;

Not applicable for any of the listed flora species.

e) changes foraging behaviour;

Not applicable for any of the listed flora species.

f) affects migration and dispersal ability;

Targeted surveys did not reveal either of these species. Neither species has been previously recorded within the locality. Substantial alternative habitat exists within the study area. The proposal is unlikely to disturb pollinators (see section g) and habitat would be restored once construction is complete. As such the proposal is unlikely to affect migration and dispersal ability.

g) disrupts pollination cycle;

Information on pollinators for these species was not available other than Buttercup Doubletail mimics pea flowers to attract pollinators. Button Wrinklewort is likely to be wind dispersed. The proposal would result in the loss of only a small percentage of these species habitat from the surrounding area. Areas of impact would be restored after construction. Vegetation retained at the study area would not be isolated by the proposal, and would not create any barriers within the landscape. As such the proposal is unlikely to disrupt the pollination cycle of either of these species.

h) disturbs seedbanks;

The proposal would result in the loss of some potential habitat for these two plant species. Neither has been previously recorded in the locality. The proposal would result in the loss of only a small percentage of these species' habitat from the surrounding area. Areas of impact would be restored after construction. Vegetation retained at the study area would not be isolated by the proposal, and thus the proposal is unlikely to disturb any seedbank.

i) disrupts recruitment (i.e. germination and establishment of plants);

The proposal would result in the loss of some potential habitat for these species, however the majority of the habitat for these species at the study area would be retained including substantial areas of better quality habitat in remnant bushland areas. The proposal is unlikely to disrupt any known pollinators (see section g above).

j) As targeted searches did not reveal the presence of any of these species, and they have not been previously recorded in the locality, then they are considered unlikely to occur, and thus the proposal is unlikely to disturb recruitment.

k) Affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal is unlikely to disrupt any known pollinators (see section g above).

Only a small percentage of potential habitat would be removed for these species. Neither has been previously recorded within the locality and better quality habitat exists within the study area and locality. Targeted surveying did not reveal the presence of these flora species, and thus the proposal is unlikely to affect interactions with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

a) disturbs any permanent, semi permanent or ephemeral water bodies;

Not applicable for the listed flora species.

b) degrades soil quality;

Targeted surveys did not reveal either of these threatened species. Areas of impact would be restored after construction back to existing grazing land and better quality alternative habitat exists else where in the study area and these areas would not be affected. Measures to contain impacts from construction including sediment control and the retention and re-spreading of topsoil would be implemented, and thus soil quality is unlikely to be affected.

c) clears or modifies native vegetation;

The proposal would impact small areas of remnant vegetation on the edge of significant stands of native vegetation, predominately *Acacia parramattensis* scrub, however the pipeline has been deliberately positioned to avoid trees and shrubs where possible. The pipeline would also impact areas of native pasture however these would be restored once construction is complete. The majority of vegetation to be cleared is poorer quality compared to adjacent areas of forest and woodland. As such, proposed vegetation clearance is unlikely to impact on any of these species.

d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil. Run-off controls and sowing soil stockpiles with a sterile cover crop are to be implemented to manage weeds at the study area. As such an increase in weeds is not expected.

e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Not applicable for the listed flora species.

f) affects natural revegetation and recolonisation of existing species following disturbance.

The subject land is currently subject to grazing and as such is unlikely to be effectively colonised by native vegetation. However, existing topsoil would be re-used to restore areas of impact and would result in the recolonisation of existing species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Buttercup Doubletail has been recorded in Kanangra-Boyd National Park, Gurnang State Forest, towards Wombeyan Caves, the Taralga - Goulburn area, and the ranges between Braidwood, Tarago and Bungendore. The Type collection (from the 19th Century) is from Liverpool, west of Sydney (DEC

2005). Local populations of Button Wrinklewort occur in the Goulburn area, the Canberra - Queanbeyan area and at Michelago. Other populations occur in Victoria (DEC 2005). If this species occurred at the study area it is likely to be at its northern limit, however this species has not been previously recorded in the locality and was not identified despite targeted surveys. Habitat for these species at the study area is marginal and the proposal is unlikely to affect any populations of either species that are at the limit of their known distribution.

iv) How is the proposal likely to affect current disturbance regimes?

a) **modifies the intensity and frequency of fires;**

Fire regimes are unlikely to change as a result of the proposal.

b) **modifies flooding flows;**

Not applicable to the study area.

v) How is the proposal likely to effect habitat connectivity?

a) **creates a barrier to fauna movement;**

b) **removes remnant vegetation or wildlife corridors; and**

c) **modifies remnant vegetation or wildlife corridors.**

The proposal would not create any barrier to remnant vegetation and would not modify any remnant vegetation. No habitat would become isolated or fragmented as a result of the proposal. The proposal would not remove any vegetation corridors or disconnect any vegetation. The proposal would not isolate any vegetation or inhibit any known pollinators.

vi) How is the proposal likely to affect critical habitat?

a) **removes or modifies key habitat features;**

b) **affects natural revegetation or recolonisation of existing species following disturbance**

c) **introduces weeds, vermin or feral species;**

d) **generates or disposes of solids, liquid or gaseous waste; or**

e) **uses pesticide, herbicides, other chemicals.**

No critical habitat listed under legislation occurred in the study area or within adjacent areas of vegetation. Targeted surveys both within the areas of clearance and in adjacent areas did not reveal either of the threatened flora species considered to have the potential to occur onstudy area, and the small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

Targeted surveys within the areas proposed for clearing and adjacent vegetation did not reveal the presence of Button Wrinklewort or Buttercup Doubletail. No habitat would be permanently removed or modified as a result of the proposal and the area to be disturbed represents only a small portion of suitable habitat for these species in the surrounding area. Extensive habitat, including native vegetation adjacent to the route would be retained. Management measures of particular relevance would include:

- Retention and re-use of existing topsoil;
- Deliberate avoidance of remnant vegetation where possible; and
- A run-off and sedimentation protocols;

If recommended impact mitigation and management measures for the proposed development of the study area are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for any of these species. Given the above considerations, it is considered unlikely that Button Wrinklewort or Buttercup Doubletail would be significantly adversely impacted as a result of this proposal.

Fauna

Forest Dependent Bird Species

- Glossy-black Cockatoo
- Gang-gang Cockatoo
- Speckled Warbler
- Hooded Robin
- Powerful Owl

Granivorous Ecotonal Species

- Diamond Firetail

Glossy-black Cockatoo

This species is highly specialised, feeding almost exclusively on the seeds extracted from the wooden cones of Allocasuarina species including Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*Allocasuarina torulosa*) or Drooping She-oak (*Allocasuarina verticilliata*). It is uncommon although widespread throughout suitable forest and woodland habitats, from central QLD to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW. This species needs suitable hollows in living and dead trees for nesting and breeds between March and August (DEC 2005).

Gang-gang Cockatoo

This species is nomadic, spending summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests and winter at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense under storey, and occasionally in coastal forests (DEC 2005).

Speckled Warbler

This species of small wren occurs in a range of Eucalyptus dominated communities that have a grassy under storey with a sparse shrub layer and open canopy, often in gullies or on rocky ridges. The species requires large, relatively undisturbed remnants in order to persist in an area. Its diet consists mainly of seeds and insects. Threats include habitat loss and fragmentation through clearing for firewood and development, grazing, removal of fallen timber and logs, and nest predation by feral animals due to urbanisation and fragmented habitat (DECC 2005).

Hooded Robin

The Hooded Robin is a large Australian robin reaching 17 cm in length. The Hooded Robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania.

This species requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses (DECC 2005).

Powerful Owl

This species is a nocturnal, solitary and sedentary species. They occur in a number of vegetation types ranging from woodland and open sclerophyll forest to tall open wet forest and rainforest. However, this species does prefer large tracts of vegetation. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old with breeding taking place from late summer to late autumn. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and would defend a large home range of 400 - 1,450 ha. It forages within open and closed woodlands as well as open areas (DEC 2006). This Owl has a variety of vocal calls and is known to 'dawn call' when returning from its night hunting activities to mark the position of its daytime roost (Parks Victoria 2003).

Diamond Firetail

This species is known to occur in grassy eucalypt woodlands, including Box-Gum Woodlands, and Snow Gum (*Eucalyptus pauciflora)* Woodlands, riparian areas (rivers and creeks), and sometimes in lightly wooded farmland (DEC 2007).

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

a) Displaces or disturbs threatened species and/or populations;

Small areas of edge vegetation (predominately *Acacia parramattensis* scrub) would be impacted as a result of the proposal. No direct habitat in the form of forest / woodland or hollow-bearings trees would be affected by the proposal. The proposal would remove one identified stand of *Allocasuarina littoralis* which showed evidence of feeding by Glossy Black Cockatoo, however a substantial number of alternative trees (which also showed evidence of foraging) have been recorded in vegetation adjacent to the proposed pipeline route (see Figure 3). The proposal would also temporarily remove native grass areas (foraging for Diamond Firetail), however, these would be reinstated. No breeding habitat for any of these species would be impacted. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Given the above considerations, the proposal is unlikely to displace or disturb any of the listed fauna species as a result of the proposal.

b) disrupts breeding cycle;

Small areas of edge vegetation (predominately *Acacia parramattensis* scrub) would be impacted as a result of the proposal. No direct habitat in the form of forest / woodland or hollow-bearings trees would be affected by the proposal. No breeding habitat for any of these species would be impacted. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Given the above considerations, it is unlikely that the proposal would disrupt the breeding cycle of any of the listed threatened fauna would they occur in surrounding areas of retained vegetation.

c) disturbs the dormancy period;

Not applicable for any of the listed fauna species.

d) disrupts roosting behaviour;

The proposal would not impact on roosting habitat for any of these species. Works would not be conducted at night and as such is unlikely to disturb roosting behaviour and would not destroy or displace any roost trees for these species.

e) Changes foraging behaviour;

The proposal would remove one identified stand of *Allocasuarina littoralis* which showed evidence of feeding by Glossy Black Cockatoo, however a substantial number of alternative trees (which also showed evidence of foraging) have been recorded in vegetation adjacent to the proposed pipeline route. The proposal would also temporarily remove native grass areas (foraging for Diamond Firetail) however these would be reinstated. The proposal is unlikely to disturb the prey of the Powerful Owl (possums, gliders) or impact on important habitat for the Speckled Warbler. The proposal is unlikely to change foraging behaviour of any of the listed bird species.

e) affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat nor would it create any barriers to fauna movement. No breeding habitat for any of these species would be affected. The proposal is unlikely to disturb these species in the area or locality and is considered unlikely to affect migration and dispersal.

f) disrupts pollination cycle;

Not applicable for listed fauna species.

g) disturbs seedbanks;

Not applicable for listed fauna species.

h) disrupts recruitment (i.e. germination and establishment of plants);

Not applicable for listed fauna species.

i) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

Small areas of edge vegetation (predominately *Acacia parramattensis* scrub) would be impacted as a result of the proposal. No direct habitat in the form of forest / woodland or hollow-bearings trees would be affected by the proposal. The proposal would remove one identified stand of *Allocasuarina littoralis* which showed evidence of feeding by Glossy Black Cockatoo, however a substantial number of alternative trees (which also showed evidence of foraging) have been recorded in vegetation adjacent to the proposed pipeline route (see Figure 3). The proposal would also temporarily remove native grass areas (foraging for Diamond Firetail) however these would be reinstated. The proposal is unlikely to disturb the prey of the Powerful Owl (possums, gliders) or impact on important habitat for the Speckled Warbler. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Areas of impact are unlikely to directly affect any of the listed fauna species. Thus the proposal is unlikely to affect interactions with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

a) disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

b) **degrades soil quality;**

Areas of impact would be restored after construction and better quality potential habitat exists else where in the study area and these areas would not be affected. Measures to contain impacts from construction

including sediment control and the retention and re-spreading of topsoil would be implemented, and thus soil quality is unlikely to be affected.

c) **clears or modifies native vegetation;**

The proposal would impact small areas of remnant vegetation on the edge of significant stands of native vegetation, predominately *Acacia parramattensis* scrub, however the pipeline has been deliberately positioned to avoid trees and shrubs where possible. The pipeline would also impact areas of native pasture however these would be restored once construction is complete. The majority of vegetation to be cleared is poorer quality compared to adjacent areas of forest and woodland. As such, proposed vegetation clearance is unlikely to impact on any of these species.

d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil. Run-off controls and sowing soil stockpiles with a sterile cover crop are to be implemented to manage weeds at the study area. As such an increase in weeds is not expected. The proposal is unlikely to increase the presence of feral animals within the study area as no vegetation would be fragmented or isolated. Vermin or feral species are not expected to increase and/or spread as a result of the proposal. Any EMP would detail appropriate rubbish disposal measures by construction personnel during construction to avoid encouragement of vermin and feral species into the area.

e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

The proposal would not remove any hollow-bearing trees or caves. The proposal would displace some areas of rock temporarily, however, this would be returned. The proposal would remove one identified stand of *Allocasuarina littoralis* which showed evidence of feeding by Glossy Black Cockatoo, however a substantial number of alternative trees (which also showed evidence of foraging) have been recorded in vegetation adjacent to the proposed pipeline. The proposal would also temporarily remove native grass areas (foraging for Diamond Firetail) however these would be reinstated.

f) affects natural revegetation and recolonisation of existing species following disturbance.

The subject land is currently subject to grazing and as such is unlikely to be effectively colonised by native vegetation. However, existing topsoil would be re-used to restore areas of impact and would result in the recolonisation of existing species.

f) generates or disposes of solids, liquid or gaseous waste; or

Not applicable.

g) uses pesticide, herbicides, other chemicals.

Not applicable.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

c) modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

d) modifies flooding flows;

Not applicable to the study area.

v) How is the proposal likely to effect habitat connectivity?

d) creates a barrier to fauna movement;

e) removes remnant vegetation or wildlife corridors; and

f) modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to remnant vegetation and would not modify any remnant vegetation. No habitat would become isolated or fragmented as a result of the proposal. The proposal would not remove any vegetation or wildlife corridors or disconnect any vegetation. The proposal would not isolate any vegetation or wildlife corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the study area or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

If the following recommended impact mitigation and management measures for the proposed development of the study area are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for any of these species.

- Retention and re-use of existing topsoil;
- Retention of hollow-bearing trees
- Deliberate avoidance of remnant vegetation where possible; and
- A run-off and sedimentation protocols.

Given the above considerations, it is considered unlikely that Powerful Owl, Speckled Warbler, Gang-gang Cockatoo, Glossy Black Cockatoo, Hooded Robin and Diamond Firetail.

Microchiropteran Bat Species

- Large-footed Myotis
- Eastern Bentwing Bat

Large-footed Myotis

Primarily a coastal species that forages over streams and watercourses feeding on fish and insects which it catches by raking its feet across the water surface, it would occur inland along large river systems. Breeding takes place during November or December, roosting in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. Threats include loss and degradation of roosting and feeding study areas, increased use of pesticides, and the reduction in water quality occuring within waterbodies (DECC 2007).

Eastern Bentwing Bat

This species has dark reddish-brown to dark brown fur and is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998, DEC 2006). In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within six m of the ground. Moths form the major component of their diet and breeding takes place from October to April (Churchill 1998).

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

a) displaces or disturbs threatened species and/or populations;

Small areas of edge vegetation (predominately *Acacia parramattensis* scrub) would be impacted as a result of the proposal. No direct habitat in the form of forest / woodland or hollow-bearing trees or caves/culverts would be affected by the proposal. No breeding habitat for any of these species would be impacted. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Given the above considerations, the proposal is unlikely to displace or disturb any of the listed bat species as a result of the proposal.

b) disrupts breeding cycle;

Small areas of edge vegetation (predominately *Acacia parramattensis* scrub) would be impacted as a result of the proposal. No direct habitat in the form of forest / woodland or hollow-bearings trees or caves would be affected by the proposal. No breeding habitat for any of these species would be impacted. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Given the above considerations, it is unlikely that the proposal would disrupt the breeding cycle of any of the listed threatened fauna would they occur in surrounding areas of retained vegetation.

c) disturbs the dormancy period;

Not applicable for any of the listed fauna species.

d) **disrupts roosting behaviour;**

The proposal would not impact on roosting habitat for any of these species. Works would not be conducted at night and as such is unlikely to disturb roosting behaviour.

e) changes foraging behaviour;

The proposal would not remove any foraging habitat for these species. The proposal would not create any barriers to fauna movement. The proposal is unlikely to change foraging behaviour of any of the listed bat species.

f) affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat nor would it create any barriers to fauna movement. No breeding habitat for any of these species would be affected. The proposal is unlikely to disturb these species in the area or locality and is considered unlikely to affect migration and dispersal habitat.

g) disrupts pollination cycle;

Not applicable for listed fauna species.

h) disturbs seedbanks;

Not applicable for listed fauna species.

i) disrupts recruitment (i.e. germination and establishment of plants);

Not applicable for listed fauna species.

II) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

Small areas of edge vegetation (predominately *Acacia parramattensis* scrub) would be impacted as a result of the proposal. No direct habitat in the form of forest / woodland or hollow-bearings trees or caves would be affected by the proposal. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Areas of impact are unlikely to directly affect any of the listed fauna species. Thus the proposal is unlikely to affect interactions with other species in the community.

III) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

a) disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

b) **degrades soil quality;**

Areas of impact would be restored after construction and better quality potential habitat exists else where in the study area and these areas would not be affected. Measures to contain impacts from construction including sediment control and the retention and re-spreading of topsoil would be implemented, and thus soil quality is unlikely to be affected.

c) **clears or modifies native vegetation;**

The proposal would impact small areas of remnant vegetation on the edge of significant stands of native vegetation, predominately *Acacia parramattensis* scrub, however the pipeline has been deliberately positioned to avoid trees and shrubs where possible. The pipeline would also impact areas of native pasture however these would be restored once construction is complete. The majority of vegetation to be cleared is poorer quality compared to adjacent areas of forest and woodland. As such, proposed vegetation clearance is unlikely to impact on any of these species.

d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil. Run-off controls and sowing soil stockpiles with a sterile cover crop are to be implemented to manage weeds at the study area. As such an increase in weeds is not expected. The proposal is unlikely to increase the presence of feral animals within the study area as no vegetation would be fragmented or isolated. Vermin or feral species are not expected to increase and/or spread as a result of the proposal.

e) **removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;**

The proposal would not remove any hollow-bearing trees or caves. The proposal would displace some areas of rock temporarily however this would be returned.

f) **affects natural revegetation and recolonisation of existing species following disturbance.**

The subject land is currently subject to grazing and as such is unlikely to be effectively colonised by native vegetation. However, existing topsoil would be re-used to restore areas of impact and would result in the recolonisation of existing species.

h) generates or disposes of solids, liquid or gaseous waste; or

Not applicable

i) uses pesticide, herbicides, other chemicals.

Not applicable

IV) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

a) modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

b) modifies flooding flows;

Not applicable to the study area.

V) How is the proposal likely to effect habitat connectivity?

g) creates a barrier to fauna movement;

h) removes remnant vegetation or wildlife corridors; and

i) modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to remnant vegetation and would not modify any remnant vegetation. No habitat would become isolated or fragmented as a result of the proposal. The proposal would not remove any vegetation or wildlife corridors or disconnect any vegetation. The proposal would not isolate any vegetation or wildlife corridors.

VI) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the study area or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact upon important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Retention of hollow-bearing trees and caves;
- Deliberate avoidance of remnant vegetation where possible; and
- Run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the study area are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for any of these species. Given the above considerations, it is considered unlikely that the large-footed Myotis and Eastern Bentwing Bat would be significantly affected by the proposal.

Reptiles

Striped Legless Lizard

This species of lizard is found in natural and secondary temperate grasslands and open Box-Gum Woodland containing tussock forming perennial grasses, and occasionally in areas containing surface rock or high amount of exotic grasses. It feeds on spiders, moth larvae, crickets and cockroaches. This species shelters under logs and rocks, and lays its eggs in early summer. Threats include clearing and fragmentation of habitat, agricultural practices, weed invasion, vehicle movement, changed fire regimes, and any other change to vegetation structure (DEC 2007).

l) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

a)displaces or disturbs threatened species and/or populations;

The proposal would impact on native pasture and areas of rock that may provide habitat for the Striped Legless Lizard. The species has not been previously recorded in the locality and was not identified within the study area despite targeted searches. Where possible, areas of potential habitat would be avoided. Where rock areas must be impacted these would be shifted and then returned once works are complete. Native pastures would be rehabilitated back to their existing state. Alternative habitat exists within the area. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Given the above considerations, the proposal is unlikely to displace or disturb any of the listed flora species as a result of the proposal.

b) **disrupts breeding cycle;**

The proposal would impact on native pasture and areas of rock that may provide breeding habitat for the Striped Legless Lizard. The species has not been previously recorded in the locality and was not identified within the study area despite targeted searches. Where possible, areas of potential habitat would be avoided. Where rock areas must be impacted these would be shifted and then returned once works are complete. Native pastures would be rehabilitated back to their existing state. Alternative habitat exists within the area. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Given the above considerations, it is unlikely that the proposal would disrupt the breeding cycle of this species would it occur.

c) disturbs the dormancy period;

NA for the Striped Legless Lizard.

d) disrupts roosting behaviour;

NA for the Striped Legless Lizard.

e) changes foraging behaviour;

The proposal would remove potential habitat for the Striped Legless Lizard. The species has not been previously recorded in the locality and was not identified within the study area despite targeted searches. If the species is present in the study area it would be relocated during pre-clearance surveys in consultation with DECC, however the species is unlikely to occur. Where possible areas of potential habitat would be avoided. Where rock areas must be impacted these would be shifted and then returned once works are complete. Native pasture would be rehabilitated back to their existing state. Alternative

habitat exists within the area. The proposal would not isolate or fragment any vegetation from other areas of vegetation.

f) **affects migration and dispersal ability;**

The proposal would not fragment or isolate any existing habitat nor would it create any barriers to fauna movement. Where possible, potential habitat would be avoided. Alternative habitat exists within the area. The proposal is unlikely to disturb these species in the area or locality and is considered unlikely to affect migration and dispersal habitat.

g) disrupts pollination cycle;

Not applicable for the Striped Legless Lizard.

h) **disturbs seedbanks;**

Not applicable for the Striped Legless Lizard.

i) **disrupts recruitment (i.e. germination and establishment of plants);**

Not applicable for the Striped Legless Lizard.

j) **affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).**

Some potential habitat for the Striped Legless Lizard would be impacted as a result of the proposal. However, habitat to be impacted would be re-instated once works are complete, and no habitat would be isolated or fragmented as a result of the proposal. Alternative habitat exists within the area. Thus the proposal is unlikely to affect interactions with other species in the community.

II) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

a) disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

b) degrades soil quality;

Areas of impact would be restored after construction and alternative habitat exists else where in the study area and these areas would not be affected. Measures to contain impacts from construction including sediment control and the retention and re-spreading of topsoil would be implemented, and thus soil quality is unlikely to be affected.

c) clears or modifies native vegetation;

The pipeline would impact areas of native pasture that may include habitat for the Striped Legless Lizard, however these would be restored once construction is complete. Alternative habitat also exists within the locality. As such, proposed vegetation clearance is unlikely to impact on any of these species.

d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil. Run-off controls and sowing soil stockpiles with a sterile cover crop are to be implemented to manage weeds at the study area. As such an increase in weeds is not expected. The proposal is unlikely to increase the presence of feral

animals within the study area as no vegetation would be fragmented or isolated. Vermin or feral species are not expected to increase and/or spread as a result of the proposal.

e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

The proposal would temporarily remove some areas of rocky debris, boulders or outcrops within areas of native pasture however this would be returned and grassland re-established.

f) **affects natural revegetation and recolonisation of existing species following disturbance.**

The subject land is currently subject to grazing and as such is unlikely to be effectively colonised by native vegetation. However, existing topsoil would be re-used to restore areas of impact and would result in the recolonisation of existing species.

g) **generates or disposes of solids, liquid or gaseous waste; or**

Not applicable

h) **uses pesticide, herbicides, other chemicals.**

Not applicable

II) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Striped Legless Lizard occurs in the Southern Tablelands, the South Western Slopes and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. If the species is present at the study area it is likely to be at the northern limit of its distribution. However, this species has not been previously recorded in the locality (ten km radius) and was not identified despite targeted searches.

a) **modifies the intensity and frequency of fires;**

Fire regimes are unlikely to change as a result of the proposal.

b) **modifies flooding flows;**

Not applicable to the study area.

III) How is the proposal likely to effect habitat connectivity?

a) **creates a barrier to fauna movement;**

b) **removes remnant vegetation or wildlife corridors; and**

c) **modifies remnant vegetation or wildlife corridors.**

The proposal would not create any permanent barrier to remnant vegetation and would not modify any remnant vegetation. No habitat would become isolated or fragmented as a result of the proposal. The proposal would not remove any vegetation or wildlife corridors or disconnect any vegetation. The proposal would not isolate any vegetation or wildlife corridors.

IV) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the study area or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. The following mitigation measures would manage any impacts on potential habitat for this species:

- Retention and re-use of existing topsoil;
- Re-instatement of rocky areas;
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the study area be implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for the Striped Legless Lizard.

Box-Gum Woodland EEC

White Box Yellow Box Blakely's Red Gum Woodland is an open woodland or forest community, and is characterized by White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*). Intact study areas contain a high diversity of plant species, including dominant and additional tree species, shrubs, climbers, grass species and a high diversity of herbs. Intact stands that contain diverse upper and mid-storeys and groundlayers are rare. Modified study areas include the following areas where the main tree species are present ranging from an open woodland formation to a forest structure, with the groundlayer predominantly being composed of exotic species. On study areas where the trees have been removed, only the grassy groundlayer and some herbs remain. It occurs in the tablelands and western slopes of NSW (DEC 2007). At the study area this community consists of scattered Yellow Box trees associated with native pasture and other vegetation communities such as Snow Gum Woodland.

l) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

a)displaces or disturbs threatened species and/or populations;

The proposed pipeline route would impact areas of native grassland associated with scattered yellow Box trees. This grass would be restored once construction works are complete. No canopy trees would be impacted. The proposal would not isolate or fragment any vegetation from other areas of vegetation and is unlikely to displace or disturb this community at the study area.

a) **disrupts breeding cycle;**

Not applicable for Box-Gum Woodland

b) **disturbs the dormancy period;**

Not applicable for Box-Gum Woodland

c) **disrupts roosting behaviour;**

Not applicable for Box-Gum Woodland

d) **changes foraging behaviour;**

Not applicable for Box-Gum Woodland

e) **affects migration and dispersal ability;**

The proposal would not fragment or isolate any existing habitat. Grazing regimes at the study area are unlikely to change once works are complete. Migration and dispersal ability of flora species associated with this community is unlikely to change at the study area.

f) disrupts pollination cycle;

As above.

g) **disturbs seedbanks;**

The proposal would disturb native grass areas associated within scattered Yellow Box trees. The construction phase of the project may temporarily disturb seed banks for flora species associated with this community, however, once native pasture areas are restored these disruptions would cease.

h) **disrupts recruitment (i.e. germination and establishment of plants);**

The pipeline is unlikely to disrupt recruitment as native pasture areas would be restored once works are complete and the study area has been grazed for over 100 years thus reducing recruitment over a long period of time.

i) **affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).**

Areas of native pasture associated with scattered Yellow Box trees would be removed however these would be reinstated. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Thus the proposal is unlikely to affect interactions with other species in the community.

II) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

a)disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

b) **degrades soil quality;**

Areas of impact would be restored after construction and better quality potential habitat exists else where in the study area and these areas would not be affected. Measures to contain impacts from construction including sediment control and the retention and re-spreading of topsoil would be implemented, and thus soil quality is unlikely to be affected.

c) **clears or modifies native vegetation;**

The proposal would impact small areas of native pasture however these would be restored once construction is complete. No canopy trees would be directly affected. As such, proposed vegetation clearance is unlikely to impact on this community.

c) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil. Run-off controls and sowing soil stockpiles with a sterile cover crop are to be implemented to manage weeds at the study area. As such an increase in weeds is not expected. The proposal is unlikely to increase the presence of feral animals within the study area as no vegetation would be fragmented or isolated. Vermin or feral species are not expected to increase and/or spread as a result of the proposal.

d) **removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;**

Not applicable for Box-Gum Woodland

e) **affects natural revegetation and recolonisation of existing species following disturbance.**

The subject land is currently subject to grazing and as such is unlikely to be effectively colonised by native vegetation. However, existing topsoil would be re-used to restore areas of impact and would result in the recolonisation of existing species.

f) **generates or disposes of solids, liquid or gaseous waste; or**

Not applicable.

g) **uses pesticide, herbicides, other chemicals.**

Not applicable

III) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

This community is not at the limit of its known distribution.

a) **modifies the intensity and frequency of fires;**

Fire regimes are unlikely to change as a result of the proposal.

b) **modifies flooding flows;**

Not applicable to the study area.

IV) How is the proposal likely to effect habitat connectivity?

a)creates a barrier to fauna movement;

b) removes remnant vegetation or wildlife corridors; and

c) modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to remnant vegetation and would not modify any remnant vegetation. No habitat would become isolated or fragmented as a result of the proposal. The proposal would not remove any vegetation or wildlife corridors or disconnect any vegetation. The proposal would not isolate any vegetation or wildlife corridors.

V) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the study area or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact upon important habitat for this community. Relevant mitigation measures include:

- Retention and re-use of existing topsoil;
- Deliberate avoidance of canopy trees associated with this community;
- Run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the study area are implemented, the proposal is unlikely to result in the degradation of this area of Box-Gum Woodland EEC.

Appendix E

Assessment under EPBC Act

Assessment under the EPBC Act - Flora

The study area offers potential marginal habitat for two federally listed flora species:

- Button Wrinklewort (*Rutidosis leptorrhynchoides*) listed as endangered;
- Buttercup Doubletail (*Diuris aequalis*) listed as vulnerable;

And one listed fauna species:

- Striped Legless Lizard (*Delma impar*) listed as vulnerable.

Critically endangered and endangered species significant impact criteria

Button Wrinklewort

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

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

Targeted surveying did not identify any Button Wrinklewort within the study area and it has not been previously recorded within the locality. The study area offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Therefore the proposal is unlikely to result in a long-term decrease in the size of a population would it occur.

Reduce the area of occupancy of the species

No individuals of this species were identified despite targeted surveys. It has not been previously recorded within the locality. The study area offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. As such, the proposal is unlikely to result in the area of occupancy for this species.

Fragment an existing population into two or more populations

No identified populations exist within the study area. The area of impact offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing native pasture habitats. The proposal is unlikely to result in any existing population being fragmented into two or more populations.

Adversely affect habitat critical to the survival of a species

No critical habitat listed under legislation occurred in the study area or within adjacent areas of vegetation. Significant alternative habitat for this species exists throughout the surrounding area and locality. The habitat to be removed is unlikely to be important or critical habitat for this species.

Disrupt the breeding cycle of a population

No individuals have been identified within the study area. The area of impact offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing native pasture habitats. The proposal is unlikely to disrupt the breeding cycle of this species.

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

The habitat to be affected by the proposal is marginal. Significant better quality alternative habitat exists in adjacent bushland areas. Areas of impact would be remediated and are likely to be colonized by existing species. Therefore, the proposal is unlikely to impact on habitat for this species to the extent that the species is likely to decline.

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 proposal is unlikely to introduce more weeds into the area. Top soil would be retained and used to rehabilitate areas of disturbance. The proposal is unlikely to result in an invasive species becoming established within the habitat of Button Wrinklewort.

Introduce disease that may cause the species to decline

There is the potential for the proposed construction works to introduce *Phytophthera cinnamomi* into the study area. Measures to control *Phytophthora cinnamomi* would be developed and implemented and hygiene measures to prevent the introduction or spread of the pathogen during the construction and operational phases of the development incorporated into any CEMP for the study area. The proposal is therefore considered unlikely to result in the introduction of this disease thus causing species decline.

Interfere with the recovery of the species

This species was not identified despite targeted surveys. It has not been previously recorded in the locality. Habitat to be impacted by the proposal is marginal and unlikely to constitute important habitat for this species. Therefore the proposal is unlikely to interfere with the recovery of this species.

Conclusion

Consideration of the above assessment criteria concludes that the proposal is unlikely to have a significant impact on Button Wrinklewort an endangered species listed under the EPBC Act.

Vulnerable Species

Buttercup Doubletail

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

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

Targeted surveying did not identify any Buttercup Doubletail within the study area and it has not been previously recorded within the locality. The study area offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Therefore the proposal is unlikely to result in a long-term decrease in the size of a population would it occur.

Reduce the area of occupancy of an important population

No individuals of this species were identified despite targeted surveys. It has not been previously recorded within the locality. The study area offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. As such, the proposal is unlikely to result in the area of occupancy for this species.

Fragment an existing important population into two or more populations

No identified populations exist within the study area. The area of impact offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing native pasture habitats. The proposal is unlikely to result in any existing population being fragmented into two or more populations.

Adversely affect habitat critical to the survival of a species

No critical habitat listed under legislation occurred in the study area or within adjacent areas of vegetation. Significant alternative habitat for this species exists throughout the surrounding area and locality. The habitat to be removed is unlikely to be important or critical habitat for this species.

Disrupt the breeding cycle of an important population

No individuals have been identified within the study area. The area of impact offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing native pasture habitats. The proposal is unlikely to disrupt the breeding cycle of this species.

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

The habitat to be affected by the proposal is marginal. Significant better quality alternative habitat exists in adjacent bushland areas. Areas of impact would be remediated and are likely to be colonized by existing species. Therefore, the proposal is unlikely to impact on habitat for this species to the extent that the species is likely to decline.

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

The proposal is unlikely to introduce more weeds into the area. Top soil would be retained and used to rehabilitate areas of disturbance. The proposal is unlikely to result in an invasive species becoming established within the habitat of *Buttercup Doubletail.*

Introduce disease that may cause the species to decline

There is the potential for the proposed construction works to introduce *Phytophthera cinnamomi* into the study area. Measures to control *Phytophthora cinnamomi* would be developed and implemented and hygiene measures to prevent the introduction or spread of the pathogen during the construction and operational phases of the development incorporated into any CEMP for the study area. The proposal is therefore considered unlikely to result in the introduction of this disease thus causing species decline.

Interfere substantially with the recovery of the species

This species was not identified despite targeted surveys. It has not been previously recorded in the locality. Habitat to be impacted by the proposal is marginal and unlikely to constitute important habitat for this species. Therefore the proposal is unlikely to interfere with the recovery of this species.

Conclusion

Consideration of the above assessment criteria concludes that the proposal is unlikely to have a significant impact on *Buttercup Doubletail*.

Striped Legless Lizard

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

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

Targeted surveying did not identify any *Striped Legless Lizard* within the study area and it has not been previously recorded within the locality. The study area offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Therefore the proposal is unlikely to result in a long-term decrease in the size of a population would it occur.

Reduce the area of occupancy of an important population

No individuals of this species were identified despite targeted surveys. It has not been previously recorded within the locality. The study area offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. As such, the proposal is unlikely to result in the area of occupancy for this species.

Fragment an existing important population into two or more populations

No identified populations exist within the study area. The area of impact offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing native pasture habitats. The proposal is unlikely to result in any existing population being fragmented into two or more populations.

Adversely affect habitat critical to the survival of a species

No critical habitat listed under legislation occurred in the study area or within adjacent areas of vegetation. Significant alternative habitat for this species exists throughout the surrounding area and locality. The habitat to be removed is unlikely to be important or critical habitat for this species.

Disrupt the breeding cycle of an important population

No individuals have been identified within the study area. The area of impact offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing native pasture habitats. The proposal is unlikely to disrupt the breeding cycle of this species.

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

The habitat to be affected by the proposal is marginal. Significant better quality alternative habitat exists in adjacent bushland areas. Areas of impact would be remediated and are likely to be colonized by existing species. Therefore, the proposal is unlikely to impact on habitat for this species to the extent that the species is likely to decline.

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

The proposal is unlikely to introduce more weeds into the area. Top soil would be retained and used to rehabilitate areas of disturbance. The proposal is unlikely to result in an invasive species becoming established within the habitat of *Striped Legless Lizard.*

Introduce disease that may cause the species to decline

There is the potential for the proposed construction works to introduce *Phytophthera cinnamomi* into the study area. Measures to control *Phytophthora cinnamomi* would be developed and implemented and hygiene measures to prevent the introduction or spread of the pathogen during the construction and operational phases of the development incorporated into any CEMP for the study area. The proposal is therefore considered unlikely to result in the introduction of this disease thus causing species decline.

Interfere substantially with the recovery of the species

This species was not identified despite targeted surveys. It has not been previously recorded in the locality. Habitat to be impacted by the proposal is marginal and unlikely to constitute important habitat for this species. Therefore the proposal is unlikely to interfere with the recovery of this species.

Conclusion

Consideration of the above assessment criteria concludes that the proposal is unlikely to have a significant impact on *Striped Legless Lizard*.

Endangered Ecological Communities

Box-Gum Woodland EEC

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

Reduce the extent of an ecological community

The route may impact on grassland adjacent to areas of EPBC Act Box-Gum Woodland, however, no canopy trees would be affected and if possible this route would be avoided. No patches of this EEC would be fragmented or isolated as a result of the proposal. Grassland associated with this community would be re-instated using existing topsoil and associated seed bank. Weeds would also be managed. Consequently, the proposal would not reduce the extent of this ecological community.

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

The proposal would not fragment or isolate or increase fragmentation of this community at the site.

Adversely affect habitat critical to the survival of an ecological community

No critical habitat listed under legislation occurs in the site or within adjacent areas of vegetation. The grassland associated with this community would be re-established and is unlikely to be considered critical habitat for this community. Larger patches of Box-Gum Woodland exist elsewhere in adjacent areas (Facilities' site). The proposed western pipeline route would not adversely affect habitat critical to the survival of this EEC.

Modify or 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

The proposal would not reduce groundwater levels or result in substantial alterations of the surface water drainage patterns within the study area. Topsoil would be retained and re-used. Nutrient levels are unlikely to alter as a result of the project.

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 route may impact on grassland adjacent to areas of EPBC Act Box-Gum Woodland, however no canopy trees would be affected and if possible this route would be avoided. No patches of this EEC would be fragmented or isolated as a result of the proposal – areas of EPBC Act Box-Gum Woodland would be avoided and indirect impacts managed (see Mitigations section). Grassland associated with this community would be re-instated using existing topsoil and associated seed bank. Weeds would also be managed.

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; or**
- **Interfere with the recovery of an ecological community.**

The proposed Western pipeline route would aim to avoid areas of EPBC Act Box-Gum Woodland (depending on land owner constraints). If this is not possible then direct impacts on this community would be avoided. Grassland adjacent to areas of EPBC Act Box-Gum Woodland may be impacted, however no canopy trees would be affected. No patches of this EEC would be fragmented or isolated as a result of the proposal. Grassland associated with this community would be re-instated using existing topsoil and associated seed bank. Weeds would also be managed. The proposal is unlikely to cause a substantial reduction in the quality or integrity of an occurrence of an ecological community.

Conclusion

Consideration of the above assessment criteria concludes that the proposal is unlikely to have a impact on Box-Gum Woodland EEC.

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-

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	B Harrington V Keyzer	N Witting	N Witting	J Tipping	J Tipping	17/11/08
1	V. Keyzer	W Penrose	*W Penrose*	J Tipping	J Tipping	9/12/08

Appendix B

Ecological assessment - western route

Ecological impact assessment of the proposed western pipeline route (February, 2009), GHD

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EnergyAustralia & Delta Electricity

Report for Marulan Gas Pipeline Route

Ecological Impact Assessment of Proposed Western Pipeline Route Option

February 2009

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Proposed Development

EnergyAustralia and Delta Electricity (the Proponent) aim to construct and operate a pipeline in the order of DN450, which would traverse a distance of approximately seven and a half kilometres, including associated ancillaries, for the transmission of natural gas from the Moomba - Sydney Gas Pipeline east of Marulan NSW to fuel the proposed two separate gas turbine facilities (the "Facilities") at Brayton.

Currently, two pipeline routes are being considered ("Eastern" and "Western"), with the affected landowners on both route options being consulted. Easement agreements would be negotiated on the preferred route with the affected landowners. The easement would nominally be a 20 metre corridor. This report focuses on the proposed "western" pipeline route which begins at the proposed gas turbine facilities north of Canyonleigh Road, at Brayton, then traverses private property south (through a woodland area) to an existing crown road reserve and then east along Wollombi Road, towards the Hume Highway, near Marulan.

The pipeline would be owned jointly by EnergyAustrala and Delta Electricity to supply natural gas metered separately to individual gas turbine Facilities, one to be owned by EnergyAustralia and the other to be owned by Delta Electricity. The EnergyAustralia facility is planned to operate on peak load basis and would consist of two 175 MW_e gas turbines units. The Delta Electricity facility is planned to operate initially on peak load basis and would consist of two 175 MW_e gas turbine units. At a later stage, the Delta Electricity facility would be upgraded for base load operation as a combined cycle power plant by adding a 100 MW_e steam turbine to boost the power rating to 450 MW_e.

Together with the Facilities, the environmental approval for the pipeline is currently being undertaken via a Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as *a* "Major Project", the consent authority being the Minister for Planning. The Facilities have also been offered "Critical Infrastructure" status under Section 75C of the EP&A Act.

The proposed pipeline location is shown on Figure 1.

1.2 Route Selection

Two route options have been considered in detail for the proposed gas pipeline ("Eastern" and "Western") – see Figure 1.

Whilst the Eastern route provides a more direct route from the off-take valve station of the Moomba to Sydney gas lateral, off Wollumbi Road to the Facilities site, it has a number of impediments, for example:

- Landowners are opposed to having the pipeline directly through the land parcels that make up their properties because:
  - There is a potential for severe impact on livestock and agricultural production;
  - Propensity for the gas pipeline to require maintenance;
  - Extensive improvements have been carried out and improved pastures established;
  - Paddocks are used for sheep and cattle grazing and any disruption would have a consequential effect on the landowner's livelihood - the pipeline would have negative financial effect on farm operations;
  - Substantial impact on the ability to subdivide with a pipeline located across the land parcels; and
  - Inability to reinstate the land back to its former condition (that is, pipeline markers) and certain limitations would be imposed.

- Lot 12 is in probate and involves some legal difficulties for the Proponent
- Identified PADs in Lot 153 – land that is now owned by the Proponents

During discussions with the landowners affected by the Eastern route, it was suggested that the Proponents carry out an assessment on an alternative corridor, through or adjacent to the woodland area to the west of the proposed Eastern route, and not through privately held land holdings. With this in mind, the Proponents set out to review an alternative route – the Western route as indicated in Figure 1. Although the Western pipeline route would require the removal/clearance of trees and vegetation within a 20 metre easement through crown road reserves, it has the following advantages:

- Avoidance of direct impacts on property owners who are opposed to the pipeline traverse their properties (for the reasons stated above);
- The Rural Fire Service has indicated that a clearance through bushland associated with the Western pipeline route would be advantageous from a bush fire management perspective; and
- Portions of the western route exist along already cleared paths which would minimise vegetation disturbance.

An options analysis has been carried out, and based on overall impacts associated with ecology, heritage, and social equity; the Western pipeline route is the preferred option. Impacts associated with the proposed Western pipeline route would be mitigated and where applicable offset.

1.3 Scope of Report

GHD Pty Ltd (GHD) was engaged by the Proponent to undertake an Ecological Assessment for the proposed Western pipeline.

The Proponent requires assistance to complete the environmental assessment for the gas lateral connection between the proposed Facilities to the Moomba-Sydney gas main, a distance of approximately seven kilometres. Once completed, the findings will be summarised in a Preferred Project Report.

The proposal is a Major Project pursuant to NSW *State Environmental Planning Policy (Major Projects)*. Accordingly, the proposal is subject to the development and assessment processes and requirements of Part 3A of the NSW *Environmental Planning & Assessment Act 1979* (EP&A Act), with the Minister for Planning as the consent authority. A Concept Application with preliminary assessments was lodged with the NSW Department of Planning and was exhibited from Wednesday 10 September 2008 until Monday 13 October 2008.

The initial desktop review identifying potential ecological constraints for the proposed gas pipeline was undertaken as part of the URS *Biodiversity Impact Assessment Gas Turbine Facilities Project, Marulan NSW* (2008). This report assessed potential flora and fauna constraints within a broad pipeline corridor. A pipeline route was not fully defined and a detailed assessment of impacts had not been undertaken. A Preferred Project Report in accordance with Section 75(H) of the EP&A Act is therefore required to be submitted to the NSW Department of Planning outlining the proposed changes to the concept pipeline corridor. In order to prepare this Preferred Project Report, and gain project approval, field investigations of the pipeline route were undertaken by GHD to more accurately assess any likely impacts on flora and fauna.

This Report has been prepared as a technical document to support the Environmental Assessment (EA), and addresses the environmental assessment requirements, which state that the EA must include a 'flora and fauna impact assessment in accordance with the NSW Department of Environment and Climate Change (DECC) *Guidelines for Threatened Species Assessment* (DEC, 2005). This Report assesses the ecological

impacts of the proposed construction and operation of the gas pipeline, with due consideration of relevant Commonwealth and State legislation (see Section 3), as well as relevant guidelines, including:

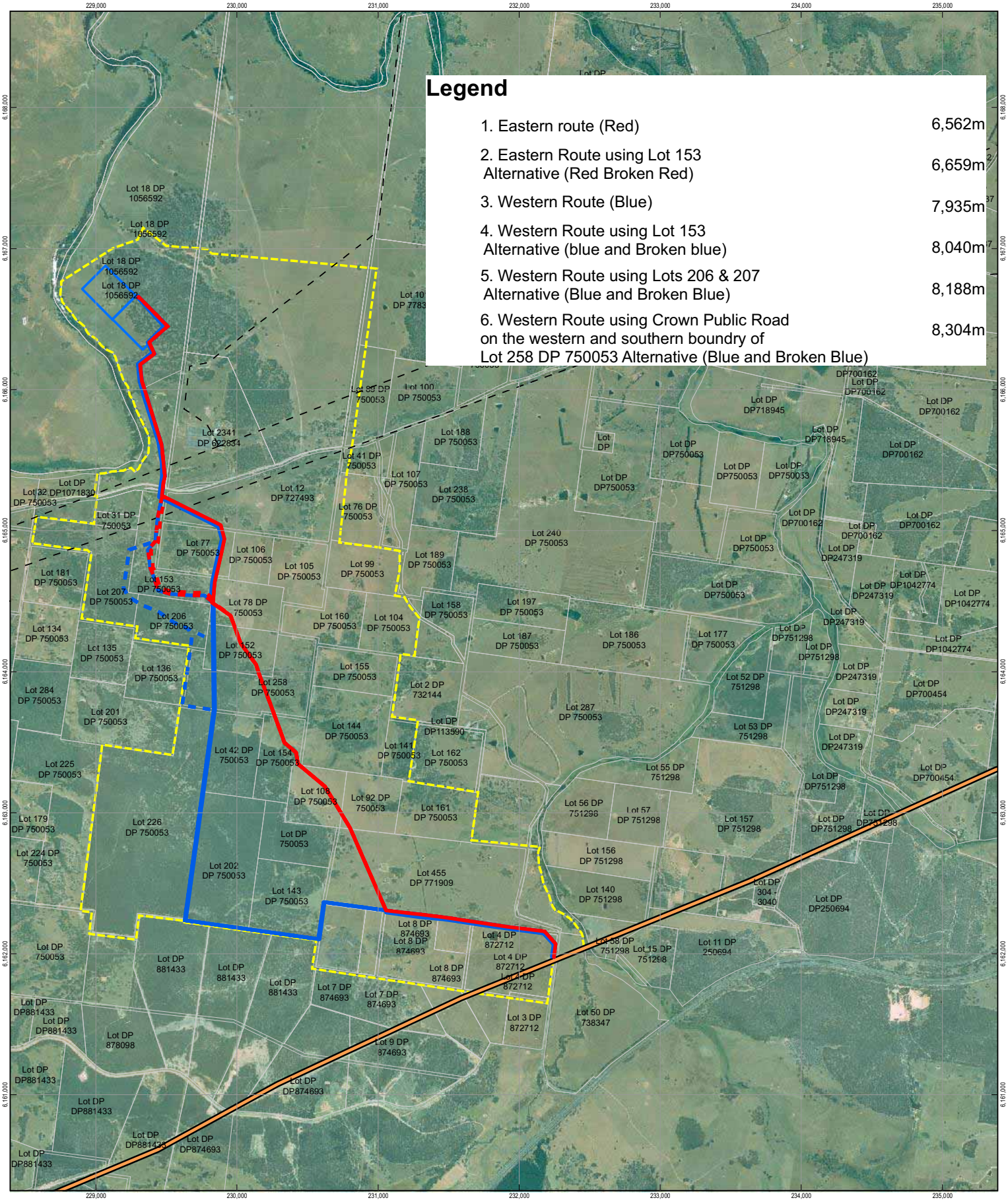
- *Guidelines for Threatened Species Assessment* (DEC, 2005), with regard to the nature and content of this report; and
- *DEC Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft* (DEC 2004). The field surveys completed for this assessment, as described in Chapter 4, have been designed and implemented to comply with the requirements recommended in these guidelines.

The DEC (2005) guidelines identify important factors and/or heads of consideration that must be considered by proponents and consultants when assessing potential impacts on threatened species, populations, or ecological communities, or their habitats for development applications assessed under Part 3A. The principles outlined in these guidelines and addressed in the current assessment are as follows:

- 'maintain or improve' biodiversity values (i.e. there is no net impact on threatened species or native vegetation);
- conserve biological diversity and promote ecologically sustainable development;
- protect areas of high conservation value (including areas of critical habitat);
- prevent the extinction of threatened species;
- protect the long-term viability of local populations of a species, population or ecological community; and
- protect aspects of the environment that are matters of national environmental significance.

The assessment is based on length of the proposed pipeline from the off-take valve station of the Moomba to Sydney gas lateral to the gully just south of the facilities site (see Figure 3). The pipeline north of this gully has been assessed as part of the Facilities Site Environmental Assessment completed by URS.

This assessment assumes a 20 metre corridor of impact ("the study area") and is designed to provide information and analysis to demonstrate that feasible alternatives have been considered, that the project has been designed to be consistent with the principles outlined above, and where there would be impacts, that adequate mitigation measures and biodiversity offsets would be implemented.



Legend

- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative
- Moomba Sydney Gas Pipeline
- Plant Foot print
- Gas Pipeline Corridor
- LandOwnership

1:25,000 (at A3)

0 95 190 380 570 760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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EnergyAustralia

Delta electricity

GHD

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Delta Energy and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number 21-17633
Revision A
Date 14 Dec 2008

Site Locations

Figure 1

G:\21\17633\CADD\GIS\MapDocuments\Z012_Site_Location.mxd

10 Bond Street Sydney NSW 2000 Australia 61 2 9239 7000 61 2 9239 7199 sydmail@ghd.com.au www.ghd.com.au

2. Site Description

2.1 Site Location

The proposed Western pipeline route begins at the proposed Facilities north of Canyonleigh Road, at Brayton, then traverses private property south (through a woodland area) to an existing crown road reserve and then east along Wollombi Road, towards the Hume Highway, near Marulan (see Figure 1).

The study area is within the south eastern Highlands Bioregion and the Facilities site area falls within the Upper Lachlan Shire Council LGA, however the pipeline route is within the Goulburn-Mulwaree Council area.

For the purposes of this report the 20 metre area of impact for the proposed pipeline route option is defined as the 'study area'.

2.2 Geology and Soils and Topography

The 1:250,000 Goulbourn Soil Landscape Series states that the study area is underlain with Marulan Granite resulting in undulating rises and low hills with patches of granite outcrops and boulders. Soils are sandy red podzolics on hillcrests and upper slopes, yellow podzolics on lower slopes and gleyed podsolic soils in drainage depressions.

2.3 Hydrology

The Wollondilly River occurs to the immediate northwest of the proposed pipeline route. The southern extreme of the proposed pipeline would pass within approximately 200 metres of Uringalla Creek, and transects Wollombi Road. The proposed gas pipeline would also cross a number of drainage lines characterised as ephemeral, channel confined streams, which form a chain of shallow ponds after heavy rainfall. All of the drainage lines are tributaries of Wollondilly River, Paddys River or Uringalla Creek and are all within the Wollondilly River sub-catchment of the Hawkesbury catchment. There are also several farm dams located in close proximity to the proposed pipeline route. These dams are located in areas of cleared grassland and contain near-permanent water.

2.4 Climate

Weather statistics are taken from the nearest weather station to the study area at Goulburn Airport approximately 30 kilometres south (BOM, 2008). The area has a mean maximum temperature of 27.6^{o} Celsius in January and 11.6^{o} C in July. Mean minimum temperatures are 12.6^{o} C in summer and 0.3^{o} C in winter.

Mean annual rainfall is 514.5 mm with the majority of rain falling in winter.

3. Legislative Framework

3.1 Environmental Planning & Assessment Act 1979

The EP&A Act forms the legal and policy platform for development assessment and approval in NSW and aims to, *inter alia*, 'encourage the proper management, development and conservation of natural and artificial resources'. The proposal is a Major Project according to *State Environmental Planning Policy (Major Projects) 2005* and as such, is to be assessed under the provisions of Part 3A of the EP&A Act, with the Minster for Planning as the Consent Authority for the Project Applications. The Minister for Planning has subsequently declared the proposal Critical Infrastructure under Section 75C of the EP&A Act.

3.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides legal status for biota of conservation significance in NSW. The TSC Act aims to, *inter alia,* 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

- the listing of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, and vulnerable species and communities listed under Schedule 2;
- the listing of 'Key Threatening Processes' (under Schedule 3);
- the preparation and implementation of Recovery Plans and Threat Abatement Plans; and
- requirements for the preparation of Species Impact Statements (SISs).

The TSC Act has been addressed in the current assessment through:

- desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the study area and hence could occur subject to the habitats present;
- targeted field surveys for threatened species listed under the Act;
- development of suitable impact mitigation and environmental management measures for threatened species, where required; and
- assessment of potential impacts on threatened species.

3.3 Environment Protection and Biodiversity Conservation Act

The purpose of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Commonwealth Minister for the Environment and Water Resources.

In January 2007 the Commonwealth and NSW governments signed a Bilateral Agreement which accredits the assessment regimes under Part 3A, Part 4 and Part 5 of the EP&A Act for assessment purposes under the EPBC Act. The Bilateral Agreement applies only to proposals that the Commonwealth Environment Minister has determined are controlled actions under the EPBC Act, with the exception of nuclear actions.

The EPBC Act identifies matters of national environmental significance as:

- world heritage properties;
- national heritage places;
- wetlands of international importance (Ramsar wetlands);
- threatened species and ecological communities;
- migratory species;
- commonwealth marine areas; and
- nuclear actions (including uranium mining).

The Administrative Guidelines for the EPBC Act (Department of the Environment & Heritage 2006) set out criteria intended to assist in determining whether an action is controlled and hence requires approval. In particular, the Guidelines contain criteria for determining whether a proposed action is likely to have a 'significant impact' on a matter of national environmental significance (NES). Should the proponent deem the proposal likely to have a significant impact on a matter of NES, a referral to the Commonwealth Minister for the Environment should be undertaken to obtain a determination as to whether the proposal is a 'controlled action' requiring Commonwealth approval.

The EPBC Act has been addressed in the current assessment through:

- desktop review to determine the threatened species or ecological communities that have been previously recorded within the locality of the study area and hence could occur, subject to the habitats present;
- targeted field surveys for threatened species listed under the Act;
- development of suitable impact mitigation and environmental management measures for threatened species, where required; and
- assessment of potential impacts on threatened species.

3.4 Native Vegetation Act 2003

The NSW Government released the regulations for the *Native Vegetation Act 2003* (NV Act) on 14 November 2005, which came into effect on 1 December 2005. The NV Act regulates the clearing of native vegetation on all land in NSW except for land listed in Schedule 1 of the Act. Excluded land under Schedule 1 of the Act includes National Parks and other conservation areas, State forests and reserves, and urban areas. Specifically, urban areas, which are excluded, include areas zoned residential (but not rural residential), village, township, industrial or business.

According to Section 75U(e) of the EP&A Act, an authorisation under Section 12 of the NV Act to clear native vegetation is not required for a project approved under Part 3A. Hence, the NV Act does not apply to the current proposal.

3.5 Noxious Weeds Act 1993

Under the *Noxious Weeds Act 1993* (NW Act), Goulburn-Mulwaree Council is responsible for the control of noxious weeds in the LGA. The NW Act provides for the declaration of noxious weeds by the Minister of Agriculture. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act. Noxious weeds within the study area have been recorded as part of this assessment.

4. Methodology

4.1 Literature Review

A desktop literature review based on habitats present was undertaken by GHD to identify the representative spectrum of flora and fauna, threatened species, populations and ecological communities listed under the NSW TSC Act and the Commonwealth EPBC Act that could be expected to occur within the study area. To this end, the following documentation was reviewed prior to the conduct of the field investigations:

- NSW NPWS Wildlife Atlas database (July 2008 – 10 km radius search for TSC Act listed flora and fauna, centred on the site. The NSW Bungonia and Crookwell CMA sub-regions were searched for Endangered Ecological Communities);
- EPBC online Protected Matters Database (July 2008 – to a 10 km radius);
- URS, 2008 *Biodiversity Impact Assessment, Gas Turbine Facilities Project, Marulan, NSW* including the listed of target threatened species provided by DECC in the EARs for that project*;* and
- PB, 2005 *Big Hill Gas Turbine Baseline Ecological Surveys.*

4.2 Field Surveys

An initial site walkover was performed by a GHD ecologist at and within the vicinity of the proposed route (the study area) on 9 July 2008. A targeted flora and fauna survey was performed by GHD ecologists from 15 to 17 July 2008. A supplementary survey was performed on 18 and 19 September 2008 and surveys targeting an alternative route in adjacent lands were conducted on 8 to 10 October 2008. A further survey aiming to target potential threatened orchid species was undertaken on 5 November, 2008. Survey locations are shown on Figure 2. Survey methodology is described below and survey effort detailed in Table 1.

4.2.1 Flora Survey

Flora surveys were consistent with the DECC guidelines (DEC 2004). All vascular plants (i.e. not mosses, lichens or fungi) observed were recorded on appropriate pro-forma field data sheets.

Plant specimens not readily identifiable in the field were collected and subsequently identified using standard botanical texts and where required were compared with voucher specimens held in the National Herbarium of New South Wales Online Reference Collection. Structural vegetation communities were described according to classifications made by Specht (1970). Plant identifications were made according to nomenclature in Harden (1990, 1991, 1992, and 1993). Plant specimens which were difficult to identify (either insufficient sample collected or buds/fruiting bodies were not available at the time of the survey) were submitted to the NSW National Herbarium for identification.

On the basis of air photo interpretation, initial site walkover and habitat assessment, the site was divided into stratification units i.e. functionally similar units for the purposes of environmental assessment according to the DECC guidelines (DEC 2004). Surveying included eighteen 20 m x 20 m quadrats. A ‘random meander’ survey was also performed over the whole route and its immediate vicinity to detect threatened flora species.

Plant species were recorded on appropriate pro forma field data sheets. Each data sheet included a detailed biophysical description including vegetation structure, soils, geology and geomorphology, habitat and fire and disturbance history.

The location of field survey quadrats and significant species, habitat and communities were captured with a handheld GPS unit. The location of the vegetation survey quadrats are shown in Figure 2.

Table 1 Survey Effort

Task	Technique	Person Hours / Number
FLORA		
Flora Inventory	Quadrats	18 quadrat throughout the study area
Targeted Searches for Threatened Flora	Random Meander	5 random meanders along the length of the pipeline route and surrounds
FAUNA		
Bird Survey	Diurnal Bird Counts	Two people conducting two 40 min searches over 6 mornings 16 person hours
Reptiles and Amphibians	Active Searches	Incidentally through out 8 survey days ~ 16 person hours
Bats	Anabat Harp Traps	Two Anabats out each night of surveys 10 Anabat nights 2 harp traps over 1 night
Forest Owls and threatened arboreal fauna	Call Play Back	Conducted each surveys night for approximately 1 hour ~ 5 survey hours
Arboreal and other nocturnal fauna	Spotlighting	Two people spotlighting for approximately 2 hours each survey night ~10 person hours

4.2.2 Fauna Survey

Targeted fauna surveys were generally consistent with the DECC guidelines (DEC 2004). The survey design was based on the likelihood of threatened species identified in the literature review occurring on site and the initial habitat assessment. Methods included diurnal bird counts, Anabat bat detector recording, active searches, nocturnal call playback, spotlighting, litter searches, opportunistic observations and track and scat analysis. All observations were recorded on appropriate pro forma field data sheets.

Weather during the field survey was predominately warm and dry (BOM, 2008) and there was no light spill from human sources. Traffic along the local roads was very light with less than one vehicle movement per hour. Conditions throughout the survey were suitable for the detection of small nocturnal fauna. No rain fell during the survey period, however, there was standing water in farm dams and wetlands across the site and frogs were actively calling. A summary of survey effort for the project is provided in Table 1 above and is discussed below.

Diurnal Bird Counts

Diurnal bird counts consisted of area searches through habitat on site. Searches were conducted at dawn and dusk, for at least 40 minutes over approximately one hectare in each habitat type. Opportunistic observations of bird species were recorded throughout the duration of all surveys on the site. Species were identified by visual observation and call and were documented along with numbers of individuals, behaviour, breeding activity and habitat type on pro forma data sheets.

Trees were also scanned for nests, whitewash (guano deposits) and roosts throughout the study area and their locations captured with a handheld GPS unit.

Active Searches

Active searches for frogs and reptiles were performed within and adjacent to the study area focussing on wetlands and suitable substrate. Banks and streamsides were systematically searched and semi-aquatic vegetation was visually scanned. Shelter sites were carefully lifted and replaced, trunks and decorticating bark were scanned, rock crevices were searched, leaf litter was raked and visual scanning of vegetation for active and foraging specimens was undertaken. Frogs were identified by sight and by call.

Microchiropteran Bat Survey

Fixed Anabat recordings were undertaken, recording from half an hour before dusk until the following morning. Two Anabat units were placed for two nights in the initial July 15-17 survey. Further surveys included two Anabats over one night during the supplementary on 18/19 September and again over two nights on 8-10 October 2008. Overall, five full nights of bat call recordings were taken near dams and within flyways. Recordings were sent to Ecotone for identification. Calls were identified to the species level where possible and were reported as 'definite', 'probable' or 'possible' depending on the confidence of the identification. Two harp traps were also placed out during September supplementary surveys.

Call Playback

Call playback was performed over five nights targeting the squirrel glider (*Petaurus norfolcensis)*, powerful owl (*Ninox strenua)*, sooty owl (*Tyto tenebricosa),* masked owl (*Tyto novaehollandiae*) and barking owl (*Ninox connivens)*.

Call playback included at least five minutes broadcasting and ten minutes listening for each species per night plus additional listening and spotlighting at the beginning and end of the call playback period.

Spotlighting

Spotlighting surveys were performed on a total of five evenings and involved walking one km transects for one hour. Approximately two hours of additional, opportunistic spotlighting in areas of interest or of high activity was performed each evening, either on foot or from a vehicle through the entire survey period.

Fauna Habitat Assessment

An assessment of the quality of habitats present for native fauna was made across the entire study area. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. Indicative habitat criteria for targeted threatened species (i.e. recorded in the TSC and EPBC Act searches) were identified prior to fieldwork. Criteria were based on information provided in TSC Act species profiles, field notebooks and the knowledge and experience of GHD field ecologists. Habitat assessments assists in the compilation of a comprehensive list of fauna that are predicted within the vicinity of the study area, rather than relying solely on single event surveys that are subject to seasonal limitations and may only represent a snapshot of assemblages present.

The locations and quantitative descriptions of significant habitat features were captured with a handheld GPS unit and photographed where appropriate.

*Ground Debris Searche*s

Ground debris searches were undertaken incidentally during the entire survey period while traversing the study area. These included active searches for scats, tracks, burrows or other traces.

Opportunistic Observations

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. Survey effort was concentrated on suitable areas of habitat throughout the course of the flora survey, for instance fallen timber was scanned for reptiles and paddock trees and dams were scanned for roosting birds.

4.3 Staff Qualifications

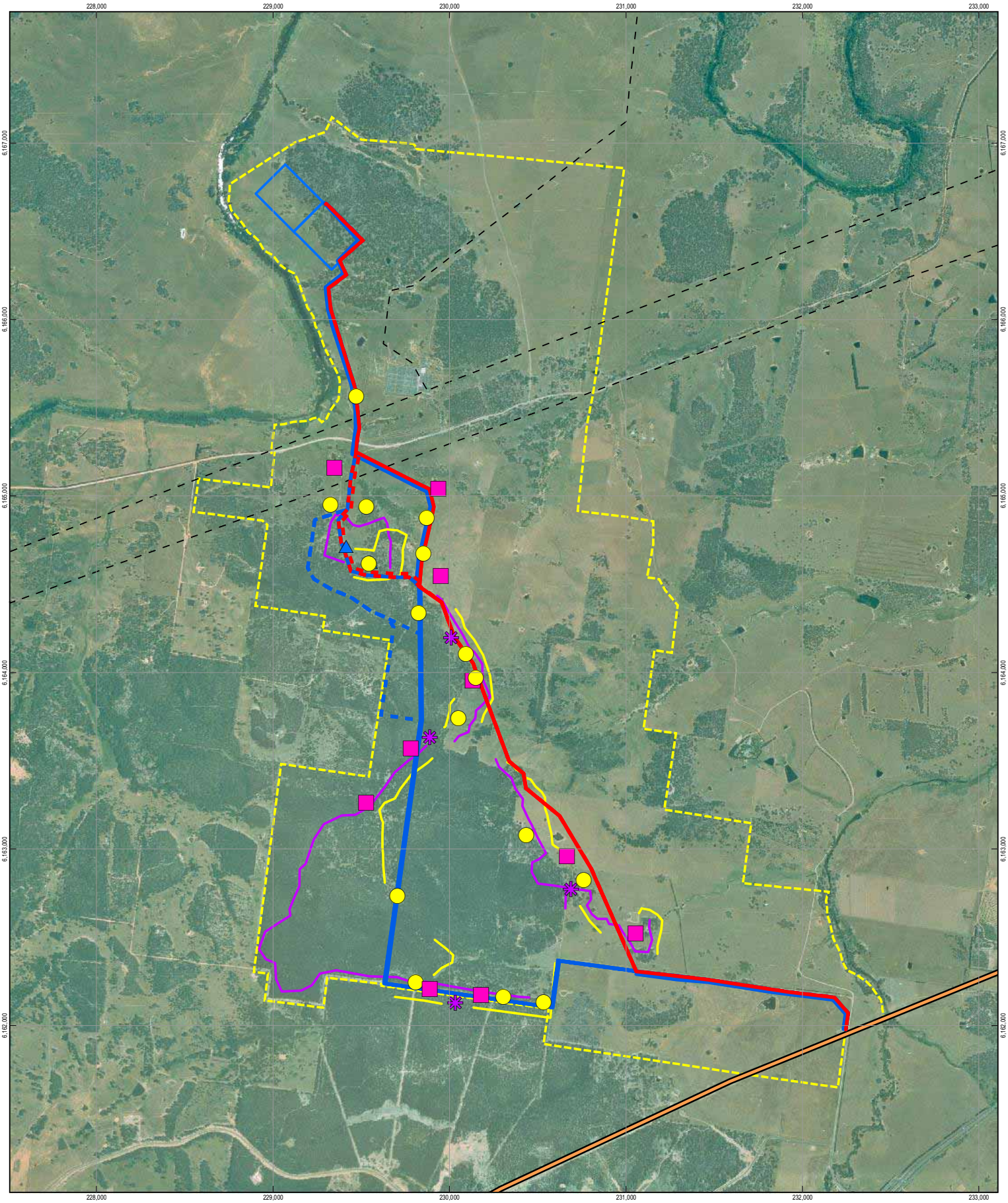
Field surveys were undertaken by qualified GHD field ecologists. Staff qualifications and experience are presented in Table 2 below.

Table 2 GHD Ecology Personnel and Qualifications

Name	Position / Project Role	Qualifications	Relevant Experience
Ben Harrington	Fauna Ecologist / field surveys and reporting	Master of Science, Bachelor of Science, Macquarie University	5+ years
Vanessa Keyzer	Flora Ecologist / field surveys and reporting	Master of Applied Science (Environmental Management) – currently enrolled CSU, Bachelor of Social Science, UNE	8+ years
Brendan Ryan	Senior Fauna Ecologist / field surveys	Master of Environmental Science, Bachelor of Science, Sydney University	10 + years
Natasha Witting	Senior Ecologist / technical review and QA	Bachelor of Science (Environmental Science), Griffith University Bachelor of Science (Environmental Science) Ecology (hons1), Griffith University	10 years + experience

4.4 Survey Limitations

It is possible that some species utilise the study area but were not detected during the survey period. These species are likely to include flora species that flower after rainfall as well as annual, ephemeral or cryptic species that are difficult to detect or identify when not in flower; fauna species which are inactive during cooler months, especially frogs, reptiles and microbats, and migratory or nomadic species that occur on a seasonal basis. Some fauna species are also mobile and transient in their use of resources and it is likely that not all species (resident or transitory) were recorded during the survey period. The habitat assessment conducted for the study area allows for the identification of habitat resources for such species to determine their likely occurrence. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values of the study area in order to predict potential impacts of the proposal. However, surveys were generally consistent with the DECC draft survey guidelines (DEC 2004), and were modified where relevant.



Legend

- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative
- Harp trap
- Anabat
- Quadrats
- Call Play Back
- Bird Survey
- Spotlighting
- Plant Foot print
- Gas Pipeline Corridor
- Powerlines
- Moomba Sydney Gas Pipeline

1:20,000 (at A3)

0 125 250 500 750 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

EnergyAustralia

Delta electricity

GHD

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Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number	21-17633
Revision	A
Date	29 October 2008

Survey Locations

Figure 2

G:\21\17633\CADD\GIS\MapDocuments\Z013_Survey_Location.mxd

10 Bond Street Sydney NSW 2000 Australia 61 2 9239 7000 61 2 9239 7199 sydmail@ghd.com.au www.ghd.com.au

5. Results

5.1 Flora

5.1.1 Flora Species

Approximately 170 plant species were recorded during the field survey. No threatened flora was identified during surveys. The total plant species list recorded during the field survey is presented in Appendix A.

5.1.2 Vegetation Communities

Vegetation communities described and mapped within the study area are shown on Figure 3 and described below. Where relevant, communities have been defined based on Tindell *et al.* 2004.

Riverbank Forest

This community occurred along the Wollondilly River and was dominated by river sheoak (*Casuarina cunninghamiana*). The understorey was generally very disturbed and included a mix of native and introduced grasses and herbs, with large areas dominated by blackberry (*Rubus fruticosus*) and stands of Parramatta green wattle (*Acacia parramattensis*).

Eastern Tablelands Dry Forest

This community included two sub-communities:

Stringybark / Black Sheoak Forest

This was the dominant vegetation community within the study area and occurred on the hillslopes of the proposed pipeline route.

Dominant species included blue-leaved stringybark (*Eucalyptus agglomerata*) and brown stringybark (*Eucalyptus eugenoides*) as well as silvertop ash (*Eucalyptus sieberi*), candlebark (*Eucalyptus rubida* ssp. *rubida*), snow gum (*Eucalyptus pauciflora*), apple box (*Eucalyptus bridgesiana*), grey gum (*Eucalyptus punctata*), cabbage gum (*Eucalyptus amplifolia*) and Sydney peppermint (*Eucalyptus piperita*). Patches of this forest were also dominated by black sheoak (*Allocasuarina littoralis*), and in areas where grazing occurred contained few understorey or ground layer species. However, areas from which grazing had been excluded showed a diversity of shrub species including urn heath (*Melichrus urceolatus*), kangaroo thorn (*Acacia paradoxa*), Parramatta green wattle, hoary guinea flower (*Hibbertia obtusifolia*), matt-rush (*Lomandra filiformis*), violet kunzea (*Kunzea parvifolia*) and rusty pomaderris (*Pomaderris ferruginea*). Ground layer species in intact areas included mulga fern (*Cheilathes sieberi*), raspworts (*Gonocarpus teucriiode; Gonocarpus tetragynus*), and *Pomax umbellata*.

Cabbage Gum / Stringybark Forest

Two areas of this forest occurred within the study area. Lot 77 DP 750053 contained gully vegetation that was dominated by stringybark eucalypts, cabbage gum, snow gum and candlebark with a mid-storey of Parramatta green wattle (see Figure 3). Understorey and ground layer species were virtually absent from this area except for occasional scattered mulga fern, rasp wort and some native grasses. This community also contained silver banksia (*Banksia marginata*), violet kunzea and urn heath. A second area occurred on Lots 96 and 108 DP 750035 and Lot 455 DP 771909. These areas contained cabbage gums and stringybarks with a modified understorey of weeping meadow grass (*Microlaena stipoides*), sheep sorrel (*Acetosella*

vulgaris), carrot weed (*Cotula australis*), stinking pennywort (*Hydrocotyle laxiflora*) and grazed introduced pasture species. Candlebark and Sydney peppermint also occurred in these patches (see Figure 3).

Frost Hollow Grassy Woodland

This community occurred on flats adjacent to hill slopes. It was dominated by snow gum (*Eucalyptus pauciflora*), and/or apple box (*Eucalyptus bridgesiana*) and contained a grassy understorey dominated by kangaroo grass (*Themeda australis*) and wire grasses (*Aristida calycina* var. *calycina, Aristida racemosa* var. *speciosa*). Other occasionally occurring species in this community included candlebark, golden moths (*Diuris chryseopsis*), violet kunzea, spear grass (*Austrostipa* sp.) and canary grass (*Phalaris aquatica*)

Individual apple box also occurred in association with yellow box (*Eucalyptus melliodora*) on the edges of other forest types (see Figure 3).

Tablelands Grassy Box Gum Woodland

Yellow box occurred in scattered locations adjacent to snow gum woodland on Lots 77 and 106 DP 750053 and Lot 12 DP 727493 (see Figure 3). A patch of yellow box also occurred in association with cabbage gum and candlebark south of the house site on Lot 153 DP 750053. One individual also occurred adjacent to cabbage gum forest on Lot 108 DP 750053.

The presence of scattered individuals adjacent to areas of native pasture suggests that box gum woodland occurred in a mosaic with other vegetation types across the landscape, however, this community has been predominately removed to accommodate cattle and sheep grazing. This makes defining boundaries of this community within the study area difficult.

Scribbly Gum Woodland

This community occurred along parts of Wollombi Road. The dominant tree was scribbly gum (*Eucalyptus rossi*) with occasional shrubs such as native peas such as austral indigo (*Indigofera australis*) and wattles (*Acacia brownii, A. parramattensis*). The ground layer was dominated by native grasses such as weeping meadow grass, wire grasses (*Arisitida* spp.), kangaroo grass and herbs such as forest goodenia (*Goodenia hederacea*), mulga fern and yellow buttons (*Chrysocephalum apiculatum*). Floristic diversity was highest along Wollombi Road.

Argyle Apple Woodland

This was a modified vegetation community that was dominated by argyle apple (*Eucalyptus cinerea*) with a grazed understorey of native and introduced grasses. This community occurred on property to the east of the western pipeline route option. Access to this property was not possible and consequently a detailed description of vegetation cannot be provided, however, the Western pipeline route would not impact on this community.

Candlebark Gully Forest

This community occurred along a gully that transected Wollombi Road. This community was dominated by candlebark with an understorey of weeping meadow grass, stinking pennywort (*Hydrocotyle laxiflora*), forest goodenia and bracken fern (*Pteridium esculentum*).

Native Pasture

Native pasture occurred throughout the northern portion of the study area. Aspect and slope affected the species composition with areas on the lower slopes dominated by kangaroo grass, slopes with an easterly aspect were dominated by wire grasses, and slopes with a southerly aspect were dominated by weeping meadow grass (*Microlaena stipoides*). Other grasses present included wallaby grasses (*Austrodanthonia*

tenuior, Austrodanthonia racamosa var racamosa), spear grass (*Austrostipa* spp.), plume grass (*Dichlachne micrantha*) and weed grasses such as canary grass (*Phalaris aquatica*) and serrated tussock (*Nasella trichotoma*). Other pasture species included clover (*Trifolium* spp.), capeweed (*Arcotheca calendula*), cats ear (*Hypochaeris radicata*), onion grass (*Romulea rosea*), sheep sorrel, plantain (*Plantago lanceolata*) and bittercress (*Lepidium* s.p). These areas would once have supported woodland and have been cleared of canopy trees for agriculture.

Modified or Disturbed Land

This community refers to areas of exotic grassland that occurred primarily within the southern section of the pipeline route in association with woodland and native pasture. These areas were dominated by introduced pasture species such as prairie grass (*Bromus catharticus*), canary grass, plantain (*Plantago lanceolata*), sheep sorrel, and clover. These areas were heavily grazed, making identification of species difficult.

Acacia Scrub

Occasional patches of Parramatta green wattle occurred as pure stands or in association with regenerating eucalypts at a number of locations throughout farmland adjacent to the subject study area (see Figure 3). The Western pipeline route would not impact on this community.

5.1.3 Threatened Species

The desktop literature review indicates twenty-four threatened plant species which have been previously recorded or are predicted to occur in the locality (see Table 11 in Appendix 3). None of these species were identified within the study area, however, the study area contains suitable habitat for a number of threatened plants including:

- buttercup doubletail (*Diuris aequalis*);
- camden woollybutt (*Eucalyptus macarthurii*);
- hoary sunray (*Leuchochyrsum albicans* var *tricolour*);
- Tallong midge orchid (*Genoplesium plumosum*);
- delicate pomaderris (*Pomaderris delicata*);
- button wrinklewort (*Rutidosis leptorrhynchoides*); and
- dwarf kerrawang (*Rulingia prostrata*).

Targeted surveys throughout winter and spring did not detect any of these species. As most are either large or easily identifiable in the field, or were surveyed for during their known flowering times, it is considered unlikely that any of these species occur within the study area. For a detailed assessment of each species and their habitat requirements, see Table 11 in Appendix 3.

5.1.4 Endangered Ecological Communities

Two small patches of Tablelands Grassy Box Gum Woodland exist within the study area and may be impacted by the proposal depending on the final route selection. This community qualifies as the endangered ecological community (EEC) *White Box, Yellow Box, Blakely's Red Gum Grassy Woodland* (Box-Gum Woodland) EEC. This EEC is listed under both state and federal legislation, however, is defined based on slightly different criteria in each. Under federal legislation (EPBC Act) the patch must be in "reasonable condition" and support at least 12 native non-grass species in the ground layer, or be greater than two ha in size if otherwise. State legislation (TSC Act) only requires the presence of relevant canopy

species (i.e. Yellow Box, White Box or Blakely's Red Gum). Table 3 and Table 4 detail the criteria for determining TSC Act and EPBC Act box-gum woodland in regards to the study area.

Within the study area, a stand of yellow box (Box-Gum Woodland) occurred in association with a number of other eucalypts as well as shrubs and native grasses south of the house site on Lot 153 DP 750053 (see Figure 3). This area contained nine native non-grass species and this total could potentially come up to 12 considering seasonal variations. This patch would also be considered to be in 'reasonable' condition. Based on these criteria (see Table 3 and Table 4), the patch south of the house site on Lot 153 DP 750053 qualifies as an EEC under the TSC Act, and may qualify under the EPBC Act. One route option (Western pipeline route Option 4) may traverse native grassland adjacent to this community but no canopy trees would be directly impacted.

A second area containing scattered individual yellow box trees also occurred in association with other canopy trees either as isolated patches or adjacent to other vegetation types (see Figure 3) on the north-eastern corner of Lot 77 DP 750053. Western pipeline route Option 3 may impact on native grassland associated with these trees, but again, no canopy trees would be directly affected. These areas of scattered individual yellow box trees and associated grassy understorey did not meet the federal criteria for determination of the Box-Gum Woodland EEC listed under the EPBC Act (i.e. at least 12 non-grass understorey species, or greater than two ha in size if otherwise), however did qualify under the TSC Act (see Table 3 and Table 4).

Table 3 NSW TSC Act criteria for the determination of Box Gum Woodland EEC

Criteria	Description	Does woodland in the study area meet the criteria?
1	Does the site fall within the area defined in the NPWS Scientific Determination for Box Gum Woodland EEC?	Yes.
2	Are characteristic trees white box, yellow box or blakely's cabbage gum present (or likely to have been present) at the site?	Yes, yellow box is present at a number of locations (see Figure #).
3	Is the site mainly grassy?	Yes, sites containing yellow box have a mainly grassy understorey.
4	Do any of the listed characteristic species occur?	Yes. (See NPWS Scientific determination and species list http://www.environment.nsw.gov.au/determinations/BoxgumWoodlandEndComListing.htm)
5	If the site is degraded, is there potential for assisted regeneration of the overstorey or understorey?	Yes, there is potential for assisted regeneration in all areas containing yellow box.

Table 4 Commonwealth Listing Advice on White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (2006) criteria for assessing box gum woodland

Criteria	Description	Does the site meet the criteria?
1	Does the site contain or previously have contained white box, yellow box or blakely's red gum?	Yes, a number of sites contain yellow box
2	Does the site have a predominately native understorey?	Yes. Areas where yellow box occur have a predominately native understorey.
3	Is the patch 0.1 ha or greater in size?	Yes. The patch south of the south of the house site on Lot 153 DP750053 is greater than 0.1 ha in size.
4	Are there 12 or more native understorey species present (excluding grasses)?	Scattered trees adjacent to native pasture do not meet this criteria however, the patch of box gum woodland south of the house site on Lot 153 DP750053 contained nine native non-grass species Seasonal surveys may reveal a higher presence of non-grass native species.
5	Is the site in "reasonable" condition? (i.e. at least one of the understorey species will be an important species (e.g. grazing-sensitive, regionally significant or uncommon species; such as kangaroo grass or orchids) in order to indicate a reasonable condition).	Yes. All areas containing yellow box meet this criteria expect the isolated individual on Lot 108 DP 750053.
6	Where sites do not meet does the site meet criteria 4 and 5, is the patch two ha or greater in size?	No. Areas of scattered yellow box do not meet this criterion.
7	If yes, than does the patch have an average of 20 or more mature trees per hectare or is there natural regeneration of dominant overstorey Eucalypts?	The patch of Box Gum Woodland south of the house site on Lot 153 DP 750053 meets this criterion, however, areas with scattered individual Yellow Box do not.

Neither of these areas of Box-Gum Woodland is likely to be impacted by the proposal, and they may be avoided altogether depending on final route selection. However, based on the precautionary principle relevant state and federal assessment criteria for these communities was undertaken and is discussed in Section 6.3.2.

One other EEC, natural temperate grassland of the southern tablelands (NSW and ACT), is predicted to occur within the study area (DEWHA, 2008), however the guidelines for identifying this community require that an area historically did not contain canopy trees and this is unlikely to be the case within the study area. Open grassland areas within the study area are the result of clearing for agriculture and would have contained woodland vegetation prior to clearance.

5.1.5 Noxious Weeds

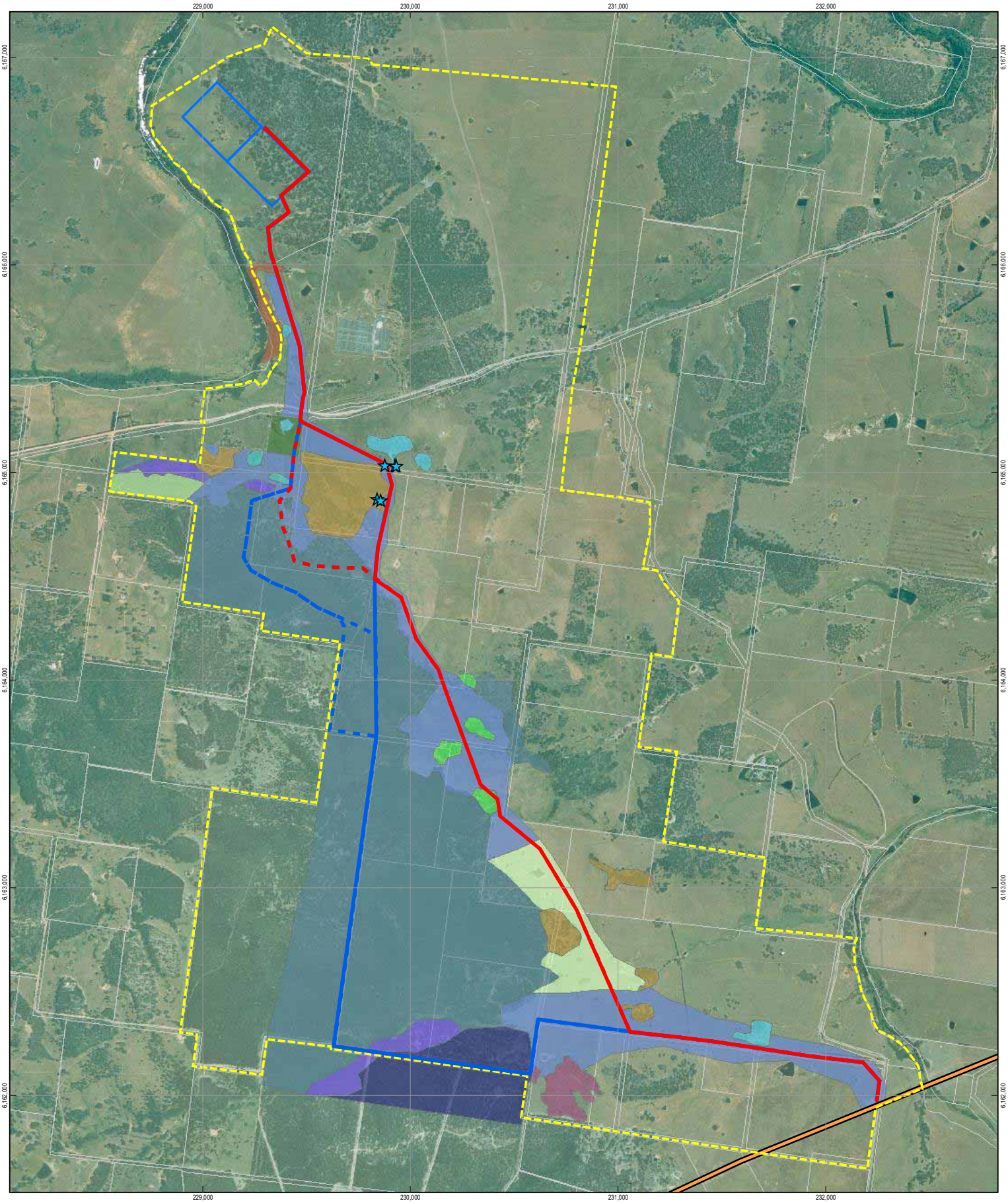
The *Noxious Weeds Act 1993* provides for the declaration of noxious weeds in local government areas. Landowners and occupiers must control noxious weeds according to the control category specified in the Act. Public authorities must control noxious weeds according to the control category to the extent necessary to prevent their spread to adjoining land.

The study area contains nine species declared as noxious weeds in Goulburn-Mulwarree LGA as shown in Table 5 below. These species were scattered throughout the study area. Blackberry was particularly prominent along the Wollondilly River, and lantana occurred as infestations in areas of Eastern Dry Tablelands Forest. Other species occurred in areas of pasture.

Table 5 Noxious weeds present in the study area

Common name	Scientific name	Control category
African love grass	*Eragrostis curvula*	4
blackberry	*Rubus fruticosus*	4
Fireweed	*Senecio madagascarensis*	4
Lantana	*Lantana* spp.	4
onion grass	*Romulea species*	5
scotch thistle	*Onopordum species*	4
serrated tussock	*Nasella trichotoma*	4
prickly pear	*Opuntia* spp.	4
briar rose	*Rosa rubignosa*	4

For Category 4: 'the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority'. For Category 5: 'the requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with'.



Legend

- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative
- Plant Foot print
- Gas Pipeline Corridor
- Moomba Sydney Gas Pipeline
- Modified Grassland
- Riverbank Forest
- River She-oak Forest
- Frost Hollow Grassy Woodland
- Snow Gum / Apple Box Woodland
- Unclassified
- Acacia Scrub
- Argyle Apple Forest
- Box- Gum Woodland EEC
- Cabbage Gum / Stringybark Forest
- Candlebark gully Forest
- Garden
- Native Grassland
- Red Gum Woodland
- Red Stringy Bark Forest
- Scribbly Gum woodland
- Snow Gum/Candlebark/Applebox Woodland
- Stringybark/ Black Sheoak forest
- Tableland Hills Grassy Woodland

1:17,000 (at A3)

0 60 120 240 360 480

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

EnergyAustralia

Delta electricity

GHD

CLIENTS | PEOPLE | PERFORMANCE

Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number 21-17633
Revision A
Date 9 December 2008

Figure 3

G:\21\17633\CADD\GIS\MapDocuments\Z014_Vegetation_Communities.mxd

10 Bond Street Sydney NSW 2000 Australia 61 2 9239 7000 61 2 9239 7199 sydmail@ghd.com.au www.ghd.com.au

5.2 Fauna Species

Birds

There was a high diversity of native birds at the site (overall surveys recorded ~80 species). These included:

- the threatened gang-gang (*Callocephalon fimbriatum*) and glossy black-cockatoos (*Calyptorhynchus funereus*);
- open country species such as the Australian magpie (*Gymnorhina tibicen*), Australian raven (*Corvus coronoides*), Australian pipit (*Anthus* australis), yellow-rumped thornbill (*Acanthiza chrysorrhoa*) and scarlet robin (*Petroica boodang*);
- dry forest and woodland species including the white-throated treecreeper (*Cormobates leucophaea*), striated thornbill (*Acanthiza lineata*), white-browed scrubwren (*Sericornis frontalis*) and red-browed finch (*Neochmia temporalis*) and the threatened speckled warbler (*Pyrrholaemus saggitatus*) identified in stringybark / black sheoak forest;
- waterbirds including Pacific black duck (*Anas superciliosa*), dusky moorhen (*Gallinula tenebrosa*) and Australian wood duck (*Chenonetta jubata*);
- raptors including the wedge-tailed eagle (*Aquila audax*) and little eagle (*Hieraaetus morphnoides*); and
- nocturnal, predatory species such as tawny frogmouth (*Podargus strigoides*), and the threatened powerful owl (*Ninox strenua*).

Mammals

Native ground-dwelling mammals observed included macropods such as the eastern grey kangaroo (*Macropus giganteus*) and swamp wallaby. Red-necked wallabies (*Macropus rufogriseus*) were observed in steeper country with intact forest and rock outcrops. Common wombats (*Vombatus ursinus*), including numerous active burrows, were recorded throughout the site, notably on the lower slopes associated with pasture areas.

Arboreal mammals, such as the common brushtail possum (*Trichosurus vulpecula*), common ringtail possum (*Pseudochreirus peregrinus*) and sugar glider *(Petaurus breviceps*), were noted feeding on *Eucalyptus* blossom and *Acacia parramattensis* sap throughout the study area. Exotic species included the rabbit (*Oryctolagus cuniculus*) and the red fox (*Vulpes vulpes*).

Four species of microbat were identified as 'definite' records within the study area: southern forest bat (*Vespadelus regulus*), little forest bat (*Vespadelus vulturnus*), gould's wattle bat (*Chalinolobus gouldii*) and the chocolate wattled bat (*Chalinobolus morio*). A further five species were tentatively identified: the large forest bat (*Vespadelus darlingtoni*), a long-eared bat (*Nyctiphilus* spp.) and a freetail bat (*Mormopterus* spp.) as well as two species listed as vulnerable under the TSC Act eastern bentwing-bat *(Miniopterus schreibersii oceanensis*) and large-footed myotis *(Myotis macropus)*.

Five bats were caught in harp traps over the two-day supplementary survey and were either southern forest bats or little forest bats. Field surveys conducted by URS in 2006 and 2007 noted large numbers of 11 species of microbats on the nearby Proposed Marulan Gas Turbine Facility site (URS, 2008).

Reptiles and Amphibians

Diurnal reptiles were relatively sparse. Jacky lizards (*Amphibolurus muricatus*) were recorded at a number of locations as well as a sunskink species (*Lampropholis* spp.) sheltering amongst woody debris.

A moderate diversity and abundance of frogs were recorded across the study area. The common eastern froglet (*Crinia signifera*) was abundant and calling in permanent open wetlands and ephemeral drainage lines and ponds across within the study area. Whistling tree frog (*Litoria verreauxii),* spotted marsh frogs (*Limnodynastes tasmaniensis*) and dusky toadlets (*Uperoleia fusca*) were observed sheltering beneath rocks and woody debris in grassland and woodland, with smooth toadlet (*Uperoleia laevigata*), beeping toadlet (*Crinia parainsignifera*) and Perons' tree frog (*Litoria peroni*) heard calling from farm dams. Frogs were less common in areas of forest.

5.2.1 Fauna Habitat

Habitat assessments were conducted across the entire study area in order to determine the conservation significance of fauna habitats and to assess the potential presence of native fauna (and especially threatened species) not directly observed during the surveys.

Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species previously recorded in the study area. Important habitat resources are mapped on Figure 4.

Forest and Woodland

Woodland and forest at the site was relatively intact and contained healthy, mature trees. There was good structural diversity with a mix of mature eucalypts and stags and evident recruitment of juveniles and seedlings. These areas supported a rich diversity of native birds, as well as microchiropteran bats and arboreal mammals. There was a well-developed small tree stratum consisting of black sheoak *(Allocasuarina littoralis*), as well as an intact, albeit sparse, native shrub layer.

Acacia was abundant along cleared margins of the forest. This stratum would be important for forest bird species, the sugar glider and potentially the squirrel glider, providing shelter, nectar and sap.

Numerous hollow bearing trees and old-aged emergents were recorded throughout areas of forest and woodland. Large, important habitat trees are plotted on Figure 4 and discussed in greater detail below. Stringybark species present within the study area are nectar-bearing and would provide a food resource for native fauna, including birds such as the red wattlebird and yellow-faced honeyeater observed within the study area, and other nectar feeding birds and arboreal mammals. These stringybark species are autumn and winter-flowering and may provide seasonal nectar resources for the swift parrot and regent honeyeater. Local populations of gang-gang cockatoo feed on stringybark flowers and fruits during their annual winter-feeding migrations and this species was recorded within forest areas during previous surveys (GHD Surveys 18/19 September 2008; URS, 2008). Use of existing clearances along parts of the route and avoidance of habitat trees where possible will minimise impacts to habitat resources along the proposed pipeline route.

Black sheoak was present in good numbers throughout the stringybark / black sheoak forest and formed localised dense stands. Black sheoak is an important food resource for the glossy black cockatoo (*Calyptorhynchus lathami)*. The species is known to frequent preferred feed trees which are mature, healthy, in dense stands and bear good quantities of fruit (DECC, 2008_b). Black sheoak within the study area were mature and healthy with abundant fruit. Evidence of use by the glossy black cockatoo (in the form of chewed cones beneath stands of trees) was evident along the proposed western pipeline route. Two individuals were also observed directly during GHD surveys, and forest areas at this locality are likely to comprise an important habitat for this species. Numerous (see Figure 4) large hollow-bearing trees were also present within the study area and may constitute breeding habitat for the glossy black cockatoo.

Understorey growth in forest areas is suppressed by black sheoak in many areas, and in some cases, as a result of grazing. The combination of extensive intact vegetation, large hollow-bearing trees, high structural

and floristic diversity and drainage lines means that the study area provides habitat for large forest owls and their prey species (e.g. arboreal and terrestrial mammals). Hollow-bearing trees within the study area and surrounds were large enough to support breeding owls, such as the powerful owl (*Ninox strenua*) which was recorded during current surveys (and previously by PB 2005).

Grassy understorey associated within woodland habitat would provide suitable foraging habitat for native herbivorous mammals. This would also provide shelter and foraging habitat for small terrestrial animals including native invertebrates, reptiles and mammals.

Other Habitat Resources

The DEC (2004) survey guidelines identify "special habitats" (e.g. water bodies, rocky outcrops and cliffs) that are likely to support specific fauna assemblages. These resources may be significant for threatened species (DECC, 2008a). Tree hollows are important for native fauna as diurnal or nocturnal shelter sites, for rearing young, for feeding, for thermoregulation, and to facilitate ranging behaviour and dispersal. An estimated 15% of all terrestrial vertebrate fauna in Australia are dependent upon tree hollows and for many of these species the relationship is obligate i.e. no other habitat resource represents an adequate substitute (Gibbons and Lindenmayer, 2002). Accordingly, the field survey included a targeted survey of specific habitat resources in addition to the assessment of the communities described above.

Forest and woodland in the study area was mature and contained pre-European settlement aged habitat trees. Intact woodland and forest contained substantial numbers of hollow-bearing trees (see Figure 4). Overall the study area contains sufficient quantities of these resources to support local populations of hollow-dependant fauna.

Hollow-bearing trees may provide suitable diurnal roost sites for tree-roosting microbats including the threatened eastern freetail bat (*Mormopterus norfolkensis*), little bent-wing bat (*Miniopterus australis*), eastern bent-wing bat (*Miniopterus schreibersii oceanensis*), greater broad-nosed bat (*Scoteanax rueppellii*) and eastern falsistrelle (*Falsistrellus tasmaniensis*) which have previously been recorded in the locality (URS, 2008; PB, 2005). They are also likely to support native parrots including the sulphur-crested Cockatoo (*Cacatua galerita),* yellow-tailed black-cockatoo (*Calyptorhynchus funereus*) and threatened parrot species such as the gang-gang cockatoo and glossy black cockatoo observed during the field survey. Larger hollows may provide nest sites for threatened forest owls such as the powerful owl (*Ninox strenua*) and masked owl (*Tyto novaehollandiae*).

The study area contains reasonable amounts of standing and fallen dead timber which will provide important shelter and foraging resources for native invertebrates, reptiles and small terrestrial mammals.

There are numerous large, significant conglomerate rock outcrops throughout the proposed western pipeline route. Outcrops contain cracks and fissures, large boulders and fragments and some caves and overhangs. Caves are used for shelter by red-necked wallabies and eastern grey kangaroos (identified by tracks and scats). Fissures and overhangs may provide diurnal roost sites for microbats however none of the caves are large or sheltered enough to provide suitable sites for maternity colonies. These areas are also likely to provide habitat for reptiles and possibly small mammals.

Exotic Species

The predatory red fox, the feral dog (*Canis lupus*) and wild pig (*Sus scrofa*) were sighted within the study area. It is expected that the cat (*Felis catus*) would also occupy the study area. The presence of these predators reduces the likelihood of some native animals occurring at the site.

Patch Sizes and Connectivity

The main patch of stringybark / black sheoak forest in the study area is large (see Figure 3) and has excellent connectivity with native vegetation to the west and south. It supports healthy local populations of a range of native birds, mammals and reptiles including patch-size dependant species such as the threatened speckled warbler. This species requires large relatively intact patches of native vegetation to persist in an area. This connectivity will also facilitate the movement of native birds, some reptiles, arboreal mammals and potentially small terrestrial mammals.

Smaller patches isolated by surrounding pasture and farm structures will support open country bird species and a more limited suite of native reptiles and mammals. Land to the north and east features a matrix of patchy open woodland and grassland. These areas have similar habitat value to the study area and will combine to form a large area of habitat suitable for open country and woodland species. Connectivity is good to the south for approximately two km but then is limited by the Hume Highway.

The Wollondilly River is less than 200 metres from the northern portion of the study area. The riparian corridor features stretches of intact riparian forest alternating with willow (*Salix* spp.) infestations and cleared agricultural land. The riparian zone provides a near-continuous habitat corridor for aquatic species, waterfowl and semi-aquatic, frogs, reptiles and mammals.

5.2.2 Threatened Fauna Species

Four threatened bird species were observed during GHD (July, September & October 2008) field surveys:

- gang-gang cockatoo *(Callocephalon fimbriatum);*
- glossy black-cockatoo *(Calyptorhynchus lathami);*
- speckled warbler (*Pyrrholaemus saggitatus);*
- powerful owl (*Ninox strenua*).

Two microchiropteran bats listed as vulnerable under the TSC act were tentatively detected by Anabat:

- eastern bentwing-bat *(Miniopterus schreibersii oceanensis*); and
- large-footed myotis *(Myotis macropus).*

A number of gliders (*Petaurus* spp.) were observed during spotlight surveys. This genus is difficult to identify to species level by spotlight. Several individuals were positively identified by call as sugar glider, however some individuals may have been either the sugar glider or the squirrel glider with the latter being listed as vulnerable under the TSC Act.

The desktop review indicates the potential presence of a further 33 threatened fauna species listed under the TSC Act as Wildlife Atlas records in the locality (10 km radius), and/or the EPBC Act and predicted to occur in the local area. The full list of threatened fauna, including their conservation status, habitat requirements, previous records and likelihood of occurrence is presented in Table 7 of Appendix C. A review of the specific habitat requirements of these species, and the habitat present within the study area allowed a number of these species to be eliminated as having low likelihood of occurrence within the study area.

Three threatened bird species (gang-gang cockatoo, diamond firetail and hooded robin) and two threatened microbats (eastern false pipistrelle and eastern bent-wing bat) were recorded near the proposed gas turbine facilities site during 2007 (URS, 2008). An additional four threatened fauna species (powerful owl, greater broad-nosed bat, eastern bent-wing bat and little bent-wing bat) were recorded less than two km to the northwest in 2005 (PB, 2005). Woodland and forest in the study area provides suitable habitat for these species.

Therefore a total of six threatened species were considered to have a high likelihood of occurrence at the site based on the presence of suitable foraging and roosting habitat and recent records in the local area:

- diamond firetail *(Stagonopleura guttata*);
- hooded robin *(Melanodryas cucullate*);
- eastern false pipistrelle *(Falsistrellus tasmaniensis*);
- eastern freetail bat (*Mormopterus norfolkensis*);
- little bentwing-bat *(Miniopterus australis);* and
- greater broadnosed bat *(Scoteanax ruepellii).*

Another five threatened species are considered to have the potential to occur:

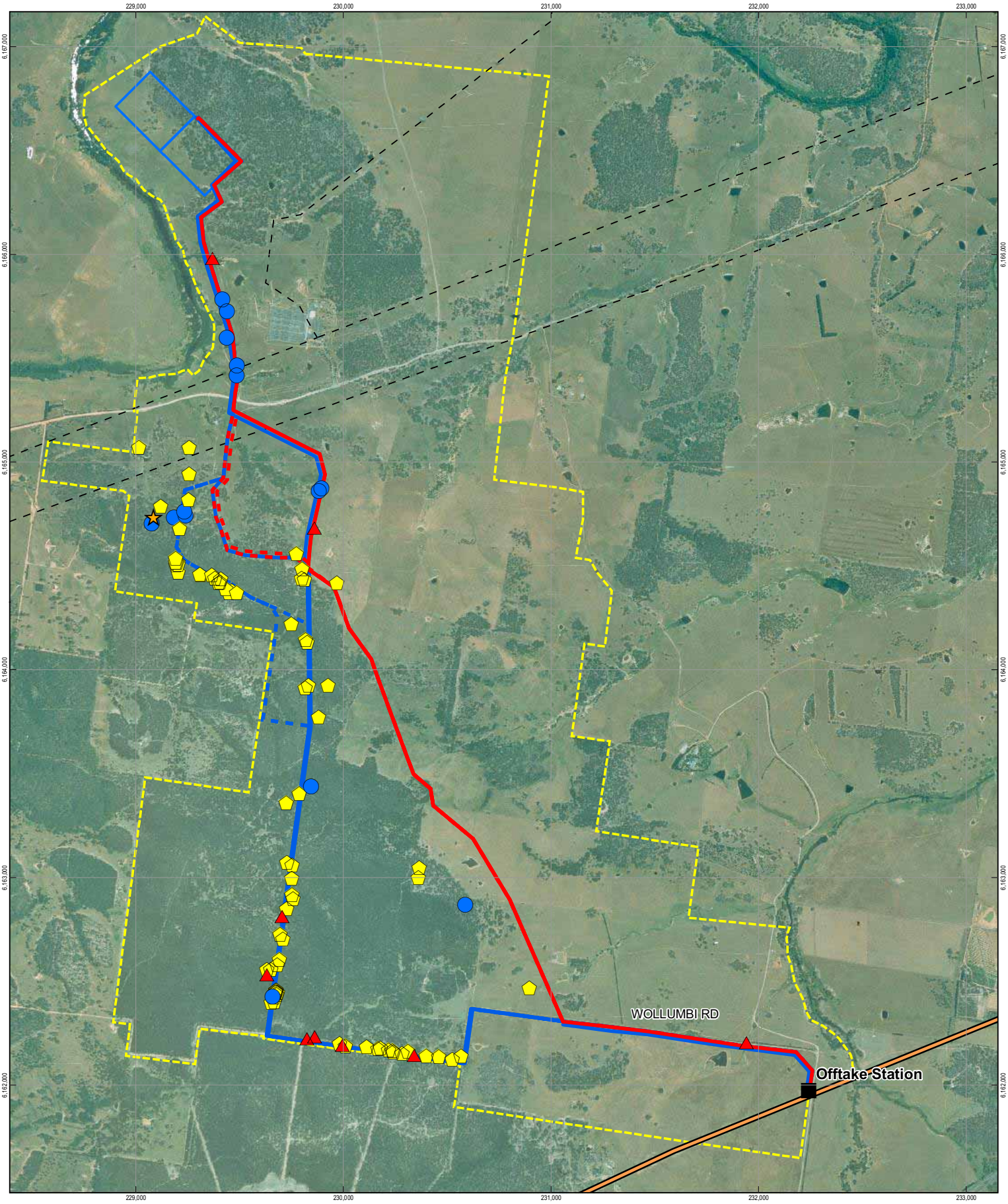
- black-chinned honeyeater (*Melithreptus gularis gularis*);
- turquoise parrot (*Neophema pulchella*);
- yellow-bellied glider (*Petaurus australis*);
- squirrel glider *(Petaurus norfolcensis);*
- striped legless lizard (*Delma impar*)

A further seven threatened species may utilise habitats within the study area on an occasional or opportunistic basis:

- large-eared pied bat *(Chalinolobus dwyeri);*
- brown treecreeper *(Climacteris picumnus);*
- swift parrot *(Lathamus discolour);*
- regent honeyeater *(Xanthomyza phrygia);*
- barking owl *(Ninox connivens);*
- masked owl *(Tyto noaehollandiae*); and
- spotted-tailed quoll *(Dasyurus maculatus).*

Although the pipeline would temporarily remove habitat for the above species, sensitive construction techniques, mitigation measurers and remediation commitments would substantially reduce any impacts on these species should they occur. Consequently, it is not expected that the proposed Western pipeline route would significantly impact on any of these species. Furthermore, substantial alternative habitat would be retained in the immediate vicinity of the proposed gas turbine facility site as well as within the offset site that occurs adjacent to study area.

A more detailed discussion of potential impacts on threatened species is provided in Section 6.



Legend

- Offtake Station
- Cave
- Rock outcrop
- Habitat tree
- Drainage line
- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative
- Powerlines
- Moomba Sydney Gas Pipeline
- Plant Foot print

1:17,000 (at A3)

0 125 250 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Marulan Gas Turbines Facilities

Job Number	21-17633
Revision	A
Date	9 March 2009

Figure 4

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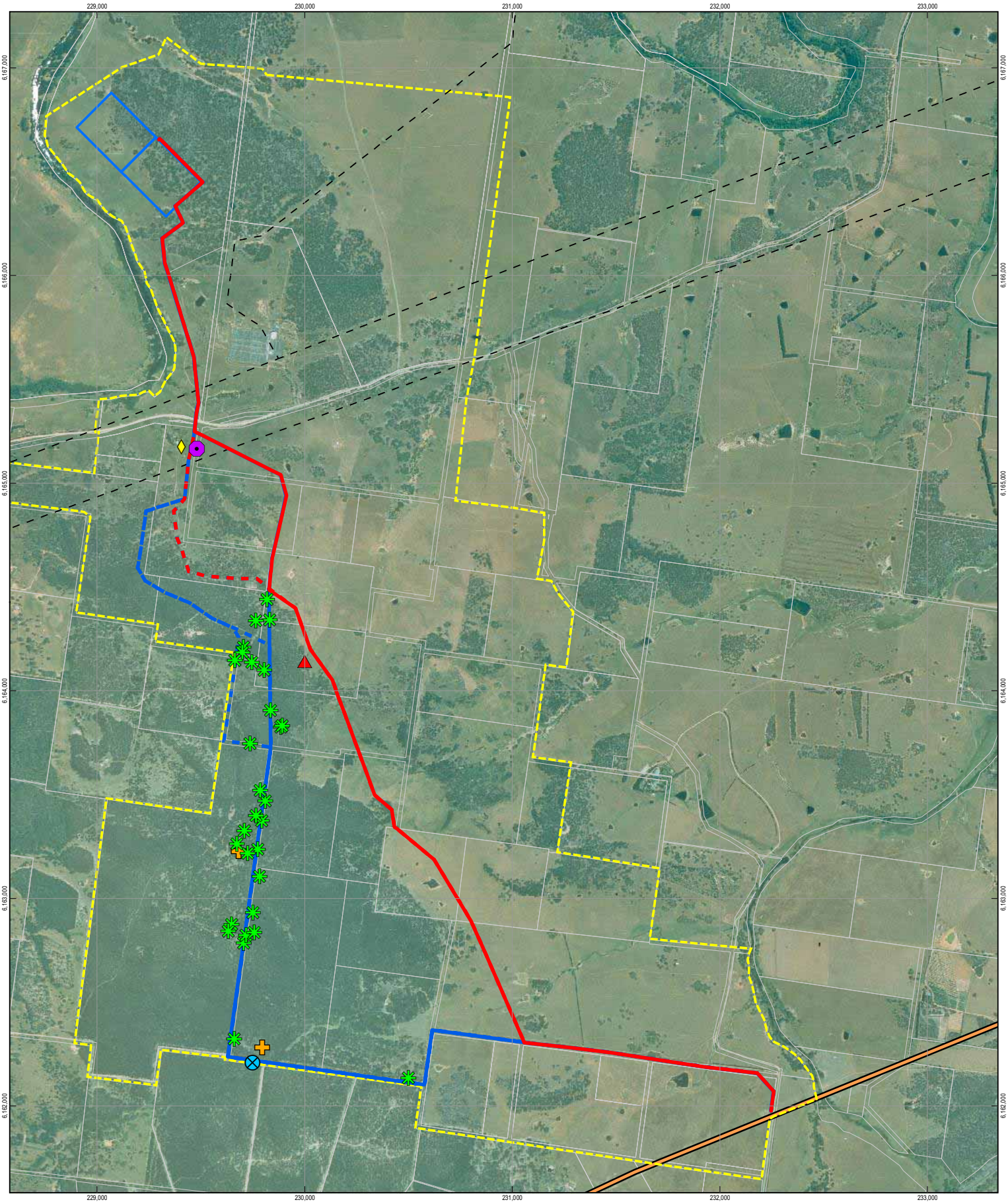
10 Bond Street Sydney NSW 2000 Australia 61 2 9239 7000 61 2 9239 7199 sydmail@ghd.com.au www.ghd.com.au



Legend

- Large- footed Myots (tentaive record)
- Eastern Bent Wing Bat
- Speckled Warbler
- Glossy Black Cockatoo, Preferred feed Tree
- Powerful owl
- Gang-gang Cockatoo
- Plant Foot print
- Gas Pipeline Corridor
- Sydney Moomba Gas Main
- 1. Eastern Route (Red)
- 2. Eastern Route using Lot 153 Alternative (Red and Broken Red)
- 3. Western Route (Blue)
- 4. Western Route using Lot 153 Alternative (Blue and Broken Blue)
- 5. Western Route using 206 & 207 Alternative (Blue and Broken blue)
- 6. Western Route using crown Public Roads ("L" shape) Alternative

1:17,000 (at A3)

0 87.5 175 350 525 700

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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Job Number	21-17633
Revision	A
Date	30 October 2008

Thereatened Species

Figure 5

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6. Impact Evaluation

This section assesses the potential impacts of the proposal during construction and operation on the flora and fauna of the study area.

6.1 Flora

6.1.1 Vegetation Clearing and Construction Impacts

The Western pipeline route option would initially remove/modify between eight and 10 hectares of intact forest and woodland habitat as well as approximately nine of cleared native pasture. The majority of the route would be rehabilitated.

Table 6 outlines the impacts on vegetation to accommodate the proposed Western pipeline route. A number of alternatives have been put forward and each one is detailed, including associated clearance of each vegetation type (as relevant), below. For each route alternative see Figure 1.

Approximately half the proposed route falls within already cleared agricultural land. Furthermore, existing clearing along Wollombi Road equates to a width of six metres from approximately three kilometres and is common to all proposed route options, substantially minimising vegetation clearance. This clearance also allows more flexibility to avoid important habitat features such as hollow-bearing trees.

Western route option 5 includes an existing track through Lots 206 & 207 further reducing required clearance. This equates to a width of three metres for approximately 1500 metres and again would minimise vegetation clearance in these areas. Extent of clearing in Table 6 takes into consideration this existing clearance. Approximate areas of clearing required is based on an initial clearance of 20 metre corridor, with the corridor being rehabilitated back to bushland, including a maintained six metre corridor of shrubs and ground layer directly over the pipeline (NB this is not relevant to areas of native pasture).

Table 6 Approximate clearance of each vegetation type for each alternative route

Proposed Western pipeline route Alternative (See Figure 1 for each alternative route option)	Vegetation Type	Approximate area of initial clearance of 20 metres	Rehabilitated modified 6 metre corridor (m^2)
Western pipeline route (3) Along Wollombi Road, through crown road reserve, Lot 152, Lot 78, Lot 77, Lot 12, Lot 8, across Canyonleigh Road through Lot 1 to Facilities site. Total Distance: 7935 metres	Native pasture	90000	NA – entire area of impact rehabilitated to existing grassland
	Native pasture associated with Box-Gum Woodland EEC (scattered Yellow Box trees)	2000	NA – entire area of impact rehabilitated to existing grassland
	Stringybark / Black Sheoak Forest	50000	15000
	Candlebark Gully Forest (excluding 6m existing clearance along Wollombi Road)	7476	534
	Scribbly Gum Woodland (excluding 6m existing clearance along Wollombi Road)	35000	NA (existing 6 metre corridor would be maintained above proposed pipeline)
TOTAL for Western pipeline route (3)		**152976** **15 ha**	**15534 m^2** **1.55 ha**
Western pipeline route (4) using Lot 153 (Boltezar)	Native pasture	90000	NA – entire area of impact rehabilitated to existing grassland

Proposed Western pipeline route Alternative (See Figure 1 for each alternative route option)	Vegetation Type	Approximate area of initial clearance of 20 metres	Rehabilitated modified 6 metre corridor (m^2)
Along Wollombi Road, through crown road reserve, Lot 152, Lot 78, through Lot 153 to Lot 8, across Canyonleigh Road through Lot 1 to Facilities site. Total Distance: 8040 metres	Native pasture associated with Box-Gum Woodland EEC (on Lot 153)	5000	NA – entire area of impact rehabilitated to existing grassland
	Stringybark / Black Sheoak Forest	70000	21000
	Candlebark Gully Forest (excluding 6m existing clearance along Wollombi Road)	7476	534
	Scribbly Gum Woodland (excluding 6m existing clearance along Wollombi Road)	35000	NA (existing 6 metre corridor would be maintained above proposed pipeline)
TOTAL for Western pipeline route (4)		**207476** **20.7 ha**	**21534** **2.15 ha**
Western pipeline route (5) using Lots 206 & 207 Along Wollombi Road, through crown road reserve, Lots 206 & 207 joining Lot 153 to Lot 8, across Canyonleigh Road through Lot 1 to Facilities site. Total Distance: 8188 metres	Native pasture	90000	NA (assumes complete rehabilitation to existing state)
	Stringybark / Black Sheoak Forest	40000	12000
	Stringybark / Black Sheoak Forest where existing 3 metre path would be utilised	25500	4500 (assumes a 3 metres corridor either side of existing 3 metres track to be maintained as trees and shrubs)
	Candlebark Gully Forest (excluding 6m existing clearance along Wollombi Road)	7476	534

Proposed Western pipeline route Alternative (See Figure 1 for each alternative route option)	Vegetation Type	Approximate area of initial clearance of 20 metres	Rehabilitated modified 6 metre corridor (m^2)
	Scribbly Gum Woodland (excluding 6m existing clearance along Wollombi Road)	35000	NA (existing 6 metres corridor would be maintained above proposed pipeline)
TOTAL for Western pipeline route (5)		**197976** **19.8 ha**	**17034** **1.7 ha**
Western pipeline route (6) using Crown Public Road on the western & southern boundary of Lot 258 Along Wollombi Road, through crown road reserve until Lot 152 where it joins Lots 206 & 207 joining Lot 153 to Lot 8, across Canyonleigh Road through Lot 1 to facilities site. Total Distance: 8304 metres	Native pasture	90000	NA (assumes complete rehabilitation to existing state)
	Stringybark / Black Sheoak Forest	50000	7500
	Stringybark / Black Sheoak Forest where existing 3 metre path would be utilised	25500	4500 (assumes a 3 metre corridor either side of existing 3 metre track to be maintained as trees and shrubs)
	Candlebark Gully Forest	7476	534
	Scribbly Gum Woodland	35000	NA (existing 6m corridor will be maintained above proposed pipeline)
TOTAL for Western pipeline route (6)		**176476** **17 ha**	**12534** **1.25 ha**

6.1.2 Fragmentation of vegetation

Initial clearing may disrupt connectivity for a distance of over two kilometres and bisect a large intact patch of remnant forest that occurs within an already fragmented landscape. Linear clearings are known to favour pest species such as foxes, increase weed invasion and edge effects, and may impact on intact patch dependent species such as the speckled warbler. However, allowing native vegetation to re-colonise in these areas to a six metre shrub and grass corridor would reduce these impacts and maintain connectivity once construction and rehabilitation is complete. Furthermore, canopy trees including hollow-bearing trees and stands of *Allocasuarina* would be avoided wherever possible, minimising impacts as a result of fragmentation. Clearing would also be conducted in a way that avoids the proposed pipeline route remaining cleared for long periods of time (see Section 7) with remediation beginning as soon as is feasible after construction. Table 7 below summarises the initial areas of clearance for each alternative route and the resultant 6 metre modified corridor. It indicates that although an initial 8 to 10 hectares of native vegetation would be impacted, only one to two hectares would remain permanently modified as a result of the proposal.

Table 7 Summary of vegetation clearance, hollow-bearing trees and Glossy Black-cockatoo feed trees within each route alternative, and the area of modified habitat after rehabilitation

Route Alternative	Vegetation Clearance	Consequent modified corridor above pipeline route after rehabilitation	Number of hollow-bearing trees identified along each route*	Number of Glossy Black-cockatoo feed trees identified along each route*
Western Route (3)	15.3 ha (incl 9 ha native pasture)	1.55 ha	39	16
Western Route (4)	20.7 ha (incl 9 ha native pasture)	2.15 ha	39	16
Western Route (5)	19.8 (incl 9 ha native pasture)	1.7 ha	45	16
Western Route (6)	17 ha (incl 9 ha native pasture)	1.25 ha	39	19

* Numbers are for trees identified within 30 m of the pipeline route. Note that many trees would be avoided during construction as detailed in mitigations section.

6.2 Fauna

Native vegetation within the study area footprint is shown on Figure 3 and threatened fauna and important habitat resources on Figure 4**.** The removal of these resources would impact fauna within the study area. The magnitude of these impacts is assessed below.

A considerable abundance and diversity of native bird species occupy the study area and would be impacted by the removal of native vegetation and other habitat resources. The majority of these species are mobile, widespread and common. Further, there are large quantities of equivalent habitat and resources in the locality and so it is likely that the impact on local populations of native birds would be minor.

Arboreal mammals occur in areas of Eastern Tablelands Dry Forest and these areas would not be impacted as a result of the proposed pipeline. A number of microchiropteran bats were recorded within the study area, however, the impacts associated with the pipeline would be unlikely to substantially affect habitat of

relevance for any of these species. Mitigation measures outlined in Section 7 would be likely to ameliorate any impacts on these species.

The pipeline may directly impact active wombat burrows which would need to be identified and any resident wombats carefully relocated. Mitigation measures outlined in Section 7 would be likely to ameliorate impacts on these species:

- identification of active wombat burrows prior to construction; and
- the careful relocation of any wombats that may be directly impacted by the proposal.

A moderate diversity and abundance of native frogs and reptiles are likely to occupy the study area. Species recorded during field surveys were widespread and common (Cogger, 1996). It is likely that individuals would be killed or displaced during clearing, particularly species which burrow or shelter beneath woody debris. Mitigation measures outlined in Section 7 would be likely to ameliorate these impacts. These include: a pre-clearance survey and relocation of individuals where practicable; and careful removal of large woody debris and placement within adjoining areas. The loss of habitat resulting from the proposal would be likely to have a minor impact on local populations of these species given the large areas of native vegetation and other resources in the vicinity of the study area.

There would be moderate, ongoing impacts on fauna utilising adjacent areas of habitat during construction associated with noise and other disturbances. Impacts would be likely to be minor as construction would only occur during daylight hours and would be temporary. There are already disruptive human activities in the vicinity of the study area associated with agriculture. Larger, more mobile fauna currently occupying the study area are therefore likely to be adapted to these disturbances. There would be impacts upon smaller, less mobile fauna in the immediate vicinity of the proposed works.

6.3 Species and Communities of Conservation Significance

6.3.1 Threatened Flora Species

Although the study area contains habitat for a number of potential threatened flora species, targeted surveying during the known flowering times of these species was conducted and these species were not detected. It is consequently considered unlikely that any of these threatened flora occur within the study area.

6.3.2 Endangered Ecological Communities

One endangered ecological community (EEC) occurs in the study area: *White Gum, Yellow Box, Blakely's Red Woodland endangered ecological communities* (TSC Act).

Portions of this community may also constitute EPBC Act *listed White Gum, Yellow Box, Blakely's Red Gum and Derived Native Grassland critically endangered ecological community (*see discussion in Section 5.1.4).

The Project may involve the clearing of derived native grassland associated with these EECs depending on the final route selection. The Project may also impact this area by creating disturbance which can encourage weeds or by temporarily interfering with natural surface flow regimes. An assessment of impacts associated with the proposed development on EECs has been undertaken via an Assessment of Significance (see Appendix D). Furthermore, based on the pre-cautionary principle, an assessment was also undertaken using relevant Significant Impact Criteria for assessment under the EPBC Act (see Appendix E). Both assessments concluded that if mitigation measures are followed, ensuring that no canopy trees associated with this

community are removed, and that appropriate re-establishment of native grassland areas is conducted, then the proposed pipeline route would be unlikely to result in a significant impact on these communities.

6.3.3 Threatened Fauna Species

Forest Dependent Bird Species

The proposed development would impact on habitat for the following threatened forest dependent birds:

- speckled warbler;
- hooded robin;
- brown treecreeper; and
- black-chinned honeyeater.

An assessment of impacts on these threatened forest dependent birds was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for threatened birds within the study area based on the following:

- these species are mobile;
- construction would avoid disturbing canopy trees where possible;
- fragmentation would be temporary and would not be of a distance impassable to these species;
- woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- impact areas would be remediated post-construction; and
- substantial alterative habitat exists within the locality.

Large Forest Owls

The proposed development would impact on habitat for large forest owls including:

- powerful owl;
- masked owl; and
- barking owl.

An assessment of impacts on these large forest owls was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for threatened birds within the study area based on the following:

- these species are highly mobile with large home ranges;
- construction would avoid disturbing hollow-bearing trees where possible;
- where practical, any identified breeding trees would be avoided;
- woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- impact areas would be remediated post-construction.
- substantial alterative habitat exists within the locality.

Glossy Black Cockatoo

The proposed development would impact on habitat for the glossy black cockatoo. An assessment of impacts on the glossy black cockatoo was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for the glossy black cockatoo within the study area based on the following:

- this species are mobile;
- construction would aim to avoid disturbing hollow-bearing trees and stands of *Allocasuarina* where possible;
- where practical, any identified breeding trees would be avoided;
- woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- impact areas would be remediated post-construction.
- substantial alterative habitat exists within the locality.

Gang-gang Cockatoo

The proposed development would impact on habitat for the gang-gang cockatoo. An assessment of impacts on the gang-gang cockatoo was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for the gang-gang cockatoo within the study area based on the following:

- this species are mobile;
- this species is unlikely to utilise the site during its breeding period;
- construction would aim to avoid disturbing hollow-bearing trees and other canopy trees where possible;
- woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- impact areas would be remediated post-construction.
- substantial alterative habitat exists within the locality.

Migratory or Nomadic birds

The proposed development would impact on habitat for the migratory or nomadic swift parrot and regent honeyeater. An assessment of impacts on the swift parrot and regent honeyeater was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for the swift parrot and regent honeyeater within the study area based on the following:

- these species are highly mobile;
- these species are only likely to use the study area on a transitory basis;
- these species have known breeding sites which do not include any sites near Marulan, and the habitat at the study area is unlikely to be important habitat for either of these species;
- woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- impact areas would be remediated post-construction.
- substantial alterative habitat exists within the locality.

Granivorous Birds

The proposed development would impact on habitat for the granivorous birds the diamond firetail and turquoise parrot. An assessment of impacts on the diamond firetail and turquoise parrot was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for the diamond firetail and turquoise parrot within the study area based on the following:

- these species are mobile;
- these species are only likely to use the study area on a transitory basis;
- woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- impact areas would be remediated post-construction.
- substantial alterative habitat exists within the locality.

Cave-roosting Microchiropteran Bats Species

The proposed development would impact on habitat for the cave-roosting microchiropteran bat species:

- large-eared pied bat;
- little bentwing bat; and
- eastern bentwing bat.

An assessment of impacts on these bats was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for these bats within the study area based on the following:

- these species are mobile;
- construction would aim to avoid these species breeding periods (Spring)
- construction would to avoid disturbing hollow-bearing trees and other canopy trees where possible;
- construction would not impact on any substantial caves;
- woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- impact areas would be remediated post-construction.
- substantial alterative habitat exists within the locality.

Hollow-dependent Microchiropteran Bat Species

The proposed development would impact on habitat for the hollow-dependent microchiropteran bat species:

- eastern false pipistrelle;
- eastern freetail bat bat; and
- greater broadnosed bat.

An assessment of impacts on these bats was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for these bats within the study area based on the following:

- these species are mobile;

- where practical, any identified roost trees would be avoided;
- construction would aim to avoid disturbing hollow-bearing trees and other canopy trees where possible;
- woody debris would be retained and reused promoting regeneration of local native species;
- impact areas would be remediated post-construction.
- substantial alterative habitat exists within the locality.

Arboreal Mammals

The proposed development would impact on habitat for arboreal mammals including potentially the squirrel glider and yellow-bellied glider.

An assessment of impacts on these gliders was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for these gliders within the study area based on the following:

- these species are mobile;
- where practical, trees with resident fauna would be avoided;
- fragmentation would be temporary and would not be of a distance impassable to either of these species;
- construction would aim to avoid hollow-bearing trees and other canopy trees where possible;
- woody debris would be retained and reused promoting regeneration of local native species;
- impact areas would be remediated post-construction.
- substantial alterative habitat exists within the locality.

Spotted-tail Quoll

The proposed development would impact on habitat for arboreal mammals including potentially the spotted-tail quoll.

An assessment of impacts on the spotted-tail quoll was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for this species within the study area based on the following:

- these species are highly mobile with large home ranges;
- fragmentation would be temporary and would not be of a distance impassable to this species;
- construction would aim to avoid disturbing hollow-bearing trees and other canopy trees where possible;
- woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- impact areas would be remediated post-construction.
- substantial alterative habitat exists within the locality.

Striped Legless Lizard

The proposed development would be unlikely to significantly adversely affect potential habitat for Striped Legless Lizard within the study area based on the following:

- this species was not identified despite targeted searches;
- this species has not been previously recorded within the locality;

- mitigation measures include pre-clearance surveys when any reptiles identified within areas of impact would be relocated; and
- habitat features for this species would be retained and re-instated adjacent to the development site.

6.3.4 Matters of NES

Three Matters of National Environmental Significance (MNES) are considered relevant to this proposal: Box - Gum Woodland, spotted-tail quoll and striped legless lizard.

White Gum, Yellow Box, Blakely's Red Gum and Derived Native Grassland critically endangered ecological community (Box-Gum Woodland) was tentatively recorded in the study area (Figure 3 and discussion in Section 5.1.4). Based on the pre-cautionary principle, this community was assessed using relevant Significant Impact Criteria (Appendix E). This assessment concluded that this community would not be significantly impacted by the proposal based on the following:

- depending on final route selection, areas of Box-Gum Woodland may be completely avoided;
- if this is not the case, no direct impacts to this community would occur, only grassland adjacent to this community would be impacted by the proposal; and
- grassland areas would be rehabilitated using existing topsoil and associated seed bank back to current condition.

Both the spotted-tail quoll and striped legless lizard are also listed federally. These species were assessed using relevant Significant Impact Criteria (Appendix E). These assessments concluded that neither of these species would be significantly impacted by the proposal for the same reason outlined for these two species Threatened Fauna Section (6.3.3) above.

6.4 Indirect and Operational Impacts

Sediments and Runoff

The Construction Environmental Management Plan (CEMP) would include safeguards and mitigation measures to minimise potential impacts from additional runoff and associated erosion and transfer of sediments. Assessment of impacts based on soils assessment and residual impacts after mitigation measures would be finalised in the detailed design stage.

Groundwater and Hydrology

Detailed design of the proposed gas pipeline and the CEMP would include safeguards and mitigation measures to minimise the impacts on surface and groundwater flow regimes

The study area contains a number of sensitive receptors which could be impacted by changes to surface and groundwater flows, including:

- the Wollondilly River, down slope and approximately 200 metres from the northern portion of the pipeline route;
- three ephemeral drainage lines traversed by the pipeline route;
- ephemeral wetlands in grassland adjacent to the pipeline route; and
- a number of farm dams across and down slope from the pipeline route.

Assessment of impacts based on hydrological assessment and residual impacts after mitigation measures would be finalised in the detailed design stage.

6.5 Long Term Impacts

The construction phase of the proposed activity would take approximately 3 to 4 months. After construction, remediation of the pipeline route would be undertaken as described in Section 7.2.

Long-term impacts on native fauna would include the loss of ecological functions and habitat resources that take a long time to develop. These include:

- some mature hollow-bearing trees;
- feed trees, since trees must reach full sexual maturity to produce large volumes of blossom and fruit;
- structurally diverse vegetation, with a number of age classes and mature emergents; and
- a healthy soil seed bank, with sufficient number and diversity of propagules to allow the native vegetation to regenerate following disturbances such as bushfire.

Provided the mitigation measures outlined in Section 7 are adopted, the Project would be unlikely to result in permanent or irreversible impacts on native biodiversity. These would specifically include:

- avoidance of hollow-bearing trees and other habitat features;
- remediation of impacted areas;
- retention of alternative habitat immediately adjacent to the impact site; and
- an offset package which includes the retention of substantial areas of intact native vegetation.

6.6 Threatening Processes

A 'Key Threatening Process' (KTP) is defined under the TSC Act as 'a threatening process specified in Schedule 3' of the Act. A 'threatening process' is defined as 'a process that threatens, or may have the capability to threaten the survival or evolutionary development of species, populations or ecological communities'.

The following key threatening process is currently operating within the study area:

- predation by the European Red Fox.

The following processes would have operated previously, given the modified vegetation communities present within the study area:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- loss of Hollow-bearing Trees; and
- removal of dead wood and dead trees.

The proposal would directly contribute to the operation of two KTPs:

- clearing of native vegetation; and
- removal of dead wood and dead trees.

The extent of vegetation clearing required is presented in Table 6.

The proposal would remove approximately seven ha of native vegetation and seven ha of native pasture. Rehabilitation works associated with the Project would aim to re-instate much of this vegetation resulting in a six metre corridor of native shrubs and ground layer species directly above the proposed pipeline. Furthermore, where possible dead wood would be placed into adjacent areas prior to construction and then

re-instated into the development footprint. Where possible, dead standing trees would be avoided. These measures are detailed in Section 7.

The following KTPs may also be of relevance to the proposed activity:

- invasion and establishment of exotic vines and scramblers;
- invasion of native plant communities by exotic perennial grasses; and
- infection of native plants by *Phytophthora cinnamomi.*

Provided the soil and weed management measures outlined in Section 7 are followed, the proposed activity would not result in the operation of, or increase the impact of, any of these KTPs. The likelihood of these KTPs operating would be further minimised by the limited duration of the proposed works.

7. Mitigation

7.1 Avoidance of Impacts

7.1.1 Project Location

Where possible, direct impacts on remnant forest and woodland have been avoided by strategic placement of the pipeline route. Existing clearing such as that along Wollombi Road (a width of six metres from approximately 3000 metres) would be utilised to minimise impacts on native biota. Route alignments such as through Lots 206 and 207 (a width of 3 metres for approximately 1500 metres) would also utilise an existing track thereby further minimising required clearing. Although an initial 8 to 10 hectares of native vegetation would be impacted, only one to two hectares would remain permanently modified as a result of the proposal (see Table 7).

7.1.2 Utilising Existing Clearing and Avoidance of Key Habitat Features

Approximately half of the proposed route falls within already cleared grazing land (see Figure 3 and Table 6).

Furthermore, a large portion of the proposed Western pipeline route also aims to utilise existing clearing. All route options will utilise Wollombi Road which already contains a six metre clearance to accommodate local traffic. In this area, important habitat features, such as hollow-bearing tree can generally be avoided. Other areas of existing clearing include Western route option 5, through Lots 206 and 207, which will also utilise an existing three metre cleared track.

There is also some flexibility with route design in areas containing native vegetation. The pipeline can be adjusted to avoid hollow-bearing trees and other important habitat features (such as stands of *Allocasuarina*). These features will be identified and marked prior to construction to ensure they are not impacted by the proposal.

7.2 Mitigation of Impacts

7.2.1 Planning

A Construction Environmental Management Plan (CEMP), Operational Environment Management Plan (OEMP) and rehabilitation plan would be developed for the construction and operation of the proposed gas pipeline and would include the mitigation measures outlined in the following sections.

7.2.2 Construction Techniques

A number of strategies would be incorporated into the construction of the proposed route through ecologically sensitive areas to minimise and mitigate impacts on native biota including:

- minimising vegetation clearance (as specified above);
- avoidance of disturbing key habitat features such as hollow-bearing trees where possible; and
- placing stockpiles and lay down areas in existing clearings.

These are discussed in detail in the following sections.

7.2.3 Soil Erosion / Runoff

The CEMP would contain detailed safeguard measures to reduce soil erosion and pollutant run-off during both construction and operation phases of the Project.

7.2.4 Dust

Appropriate construction and operational mitigation measures would be incorporated into the final detailed design to minimise the generation of dust and associated impacts on adjacent natural environments. These are likely to include:

- setting maximum speed limits for construction and operational traffic on site to limit dust generation; and
- use of a water tanker or similar to spray unpaved roads during construction and operation where required.

7.2.5 Pre-clearance Survey

A detailed pre-clearance survey by a qualified ecologist would be undertaken immediately prior to development of the Project. This would involve:

- diurnal searches for birds, nests and roosts;
- active searches for reptiles, including checking of woody debris within the construction footprint,
- active searches for micro bats, including checking under exfoliating bark;
- identification of active wombat burrows and the careful re-location of these species prior to construction; and
- nocturnal surveys, including stag-watching of identified habitat trees, specifically focusing on observing use of trees by micro bats.

This survey would focus on locating individuals, and especially roosts of threatened species.

If nests or nestlings are observed within, or close to, the development footprint then construction, then nests and/or nestlings would be carefully relocated into adjacent areas.

7.2.6 Protection of Endangered Ecological Communities

The proposed Western pipeline route may impact on derived native grassland associated with the EEC Box-Gum Woodland depending on final route selection (Western route 3 and 4 – see Figure 1 and Table 6). If either of these routes becomes the final route option the following measures are recommended to mitigate potential impacts on these areas:

- No canopy trees should be impacted by the proposal; the pipeline should be placed to provide as large an area of clearance between EECs and the pipeline as possible;
- Areas should be fenced to clearly demarcate the vegetation;
- Areas of adjacent grassland should be rehabilitated as detailed in Section 7.2.11 Remediation below; and
- Weeds should be managed both within and adjacent to areas of EEC to ensure there is no decline in quality within these communities.

If these measures are undertaking it is not expected that any areas of EEC within the study area are likely to be adversely impacted by the proposal.

7.2.7 Timing of Works

Where feasible, construction works would aim to be conducted in areas of forest and woodland to avoid the breeding season of threatened species identified at the site. Details of any timing of works would be outlined in the CEMP for the site.

7.2.8 Tree Fauna Management

A plan for the management of tree dwelling fauna would be required as the proposal involves the removal of a number of mature trees. Due care during clearing would be implemented to reduce direct impacts to any tree dwelling fauna species which may be utilising the area. The CEMP would detail procedures for a pre-clearance survey and fauna management including the following points:

- trees would be monitored for fauna before and during clearing operations;
- trees with resident fauna would be avoided as far as is practicable;
- hollow-bearing trunks and branches would be carefully sawn and placed intact in adjacent areas of native vegetation; and
- replacement habitat, such as nest boxes, would be provided where habitat trees are to be removed.

Any trees that show evidence of breeding by the powerful owl (whitewash on a tree with suitably sized hollows) would be carefully avoided if practicable.

7.2.9 Groundcover Clearance Protocol

Groundcover substrate and especially large woody debris provides important habitat for native fauna, including threatened species. A groundcover clearance protocol would be incorporated into the CEMP which would include the following steps:

- remove large woody debris and rock fragments using excavator grabs or manual handling if practicable;
- placing intact large woody debris and rock fragments within adjacent areas of intact vegetation;
- scrape and stockpile leaf litter and topsoil separately from deeper fill material; and
- reuse leaf litter and topsoil in remediation works.

7.2.10 Site Management

The following mitigation measures would be implemented in order to minimise operational impacts of the proposed development:

- limit vehicular and personnel entry into adjacent remnant vegetation during construction through appropriate marking of operational areas;
- regularly monitor the condition of surrounding native vegetation, in accordance with the management plans developed for the proposed pipeline, to ensure that areas of remnant vegetation are not impacted upon during the construction;
- implementing and enforcing putrescible waste hygiene measures to reduce the likelihood of foxes, dogs and cats being attracted into the area.

7.2.11 Remediation

The western pipeline route option would initially remove/modify between eight and 10 hectares of intact forest and woodland habitat (depending on final route choice) as well as approximately nine of cleared native

pasture. The majority of the route would be rehabilitated. Table 7 summarises the extent of initial clearance and the resultant areas of rehabilitation. The following methods would be utilised to rehabilitate impacted areas.

Stockpiling of original topsoil and leaf litter

The original topsoil would be retained and stockpiled to assist in remediation of the proposed pipeline site. Once works are complete this would be placed back over areas of clearance to encourage natural regeneration of native plant species. Soil would be stockpiled for as short a period as practicable to avoid weeds colonising the stockpile and to avoid native seed within the stockpile from composting.

Stockpiling of wood chipped material

Trees and shrubs cleared from the construction area would be chipped and stockpiled on the edge of the construction zone for spreading over disturbed areas as part of the remediation works.

Retention and replacement of woody debris

The proposed pipeline site contains fallen timber that is likely to constitute an important habitat resource for native fauna. Woody debris the development footprint would be carefully stockpiled within cleared areas, and then respread as part of remediation works.

Regeneration and revegetation of native flora

Remediation works would aim to encourage natural regeneration of native plant species. Natural regeneration is preferable to revegetation with tube stock, as plants that have grown naturally in area tend to:

- grow faster;
- be healthier and more resilient;
- occur in natural appropriate niches;
- require minimal follow up such as watering.

Canopy trees, shrubs and ground layer would be allowed to encroach to a width of six metres adjacent to the pipeline. A six metre clearance directly above the pipeline would be allowed to encroach with shrubs and ground layer species only. If natural regeneration does not occur within an appropriate timeframe (e.g. one year) then revegetation with tube stock would be undertaken. All plantings would utilise indigenous native species of local provenance and seed collection would be undertaken as required.

The health of revegetated areas would be monitored closely and supplementary watering supplied as appropriate. Revegetated areas would be monitored for weed infestation and any infestations actively managed to minimise further weed spread. Methods to enhance regeneration/revegetation would also be considered if deemed necessary.

Fencing

Some areas of native forest that would require clearance are currently grazed by sheep. In order for any regeneration/revegetation to be successful, these areas would need to be temporarily fenced until native plants are large enough to tolerate grazing. Fencing could be minimal, enough to keep stock out of the site.

7.2.12 Weed and Pest Management

A Weed and Pest management plan would be prepared as part of the Construction Environmental Management Plan and Operation Environmental Management Plan for the proposed pipeline.

The following measures would be adopted to manage environmental weeds during construction and operation of the proposed pipeline:

- perform a baseline weeds survey to assess the extent and severity of weed infestation in extant native vegetation within the study area pre and post construction;
- incorporate control measures in the design of the Project to limit the spread of weed propagules downstream of the proposed pipeline;
- during construction: maintenance of silt fences and other mitigation measures to isolate runoff; and immediate rehabilitation of disturbed vegetation to limit the potential for colonisation by weeds;
- during construction areas of vegetation that would not be cleared would be clearly marked, restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill would not be placed in areas of remnant vegetation but instead in adjacent cleared areas;
- post-construction landscaping of any open areas with indigenous native vegetation in order to limit the potential for colonisation by weeds;
- during operations monitor and control Noxious Weed species in line with legislative obligations;
- perform ongoing monitoring of weed infestation on and adjoining the study area, utilising the baseline weeds survey of the proposed pipeline route and its surrounds.

7.2.13 Monitoring

In order to ensure remediation works are successful and that impacts on native biota are effectively mitigated, a monitoring program would be implemented. This program would include:

- monitoring of weeds especially noxious weeds;
- monitoring native regeneration success;
- monitoring plant health and planting success rates of any revegetation; and
- implementing remediation works if necessary

Details of the monitoring program would be provided in the CEMP.

7.3 Offsetting of Impacts

It is recognised that although the impacts from the proposed pipeline would be avoided where possible, and substantially mitigated where avoidance is not possible, nevertheless the Project would result in the modification of approximately seven hectares of native vegetation. A complete offset strategy for the proposed gas pipeline as well as the Facilities' site to the north of Canyonleigh Road is presented in the Preferred Project Report.

8. Conclusion

8.1 Key Thresholds

Pursuant to DEC (2005) assessment guidelines development applications under Part 3A must contain a justification of the preferred option based on the following key thresholds.

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.

The Western pipeline route option would initially remove/modify between eight and ten hectares of intact forest and woodland habitat as well as approximately nine of cleared native pasture. The majority of the pipeline route would be rehabilitated with only one to two hectares remaining permanently modified as a result of the proposal. Where possible the proposed western pipeline route has aimed to avoid vegetation communities of conservation significance such as Box-Gum Woodland EEC. The route/s have aimed to utilise existing pathways (such as along Wollombi Road and through Lots 206 and 207) and would incorporate sensitive construction techniques to avoid adverse impacts to important habitat features such as hollow-bearing trees and glossy black cockatoo feed trees where practicable. Furthermore, substantial measures would be taken to retain and re-use:

- existing topsoil and associated seed bank;
- existing leaf litter; and
- woody debris.

These measures would allow for the natural regeneration of disturbed areas with existing native species whilst re-instating habitat features along the route. If natural regeneration is determined to be ineffective then revegetation with species of local native province would be undertaken. Weed management measures and fencing would furthermore protect and improve areas of impact.

Although impacts associated with the proposed pipeline route would be substantially mitigated there, the Proponent acknowledges that the Project would result in the modification of approximately seven ha of native vegetation. To compensate for this loss, an offset package has been developed which is discussed in detail in the Preferred Project Report. This proposed offset includes improvements such as weed management (including the control of noxious weeds such as serrated tussock), exclusion of grazing, and rehabilitation of degraded areas as necessary.

Based on the above the Project would maintain as well as improve biodiversity values within the proposed offset area.

Whether or not the proposal is likely to reduce the long-term viability of a local population of any threatened species, population or ecological community.

Although the proposal would modify habitat for a number of threatened species, these impacts are considered to be temporary (until remediation takes place), and alternative habitat would be retained within the immediate area as well as via an offset site which is currently connected to vegetation associated within the proposed western route of the pipeline. Vegetation within the study area would only be temporarily disconnected and a range of mitigation measures would be implemented to reduce impacts on native biota. Areas of endangered ecological community have been deliberately avoided. It has therefore been determined that the proposal would not reduce the long-term viability of a local population of any threatened species, population or ecological community.

Whether or not the proposal is likely to accelerate the extinction of any species, population or ecological community or place it at risk of extinction.

The proposed development is considered unlikely to accelerate the extinction of threatened species given that:

- vegetation clearance and loss of important habitat features would be minimised via sensitive construction techniques;
- site remediation measures would ensure that any impacts are temporary and that connectivity of native vegetation would be restored;
- substantial alternative habitat would be retained including a high-quality offset (discussed in the Preferred Project Report); and
- the proposed development would be highly unlikely to inhibit the movement of migratory or nomadic fauna along recognised corridors or linkages in the locality or region.

Whether or not the proposal will adversely affect critical habitat.

No listed critical habitat would be removed or adversely affected as a result of this proposal.

8.2 Summary

Where possible, items of conservation concern would be avoided; for example, direct impacts on Box-Gum Woodland EEC and important habitat features such as hollow-bearing trees. Where avoidance is impossible, detailed mitigation measures would be implemented to ameliorate impacts on native biota. However, it is recognised that the proposal would modify seven hectares a of native forest, of which a six metre corridor would need to be maintained in this modified state (shrubs and ground layer species only). Although an initial 8 to 10 hectares of native vegetation would be impacted, only one to two hectares would remain permanently modified as a result of the proposal. To offset this impact (and impacts associated with the Facilities site north of Canyonleigh Road) an offset package has been proposed - see the Preferred Project report for details of this proposed offset strategy.

The proposed Western pipeline route has the potential to impact on a number of species and communities listed under the NSW TSC Act and Federal EPBC Act. Assessment to determine the significance of impacts on these species and communities was conducted, and the implementation of these mitigation measures would result in significant impacts on any of these species or communities being unlikely to occur.

Based on the above, the Project addresses the “Avoid, Mitigate, Offset” criteria required under Part 3A and effectively meets the “improve or maintain” test.

9. References

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Appendix 1

Flora Species List

Table 8 Flora Species List

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
ADIANTACEAE	Cheilanthes sieberi	Mulga Fern		x		x	x		x		x				x		x		x		x		x		x
APIACEAE	Centella asiatica				x							x		x	x	x	x						x	x	x
APIACEAE	Hydrocotyle laxiflora	Stinking Pennywort																			x				
ASTERACEAE	Arcotheca calendula	Cape Weed												x											x
ASTERACEAE	Carthamus lanatus*	Saffron Thistle			x						x			x											
ASTERACEAE	Cassinia aculeata																				x				x
ASTERACEAE	Chrysocephalum apiculatum	Yellow Buttons							x	x	x														x
ASTERACEAE	Cirsium sp	A Thistle					x																		
ASTERACEAE	Conyza sp*	Fleabane	x					x						x									x		x
ASTERAC	Cotula	Carrot					x				x	x		x											x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
EAE	australis	Weed																							
ASTERACEAE	Cymbonotus sp.	Bear's Ear										x		x		x	x						x		x
ASTERACEAE	Euchiton sphaericus	Cud Weed	x	x	x			x	x	x				x		x							x		x
ASTERACEAE	Gamochaeta americanum*	Cud Weed	x			x																			
ASTERACEAE	Hypochoeris radicata*	Cat's Ear	x	x						x		x		x	x						x			x	x
ASTERACEAE	Olearia microphylla																								x
ASTERACEAE	Olearia viscidula											x									x		x		
ASTERACEAE	Onorpordum acanthium*	Scotch Thistle										x		x		x									x
ASTERACEAE	Ozothamnus diosmifolius	Dog Wood		x								x				x					x		x	x	x
ASTERACEAE	Sonchus olearaceus	Milk Thistle																							
ASTERACEAE	Taraxacum officinale	Dandelion				x		x	x																x
ASTERAC	Xerochrysum	Everlastin																							x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
EAE	sp	g																							
BRASSICAEAE	Capsella bursa-pastoris	Shepherd's Purse												x											
BRASSICAEAE	Lepdium sp	A Cress												x											
BRASSICAEAE	Raphaneus raphanistrum	Wild Radish												x											
CACTACEAE	Opuntia sp	Prickly Pear															x								
CARYOPHYLLACEAE	Cerastium glomeratum*	Mouse Ear Chickweed												x										x	
CARYOPHYLLACEAE	Paronychia brasiliana	Brazilian Whitlow									x			x											
CARYOPHYLLACEAE	Polycarpon tetraphylla	Four-leaf Allseed					x				x														
CARYOPHYLLACEAE	Scleranthus diander																			x					
CASUARINACEAE	Allocasuarina littoralis	Black Sheoak		x		x		x											x			x	x	x	x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
CASUARINACEAE	Casuarina cunninghamiana	River Sheoak	x											x				x							
CHENOPODACEAE	Einadia hastata	A Salt Bush										x													
CHENOPODACEAE	Einadia nutans ssp nutans	Climbing Saltbush	x																			x			x
CLUSIACEAE	Hypericum perforatum*	St Johns Wort									x														
CONVOLVULACEAE	Dichondra repens	Kidney Weed				x	x				x										x				
CYPERACEAE	Cyperus congestus*										x														
CYPERACEAE	Cyperus imbecillis		x																						
CYPERACEAE	Lepidosperma gunni					x																x	x		
Dennstaedtiaceae	Pteridium esculentum	Bracken			x	d		d			x										x		x	x		
DILLENIACEAE	Dampiera purpurea																					x			x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
DILIENIACEAE	Hibbertia acicularis																						x		
DILIENIACEAE	Hibbertia empetrifolia										x												x		
DILIENIACEAE	Hibbertia obtusifolia	Hoary Guinea Flower		x		x					x					x	x		x			x			
DROSERACEAE	Drosera sp																						x	x	
Dryopteridaceae	Polystichum sp	Broad Shield Fern									x														
ERIACEAE	Astroloma humifusum	Native Cranberry		x		x					x				x	x								x	
ERIACEAE	Brachyloma daphnoides																	x					x	x	
ERIACEAE	Epacris pulchella										x														
ERIACEAE	Lissanthe strigosa ssp subulata	Peach Heath																				x			
ERIACEAE	Melichrysus urceolatus					x	x				x					x	x	x	x						

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
FABACEAE	Aotus ericoides																								x
FABACEAE	Bossiaea buxifolia																					x			
FABACEAE	Daviesia leptophylla																								x
FABACEAE	Dillwynia sericea																								x
FABACEAE	Glycine microphylla																						x		
FABACEAE	Glycine tabacina																				x		x	x	
FABACEAE	Hardenbergia violacea	Purple Coral Pea																x					x	x	x
FABACEAE	Hovea heterophylla														x							x			
FABACEAE	Indigofera autralis	Austral Indigo																					x		x
FABACEAE	Jacksonia scoparia	Jacksonia														x		x							x
FABACEAE	Mirbelia rubifolia																								x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
FABACEAE	Mirberlia platylobioides																								
FABACEAE	Pultenaea scabra																						x		
FABACEAE	Trifolium repens	White-flowering Clover										x												x	
FABACEAE	Trifolium subbterraneum*	Subterrnean Clover				x				x	x			x											
GENTIANACEAE	Centaurium erythraea*	Common Centaury		x		x																x			
GERANIACEAE	Erodium cicutarium*	Common Storksbill												x											
GOODENIACEAE	Goodenia hederacea	Ivy-leaved Goodenia		x		x										X			x		x	x	x			
HALOGORACEAE	Gonocarpus tetragynus			x		x				x					x		x		x			x	x		x	
HALOGORACEAE	Gonocarpus teucrioides	Rasp Wort		x							x															
IRIDACEAE	Romulea rosea	Onion Grass												x												

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
JUNCACEAE	Juncus continuus					x	x	x		x	x														x
LILIACEAE	Patersonia sericea																						x	x	
LILIACEAE	Wahlenbergia gracilis	Bluebell																			x		x		x
LILIACEAE	Wahlenbergia sp	Bluebell		x																		x			
LILIACEAE	Wahlenbergia stricta	Bluebell																				x			
LILIACEAE	Wurmbea dioica																								x
Loganaceae	Mitrasacme polymorpha																								x
LOMANDRACEAE	Lomandra filiformis	A Mat-rush		x					x		x				x	x	x		x			x	x		x
LOMANDRACEAE	Lomandra longifolia	Spiny-headed Mat-rush																	x					x	
LOMANDRACEAE	Lomandra multiflora	Many-flowering Mat-rush																				x	x		x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
LOMANDRACEAE	Lomandra obliqua																						x	x
MALVACEAE	Malva parvifloa													x											
MALVACEAE	Modiola caroliana*	Small-flowering Mallow									x			x											
MIMOSOIDEAE	Acacia brownii																				x		x	x	
MIMOSOIDEAE	Acacia implexa													x											
MIMOSOIDEAE	Acacia obtusifolia																							x	
MIMOSOIDEAE	Acacia paradoxa	Kangaroo Thorn																x					x		
MIMOSOIDEAE	Acacia parramattensis	Parramatta Green Wattle	x		d	d	d								x		x		x			x			x
MIMOSOIDEAE	Acacia terminalis	Sunshine wattle																					x		
MYRSINACEAE	Anagallis arvensis*	Scarlet Pimpernel									x														

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
MYRTACEAE	Calytrix tetragona																				x				
MYRTACEAE	Eucalyptus agglomerata	Blue-leaved Stringybark		x											d	x			x			x		x		
MYRTACEAE	Eucalyptus amplifolia	Cabbage Gum							x			x			d		d						x		x	
MYRTACEAE	Eucalyptus bridgesiana	Apple Box							x					x				x								
MYRTACEAE	Eucalyptus cinerea	Argyle Apple									x			x										x	x	
MYRTACEAE	Eucalyptus eugenoides	Brown Stringybark										x			d	x								x	x	
MYRTACEAE	Eucalyptus mannifera ssp mannifera	Brittle Gum																						x	x	
MYRTACEAE	Eucalyptus melliodora	Yellow Box															d	x								
MYRTACEAE	Eucalyptus pauciflora	Snow Gum							d		x			x	d										x	
MYRTACE	Eucalyptus	Sydney												x				x								

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silash	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
AE	piperita	Peppermint																							
MYRTACEAE	Eucalyptus punctata	Grey Gum																				x		x	x
MYRTACEAE	Eucalyptus rossi	Scribbly Gum																	x						x
MYRTACEAE	Eucalyptus rubida ssp rubida	Candlebark									x			x			d	x						x	x
MYRTACEAE	Eucalyptus sieberi	Silvertop Ash																					x	x	x
MYRTACEAE	Kunzea parvifolia	Violet Kunzea		x		x											x	x							x
MYRTACEAE	Leptospermum trinervium									x														x	
MYRTACEAE	Leptospermyum myrtifolium	Grey Tea-tree									x							x						x	x
ORCHIDACEAE	Caladenia sp																	x							
ORCHIDACEAE	Diuris chryseopsis	Golden Moths																x							
OXALIAC	Oxalis sp	Oxalis									x												x		x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
EAE																									
PHORMIACEAE	Dianella sp																						x	x	
PHORMIACEAE	Stypandra glauca	Nodding Blue Lily																					x		
PHYLLANTHACEAE	Poranthera microphylla																							x	
PHYTOLACCEACEAE	Phytolacca octandra*	Ink Weed			x																				
PITTOSPORACEAE	Billardiera scandens																				x		x	x	
PLANTAGINACEAE	Plantago gaudichaudii																								
PLANTAGINACEAE	Plantago lanceolata*	Plantain	x											x			x							x	
PLANTAGINACEAE	Veronica calycina	Hairy Speedwell													x	X									
PLANTAGINACEAE	Veronica sp	Speedwell																				x	x	x	
POACEAE	Anthoxanthum ororatum*	Sweet Vernal Grass				x					x														

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
POACEAE	Aristida calycina var calycina	A Wire Grass	d	d	x	x					x				x	x	x								x
POACEAE	Aristida ramosa var speciosa	A Wire Grass	d	d	d	d	x		x	d	x				x	x								x	x
POACEAE	Aristida sp	A Wire Grass	x			x																x			
POACEAE	Austrodanthonia racemosa var racemosa	A Wallaby Grass			x																				x
POACEAE	Austrodanthonia tenuoir	A Wallaby Grass	x	x			x					x				x	x							x	x
POACEAE	Austrostipa densiflora	A Spear Grass	x				x	x	d			x		x								x	x		
POACEAE	Bothriochloa macra	Red-leg Grass	x		x			x																	
POACEAE	Bromus catharticus	Prairie Grass																						x	
POACEAE	Cynodon dactylon*	Couch	x				x							x											x
POACEAE	Dichelachne	Short-	x			x	x	x								x									x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
	micrantha	haired Plume Grass																							
POACEAE	Echinopogon caesapitosus	Hedgehog Grass		x											x				x		x				x	
POACEAE	Eleusine indica*	Crab Grass									x	x		x												
POACEAE	Entolasia stricta	Right-angle Grass																				x		x		
POACEAE	Eragrostis elongatus										x														x	
POACEAE	Eragrostis leptostachya	Paddock Love Grass	x	x		x	x	x	x	x															x	
POACEAE	Holcus lanatus																								x	
POACEAE	Imperata cylindrica	Blady Grass									x															
POACEAE	Lachnagrostis aemula	Blown Grass										x														
POACEAE	Microlaena stipoides	Weeping Meadow Grass			d		d	d	x			x		x	x	x			x		x	x	x		x	

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
POACEAE	Nassella trichotoma *	Serrated Tussock	d											x		x	x								x
POACEAE	Panicum sp	Panic Grass	x	x	x		x		x					x		x									x
POACEAE	Pennisetum clandestinum *	Kikuyu	x																						
POACEAE	Phalaris aquatica*	Canary Grass									x			x											x
POACEAE	Poa sp																								x
POACEAE	Setaria gracilis*	Pigeon Grass	x																						
POACEAE	Sporobolus elongatus	Rat's Tail Grass	d						x	d	x														x
POACEAE	Themeda australis	Kangaroo Grass	x			x		x	d	d						x	x								x
POLYGONACEAE	Acetosella vulgaris*	Sheep Sorrel		x			x	x		x	x	x		x			x								
POLYGONACEAE	Rumex sp	A Dock										x		x											
Polytrichaceae	Dawsonia superba	Giant Moss																				x	x		

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
PROTEACEAE	Banksia marginata	Silver Banksia																x						x	
PROTEACEAE	Persoonia laurina										x														
PROTEACEAE	Persoonia linearis																							x	
PROTEACEAE	Persoonia mollis ssp livens																								
RANUNCULACEAE	Clematis aristata																							x	
RHAMNACEAE	Cryptandra amara var amara														x										
RHAMNACEAE	Pomaderris betulina ssp betulina	Rusty Pomaderris									x					x							x		x
ROSACEAE	Acaena sp probably ovina								x		x														
ROSACEAE	Rosa rubignosa*	Briar Rose							x		x														
ROSACEAE	Rubus fruticosus	Blackberry	x												x										x

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
	aggregate*																								
RUBIACEAE	Galium gaudichaudii		x																						
RUBIACEAE	Galium propinquum																				x			x	
RUBIACEAE	Opercularia aspera	Coarse Stink Weed																						x	
RUBIACEAE	Pomax umbellata															x	x						x	x	
SANTALACEAE	Exocarpus cuppressiformis	Cherry Ballart												x											
SOLANACEAE	Solanum aviculare	Kangaroo Apple					x																		
SOLANACEAE	Solanum chenopodioides*	White-tip Nightshade					x																		
SOLANACEAE	Solanum nigrum*	Blackberry Nightshade									x														
SOLANACEAE	Solanum prinophyllum	Forest Nightshade																			x	x	x		

Family	Scientific Name	Common Name	Route 1 Q1	Route 1 Q2	Route 1 Q3	Route 1 Q4	Route 1 Q5	Route 1 Q6	Route 1 Q7	Route 1 Q8	RM Silah	Weiss Q1	Weiss Q2	Weiss RM	Bolte zar Q1	Bolte zar Q2	Bolte zar Q3	Bolte zar RM	Route 2 Q1	Route 2 Q2	Route 2 Q3	Route 2 Q4	Route 2 Q5	Route 2 RM (excl Wollombi Rd)	Wollombi Rd RM
URTICACEAE	Urtica incisa	Stinging Nettle					x																		
VERBENACEAE	Verbena bonariensis*	Purpletop									x														
VIOLACEAE	Viola sp																								x
XANTHORRHOECEAE	Xanthorrhoea australis	Grass Tree																	x						x
CHEOPODACEAE	Chenopdodium sp.	Crumb Weed																				x			

Appendix 2

Fauna Species List

Table 9 Fauna species list

Scientific Name	Common Name	Observation type
Frogs		
Limnodynastes tasmaniensis	Spotted Grass Frog	Seen
Crinia parainsignifera	Beeping Toadlet	Heard
Crinia signifera	Common Eastern Froglet	Heard
Litoria peroni	Peron's Tree Frog	Heard
Litoria verreauxii	Whistling Tree Frog	Seen
Uperoleia fusca	Dusky Toadlet	Seen
Uperoleia laeviagata	Smooth Toadlet	Heard
Birds		
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Seen
Acanthiza lineata	Striated Thornbill	Seen
Acanthiza nana	Yellow Thornbill	Seen
Acanthiza pusilla	Brown Thornbill	Seen
Acanthiza reguloides	Buff-rumped Thornbill	Seen
Acanthiza sp.	Unidentified Thornbill	Seen
Acanthorhynchus tenuirostris	Eastern Spinebill	Heard
*Acridotheres tristis**	Common Myna	Seen
Aegotheles cristatus	Australian Owlet-nightjar	Heard
Anas gracilis	Grey Teal	Seen
Anas superciliosa	Pacific Black Duck	Seen
Anthochaera carunculata	Red Wattlebird	Heard
Anthus australis	Australian Pipit	Seen
Aquila audax	Wedge-tailed Eagle	Seen
Cacatua galerita	Sulphur-crested Cockatoo	Heard
Cacatua sanguinea	Little Corella	Heard
Cacomantis flabelliformis	Fan-tailed Cuckoo	Heard
Cacomantis variolosus	Brush Cuckoo	Seen
Callocephalon fimbriatum	**Gang-gang Cockatoo**	**Seen**
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	Seen

Scientific Name	Common Name	Observation type
Calyptorhynchus lathami	**Glossy Black-Cockatoo**	**Seen, chewed cones**
Chenonetta jubata	Australian Wood Duck	Seen
Chthonicola sagittata	**Speckled Warbler**	**Seen**
Chrysococcyx basalis	Horsefields Bronze Cuckoo	Seen
Colluricincla harmonica	Grey Shrike-thrush	Heard
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Seen
Corcorax melanorhamphos	White-winged Chough	Seen
Cormobates leucophaea	White-throated Treecreeper	Seen
Corvus coronoides	Australian Raven	Seen
Corvus mellori	Little Raven	Heard
Cracticus torquatus	Grey Butcherbird	Seen
Cuculus pallidus	Pallid Cuckoo	Heard
Dacelo novaeguineae	Laughing Kookaburra	Seen
Dicaeum hirundinaceum	Mistletoebird	Seen
Egretta novaehollandiar	White-faced Heron	Seen
Eolophus roseicapillus	Galah	Seen
Eopsaltria australis	Eastern Yellow Robin	Seen
Falco longipennis	Australian Hobby	Seen
Gallinula tenebrosa	Dusky Moorhen	Heard
Grallina cyanoleuca	Magpie-lark	Seen
Gymnorhina tibicen	Australian Magpie	Seen
Hieraaetus morphnoides	Little Eagle	Seen
Hirundo ariel	Fairy Martin	Seen
Hirundo neoxena	Welcome Swallow	Seen
Lichenostomus chrysops	Yellow-faced Honeyeater	Seen
Lichenostomus leucotis	White-eared Honeyeater	Seen
Lichenostomus penicillatus	White-plumed Honeyeater	Seen
Malurus cyaneus	Superb Fairy-wren	Seen
Manorina melanocephala	Noisy Miner	Seen
Microeca fascinans	Jacky Winter	Seen
Neochmia temporalis	Red-browed Finch	Seen

Scientific Name	Common Name	Observation type	
Ninox strenua	**Powerful Owl**	**Seen**	
Ocyphaps lophotes	Crested Pigeon	Seen	
Pachycephala pectoralis	Golden Whistler	Seen	
Pardalotus punctatus	Spotted Pardalote	Heard	
Pardalotus striatus	Striated Pardalote	Seen	
*Passer domesticus**	House Sparrow	Seen	
Pelecanus conspicillatus	Pelican	Seen	
Petrochelidon sp.	Martin	Nest	
Petroica boodang	Scarlet Robin	Seen	
Philemon citreogularis	Little Friarbird	Seen	
Philemon corniculatus	Noisy Friarbird	Seen	
Platycercus adscitus eximius	Eastern Rosella	Seen	
Platycercus elegans	Crimson Rosella	Seen	
Podargus strigoides	Tawny Frogmouth	Seen	
Poryphyrio poryphyrio	Purple Swamphen	Seen	
Psephotus haematonotus	Red-rumped Parrot	Seen	
Rhipidura fuliginosa	Grey Fantail	See	
Rhipidura leucophrys	Wouldie Wagtail	Seen	
Sericornis frontalis	White-browed Scrubwren	Seen	
Strepera graculina	Pied Currawong	Heard	
*Sturnus vulgaris**	Common Starling	Seen	
Tachybaptus novaehollandiae	Australasian Grebe	Seen	
Taeniopygia bichenovii	Double-barred Finch	Seen	
Todiramphus sanctus	Sacred Kingfisher	Seen	
*Turdus merula**	Eurasian Blackbird	Seen	
Vanellus miles	Masked Lapwing	Heard	
Zosterops lateralis	Silvereye	Heard	
Mammals			
*Bos taurus**	European cattle	Seen	
*Canis lupus**	Dingo, domestic dog	Scat	
Chalinolobus gouldii	Gould's Wattled Bat	Anabat	Definite record

Scientific Name	Common Name	Observation type	
Chalinolobus morio	Chocolate Wattled Bat	Anabat	Definite record
*Equus caballus**	Horse	Seen	
*Lepus capensis**	Brown Hare	Seen	
Macropus giganteus	Eastern Grey Kangaroo	Seen	
Macropus robusta	Wallaroo	Seen	
Macropus rufogriseus	Red-necked Wallaby	Seen	
Miniopterus schreibersii oceanensis	**Eastern Bentwing-bat**	Anabat	**Possible record**
Myotis macropus	**Large-footed Myotis**	Anabat	**Possible record**
Nyctophilus sp.	A Long-eared Bat	Anabat	Definite
*Oryctolagus cuniculus**	Rabbit	Seen	
*Ovis aries**	Sheep	Seen	
Petaurus breviceps	Sugar Glider	Seen, heard	
Pseudocheirus peregrinus	Common Ringtail Possum	Seen	
*Sus scrofa**	Pig	Scat	
Trichosurus vulpecula	Common Brushtail Possum	Seen	
Vespadelus darlingtoni	Large Forest Bat	Anabat	Definite record
Vespadelus regulus	Southern Forest Bat	Harp Trap	
Vespadelus vulturnus	Little Forest Bat	Anabat	Definite record
Vombatus ursinus	Common Wombat	Scat, burrow	
*Vulpes vulpes**	Fox	Dead, scat	
Reptiles			
Amphibolurus muricatus	Jacky Lizard	Seen	
Lampropholis sp.	Sunskink	Seen	

* = introduced species

bold = threatened species

Appendix 3

Threatened Species Table

Table 10 Threatened fauna with the potential to occur and likelihood of proposal impacting

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Fish					
Macquaria australasica	Macquarie Perch	FV		This species of freshwater fish inhabits river and lake habitats, especially the upper reaches of rivers and their tributaries. Spawning occurs in spring and summer in shallow upland streams or flowing sections of river systems. This species is found in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas.	Potentially present in Wingecaribbee River. Would not occur in isolated farm dams.
Frogs					
Litoria aurea	Green and Golden Bell Frog	E1		This species inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. It prefers sites containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. They are active by day and breed during the summer months (DEC 2006).	Unlikely. Suitable habitat absent from the study area.
Birds					

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Botaurus poiciloptilus	Australasian Bittern	V		This species favours permanent freshwater wetlands with tall dense reedbeds particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.) with adjacent shallow, open water for foraging. It hides during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Unlikely. Potentially present along Wingecaribbee River. Would not occur in isolated farm dams which lack aquatic vegetation.
Callocephalon fimbriatum	Gang-gang Cockatoo	V		This species is nomadic, spending summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests and winter at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests (DEC 2007).	Present. Suitable habitat in woodland and forest throughout study area.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		This species is highly specialised, feeding almost exclusively on the seeds extracted from the wooden cones of Allocasuarina species including Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*Allocasuarina torulosa*) or Drooping She-oak (*Allocasuarina verticilliata*).This species needs suitable hollows in living and dead trees for nesting and breeds between March and August (DEC 2007).	Present. Large areas of habitat for this species to be impacted.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V		This species inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey within coastal areas. They nest in hollows in standing dead or live trees and tree stumps. Fallen timber is an important habitat component for this species (DEC 2007).	Possible. May occur in forest and woodland areas.
Melanodryas cucullata	Hooded Robin	V		The Hooded Robin is a large Australian robin reaching 17 cm in length. The Hooded Robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. (DECC 2007).	Highly likely. Recorded in immediate vicinity of site in 2007 (URS, 2008).

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V		This species is the largest of its genus, and is widespread, from the Tablelands of the Great Dividing Range to the northwest and central west plains of the Riverina. It is rarely recorded eat of the Great Dividing Range, although regularly observed from the Richmond River district. It occupies mostly upper levels of drier open forest or woodlands dominated by Box and Ironbark eucalypts, as well as open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. This species usually occurs in pairs or is nomadic. It forages along twigs, branches, and trunks probing for insects. Nectar is taken from flowers and honeydew is gleaned from foliage. The Black-chinned Honeyeater nests high in the crown of a tree in the uppermost lateral branches (DEC 2007).	Possible. May forest and woodland areas.
Neophema pulchella	Turquoise Parrot	V		This species of parrot occurs in open eucalypt woodlands and forests, typically with a grassy understorey. It favours the edges of woodlands adjoining grasslands or timbered creek lines and ridges. A granivorous species, the Turquoise Parrot feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat for this species. This species nests in tree hollows, logs or posts from August to December.	Possible. May occur in forest and woodland areas.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Ninox connivens	Barking Owl	V		Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or in dense clumps of canopy leaves in large eucalypts. The Barking owl feeds on a variety of prey, with invertebrates predominant for most pf the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits important during breeding. This species lives alone or in a pair with territories ranging from 30 to 200 hectares. Nests are built in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camandulensis*), White Box (*Eucalyptus albens*), Red Box (*Eucalyptus polyanthemos*), and Blakely's Red Gum (*Eucalyptus blakelyi*). Breeding occurs during late winter and early spring (DEC 2007).	Possible. May occur in forest and woodland areas.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Ninox strenua	Powerful Owl	V		This species is a nocturnal, solitary and sedentary species. They occur in a number of vegetation types ranging from woodland and open sclerophyll forest to tall open wet forest and rainforest. However, this species does prefer large tracts of vegetation. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old with breeding taking place from late summer to late autumn. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400 - 1,450 ha. It forages within open and closed woodlands as well as open areas (DEC 2006). This Owl has a variety of vocal calls and is known to 'dawn call' when returning from its night hunting activities to mark the position of its daytime roost (Parks Victoria 2003).	Present. Project would include the loss of vegetation that would constitute foraging and possibly breeding habitat.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Oxyura australis	Blue-billed Duck	V		It is a partly migratory bird that travels short-distances between breeding swamps and over-wintering lakes, with some long-distance dispersal to breed during spring and early summer. It prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Nesting occurs in Cumbungi over deep water between September and February, as well as in trampled vegetation of Lignum, sedges or Spike-rushes, where a bowl-shaped nest is constructed. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes. The species is completely aquatic, swimming low in the water along the edge of dense cover. They feed on seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies found on the bottom of swamps they inhabit.	Unlikely. Farm dams in study area too small and lacking in aquatic vegetation.
Pachycephala olivacea	Olive Whistler	V		The Olive Whistler inhabits the wet forests on the ranges of the east coast mostly above 500 m. During the winter months they may move to lower altitudes. Favours beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range. It forages in trees and shrubs and on the ground, feeding on berries and insects, making a nest of twigs and grass in low forks of shrubs (DECC 2007).	Unlikely. May occur in forest and woodland areas but typically favours moister, higher altitude forests.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Pyrrholaemus sagittatus	Speckled Warbler	V		This species of small wren occurs in a range of Eucalyptus dominated communities that have a grassy understorey with a sparse shrub layer and open canopy, often in gullies or on rocky ridges. The species requires large, relatively undisturbed remnants in order to persist in an area. Its diet consists mainly of seeds and insects. Threats include habitat loss and fragmentation through clearing for firewood and development, grazing, removal of fallen timber and logs, and nest predation by feral animals due to urbanisation and fragmented habitat (DECC 2007).	Present. The proposal would remove foraging and potentially nesting habitat for this species.
Rostratula benghalensis	Painted Snipe (was Australian Painted Snipe)	E	V, M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. This cryptic species nests on the ground amongst tall reed-like vegetation near water. It emerges from the dense growth at dusk to feed on mudflats and the water's edge taking insects, worm and seeds (DEC 2007). This species prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Unlikely. Potentially present along Wingecaribbee River. Would not occur in isolated farm dams which lack aquatic vegetation.
Stagonopleura guttata	Diamond Firetail	V		This species is known to occur in grassy eucalypt woodlands, including Box-Gum Woodlands, and Snow Gum (Eucalyptus pauciflora) Woodlands, riparian areas (rivers and creeks), and sometimes in lightly wooded farmland (DEC 2007).	Likely. 2007 record of species in similar habitat 1 km to the north of the site (URS, 2008).

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Tyto novaehollandiae	Masked Owl	V		This species occurs in dry eucalypt woodlands at altitudes from sea level to 1100 m and roosts and breeds in hollows and sometime caves in moist eucalypt forested gullies. It hunts along the edges of forests and roadsides and has a home range covering between 500 ha and 1000 ha. Prey for this species are principally terrestrial mammals but arboreal species may also be taken. It has also been recorded on the Nullarbor plain. The southern subspecies occupies a home range of 5 to 10 square km (DEC 2007).	Possible. May occur in forest and woodland areas.
Xanthomyza phrygia	Regent Honeyeater	E1		This species is a semi-nomadic species that inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak where there are significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast (DEC 2007).	Possible. May occur in forest and woodland areas.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Lathamus discolor	Swift Parrot	E	E	The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta)*, Spotted Gum (*Corymbia maculate)*, Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box *(E. albens*). Commonly used lerp infested trees include Grey Box (*E. macrocarpa*), Grey Box *(E. moluccana*) and Blackbutt (*E. pilularis*). Swift Parrots will return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum *(E. globulus*). (DECC 2005).	Possible. May occur in forest and woodland areas.
Mammals					
Chalinolobus dwyeri	Large-eared Pied Bat	V		This species is distributed between south-eastern QLD to NSW from the coast to the western slopes of the divide. This species roosts in caves and mines and has been most commonly recorded from dry sclerophyll forests and woodlands. C. dwyeri is an insectivorous species that flies relatively slowly over the canopy or along creek beds (Churchill 1998). Threats include clearing and isolation of habitat, damage to roosting and maternal sites from mining operations, and recreational caving activities, and the use of pesticides (DEC 2007).	Likely. Suitable foraging habitat in woodland and forest throughout study area. Suitable roosts in rock outcrops throughout study area.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Dasyurus maculatus	Spotted-tailed Quoll	V		This species of carnivorous marsupial is largely nocturnal but opportunistically hunts prey during the day. It inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are found in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines. Threats include habitat loss and fragmentation, poisoning through dog-baiting programs, and competition for food with feral animals (DEC 2007).	Possible. May occur in forest and woodland areas.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		This species of bat inhabits moist forest generally with trees larger than 20 m and roosts in eucalypt hollows, underneath bark or in buildings. Diet consists of moths, beetles and other insects, which it collects within or just below the tree canopy. This species hibernates during winter and breeding takes place in late spring (DEC 2007).	Likely. Recent (URS, 2008) record in locality. Suitable foraging and roosting habitat in woodland and forest throughout study area.
Miniopterus australis	Little Bentwing-bat	V		This species of bat inhabits moist eucalypt forest, rainforest or dense coastal Banksia scrub. This species primarily roosts in caves, tunnels and sometimes tree hollows. Breeding for this species occurs during winter at maternal roost sites (DEC 2007).	Likely. Recent (PB, 2005) record in locality. Suitable habitat in woodland and forest throughout study area.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		This species has dark reddish-brown to dark brown fur and is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998, DEC 2006). In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within 6 m of the ground. Moths form the major component of their diet and breeding takes place from October to April (Churchill 1998).	Likely. Tentatively recorded via anabat by GHD. Recent (PB, 2005) record in locality. Suitable foraging habitat in woodland and forest throughout study area. Suitable roosts in rocky cliffs. Maternity colony within 300km of study area (Bungonia)
Mormopterus norfolkensis	Eastern Freetail-bat	V		This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range and roosts primarily in tree hollows but also in man-made structures or under bark. This species is solitary and probably insectivorous (DEC 2007).	Likely. Recent (URS, 2008) record in locality. Suitable foraging and roosting habitat in woodland and forest throughout study area.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Myotis adversus	Large-footed Myotis	V		Primarily a coastal species that forages over streams and watercourses feeding on fish and insects which it catches by raking its feet across the water surface, it will occur inland along large river systems. Breeding takes place during November or December, roosting in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. Threats include loss and degradation of roosting and feeding sites, increased use of pesticides, and the reduction in water qulaity occuring within waterbodies (DECC 2007).	Likely. This species was tentatively identified via anabat over a farm dam (not to be impacted by the proposal). Suitable forging habitat in Wingecaribee River and farm dams. Roosting habitat in woodland and forest.
Petaurus australis	Yellow-bellied Glider	V		This species of large arboreal mammal occurs in a variety of forest types though prefers tall mature eucalypt forest with high rainfall and rich soils, along the east coast to the western slopes of the Great Divide. This species relies on hollow-bearing trees for shelter and nesting. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Plant and insect exudates provide the bulk of this gliders diet including nectar, sap, honeydew and manna, whilst protein is obtained from arthropods and some pollen. The Yellow-bellied Gilder incises tree trunks and branches to obtain phloem sap, often leaving a distinctive 'V'-shaped scar. Tree selection and usage is complex and a large number of tree species are used as sap trees throughout the range of this glider. Threats include loss and fragmentation of habitat, and loss of hollow-bearing and feed trees (DEC 2007).	Possible. May occur in forest and woodland areas however not identified despite targeted surveys.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Petaurus norfolcensis	Squirrel Glider	V		This species of glider is widely though sparsely distributed throughout eastern Australia. In NSW it inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. This species prefers a diversity of food supplies including acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein, and requires an abundant supply of tree-hollows for nesting and shelter. Threats include loss and fragmentation of habitat, flowering trees and shrubs, and hollow-bearing trees, and barbed wire fences snagging individuals whilst gliding (DEC 2007).	Possible. May occur in forest and woodland areas.
Petrogale penicillata	Brush-tailed Rock-wallaby	E1		This species of small wallaby occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. (DECC 2008).	Possible but unlikely. Suitable habitat in ridgeline to west of study area however unlikely due to presence of foxes and dogs.
Phascolarctos cinereus	Koala	V		The Koala is limited to areas of preferred feed trees in eucalypt woodlands and forests. The size of their home range varies depending on the quality of habitat, ranging from less than 2 ha to several hundred hectares in size.	Possible but unlikely. Suitable foraging habitat in woodland and forest throughout study area however his species has not

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
					been previously recorded in the locality.
Scoteanax rueppellii	Greater Broad-nosed Bat	V		It hunts from above rows of trees lining creeks and the edges of woodland in otherwise cleared paddocks, roosting in hollow tree trunks and branches as well as the roofs of old buildings (Churchill 1998). It inhabits a variety of habitats ranging from moist and dry eucalypt forest and rainforest to tall wet forest, however tends to prefers moist gullies in mature coastal forest or rainforest from the Atherton Tablelands in north QLD, along the coastal regions to southern NSW.	Likely. Recent (PB, 2005) records in locality. Suitable foraging and roosting habitat in study area.
Reptiles					
Delma impar	Striped Legless Lizard	V		Found in natural and secondary temperate grasslands and open Box-Gum Woodland containing tussock forming perennial grasses, and occasionally in areas containing surface rock or high amount of exotic grasses. It feeds on spiders, moth larvae, crickets and cockroaches. This species shelters under logs and rocks, and lays its eggs in early summer.	Possible. Suitable habitat in native grasslands in north of study area, less suitable in heavily grazed improved pasture in south.

Table 11 Threatened fauna and EECs with the potential to occur and likelihood of impacting

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Endangered Ecological Communities	Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT	EEC	E	Fertile lower parts of the landscape where water and nutrients are abundant but tree growth is limited by other factors. Altitude between 560 and 1200 metres above sea level.	Unlikely to occur within the study area. This community is typified by being historically treeless and this is unlikely to be the case with grassland within the study area. These areas are treeless due to clearing for agriculture.
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland	E	CE	Tablelands and western slopes of NSW, typically on fertile substrates in lower parts of the landscape.	Small patches identified within the broader subject site, the proposal would remove native pasture associated with isolated yellow box trees.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
FLORA					
Baloskion longipipes		V		Dense Cord-rush is a perennial, grass-like herb. It has been recorded from the Kanangra-Boyd area to the Southern Tablelands but all populations are small. Populations have been recorded in Blue Mountains National Park, Kanangra-Boyd National Park, Penrose State Forest (in Hanging Rock Swamp), Morton National Park (The Vines), the Clyde Mountain area and Ballalaba (south of Braidwood). This species is commonly found in swamps or depressions in sandy alluvium, sometimes growing with sphagnum moss. It also occurs in swales within tall forest, and in Black Gum (*Eucalyptus aggregata*) Woodland. Threats include damage to plants from roadworks and weed spraying. Pigs rooting for food cause direct damage to the species and to the surrounding habitat.	Unlikely. The study area did not include appropriate habitat such as swamps
Bossiaea oligosperma	Few-seeded Bossiaea	V		Erect shrub to 2 m tall. The Few-seeded Bossiaea is known from two disjunct areas - the lower Blue Mountains in the Warragamba area and the Windellama area in Greater Argylle Shire, where it is locally abundant. It occurs on stony slopes or ridges on sandstone in the Yerranderie area, and low woodland on loamy soil in the Windellama area. Nothing is known about its ecology but it probably has hard-coated seeds that respond well to fire and soil disturbance. Frequent fire, clearing and habitat loss are the primary threats t this species (DECC 2008).	Unlikely. May occur forest but not previously recorded within the locality. Not identified despite targeted surveys.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Caladenia tesselata	Thick-lipped Spider Orchid	E	V	This species of orchid inhabits grassy sclerophyll woodland on clay loam or sandy soils, and low woodland with stony soil. Flowering generally occurs between September and November, however late flowering in September or early October has been recorded in southern populations. This species is known from Sydney (historic records), Wyong, Ulladulla and Braidwood regions in NSW. Kiama and Queanbeyan populations are presumed extinct. Records from the 1930's occur within the Huskisson area. *C. tessellata* occurs on the coast of Victoria from east of Melbourne to almost the NSW border. Threats to this species include clearing associated with urban development, pedestrian activity associated with recreational use along coastal areas, long-term absence of fire, and events leading to local population extinctions (DEC 2007).	Unlikely. May occur in forest and woodland at the site, however surveys conducted during its flowering period did not identify this species.
Dillwynia glaucula	Michelago Parrot-pea		E1	This erect shrub grows to 2.5m and is recorded from three areas on the NSW Southern Tablelands - near Windellama, where the species is locally abundant, north-east of Michelago and at Numeralla. There is potential habitat between the known sites. Threats include weed invasion, stock grazing, damage during road maintenance/widening and overspray from chemical weed control (DECC 2008).	Unlikely. May occur in Scribbly Gum woodland along Wollombi Rd however not identified despite targeted surveys.
Diuris aequalis	Buttercup Doubletail		E1	This species is a terrestrial "donkey" orchid, and has been recorded in forest, low open woodland with grassy understorey and secondary grasslands on the higher parts of the central and southern tablelands. Threats include habitat loss, roadwork's, rubbish dumping and rural-residential subdivision (DEC 2007)	Unlikely. May occur in forest and woodland at the site however not identified despite targeted surveys over a number of months.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Diuris tricolor	Pine Donkey Orchid	V		This species is a tuberous terrestrial species, with a flower stalk 20 to 40 cm high, flowering in September and November with bright yellow to orange flowers speckled with red, purple, or white flecks. It is sporadically distributed along the western slopes of NSW, growing in sclerophyll forests among grass, often with native Cypress Pine (*Callitris* sp.). It is found on sandy soils, and may appear to favour disturbed soils (DEC 2007).	Unlikely. Known associated overstorey species not present within the study area.
Dodonaea procumbens	Creeping Hop-bush		V	This species of low-spreading shrub occurs in bare patches on sandy-clay soils on or near shale outcrops in Natural Temperate Grassland or Snow Gum (*Eucalyptus pauciflora)* Woodland in the dry areas of the Monaro. Flowering occurs in early spring with fruits forming late spring and early summer. Threats include habitat loss and degradation from clearing for urban and agricultural development, road construction and upgrading, stock grazing, and weed invasion (DEC 2007).	Unlikely. otential habitat present within the study area, however this species not identified despite targeted searches.
Eucalyptus aqautica	Broad-leaved Sally			This species of small tree grows to 7 m and occurs on open, swampy flats as scattered individuals in the Penrose area near Goulburn in NSW. Threats include too frequent and hot fire, and localised events leading to population extinctions (DEC 2007).	Unlikely. Known habitat absent from the study area.
Eucalyptus macarthurii	Camden Woollybutt		V	This species of tree grows to 40 m and occurs in grassy woodlands on relatively fertile soils on broad cold flats from the Moss Vale District to Kanangra Boyd National Park, and in the southern highlands in the north west part of the Boyd Plateau (DEC 2007: Royal Botanic Gardens & Domain Trust - PlantNET 2007). Threats include habitat loss and degradation through clearing for agricultural and urban development, stock grazing, weed infestation, and localised extinctions due to random natural and human-induced events.	Unlikely. May occur in forest and woodland at the site however not identified despite targeted surveys over a number of months.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Eucalyptus recurva	Mongarlowe Mallee	E1		This species of Mallee grows to 4 m and occurs on shallow soils on gentle slopes in low heathland dominated by Stunted She-oak (*Allocasuarina nana*) and Finger Hakea (*Hakea dactyloides*), and at the margins of adjacent low woodland dominated by Brittle Gum (*Eucalyptus mannifera*) and Snow Gum (*E. pauciflora*). This species is confined to the NSW Southern Tablelands where it is known from only four locations between Mongarlowe and Windellama. Only 5 indivduals of this tree are known to exist. They are likely to be relics from a more widespread ancestor and it is unlikely that further extensive populations of the species remain undiscovered (DEC 2005).	Unlikely. Although associated canopy species are present within the study area other undiscovered population are considered unlikely to exist.
Genoplesium plumosum	Tallong Midge Orchid		E1	The Tallong Midge Orchid has flower spikes to 20 cm tall, with one to eight flowers on each spike. It was originally collected at Kurnell in 1947; presumably it also occurred south of there, but it is now only known from two areas - the village of Tallong and its immediate environs, and a site in Morton National Park 8.5 km south-east of the town of Wingello. It occurs exclusively in heathland, generally dominated by Violet Kunzea (*Kunzea parvifolia*), Common Fringe-myrtle (*Calytrix tetragona*) and parrot-peas (*Dillwynia* spp.) and grows on very shallow soils or within mosses on sandstone conglomerate shelves. This spcies of orchid reproduces by seed and has no mechanism for vegetative reproduction. Individuals exist as a dormant tuber for much of the year, dying back after flowering and fruiting in late summer or early autumn. The Tallong Midge Orchid can be difficult to survey as flowering is highly dependant on seasonal conditions. Threats include loss, degradation and fragmentation of habitat and/or populations for residential developments and road works (DECC 2008).	Unlikely. May occur in association with *Kunzea parviflora* patches, however not recorded despite targeted surveys.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Gentiana wingecarribensis	Wingecarribee Gentian	E	E	Wingecarribee Gentian is an erect annual herb, to 9 cm tall, and is known only from Hanging Rock Swamp and Wingecarribee Swamp on the Southern Highlands. Wingecarribee Gentian grows in bogs, in Sphagnum Moss humps and in sedge communities.	Unlikely. Preferred habitat absent from the study area.
Grevillea molyneuxii	Wingello Grevillea	V	V	The Wingello Grevillea is a low spreading shrub to 60 cm tall that is restricted to a small area south of Penrose, above Tallowa Gully and Bundanoon Creek, in Morton National Park and on Crown Land. This species has only been recorded in low heathland on sandstone, where it grows in skeletal soil on flat, wet sandstone shelves above dissected valleys. It seems to prefer open areas within heathland patches and is colonising the few tracks that bisect its habitat. Plants are killed by fire but seem to regenerate readily from seed in open spaces. Very young plants have been observed to flower so the species is probably well adapted to fire. Threats include damage by vehicles, digging by animals and frequent fire (DECC 2008).	Unlikely. Preferred habitat absent from the study area.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Kunzea camgagei	Cambage Kunzea	V	V	Wingecarribee Gentian is an erect annual herb, to 9 cm tall, and is known only from Hanging Rock Swamp and Wingecarribee Swamp on the Southern Highlands. Wingecarribee Gentian grows in bogs, in Sphagnum Moss humps and in sedge communities. Cambage Kunzea is a ground cover. Like other species of Kunzea, it appears to be a relatively long-lived species with older plants having tangled mats of thick, woody stems that grow up to a metre tall. Cambage Kunzea occurs mainly in the Yerranderie / Mt Werong area in the Blue Mountains but has also been collected on the Wanganderry Plateau, and at Medway and along the Wingecarribee River (near Berrima). Cambage Kunzea is restricted to damp, sandy soils in wet heath or mallee open scrub at higher altitudes on sandstone outcrops or Silurian group sediments. Some populations have been recorded on roadsides where road maintenance (e.g. road widening, weed spraying) may be a threat.	Unlikely. Preferred habitat absent from the study area.
Leuchochrysum albicans var tricolor	Hoary Sunray		E	A perennial herb with a stout, erect, woody rootstock. This species will have originally occupied *Eucalyptus pauciflora* woodland and tussock grassland, however most of this habitat is now converted to improved pasture or cropland. Little information is known of this species ecology in NSW.	Unlikely. This species may occur in association with Snow Gum woodland although none were identified during surveys. No Snow Gum woodland areas are being directly impacted.
Phyllota humifusa	Dwarf Phyllota	V		Dwarf Phyllota is a prostrate shrub with hairy leaves, at least when they are young that is is known from the southern Blue Mountains (Bimlow Tableland), the Joadja area west of Mittagong and Penrose area near Paddys River. The species occurs in dry sclerophyll forest, sometimes near swamps, in deep sandy soils or gravely loams over a sandstone substrate. Accompanying trees are often Brittle Gum Eucalyptus	Unlikely. Preferred overstorey species absent.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
				mannifera, Narrow-leafed Peppermint (*E. radiata*) or Sydney Peppermint (*E. piperita*). Plants apparently resprout following fire and threats include sand and sandstone mining, both directly and through changes to hydrology. The species may also be threatened by forestry activities (DECC 2008).	
Pomaderris cotoneaster	Cotoneaster Pomaderris		E1	Cotoneaster Pomaderris is a shrub growing to 4 m tall. It has a very disjunct distribution, being known from the Nungatta area, northern Kosciuszko National Park (near Tumut), the Tantawangalo area in South-East Forests National Park and adjoining freehold land, Badgery's Lookout near Tallong, the Yerranderie area, the Canyonleigh area and Ettrema Gorge in Morton National Park. Cotoneaster Pomaderris has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs. Little is known about the ecology of the species. It is probably killed by fire but plants have been observed to re-sprout from the stem following death of the crown from apparent drought. Populations tend to be isolated and range in size from a few individuals to many hundreds. The distribution of this species suggests that catastrophic events have led to its fragmentation, of which fire is the most likely. Fires at too short an interval may cause local extinction. Some populations are located in areas of high public use and some plants have been damaged along walking tracks (DECC 2008).	Unlikely. May occur in forested areas on slopes but is distinct and easily identified in the field. Not identified despite targeted surveys.
Pomaderris delicata	Delicate Pomaderris	E1		This species of shrub is known from only two sites between Goulbourn and Bungonia and south of Windellana, where it occurs in dry open forest dominated by *Eucalyptus sieberi* with a dense she-oak understorey. Soils are shallow and derived from sandstone and siltstone. Threats include habitat disturbance and under-scrubbing (DEC 2007).	Unlikely. Although potential habitat for this species exists in Stringybark forest where both *E sieberi* and *Allocasuarina littoralis* were present, this species was not identified despite targeted surveys.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
Pomaderris pallida	Pale Pomoderris	V		Pale Pomaderris is a compact rounded shrub to 1.5 m tall. Pale Pomaderris has been recorded from near Kydra Trig, north-west of Nimmitabel, Tinderry Nature Reserve, and the Queanbeyan River. A record from Byadbo in Kosciuszko National Park has not been relocated. The main distribution is along the Murrumbidgee in the ACT. This species usually grows in shrub communities surrounded by Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhynca*) or *Callitris* spp. woodland. It is threatened by rural residential development, weed competition, goat browsing (Kydra) and too-frequent fire patterns (DECC 2008).	Unlikely. Preferred overstorey species absent.
Pultenaea pedunculata	Matted Bush-pea	E1		This species of prostrate shrub grows to 20 cm high. It is found on clay or sandy clay soils on Wianamatta Shale, close to localised patches of tertiary alluvium, or on the shale / sandstone interface. In NSW it is represented by three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn (where it is locally abundant). The species occurs in a range of habitats including woodland vegetation, road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area. Threats include habitat loss and fragmentation due to clearing for urban, rural, and pastural development, powerline, trail, and road maintenance, and poor understanding and management of species populations. Low intensity fires or an absence of fire may also be a threat (DEC 2007).	Unlikely. May occur in forest and woodland at the site however not identified despite targeted surveys over a number of months.
Rulingia prostrata	Dwarf Kerrawang	E	E1	This species is a prostrate shrub that forms mats to more than 1 m across, occurring on sandy, sometimes peaty soils in a wide variety of habitats. Occurs on sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum (*Eucalyptus pauciflora*) Woodland at Rose Lagoon; Blue leaved Stringybark *(E. agglomerata*) Open Forest at Tallong; and in Brittle Gum (*E. mannifera*) Low Open Woodland at Penrose; Scribbly Gum (*Eucalyptus haemostoma*)/ Swamp Mahogany (*E. robusta*) Ecotonal Forest at Tomago. Associated native species may include *Imperata cylindrica, Empodisma*	Unlikely. May occur in forest and woodland at the site however not identified despite targeted surveys over a number of months.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence Western Pipeline Route
				minus and *Leptospermum continentale*. This species is threatened by a poor understanding of responses to environmental conditions and management practices which could result in inappropriate management actions or inactions (DEC 2007).	
Rutidosis leptorhynchoides	Button Wrinklewort	E	E	The Button Wrinklewort is a perennial, multi-stemmed herb. Flower-heads are bright yellow, slightly domed and button-like, to 2 cm wide. Occurs in Box-Gum Woodland, secondary grassland derived from Box-Gum Woodland or in Natural Temperate Grassland; and often in the ecotone between the two communities. Threats include competition with other grassland species, changes in fire regime, road/rail maintenance, grazing and weed invasion.	Unlikely. Although Box Gum Woodland present within the study area this species was not identified despite targeted surveys.
Solanum celatum		E1		This species of shrub grows to 2.5 m and occurs in rainforest clearings, or in wet sclerophyll forests from Wollongong to just south of Nowra, and west to Bungonia in NSW. Flowering occurs from August to October with fruiting following in December/January. Threats inlcude habitat loss and degradation from weed infestation, in particular Lantana camara, local extinction due to small population size, and too frequent fire (DECc 2008).	Unlikely. Preferred habitat absent from the study area.
Zieria murphyi	Velvet Zieria	V		Zierias are shrubs or small trees closely related to the boronias; the Velvet Zieria species is found in the Blue Mountains at Mt Tomah and on the southern tablelands where it has been recorded in Morton National Park in the Bundanoon area. It is found in gullies in dry sclerophyll forest with sandy soil. Frequent fire is a potential threat (DECC 2008).	Unlikely. Although Gullies with intact remnant vegetation present within the study area this species was not identified despite targeted surveys.

Appendix 4

Part 3A Threatened Species Assessment

Forest Dependent Small Birds

Large Forest Owls

Glossy Black Cockatoo

Gang-gang Cockatoo

Migratory or Nomadic Birds

Granivorous Birds

Cave-roosting Bats

Hollow-dependent Bats

Gliders

Spotted-tail Quoll

Striped Legless Lizard

Forest Dependent Small Bird Species

Speckled Warbler

This species of small wren occurs in a range of eucalyptus dominated communities that have a grassy under storey with a sparse shrub layer and open canopy, often in gullies or on rocky ridges. The species requires large, relatively undisturbed remnants in order to persist in an area. Its diet consists mainly of seeds and insects. Threats include habitat loss and fragmentation through clearing for firewood and development, grazing, removal of fallen timber and logs, and nest predation by feral animals due to urbanisation and fragmented habitat (DECC 2005). This species was identified (visually) at a number of locations throughout the study area. This species is listed as vulnerable under the TSC Act.

Hooded Robin

The hooded robin is a large Australian robin reaching 17 cm in length. The hooded robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania (DECC 2005). The hooded robin prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. The hooded robin requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses (DECC 2005). This species is listed as vulnerable under the TSC Act.

This species has been recorded near the study area north of Canyonleigh Rd, at the proposed gas facilities site.

Brown treecreeper

The eastern subspecies of the brown treecreeper, is Australia's largest treecreeper. It is found in eucalypt woodlands Box-Gum Woodland and dry open forest of the inland slopes and plains of the Great Dividing Range. It mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species (DECC 2006). This species is not usually found in woodlands with a dense shrub layer and fallen timber is an important habitat component for foraging. Hollows in standing dead or live trees and tree stumps are essential for nesting. The brown treecreeper is terrestrial and arboreal and forages on trunks and branches of trees and fallen timber in groups of 8-12 birds. Ants constitute up to 80% of the diet, though other invertebrates (including spiders, insect larvae, moths and beetles) are also taken. The brown treecreeper frequents drier forests and woodlands, including Box-Gum Woodland, preferring more woodland with an open understorey and plentiful fallen timber. This species breeds between May and December, utilizing nests of grass, usually in tree hollows. Breeding occurs in pairs or in co-operative groups of 2-5 birds in territories ranging in size from 1.1 to 10.7 ha. This species is territorial year-round at many sites, although some birds may disperse locally following breeding.

The major potential impact to the lifecycle of a local population of this species would be further loss or degradation of habitat, particularly loss of potential breeding sites and foraging areas. The clearing of dead and fallen timber removes nesting and roosting hollows and major foraging substrates.

This species was not recorded during surveys but the study area contains potential habitat for this species. It has been previously recorded in the locality. This species is listed as vulnerable under the TSC Act.

Black-chinned honeyeater

The black-chinned honeyeater occupies mostly upper levels of drier open forest or woodlands dominated by Box and Ironbark eucalypts, as well as open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. This species usually occurs in pairs or is nomadic. It forages along twigs, branches, and trunks probing for insects. Nectar is taken from flowers and honeydew is gleaned from foliage. The black-chinned honeyeater nests high in the crown of a tree in the uppermost lateral branches (DECC 2005).

This species was not recorded during surveys but the study area contains potential habitat for this species. It has been previously recorded in the locality. This species is listed as vulnerable under the TSC Act.

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

a) displaces or disturbs threatened species and/or populations;

The proposal would modify seven ha of native forest however, vegetation clearance of canopy trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide foraging and breeding habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Temporary fragmentation of this vegetation may result in an increase in predators such as the red fox, however, vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and woodland would also be retained and improved. Construction during the peak breeding season for these species (spring) would be avoided. Given the above considerations, the proposal is unlikely to affect the life cycle of any forest dependent bird species.

b) disrupts breeding cycle;

The proposal would modify seven ha of native forest, however, vegetation clearance of canopy trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide breeding habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Temporary fragmentation of this vegetation may result in an increase in predators such as the red fox, however, vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native vegetation would also be retained. Impacts to foraging and potential breeding habitat for these species would be temporary and alterative breeding habitat exists within the vicinity of the site and in the locality. These species are mobile and transient in their use of resources. It is not expected that the proposal would disrupt the breeding cycle of these species.

c) disturbs the dormancy period;

NA for any of the listed forest dependent bird species.

d) disrupts roosting behaviour;

The proposal would modify seven ha of native forest, however, vegetation clearance of canopy trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide roosting habitat for these species. This vegetation would be re-instated either as existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Temporary fragmentation of this vegetation may result in an increase in predators such as the red fox, however, vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest would also be retained. Pre-clearance surveys would aim to identify roosting birds prior to construction and construction would wait until these birds have moved on. These species are mobile and roosting behaviour is unlikely to be affected.

e) changes foraging behaviour;

The proposal would modify up to seven ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees and stands of Allocasuarina where possible. These species are mobile. The proposal is unlikely to change foraging behaviour of any of the listed bird species.

f) affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by any of the listed bird species. Connectivity would be restored via site remediation with native species. Substantial alternative habitat exists within the vicinity of the site and the locality. Construction works would aim to avoid the spring breeding period of these species in forested areas. The proposal is considered unlikely to affect migration and dispersal ability.

g) disrupts pollination cycle;

NA for listed fauna species.

h) disturbs seedbanks;

The proposal would impact on approximately seven ha of vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

i) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to seven ha of habitat for each of these bird species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to lands the pipeline would traverse. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. Works are not expected to reduce these species' food sources. Temporary fragmentation of this vegetation may result in an increase in predators such as the red fox, however, vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. Thus the proposal is

unlikely to affect interactions with other species in the community. Local land owners currently control foxes on lands associated with the proposal.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

a) disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

b) degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

c) clears or modifies native vegetation;

The proposal would initially remove up to seven ha of forested vegetation and other seven ha of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area however this modification is unlikely to impact any of the listed forest-dependent bird species.

d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated. Local land owners currently control foxes on lands associated with the proposal.

e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. No substantial caves would be impacted as a result of the proposal, however some rock outcrops are likely to be disturbed. The proposal would also result in an initial removal of seven ha of foraging habitat for the listed bird species however this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site, including a high quality offset within the locality. Leaf litter and top soil would be retained and reused. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

f) affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

a) generates or disposes of solids, liquid or gaseous waste; or

NA

b) uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control, however, these are unlikely to impact on the listed species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

a) modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

b) modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

a) creates a barrier to fauna movement;

b) removes remnant vegetation or wildlife corridors; and

c) modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to any of the listed bird species however vegetation would be fragmented until remediation of the pipeline route is undertaken. This fragmentation is unlikely to be of a width that is unpassable for these species. However, no vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of canopy trees where possible;
- Remediation of the site with local native vegetation; and
- Run-off and sedimentation protocols.

Given the above considerations, it is considered unlikely that the Hooded Robin, Speckled Warbler, Brown Treecreeper and Black-chinned Honeyeater would be significantly impacted by the proposal.

Large Forest Owls

Powerful Owl

The powerful owl is a nocturnal, solitary and sedentary species. They occur in a number of vegetation types ranging from woodland and open sclerophyll forest to tall open wet forest and rainforest. However, this species does prefer large tracts of vegetation. Powerful owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old with breeding taking place from late summer to late autumn. Pairs of powerful owls are believed to have high fidelity to a small number of hollow-bearing nest trees and would defend a large home range of 400 - 1,450 ha. The powerful owl forages within open and closed woodlands as well as open areas (DECC 2005). This species responded to call playback and was spotlighted along Wollombi Rd during recent surveys.

Barking Owl

The barking owl inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or in dense clumps of canopy leaves in large eucalypts. The barking owl feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits important during breeding. This species lives alone or in a pair with territories ranging from 30 to 200 hectares. Nests are built in hollows of large, old eucalypts including river red gum (*Eucalyptus camandulensis*), white box (*Eucalyptus albens*), red box (*Eucalyptus polyanthemos*), and Blakely's red gum (*Eucalyptus blakelyi*) (DECC 2005). Habitat for this species exists within the study area however none were identified despite targeted surveys (call playback and spotlighting).

Masked Owl

This species occurs in dry eucalypt woodlands at altitudes from sea level to 1100 m and roosts and breeds in hollows and sometime caves in moist eucalypt forested gullies. It hunts along the edges of forests and roadsides and has a home range covering between 500 ha and 1000 ha. Prey for this species are principally terrestrial mammals but arboreal species may also be taken. Masked Owls are sparsely distributed from southern QLD to SA and WA. It has also been recorded on the Nullarbor plain. The southern subspecies occupies a home range of 5 to 10 square km. Threats include clearing for agriculture (DECC 2005). Habitat for this species exists within the study area, however, none were identified despite targeted surveys (call playback and spotlighting).

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

j) displaces or disturbs threatened species and/or populations;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees of a size to support breeding owls, however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide foraging habitat for each of the listed owl species. This vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would also be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees would also be retained. Powerful Owls are known to return to preferred breeding trees each year. Pre-clearance surveys would aim to identify roosting or breeding

trees for forest owls prior to construction and these trees would be avoided where practicable. Given the above considerations, the proposal is unlikely to affect the life cycle of any large forest owls as a result of the proposal.

k) disrupts breeding cycle;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees of a size to support breeding owls however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide foraging habitat for each of the listed owl species. This vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees would also be retained. Powerful Owls are known to return to preferred breeding trees each year. Pre-clearance surveys would aim to identify roosting or breeding trees for forest owls prior to construction and these trees would be avoided wherever practicable. It is not expected that the proposal would disrupt the breeding cycle of these species.

l) disturbs the dormancy period;

NA for the listed owl species.

m) disrupts roosting behaviour;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes hollow-bearing trees and roosting habitat would also be retained. Pre-clearance surveys would aim to identify roosting trees prior to construction and these trees would be avoided where possible. Therefore the proposal is unlikely to disrupt the roosting behaviour of these owl species.

n) changes foraging behaviour;

The proposal would modify up to seven ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. The proposal is unlikely to change foraging behaviour of any of the listed owl species.

o) affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by any of the listed owl species. Fragmentation would be temporary and connectivity would be restored. These species are highly mobile and have large home ranges. Substantial alternative habitat exists within the vicinity of the site and the locality. Construction works would aim to avoid the autumn/winter breeding period of these species in forested areas. The proposal is considered unlikely to affect migration and dispersal ability of these owls.

p) disrupts pollination cycle;

NA for listed fauna species.

q) disturbs seedbanks;

The proposal would impact on approximately seven ha of vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

r) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to seven ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. Works are not expected to disrupt these species' preferred prey (e.g. small mammals, insects etc.). Thus the proposal is unlikely to affect interactions with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

g) disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

h) degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

i) clears or modifies native vegetation;

The proposal would initially remove seven ha of forested vegetation and other seven ha of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area, however, this modification is unlikely to impact any of the owl species.

j) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes, cats and dogs into this area, however, this impact would be temporary as native vegetation would be re-established, and unlikely to impact upon owl species. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once

established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated. Landowners currently control foxes at the site.

k) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. The proposal would also result in an initial removal of seven ha of foraging habitat for the listed owls, however, this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site and in the locality, including a high quality offset and within the locality. Woody debris would be stockpiled in adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

l) affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

c) generates or disposes of solids, liquid or gaseous waste; or

NA

d) uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these are unlikely to impact on the listed species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

c) modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

d) modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

d) creates a barrier to fauna movement;

e) removes remnant vegetation or wildlife corridors; and

f) modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to any of the listed owl species; however, vegetation would be fragmented until remediation of the pipeline route is undertaken. This fragmentation is unlikely to affect these species. No vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees and potential breeding trees where possible;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for any of these species. Given the above considerations, it is considered unlikely that the powerful owl, masked owl and barking owl would be significantly impacted by the proposal.

Glossy Black Cockatoo

This species is highly specialised, feeding almost exclusively on the seeds extracted from the wooden cones of Allocasuarina species including black she-oak (*Allocasuarina littoralis*), forest she-oak (*Allocasuarina torulosa*) or drooping she-oak (*Allocasuarina verticilliata*). It is uncommon although widespread throughout suitable forest and woodland habitats, from central QLD to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW. This species needs suitable hollows in living and dead trees for nesting and breeds between March and August (DECC 2005). This species was recorded within the study area during recent surveys and substantial numbers of feed trees (including evidence of chewed cones) were identified throughout the study area.

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

s) displaces or disturbs threatened species and/or populations;

The proposal would modify seven ha of native forest and would impact on a high number of stands of Allocasuarina that showed evidence of feeding by glossy black cockatoo (chewed cones). The project would also remove hollow-bearing trees that may be of a size to support breeding cockatoos however, these both hollow-bearing trees and stands of Allocasuarina trees would be avoided wherever possible using controlled, sensitive construction techniques. This vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contained hollow-bearing trees and substantial stands of *Allocasaurina*. This vegetation is also contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest, substantial areas of Allocasuarina and hollow-bearing trees would also be retained. Pre-clearance surveys would aim to identify feeding or breeding trees for glossy black cockatoos prior to construction and where possible these trees would be avoided. Given the above considerations, the proposal is unlikely to affect the life cycle of the glossy black cockatoo as a result of the proposal.

t) disrupts breeding cycle;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees of a size to support breeding birds however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Construction would aim to avoid the peak breeding period of these birds (March to August). Vegetation within the study area provides foraging habitat for the glossy black cockatoo. This vegetation would be re-instated including Allocasuarina except for a width of six metres immediately above the pipeline which can only have shrubs and ground layer species. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contained hollow-bearing trees and substantial stands of *Allocasaurina*. This vegetation is also contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest, substantial areas of Allocasuarina and hollow-bearing trees would also be retained. Constructions during these species' breeding period (March to August) would be avoided. It is not expected that the proposal would disrupt the breeding cycle of this species.

u) disturbs the dormancy period;

NA for the glossy black cockatoo.

v) disrupts roosting behaviour;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees however, these canopy trees including hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation to be removed would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes hollow-bearing trees would also be retained. These species are mobile and would have access to substantial alternative habitat in the locality. Therefore the proposal is unlikely to disrupt the roosting behaviour of the glossy black cockatoo.

w) changes foraging behaviour;

The proposal would modify up to seven ha of known foraging habitat for the glossy black cockatoo. This is likely to result in a reduction in this feeding resource some time into the future as Allocasuarina trees must be fairly mature to produce fruit. Where possible stands of Allocasuarina would be avoided using controlled, sensitive construction techniques. The glossy black cockatoo is mobile and transient in its use of resources. Alternative foraging habitat is present within the study area and broader locality including within the proposed offset site.

x) affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by the glossy black cockatoo. Fragmentation would be temporary and connectivity would be restored. These species are highly mobile and have large home ranges. Substantial alternative habitat exists within the vicinity of the site and the locality. Hollow-bearing trees would be avoided where possible and alternative habitat exist in the immediate vicinity and locality of the site. Construction works would aim to avoid the autumn/winter breeding period of these species in forested areas. The proposal is considered unlikely to affect migration and dispersal ability of the glossy black cockatoo.

y) disrupts pollination cycle;

NA for listed fauna species.

z) disturbs seedbanks;

The proposal would impact on approximately seven ha of vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

aa) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to seven ha of habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. Works in forested areas would aim to minimise impacts on canopy trees where possible. These species are mobile and transient in their use of resources. The proposal is unlikely to affect the interaction of the species with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

m) disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

n) degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

o) clears or modifies native vegetation;

The proposal would initially remove seven ha of forested vegetation and other seven ha of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area. This impact would be mitigated by an offset package that includes potential glossy black cockatoo feed trees.

p) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

q) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. The proposal would also result in an initial removal of seven ha of foraging habitat for the glossy black cockatoo however this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site and in the locality, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect this species.

r) affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. Tube stock would aim to include

Allocasuarina species with seed collected from trees that show a past evidence of feeding. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

e) generates or disposes of solids, liquid or gaseous waste; or

NA

f) uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

e) modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

f) modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

g) creates a barrier to fauna movement;

h) removes remnant vegetation or wildlife corridors; and

i) modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to the glossy black cockatoo, however, vegetation would be fragmented until remediation of the pipeline route is undertaken. This fragmentation would not be of a width that is unpassable for this species. No vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for this species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees and Allocasuarina trees where possible;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for the glossy black cockatoo.

Gang-gang Cockatoo

This species is nomadic, spending summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests and winter at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests (DECC 2005). This species was recorded within the study area during recent surveys and is likely to feed on flowering stringybarks in the study area.

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

bb) displaces or disturbs threatened species and/or populations;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees of a size to support breeding gang-gang cockatoos, however, this species shows a preference for breeding near water which is not present within the vicinity of the study area. Also, hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide foraging habitat for the gang-gang. This vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees would also be retained. Gang-gangs migrate seasonally and were observed at the site in winter. This species is unlikely to be present at the site during its known breeding season. Given the above considerations, the proposal is unlikely to affect the life cycle of the gang-gang cockatoo as a result of the proposal.

cc) disrupts breeding cycle;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees of a size to support breeding gang-gangs, however, this species shows a preference for breeding near water which is not present within the vicinity of the study area. Also, hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide foraging habitat for the gang-gang. This vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees would also be retained. Gang-gangs migrate seasonally and were observed at the site in winter, however this species breeds in spring/summer and as such is unlikely to breed within the study area. Construction would aim to avoid this period when gang-gangs are likely to be active at the site which would further mitigate impacts on this species. Given the above considerations it is not expected that the proposal would disrupt the breeding cycle of this species.

dd) disturbs the dormancy period;

NA for the gang-gang cockatoo.

ee) disrupts roosting behaviour;

The proposal would modify seven ha of native forest which may be utilised by the gang-gang cockatoo for roosting, however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation removed would be re-instated either as existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east and includes relevant feed trees for this species. A high quality offset which includes potential roost sites for this species would also be retained. These species are mobile and transient in their use of resources. Therefore the proposal is unlikely to disrupt the roosting behaviour of gang-gang cockatoo.

ff) changes foraging behaviour;

The proposal would modify seven ha of native forest and may remove canopy trees such as stringybarks which the gang-gang is likely to feed on (blossom), however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation removed would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east and includes relevant feed trees for this species. A high quality offset which includes hollow-bearing trees and a large area of potential feed trees would also be retained. These species are mobile and transient in their use of resources. Therefore the proposal is unlikely to change foraging behaviour of the gang-gang cockatoo.

gg) affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by the gang-gang cockatoo. Fragmentation would be temporary and connectivity would be restored. These species are highly mobile. Substantial alternative habitat exists within the vicinity of the site and the locality. The proposal is considered unlikely to affect migration and dispersal ability of the gang-gang cockatoo.

hh) disrupts pollination cycle;

NA for listed fauna species.

ii) disturbs seedbanks;

The proposal would impact on approximately seven ha of vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

jj) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to seven ha of habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. Works are not

expected to substantially deprive this species of feeding resources in the locality. Thus the proposal is unlikely to affect interactions with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

s) disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

t) degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

u) clears or modifies native vegetation;

The proposal would initially remove seven ha of forested vegetation and other seven ha of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas will be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area. This modification is unlikely to impact on the gang-gang cockatoo as substantial alternative habitat is present in the immediate vicinity of the site and in the locality.

v) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

w) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. The proposal would also result in an initial removal of seven ha of potential foraging habitat for the gang-gang cockatoo however this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site and in the locality, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

x) affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

g) generates or disposes of solids, liquid or gaseous waste; or

NA

h) uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

g) modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

h) modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

j) creates a barrier to fauna movement;

k) removes remnant vegetation or wildlife corridors; and

l) modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to the gang-gang cockatoo. Vegetation would be fragmented until remediation of the pipeline route is undertaken however this fragmentation would not be of a width that is unpassable for this species. No vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees and other canopy trees where possible;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, it is considered unlikely that the gang-gang cockatoo would be significantly impacted by the proposal.

Migratory or Nomadic Birds

Swift parrot

The swift parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Favoured feed trees include winter flowering species such as swamp mahogany (*Eucalyptus robusta*), spotted gum (*Corymbia maculata*), red bloodwood (*C. gummifera*), mugga ironbark (*E. sideroxylon*), and white box (*E. albens*).

Commonly used lerp infested trees include grey box (E*. macrocarpa*), grey box (*E. moluccana*) and blackbutt (*E. pilularis*) and swift parrots would return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian blue gum (*E. globulus*). (DECC 2005).

Regent honeyeater

This species is a semi-nomadic species that inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of river she-oak where there are significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. The regent honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years non-breeding flocks converge on flowering coastal woodlands and forests. (DECC 2005).

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

i) displaces or disturbs threatened species and/or populations;

The proposal would modify seven ha of native forest which may provide occasional foraging habitat for the regent honeyeater and swift parrot, however, these species generally follow known migration paths that does not include the Marulan site. However, the swift parrot particularly may occur on a transient basis in some years. Vegetation at the site would be avoided wherever possible using controlled, sensitive construction techniques. Where vegetation must be removed, this vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest would also be retained. These species are only likely to occur on a transient occasional basis and the site is unlikely to constitute important habitat for this species and there is substantial alternative habitat in the locality. Given the above considerations, the proposal is unlikely to affect the life cycle of either the regent honeyeater or swift parrot as a result of the proposal.

ii) disrupts breeding cycle;

The proposal would modify seven ha of native forest which may provide occasional foraging habitat for the regent honeyeater or swift parrot, however these species generally follow known migration paths that does not include the Marulan site. Both the swift parrot and regent honeyeater have known breeding grounds that do not occur within the vicinity of the site. It is not expected that the proposal would disrupt the breeding cycle of this species.

iii) disturbs the dormancy period;

NA for the listed migratory species.

iv) disrupts roosting behaviour;

The proposal would modify seven ha of native forest which may provide temporary roosting habitat for the regent honeyeater or swift parrot, however these species generally follow known migration paths that does not include the Marulan site. Substantial vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest would also be retained. These species are only likely to occur on a transient occasional basis, and the site is unlikely to constitute important habitat for these species and there is substantial alternative habitat in the locality. Therefore the proposal is unlikely to disrupt the roosting behaviour of these species.

v) **changes foraging behaviour;**

The proposal would modify up to seven ha of potential foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. These species are only likely to occur on a transient occasional basis, and the site is unlikely to constitute important habitat for these species and there is substantial alternative habitat in the locality. The proposal is unlikely to change foraging behaviour of either the regent honeyeater or swift parrot.

vi) **affects migration and dispersal ability;**

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by of either the regent honeyeater or swift parrot. These species are highly mobile. Fragmentation would be temporary and connectivity would be restored. Substantial alternative habitat exists within the vicinity of the site and the locality. The proposal is considered unlikely to affect migration and dispersal ability of either the regent honeyeater or swift parrot.

vii) disrupts pollination cycle;

NA for listed fauna species.

viii) **disturbs seedbanks;**

The proposal would impact on approximately seven ha of vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

iv) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

x) **affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).**

The proposal would modify up to seven ha of potential foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. These species are only likely to occur on a transient occasional basis, and the site is unlikely to constitute important habitat for these species and there is substantial alternative habitat in the locality. Thus the proposal is unlikely to affect interactions with other species in the community.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

i) disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

ii) **degrades soil quality;**

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

iii) **clears or modifies native vegetation;**

The proposal would initially remove seven ha of forested vegetation and other seven ha of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area, however, this modification is unlikely to impact either the regent honeyeater or swift parrot.

iv) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

v) **removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;**

Sensitive construction techniques would be used in areas of native vegetation to avoid canopy trees wherever possible. The proposal would also result in an initial removal of seven ha of foraging habitat however this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site and in the locality, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. These species are only likely to occur on a transient occasional basis, and the site is unlikely to constitute important habitat for these species and there is substantial alternative habitat in the locality.

Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

vi) **affects natural revegetation and re-colonisation of existing species following disturbance.**

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works will also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

vii) **generates or disposes of solids, liquid or gaseous waste; or**

NA

viii) **uses pesticide, herbicides, other chemicals.**

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

c) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

i) modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

ii) **modifies flooding flows;**

Not applicable to the site.

d) How is the proposal likely to effect habitat connectivity?

i) creates a barrier to fauna movement;

j) removes remnant vegetation or wildlife corridors; and

k) modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier for either the regent honeyeater or swift parrot, however, vegetation would be fragmented until remediation of the pipeline route is undertaken. This fragmentation would not be of a width that is unpassable for these species. These species are only likely to occur on a transient occasional basis, and the site is unlikely to constitute important habitat for these species and there is substantial alternative habitat in the locality. No vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

e) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

Given the above considerations, it is considered unlikely that either the regent honeyeater or swift parrot would be significantly impacted by the proposal.

Granivorous Birds

Diamond Firetail

This species is known to occur in grassy eucalypt woodlands, including Box-Gum Woodlands, and Snow Gum (*Eucalyptus pauciflora)* Woodlands, riparian areas (rivers and creeks), and sometimes in lightly wooded farmland (DECC 2005).

Turquoise Parrot

This species of parrot occurs in open eucalypt woodlands and forests, typically with a grassy understorey. It favours the edges of woodlands adjoining grasslands or timbered creek lines and ridges. A granivorous species, the turquoise parrot feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat. This species nests in tree hollows, logs or posts from August to December. (DECC 2005).

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Displaces or disturbs threatened species and/or populations;

The proposal would modify seven ha of native forest and temporarily remove up to seven ha of native pasture. Vegetation within the study area would provide habitat for the diamond firetail and turquoise parrot. Hollow-bearing trees (used by the turquoise parrot for breeding) would be avoided wherever possible during construction. Vegetation to be impacted would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Forested areas currently contain limited native grasses reducing the value of these areas for either of these species, however, grasses may become more established in the six m corridor once canopy trees area removed. Substantial areas of alternative habitat are present within the locality and edge habitats preferred by the turquoise parrot would be retained. This vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest, woodland and grassland areas would also be retained. Pre-clearance surveys would aim to identify roosting areas or nests trees prior to construction and these trees would be avoided. Given the above considerations, the proposal is unlikely to affect the life cycle of either the turquoise parrot or diamond firetail as a result of the proposal.

disrupts breeding cycle;

The proposal would modify seven ha of native forest and temporarily remove up to seven ha of native pasture. Vegetation within the study area would provide habitat for the diamond firetail and turquoise parrot. Hollow-bearing trees (used by the turquoise parrot for breeding) would be avoided wherever possible during construction. Vegetation to be impacted would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Forested areas currently contain limited native grasses reducing these areas value for either of these species however grasses may become more established in the six m corridor once canopy trees area removed. Substantial areas of alternative habitat are present within the locality and edge habitats preferred by the turquoise parrot would be retained. This vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest, woodland and grassland areas would also be retained. Pre-clearance surveys would aim to identify roosting areas or nests trees prior to construction and these trees would be avoided. It is not expected that the proposal would disrupt the breeding cycle of these species.

disturbs the dormancy period;

NA for the listed bird species.

disrupts roosting behaviour;

The proposal would modify seven ha of native forest and temporarily remove up to seven ha of native pasture. Vegetation within the study area would provide habitat for the diamond firetail and turquoise parrot. Vegetation to be impacted would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Forested areas currently contain limited native grasses reducing these areas value for either of these species, however, grasses may become more established in the six m corridor once canopy trees area removed. Substantial areas of alternative habitat are present within the locality and edge habitats preferred by the turquoise parrot would be retained. This vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest, woodland and grassland areas would also be retained. Pre-clearance surveys would aim to identify roosting areas or nests trees prior to construction and these trees would be avoided. These species are mobile and are unlikely to be directly impacted by the proposal. Therefore the proposal is unlikely to disrupt the roosting behaviour of these two bird species.

changes foraging behaviour;

The proposal would modify up to 14 ha of potential foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, vegetation within forested areas does not currently contain much native grass due to shading, grazing and competition from *Allocasuarinas*. Substantial alternative habitat exists in the locality including a high quality offset of intact native forest, woodland and grassland adjacent to the subject lands. Both these species are mobile and unlikely to be directly impacted by the proposal.

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by either the diamond firetail or turquoise parrot. Fragmentation would be temporary and connectivity would be restored. These species are mobile. Substantial alternative habitat exists within the vicinity of the site and the locality. The proposal is considered unlikely to affect migration and dispersal ability of these species.

disrupts pollination cycle;

NA for listed fauna species.

disturbs seedbanks;

The proposal would impact on approximately 14 ha of vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to 14 ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. Thus the proposal is unlikely to affect interactions with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

clears or modifies native vegetation;

The proposal would initially remove seven ha of forested vegetation and other seven ha of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area, however, this modification is unlikely to impact the diamond firetail or turquoise parrot as substantial alternative habitat exists in the vicinity of the site and in the locality.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. The proposal would also result in an initial removal of seven ha of forest and seven ha of native pasture, however, this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site and in the locality, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement; **removes remnant vegetation or wildlife corridors; and**

modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to either the diamond firetail or turquoise parrot, however, vegetation would be fragmented until remediation of the pipeline route is undertaken. This fragmentation would not be of a width that is unpassable for these species. However, no vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for either of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees where possible;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

Given the above considerations, it is considered unlikely that the diamond firetail and turquoise parrot would be significantly impacted by the proposal.

Cave-roosting Microchiropteran Bat Species

Large-eared Pied bat

This species is distributed between south-eastern QLD to NSW from the coast to the western slopes of the divide. This species roosts in caves and mines and has been most commonly recorded from dry sclerophyll forests and woodlands. The large-eared pied bat is an insectivorous species that flies relatively slowly over the canopy or along creek beds (Churchill 1998). Threats include clearing and isolation of habitat, damage to roosting and maternal sites from mining operations, and recreational caving activities, and the use of pesticides (DECC 2005).

Little Bentwing Bat

This species of bat inhabits moist eucalypt forest, rainforest or dense coastal Banksia scrub. This species primarily roosts in caves, tunnels and sometimes tree hollows. Breeding for this species occurs during winter at maternal roost sites (DECC 2005).

Eastern Bentwing Bat

This species has dark reddish-brown to dark brown fur and is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998, DECC 2005). In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within six m of the ground. Moths form the major component of their diet and breeding takes place from October to April (Churchill 1998).

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

displaces or disturbs threatened species and/or populations;

No substantial caves that are likely to house roosting bats would be directly impacted by the proposal, however, a number of rocky outcrops are likely to be disturbed which may include temporary roost sites. The proposal would also modify seven ha of native forest which would provide foraging habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Furthermore, vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact forest would also be retained. Given the above considerations, the proposal is unlikely to affect the life cycle of any cave-roosting bat species as a result of the proposal.

disrupts breeding cycle;

All three species require caves of medium to substantial size for breeding. No breeding habitat in the form of caves would be directly impacted by the proposal. Alternative habitat in the form of small caves which may be utilised by the large-eared pied bat occur within the broader study area including on the proposed offset site. Consequently, as no maternal breeding habitat would be impacted by the proposal it is considered unlikely that the proposal would disrupt the breeding cycle of any of these bat species.

disturbs the dormancy period;

Many species of microchiropteran bat species would become dormant during cold weather. As the above listed species all rely of caves for roosting, and no caves would be directly impacted by the proposal, it is considered unlikely that the proposal would disturb the dormancy period of any of these bat species.

disrupts roosting behaviour;

As the above listed species all rely of caves for roosting, and no caves would be directly impacted by the proposal, and works would not be conducted at night, the proposal is unlikely to disturb roosting behaviour.

changes foraging behaviour;

The proposal would modify up to seven ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. The proposal is unlikely to change foraging behaviour of any of the listed bat species.

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by any of the listed bat species nor would it create any barriers to fauna movement. No breeding habitat for any of these species would be affected. The proposal is considered unlikely to affect migration and dispersal ability.

disrupts pollination cycle;

NA for listed fauna species.

disturbs seedbanks;

The proposal would impact on approximately seven ha of vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to seven ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. Works are not expected to disrupt these species' preferred prey (e.g. insects) nor substantially increase predators of these species in the locality. Thus the proposal is unlikely to affect interactions with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

clears or modifies native vegetation;

The proposal would initially remove seven ha of forested vegetation and other seven ha of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area, however, this modification is unlikely to impact any of the listed cave-roosting bat species. The initial removal of native vegetation is also not expected to impact on these species as substantial alternative habitat exists and no important features for these species such as roost caves would be impacted by the proposal.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. No substantial caves would be impacted as a result of the proposal, however, some rock outcrops are likely to be disturbed. The proposal would also result in an initial removal of seven ha of foraging habitat for the listed bat species however this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and

modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to any of the listed bat species however vegetation would be fragmented until remediation of the pipeline route is undertaken. However, no vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees where possible;
- No direct impacts on any caves;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for any of these species not would any important habitat features such as roosting or maternity caves be impacted by the proposal. Given the above considerations, it is considered unlikely that the large-eared pied bat, little bentwing bat or eastern bentwing bat would be significantly impacted by the proposal.

Hollow-dependent Microchiropteran Bat Species

- eastern false pipistrelle *(Falsistrellus tasmaniensis*);
- eastern freetail bat (*Mormopterus norfolkensis*);
- greater broadnosed bat *(Scoteanax ruepellii).*

Eastern False Pipestrelle

This species of bat inhabits moist forest generally with trees larger than 20 m and roosts in eucalypt hollows, underneath bark or in buildings. This species generally roosts in hollow trunks of Eucalypts in colonies of 3 to 36 (Churchill, 1998). Diet consists of moths, beetles and other insects, which it collects within or just below the tree canopy. This species hibernates during winter and breeding takes place in late spring (DECC 2005).

Eastern Freetail Bat

This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range and roosts primarily in tree hollows but also in man-made structures or under bark. This species is solitary and probably insectivorous (DECC 2005).

Greater Broadnosed bat

This species is a large and robust bat that feed on slow-flying prey such as large moths and beetles. It hunts from above rows of trees lining creeks and the edges of woodland in otherwise cleared paddocks, roosting in hollow tree trunks and branches as well as the roofs of old buildings (Churchill 1998). It inhabits a variety of habitats ranging from moist and dry eucalypt forest and rainforest to tall wet forest, however tends to prefers moist gullies in mature coastal forest or rainforest from the Atherton Tablelands in north QLD, along the coastal regions to southern NSW. The species is only found at low altitudes (below 500 m) (Churchill 1998; DECC 2005). Reproduction takes place in January at maternal roosting sites (DECC 2005). Suspected threats include clearing and fragmentation of forests in coastal and lowland areas, and the effects of logging activities including direct mortality and reduction of suitable hollows.

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

displaces or disturbs threatened species and/or populations;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide foraging habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of 6 metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes hollow-bearing trees would also be retained. Pre-clearance surveys would aim to identify roosting trees prior to construction and these trees would be avoided. Given the above considerations, the proposal is unlikely to affect the life cycle of any hollow-dependent bat species as a result of the proposal.

disrupts breeding cycle;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees however, these trees would be avoided wherever possible using controlled, sensitive construction techniques.

Vegetation within the study area would provide foraging habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes hollow-bearing trees would also be retained. Pre-clearance surveys would aim to identify roosting trees prior to construction and these trees would be avoided. Impacts to foraging and potential breeding habitat for these species would be temporary and alterative breeding habitat exists within the vicinity of the site and in the locality. It is not expected that the proposal would disrupt the breeding cycle of this species.

disturbs the dormancy period;

Many species of microchiropteran bat species become dormant during cold weather. Pre-clearance surveys would aim to identify roosting trees prior to construction and these trees would be avoided. Where possible, construction would aim to avoid the breeding period of microchiropteran bat species. Consequently, it is considered unlikely that the proposal would disturb the dormancy period of any of these species.

disrupts roosting behaviour;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide foraging habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes hollow-bearing trees would also be retained. Pre-clearance surveys would aim to identify roosting trees prior to construction and these trees would be avoided. Therefore the proposal is unlikely to disrupt the roosting behaviour of these bat species.

changes foraging behaviour;

The proposal would modify up to seven ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. The proposal is unlikely to change foraging behaviour of any of the listed bat species.

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by any of the listed bat species. Substantial alternative habitat exists within the vicinity of the site and the locality. The proposal is considered unlikely to affect migration and dispersal ability.

disrupts pollination cycle;

NA for listed fauna species.

disturbs seedbanks;

The proposal would impact on approximately seven ha of vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to seven ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. Works are not expected to disrupt these species' preferred prey (e.g. insects) nor substantially increase predators of these species in the locality. Thus the proposal is unlikely to affect interactions with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

clears or modifies native vegetation;

The proposal would initially remove seven ha of forested vegetation and other seven ha of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area however this modification is unlikely to impact any of the listed hollow-dependent bat species.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation will be remediated.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. No substantial caves would be impacted as a result of the proposal, however, some rock outcrops are likely to be disturbed. The proposal would also result in an initial removal of seven ha of foraging habitat for the listed bat species, however, this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and

modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to any of the listed bat species, however, vegetation would be fragmented until remediation of the pipeline route is undertaken. This fragmentation is unlikely to be of a width that is unpassable for these species. However, no vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees where possible;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for any of these species not would any important habitat features such as roosting or maternity caves be impacted by the proposal. Given the above considerations, it is considered unlikely that the eastern false pipistrelle *(Falsistrellus tasmaniensis*), eastern freetail bat (*Mormopterus norfolkensis*); and greater broadnosed bat *(Scoteanax ruepellii)* would be adversely impacted by the proposed development.

Arboreal Mammals

Yellow-bellied glider

This species of large arboreal mammal occurs in a variety of forest types though prefers tall mature eucalypt forest with high rainfall and rich soils, along the east coast to the western slopes of the Great Divide. This species relies on hollow-bearing trees for shelter and nesting. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Plant and insect exudates provide the bulk of this gliders diet including nectar, sap, honeydew and manna, whilst protein is obtained from arthropods and some pollen. The Yellow-bellied Gilder incises tree trunks and branches to obtain phloem sap, often leaving a distinctive 'V'-shaped scar. Tree selection and usage is complex and a large number of tree species are used as sap trees throughout the range of this glider. Threats include loss and fragmentation of habitat, and loss of hollow-bearing and feed trees (DECC 2005).

Squirrel glider

This species of glider is widely though sparsely distributed throughout eastern Australia. In NSW it inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. This species prefers a diversity of food supplies including acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein, and requires an abundant supply of tree-hollows for nesting and shelter. Threats include loss and fragmentation of habitat, flowering trees and shrubs, and hollow-bearing trees, and barbed wire fences snagging individuals whilst gliding (DECC 2005).

Neither of these species were recorded during surveys, or have been previously recorded in the locality, however the study area provides potential habitat for these species.

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

displaces or disturbs threatened species and/or populations;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees of a size to support gliders however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would also provide foraging habitat for thee gliders should they occur. This vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees would also be retained. The proposal would result the fragmentation of the site but only until areas of impact can be rehabilitated. This fragmentation (up to 20m) is unlikely to fragment the site to the extent that it would become unpassable for gliders as vegetation either side is intact forest at leats as tall as 20 metre. Given the above considerations, the proposal is unlikely to affect the life cycle of any gliders as a result of the proposal.

disrupts breeding cycle;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees of a size to gliders however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation to be removed would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large

areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees would also be retained. Pre-clearance surveys would aim to detect roosting individuals prior to construction and these trees would be avoided until vacated or individuals would be carefully relocated into adjacent habitat. It is not expected that the proposal would disrupt the breeding cycle of these species.

disturbs the dormancy period;

NA for the listed glider species.

disrupts roosting behaviour;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees, however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation to be removed would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes hollow-bearing trees would also be retained. Pre-clearance surveys would aim to identify roosting trees prior to construction and these trees would be avoided where possible or individuals carefully relocated.

changes foraging behaviour;

The proposal would modify up to seven ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. The proposal is unlikely to change foraging behaviour of either of these gliders.

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by either the yellow-bellied glider or squirrel glider. Fragmentation would be temporary and connectivity would be restored. These species are mobile. Substantial alternative habitat exists within the vicinity of the site and the locality. Construction works would aim to avoid the spring breeding period of these species in forested areas. The proposal is considered unlikely to affect migration and dispersal ability of either the yellow-bellied glider or squirrel glider.

disrupts pollination cycle;

NA for listed fauna species.

disturbs seedbanks;

The proposal would impact on approximately seven ha of vegetation, however, works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to seven ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

clears or modifies native vegetation;

The proposal would initially remove seven ha of forested vegetation and another seven ha of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area, however, this modification is unlikely to substantially impact either the yellow-bellied glider or squirrel glider should they occur.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. The proposal would also result in an initial removal of seven ha of foraging habitat for the yellow-bellied glider or squirrel glider however this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site and in the locality, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect either the yellow-bellied glider or squirrel glider.

affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and

modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to either the yellow-bellied glider or squirrel glider, however, vegetation would be fragmented until remediation of the pipeline route is undertaken. This fragmentation would not be of a width that is unpassable for these species. No vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees and potential breeding trees where possible;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

Given the above considerations, it is considered unlikely that the either the yellow-bellied glider or squirrel glider would be significantly impacted by the proposal.

Spotted-tail Quoll

It inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are found in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines. (DECC 2005).

The study area offers potential habitat for this species. It has been previously recorded in the locality, however no latrine sites or scats of this species were identified during surveys.

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

displaces or disturbs threatened species and/or populations;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees, fallen logs and rocky areas that may be utilised by this species, however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 m corridor. Vegetation removed during construction would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees, caves, rocky outcrops and woody debris would also be retained. Pre-clearance surveys would aim to identify roosting or breeding sites for the spotted-tail quoll prior to construction and these trees would be avoided. These species are highly mobile and have large home ranges. Given the above considerations, the proposal is unlikely to affect the life cycle of the spotted-tail quoll as a result of the proposal.

disrupts breeding cycle;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees fallen logs and rocky areas that may be utilised by this species, however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 metre corridor. Vegetation removed during construction would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees, caves, rocky outcrops and woody debris would also be retained. Pre-clearance surveys would aim to identify roosting or breeding sites for the spotted-tail quoll prior to construction and these trees would be avoided. Construction would be avoided during the peak breeding time for this species. This species are highly mobile and have large home ranges. It is not expected that the proposal would disrupt the breeding cycle of the spotted-tail quoll.

disturbs the dormancy period;

NA for the spotted-tail quoll.

disrupts roosting behaviour;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees fallen logs and rocky areas that may be utilised by this species however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 m corridor. Vegetation removed during construction would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees, caves, rocky outcrops and woody debris would also be retained. Pre-clearance surveys would aim to identify roosting or breeding sites for the spotted-tail quoll prior to construction and these areas would be avoided or quolls carefully relocated.

changes foraging behaviour;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees fallen logs and rocky areas that may be utilised by this species however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 m corridor. Vegetation removed during construction would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees, caves, rocky outcrops and woody debris would also be retained. This species are highly mobile and have large home ranges. The proposal is unlikely to change foraging behaviour of the spotted-tail quoll.

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by the spotted-tail quoll. Fragmentation would be temporary and connectivity would be restored. This species are highly mobile and have large home ranges. Substantial alternative habitat exists within the vicinity of the site and the locality. Construction works would aim to avoid the breeding period of this species in forested areas. The proposal is considered unlikely to affect migration and dispersal ability of the spotted-tail quoll.

disrupts pollination cycle;

NA for listed fauna species.

disturbs seedbanks;

The proposal would impact on approximately seven ha of vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to seven ha of habitat for the spotted-tail quoll until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. The proposal is unlikely to affect interactions with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

clears or modifies native vegetation;

The proposal would initially remove seven ha of forested vegetation and other seven ha of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area however this modification is unlikely to impact on the spotted-tail quoll in the long-term.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. This species is particularly sensitive to competition with introduced predators such as cats and dogs. The six metre corridor of shrubs and ground layer species is likely to deter feral species once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

The proposal would modify seven ha of native forest and may remove hollow-bearing trees fallen logs and rocky areas that may be utilised by this species however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 m corridor. Rocky areas disturbed by the proposal would also be placed into adjacent bushland areas. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect the spotted-tail quoll.

affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

Low-grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

None of the listed species is at the limit of its known distribution.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and

modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to any the spotted-tail quoll however vegetation would be fragmented until remediation of the pipeline route is undertaken. This fragmentation would not be of a width that is unpassable for the spotted-tail quoll. However, no vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees and potential breeding trees where possible;
- Avoidance of construction during the known breeding period of these species;
- Retention and relocation of woody debris, rocky areas etc;
- Remediation of the site with local native vegetation; and

- A run-off and sedimentation protocols.

Given the above considerations, it is considered unlikely that the spotted-tail quoll would be significantly impacted by the proposal.

Reptiles

Striped Legless Lizard

This species of lizard is found in natural and secondary temperate grasslands and open Box-Gum Woodland containing tussock forming perennial grasses, and occasionally in areas containing surface rock or high amount of exotic grasses. It feeds on spiders, moth larvae, crickets and cockroaches. This species shelters under logs and rocks, and lays its eggs in early summer. Threats include clearing and fragmentation of habitat, agricultural practices, weed invasion, vehicle movement, changed fire regimes, and any other change to vegetation structure (DECC 2005).

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

displaces or disturbs threatened species and/or populations;

The proposal would impact on native pasture and areas of rock that may provide habitat for the striped legless lizard. The species has not been previously recorded in the locality and was not identified within the study area despite targeted searches. Where possible, areas of potential habitat would be avoided. Where rock areas must be impacted these would be shifted and then returned once works are complete. Native pasture would be rehabilitated back to their existing state. Alternative habitat exists within the area. The proposal would not isolate or fragment any grassland vegetation from other areas of vegetation. Given the above considerations, the proposal is unlikely to displace or disturb this species as a result of the proposal.

disrupts breeding cycle;

The proposal would impact on native pasture and areas of rock that may provide breeding habitat for the striped legless lizard. The species has not been previously recorded in the locality and was not identified within the study area despite targeted searches. Where possible, areas of potential habitat would be avoided. Where rock areas must be impacted these would be shifted and then returned once works are complete. Native pasture would be rehabilitated back to their existing state. Alternative habitat exists within the area. The proposal would not isolate or fragment any grassland vegetation from other areas of vegetation. Given the above considerations, it is unlikely that the proposal would disrupt the breeding cycle of this species, should it occur.

disturbs the dormancy period;

NA for the Striped Legless Lizard.

disrupts roosting behaviour;

NA for the Striped Legless Lizard.

changes foraging behaviour;

The proposal would remove potential habitat for the striped legless lizard. The species has not been previously recorded in the locality and was not identified within the study area despite targeted searches. If the species is present in the study area it would be relocated during pre-clearance surveys in consultation with DECC, however the species is considered unlikely to occur. Where possible, areas of potential habitat would be avoided. Where rock areas must be impacted these would be shifted and then returned once works are complete. Native pasture would be rehabilitated back to their existing state. Alternative habitat exists within the area. The proposal would not isolate or fragment any grassland vegetation from other areas of vegetation.

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat nor would it create any barriers to fauna movement. Where possible, potential habitat would be avoided. Alternative habitat exists within the area. The proposal is unlikely to disturb these species in the area or locality and is considered unlikely to affect migration and dispersal habitat.

disrupts pollination cycle;

NA for the striped legless lizard.

disturbs seedbanks;

NA for the striped legless lizard.

disrupts recruitment (i.e. germination and establishment of plants);

NA for the striped legless lizard.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

Some potential habitat for the striped legless lizard would be impacted as a result of the proposal. However, habitat to be impacted would be re-instated once works are complete, and no habitat would be isolated or fragmented as a result of the proposal. Alternative habitat exists within the area. Thus the proposal is unlikely to affect interactions with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Areas of impact would be restored after construction and alternative habitat exists else where in the study area and these areas would not be affected. Measures to contain impacts from construction including sediment control and the retention and re-spreading of topsoil would be implemented, and thus soil quality is unlikely to be affected.

clears or modifies native vegetation;

The pipeline would impact areas of native pasture that may include habitat for the striped legless lizard, however these would be restored once construction is complete. Alternative habitat also exists within the study area and locality. As such, proposed vegetation clearance is unlikely to impact on this species.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil. Run-off controls and sowing soil stockpiles with a sterile cover crop are to be implemented to manage weeds at the site. As such an increase in weeds is not expected. The proposal is unlikely to increase the presence of feral animals within the study area as no vegetation relevant to this species would be fragmented or isolated. Vermin or feral species are not expected to increase within areas of potential habitat for this species (grassland) as a result of the proposal.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

The proposal would temporarily remove some areas of rocky debris, boulders or outcrops within areas of native pasture however this would be returned and grassland re-established.

affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The striped legless lizard occurs in the Southern Tablelands, the South Western Slopes and possibly in the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. If the species is present at the site it is likely to be at the northern limit of its distribution. However, this species has not been previously recorded in the locality (10 km radius) and was not identified despite targeted searches.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and

modifies remnant vegetation or wildlife corridors.

The proposal would not create any permanent barrier to remnant vegetation and would not modify any remnant vegetation. No habitat would become isolated or fragmented as a result of the proposal. The proposal would not remove any vegetation or wildlife corridors or disconnect any vegetation. The proposal would not isolate any vegetation or wildlife corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. The following mitigation measures would manage any impacts on potential habitat for this species:

- Retention and re-use of existing topsoil;
- Avoidance of potential habitat where possible;
- Re-instatement of rocky areas;
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for the striped legless lizard.

Box-Gum Woodland EEC

White Box Yellow Box Blakely's Red Gum Woodland is an open woodland or forest community, and is characterized by white box (*Eucalyptus albens*), yellow box (*E. melliodora*) and Blakely's red gum (*E. blakelyi*). Intact sites contain a high diversity of plant species, including dominant and additional tree species, shrubs, climbers, grass species and a high diversity of herbs. Intact stands that contain diverse upper and mid-storeys and ground layer s are rare. Modified sites include the following areas where the main tree species are present ranging from an open woodland formation to a forest structure, with the ground layer predominantly being composed of exotic species. On sites where the trees have been removed, only the grassy ground layer and some herbs remain. It occurs in the tablelands and western slopes of NSW (DEC 2007). Two small patches of Box-Gum Woodland exist at the site and may be affected by the proposal depending on final route selection.

i) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

displaces or disturbs threatened species and/or populations;

The proposed pipeline route would impact areas of native grassland associated with yellow box trees. This grass would be restored once construction works are complete. No canopy trees would be impacted. The proposal would not isolate or fragment any vegetation from other areas of vegetation and is unlikely to displace or disturb this community at the site.

disrupts breeding cycle;

NA for Box-Gum Woodland

disturbs the dormancy period;

NA for Box-Gum Woodland

disrupts roosting behaviour;

NA for Box-Gum Woodland

changes foraging behaviour;

NA for Box-Gum Woodland

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat. Grazing regimes at the site are unlikely to change once works are complete. Migration and dispersal ability of flora species associated with this community is unlikely to change at the site.

disrupts pollination cycle;

As above.

disturbs seedbanks;

The proposal would disturb native grass areas associated within yellow box trees. The construction phase of the project may temporarily disturb seed banks for flora species associated with this community, however, once native pasture areas are restored these disruptions would cease.

disrupts recruitment (i.e. germination and establishment of plants);

The pipeline is unlikely to disrupt recruitment as native pasture areas would be restored once works are complete and the site has been grazed for over 100 years thus reducing recruitment over a long period of time.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

Areas of native pasture associated with yellow box trees would be removed however these would be reinstated. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Thus the proposal is unlikely to affect interactions with other species in the community.

ii) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Areas of impact would be restored after construction and better quality potential habitat exists else where in the locality. Measures to contain impacts from construction including sediment control and the retention and re-spreading of topsoil would be implemented, and thus soil quality is unlikely to be affected.

clears or modifies native vegetation;

The proposal would impact small areas of native pasture however these would be restored once construction is complete. No canopy trees would be directly affected. As such, proposed vegetation clearance is unlikely to impact on this community.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil. Run-off controls and sowing soil stockpiles with a sterile cover crop are to be implemented to manage weeds at the site. As such an increase in weeds is not expected. The proposal is unlikely to increase the presence of feral animals within the study area as no vegetation would be fragmented or isolated. Vermin or feral species are not expected to increase and/or spread as a result of the proposal.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

NA for Box-Gum Woodland

affects natural revegetation and re-colonisation of existing species following disturbance.

Some of the subject land is currently subject to grazing and as such is unlikely to be effectively colonised by native vegetation. Areas not subject to grazing are showing signs of regeneration. Existing topsoil would be re-used to restore areas of impact and would result in the re-colonisation of existing species.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

NA

iii) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

This community is not at the limit of its known distribution.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to remnant vegetation and would not modify any remnant vegetation. No habitat would become isolated or fragmented as a result of the proposal. The proposal would not remove any vegetation or wildlife corridors or disconnect any vegetation. The proposal would not isolate any vegetation or wildlife corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for this community. Relevant mitigation measures include:

- Deliberate avoidance of canopy trees associated with Box-Gum Woodland and avoidance of scattered trees in native pasture areas;
- Retention and re-use of existing topsoil;
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of this area of Box-Gum Woodland.

Appendix 5

Assessment under EPBC Act

Assessment under the EPBC Act

Box-Gum Woodland EEC

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

Reduce the extent of an ecological community

The route may impact on grassland adjacent to areas of EPBC Act Box-Gum Woodland, however, no canopy trees would be affected and if possible this route would be avoided. No patches of this EEC would be fragmented or isolated as a result of the proposal. Grassland associated with this community would be re-instated using existing topsoil and associated seed bank. Weeds would also be managed. Consequently, the proposal would not reduce the extent of this ecological community.

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

The proposal would not fragment or isolate or increase fragmentation of this community at the site.

Adversely affect habitat critical to the survival of an ecological community

No critical habitat listed under legislation occurs in the site or within adjacent areas of vegetation. The grassland associated with this community would be re-established and is unlikely to be considered critical habitat for this community. Larger patches of Box-Gum Woodland exist elsewhere in adjacent areas (Facilities' site). The proposed western pipeline route would not adversely affect habitat critical to the survival of this EEC.

Modify or 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

The proposal would not reduce groundwater levels or result in substantial alterations of the surface water drainage patterns within the study area. Topsoil would be retained and re-used. Nutrient levels are unlikely to alter as a result of the project.

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 route may impact on grassland adjacent to areas of EPBC Act Box-Gum Woodland, however no canopy trees would be affected and if possible this route would be avoided. No patches of this EEC would be fragmented or isolated as a result of the proposal – areas of EPBC Act Box-Gum Woodland would be avoided and indirect impacts managed (see Mitigations section). Grassland associated with this community would be re-instated using existing topsoil and associated seed bank. Weeds would also be managed.

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; or**
- **Interfere with the recovery of an ecological community.**

The proposed Western pipeline route would aim to avoid areas of EPBC Act Box-Gum Woodland (depending on land owner constraints). If this is not possible then direct impacts on this community would be avoided. Grassland adjacent to areas of EPBC Act Box-Gum Woodland may be impacted, however no canopy trees would be affected. No patches of this EEC would be fragmented or isolated as a result of the proposal. Grassland associated with this community would be re-instated using existing topsoil and associated seed bank. Weeds would also be managed. The proposal is unlikely to cause a substantial reduction in the quality or integrity of an occurrence of an ecological community.

Conclusion

Consideration of the above assessment criteria concludes that the proposal is unlikely to have a impact on Box-Gum Woodland EEC.

Striped legless Lizard

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

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

Targeted surveying did not identify any *Striped Legless Lizard* within the study area and it has not been previously recorded within the locality. The study area offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Therefore the proposal is unlikely to result in a long-term decrease in the size of a population.

Reduce the area of occupancy of an important population

No individuals of this species were identified despite targeted surveys. It has not been previously recorded within the locality. The study area offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. As such, the proposal is unlikely to result in the area of occupancy for this species.

Fragment an existing important population into two or more populations

No identified populations exist within the study area. The area of impact offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing native pasture habitats. The proposal is unlikely to result in any existing population being fragmented into two or more populations.

Adversely affect habitat critical to the survival of a species

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. Significant alternative habitat for this species exists throughout the surrounding area and locality. The habitat to be removed is unlikely to be important or critical habitat for this species.

Disrupt the breeding cycle of an important population

No individuals have been identified within the study area. The area of impact offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing native pasture habitats. The proposal is unlikely to disrupt the breeding cycle of this species.

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

The habitat to be affected by the proposal is marginal. Significant better quality alternative habitat exists in adjacent bushland areas. Areas of impact would be remediated and are likely to be colonized by existing species. Therefore, the proposal is unlikely to impact on habitat for this species to the extent that the species is likely to decline.

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

The proposal is unlikely to introduce more weeds into the area. Top soil would be retained and used to rehabilitate areas of disturbance. The proposal is unlikely to result in an invasive species becoming established within the habitat of *Striped Legless Lizard.*

Introduce disease that may cause the species to decline

There is the potential for the proposed construction works to introduce *Phytophthera cinnamomi* into the site. Measures to control *Phytophthora cinnamomi* would be developed and implemented and hygiene measures to prevent the introduction or spread of the pathogen during the construction and operational phases of the development incorporated into any CEMP for the site. The proposal is therefore considered unlikely to result in the introduction of this disease thus causing species decline.

Interfere substantially with the recovery of the species

This species was not identified despite targeted surveys. It has not been previously recorded in the locality. Habitat to be impacted by the proposal is marginal and unlikely to constitute important habitat for this species. Therefore the proposal is unlikely to interfere with the recovery of this species.

Conclusion

Consideration of the above assessment criteria concludes that the proposal is unlikely to have a significant impact on *Striped Legless Lizard*.

Spotted-tail Quoll

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

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

The study area may provide potential habitat for the spotted-tail quoll. The proposal would modify seven ha of native forest and may remove hollow-bearing trees, fallen logs and rocky areas that may be utilised by this species, however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 m corridor. Vegetation removed during construction would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees, caves, rocky outcrops and woody debris would also be retained. Pre-clearance surveys would aim to identify roosting or breeding sites for the spotted-tail quoll prior to construction and these trees would be avoided. These species are highly mobile and have large home ranges. Given the above considerations, the proposal is unlikely to lead to a long-term decrease in the size of an important population of a species.

Reduce the area of occupancy of an important population

The proposal will impact on existing native vegetation but this impact will only be temporary. Substantial alternative habitat exists within the locality and this species is highly mobile with a large home range. The proposal is unlikely to result in the area of occupancy for this species.

Fragment an existing important population into two or more populations

The proposal will impact on existing native vegetation but this impact will only be temporary. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing natural habitats. The proposal is unlikely to result in any existing population being fragmented into two or more populations.

Adversely affect habitat critical to the survival of a species

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. Significant alternative habitat for this species exists throughout the surrounding area and locality. The habitat to be removed is unlikely to be important or critical habitat for this species.

Disrupt the breeding cycle of an important population

Where feasible, construction would be avoided during the breeding period of this species. Pre-clearance surveys would also aim to identify and manage any individuals within the area of impact prior to construction. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing natural habitats. The proposal is unlikely to disrupt the breeding cycle of this species.

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

The proposal will modify an initial 7-9 ha of habitat for this species but impacts will be temporary. These areas will be rehabilitated back leaving only a small portion of this vegetation modified. Substantial

alternative habitat exists in adjacent bushland areas and within the locality. Areas of impact would be remediated and are likely to be colonized by existing species. Therefore, the proposal is unlikely to impact on habitat for this species to the extent that the species is likely to decline.

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

The proposal is unlikely to introduce more weeds into the area. Top soil would be retained and used to rehabilitate areas of disturbance. The proposal is unlikely to result in an invasive species becoming established within the habitat of spotted-tail quoll.

Introduce disease that may cause the species to decline

There is the potential for the proposed construction works to introduce *Phytophthera cinnamomi* into the site. Measures to control *Phytophthora cinnamomi* would be developed and implemented and hygiene measures to prevent the introduction or spread of the pathogen during the construction and operational phases of the development incorporated into any CEMP for the site. The proposal is therefore considered unlikely to result in the introduction of this disease thus causing species decline.

Interfere substantially with the recovery of the species

Habitat to be impacted by the proposal is will only be temporarily impacted. Rehabilitation works will re-instate features of relevance for this species. Alternative habitat exists within adjacent areas and the locality. Therefore the proposal is unlikely to interfere with the recovery of this species.

Conclusion

Consideration of the above assessment criteria concludes that the proposal is unlikely to have a significant impact on spotted-tail quoll

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