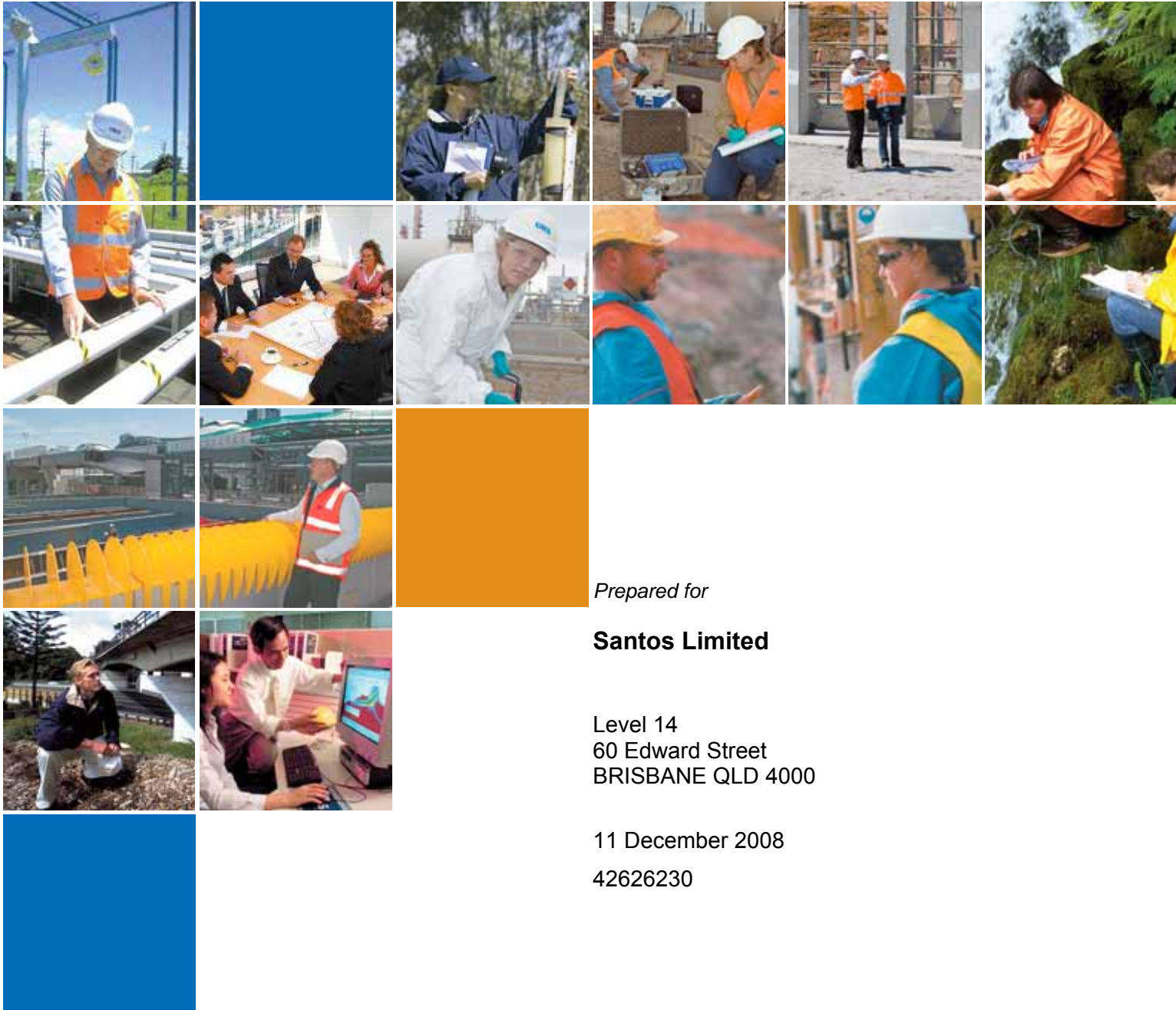


FINAL REPORT

LNG Facility Curtis Island Terrestrial Fauna Report



Prepared for

Santos Limited

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B	Fauna Survey Methodology
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A desktop assessment and terrestrial vertebrate fauna survey were conducted within a designated LNG facility study area on Curtis Island, near Gladstone, central Queensland. This study area comprises the site of the proposed LNG facility and surrounding environment, as detailed in Figure 1. The aim of the fauna assessment was to document the terrestrial 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 LNG facility 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 utilised standard vertebrate sampling techniques within primary habitat types to identify fauna present including significant species identified from the literature review.

Twenty significant species were identified as potentially present within the study area. Of these identified species, the beach stone-curlew (*Esacus neglectus*) was located during the fauna survey within the LNG facility study area.

A total of 81 native and five introduced terrestrial vertebrate species were recorded during the fauna survey. Native species identified include four amphibian, 13 reptile, 67 bird and 12 mammal species. This result is considered to be a relatively depauperate diversity given the habitat opportunities present, the habitat disturbance, with the feral predators as possible causes. Approximately 127 ha of bushland is proposed to be cleared for construction of the LNG Facility. This will result in the removal of habitat features such as arboreal hollows, dense vegetation and fallen timber. A number of potential impacts and mitigation strategies for significant species are discussed. Appropriately managed, the construction will have minimal adverse impacts on the overall biodiversity of the south-western coast of Curtis Island.

2.1 Introduction

A terrestrial fauna survey within the designated LNG facility study area (Figure 1) at the site of the LNG facility at China Bay on Curtis Island was undertaken between 2 and 9 April 2008. The survey was undertaken to assess the ecological values of the proposed LNG facility site and immediate surrounds and to specifically address the objectives described below.

2.2 Study Aim and Objectives

The aim of the survey was to document the terrestrial vertebrate fauna (amphibians, reptiles, mammals and birds) within the LNG Facility study area, with particular reference to the occurrence of endangered, vulnerable, rare or significant fauna. The objectives of the fauna study were to:

- Review existing terrestrial fauna data for the study area and environs;
- Describe the diversity and abundance of amphibians, birds, reptiles and mammals found on the site;
- Identify the presence of conservation significant or poorly known species;
- Identify habitat requirements for conservation significant or noteworthy species;
- Describe the use of areas by migratory birds and terrestrial fauna;
- Identify feral and exotic animals in the study area; and
- Discuss potential impacts and mitigation measures.

2.3 Review of Existing Information

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

- Department of Water, Heritage & the Arts (DE WHA) online Environmental Protection & Biodiversity Conservation (EPBC) Matters of Environmental Significance database;
- Queensland Museum fauna records;
- Queensland Environmental Protection Agency (EPA) Wildnet database;
- Queensland Environmental Protection Agency Essential Habitat mapping;
- Birds Australia records; 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.

Environmental Protection Biodiversity Conservation Act (EPBC) Protected Matters Report:

The Environmental Protection Biodiversity Conservation Act protected matters report search area was centred on point: Latitude: -23.76666S, Longitude: 151.2 E, with a buffer distance of 4 km.

Queensland Museum database:

The search area for the Queensland Museum database was bound by the points: Latitude: -23.42S, Longitude: 151.09E; Latitude: -23.50S, Longitude: 151.16E.

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Wildnet Wildlife Online database

The search area for the Environmental Protection Agency Wildnet database was centred on point: Latitude: -23.4638S, Longitude: 151.1318E.

Essential Habitat Mapping

The search area for the Environmental Protection Agency Essential Habitat mapping was centred on point: Latitude: -23.7836S, Longitude: 151.2155E with a buffer distance of 10 km.

Birds Australia database:

The search area for the birds Australia database was one degree square centred on the point: Latitude: -23.75309S, Longitude: 151.20735E.

2.3.1 Target Species

Significant fauna species and habitat listed under both state and commonwealth legislation were identified from the above sources and targeted for identification during the field survey. A list of identified target species and ecological notes for each are provided in Appendix A. Significant species identified include any Critically Endangered, Endangered, Vulnerable or Rare taxa listed as per:

- 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).

2.4 Survey Methodology

The LNG Facility terrestrial fauna survey was undertaken to fulfil the requirements of the GLNG Terms of Reference.

The primary fauna survey was conducted over an eight-day period between 2 and 9 April 2008. The survey sampled all habitat types within the study area, based on knowledge of the site gained during the desktop assessment and through aerial photograph interpretation. Specific sites were chosen during initial site reconnaissance to allow adequate spatial coverage of the project area and ensure all habitat types were surveyed.

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 streams on the site. Visual inspections of the two small waterbodies on the site were undertaken

Seasonally surveys were undertaken during a period of high rainfall that had followed an extended period of drought (Section 3.3). This survey period was considered the best window of opportunity to capture potential variation of diversity of faunal assemblages on the Island, making use of renewed feeding and habitat resources from rainfall. In particular an increase in activity amongst reptiles, amphibians and ground dwelling mammals would be expected to be seen with a resultant increase in other faunal assemblages due to predator prey

interactions. The other major contributing factor to seasonal variation of faunal assemblages expected for the region is migratory wader bird activity. Migratory wader bird surveys were undertaken during three independent periods in April (URS), June (URS) and December (BAAM) 2008 (Appendix B),

2.4.1 Survey Design

Preliminary identification of vegetation communities and habitat of potential significance within the LNG facility study area was conducted prior to the commencement of fieldwork via interpretation of 1: 7000 colour aerial photography (Aerometrix, 2005); 1: 100 000 Regional Ecosystems mapping Version 5.0 (EPA, 2008a); and 1:100 000 habitat Ecomaps (EPA, 2008b).

Fauna survey transect sites were selected to target and characterise key habitats within the LNG facility study area. Fauna surveys were undertaken in keeping with 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. A detailed aquatic survey was not undertaken due to the prevalent site conditions including the ephemeral nature of the streams present. However an aquatic habitat assessment was conducted to characterise habitat values present.

Surveys were conducted in accordance with the conditions of the following:

- 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.

2.4.2 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 asterisk (*). 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).

2.4.3 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.

Six Elliott trapline transects were placed across the site to sample a variety of vegetation communities/ habitat types and to achieve adequate spatial coverage. 'A' and 'B' Elliott traps were placed at 10-20 m intervals along transects at each survey site (21-23 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 (15 l) 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.

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2.4.4 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 six main sample 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.

2.4.5 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.

2.4.6 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.

2.4.7 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 on four nights at 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.

2.4.8 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 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.

Description of Environmental Values

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3.1 Regional Context

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. Typical landforms on the island include moderate to steep wooded slopes, wooded alluvial plains, intermittent and semi-permanent watercourses, estuarine systems and fresh and saltwater wetlands.

3.2 Site Characteristics

The LNG facility study area is dominated by *Eucalyptus* and *Corymbia* woodlands on moderate to low slopes and alluvial plains. Mangrove and saltmarsh communities are present within intertidal areas. The study site displays impacts consistent with a long history of use that includes grazing, clearing, cropping, and selected timber felling. The presence of agricultural weeds and a history of fire have also impacted upon the ecological values of the site. It appears that much of the woodland is regrowth, however some mature trees are scattered throughout. A number of ephemeral streams, that only flow following sustained rain, drain into China Bay.

3.3 Weather Conditions

The fauna survey of the LNG facility site was undertaken between 2 and 9 April 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 17.3°C and 29.5°C respectively. Relative humidity (recorded daily at 9 am) for the survey period averaged 57.4%. Wind direction was predominantly easterly, changing to south-easterly during the survey period. A total of 0.6 mm rainfall was recorded over the eight days of survey (BoM, 2008a).

Prior to the survey period, Curtis Island experienced unseasonably high rainfall during the month of February 2008 with a total rainfall of 451 mm recorded (BoM, 2008b). Furthermore, within a single day a total of 77.4 mm rainfall was recorded at the Gladstone Radar only four days prior to survey commencement (BoM, 2008c). This rainfall was a dramatic change in anticipated meteorological conditions, as the Curtis coast area had experienced significant long term drought conditions. Rainfall statistics for the region indicate that rainfall had been below average for approximately the past 10 years (BoM, 2008d).

3.4 Survey Results

A total of 81 native and five introduced terrestrial vertebrate species were recorded during the 2008 field survey at the project site. Native species included four amphibian, 13 reptile, 67 bird and 12 mammal species. A complete fauna species list for all taxa identified is provided in Appendix C. This list also includes species observed outside the LNG facility study area site boundary which almost certainly occur at the proposed site of the LNG Facility and elsewhere on the island.

Overall, the fauna diversity on the site was very low. This may be accounted for to some degree by the cooler weather at the time of the survey and the short duration of the survey effort, however many species expected to be present were not detected. These include native and exotic rats and mice and small ground dasyurids such as dunnarts (*Sminthopsis spp.*) and *Antechinus spp.* Further comment on specific faunal groups is provided below.

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Description of Environmental Values

3.4.1 Amphibians

Five amphibians were recorded during the surveys at the LNG facility study area, including one exotic species; the cane toad (*Bufo marinus*). Cane toad activity was high throughout the site at night, especially on tracks or around standing water. Despite this, native frogs were also commonly observed or heard. Overall, amphibian activity on the site was considered to be low due to the cooler night temperatures and a greater diversity would be expected during the warmer months. Given the overall disturbance to the site, it is unlikely that significant frog species would be present. Common frogs expected to be present supplementary to those observed include eastern sedge frog (*Litoria fallax*), emerald spotted treefrog (*Litoria peronii*) and great brown broodfrog (*Pseudophryne major*).

3.4.2 Reptiles

Twelve species of reptile were recorded during the LNG Facility survey, including one monitor (Varanidae), one blind snake (Typhlopidae), one python (Boiidae), two gecko (Gekkonidae), seven skink (Scincidae) and one colubrid (Colubridae) snake species.

Despite the cooler study area experienced, skinks were found in areas of built up leaf litter and grass cover on the LNG Facility. Geckoes such as tree toad (*Gehyra dubia*) and Bynoe's Gecko (*Heteronotia binoei*) were observed sheltering under logs and bark. An additional two snakes were observed beyond the survey area; one elapid (Elapidae) and one colubrid (Colubridae) species. These could also be expected to occur on the subject site.

3.4.3 Birds

Sixty-seven birds were recorded from within the LNG facility study area. Three additional species were recorded from the nearby pipeline alignment. Given the mobility of most species of bird, it is likely that all 70 species recorded during the surveys would utilise both the pipeline and LNG Facility areas. Additional species were recorded from more remote sections of Curtis Island. Birds were recorded from all feeding groups, especially insectivores, nectarivores, marine raptors and shore/ wading birds.

A large diversity of migratory shorebirds was not detected due to the timing of the survey being outside of the migration period (August-November). However, it is recognised that local marine and estuarine wetlands are significant feeding sites for migratory shorebirds. More than 20 species of migratory shorebird have been recorded from central Queensland coastal wetlands (WI, 2006). It is expected that a number of these would utilise the estuarine wetlands of Curtis Island.

3.4.4 Mammals

Twelve species of native mammals were recorded during the survey, indicating the diversity of this group was extremely low. No 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 the common large native mammal observed. Nine species of microbat were positively identified with another three tentatively identified from the LNG Facility study area.

Rodents and dasyurids were not detected during the survey. These groups are especially vulnerable to feral predators and habitat disturbance and also naturally experience population irruptions and crashes. Their absence may primarily be attributed to the historical disturbance and presence of feral cats and wild dogs at the LNG Facility study area.

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3.4.5 Fish

The only fish identified during the survey was the introduced mosquito fish (*Gambusia holbrooki*). All streams encountered during the survey were ephemeral and thus did not support fish. The LNG Facility study area features one constructed farm dam and one natural waterhole. As natural opportunities for population by fish is extremely difficult, it can be assumed that mosquito fish were deliberately released in an effort to locally control mosquitoes. A further description of aquatic habitat is included within Section 3.4.9, below.

3.4.6 Significant Fauna Species

Twenty significant fauna species were identified as potentially present as an outcome of the desktop review of relevant databases (refer to Section 2.3). Of these, one species; the beach stone curlew (*Esacus neglectus*) was recorded at or near the LNG study area. The water mouse (*Xeromys myoides*) may be present although dedicated searches did not locate the mouse or signs of its presence. Notes on all significant species and the likelihood of their presence within the study area are included as Appendix A.

The fauna survey within the LNG facility study area noted the presence of the beach stone curlew (*Esacus neglectus*) at the terrestrial/ saltmarsh interface. The beach stone curlew is listed as Vulnerable under the NC Act. The fauna survey for the adjacent pipeline alignment recorded the presence of the powerful owl (*Ninox strenua*) and glossy black cockatoo (*Calyptorhynchus lathami*), both listed as Vulnerable under the NC Act. While neither was recorded in the LNG Facility study area, there is potential for both species to be utilising habitat and food resources within the LNG facility area.

Essential Habitat Mapping (EPA 2008b) shows habitat mapped for the koala (*Phascolarctos cinereus*) (southern Queensland bioregion) within Regional Ecosystem 12.3.3, identified within and around the LNG Facility site. 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 the 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 or Queensland museum database records for this species on Curtis Island reinforces the likelihood that koalas are not currently active in the area.

3.4.7 Migratory Bird Species

The EPBC Act Protected Matters Report (DEWHA, 2008) sourced for the study site notes nineteen terrestrial, wetland and marine migratory birds that may occur within the area. The list includes eight terrestrial migratory species. The LNG Facility study area does not act as core habitat for any of these species as similar vegetation communities and topography is found elsewhere in the region. Similarly, those wetland migratory species that favour freshwater wetland habitats are unlikely to be reliant on the two small water bodies present in the study area. The three listed migratory marine species reliant on marine wetlands are Latham's snipe (*Gallinago hardwickii*), little curlew (*Numenius minutus*) and little tern (*Sterna albifrons*).

3.4.8 Introduced Species

Domesticated cattle and horses are present throughout the LNG facility study area and surrounds. An obvious impact from grazing practices is the spread of weed infestations typical of pasture situations. One feral cat (*Felis catus*) was observed on the site, as were numerous signs and sightings of pigs, (*Sus scrofa*) and tracks from wild dogs / dingos (*Canis familiaris*) and foxes (*Vulpes vulpes*). Cane toads were abundant throughout the study area. The presence of feral fauna is likely to have had a major impact upon native ground dwelling fauna as indicated by the low trapping results seen from the fauna survey.

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Description of Environmental Values

3.4.9 Habitat Values

The study area primarily supports *Eucalyptus* or *Corymbia* dominated woodlands. Overall habitat values throughout the LNG facility study area have been reduced through a history of grazing and farming activities. Occasional mature habitat trees provide nesting and roosting resources for arboreal mammals, bats and birds. While the grassy woodlands were found to exhibit a relatively high abundance of weed species in the ground cover (refer to flora report). While areas upslope of alluvial plains dominated by spotted gum (*Corymbia citriodora*) had little topsoil in the A horizon and were found to have a lower abundance of weeds in the ground cover. The majority of woodland communities were found to feature a large amount of fallen timber and surface rock suitable for small ground dwelling mammals. Four broad habitat types were determined from the study site as follows:

Riparian and Alluvial Woodland

The low-lying alluvial areas along watercourses support forest red gum (*Eucalyptus tereticornis*) woodland. Extremely dense *Acacia* and *Eucalyptus* regrowth was seen in places acting as functional habitat for small forest birds. Occasional habitat hollows were noted in the more mature trees lining the ephemeral creek lines. Dense growth of groundcover including native grasses and forbs such as spiked sida (*Sida hackettiana*) offer abundant habitat opportunities for reptiles and ground mammals.

Spotted Gum and Ironbark Woodland

Spotted gum (*Corymbia citriodora*) and narrow-leaved ironbark (*Eucalyptus crebra*) woodland is generally found on the slopes and crests of the low hills present at the site and is contiguous with the alluvial woodlands on low-lying ground. The typical tree size, generally < 300mm diameter at Breast height (dbh), indicates that the majority of this woodland type is regrowth and has previously been felled in the past for timber or to improve grazing opportunities. Despite this, occasional habitat hollows and stag trees offer nesting resources for squirrel gliders (*Petaurus norfolcensis*) and other arboreal fauna. The skeletal soils on the hillslopes and ridges generally support lower densities of groundcover. An abundance of fallen timber is an outcome of reduced fire frequency on this portion of Curtis Island. The fallen timber tends to offset low densities of grasses and forbs as ground habitat.

Saltpan and Mangrove Communities

Intertidal and terrestrial habitats converge at the highest astronomical tide (HAT) level at China Bay and Hamilton Point. Saltpan and mangrove communities, whilst significantly different to terrestrial communities, offer extended habitat for avian fauna and migratory wader birds in particular.

Waterbodies and Aquatic Habitat

All waterways within the LNG facility 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 catchment with flows generally ceasing quickly. Isolated pools within the waterways dry up soon after. One constructed farm dam is present in the study area and a natural waterhole is present on the northern side of Hamilton Point. They offer limited habitat for waterbirds due to their size and lack of suitable shoreline habitat. Fish species appear to be limited to the mosquitofish (*Gambusia holbrooki*).

An inventory of the LNG Facility's waterways has been undertaken as part of the G LNG EIS Surface Water Assessment. Appendix A of this assessment describes the physical characteristics of the site's waterways. All watercourses within the LNG Facility study area share similar attributes, summarised below:

Potential Impacts and Mitigation Measures

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- All waterways are ephemeral and are mostly unmodified except for track crossing points;
- A number of small pools were present at the time of the assessment, with water turbid but with no apparent algal growth;
- 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 ephemerality of the watercourses reduces opportunities for aquatic fauna. Therefore it is unlikely that fish would utilise the watercourses upstream of the dams. Amphibians such as the ornate burrowing frog (*Limnodynastes ornatus*) bury into sandy alluvium as they await water flows and would utilise these watercourses. It is unlikely that other aquatic fauna such as turtles would be present.

3.4.10 Habitat Connectivity

The well-vegetated nature of the LNG facility and broader study area currently allows for unrestricted movement for fauna in all directions. The LNG facility study area is enclosed on three sides by continuous native woodland. The western boundary features the littoral zone including saltpan, saltmarsh and mangrove communities. Whilst the marine communities are generally shunned by the majority of terrestrial fauna, some rodents, marsupials and birds will utilise these areas. There is no barrier to movement in this direction apart from habitat preferences amongst the various fauna groups present.

4.1 Potential Impacts

4.1.1 Loss of Habitat

The primary impact on fauna from construction of the LNG facility site is the direct loss of habitat. The development of the LNG infrastructure will initially involve site preparation and clearing. This will result in the removal of habitat features such as trees, shrubs, ground cover, rocks, timber, waterways, wetlands and other features. Impacts to fauna as a result of these measures will include mortality, loss of habitat and breeding areas and the removal of movement opportunities using ecological corridors.

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

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Potential Impacts and Mitigation Measures

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.

4.1.2 Fragmentation and Corridor Loss

The construction of the LNG facility site will reduce opportunities for fauna movement in this part of the island. Whilst there will be prospects for fauna to avoid construction impacts by travelling to the east of the site, this may allow potential for predation or territorial conflict. In addition, the construction of peripheral facilities such as roads will enhance the potential for impacts to fauna as they bypass the LNG facility site.

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.

Edge effects to vegetation communities adjacent to the LNG facility site will result from clearing for construction. The disturbance of soil and increased light levels will enhance the conditions for weed infestations. Reduced buffers to core habitat will result in disturbances to fauna and a further reduction in habitat quality.

4.1.3 Noise and Vibration

Secondary impacts to fauna include disturbance from noise and vibration during facility construction and operation. Fauna will generally move away from the source to avoid these impacts. However, acclimatisation by some species may occur over the long term.

Current research reveals that there are no government policies or other widely-accepted guidelines in respect to the noise levels which may be acceptable to wild life. The levels or character of noise that may "startle" or otherwise affect the feeding or breeding pattern of birds or other wild animals are also not firmly established in the technical literature (Heggies, 2008).

Poole (1982) and Algers *et al* (1978) shows that birds tend to accept and/or adapt to constant steady noise levels, even of a relatively high level (in the order of 70 dBA). Poole (1982) found that continuous exposure to higher noise levels (70 dBA to 85 dBA and above) may cause some degree of behavioural changes in birds (non species-specific).

Sudden loud or impulsive or impact noises are capable of causing birds and other animals to become startled, which if occurring over the longer term, may affect feeding and breeding behaviour in some species. Conversely, there are instances where noise has been used in an attempt to deter flocks of birds (and bats) from various sites including crops, airports and waste disposal sites. The success of such trials has been limited, due possibly to the exposure of these species to common urban or rural noise levels and the more 'domesticated' nature of some of the species. Observations of behaviour patterns also indicate a higher tolerance to intermittent, moderate level noise events such as road traffic.

Interim noise data estimates that noise generated by the LNG facility construction will reach approximately 100 dBA for piling and 80-85 dBA for heavy earthmoving activities at a distance of 100 m (Heggies, 2008). Based on the aforementioned impact levels, it would be expected that construction and piling at the LNG facility site will potentially cause temporary disturbance to wetland and terrestrial birds. This will most likely result in avoidance

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of the area for the duration of these activities. As alternative habitats are available elsewhere, an overall loss of avian diversity as a result of construction will probably not occur. Upon cessation of peak noise levels and construction activity, many, if not all species will resume utilizing wetlands and woodlands around the LNG facility site. Therefore, few long-term impacts are expected.

Impacts to mammals, such as dispersal and avoidance, are also expected from elevated noise levels. However the attenuation provided by terrain and woodlands on the site will tend to reduce the distance at which impacts are felt.

4.1.4 Light

Excessive artificial light during construction and operation of the LNG Facility could potentially deter fauna from using the general area. However it is considered that this is a minor impact compared with elevated noise levels due to the less abrupt nature of the influence. During operation, birds and microbats may benefit from increased levels of food resources as insects become attracted to lights.

4.1.5 Pests

Biting pests such as midges (sandflies) and 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. Appropriate site management is recommended to reduce this possibility. Given that China Bay already supports large numbers of these insects; the proposed works are not expected to aggravate this situation.

Curtis Island currently supports populations of foxes, pigs, feral cats and dogs and cane toads, it is highly unlikely that the proposed works will result in further impacts from the introduction of feral animals.

The introduction of exotic ant fauna is a significant 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, there remains a slight chance of spreading ants to new areas.

4.1.6 Impacts on Environmentally Sensitive Areas

Section 3.4.8 details environmentally sensitive areas such as critical habitats, ecological communities and national park estate in close proximity to the LNG Facility. Apart from Essential Habitat for the koala (*Phascolarctos cinereus*), all environmentally sensitive areas are remote from the proposed LNG facility site. Detail on potential impacts on Koala habitat are outlined in Section 3.4.6.

4.2 Mitigation Measures

4.2.1 Vegetation Clearing

Where native vegetation is to be cleared, the following recommendations are to be developed and implemented under a Site Environmental Management Plan (SEMP) to minimise impacts and ensure current ecological values of habitat are maintained during the construction and operational phases of the project:

- Restrict the amount of vegetation to be cleared to the minimum footprint required and clearly mark vegetation to be retained;
- Retain habitat hollows and other habitat features wherever practicable;

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- Consideration 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;
- Clearing will be undertaken in stages to ensure that isolated stands of vegetation are not created and the connectivity of habitat remains intact to allow for the dispersal of fauna;
- Clearing will be undertaken towards the direction of any adjacent contiguous vegetation that is not to be cleared to ensure connectivity of habitat is not disrupted;
- Clearing near any waterways or riparian areas should include adequate sedimentation fencing to ensure sediment impacts to waterways are restricted; and
- A protocol will be implemented to ensure qualified fauna spotters are actively present during clearing of woodland vegetation and any other areas of faunal habitat.

4.2.2 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;

4.2.3 Light

- Lights used at the operating LNG Facility should, of a minimum power to fulfil safety requirements and should not be directed towards surrounding bushland; and
- Hoods or covers should be used to reduce the amount of light spilling onto these areas.

4.2.4 Pests

- and
- Design and implementation of a long-term feral animal monitoring and control program will assist offsetting impacts from construction and operation of the LNG Facility.
- 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 Santos EHS09 Weed and Pest Animal Control,
- All equipment and materials will be thoroughly inspected for pest animals, especially exotic ants, prior to being shipped to Curtis Island; and
- A thorough wash down procedure should be in place to ensure weed seeds, vegetative material and exotic fauna are not excluded from site;

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4.2.5 Maintenance and Management of Habitat

An Environmental Management Plan (EMP) is to be developed for the proposed LNG Facility that addresses the potential impacts identified above. The EMP also includes 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 LNG facility flora report.

4.3 Conclusion

The fauna survey conducted within the LNG facility study area on Curtis Island found that a relatively low diversity of native fauna was present. Habitat values assessed are degraded from a range of previous impacts to the site including grazing, clearing, cropping, weed infestation, selected timber felling and other human activities. Potential impacts to the current faunal diversity from the LNG facility are expected to be manageable through implementation of appropriate planning and management.

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Section 5

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Figures





0 250m 500m

Scale 1:20 000 (A4)
Datum: MGA Zone 56 (GDA94)

- LNG Facility Study Area
- LNG Facility Site Boundary
- ▲ Survey Site

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<p>Client</p> 	<p>Project</p> <p style="text-align: center;">GLADSTONE LNG PROJECT TERRESTRIAL FAUNA ASSESSMENT CURTIS ISLAND LNG FACILITY SITE</p>	<p>Title</p> <p style="text-align: center;">FAUNA SURVEY LOCATIONS LNG FACILITY SITE STUDY AREA</p>						
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Drawn: CA</td> <td style="width: 33%;">Approved: JB</td> <td style="width: 33%;">Date: 06-11-2008</td> </tr> <tr> <td colspan="2">Job No: 4262 6220</td> <td>File No: 42626220-g-608.wor</td> </tr> </table>	Drawn: CA	Approved: JB	Date: 06-11-2008	Job No: 4262 6220		File No: 42626220-g-608.wor	<p>Figure: 1</p>
Drawn: CA	Approved: JB	Date: 06-11-2008						
Job No: 4262 6220		File No: 42626220-g-608.wor						
		<p>Rev: A</p> <p style="text-align: center;">A4</p>						

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Significant Fauna Species

Appendix A

Table A-1 Significant Fauna Species

Scientific Name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
Birds					
<i>Epthianura crocea macgregori</i> yellow chat (Dawson)	E	CE	Known only from Curtis Island, the Torilla Plain and Fitzroy River delta in central Queensland. On Curtis Island, it occurs in swampy grassland and saline herbland in the north.	The requisite habitat is not found at or near the study site.	BA
<i>Erythrotriorchis radiatus</i> 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 2005). 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).	Curtis Island on the whole may form part of the range of an individual bird or pair of red goshawks. However, vegetation on the proposed plant site does not form core habitat for this species.	DEWHA
<i>Esacus neglectus</i> beach stone- curlew	V	M	Considered vulnerable due to coastal disturbance; only secure in remote parts of the north coast of the country.	The species was observed within the study site.	EPA (i), BA

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Significant Fauna Species

Scientific Name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
<i>Geophaps scripta</i> squatter pigeon, southern form	V	V	The squatter pigeon is listed as 'Vulnerable' under the Queensland <i>NC Act 2002</i> and the Commonwealth <i>EPBC Act 1999</i> . 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 not recorded during the survey. There is suitable habitat present.	DEWHA, BA
<i>Haematopus fuliginosus</i> 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).	A pair was observed overflying the township of South End, approximately 10 km to the east of the study site. The habitat present at the study site may not be utilised by this species.	EPA (i)
<i>Lophoictinia isura</i> square-tailed kite	R	-	Eucalypt forest and woodlands, not generally encountered in more open habitats.	Not observed on Curtis Island. This species may be an occasional visitor from the mainland.	BA

Significant Fauna Species

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Scientific Name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
<i>Macronectes giganteus</i> 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).	Curtis Island does not form part of the breeding or feeding range of the southern giant-petrel.	DEWHA
<i>Nettapus coromandelianus</i> cotton pygmy- goose	R	M	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).	Whilst one small dam is found on the subject site, specific habitat requirements are not met and it is highly unlikely the species would be present.	BA
<i>Pterodroma neglecta neglecta</i> 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".	Curtis Island does not form part of the Kermadec petrel's feeding or nesting range and it is highly unlikely that it would even be an accidental visitor to the Island.	DEWHA
<i>Rallus pectoralis</i> 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.	Suitable habitat is not present at the proposed plant site.	BA

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Significant Fauna Species

Scientific Name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
<i>Rostratula australis</i> 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).	The species' requirement for tall reeds is not fulfilled on the site and at best, the Australian painted snipe may only be an occasional visitor to the project area.	DEWHA
<i>Sterna albifrons</i> little tern	E	M	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).	May be expected to utilise waters in the locality the project site.	BA
<i>Tadorna radjah</i> radjah shelduck	R	M	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.	BA

Significant Fauna Species

Appendix A

Scientific Name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
<i>Turnix melanogaster</i> 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 2008). 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 exists in the vicinity of the proposed LNG site to support the black-breasted button-quail. However grazing and other disturbances caused by cattle, horses and feral pigs, as found within the study area, may contribute to a preference by the species for more secure sites.	DEWHA, BA
Mammals					
<i>Phascolarctos cinereus</i> 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, <i>E. fibrosa</i> , <i>E. propinqua</i> ; <i>E. umbra</i> , <i>E. grandis</i> , <i>E. microcorys</i> , <i>E. tindaliae</i> , <i>E. resinifera</i> , <i>E. populnea</i> ; <i>E. robusta</i> , <i>E. nigra</i> , <i>E. signata</i>) (EPA 2008).	Suitable potential habitat is present at the study site.	EPA (ii)

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Significant Fauna Species

Scientific Name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
<i>Chalinolobus dwyeri</i> large-eared pied bat	R	V	It seems this species will occur in most vegetation types provided there are caves or tunnels in which it can roost. Daytime roosts are listed as caves, abandoned mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins (Ayers <i>et al.</i> 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. Isolated records have also been obtained from sub-alpine woodland above 1500m and at the edge of rainforest.	Suitable roosting habitat is not present within the study area. Individuals may forage across the island.	DEWHA
<i>Dasyurus hallucatus</i> 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).	Considering the habitat alteration and disturbance to the Curtis site, there is a low probability that the northern quoll is present	DEWHA
<i>Xeromys myoides</i> 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.	The water mouse may be present within or adjacent to the subject site.	DEWHA

Significant Fauna Species

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Scientific Name Common Name	NC Act Status	EPBC Act Status	Distribution/Habitat	Likelihood of presence	Source
Reptiles					
<i>Egernia rugosa</i> yakka skink	V	V	Usually found in open dry sclerophyll forest or woodland, often taking refuge among dense ground vegetation, hollow logs, and cavities in soil-bound root systems of fallen trees and beneath rocks. Alternatively, skinks may also excavate burrow systems among low vegetation.	The yakka skink may be present within the subject site.	DEWHA
<i>Paradelma orientalis</i> brigalow scaly-foot	V	V	Occurs on sandstone ridges in woodlands and vine thickets, and in open forests.	The brigalow scaly-foot has been recorded from Boyne Island and may be present within the study site.	DEWHA

Key to Table A-1

Key to Sources:

- DEWHA – Department of Water, Environment, Heritage and the Arts EPBC Act Protected Matters Report
- BA – Birds Australia database
- 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 (-).

Appendix A

Significant Fauna Species

The LNG Facility terrestrial fauna survey was undertaken to fulfil the requirements of the GLNG Terms of Reference.

The survey was conducted over an eight-day period between 2 and 9 April 2008. The survey sampled all habitat types within the study area, based on knowledge of the site gained during the desktop assessment and through aerial photograph interpretation. Specific sites were chosen during initial site reconnaissance to allow adequate spatial coverage of the project area and ensure all habitat types were surveyed.

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 streams on the site. Visual inspections of the two waterbodies on the site revealed the presence of Mosquitofish (*Gambusia holbrooki*) only.

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 asterisk (*). Field references used for the identification and description of fauna species include Allen et al (2002), Churchill (1998), Cogger (2000), Menkhurst and Knight (2001), Morecombe (2004), Robinson (1998), Simpson and Day (2004), Strahan (2008), Triggs (2004) and Wilson (2005).

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.

Six Elliott trapline transects were placed across the site to sample a variety of vegetation communities/ habitat types and to achieve adequate spatial coverage. 'A' and 'B' Elliott traps were placed at 10-20 m intervals along transects at each survey site (21-23 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 (15 l) 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.

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 six main sample 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.

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.

Significant Fauna Species

Appendix A

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.

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 on four nights at 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.

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 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.

Appendix B

Fauna Survey Methodology

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
C01 031	8860 7368407	20 2		3	66 12		Woodland 15-20 m of <i>E. tereticornis</i> with midstory (5-10m) of <i>Acacia</i> spp. Grassy understory to 1 m high, dense. Ground cover of leaf litter, fallen logs, Soils alluvial – loam. Dense Sida. Fire scars 2-5 years old. Presence of horses, cattle.
C02 031	8133 7368727	20	2	3	66	12	Mid high open forest dominated by <i>E. crebra</i> on stony slope adjacent to marine flats. Mangroves 150 m away. Grassy understory, hollow limbs sparse. Ground stony/gravel. Fire scars 2-5 years old. Horses/cattle present. Sparse fallen branches present.
C03 031	7394 7369409	20	1	3	63	12	Tall (>20 m) open forest of <i>E. tereticornis</i> . Medium-dense understory of shrubs (to 1.5 m) and tussock grasses. Fire scars indicate fire 2-5 years ago. Hollows small, sparse trees mainly immature. Ground cover – fallen trees, limbs. Soils sandy clay. Horses/cattle present.

Fauna Survey Methodology

Appendix B

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
C04 031	9159 7368859	20	1	3	63	12	Mid-high (10-15m) woodland/ open forest of <i>Corymbia citriodora</i> and <i>E. crebra</i> . Dense <i>Acacia</i> forms a mid layer of closed forest in patches on the ridge. Understory of tussock grasses. Gravelly soil with minor rock outcroppings. Rock size <0.5 m. Tree hollows scarce. Ground cover of fallen branches, rocks, tussocks. No recent fires (>5 years). Disturbed by horses.
C05 031	7935 7368125	20	1	3	63	12	Coastal vine thicket – low closed mixed forest to 8 m. Understorey sparse, tussock grassy. Occasional Eucalypts. Ground cover – leaf litter, flotsam, fallen branches. Soil gravelly/sand. No fire scars present. Permanent waterhole <50 m away. Horse, cattle, pig presence. Few hollows.
C06 318	141 7368967	22	1	3	69	12	Mid-high to 20 m woodland dominated by <i>E. crebra</i> / <i>C. citriodora</i> . Understory of tussock grass. Ground cover of leaf litter, fallen logs etc. Stony skeletal soils on top of ridge. Small stones on surface. Fires within last 2 years. Area disturbed from old sawmill. Few hollows, none large.

Appendix B**Fauna 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
Totals		122 8		18	390 72		

LNG Facility Fauna Species

Appendix C

Table C-2 LNG Facility Fauna Species

Common Name	Scientific Name	LNG Facility	Curtis Island Pipeline ¹	Incidental Records ²	Status ³
Amphibians					
cane toad	<i>Bufo marinus</i>	X X		X	e
green tree frog	<i>Litoria caerulea</i>	X			
desert tree frog	<i>Litoria rubella</i>	X		X	
ornate burrowing frog	<i>Limnodynastes ornatus</i>	X			
northern banjo frog	<i>Limnodynastes terrareginae</i>	X			
Reptiles					
tree dtella	<i>Gehyra dubia</i>	X X		X	
Bynoe's gecko	<i>Heteronotia binoei</i>	X X			
jewel skink	<i>Carlia munda</i>	X			
jewel skink	<i>Carlia pectoralis</i>	X			
jewel skink	<i>Carlia schmeltzii</i>	X			
wall skink	<i>Cryptoblepharus virgatus</i>	X X			
copper-tailed skink	<i>Ctenotus taeniolatus</i>	X			
eastern grass skink	<i>Lampropholus delicata</i>	X X			
skink	<i>Menetia timlowi</i>	X			
freckled monitor	<i>Varanus tristis</i>	X			

Appendix C

LNG Facility Fauna Species

Common Name	Scientific Name	LNG Facility	Curtis Island Pipeline ¹	Incidental Records ²	Status ³
blind snake	<i>Ramphotyphlops</i> sp.	X			
spotted python	<i>Antaresia maculosa</i>	X			
common tree snake	<i>Dendrelaphus punctulatus</i>	X X			
brown tree snake	<i>Boiga irregularis</i>			X	
red-bellied black snake	<i>Pseudechis porphyriacus</i>			X	
Birds					
brown quail	<i>Coturnix ypsilophora</i>	X			
pacific black duck	<i>Anas superciliosa</i>	X			
great egret	<i>Ardea alba</i>	X**			
intermediate egret	<i>Ardea intermedia</i>	X			
piebald cormorant	<i>Phalacrocorax varius</i>	X* X			
white-faced heron	<i>Egretta novaehollandiae</i>	X*			
osprey	<i>Pandion haliaetus</i>	X X		X	
Brahminy kite	<i>Haliastur indus</i>	X* X		X	
whistling kite	<i>Haliastur sphenurus</i>	X X		X	
wedge-tailed eagle	<i>Aquila audax</i>			X	
white-bellied sea-eagle	<i>Haliaeetus leucogaster</i>	X* X			
pacific baza	<i>Aviceda subcristata</i>	X* X			

LNG Facility Fauna Species

Appendix C

Common Name	Scientific Name	LNG Facility	Curtis Island Pipeline ¹	Incidental Records ²	Status ³
whimbrel	<i>Numenius phaeopus</i>	X*		X	
bush stone-curlew	<i>Burhinus grallarius</i>	X X		X	
beach stone-curlew	<i>Esacus neglectus</i>	X*			V
pieb oystercatcher	<i>Haematopus longirostris</i>	X*			
sooty oystercatcher	<i>Haematopus fuliginosus</i>	X		X	R
red-capped plover	<i>Charadrius ruficapillus</i>	X**			
masked lapwing	<i>Vanellus miles</i>	X* X			
banded lapwing	<i>Vanellus tricolor</i>			X	
silver gull	<i>Larus novaehollandiae</i>	X* X		X	
crested tern	<i>Sterna bergii</i>	X**			
Caspian tern	<i>Sterna caspia</i>	X**			
gull-billed tern	<i>Sterna nilotica</i>	X**		X	
peaceful dove	<i>Geopelia striata</i>	X* X		X	
bar-shouldered dove	<i>Geopelia humeralis</i>	X* X			
red-tailed black-cockatoo	<i>Calyptorhynchus banksii</i>	X			
glossy black cockatoo	<i>Calyptorhynchus lathami</i>	X			V
rainbow lorikeet	<i>Trichoglossus haematodus</i>	X X		X	

Appendix C

LNG Facility Fauna Species

Common Name	Scientific Name	LNG Facility	Curtis Island Pipeline ¹	Incidental Records ²	Status ³
little lorikeet	<i>Glossopsitta pusilla</i>	X			
pale-headed rosella	<i>Platycercus adscitus</i>	X X		X	
fan-tailed cuckoo	<i>Cacomantis flabelliformis</i>	X			
little bronze-cuckoo	<i>Chrysococcyx minutillus</i>	X**			
pheasant coucal	<i>Centropus phasianinus</i>	X* X		X	
powerful owl	<i>Ninox strenua</i>	X			V
barking owl	<i>Ninox connivens</i>	X X			
laughing kookaburra	<i>Dacelo novaeguineae</i>	X* X		X	
blue-winged kookaburra	<i>Dacelo leachii</i>	X			
forest kingfisher	<i>Todiramphus macleayii</i>	X X			
collared kingfisher	<i>Todiramphus chloris</i>	X**			
sacred kingfisher	<i>Todiramphus sanctus</i>	X* X			
rainbow bee-eater	<i>Merops ornatus</i>	X* X		X	
striated pardalote	<i>Pardalotus striatus</i>	X* X		X	
mangrove gerygone	<i>Gerygone levigaster</i>	X**			
white-throated gerygone	<i>Gerygone olivacea</i>	X X			
helmeted friarbird	<i>Philemon buceroides</i>	X**			
noisy friarbird	<i>Philemon corniculatus</i>	X X		X	

LNG Facility Fauna Species

Appendix C

Common Name	Scientific Name	LNG Facility	Curtis Island Pipeline ¹	Incidental Records ²	Status ³
little friarbird	<i>Philemon citreogularis</i>	X			
noisy miner	<i>Manorina melanocephala</i>	X X		X	
blue-faced honeyeater	<i>Entomyzon cyanotis</i>	X X		X	
Mangrove honeyeater	<i>Lichenostomus virescens</i>	X**			
brown honeyeater	<i>Lichmera indistincta</i>	X* X		X	
white-throated honeyeater	<i>Melithreptus albogularis</i>	X X			
Leaden flycatcher	<i>Myiagra rubecola</i>	X**			
satin flycatcher	<i>Myiagra cyanoleuca</i>	X X			
shining flycatcher	<i>Myiagra alecto</i>	X**			
grey fantail	<i>Rhipidura fuliginosa</i>	X* X			
willy wagtail	<i>Rhipidura leucophrys</i>	X* X		X	
spangled drongo	<i>Dicrurus bracteatus</i>	X* X		X	
rufous whistler	<i>Pachycephala rufiventris</i>	X* X			
little shrike-thrush	<i>Colluricincla megarhyncha</i>	X**			
varied triller	<i>Lalage leucomela</i>	X*			
black-faced cuckoo-shrike	<i>Coracina novaehollandiae</i>	X X		X	
white-bellied cuckoo-shrike	<i>Coracina papuensis</i>	X			

Appendix C

LNG Facility Fauna Species

Common Name	Scientific Name	LNG Facility	Curtis Island Pipeline ¹	Incidental Records ²	Status ³
cidabird	<i>Coracina tenuirostris</i>	X			
grey butcherbird	<i>Cracticus torquatus</i>	X X			
piebald butcherbird	<i>Cracticus nigrogularis</i>	X*		X	
Australian magpie	<i>Gymnorhina tibicen</i>	X* X		X	
piebald currawong	<i>Strepera graculina</i>	X X			
Torresian crow	<i>Corvus orru</i>	X X		X	
mistletoe bird	<i>Dicaeum hirundinaceum</i>	X**			
welcome swallow	<i>Hirundo neoxena</i>	X		X	
Mammals					
eastern grey kangaroo	<i>Macropus giganteus</i>	X X		X	
squirrel glider	<i>Petaurus norfolcensis</i>	X X			
common brushtail possum	<i>Trichosurus vulpecula</i>	X X		X	
domestic cattle	<i>Bos taurus</i>	X		X	e
domestic horse	<i>Equus caballus</i>	X X		X	e
dog/dingo	<i>Canis lupus dingo</i>	X		X	e
feral pig	<i>Sus scrofa</i>	X X		X	e
yellow-bellied sheath-tailed bat	<i>Saccolaimus flaviventris</i>	X (X)		
northern free-tailed bat	<i>Chaerephon jobensis</i>	X (X)		
Beccari's free-tailed bat	<i>Mormopterus beccarii</i>	X X			

LNG Facility Fauna Species

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Common Name	Scientific Name	LNG Facility	Curtis Island Pipeline ¹	Incidental Records ²	Status ³
eastern free-tailed bat	<i>Mormopterus sp. 2</i>	X	(X)		
Gould's wattled bat	<i>Chalinolobus gouldii</i>	X (X)		
hoary wattled bat	<i>Chalinolobus nigrogriseus</i>	X (X)		
little bent-winged bat	<i>Miniopterus australis</i>	X X			
eastern bent-winged bat	<i>Miniopterus schreibersii</i>	X			
unknown long-eared bat	<i>Nyctophilus sp.</i>	(X)			
greater broad-nosed bat	<i>Scoteanax rueppellii</i>	(X)			
inland broad-nosed bat	<i>Scotorepens balstoni</i>	(X)			
little broad-nosed bat	<i>Scotorepens greyii</i>	X X			
white-striped free-tailed bat	<i>Tadarida australis</i>	X			
Fish					
Mosquitofish	<i>Gambusia holbrooki</i>	X			

Notes for Table C-1

- 1: Fauna records for the pipeline 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: e refers to exotic fauna; V refers to Vulnerable, R refers to Rare as per the NC Act 1992.
- (X): Refers to microbats that could not be reliably identified due to poor data quality and/or call similarities between species.
- X*: Wader bird species observed during URS terrestrial fauna survey April 2008 and marine ecology intertidal surveys June 2008
- X**: Wader bird species recorded during marine ecology intertidal surveys June 2008)