FINAL REPORT

Santos GLNG Pipeline Fauna Assessment (Gas Transmission Pipeline)

Prepared for

Santos Ltd

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Executive Summary

The gas transmission pipeline will link the central Queensland Coal Seam Gas (CSG) fields to the LNG facility on Curtis Island, off the coast of Gladstone, Central Queensland. Existing land use along the proposed route is predominantly rural. Curtis Island and the Calliope, Callide, Dawson, Expedition and Carnarvon Range crossings are generally well-vegetated. Grazing and cropping dominates the remaining areas with few large expanses of remnant vegetation enduring. Isolated patches of woodland and riparian vegetation remain as relics of the extent of former widespread vegetation communities over the majority of the study area.

An assessment of fauna habitat was conducted for the length of the gas transmission pipeline. A desktop assessment was undertaken for the entire length. A terrestrial vertebrate fauna survey was conducted within the proposed pipeline route on Curtis Island. A broad assessment of habitat values and presence of fauna was undertaken for the mainland pipeline section. The aim of the fauna assessment was to document the terrestrial and aquatic vertebrate fauna (amphibians, reptiles, mammals and birds) of the area, with particular reference to the occurrence of endangered, vulnerable, rare or significant fauna. In addition, the survey sought to identify feral and exotic animals in the study area, identify habitat requirements for conservation significant or noteworthy species, describe the use of areas by migratory birds and terrestrial fauna, discuss potential impacts and outline mitigation strategies.

A desktop study of the pipeline survey area identified fauna potentially present, including significant species listed under the Queensland *Nature Conservation Act, 1992* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act, 1999*. The fauna survey on Curtis Island utilised standard vertebrate sampling techniques within primary habitat types to identify fauna present including significant species identified from the literature review.

Forty-six significant species were identified as potentially present within the gas transmission pipeline study corridor. Of these identified species, only the powerful owl (*Ninox strenua*), glossy black cockatoo (*Calyptorhynchus lathami lathami*) (Curtis Island section) and squatter pigeon (southern form) (*Geophaps scripta scripta*) (mainland section) were located during the surveys.

A total of 50 native and 5 introduced terrestrial vertebrate species were recorded during the field survey for the Curtis Island section. Native species included 5 reptile, 37 bird and 7 mammal species including 4 species of microbat with another five tentatively identified. Seventy-two native and 8 introduced terrestrial vertebrate species were recorded during the field survey of the mainland pipeline. Native species included 2 reptile, 64 bird and 5 mammal species.

The clearing of remnant vegetation within the gas transmission pipeline right of way (ROW) will provide the greatest impacts to fauna and flora. The ROW will be a width of 30 metres on the mainland and 100 metres on Curtis Island, where it will also accommodate a road and power transmission line. Impacts to remnant vegetation will be minimised by the alignment of the gas transmission pipeline abutting the existing Queensland Gas Pipeline (QGP) for approximately 100 km of the 425 km corridor. Approximately 188.6 ha of remnant vegetation will be removed on the mainland and 69.6 ha of remnant vegetation will be removed on Curtis Island during this phase of the project. Approximately 258.2 hectares of remnant vegetation will be cleared for pipeline construction overall. The greater proportion of the pipeline ROW (approximately 1084.5 ha or 81%) will traverse cleared pasture or non-remnant vegetation within which impacts to fauna and flora will be minimal. The construction of the gas transmission pipeline is not expected to present long-term impacts to fauna as rehabilitation will allow for fauna habitation and usage following completion of works.

Introduction Section 1

1.1 Introduction

As part of the Environmental Impact Statement (EIS) being conducted for the proposed Gladstone Liquefied Natural Gas (GLNG) project, an assessment of faunal habitat values was undertaken along the length of the proposed gas transmission pipeline. Different assessment approaches were adopted for the Curtis Island and mainland sections of the gas transmission pipeline, as agreed with the Environmental Protection Agency (EPA). The Curtis Island assessment involved a fauna survey including trapping, spotlighting, bird census counts and other standard techniques. The mainland assessment, conducted between Santos' Fairview Coal Seam Gas (CSG) Field and the Bruce Highway, west of Gladstone, utilised a standard large scale pipeline assessment methodology including habitat assessments, opportunistic observation, and interpretation of fauna signs to determine conservation values and potential habitat utilisation. This report is structured to reflect the divergent methodologies used.

1.2 Study Aim and Objectives

The gas transmission pipeline terrestrial and aquatic fauna survey was undertaken to fulfil the requirements of the GLNG Terms of Reference. The aim of the survey was to document the potential terrestrial and aquatic vertebrate fauna (amphibians, reptiles, mammals, birds and fish) habitat of the proposed GLNG gas transmission pipeline, with particular reference to the potential occurrence of endangered, vulnerable, rare or significant fauna. The objectives of the fauna study were to:

- Review existing terrestrial and aquatic fauna data for the study area and environs;
- Describe the species diversity of animals, including amphibians, birds, reptiles, mammals and fish;
- Describe the habitat values, habitat requirements and barriers to movement for amphibians, birds, reptiles, mammals and fish;
- Describe aquatic habitat values for the length of the pipeline;
- Identify the presence of potential habitat utilised by conservation significant or poorly known species;
- Describe the use of different habitat types by terrestrial fauna assemblages across the landscape of the study area;
- Describe use of the areas by migratory birds, and nomadic birds, fish and terrestrial fauna;
- Identify the presence of any feral and exotic animals in the study area; and
- Discuss potential impacts and mitigation measures.

1.3 Review of Existing Information

Existing data on fauna within the study area was compiled through acquisition and review of the following key references:

- Department of Water, Heritage & the Arts (DEWHA) online Environmental Protection & Biodiversity Conservation (EPBC) Matters of National Environmental Significance (MNES) database;
- Queensland Museum fauna records;
- Queensland Environmental Protection Agency Wildnet database;

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- Queensland Environmental Protection Agency Essential Habitat mapping; and
- Species distribution maps from current field guides.

In order to identify the range of fauna species present within the study area and the broader region, reviews of the above data sources were conducted for the area as defined by the coordinates presented below.

EPBC Act Protected Matters Report

The EPBC Act protected matters report search area was a linear search along the gas transmission pipeline with a buffer of 5kms for its length and includes the Mainland and Curtis Island sections.

-25.6161	148.9233	-25.6237	148.6738	-25.4337	148.6221	-25.3813	148.626
-25.3375	148.6586	-25.2969	148.6679	-25.2751	148.6603	-25.2356	148.6966
-25.1423	148.7201	-25.0822	148.7203	-24.711	148.8427	-24.6869	148.9456
-24.6506	149.032	-24.6219	149.2138	-24.5542	149.3986	-24.4543	149.7445
-24.4194	149.8485	-24.4052	149.9689	-24.369	150.0372	-24.3655	150.1454
-24.2918	150.3736	-24.2664	150.5163	-24.1314	150.7391	-24.0864	150.8698
-24.039	150.9567	-23.9886	150.9734	-23.9666	150.9645	-23.8829	151.0135
-23.8663	151.0375	-23.8568	151.0726	-23.8486	151.1013	-23.8398	151.1169
-23.8274	151.1323	-23.826	151.1388	-23.8127	151.1475	-23.7852	151.1506
-23.7656	151.144	-23.7701	151.1439	-23.7505	151.1553	-23.7506	151.177
-23.7457	151.1789	-23.7447	151.1883	-23.7504	151.2017	-23.7557	151.2069
-23.7742	151.2163	-23.7774	151.2217	-23.7876	151.2208		

Wildnet Wildlife Online database

The EPA Wildnet database search used the same coordinates as the EPBC Act search (above).

Queensland Museum database

The search area for the Queensland Museum database was bounded by the following points:

150^0 54', -23^0 59'; 151^0 17', 23^0, 43'; 150^0 40', -24^0 14'; 151^0 01', -23^0 59'; 150^0 10', -24^0 25'; 150^0 39', -24^0 07'; 149^0 28', -24^0 36'; 150^0 10', -24^0 19'; 148^0 47', -24^0 44'; 149^0 28', -24^0 29'; 148^0 39', -25^0 06'; 148^0 58', -24^0 44'; 148^0 45', -25^0 39'; 148^0 59', -24^0 39'.

Environmentally Sensitive Areas Mapping

Environmentally sensitive areas mapping was sourced for the length of the gas transmission pipeline.

Essential Habitat Mapping

Essential Habitat mapping was reviewed for the length of the gas transmission pipeline using mapping supplied by the EPA.

1.4 Target Species

Forty-six conservation significant terrestrial fauna species (31 birds, 9 reptiles and 6 mammals) listed under both state and commonwealth legislation were identified as potentially occurring within the study area from the above sources. Habitat for these species was targeted for identification during the field survey. A list of the target

species and ecological notes for each are provided in Appendix A. Significant species identified include any Extinct in the wild, Critically Endangered, Near Threatened, Endangered, Vulnerable, Conservation Dependent or Rare taxa listed under:

- The Queensland *Nature Conservation (Wildlife) Regulation, 2006* under the provisions of the Queensland *Nature Conservation Act, 1992* (NC Act); and
- The Commonwealth *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act).

1.5 Nomenclature

Taxonomic nomenclature used for description of fauna species follows Stanger *et al* (1998), with the exception of recently published taxonomic revisions. Feral species are denoted in the text by an asterix (*). Field references used for the identification and description of fauna species include Allen *et al* (2002), Churchill (1998), Cogger (2000), Menkhorst and Knight (2001), Morecombe (2004), Robinson (1998), Simpson and Day (2004), Strahan (2008), Triggs (2004) and Wilson (2005).

1.6 Survey Approach

The assessment of fauna and habitat for the gas transmission pipeline study area was undertaken utilising different survey approaches for the Mainland and Curtis Island sections.

The approach for the mainland section utilised several accepted standard fauna assessment methodologies traditionally employed for the assessment of large scale corridors (HLA, 2006 & HLA, 2007), in this case approximately 420 km for the mainland section. This approach focussed on assessing fauna habitat values in conjunction with incidental observations and analysis of fauna signs along the corridor. The study area for the gas transmission pipeline was within a 200 metre buffer around the nominated pipeline centreline

The smaller scale of the Curtis Island section, and the incorporation of a road corridor within the gas transmission pipeline ROW (total width 100m) necessitated a trapping fauna survey to be undertaken allowing for assessment of habitat and species diversity.

Aquatic surveys for both the mainland and Curtis Island gas transmission pipeline sections employed standard methodology for the assessment of aquatic habitat values and physical stream characteristics for ephemeral waterways. .

1.6.1 Curtis Island Gas Transmission Pipeline Survey Design

Preliminary identification of vegetation communities and habitats of potential significance within the Curtis Island gas transmission pipeline route was conducted prior to the commencement of fieldwork via interpretation of 1:7 000 colour aerial photography (Aerometrix, 2005); 1:100 000 Regional Ecosystems mapping Version 5.0 (EPA, 2008a); and 1:100 000 habitat Ecomap (EPA, 2008b). The survey design was established in consultation with the EPA.

Fauna survey transect sites were selected to target and characterise key habitats within the study area. Fauna surveys were undertaken in keeping with the accepted standard methods for the systematic survey of terrestrial fauna in eastern Australia (Eyre *et al*, 1997 and EPA, 1999) and a number of non-standard observational methods. Aquatic assessments were undertaken at a number of ephemeral waterways found within the study area using methodology in keeping with the AUSRIVAS Physical Assessment Protocol (Parsons *et al* 2002) to record physical habitat descriptions. Surveys were conducted in accordance with the conditions of the following:

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- Queensland Department of Primary Industries (DPI) Scientific Purpose (registration number 046);
- DPI Animal Ethics Committee (AEC) (approval number CA 2006/06/124); and
- Queensland EPA Scientific Purposes Research Permit (number WISP02056304).

Survey effort, methodology and survey limitations are described in further detail in Appendix B. Fauna survey locations are shown on Figure 1.

1.6.2 Mainland Gas Transmission Pipeline Survey Design

Preliminary identification of vegetation communities and habitat of potential significance along the proposed mainland gas transmission pipeline route was conducted prior to the commencement of fieldwork via interpretation of 1:22 000 colour aerial photography (Aerometrix, 2008); 1:100 000 Regional Ecosystems mapping Version 5.0 (EPA, 2008a); and 1:100 000 habitat Ecomap (EPA, 2008b).

Fauna observations and analysis of fauna signs, tracks and scats were undertaken along the pipeline route to enable identification of habitat values present. The assessments were conducted concurrently with the flora surveys at 124 sites (Figures 4 to 28 of the Santos GLNG Ecological Assessment Report – Pipeline Flora). Sites were chosen based on accessibility, representativeness of habitat within the landscape and also to target areas identified as potential Essential Habitat by the EPA for conservation significant species. Specific methods used to assess habitat value and fauna presence at each site included:

- Opportunistic observations of mammals, reptiles and amphibians;
- Targeted bird observations for the duration of the site assessment (45 minutes at each site);
- Opportunistic micro-habitat searches concentrating on features such as loose bark, fallen woody debris , cracking clay surfaces, rocky habitat and flowering trees; and
- Analysis of tracks, signs, scats and scratchmarks to indirectly determine faunal usage of the site.

Incidental observations of fauna were also recorded whilst driving through the region and between survey sites. The survey design was established in consultation with the EPA.

The assessment of aquatic values was undertaken as part of the Surface Water component of the EIS. Results from this study can be found in Appendix A of the Gladstone LNG Gas Transmission Pipeline – Surface Water EIS. Aquatic assessments were undertaken at a number of waterways found within the study area using methodology in keeping with the AUSRIVAS Physical Assessment Protocol (Parsons *et al* 2002) to record physical habitat descriptions.

Survey effort, methodology and survey limitations are described in further detail in Appendix B.

2.1 Regional Context

2.1.1 Bioregions

The gas transmission pipeline study area is predominantly situated within the Brigalow Belt bioregion, with a small section in the north-east of the study area located near Gladstone within the South-East Queensland bioregion. The bioregions of Queensland are based on landscape patterns that reflect changes in geology and climate, as well as major changes in floral and faunal assemblages at a broad scale and are used as the fundamental framework for the planning and conservation of biodiversity.

Nature conservation of the Brigalow Belt bioregion has received increasing attention due to the rapid and extensive loss of habitat that has occurred. Major impacts upon vegetation of the Brigalow Belt include tree clearing, high grazing pressure and the proliferation of exotic species such as the prickly pear (Young *et al*, 1999).

The South-East Queensland bioregion is one of the most species rich and diverse parts of Australia for flora and fauna. The bioregion is approximately 6,600,000 hectares in size and contains localised areas of endemism and a wide range of habitat types (Young and Dillewaard, 1999). The area is also the most intensely populated part of Queensland and continues to experience high levels of growth.

2.1.2 Sub-regions

The Brigalow Belt bioregion contains 36 sub-regions or provinces that delineate significant differences in geology and geomorphology (Young *et al*, 1999). The GLNG gas transmission pipeline falls within several sub-regions within the Brigalow Belt including the Mount Morgan Ranges, Callide Creek Downs, Banana-Auburn Ranges, Dawson River Downs, Arcadia, and Carnarvon Ranges.

The South-East Queensland bioregion contains 10 sub-regions or provinces that delineate significant differences in geology and geomorphology (Young and Dillewaard, 1999). The gas transmission pipeline on Curtis Island is located within the Burnett-Curtis Hills and Ranges sub-region. The area of Curtis Island featuring the gas transmission pipeline route is bordering on the Marlborough Plains sub-region of the adjacent Brigalow Belt bioregion and therefore there may be some overlap of fauna and flora common to both sub-regions.

2.1.3 Site Characteristics

The gas transmission pipeline will link the central Queensland Coal Seam Gas (CSG) fields to the LNG facility on Curtis Island, off the coast of Gladstone, Central Queensland. The gas transmission pipeline is to be approximately 425km in length, within a 30 m wide easement on the mainland and 100 m easement on Curtis Island. Existing land use along the proposed route is predominantly rural. Curtis Island and the Calliope, Callide, Dawson, Expedition and Carnarvon Range crossings are generally well-vegetated. Grazing and cropping dominates the remaining areas with few large expanses of remnant vegetation enduring. Isolated patches of woodland and riparian vegetation remain as relics of the extent of former widespread vegetation communities over the majority of the study area.

Curtis Island

Curtis Island is located off the coast of central Queensland near Gladstone and forms part of the eastern rim of Port Curtis. It is approximately 40 km long and 20 km across at its widest point. It is located within the Gladstone Regional Council area.

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Typical landforms on the island include moderate to steep wooded slopes, wooded alluvial plains, ephemeral watercourses, estuarine systems and fresh and saltwater wetlands. The gas transmission pipeline is proposed to be constructed primarily in the basin of a narrow fluvial valley.

The valley is dominated by *Eucalyptus* and *Corymbia* woodlands on moderate to low slopes and along watercourses. Mangrove and saltmarsh communities are present within intertidal areas. The gas transmission pipeline study area, as with the LNG facility site, displays impacts consistent with a long history of use that includes grazing, clearing, cropping, and selected timber felling. The presence of weeds and a history of fire have also impacted upon the ecological values of the site. Whilst the majority of the woodland is regrowth, mature trees are present, especially along the ephemeral creeks in the low-lying portions of the valley. In the north of the valley, streams discharge into Graham Creek. Southern streams drain to The Narrows north of China Bay.

Mainland Section

The gas transmission pipeline route on the mainland traverses a range of landforms and land uses. The majority of the route is situated within cleared land supporting grazing or cropping activities. The Calliope, Callide, Dawson, Expedition and Carnarvon ranges generally feature large expanses of bushland with various degrees of integrity. Isolated patches of bushland exist as open woodland often along and adjacent to the waterways. Much of the bushland is held in forestry leases with typical uses being commercial timber harvesting and grazing. Bushland on privately owned land is generally grazed and is often subject to light timber harvesting for private use.

2.2 Survey Results

2.2.1 Weather Conditions

Curtis Section

The Curtis Island gas transmission pipeline fauna survey was undertaken over 10 days between 14 and 23 May, 2008. Weather conditions were typical for the season in the region; warm days and mild nights with occasional gusty winds. Bureau of Meteorology daily weather observations at the Gladstone Radar shows that the minimum and maximum temperatures were 7.7^0 C and 27.9^0 C respectively. Relative humidity (recorded daily at 9 am) for the survey period averaged 59.5%. No rainfall was experienced at the study site during the survey. Prevalent winds were light to moderate from the south east and south west (BoM, 2008).

Mainland Section

Flora and Fauna assessments for the mainland gas transmission pipeline section were undertaken during two survey periods; over the course of 20 days between 30 June and 25 July 2008 and over a 5 day period between 6 and 10 October 2008. Weather observations are taken from the Bureau of Meteorology (BoM) Gladstone Radar for the period 30 June to 11 July, as an indication of the weather conditions on the eastern mainland pipeline section during the survey period.

Weather observations for the period 12 to 25 July 2008 are taken from the BoM Rolleston weather station as more indicative of conditions in the western portion of the gas transmission pipeline during this period. During the period 30 June to 11 July 2008 (at Gladstone Radar), temperatures were cool and ranged between 13.2^0 C and 22.9^0 C with wind speeds averaging 13 km/h. Relative humidity for this period averaged 66 % and a total of 58.4 mm of rainfall was recorded. During the period 12 July to 25 July 2008 (at Rolleston), temperatures were

cool and ranged between 10.1^0 C and 22.4^0 C. No wind data is available from this station during this period. Relative humidity for this period averaged 90.6 % and a total of 63.1 mm of rainfall was recorded.

The survey undertaken between 6 and 10 October 2008 was conducted over a large area between the Expedition Range and Calliope. Weather statistics are taken from the Baralaba station as they are the most central records available for this section. Weather conditions for the October period were typical for this season in the region, with temperatures being warmer, ranging from 15.1^0 C to 29.5^0 C. Relative humidity for this period was 51.0 %. No wind data is available from this station during this period. A total of 3.2 mm of rainfall was recorded for the region for the month (BoM, 2008).

2.2.2 Curtis Island Fauna Diversity

A total of 51 native and 5 introduced terrestrial vertebrate species were recorded during the field survey along the Curtis Island gas transmission pipeline study area. Native species included 5 reptile, 39 bird and 7 mammal species. A complete fauna species list for all taxa identified on Curtis Island is provided in Appendix C. This list also includes species observed elsewhere on Curtis Island and species observed during the ecological assessment on the mainland section of the gas transmission pipeline.

The diversity of fauna found on the site was very low. Many species that typically might be expected to be present utilising the habitat available were not detected. These include native and exotic rats and mice and small ground dasyurids such as dunnarts (*Sminthopsis* spp.) and *Antechinus* spp. The conspicuous absence of an assemblage of ground dwelling mammals is considered to be due to a number of factors including the degree of disturbance to ground cover from current and historical grazing, presence of exotic flora in the groundcover; the extended drought conditions preceding the survey year, impacts from other historical land use disturbances such as fire, timber felling and thinning, cropping, and the high number of feral species known to be active in the locality (Section 2.2.6). Further comment on specific faunal groups is provided below.

Amphibians

Only one amphibian was recorded during the surveys in the gas transmission pipeline study area; the exotic cane toad (*Bufo marinus*). Whilst common, cane toads were not as obvious within the gas transmission pipeline section as those found at the adjacent LNG facility site. No native frogs were observed during the survey period, but habitat for common species such as green tree frog (*Litoria caerulea*), desert tree frog (*Litoria rubella*), ornate burrowing frog (*Limnodynastes ornatus*) and northern banjo frog (*Limnodynastes terrareginae*) was present and these species would be expected to be readily detectable during periods of more suitable conditions. All of these species were found in similar habitat surveyed at the adjacent LNG facility in warmer and more humid conditions in March.

Reptiles

Five species of reptile were recorded during the Curtis Island gas transmission pipeline survey, including one gecko (Gekkonidae), three skink (Scincidae) and one colubrid (Colubridae) snake species. This is a lower recorded diversity compared with the nearby LNG facility study area, where twelve species of reptile were recorded. Lower recorded diversity may be attributed to the considerable denser vegetation and micro-habitat of the Curtis Island pipeline study area limiting opportunistic observation detectability of small ground dwelling reptiles.

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Birds

Thirty-nine bird species were recorded from the site of the gas transmission pipeline study area. In conjunction with those found at the LNG facility site, a total of 70 birds species were recorded from the south-west coast of Curtis Island during the surveys for LNG infrastructure. Birds were recorded from all feeding groups, especially insectivores, nectarivores, marine raptors and shore/ wading birds.

Littoral communities form a relatively small proportion of ecosystem types along the Curtis Island gas transmission pipeline section. As a result, shorebirds, including migratory species, are poorly represented in records from the study. Migratory shorebirds in the vicinity of the proposed gas transmission pipeline and LNG facility are described in detail within Section 3.4.3 of the Curtis Island LNG facility Fauna Survey report.

Mammals

Seven species of native mammals were recorded during the gas transmission pipeline survey, indicating a relatively low diversity of this group. No ground mammals were captured in the Elliott or pitfall traps. Two species of arboreal mammals; the common brushtail possum (*Trichosurus vulpecula*) and squirrel glider (*Petaurus norfolcensis*) were recorded within woodland communities at low densities. The eastern grey kangaroo (*Macropus giganteus*) was commonly observed within the gas transmission pipeline study area. Four species of microbat were positively identified from ultrasonic call analysis.

Including results from the adjacent LNG Facility site survey, ten microbat species are utilising the woodlands of the south west coast of Curtis Island. As there are few rocky outcrops or caves existing in this area, it is apparent that arboreal hollows are an important microbat roost habitat in the area.

As for the LNG facility site, small ground mammals such as rodents and dasyurids were not detected during the survey. It is likely that their absence is again attributable to prolonged drought preceding the survey year, historical disturbance and the high incidence of feral predators. The domestic horse (*Equus caballus*) and feral pig (*Sus scrofa*) were noted for the pipeline study site. Other non-native animals identified during the LNG Facility study include domestic cattle (*Bos taurus*), dingo / wild dog (*Canis lupus dingo*), and feral cat (*Felis catus*).

Aquatic Fauna

There are no permanent freshwater bodies present within the Curtis Island gas transmission pipeline area. No water was present within the ephemeral waterways during the study. Even at times of flow, the waterways within the study area would not be expected to support an assemblage of fish species as there are no core populations present in the locality to act as sources for migration and reintroduction of species. Semi-aquatic fauna such as frogs would be present and would utilise ponds in the waterways for breeding. Further detail on the aquatic habitat present is described in Section 2.2.5.

2.2.3 Curtis Island Section Habitat Values

The Curtis Island gas transmission pipeline study area is mainly located within a shallow, narrow valley between low metamorphic ranges. Dominant vegetation communities present include spotted gum (*Corymbia citriodora*) and narrow-leaved ironbark (*Eucalyptus crebra*) woodlands. These are generally found on low hills on skeletal and rocky soils. Most trees are immature; a sign that this community has been subjected to clearing or thinning in the past. A small number of mature trees scattered throughout bear habitat hollows which would support populations of arboreal mammals, microbats and nocturnal birds. Spotlighting in this community detected very low densities of arboreal fauna.

Whilst some areas support a dense understory of wattles (*Acacia* spp.), red ash (*Alphitonia excelsa*) and juvenile eucalypts, much of the community is devoid of a shrub layer. Similarly, the ground layer is variably dense or sparse depending upon shade and soil depth. There is generally an abundance of ground habitat features such as timber, rocks and clumps of native grasses. Areas supporting a denser mid-storey are attractive to forest birds, whilst honeyeaters and canopy gleaners are active in the canopy.

Within the valleys and gullies, narrow fringing woodland of forest red gum (*E. tereticornis*) is found along the ephemeral watercourses on alluvium. Trees of this species are generally mature with a large number of habitat hollows. Recruitment is occurring in at low levels. A low tree layer featuring wattles (*Acacia* spp.), sheoak (*Allocasuarina torulosa*) and juvenile *Eucalyptus* and *Corymbia* species is present. The alluvial areas generally possess a denser ground covering due to the moister microclimate and more fertile soils in these areas.

As elsewhere in the area, ground habitat features are abundant and include rank grasses, fallen timber and microhabitat within the creek lines. Field studies confirmed that the high concentration of hollows within the alluvial communities support arboreal fauna such as the common brushtail possum (*Trichosurus vulpecula*) and squirrel glider (*Petaurus norfolcensis*), along with their primary predator, the powerful owl (*Ninox strenua*). The canopy, when in blossom, supports flocks of lorikeets, honeyeaters and insectivores. Where a denser mid-layer is present, insectivorous birds such as the rufous whistler (*Pachycephala rufiventris*), satin flycatcher (*Myiagra cyanoleuca*) and grey fantail (*Rhipidura fuliginosa*) are active.

At Laird Point, mangrove and saltmarsh communities inhabit the intertidal areas. The terrestrial woodland typically merges into grassland dominated by exotic pastures species and then to saltmarsh, claypan and mangroves communities. Spotted mangrove (*Rhizophora stylosa*) is the dominant species, often in association with grey mangrove (*Avicennia marina*) and black mangrove (*Lumnitzera racemosa*). The littoral communities offer significant feeding resources for shore/ wader birds such as the whimbrel (*Numenius phaeopus*) and beach stone-curlew (*Esacus neglectus*). Mangroves are also productive for members of the swallow, honeyeater and gerygone groups.

All waterways within the gas transmission pipeline study area are ephemeral, and as such are dry for the majority of the year. All flows stem from heavy and sustained rain in the catchments, with flows generally ceasing quickly. Isolated pools within the waterways dry up soon after storm events. All watercourses within the Curtis Island gas transmission pipeline study area share similar attributes, as summarised below:

- All waterways are ephemeral and are mostly unmodified except for track crossing points;
- Channels vary from highly sinuous to straight;
- Channel shapes vary from flat to steep sided. Undercutting is often present;
- Bank erosion is common, especially where steeper banks exist;
- Sediment deposition is common and consists of fines, pebbles and boulders; and
- Instream leaf and branch debris is common, and native grasses and forbs are locally abundant in places.

An analysis of the physical characteristics shows that while habitat features such as undercut banks, a variety of substrate types and instream debris and plants are present, the ephemeral nature of the watercourses reduces opportunities for aquatic fauna. Even at times of flow, the waterways within the study area would not support fish as there are no populations present to act as sources for reintroduction of species. Semi-aquatic fauna such as frogs would be present and would utilise ponds in the waterways for breeding following rain events.

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2.2.4 Mainland Gas Transmission Pipeline Fauna Diversity

Seventy-two native and eight introduced terrestrial vertebrate species were recorded during the field survey of the mainland gas transmission pipeline study area. Native species included 2 reptile, 64 bird and 5 mammal species. A complete fauna species list for all taxa identified is provided in Appendix C.

Fauna surveys of the mainland gas transmission pipeline study area were primarily based on fauna habitat assessment as opposed to a targeted census of faunal diversity (Section 1.6.2). Diversity of fauna recorded for the gas transmission pipeline is indicative based on opportunistic observational methods. Diurnal birds were usually easily observed directly or from calls during the vegetation surveys. Larger mammals were readily identified from observations or analysis of scats and tracks. Core habitat areas, such as found on the range crossings, were found to support a greater diversity of fauna, as would normally be anticipated.

Amphibians

Only one amphibian was recorded during the surveys along the mainland gas transmission pipeline; the exotic cane toad (*Bufo marinus*). No native frogs were observed. Common species such as the green tree frog (*Litoria caerulea*), desert tree frog (*Litoria rubella*), ornate burrowing frog (*Limnodynastes ornatus*) and northern banjo frog (*Limnodynastes terrareginae*) would be expected to be present within the more integral habitat types and watercourses found along the gas transmission pipeline study area. Cleared and grazed paddocks are likely to support a lower diversity of frog species than less impacted woodlands, wetlands and watercourses.

Whilst the frog species expected along the gas transmission pipeline study area require standing water for breeding, they are often located some distance away from watercourses, and diversity may be found in any vegetation type with the requisite resource availability.

Frogs utilise a range of microhabitat features (such as rocks, fallen timber, burrows, and soil fissures) to conceal themselves as they await rain to commence breeding. Areas devoid of this microhabitat such as cleared paddocks are unlikely to support a diversity of amphibian fauna. In addition, floristically poor pastures comprised of buffel grass or other exotic species as found along the majority of the mainland section do not maintain a healthy diversity of the invertebrates on which frogs prey.

Reptiles

Three reptile species were recorded during the mainland gas transmission pipeline assessment, including the striped wall skink (*Cryptoblepharus virgatus*), the eastern brown snake (*Pseudonaja textilis*) and the yellow-faced whip snake (*Demansia psammophis*). All are common species, with the striped wall skink ubiquitous on walls, posts and tree trunks. A number of snakes were seen at various times crossing roads or within scrub. These could not be positively identified. As with amphibians, reptiles are typically more diverse in floristically-rich vegetation communities, such as those found in the range crossings along the mainland pipeline study area, although will readily utilise pastures seeking prey such as rodents. Riparian vegetation acts as significant hunting and dispersal habitat in such fragmented landscapes.

Birds

Sixty-five species of avian fauna were recorded from sites along the mainland gas transmission pipeline. Birds were recorded from all feeding groups, especially forest gleaners, insectivores, nectarivores and raptors. Whilst rain was recorded during phases of the assessment, there were few ephemeral wetlands with standing water, and therefore waterbirds are poorly represented given the linear extent of the survey.

Mammals

Eleven species of mammal were detected by incidental observations or analysis of signs (e.g. scats, tracks or scratchmarks) during the gas transmission pipeline study. Of the 11 species observed, 6 are native and the remainder either domestic stock or true feral animals. Macropods, including the eastern grey kangaroo (*Macropus giganteus*), whiptail wallaby (*Macropus parryi*), red-necked wallaby (*Macropus rufogriseus*) and swamp wallaby (*Wallabia bicolor*) dominate the native species due to their size and the evidence of their presence. The echidna (*Tachyglossus aculeatus*) was mainly detected through location of their distinctive scats along the length of the gas transmission pipeline.

The presence of water rat (*Hydromys chrysogaster*) was perceived from mussel shells left at a 'feeding table' on a low wooden bridge pylon. Whilst platypus (*Ornithorhynchus anatinus*) were not observed during the survey, they are known to be present in many of the creek systems along the gas transmission pipeline including Hutton Creek at the Fairview CSG field (Connell Wagner, 2008).

A range of other native species including members of the rodent, dasyurid, glider, microbat and possum groups would be present in areas along the gas transmission pipeline, especially within core habitat such as on the forested ranges.

Aquatic fauna

Many of the streams and rivers on the mainland that the gas transmission pipeline crosses are permanent or semi-permanent waterbodies. The objective of aquatic surveys along the pipeline study area was to characterise in-stream features and aquatic habitat (Section 1.2). It is expected that fish such as the silver perch (*Bidyanus bidyanus*), spangled perch (*Leiopotherapon unicolor*), saratoga (*Scleropages leichardti*), bony bream (*Nematalosa erebi*) and freshwater catfish (*Tandanus tandanus*) would be present in many of the larger waterways crossed by the gas transmission pipeline. A variety of turtles would be also expected to utilise waterways along the gas transmission pipeline route, including Krefft's river turtle (*Emydura macquarii krefftii*), broad-shelled river turtle (*Macrochelodina expansa*) and saw-shelled turtle (*Wollumbinia latisternum*).

The vulnerable (NC Act and EPBC Act) Fitzroy turtle (*Rheodytes leukops*) is restricted to the waterways of the Fitzroy River Catchment. The majority of waterways crossed by the gas transmission pipeline do not satisfy its need for high water clarity and the presence of pool-riffle systems. The platypus (*Ornithorhynchus anatinus*) has been recorded from the Calliope River, Hutton Creek and many other catchments through which the gas transmission pipeline traverses. Being secretive and active at dawn and dusk, it may be present in more waterways than currently acknowledged. Semi-aquatic fauna such as amphibians and the water rat (*Hydromys chrysogaster*) are also present in waterways along the gas transmission pipeline route.

2.2.5 Mainland Gas Transmission Pipeline Habitat Values

The mainland gas transmission pipeline traverses a large variety of ecosystems and landforms along its 425 km length. Whilst much of the alignment has been historically cleared for grazing and cropping purposes, areas of remnant bushland will be traversed in several sections along the gas transmission pipeline, primarily on the low ranges encountered. Meta-sedimentary rocks form the basis for the low ranges, and support woodlands dominated mainly by narrow-leaved ironbark (*Eucalyptus crebra*). Other canopy species encountered in the woodlands include poplar box (*E. populnea*), mountain coolibah (*E. orgadophila*), gum-topped ironbark (*E. decorticans*), red bloodwood (*Corymbia erythrophloia*), silver-leaf ironbark (*E. melanophloia*) and spotted gum (*C. citriodora*). Alluvium on drainage lines often supports woodlands dominated by forest red gum (*E. tereticornis*), poplar box (*E. populnea*) and Moreton Bay ash (*C. tessellaris*). Habitat values in these alluvial wooded areas can often be high due to the prodigious habitat hollow productivity of mature forest red gums.

Section 2 Environmental Values

The majority of the gas transmission pipeline route on the mainland has been cleared of native vegetation for cropping and grazing. However, several core areas of remnant vegetation, primarily on the Calliope, Callide, Dawson, Expedition and Carnarvon Ranges, are likely to act as valuable habitat for fauna. Most of these areas have experienced impacts from grazing, forestry and other activities. Therefore it is likely that these areas have reduced capacity to support a large diversity of those animals susceptible to disturbance such as small ground mammals and some reptiles. Macropods such as pretty-faced wallabies (*Macropus parryi*) and eastern grey kangaroos (*Macropus giganteus*) benefit from the mosaic pattern of vegetation which provides both shelter and forage opportunities. Conversely, populations of arboreal mammals and hollow nesting birds have been adversely affected in places by the loss of hollow-bearing trees. However, mature trees such as forest red gums (*E. tereticornis*) along creeks and rivers, often the only remnant vegetation in the landscape, provide habitat for arboreal species.

Furthermore, riparian corridors often act as the only opportunity for fauna and flora movement and dispersal in rural areas. Birds, being mobile animals, are generally less impacted by fragmentation of vegetation. Whilst individual habitat and feeding requirements are often disrupted, thus reducing species' distributions, isolated stands of bushland and riparian vegetation enable movement across the landscape. The resilience of birds in particular in this matrix is reflected in the diversity recorded during the survey.

In order to evaluate aquatic habitat, 24 aquatic site assessments were undertaken on creeks and rivers along the gas transmission pipeline. The site assessments determined that at the time of the surveys, more that half the waterways evaluated were devoid of water. These included Bell, Callide, Banana, Conciliation, Zamia and Clematis Creeks. Other waterways, such as Larcom, Sardine and Baffle Creeks featured small pools of water, often turbid or stagnant. Instream debris was variable, with some watercourses displaying significant amounts of woody debris, and others clear of timber. The vegetation of the riparian zone varied between fairly natural and wooded to mostly cleared of trees. The waterways surveyed generally displayed minor erosion or the banks were vegetated and stable.

The assessments determined that most aquatic ecosystems found along the mainland gas transmission pipeline are ephemeral. It is therefore apparent that aquatic faunal use is restricted to episodes of water flow. However, systems such as the Calliope and Dawson Rivers are permanent or comprise permanent isolated waterholes. Within these systems fish, turtles and potentially, platypus populations can exist. Physical features such as undercut banks, instream timber, overhanging vegetation and deep pools contribute to overall aquatic habitat values.

Carnarvon Range

The Carnarvon Range is situated to the south and west of the Arcadia Valley. The gas transmission pipeline route traverses the Expedition Range via the Lonesome Holdings and Kentucky properties (refer to Figure 1). The Carnarvon Range is comprised of metamorphosed sedimentary rocks that have eroded by fluvial action to form a series of scarps and gorges. Plateaus are typically well-vegetated and narrow-leaf ironbark (*Eucalyptus crebra*) and brigalow (*Acacia harpophylla*) communities are common. The Dawson River flows through Lonesome Holdings at the southern extent of the Arcadia Valley.

The section of the Carnarvon Range in which the gas transmission pipeline is to be constructed generally features contiguous native vegetation and therefore acts as significant fauna habitat and movement corridor. Macropods such as pretty-faced wallabies (*Macropus parryi*) and red-necked wallabies (*Macropus rufogriseus*) are common. Hollow bearing trees are uncommon within the Kentucky section, however mature forest red gums (*Eucalyptus tereticornis*) bearing habitat hollows along the Dawson River within Lonesome Holdings potentially acts as habitat for arboreal fauna such as greater gliders (*Petauroides volans*) and squirrel glider (*Petaurus*

norfolcensis). An abundance of ground habitat features including rocky scarps, scree slopes, rock crevices, fallen timber and dense vegetation offers significant habitat for small mammals, reptiles and frogs. The Dawson River features permanent spring-fed pools which potentially act as habitat for turtles, frogs, fish and potentially, platypus.

Expedition Range

The Expedition Range, whilst composed of meta-sedimentary rocks, has not been shaped in the same manner as the Carnarvon Range. Slopes are generally milder and relief is less pronounced. As a result, topographical features are less pronounced. Vegetation communities are dominated by narrow-leaf ironbark (*Eucalyptus crebra*) open woodland. The soils are generally skeletal and stony, and groundcovers are sparse. As elsewhere along the alignment, alluvial areas support a greater density and diversity of vegetation. The Expedition Range features a large expanse of contiguous bushland and thus it is expected that core bushland away from disturbance (such as the Dawson Highway) supports a large diversity of fauna. Forestry and grazing activities may also reduce habitat values in places. A high density of macropods including the grey kangaroo (*Macropus giganteus*) is likely to be present based on the large number of scats observed during the assessments. Given that areas to the east and west of the range are cleared, it is likely that this remnant holds significance in the landscape for fauna. The gas transmission pipeline traverses the Expedition State Forest section of the Expedition Range (Figure 1).

Dawson Range

The Dawson Range is a narrow range bounded on one side by Mimosa Creek and on the other by the Dawson River. Whilst cultivation and grazing activities surrounding the Dawson Range have altered vegetation patterns, large areas of contiguous bushland linking the local catchments provide for fauna movement and habitat. The Dawson River is permanent and Mimosa Creek features semi-permanent waterholes. Both appear to be suitable for platypus and turtle habitation. A high diversity of avian fauna was observed in woodlands surrounding the Dawson Range, and due to the Range's north-south corridor connectivity, it would be expected that a diversity of macropods and reptiles in particular would utilise this area.

Callide Range

The Callide Range (featuring the Callide Timber Reserve) is comprised of a very large extent of remnant bushland interspersed with patches of non-remnant vegetation resulting from clearing for grazing and forestry. Narrow-leaf ironbark (*Eucalyptus crebra*) and spotted gum (*Corymbia citriodora*) on metasediments are the dominant vegetation types. Overall the soil is stony and supports a sparse groundcover of native grasses, forest grass trees (*Xanthorrhoea johnsonii*), macrozamia species and cycads. The open woodland communities have generally been subjected to clearing and thinning and thus the regrowth has not reached an age where hollow bearing trees are commonly found. Due to the level of historic disturbance, it is likely that ground mammal species are scarce. However, macropods are common based on track and scat evidence, and high bird diversity was noted. It is also probable that a diversity of reptiles is present.

Calliope Range

The Calliope Range has been affected by a range of impacts including the railway, the Dawson Highway and adjacent hardwood plantation activities. Whilst there is excellent connectivity in a north-south direction, habitat values appeared to be lower than within the ranges to the west (as described above). Again, macropod presence was detected through the occurrence of scats and tracks. The level of disturbance in the environs of the gas transmission pipeline alignment indicated that many of the sensitive species of mammals, reptiles and frogs may be absent or irregular migratory visitors to this area.

Client

Project

GLADSTONE LNG PROJECT
TERRESTRIAL FAUNA ASSESSMENT
CURTIS ISLAND PIPELINE

Drawn: RG | Approved: JB | Date: 06-01-2009

Job No: **4262 6220** | File No: 42626220-g-718.wor

Title

GAS TRANSMISSION PIPELINE
CURTIS ISLAND
FAUNA SURVEY LOCATIONS

Figure: **1**

Rev: A

A4

Riparian Vegetation

The fertile nature of the alluvial soils along the gas transmission pipeline alignment has resulted in the majority of alluvial vegetation communities being cleared or thinned for cropping and grazing. As a result, a narrow riparian corridor is often the only remaining vegetation in these fragmented landscapes. Occasionally, open woodlands of forest red gum (*Eucalyptus tereticornis*) or coolibah (*E. coolabah*) have been retained on floodplains. Habitat values for ground-dwelling fauna have generally been reduced due to grazing activities, however macropods are common and arboreal fauna such as gliders and possums utilise the habitat hollows found widespread throughout these communities. Generalist bird species such as corvids and honeyeaters are prevalent, however many other species utilise these areas for dispersal throughout the landscape.

Cleared Land

A large proportion of the study area comprises land cleared of native vegetation for grazing or cropping purposes. Cultivated areas are mostly devoid of native fauna due to the intensive agricultural activities and lack of habitat features. Grazing lands generally feature a groundcover, often dominated by introduced species such as buffel grass (*Pennisetum ciliare*). Occasionally a sparse shrub or tree layer is present. Whilst possessing reduced habitat value, such land can support a range of reptiles and birds such as raptors and grassland generalists. The lack of a mid-story or connected canopy cover impacts upon faunal movement across these areas, although mobile species such as birds are less restricted.

2.2.6 Introduced Species - Mainland and Curtis Island

Eight introduced fauna species were recorded during the gas transmission pipeline study. Grazing lands along the gas transmission study area support domesticated horses (*Equus caballus**) and cattle (*Bos taurus**). Cane toads (*Bufo marinus**) were plentiful on Curtis Island, but were less obvious on drier sections in western portions on the mainland. Signs of feral pigs (*Sus scrofa**), rabbits (*Oryctolagus cuniculus**) and wild dogs/ dingoes (*Canis lupus dingo**) were locally common in areas along the alignment. The fox (*Vulpes vulpes**) was observed at one site on the mainland, and is expected to be common along the route.

2.2.7 Significant Fauna Species - Mainland and Curtis Island

Significant fauna species include those recognised under various categories of the NC Act or EPBC Act[1]. The potential presence of significant species in a designated area is determined through a search of available databases such as Wildlife Online and the EPBC protected matters report. These searches are very broad and therefore are only useful as a guide to the potential presence of a species. Many species are captured within the databases as rare vagrants or occasional visitors and therefore a listing is not necessarily indicative of habitation, regular usage, or dependence upon that area. Conversely, absence from such a list does not necessarily mean a certain species is not present within the study area.

Forty-six significant fauna species were identified as potentially present along the proposed gas transmission pipeline route as determined by the desktop review of relevant environmental databases (refer to Section 1.3 and Appendix A). Of these, three species; squatter pigeon (*Geophaps scripta scripta*), powerful owl (*Ninox*

[1] Significant species are threatened species listed as either “Extinct in the wild”, “Critically Endangered”, “Near Threatened”, “Endangered”, “Vulnerable”, “Conservation Dependent” or “Rare” under the NC Act and/ or EPBC Act, and other noteworthy species that carry significance other than legislative status occurring at the extent of their natural geographic range, or those that carry cultural heritage significance.

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strenua) and glossy black cockatoo (*Calyptorhynchus lathami lathami*) were recorded during surveys for the gas transmission pipeline. The former was only recorded on the mainland, while the latter two were found within the Curtis Island section. Another two significant species; the beach stone curlew (*Esacus neglectus*) and sooty oystercatcher (*Haematopus fuliginosus*) were recorded outside of the study area on Curtis Island. Notes on all significant species and the likelihood of their presence within the study area as identified during the desktop study are included in Appendix A.

The powerful owl (*Ninox strenua*) and glossy black cockatoo (*Calyptorhynchus lathami lathami*) are both listed as Vulnerable under the NC Act. Both rely on large arboreal hollows for nesting, a resource in abundance within the study area on Curtis Island. Arboreal hollows are also utilised by mammals such as squirrel gliders (*Petaurus norfolcensis*) and common brushtail possums (*Trichosurus vulpecula*), primary prey items of the powerful owl. The glossy black cockatoo feeds on seeds of the black sheoak (*Allocasuarina littoralis*) and forest oak (*A. torulosa*), both of which are well distributed across Curtis Island.

Essential Habitat Mapping (EPA 2008b) shows habitat mapped for the koala (*Phascolarctos cinereus*) (southern Queensland bioregion) in Regional Ecosystems 12.3.3 and 12.3.7 present within the gas transmission pipeline study area. The koala is listed as Vulnerable under the NC Act. Although targeted during the survey, no signs of the presence of koalas were observed during the field survey. Anecdotal evidence from a local landowner in south-west Curtis Island shows that koalas have not been seen for many years in the locality. Additionally, that there are no WildNet database records for this species on Curtis Island reinforces the likelihood that koalas are not currently active in the area.

2.2.8 Migratory Bird Species – Mainland and Curtis Island

The EPBC Act Protected Matters Report (DEWHA, 2008) sourced for the gas transmission pipeline notes that seventeen terrestrial, wetland and marine migratory birds may occur across the study area. It is not expected that vegetation communities within the mainland gas transmission pipeline study area and the estuarine wetlands on Curtis Island act as critical habitat for any of these species due to levels of disturbance found throughout most habitat types. The Curtis Island gas transmission pipeline survey was undertaken outside of the waterbird migration season (starting late August and September) and therefore the diversity and abundance of migratory wader birds was naturally low. A subsequent study in December 2008 by BAAM revealed a total of 22 wader and shorebird species identified within or near the study area. Eleven of these species are considered as Migratory species under the EPBC Act. BAAM noted that “Wader/shorebird species were observed in relatively low numbers within the study area. Habitat values appeared to be low for many species due to low foraging potential. There is abundant existing habitat elsewhere on Curtis Island and surrounds. Most of the observed wader species were recorded foraging on more suitable habitat (sand/mudflats) at South End in greater numbers than that seen within the study area” (BAAM 2008). All waderbirds recorded during studies on Curtis Island are shown in Appendix C. Potential migratory waderbird habitat in the Port of Gladstone south of The Narrows is generally accepted as degraded and devoid of suitable populations of invertebrate food sources for waderbirds due to industrial land use and petro-chemical impacts.

2.2.9 Environmentally Sensitive Areas – Mainland and Curtis Island

Curtis Island

Desktop studies have ascertained that there are no environmentally sensitive areas[2] that will be impacted by the gas transmission pipeline. A number of sensitive areas are located on or around Curtis Island or in the region as described below. There are no Ramsar-listed wetlands on or near Curtis Island (EPA, 2007).

World Heritage Areas

The Great Barrier Reef Marine Park (GBRMP) extends for approximately 2000 kilometres along the Queensland coast. On the western side of Curtis Island, the GBRMP stretches along The Narrows south to Graham Creek, approximately six kilometres north of the study area (GBRMPA, 2003).

State Parks, Reserves, Forests and Refuges

The following estates are present on Curtis Island. All are located north of Graham Creek, except for Garden Island Conservation Park, which is located approximately four kilometres to the east of the study site (EPA, 2007).

- Cape Capricorn Conservation Park;
- Curtis Island Conservation Park;
- Curtis Island National Park;
- Curtis Island State Forest;
- North Curtis Island State Forest;
- Curtis Island Nature Refuge; and
- Garden Island Conservation Park.

Nationally Important Wetlands

To be considered nationally important, a wetland must meet at least one of the six nationally agreed criteria. The criteria cover the following areas:

- Biogeographic representativeness;
- Important ecological or hydrological functions;
- Provision of animal habitat during times of vulnerability or adverse conditions;
- Support for more than 1% of the national population of any taxa;

[2] Environmentally sensitive areas include areas classified as having national, state, regional or local biodiversity significance, or flagged as important for their integrated biodiversity values. Other areas could include nature refuges, national parks, conservation parks, declared fish habitat areas, wilderness areas, aquatic reserves, heritage/historic areas or items, national estates, world heritage listings and sites covered by international treaties or agreements (e.g. Ramsar, Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement), areas of cultural significance and scientific reserves.

Section 2 Environmental Values

- Support for threatened taxa or communities; and
- Historical or cultural significance (DEW, 2005)

The Directory of Important Wetlands in Australia (DIWA) lists 4 nationally important wetlands in the area (DEW, 2005):

- Great Barrier Reef Marine Park;
- Northeast Curtis Island;
- Port Curtis; and
- The Narrows.

Referable Wetlands

A map of referable wetlands under the *Integrated Planning Regulation 1998* (subordinate to the *Integrated Planning Act 1994*) indicates that there are no referable wetlands at or near the project site (EPA, 2008).

Essential Habitat

RE 12.3.3 (*Eucalyptus tereticornis* woodland to open forest on alluvial plains) within the study area has been mapped by the EPA as Essential Habitat for the koala (*Phascolarctos cinereus*) (EPA 2008c).

Mainland Section.

Conservation and forestry areas located in the vicinity of the mainland gas transmission pipeline route are listed in Section 9.13.2.2 of the EIS report (Land Use and Infrastructure chapter). Those areas directly impacted by the gas transmission pipeline include the Expedition State Forest and the Callide Timber Reserve. The values of these areas are discussed in Section 2.2.5. The gas transmission pipeline and location of National Estate and Forestry Reserves are shown on Figures 9.13.2a and 9.13.2b, found within the Land Use and Infrastructure chapter.

3.1 Potential Impacts and Mitigation Measures - Mainland and Curtis Island

3.1.1 Proposed Development

The gas transmission pipeline corridor is closely aligned with the existing Queensland Gas Pipeline (QCP) for approximately 100 km of its length. The exception is the section north of Injune where the preferred corridor will traverse the Arcadia Valley. The gas transmission pipeline will approach Gladstone from the north and will pass through the Gladstone State Development Area (GSDA) before crossing Port Curtis at the Narrows to Curtis Island. To cross Port Curtis the gas transmission pipeline will be laid on the seabed and overlain with a protective rock cover. The length of this route is approximately 425 km.

The gas transmission pipeline will be buried for its entire length. It will be designed so that current land use activities will be able to continue after the pipe has been installed. Typical cover depth will be 750 mm – 2000 mm depending on location. Typical construction procedures and activities include:

- Survey of the gas transmission pipeline route;
- Provision of access tracks and temporary facilities;
- Clear and grade of the right-of-way (ROW) including vegetation removal;
- Trenching;
- Pipe stringing and bending
- Pipe welding;
- Pipe placement in the trench (lowering in and laying);
- Trench backfilling;
- Hydro-testing; and
- Rehabilitation.

The clearing of remnant vegetation within the gas transmission pipeline study area will provide the greatest impacts to fauna and flora. The pipeline ROW width will be 30 m on both the mainland and Curtis Island. The Curtis Island easement will however also accommodate a road and power line and be a total width of 100m. Approximately 188.6 hectares of remnant vegetation on the mainland and 69.6 hectares of remnant vegetation on Curtis Island will be cleared during this phase of the project. Approximately 258.2 hectares of remnant vegetation will be cleared for pipeline construction overall. The greater proportion of the pipeline ROW (approximately 1084.5 ha or 81%) will traverse cleared pasture or non-remnant vegetation within which impacts to fauna and flora will be minimal.

3.1.2 Potential Impacts

Loss of Habitat

The construction of the gas transmission pipeline may involve the loss of habitat through initial site preparation and clearing. This may result in the removal of habitat features such as trees, shrubs, ground cover, rocks and timber within the gas transmission pipeline ROW. Impacts to fauna as a result of these measures may include

mortality and loss of habitat and breeding areas. Implementation of appropriate strategies (Section 3.1.3) will considerably reduce the potential for fauna mortality. As approximately 81% of the pipeline ROW traverses cleared land or non-remnant vegetation with reduced habitat values the impacts to fauna overall should be low.

During the pipe trenching phase, the open trench will create an obstacle for fauna. The trench may effectively act as a large pitfall trap where fauna may fall in and will not be able to escape. The most serious implication for fauna is mortality to some individuals due to heat stress. Mitigation measures for these potential impacts are discussed below in Section 3.1.3.

Members of all fauna groups may be impacted to some extent by the proposal. Small ground mammals (e.g. rodents and dasyurids), reptiles and amphibians will be directly disturbed by vehicular movement and groundbreaking activities. As many species within these groups shelter within or utilise ground habitat features, there is the potential for these groups to be affected by these works.

Fauna utilising arboreal hollows and feeding resources such as possums, gliders and many species of birds and insectivorous bats, may be affected by the removal of these habitat features. In addition to the possibility of some fauna mortality during clearing, the loss of nesting resources may affect local prey and predator fauna populations into the future. Avian fauna will be less affected by the proposal due to their ability to easily move from the zone of impact. In addition, while the loss of habitat may affect certain types of birds, the alteration may be beneficial to others. An example, in a woodland area, may be a displacement of forest birds with a subsequent replacement by grassland species in the vicinity of the gas transmission pipeline.

Mortality impacts and predator prey disruption from habitat loss are expected to be relatively low in the context of the overall landscape ecology and there should not be significant long term impacts to overall faunal assemblages and species populations.

Fragmentation and Loss of Movement Opportunities

The construction of the gas transmission pipeline may create a barrier to fauna movement within well vegetated portions of the route, particularly in the range sections of the alignment. Fauna such as small mammals and birds are often deterred from crossing 30 metre wide cleared zones such as created by the ROW. In addition, the crossing of open areas can increase the potential for predation by native and introduced predators.

Gliders move through bushland by volplaning, or gliding from tree to tree. For squirrel gliders (*Petaurus norfolcensis*) and sugar gliders (*Petaurus breviceps*), the maximum distance volplaned is approximately 60 metres. For the greater glider (*Petauroides volans*) and yellow-bellied glider (*Petaurus australis*) the maximum distance can exceed 100 m. Often distances travelled are much less (20 to 30 m), and are partly dependant upon the height of trees utilised (Lindenmayer, 2002). The clearing of a 30 metre ROW for the mainland gas transmission pipeline section should not have a significant effect on glider movement (depending upon local vegetation patterns). However, on Curtis Island, the planned 100 metre ROW could potentially have a significant impact on the ability of gliders to traverse the area.

The fragmentation of remnant vegetation can result in a reduction of functional habitat. Habitat alteration may potentially result in certain species abandoning the area. Edge effects compound the impacts of fragmentation so that functional habitat is further reduced. Reduced buffers to core habitat will result in disturbances to fauna and a further reduction in habitat quality. The disturbance of soil and increased light levels will potentially enhance conditions for weed infestations.

Fragmentation and loss of movement opportunity impacts are not expected to have significant long term impacts to overall faunal assemblages and species populations in the context of the overall landscape ecology.

Noise and Vibration

Secondary impacts to fauna include disturbance from noise and vibration during construction. Fauna will generally move away from the source to avoid these impacts. However, acclimatisation by some species will occur over the longer term. It is not expected that significant impacts to fauna will occur over the long-term. Construction related noise and vibration impacts will be of a temporary nature, and will not be an issue following the pipeline construction phase.

Pests

Biting pests such mosquitoes can rapidly build-up populations when appropriate breeding conditions are provided. The pooling of water in depressions resulting from earthworks can exacerbate this problem.

As populations of foxes, pigs, feral cats and dogs and cane toads (among others) already populate areas in which the gas transmission pipeline traverses, it is highly unlikely that the proposed works will result in a proliferation of these species.

The introduction of exotic ant fauna is a potential risk. Yellow crazy ants (*Anoplolepis gracilipes*) and fire ants (*Solenopsis invicta*) are exotic ants that have the potential to seriously impact on native flora, fauna and ecological communities. They are capable of being transported from infested sites to new construction sites on equipment or within materials. Whilst many colonies of both species have been eradicated elsewhere in Queensland, there remains a slight chance of spreading ants to new areas.

The declared weeds parthenium (*Parthenium hysterophorus**), velvety tree pear (*Opuntia tomentosa**), prickly pear (*O. stricta**), mother of millions (*Bryophyllum delagoense**), Chinese celtis (*Celtis sinensis**), rubber vine (*Cryptostegia grandiflora**), harissia cactus (*Eriocereus martinii**), lantana (*Lantana camara*), creeping lantana (*Lantana montevidensis**) and cat's claw creeper (*Macfadyena unguis-cati**) were found within or adjacent to the gas transmission pipeline corridor. Of these species, parthenium has the greatest potential to significantly impact upon grazing and ecological values in the area. The majority of the corridor remains free of parthenium. However, the weed could easily be introduced to new areas through poor weed hygiene practices. Introduction to areas previously free of infestations could cause major impacts including loss of grazing potential, reduction in habitat value and increase in risk to human health.

Environmentally Sensitive Areas

Section 2.2.9 lists environmentally sensitive areas located on or around Curtis Island, and in parts of the Mainland section. Given the location and nature of the proposed activities, it is unlikely that these areas will be impacted.

3.1.3 Mitigation Measures

Vegetation Clearing

Where native vegetation is to be cleared, the following recommendations are to be developed and implemented under an Environmental Management Plan (EMP) to minimise impacts and where possible ensure current ecological values of habitat are maintained during the construction phase of the project. Recommendations include:

- Implementation of a program offsetting cleared vegetation communities in accordance with current Commonwealth and State legislative criteria for the offsetting of significant vegetation communities and habitat. (Refer to the Santos GLNG Ecological Assessment Report – Pipeline Flora for further details);

Section 3 Impacts and Mitigation

- Restriction of the amount of vegetation to be cleared to minimise the footprint required (clearly marking vegetation to be retained);
- Design of the route so that trees possessing habitat hollows and other habitat features are avoided wherever practicable;
- Retention of habitat trees within the ROW, where practicable as dictated by construction constraints;
- Salvage of timber and rocks for later placement as habitat features on the ROW;
- Clearing near any waterways or riparian areas should include adequate sedimentation fencing to ensure sediment impacts to waterways are restricted; and
- Implementation of a protocol to ensure qualified fauna spotters are actively present during clearing of woodland vegetation and any other areas of faunal habitat.

Fauna

Specific mitigation measures for potential direct impacts to fauna species include:

- Consideration should be given for the installation of nest boxes adjacent to sections of the gas transmission pipeline where trees containing habitat hollows have been identified and are to be cleared, such as on Curtis Island;
- Provision for glider movement across the ROW on the Curtis Island section should be considered. This should incorporate suitable poles in the mid-section of the ROW to enable passage from vegetated areas on either side;
- The gas transmission pipeline trench is to be left open for as short a time as possible. Where applicable, the following should be implemented: in sections left open, shade and shelter facilities (eg wet sacks for snake shelter) should be installed to ensure trapped fauna is not stressed by the heat and lack of water; ramps out of the trench should be constructed at regular intervals to enable fauna to escape; the trench should be checked regularly for fauna by an experienced wildlife handler to enable rescue.
- Placement of salvaged habitat material (logs, rocks etc) within the ROW following completion of works to enhance fauna movement; and
- The encouragement of suitable natural groundcover regeneration or sowing of pasture species (grasses and forbs only) within the ROW to assist in habitat or grazing re-establishment where appropriate.

Noise and Vibration

- All equipment and machinery used during construction should be maintained in good working order, and where possible shielded to minimise noise emissions.

Pests

- Appropriate site management to reduce the availability of breeding habitat for biting insects such as infilling of depressions to reduce retention of breeding habitat;
- Precautions and actions should be consistent with the various Regional Council pest management plans and DNRW to ensure a consistent approach;

- Inclusion of a pest and weed management plan in the construction EMP;
- Equipment and materials will be thoroughly inspected for pest animals and weeds according to Santos EHS09 Weed and Pest Animal Control, prior to being shipped to the gas transmission pipeline area.
- A thorough washdown procedure should be in place to reduce weed seeds, vegetative material and exotic fauna being transported; and
- Consideration should be given to the construction of wash down bays at various points along the gas transmission pipeline.

River and Stream Crossings

Where clearing of vegetation is within or in close proximity to riparian communities, adequate erosion and sedimentation mitigation measures are to be utilised to ensure waterways are not impacted and riparian vegetation is not unduly affected. Horizontal Directional Drilling (HDD) is proposed to be undertaken at two of the major river crossings (Calliope River and Dawson River crossing near Moura) to minimise disturbance to riparian sections of these rivers.

For minor watercourse crossings, open trenches will be used. Where possible existing gaps in the canopy will be utilised and mature trees will be avoided to minimise impacts to vegetation communities. Watercourse bed and bank material and trench spoil will be stockpiled separately, away from banks to reduce the likelihood of sedimentation from surface runoff. To minimise the period of construction and subsequent environmental disturbance, it is proposed to complete watercourse crossings within the shortest period practicable. Further erosion control measures are detailed in the following EIS sections: Section 7.3.3 (Soil Erosion and Stability), Section 7.5.4 (Surface Water: Potential Impacts and Mitigation Measures) and Section 7.11.4 (Land Use and Infrastructure: Potential Impacts and Mitigation Measures).

Maintenance and Management of Habitat

An Environmental Management Plan (EMP) is to be developed for the gas transmission pipeline that addresses the potential impacts identified above. The EMP is also to include an effective monitoring and control plan for declared pest animals and weed species. Weed control shall be in accordance with the recommendations outlined within the Santos GLNG Ecological Assessment Report – Pipeline Flora.

3.1.4 Cumulative Impacts

The regions of central Queensland in which the pipeline traverses have been historically altered by clearing for pastoral and agricultural activities. In addition, forestry, road development, mining and existing pipeline easements have further reduced the amount of remnant vegetation. In this context therefore, the construction of the gas transmission pipeline will not particularly reduce the overall conservation values of central Queensland. Route selection and planning from the commencement of the project has aimed to minimise impacts on remnant vegetation and fauna habitat through the avoidance of these areas wherever practicable. This is borne out in that approximately 81% of the gas transmission pipeline ROW traverses cleared or non-remnant vegetation. Field studies have determined that areas of remnant vegetation impacted by the ROW have often experienced historical disturbance from forestry and grazing activities. It is not anticipated that the proposed works will significantly further reduce current values.

Given the intensification of the CSG industry in central Queensland, it is conceivable that other gas transmission pipelines might be developed. Over time, the duplication of pipelines may result in further loss of remnant

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vegetation and habitat. The adherence to sound environmental policy and planning frameworks will assist in ensuring that additional pipelines will not significantly impact on natural ecosystems.

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Significant Species List

Appendix A

Appendix A Significant Species List

Table A-1 Significant Species Potentially Present as Determined Through Database Searches

Scientific name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
Birds					
Nettapus coromandelianus cotton pygmy-goose	R	-	Found near freshwater lakes, lagoons, swamps and dams, particularly those vegetated with water lilies and other floating and submerged aquatic vegetation. The Cotton Pygmy-goose uses standing dead trees with hollows close to water for roosting and breeding (NSW NPWS 2005).	The cotton pygmy-goose may utilise waterbodies in the vicinity of the proposed pipeline route.	EPA (i)
Stictonetta naevosa Freckled duck	R	-	Recorded across southern and central Australia. In Qld, commonest in the Paroo-Warrego, Eyre-Georgina-Mulligan, Cooper Creek and Bulloo River Catchments. Favours brackish/ hyposaline wetlands vegetated with lignum (Garnett and Crowley, 2000).	The proposed pipeline is located beyond favoured catchments and it is unlikely that the freckled duck utilises the area more than sporadically.	EPA (i)
Tadorna radjah radjah shelduck	R	-	Common in areas of NT; scarce to rare elsewhere. In wet season moves from littoral habitat to shallow margins of expanding wetlands (Morcombe, 2004).	The radjah shelduck has been recorded from nearby Boyne Island and may be present on Curtis Island at times. The radjah shelduck favours brackish and estuarine environments and it is less likely that wetlands along the pipeline further west will be preferentially utilised.	EPA (i)
Ephippiorhynchus asiaticus black-necked stork	R	-	Habitats include wetlands and surrounds, billabongs, dams, wet heath and swamps. Common in north on coast; becomes less common inland and south (Morcombe, 2004).	May utilise wetlands and watercourses along the proposed pipeline route.	EPA (i)
Accipiter novaehollandiae grey goshawk	R	-	Inhabits rainforest, gallery forest, mangroves, eucalypt forest, and woodlands where it takes prey by ambush. Prefers mature forest with open understorey (Morcombe, 2004).	Probably inhabits riparian and range woodland along the pipeline route.	EPA (i)

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Scientific name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
Erythrotriorchis radiatus red goshawk	E	V	The red goshawk is listed as endangered in Queensland (NC Act 1992). It is known to utilise a very large home range (50 to 220 square km) including a mix of tall open forest, woodland, lightly treed savannah and the edge of rainforest (EPA 2005a). Favoured areas contain permanent water and have large populations of birds of other species. Red goshawks generally avoid very dense or very open habitats, preferring to hunt along ecotones (NSW NPWS 2002).	Vegetation on the proposed pipeline route generally does not form core habitat for this species. However, opportunities may exist in densely vegetated gullies as found on Curtis Island and within the range crossings.	EPA (i) DEWHA
Falco hypoleucos grey falcon	R	-	Favours lightly timbered country, especially stony plains and Acacia scrub (Morcombe, 2004).	May utilise vegetation along the pipeline route, especially in western portions.	EPA (i)
Lophoictinia isura square-tailed kite	R	-	Eucalypt forest and woodlands, not generally encountered in more open habitats.	Would certainly utilise vegetation communities found along the pipeline route.	BA
Rallus pectoralis Lewin's Rail	R	-	Found along east coast. Usual habitat: swamps, lakes, tidal creeks, salt marsh, lush wet pasture, paperbarks. Nomadic bird, secret and difficult to sight even momentarily in the swamps where it forages.	May use wetlands along the pipeline route, especially towards the Curtis coast.	EPA (i)
Turnix melanogaster black-breasted button-quail	V	V	The black-breasted button-quail is endemic to eastern Australia and is restricted to coastal and near-coastal regions of south-eastern Queensland and north-eastern New South Wales. The main populations occur within south-east Queensland (DEWHA 2008b). The black-breasted button-quail has a preference for low canopied forests, including rainforest, monsoon forests, vine forests and Eucalyptus forests with a dense ground and litter cover (Morecombe 2004).	Suitable habitat may exist in the vicinity of the proposed pipeline route near the Curtis coast. However grazing and other disturbances, may contribute to a preference by the species for more secure sites.	EPA (i) DEWHA
Rostratula australis Australian painted snipe	-	V	The Australian painted snipe utilises, amongst other habitats, permanent or temporary shallow inland wetlands. It is found scattered throughout many parts of Australia, although loss and alteration of wetland habitat has contributed to species decline (DEH 2003).	Suitable habitat is probably present in less disturbed portions of the pipeline route.	EPA (i) DEWHA
Numenius madagascariensis Eastern curlew	R	-	Largest Australian wader. Inhabits tidal mudflats, mangroves and other intertidal ecosystems. Common migrant to most of Aust. Coast (Morcombe, 2004).	Would utilise tidal ecosystems within Port Curtis and surrounds.	EPA (i)
Esacus neglectus beach stone-curlew	V	-	Considered vulnerable due to coastal disturbance; only secure in remote parts of the north coast of the country.	The species was observed on Curtis Island and may be present on mainland beaches.	EPA (i)

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Scientific name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
Haematopus fuliginosus sooty oystercatcher	R	-	Purely marine based bird. Usually on rocky shorelines, wave-cut platforms and reefs. Generally uncommon; scarce on disturbed coastlines, common on parts of the North coast (Morecombe, 2004).	Observed on Curtis Island and probably utilises mainland intertidal ecosystems.	EPA (i)
Sterna albifrons little tern	E	-	A very small tern that tends to live and feed over shallower coastal waters. Attracted to sandbars, estuaries and river channels. Usually in small groups or flocks. Breed on east and north-east coast of Australia (Morcombe, 2004).	The little tern would probably utilise the waters of Port Curtis.	EPA (i)
Geophaps scripta scripta squatter pigeon, southern form	V	V	The squatter pigeon is listed as 'Vulnerable' under the Queensland NC Act 2002 and the Commonwealth EPBC Act 1999. Populations in the Curtis Coast area represent the southern sub-species of the squatter pigeon, which is distributed through inland areas from northern NSW to the Burdekin region of Queensland. It occurs patchily, mainly in grassy eucalypt woodland and gravel ridge habitats, and is a seed eater. The species has declined significantly in the southern parts of its range (NSW), but appears to be stable in Queensland. Identified threats include cattle grazing and predation by foxes (Garnett & Crowley 2000).	The squatter pigeon was observed at various locations along the pipeline route on the mainland. Suitable habitat is present in many areas of the route.	EPA (i) DEWHA
Calyptorhynchus lathami lathami glossy black cockatoo	V	-	Inhabits open forest and woodlands in which stands of she-oak species, (particularly Allocasuarina littoralis, A. torulosa or A. verticillata) occur.	Was observed on Curtis Island. Its range would extend over coastal and near-coastal parts but does not extend to the interior.	EPA (i)
Lathamus discolor swift parrot	E	E	Inhabits forests and woodlands with flowering trees. Often found in association with lorikeets (Morcombe 2004). It breeds only in Tasmania but overwinters on the mainland. In Qld, prefers E. crebra and E. tereticornis woodlands (DEWHA, 2008c).	Pipeline is probably at northern extent of range. May occasionally utilise woodlands in area depending upon resource availability.	EPA (i)
Neophema pulchella turquoise parrot	R	-	Inhabits woodland and open grassland; natural or partly cleared (Morcombe, 2004). As it is a ground feeder it is probably susceptible to feral predators. Its range extends from NSW into southern Qld.	The pipeline is outside of its generally accepted range and it would probably not occur within the study area.	EPA (i)
Psephotus pulcherrimus paradise parrot	PE	EX	The paradise parrot is considered extinct. It formerly occurred in central and southern Qld, inhabiting lightly timbered river valleys (DEWHA, 2008d).	Not present - extinct	EPA (i)

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Scientific name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
Ninox strenua powerful owl	V	-	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requires large tracts of forest or woodland habitat. May occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Syncarpia glomulifera, Allocasuarina littoralis, Acacia melanoxylon, Angophora floribunda, Exocarpos cupressiformis and a number of eucalyptus species.	Observed within the Curtis Island pipeline section. It probably occurs within moister gullies on the ranges and along well-vegetated riparian corridors on the pipeline route.	EPA (i)
Aerodramus spodiopygius white-rumped swiftlet	R	-	Forms small to large flocks over coastal ranges, gorges, islands and woodlands to 1000 m altitude. Nests in small cave-like crevices (Morcombe, 2004). Known only from 5 nesting regions in Aust (EPA, 2005b).	May be present in coastal areas.	EPA (i)
Atrichornis rufescens rufous scrub-bird	V	-	Patchy distribution in north-east NSW to near Cunningham's Gap in southern Queensland. Inhabits high altitude subtropical, warm temperate and cool temperate rainforest, and moist eucalypt forest with rainforest middle storey (DEC, 2005).	Current extent not near pipeline route. Not expected to be present.	EPA (i)
Melithreptus gularis black-chinned honeyeater	R	-	Forages noisily in forests, woodlands and tree lined watercourses of arid regions (Morcombe, 2004).	May utilise woodlands and riparian vegetation along the pipeline route.	EPA (i)
Peophila cincta cincta black-throated finch (white-rumped subspecies)	V	E	Forages on ground for seed in small flocks. Inhabits open woodlands and grasslands with scattered tree cover never far from water (Morcombe, 2004).	May be present in areas along the pipeline.	EPA (i)
Neochmia ruficauda ruficauda star finch	E	E	Inhabits tall grass besides swamps and rivers, and grassy eucalypt open woodlands near watercourses.	Limited suitable habitat may be present	DEWHA
Macronectes giganteus southern giant-petrel	E	E	The southern giant-petrel is the largest of the petrels and breeds in colonies on Antarctic and sub-Antarctic islands and Antarctic mainland. It feeds at sea, favouring the continental shelf and the edge of the pack-ice (Morecombe 2000). Throughout the colder months, immature birds and most adults disperse widely, travelling as far north as the Tropic of Capricorn (DEWHA 2008a).	Is not expected anywhere along the pipeline route.	DEWHA

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Scientific name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
Pterodroma neglecta neglecta kermadec petrel (western)	-	V	The Kermadec petrel is a large pelagic bird that breeds on islands across the south west Pacific Ocean. Morecombe (2000) notes that it is an "extremely rare vagrant or accidental visitor to E coast NSW".	Is not expected anywhere along the pipeline route	DEWHA
Mammals					
Dasyurus hallucatus northern quoll	-	E	The northern quoll is found in the savannas of northern Australia. Populations of this quoll have declined across much of its former range, with cane toads thought to be a major factor. They utilise a range of habitats, with rocky areas and eucalypt forests preferred (DEH 2005).	Unlikely to be present along the pipeline given the disturbed nature of most habitats surveyed.	EPA (i) DEWHA
Phascolarctos cinereus koala (southern Queensland bioregion)	V	-	Open (structurally complex with mixture young/mature/old growth, especially 30-80cm dbh), mixed (rich in number and species diversity of food trees) eucalypt forest and woodland at lower altitude in undulating country on relatively deep and usually high nutrient soil (main species - Eucalyptus tereticornis, E. fibrosa, E. propinqua; E. umbra, E. grandis, E. microcorys, E. tindaliae, E. resinifera, E. populnea; E. robusta, E. nigra, E. signata) (EPA 2008).	The pipeline may traverse suitable habitat for koalas.	EPA (ii)
Pteropus poliocephalus grey-headed flying fox	C	V	Australia's second-largest bat. Feeds on blossoms, fruit and leaves of many plants. It is an important pollinator and disperser of seed.	May be present on the coastal fringe near Gladstone.	EPA (i)
Macroderma gigas ghost bat	V	-	The largest microchiropteran bat. They occur in a wide range of habitats from rainforest, monsoon and vine scrub, to open woodlands in arid areas (EPA, 2007a),	It has been recorded from the Calliope Basin west of Gladstone (EPA, 2007b) but may not extend further west.	EPA (i)
Chalinolobus dwyeri large-eared pied bat	R	V	This species will occur in most vegetation types provided there are caves or tunnels in which it can roost. Daytime roosts include abandoned mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins (Ayers et al. 1996). Strahan (1995) notes that this species is found in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range.	The pipeline may traverse suitable habitat for the large-eared pied bat.	DEWHA

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Scientific name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
Chalinolobus picatus little pied bat	R	-	The little pied bat is found in inland Queensland and New South Wales, and is known to utilise dry open forest and open woodland. They roost in caves, trees and abandoned mines and houses (Churchill, 1998).	Habitat is present along the pipeline route. However, its range may be restricted to areas displaying suitable roost sites.	EPA (i)
Nyctophilus timoriensis eastern long-eared bat (south-eastern form)	V	V	Inhabits Eucalyptus & Acacia woodlands in the vicinity of suitable roost sites such as tree hollows	The pipeline may traverse suitable habitat for the eastern long-eared bat.	DEWHA
Hipposideros semoni Semon's leaf-nosed bat	-	V	Semon's Leaf-nosed Bat is found in tropical rainforest, monsoon forest, wet sclerophyll forest and open savannah woodland. It utilises tree hollows, deserted buildings in rainforest, road culverts and shallow caves amongst granite boulders or in fissures (DEWHA, 2008e).	A population exists within Kroombit Tops National Park (85 km south west of Gladstone). (DEWHA, 2008). It may not be present further west of this point.	
Xeromys myoides water mouse	V	V	Inhabits saline grassland, mangroves and margins of freshwater swamps. Found along Queensland coast from Cooloola to Proserpine, including Stradbroke and Bribie Island. Also found in coastal NT.	Suitable habitat is present on the mangrove verges of Port Curtis.	DEWHA
Reptiles					
Strophurus taenicauda golden-tailed gecko	R		This gecko inhabits open woodland and open forest, utilising loose bark and hollow limbs for shelter. Almost all known records are from the Brigalow Belt bioregion (EPA, 2005c).	Would be present in suitable habitat along the pipeline route.	EPA (i)
Varanus semiremex rusty monitor	R		The rusty monitor is a small goanna inhabiting mangroves, paperbark forest, open forest and gallery forest. It dwells in trees and utilises hollows for shelter.	Known from the Boyne Island area and may be present up to 70 km inland.	EPA (i)
Egernia rugosa yakka skink	V	V	Usually found in open dry sclerophyll forest or woodland, often taking refuge among dense ground vegetation, hollow logs, cavities in soil-bound root systems of fallen trees and beneath rocks Alternatively, skinks may also excavate burrow systems among low vegetation. It has been collected from the Arcadia Valley, Banana and near Biloela (DEWHA 2008f).	The yakka skink would be present within suitable habitat on the pipeline route.	EPA (i) DEWHA

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Scientific name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
Ophioscincus cooloolensis Cooloola snake-skink	R	-	Known from Fraser Island and the adjacent mainland in wallum and rainforest (Cogger, 2000).	Suitable wallum or rainforest habitat is not represented along the pipeline route and therefore it will not be present.	EPA (i)
Paradelma orientalis brigalow scaly-foot	V	V	Occurs on sandstone ridges in woodlands and vine thickets, and in open forests. Found within the Brigalow Belt (DEWHA 2008g).	Suitable habitat for the brigalow scaly-foot exists between the coast and the Carnarvon Range.	DEWHA
Rheodytes leukops Fitzroy tortoise	V	V	This species is found only in the drainage of the Fitzroy River, Qld. Found in rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles. Preferred areas have high water clarity, and are often associated with Vallisneria spp. Beds. Common riparian vegetation includes Eucalyptus tereticornis, Casuarina cunninghamiana, Callistemon viminalis and Melaleuca linariifolia It is thought that the turtles have an affinity for well-oxygenated riffle zones, moving into deeper pools as the riffle zones cease to flow Low.	Suitable habitat is potentially present, especially towards the coast within waterways of the Fitzroy River Catchment.	DEWHA
Furina dunmalli Dunmall's snake	-	V	Preferred habitat, is Acacia harpophylla forest and woodland growing on cracking black clay and clay loam soils	Suitable habitat exists, especially in western portions of the pipeline route.	DEWHA
Denisonia maculata ornamental snake	V	V	Occurs in Acacia harpophylla woodland growing on clay and sandy soils, riverine woodland, and open forest growing on natural levees. Shows a preference for moist areas. Known only from the Brigalow Belt (DEWHA 2008h).	Suitable habitat exists within sections of the pipeline route.	EPA (i) DEWHA
Pseudechis colletti Collett's snake	R	-	Restricted to open grasslands on dark cracking clay soils. Shelters in deep soil cracks (Wilson, 2005)	Suitable habitat may be present in western sections of the pipeline route.	EPA (i)

Key to Table A-1

Key to Sources:

- DEWHA – Department of Water, Environment, Heritage and the Arts EPBC Act Protected Matters Report
- EPA (i) – EPA Queensland Wildnet database
- EPA (ii) – EPA Queensland Essential Habitat EcoMap

Key to Status:

- NC Act Status: Indicates the conservation status of each taxon under the Nature Conservation Act 1992. The codes are; Extinct in the wild (PE), Endangered (E), Vulnerable (V), Rare (R), Not listed (-)
- EPBC Act Status: Indicates the conservation status of each taxon under the Environment Protection and Biodiversity Conservation Act, 1999. The codes are: Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Migratory (M), Not listed (-).

Survey Methodology

Appendix B

Appendix B Survey Methodology

The gas transmission pipeline terrestrial and aquatic fauna survey was undertaken to fulfil the requirements of the GLNG Terms of Reference.

The survey employed different methodologies for the Curtis Island and mainland sections of the pipeline. These reflect the relatively compact nature of the Curtis Island study area and the exceptionally long and linear nature of the mainland gas transmission pipeline section.

B.1 Curtis Island Section Methodology

The survey was conducted over a ten-day period between 14 and 23 May 2008. Dense vegetation precluded access to much of the study site, therefore sites were chosen to reflect dominant vegetation communities and ease of access. The survey sampled principal habitat types within the study area, based on knowledge of the site gained during the desktop assessment, aerial photograph interpretation, the LNG Facility study and a scoping foray.

A standard survey comprising of Elliott and pitfall trapping, bird census, spotlighting, call playback, microchiropteran call analysis and active searches was conducted.

A formal aquatic sampling effort was not undertaken due to the ephemeral nature of the steams on the site.

B.1.1 Nomenclature

Taxonomic nomenclature used for description of fauna species follows Stanger et al (1998), with the exception of recently published taxonomic revisions. Feral species are denoted by an asterix (*). Field references used for the identification and description of fauna species include Allen *et al* (2002), Churchill (1998), Cogger (2000), Menkhorst and Knight (2001), Morecombe (2004), Robinson (1998), Simpson and Day (2004), Strahan (2008), Triggs (2004) and Wilson (2005).

B.1.2 Live Capture/ Release Trapping

Small mammals, reptiles and amphibians were surveyed using live trapping methods including type A and B Elliott aluminium box traps and pitfall traps used in conjunction with drift fences. Trapline locations are shown on Figure 1.

Four Elliott trapline transects were placed across the study area to sample a variety of vegetation communities/ habitat types and to achieve adequate spatial coverage. ‘A’ and ‘B’ Elliot traps were placed at 10-20 m intervals along transects at each survey site (20-26 traps per transect). Traps were placed to take advantage of various microhabitat features such as fallen timber, surface rocks or dense ground cover.

Pitfall trap lines incorporated PVC buckets approximately 40 cm deep (15L) in conjunction with a plastic drift fence 7 m long x 0.4 m high. Pitfall trapping (3 buckets per site) was undertaken at the same sites as the Elliott traplines. Pitfall traps were cleared of captures in the morning and late afternoon. Elliott and pitfall trapping were both conducted over 4 nights. Trapping details are shown in Table B-1 below.

Table B-1 Trapping Effort and Habitat Descriptions

Trapline Number	Location UTM 56k	Number of Elliott A traps	Number of Elliott B traps	Number of Pitfall Traps	Elliott trapnights	Pitfall trapnights	Habitat Notes
1	317509 7370899	24	2	-	104	-	Open woodland 20-25 m of *C. citriodora, C. trachyphloia* with mid-dense shrub layer (5-10m) of *Acacia* spp. and *Planchonia careya.* Understory to 1-2m of grasstrees and native grasses. Ground cover of leaf litter, fallen logs, Rocky soils, fire scars > 10 years. Presence of horses, cattle.
2	317544 7370936	-	-	3	-	12	Open woodland 20-25 m of *C. citriodora, C. trachyphloia* with mid-dense shrub layer (5-10m) of *Acacia* spp. and *Planchonia careya.* Understory to 1-2m of grasstrees and native grasses. Ground cover of leaf litter, fallen logs, Rocky soils, fire scars > 10 years. Presence of horses, cattle.
3	317478 7371039	22	2	-	96	-	Open woodland of *E. tereticornis* in narrow fringe along ephemeral watercourse merging with *C. citriodora* away from stream. Rocky alluvium and patches of dense grass present. Horse and cattle signs obvious.
4	317451 7371048	-	-	3	-	12	Open woodland of *E. tereticornis* in narrow fringe along ephemeral watercourse merging with *C. citriodora* away from stream. Rocky alluvium and patches of dense grass present. Horse and cattle signs obvious.
5	314152 7372352	20	-	-	80	-	Mid-high (10-15m) woodland/ open forest of *Corymbia citriodora* and *E. crebra*. Dense *Acacia* forms a mid layer of closed forest in patches on the ridge. Understory of tussock grasses. Gravelly soil with minor rock outcroppings. Tree hollows scarce. Ground cover of fallen branches, rocks, tussocks. No recent fires (>5 years). Disturbed by horses.

Appendix B Survey Methodology

Trapline Number	Location UTM 56k	Number of Elliott A traps	Number of Elliott B traps	Number of Pitfall Traps	Elliott trapnights	Pitfall trapnights	Habitat Notes
6	314102 7372347	-	-	3	-	12	Mid-high (10-15m) woodland/ open forest of *Corymbia citriodora* and *E. crebra*. Dense *Acacia* forms a mid layer of closed forest in patches on the ridge. Understory of tussock grasses. Gravelly soil with minor rock outcroppings.. Tree hollows scarce. Ground cover of fallen branches, rocks, tussocks. No recent fires (>5 years). Disturbed by horses.
7	316059 7372423	20	-	-	80	-	Mid-high (20-22 m) woodland dominated by *E. crebra C. citriodora*. Understory of tussock grass. Ground cover of leaf litter, fallen logs etc. Stony skeletal soils on top of ridge. Small stones on surface.
8	316058 7372422	-	-	3	-	12	Mid-high (20-22 m) woodland dominated by *E. crebra C. citriodora*. Understory of tussock grass. Ground cover of leaf litter, fallen logs etc. Stony skeletal soils on top of ridge. Small stones on surface.
Totals		**86**	**4**	**12**	**360**	**48**	

B.1.3 Daytime Bird Census

Diurnal birds were sampled using an area census method supplemented by broad observational surveys. Birds were systematically sampled at each of the four trapping sites. Censuses were carried out in the early morning (in the first 3-4 hours after sunrise), over a period of approximately 20 minutes per site. Incidental observations were noted at other sites, and while travelling around the site

B.1.4 Spotlight Survey

In order to locate nocturnal fauna, spotlighting on foot using hand-held spotlights was undertaken at all primary sample sites and in other areas of representative habitat. Spotlighting from a slow moving vehicle using a high powered beam was undertaken along the main tracks of the study area. This method was used to locate larger ground and arboreal mammals and nocturnal birds.

B.1.5 Owl Call Playback

Call playback of various owl species' was undertaken at various sites during the nocturnal surveys. Calls were played for several minutes followed by a period of listening for responses.

B.1.6 Microchiropteran Bat Call Detection

Microchiropteran bat echolocation calls were recorded using an ultrasonic bat call detector (AnaBat II Bat detector used in conjunction with the AnaBat CF Storage ZCA Interface Module; Titley Electronics). AnaBat detection was conducted between dusk and dawn at six separate locations. The Anabat locations were chosen for variety and representativeness and to sample areas with potential roost sites. Data was analysed by AnaBat echolocation call analysis specialist Greg Ford. The locations of each AnaBat site are listed in Table B-2 and shown on Figure 1.

Table B-2 Location of AnaBat Sites

	Location (MGA 94 Zone 56)	
AnaBat Site Number	Easting (m)	Northing (m)
1	314,755	7,372,678
2	313,877	7,372,667
3	315,987	7,372,320
4	316,057	7,372,677
5	317,546	7,371,134
6	317,726	7,370,870

B.1.7 Active Searches

Active diurnal searching for reptiles, amphibians and small mammals included scanning of trees and ground, removal of cover such as rocks and fallen logs and peeling the bark from trees. Searches also focussed on locating and identifying tracks and traces such as nests, scats and tree scars. All efforts were made to replace

Appendix B Survey Methodology

logs and rocks in the position they were found and to limit bark removed from each tree during habitat searches. Opportunistic nocturnal searches were also undertaken.

B.2 Mainland Gas Transmission Pipeline Methodology

Preliminary identification of vegetation communities and habitat of potential significance along the mainland gas transmission pipeline study area was conducted prior to the commencement of fieldwork via interpretation of 1:22 000 colour aerial photography (Aerometrix, 2008); 1:100 000 Regional Ecosystems mapping Version 5.0 (EPA, 2008a); and 1:100 000 habitat Ecomap (EPA, 2008b).

Fauna observations and analysis of fauna signs, tracks and scats were undertaken along the pipeline route to enable identification of habitat values present. The scale of the pipeline precluded the implementation of specialist fauna survey methods such as trapping and spotlighting. The assessments were conducted concurrently with the flora surveys at 52 secondary level and 72 quaternary level vegetation assessment sites. Sites were chosen based on ease of access, representativeness and also to target areas mapped as Essential Habitat by the EPA. Specific methods used to assess habitat value and fauna presence at each site include:

- Opportunistic observations of mammals, reptiles and amphibians;
- Targeted bird observations for the duration of the site assessment (45 minutes);
- Opportunistic habitat searches concentrating on features such as loose bark, fallen timber and surface rocks; and
- Analysis of tracks, signs, scats and scratchmarks to indirectly determine faunal usage of the site.

Incidental observations of fauna were also recorded whilst driving through the region and between survey sites.

B.3 Aquatic Habitat Assessments

An assessment of the physical and ecological characteristics of streams occurring along the gas transmission pipeline study area was undertaken during both the ecological and surface water field investigations. At the time of the assessments no significant rainfall had occurred in the previous weeks so waterways were at low flow levels. The survey on the mainland section examined 24 sites on 18 waterways. These are listed in Table B-3, below.

Table B-3 Mainland Aquatic Assessment Sites

Site Number	Waterway
1	Larcom Creek
2	Calliope River
3	Bell Creek
4	Callide Creek
5	Kroombit Creek
6	Banana Creek
7	Kianga Creek
8	Dawson River (d/s)
9	Mimosa Creek

Site Number	Waterway
10	Conciliation Creek (d/s)
11	Zamia Creek (d/s 1)
12	Zamia Creek (d/s 2)
13	Zamia Creek (u/s 2)
14	Zamia Creek (u/s 1)
15	Conciliation Creek (u/s)
16	Clematis Creek
17	Brown River
16	Spring Creek
19	Arcadia Creek
20	Dawson River (u/s)
21	Sardine Creek
22	Baffle Creek (u/s)
23	Baffle Creek (d/s)

Physical habitat descriptions were recorded using AUSRIVAS Physical Assessment Protocol Field Data Sheets (Parsons *et al,* 2002). Parameters recorded included: land-use; stream impacts; riparian zone vegetation composition and disturbance; channel shape and cross-section; sediment matrix and bed compaction; and bed stability. Additional notes regarding site description and water presence were also made.

Fauna Species List

Appendix C

Appendix C Fauna Species List

Table C-1 Fauna Species List

Common Name	Scientific Name	LNG Facility [1]	Curtis Island Pipeline	Mainland Pipeline	Curtis Island Incidental Records[2]	Status[3] (NC Act, EPBC Act)
Amphibians						
cane toad	*Bufo marinus*[#]	X	X	X	X	
green tree frog	*Litoria caerulea*	X				
desert tree frog	*Litoria rubella*	X			X	
ornate burrowing frog	*Limnodynastes ornatus*	X				
northern banjo frog	*Limnodynastes terrareginae*	X				
Reptiles						
tree dtella	*Gehyra dubia*	X	X		X	
Bynoe's gecko	*Heteronotia binoei*	X	X			
jewel skink	*Carlia munda*	X				
jewel skink	*Carlia pectoralis*	X				
jewel skink	*Carlia schmeltzii*	X				
striped wall skink	*Cryptoblepharus virgatus*	X	X	X		
copper-tailed skink	*Ctenotus taeniolatus*	X				
eastern grass skink	*Lampropholus delicata*	X	X			
skink	*Menetia timlowi*	X				
freckled monitor	*Varanus tristis*	X				
blind snake	*Ramphotyphlops* sp.	X				
spotted python	*Antaresia maculosa*	X				
common tree snake	*Dendrelaphus punctulatus*	X	X			
brown tree snake	*Boiga irregularis*				X	
red-bellied black snake	*Pseudechis porphyriacus*				X	
eastern brown snake	*Pseudonaja textilis*			X		
yellow-faced whip snake	*Demansia psammophis*			X		
Birds						
Indian peafowl	*Pavo cristatus*[#]			X		
brown quail	*Coturnix ypsilophora*	X				
Australian wood duck	*Chenonetta jubata*			X		
pacific black duck	*Anas superciliosa*	X		X		

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Common Name	Scientific Name	LNG Facility [1]	Curtis Island Pipeline	Mainland Pipeline	Curtis Island Incidental Records[2]	Status[3] (NC Act, EPBC Act)
Australasian grebe	*Tachybaptus novaehollandiae*			X		
great egret	*Ardea alba*	X**				
intermediate egret	*Ardea intermedia*	X				
royal spoonbill	*Platalea regia*			X		
brolga	*Grus rubicunda*			X		
pied cormorant	*Phalacrocorax varius*	X*	X	X		
white-necked heron	*Ardea pacifica*			X		
white-faced heron	*Egretta novaehollandiae*	X*				
pacific baza	*Aviceda subcristata*	X*	X			
whistling kite	*Haliastur sphenurus*	X	X	X	X	
Brahminy kite	*Haliastur indus*	X*	X		X	
osprey	*Pandion haliaetus*	X	X		X	
white-bellied sea-eagle	*Haliaeetus leucogaster*	X*	X	X		
wedge-tailed eagle	*Aquila audax*			X	X	
Australian hobby	*Falco longipennis*			X		
nankeen kestrel	*Falco cenchroides*			X		
brown falcon	*Falco berigora*			X		
Australian bustard	*Ardeotis australis*			X		
whimbrel	*Numenius phaeopus*	X*			X	
bush stone-curlew	*Burhinus grallarius*	X	X		X	
beach stone-curlew	*Esacus neglectus*	X*				V
pied oystercatcher	*Haematopus longirostris*	X*				
sooty oystercatcher	*Haematopus fuliginosus*	X			X	R
red-capped plover	*Charadrius ruficapillus*	X**				
masked lapwing	*Vanellus miles*	X*	X			
banded lapwing	*Vanellus tricolor*				X	
silver gull	*Larus novaehollandiae*	X*	X		X	
crested tern	*Sterna bergii*	X**				
Caspian tern	*Sterna caspia*	X**				
gull-billed tern	*Sterna nilotica*	X**			X	

Appendix C Fauna Species List

Common Name	Scientific Name	LNG Facility [1]	Curtis Island Pipeline	Mainland Pipeline	Curtis Island Incidental Records[2]	Status[3] (NC Act, EPBC Act)
peaceful dove	*Geopelia striata*	X*	X	X	X	
diamond dove	*Geopelia cuneata*			X		
crested pigeon	*Ocyphaps lophotes*			X		
bar-shouldered dove	*Geopelia humeralis*	X*	X	X		
squatter pigeon	*Geophaps scripta scripta*			X		V , V
red-tailed black-cockatoo	*Calyptorhynchus banksii*		X	X		
glossy black cockatoo	*Calyptorhynchus lathami*	X				V
cockatiel	*Nymphicus hollandicus*			X		
little corella	*Cacatua sanguinea*			X		
sulphur-crested cockatoo	*Cacatua galerita*			X		
rainbow lorikeet	*Trichoglossus haematodus*	X	X	X	X	
little lorikeet	*Glossopsitta pusilla*	X				
red-winged parrot	*Aprosmictus erythropterus*			X		
pale-headed rosella	*Platycercus adscitus*	X	X	X	X	
fan-tailed cuckoo	*Cacomantis flabelliformis*		X	X		
little bronze-cuckoo	*Chrysococcyx minutillus*	X**				
pheasant coucal	*Centropus phasianinus*	X*	X	X	X	
powerful owl	*Ninox strenua*		X			V
barking owl	*Ninox connivens*	X	X			
laughing kookaburra	*Dacelo novaeguineae*	X*	X	X	X	
blue-winged kookaburra	*Dacelo leachii*	X				
forest kingfisher	*Todiramphus macleayii*	X	X	X		
collared kingfisher	*Todiramphus chloris*	X**				
sacred kingfisher	*Todiramphus sanctus*	X*	X			
rainbow bee-eater	*Merops ornatus*	X*	X	X	X	
brown treecreeper	*Climacteris picumnus*			X		

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Common Name	Scientific Name	LNG Facility [1]	Curtis Island Pipeline	Mainland Pipeline	Curtis Island Incidental Records[2]	Status[3] (NC Act, EPBC Act)
red-backed fairy-wren	*Malurus melanocephalus*			X		
striated pardalote	*Pardalotus striatus*	X*	X	X	X	
weebill	*Smicrornis brevirostris*			X		
mangrove gerygone	*Gerygone levigaster*	X**				
western gerygone	*Gerygone fusca*			X		
white-throated gerygone	*Gerygone olivacea*	X	X	X		
helmeted friarbird	*Philemon buceroides*	X**				
noisy friarbird	*Philemon corniculatus*	X	X	X	X	
little friarbird	*Philemon citreogularis*	X				
yellow-throated miner	*Manorina flavigula*			X		
noisy miner	*Manorina melanocephala*	X	X	X	X	
blue-faced honeyeater	*Entomyzon cyanotis*	X	X	X	X	
mangrove honeyeater	*Lichenostomus virescens*	X**				
brown honeyeater	*Lichmera indistincta*	X*	X	X	X	
white-throated honeyeater	*Melithreptus albogularis*	X	X	X		
rose robin	*Petroica rosea*			X		
varied sittella	*Daphoenositta chrysoptera*			X		
rufous whistler	*Pachycephala rufiventris*			X		
golden whistler	*Pachycephala pectoralis*			X		
leaden flycatcher	*Myiagra rubecola*	X**				
satin flycatcher	*Myiagra cyanoleuca*	X	X			
shining flycatcher	*Myiagra alecto*	X**				
grey fantail	*Rhipidura fuliginosa*	X*	X	X		
willy wagtail	*Rhipidura leucophrys*	X*	X	X	X	
spangled drongo	*Dicrurus bracteatus*	X*	X		X	
magpie-lark	*Grallina cyanoleuca*			X		
rufous whistler	*Pachycephala rufiventris*	X*	X			

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Common Name	Scientific Name	LNG Facility [1]	Curtis Island Pipeline	Mainland Pipeline	Curtis Island Incidental Records[2]	Status[3] (NC Act, EPBC Act)
little shrike-thrush	*Colluricincla megarhyncha*	X**				
varied triller	*Lalage leucomela*	X*				
black-faced cuckoo-shrike	*Coracina novaehollandiae*	X	X	X	X	
white-bellied cuckoo-shrike	*Coracina papuensis*	X				
cicadabird	*Coracina tenuirostris*	X				
grey butcherbird	*Cracticus torquatus*	X	X	X		
pied butcherbird	*Cracticus nigrogularis*	X*		X	X	
Australian magpie	*Gymnorhina tibicen*	X*	X	X	X	
pied currawong	*Strepera graculina*	X	X	X		
Australian raven	*Corvus coronoides*			X		
Torresian crow	*Corvus orru*	X	X	X	X	
white-winged chough	*Corcorax melanorhamphos*			X		
apostlebird	*Struthidea cinerea*			X		
mistletoe bird	*Dicaeum hirundinaceum*	X**				
welcome swallow	*Hirundo neoxena*	X		X	X	
mistletoebird	*Dicaeum hirundinaceum*			X		
singing bushlark	*Mirafra javanica*			X		
Australian pipit	*Anthus australis*			X		
double-barred finch	*Taeniopygia bichenovii*			X		
Mammals						
echidna	*Tachyglossus aculeatus*			X		
eastern grey kangaroo	*Macropus giganteus*	X	X	X	X	
whiptail wallaby	*Macropus parryi*			X		
red-necked wallaby	*Macropus rufogriseus*			X		
swamp wallaby	*Wallabia bicolor*			X		
squirrel glider	*Petaurus norfolcensis*	X	X			
common brushtail possum	*Trichosurus vulpecula*	X	X		X	
domestic cattle	*Bos taurus*[#]	X		X	X	e
domestic horse	*Equus caballus*[#]	X	X	X	X	e
dog/dingo	*Canis lupus dingo*[#]	X		X	X	e

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Appendix C

Common Name	Scientific Name	LNG Facility [1]	Curtis Island Pipeline	Mainland Pipeline	Curtis Island Incidental Records[2]	Status[3] (NC Act, EPBC Act)
red fox	*Vulpes vulpes*#			X		e
feral pig	*Sus scrofa*#	X	X	X	X	e
feral cat	*Felis catus*#	X				e
rabbit	*Oryctolagus cuniculus*#			X		
water rat	*Hydromys chrysogaster*			X		
yellow-bellied sheath-tailed bat	*Saccolaimus flaviventris*	X	(X)			
northern free-tailed bat	*Chaerephon jobensis*	X	(X)			
Beccari's free-tailed bat	*Mormopterus beccarii*	X	X			
eastern free-tailed bat	*Mormopterus sp.* 2	X	(X)			
Gould's wattled bat	*Chalinolobus gouldii*	X	(X)			
hoary wattled bat	*Chalinolobus nigrogriseus*	X	(X)			
little bent-winged bat	*Miniopterus australis*	X	X			
eastern bent-winged bat	*Miniopterus schreibersii*	X				
unknown long-eared bat	*Nyctophilus sp.*	(X)				
greater broad-nosed bat	*Scoteanax rueppellii*	(X)				
inland broad-nosed bat	*Scotorepens balstoni*	(X)				
little broad-nosed bat	*Scotorepens greyii*	X	X			
white-striped free-tailed bat	*Tadarida australis*		X			
Fish						
mosquitofish	*Gambusia holbrooki*#	X				

Notes for Table C-1

- #: refers to exotic fauna.
- 1: fauna records for the LNG Facility component have been included due to the close proximity of LNG Facility site and pipeline on Curtis Island.
- 2: These incidental records are from Curtis Island away from the LNG Facility or pipeline areas (e.g. at South End).
- 3: Status: V refers to Vulnerable, R refers to Rare as per the NC Act 1992 and EPBC Act 1999.
- (X): Refers to microbats that could not be reliably identified due to poor data quality and/or call similarities between species.
- X*: Refers to species observed during both the intertidal surveys for the Marine Ecology study (June 2008) and the current study.
- X**: Refers to species recorded only during intertidal surveys for the Marine Ecology study (June 2008).