

# **Australia Pacific LNG Project Supplemental information to the EIS**

## **Terrestrial Ecology Additional Surveys and Targeted Flora Searches - Pipeline**



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## Contents

1.	Introduction .....	1
1.1	Background .....	1
1.2	Scope of Works.....	1
2.	Methodology.....	3
2.1	Flora Assessment .....	3
2.1.1	Determination of Significance Level.....	3
2.1.2	Desktop Review and Previous Study Interpretation.....	4
2.1.3	Targeted Flora Searches .....	5
2.1.4	Flora Field Surveys .....	6
2.1.5	Interpretation and documentation .....	6
2.2	Fauna Assessment .....	7
2.2.1	Determination of Significance Level.....	7
2.2.2	Desktop Review and Previous Study Interpretation.....	7
2.2.3	Fauna Field Assessment – GSDA and Kangaroo Is wetlands .....	8
2.2.4	Interpretation and documentation .....	8
3.	Results – Flora .....	14
3.1	<i>Nature Conservation (Wildlife) Regulation 2006</i> Amendments .....	14
3.2	Additional Flora Surveys .....	15
3.2.1	Surveys of the Gladstone State Development Area and Kangaroo Island wetlands .....	15
3.3	Targeted Threatened Flora Searches.....	19
3.3.1	Rockybar and Fairylands .....	19
3.3.2	Callide Range and Calliope Range .....	19
3.3.3	Vine thicket environments of the Gladstone State Development Area .....	20
4.	Results – Fauna .....	24
4.1	<i>Nature Conservation (Wildlife) Regulation 2006</i> Amendments .....	24
4.2	Fauna Assessment of the GSDA and Kangaroo Is wetlands .....	25
4.2.1	Fauna species recorded.....	25
4.2.2	Fauna habitats.....	25
4.2.3	Essential Habitat .....	26

4.2.4	Migratory Shorebirds .....	26
5.	Potential Impacts.....	29
5.1	Potential Impacts on Flora .....	29
5.1.1	Measures to Avoid Reduce and Offset Impacts.....	33
5.2	Potential Impacts on Fauna .....	38
5.2.1	Potential Impacts on Fauna in General.....	38
5.2.2	Potential Impacts on Migratory Shorebirds .....	38
	Mitigation measures .....	39
6.	References .....	41

## Figures

Figure 1	Rockybar and Fairyland Targeted Flora Searches .....	9
Figure 2	Callide Range and Calliope Range Targeted Flora Searches.....	10
Figure 3	Semi-evergreen Vine Thicket Regrowth North of Gladstone Targeted Flora Searches.....	11
Figure 4	Additional Flora Survey Locations.....	12
Figure 5	Additional Fauna Survey Locations.....	13
Figure 6	The locations of the endangered large-fruited zamia palm ( <i>Cycas megacarpa</i> ) .....	21
Figure 7	The location of the vulnerable Pedley's wattle ( <i>Acacia pedleyi</i> ) .....	22
Figure 8	The location of the wedge-leaf tuckeroo ( <i>Cupaniopsis shirleyana</i> ) .....	23

## Tables

Table 1	<i>Nature Conservation (Wildlife) Regulation 2006</i> Amendments for Flora .....	14
Table 2	Locations of remnant vegetation transected by the alignment within the GSDA and Kangaroo Is wetlands.....	17
Table 3	Locations of Regulated Regrowth transected by the alignment within the GSDA .....	18
Table 4	Declared plants observed along the proposed alignment.....	19
Table 5	<i>Nature Conservation (Wildlife) Regulation 2006</i> Amendments for Fauna .....	24
Table 6	Remnant fauna habitat transected by the alignment within the GSDA and the Kangaroo Is wetlands.....	26
Table 7	Migratory shorebirds recorded in the Friend Point / Kangaroo Is wetlands / Narrows area during recent surveys .....	28
Table 8	Proposed remnant vegetation impacts on the pipeline right of way within the GSDA and the Kangaroo Is wetlands .....	29



Table 9 Potential impacts and mitigation measures for EVR flora species and threatened ecological communities .....	35
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## Appendices

Appendix 1	Fauna Field Site
Appendix 2	Flora Survey Proformas
Appendix 3	Fauna Species Recorded During Field Assessment
Appendix 4	Migratory Shorebirds

# 1. Introduction

## 1.1 Background

WorleyParsons has been commissioned by Australia Pacific LNG Pty Ltd (Australia Pacific LNG) to undertake this terrestrial flora and fauna assessment to support the Environmental Impact Statement for the proposed construction of the Project's gas transmission pipeline as part of the Australia Pacific LNG Project.

The proposed pipeline will be approximately 450km in length and run from gas fields in the Darling Downs to a proposed liquefied natural gas (LNG) plant on Curtis Island, near Gladstone in central Queensland. This alignment will require a clearing corridor width of up to 40m with additional areas possibly required either side of crossings.

The flora and fauna assessment targeted the identification of known threatened flora and fauna species and vegetation communities as listed under the Australian Government *Environment Protection and Biodiversity Act 1999* (EPBC Act), the Queensland *Nature Conservation Act 1992* (NC Act) and the *Vegetation Management Act 1999* (VMA). The assessment also considered regionally significant species and common and general flora and fauna values.

This report has been written to provide supplementary information to support the main terrestrial ecology report *Volume 5: Attachments to EIS - Attachment 15: Terrestrial Ecology – Pipeline*. This supplementary report focuses on identified knowledge gaps, sensitive ecological areas, known and targeted threatened flora species and the recommendations made in the initial report. Where additional information has been made available, for example the identification of an additional threatened species, details of the identification are discussed in this report. However, if the relevant information for a particular species or community is unchanged from the original report then it is not discussed here. Therefore this report should be read in conjunction with the original report *Volume 5: Attachments to EIS - Attachment 15: Terrestrial Ecology – Pipeline*.

## 1.2 Scope of Works

The scope of each of these items was developed to target known sensitive areas/species and knowledge gaps identified in the previous reports. Each of the separate items of work conducted as part of this assessment is discussed below:

- Rockybar targeted threatened flora survey – the scope of this study targeted flora species in the vicinity of the alignment within the broad corridor of remnant vegetation linking Expedition, Palmgrove, Isla Gorge and Precipice national parks to a number of state forests including Rockybar SF, Borania SF and Camboon SF
- Callide Range and Calliope Range targeted threatened flora survey – the scope of this study was to identify and locate populations of the endangered cycad large-fruited zamia palm (*Cycas megacarpa*) and the vulnerable Pedley's wattle (*Acacia pedleyi*) on or in close proximity to the alignment
- Semi-evergreen vine thickets (SEVT) of the Gladstone State Development Area (GSDA) – the scope targeted flora species located within the highly disturbed patches of SEVT regrowth traversed by the pipeline within the GSDA

- Flora and fauna Investigations of the Gladstone State Development Area – identify and groundtruth the key flora and fauna values of the proposed alignment and the wider study area
- Flora and fauna investigations of Port Curtis and the Narrows – identify and groundtruth the key flora and fauna values of the proposed alignment and the wider study area within the sensitive intertidal habitat surrounding the crossing from the mainland to Curtis Island
- Update the conservation status of threatened flora and fauna species following the legislative amendments to the *Nature Conservation (Wildlife) Regulation 2006* which were introduced on 21 May 2010

## 2. Methodology

### 2.1 Flora Assessment

#### 2.1.1 Determination of Significance Level

##### **Ecological Communities and Regional Ecosystems**

Significant ecological communities and Regional Ecosystems (REs) are those listed under the EPBC Act as critically endangered, endangered or vulnerable and/or under the VMA as endangered, of concern or least concern. High Quality Regulated Regrowth vegetation is defined as that listed under the VMA as endangered, of concern or least concern regrowth and significant wetlands include those wetlands listed under the Ramsar convention (of international significance) or within the Directory of Important Wetlands (of national significance). Throughout this assessment the location and extent of REs was determined using Version 6.0 of the RE mapping and the conservation status and description of the REs was determined using Version 6.0 of the Regional Ecosystem Description Database (REDD).

At Threshold REs include those REs considered at risk of falling into a higher conservation status if clearing continues and are listed under the Regional Vegetation Management Code for South-east Queensland Bioregions and/or the Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions (DERM 2009a, DERM 2009b). Regrowth Vegetation refers to high value regrowth as described under the VMA.

##### **Conservation Significant Species**

Threatened flora species include those taxa listed under the EPBC Act and/or NC Act as critically endangered, endangered or vulnerable. Near threatened species are those listed under the NC Act as “near threatened”.

Regionally significant flora are defined as those taxa not listed as threatened or near threatened species under the EPBC Act and/or NC Act, but that have been identified under a non-statutory conservation agreement as having restricted or disjunct geographical distributions or being at the extent of their geographical distribution, rare or poorly known species, poorly conserved species or species with small population sizes (Briggs and Leigh 1995, EPA 2006a, EPA 2006b, EPA 2006c).

Flora species of other conservation significance include those taxa not listed as threatened, near threatened or Regionally significant species but are afforded protection under a State or Local Government Area permit or species considered of cultural (ANBG 2009; Aboriginal Art Online 2009; Borsboom 2005; Cribb and Cribb 1981; Cribb and Cribb 1974; Kamminga 2002; Lance 1982; Lassak and McCarthy 1983; Low 1989; McDonald et al. 2001), commercial (QDPI 2009) and recreational significance (EPA 2003).

Species listed under the DERM Back on Track species prioritisation framework (DERM 2008) have also been recognised.

All other native flora species are designated as Common.



## Weed Species

The Australian Weeds Strategy (NRMMC 2006) identifies priorities for weed management across the nation with the aim of minimising the impact of weeds on Australia's environmental, economic and social assets.

As part of this strategy, a list of nationally-agreed priority plant species (Weeds of National Significance) has been selected for control and management. Species have been selected according to high rankings for invasiveness, potential to spread and impact to socioeconomic and environmental assets.

The Queensland *Land Protection (Pest and Stock Route Management) Act 2002* also identifies target weed species that have, or may potentially have, a serious economic, environmental or social impact. Declared plants are classified into three management priorities, based upon their current extent and potential to spread, including:

- Class 1 plants - weed species that are not commonly present in Queensland and, if introduced, would cause an adverse economic, environmental or social impact. Current infestations in Queensland are subject to eradication from the state and landowners must take reasonable steps to keep their land free of these species
- Class 2 plants - weed species that are established in Queensland and have, or could have an adverse economic, environmental or social impact. Landowners must take reasonable steps to keep their land free of Class 2 plants
- Class 3 plants - considered established in Queensland and have, or could potentially have, an economic, environmental or social impact. The primary objective of this listing is to prevent the sale (and therefore spread) of these pests into new areas. Landholders are not required to control these species unless their land is adjacent to an environmentally significant area

Weeds of National Significance and declared plants of Queensland are considered significant weed species. All other non-native species are considered environmental weed species.

### 2.1.2 Desktop Review and Previous Study Interpretation

A desktop review was undertaken to identify the key flora and vegetation values of the wider study area and the likelihood of these values occurring within the project area as part of the main terrestrial ecology report *Volume 5: Attachments to EIS - Attachment 15: Terrestrial Ecology – Pipeline*. This review included the following:

- Review of the DERM RE (Version 6.0) and Regulated Regrowth Vegetation mapping (Version 2.0) and the RE description database (Version 6.0 November 2009) to identify vegetation communities mapped within the wider study area
- Review of satellite imagery to identify vegetation patterns and key investigation areas and gain an appreciation of the proximity of the proposed project area to sensitive areas
- Review of the DERM Essential Habitat, Queensland Wetland and Environmentally Sensitive Area mapping to identify key ecological values of the wider study area including important habitat areas for EVR flora species, wetlands, marine plant populations, high biodiversity areas and nature refuges

- Review of the Directory of Important Wetlands database to identify nationally important wetlands within the wider study area (Blackman et al. 1999)
- Review of the DEWHA Protected Matters Search Tool to identify all matters of National environmental significance (NES) within the wider study area including Ramsar-listed wetlands, critical habitat areas, threatened ecological communities and flora species and other matters, including conservation areas such as National Parks
- Review of the Queensland Herbarium flora collection records (HERBRECS) and DERM Wildlife Online databases to identify all flora species of conservation significance known or likely to occur within the wider study area
- Review of current plant literature to identify species of other conservation value, including species of cultural, commercial and recreational significance
- Review of the DEEDI Biosecurity Queensland's Annual Pest Distribution Survey mapping to identify significant non-native species known or likely to occur within or adjacent to the project area
- Review of previous studies undertaken within the vicinity of the proposed pipeline, primarily related to the development of other LNG projects within the broader study area (AECOM 2009, Boobook 2009, Shell Australia 2009; Unidel 2009; URS 2009a, URS 2009b)

In addition to the original desktop review the results of the initial EIS were used to identify known knowledge gaps, establish where additional studies should be conducted and determine the likelihood of key flora values occurring within the proposed project site.

### 2.1.3 Targeted Flora Searches

A targeted threatened flora survey was undertaken by WorleyParsons' botanists over eight days from 4-14 May 2010. Weather conditions over the survey period were typical for the dry season in this region, with temperature ranging between 4.2 – 31.4 degrees Celsius. Average relative humidity was 61%. Wind varied in direction and was moderate to fresh. No significant rainfall events were recorded in the survey area during the study period (BOM, 2010).

The survey involved a detailed walk through of three previously identified significant ecological areas, to detect the presence and approximate densities of threatened flora species along the proposed 3H alignment option. These areas are discussed separately below.

#### **Rockybar and Fairylands**

Approximately 15 km of the alignment through the Sandstone Belt (KPs 90–105) was surveyed. This area is known to contain populations of threatened and near threatened flora species such as small-flowered polianthion (*Polianthion minutiflorum*, recorded during preliminary surveys for the pipeline), Isla Gorge mahogany (*Eucalyptus rubiginosa*), pumpkin gum (*Eucalyptus pachycalyx*) and Cracow wattle (*Acacia calantha*). The Sandstone Belt also provides potential habitat for populations of the vulnerable shiny-leaf ironbark (*Eucalyptus virens*). Seven sites were assessed along this section during field surveys undertaken for the EIS, but a detailed survey along the alignment was not carried out. Targeted flora surveys were conducted along the alignment to determine if any of these species are present in the vicinity of the alignment. The area traversed for the Rockybar and Fairylands targeted surveys is shown in Figure 1.

### **Callide and Calliope Range**

Two sections of the alignment comprising approximately 18 km through the Callide (KPs 256–272) and Calliope Ranges (KP 281.5–282.1) were surveyed. During field surveys undertaken for the EIS the endangered large-fruited zamia palm (*Cycas megacarpa*) was recorded at 10 locations along Callide Range between KPs 260–272.2, with more than 100 individuals observed within the vicinity of the proposed alignment. This species has also been recorded close to the location where the alignment crosses the Calliope Range (AECOM 2009). The vulnerable Pedley's wattle (*Acacia pedleyi*) was also recorded along the alignment on the Callide Range between KPs 257–258. Targeted surveys were conducted to determine the extent of these two species along the alignment, and to determine the number of individuals on or in close proximity to the RoW. The area traversed for the Callide Range and Calliope Range targeted surveys is shown in Figure 2.

### **Semi-evergreen Vine Thicket Regrowth North of Gladstone**

Approximately 7.5km of the alignment dominated by open grazed paddocks and SEVT regrowth was surveyed within the GSDA, east of the Bruce Highway (KPs 341.5 – 348.5). Areas of SEVT in this vicinity are known to be habitat for many threatened flora including the Yarwun whitewood (*Atalaya collina*), Wedge-leaf tuckeroo (*Cupaniopsis shirleyana*) and Smooth-barked bonewood (*Macopteranthes leiocaulis*). Targeted flora surveys were conducted along the alignment to determine if any of these species are present in the vicinity of the alignment. The area traversed for the SEVT regrowth north of Gladstone targeted surveys is shown in Figure 3.

## **2.1.4 Flora Field Surveys**

The initial flora field study of the pipeline alignment was undertaken by WorleyParsons' botanists during two separate periods from 26 September – 6 October and 15 October – 30 October 2009. An additional flora field survey of the GSDA and the Kangaroo Island intertidal wetlands (Bruce Highway to Friend Point, KPs 327.5 – 355.3) was conducted between 11– 14 May 2010. This section of the alignment was not surveyed during field assessments for the initial EIS.

During the additional survey a total of 21 sites were assessed. Of these, 8 sites were assessed to the Tertiary level and 13 sites were assessed to the Quaternary level in accordance with the methodology outlined by the Queensland Herbarium (Nelder et al. 2005). Survey sites were distributed so as to sample as much environmental variability along the alignment as possible, within practical time and accessibility constraints.

GPS co-ordinates were taken using hand held GPS (accuracy +/- 10 m) to assist in validating the existing Queensland Herbarium vegetation mapping. Photographs of vegetation communities traversed were also taken. The locations of all flora field survey sites are shown in Figure 4.

## **2.1.5 Interpretation and documentation**

Using information gathered from ground-truthing surveys, the likelihood of potential habitat for threatened flora species occurring within the proposed corridor was determined. Likely impacts on those threatened species for which potential habitat was found to be present were analysed based upon the known ecology of each species.

## 2.2 Fauna Assessment

Nomenclature used in this fauna assessment follows the Australian Faunal Directory (DEWHA 2009) updated with more recent taxonomic reviews where relevant (e.g. Parnaby 2009). Common names are taken from the CSIRO List of Australian Vertebrates (Clayton et al. 2006) where available, or where unavailable are drawn from other recent literature (e.g. Horner 2007, Churchill 2008, Parnaby 2009).

### 2.2.1 Determination of Significance Level

Listed EVR fauna are defined as those taxa listed under the EPBC Act and/or the NC Act as critically endangered, endangered, vulnerable or near threatened (NC Act only).

DERM has recently developed the Back on Track species prioritisation framework to identify priority flora and fauna species for management and recovery (DERM 2008). Although the majority of fauna species identified as Critical or High priority under the Back on Track framework are also listed EVR fauna, several identified Back on Track species are not listed under either the EPBC Act or NC Act. Non-listed fauna species identified as High or Critical priority by the Back on Track framework have been included as EVR fauna for the purposes of this assessment.

Regionally significant fauna are defined as those taxa identified by EPA (2002) as non-EVR priority taxa for the Brigalow Belt South Bioregion. Also included in regionally significant fauna are those taxa that have not been listed as EVR fauna under the EPBC Act or NC Act, but have been listed in the relevant Action Plan for their respective taxonomic group as vulnerable, rare, near threatened, insufficiently known or data deficient. Relevant Action Plans consulted to determine status were: Tyler (1997) for frogs, Cogger et al. (1993) for reptiles, Garnett and Crowley (2000) for birds, Maxwell et al. (1996) for monotremes and marsupials, Duncan et al. (1999) for bats and Lee (1995) for rodents.

All other native fauna have been designated as common. This includes those species that have been listed as Migratory species under the EPBC Act, but are not EVR or regionally significant fauna.

### 2.2.2 Desktop Review and Previous Study Interpretation

A desktop review was undertaken to identify the key fauna and habitat values of the wider study area, and the likelihood of these values occurring within the project area, as part of the initial terrestrial ecology assessment *Volume 5: Attachments to EIS - Attachment 15: Terrestrial Ecology – Pipeline*.

This review included the following:

- Collection and review of existing DERM WildNet data, Birds Australia data, Queensland Museum data and EPBC Protected Matters Search for the wider study area
- Search of the DOI Wetlands database (Blackman et al. 1999) to identify important wetlands within the wider study area
- Review of the Brigalow Belt South Biodiversity Planning Assessment version 1.3 (EPA 2008a, b, c) to identify areas that are recognised as State, Regional or Local Biodiversity Significant or flagged as important for their integrated biodiversity values that are within close proximity to the project area
- Review of the DERM Essential Habitat mapping to identify essential habitat areas for EVR fauna species within the wider study area



- Review of the DERM Environmentally Sensitive Area (ESA) mapping to identify key ecologically sensitive areas within the wider study area
- Review of Queensland Herbarium RE mapping for the corridor to establish those vegetation communities mapped by DERM at a scale of 1:100 000, as well as satellite imagery to gain an appreciation of potential fauna habitats and of the Project's proximity to sensitive areas
- Review of the DEEDI Biosecurity Queensland's Annual Pest Distribution Survey mapping to identify significant non-native species known or likely to occur within or adjacent to the project area
- Review of previous studies undertaken within the vicinity of the proposed alignment, primarily related to the development of other LNG projects within the broader study area (AECOM 2009, Boobook 2009, Unidel 2009; URS 2009a, b)

The following texts were also reviewed: Barker et al. (1995), Cogger (2000), Churchill (2008), Duncan et al. (1999), Ehmann (1992), Garnett and Crowley (2002), Johnson (2003), Menkhorst and Knight (2004), Morcombe (2003), Robinson (1998), Tyler and Knight (2009), Van Dyke and Strahan (2008), Wilson (2005a) and Wilson and Swan (2008).

In addition to the original desktop review, results from the initial EIS were used to identify known knowledge gaps, establish where additional studies should be conducted and to determine the likelihood of key fauna values occurring within the proposed project site.

### **2.2.3 Fauna Field Assessment – GSDA and Kangaroo Is wetlands**

The initial field study of the pipeline alignment for the EIS was undertaken by WorleyParsons' ecologists during two separate periods from 26 September – 6 October and 15 October – 30 October 2009. An additional field assessment of the GSDA (Bruce Highway to Friend Point, KPs 327.5 – 355.3) was conducted from 11–14 May 2010. This section of the alignment had not been ground-truthed during field assessments for the initial EIS.

A total of 31 sites were visited and assessed along the proposed alignment during surveys of the GSDA. Detailed fauna habitat assessments (HA sites) were conducted at 17 sites and general habitat observations (OB sites) recorded at a further 14 sites. Site locations are described in Appendix 1 and are shown in Figure 5.

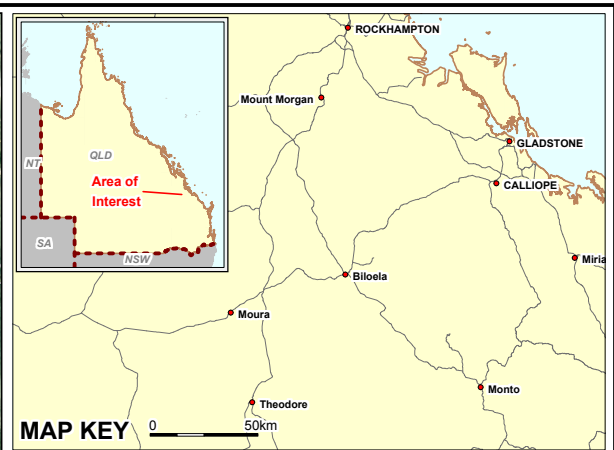
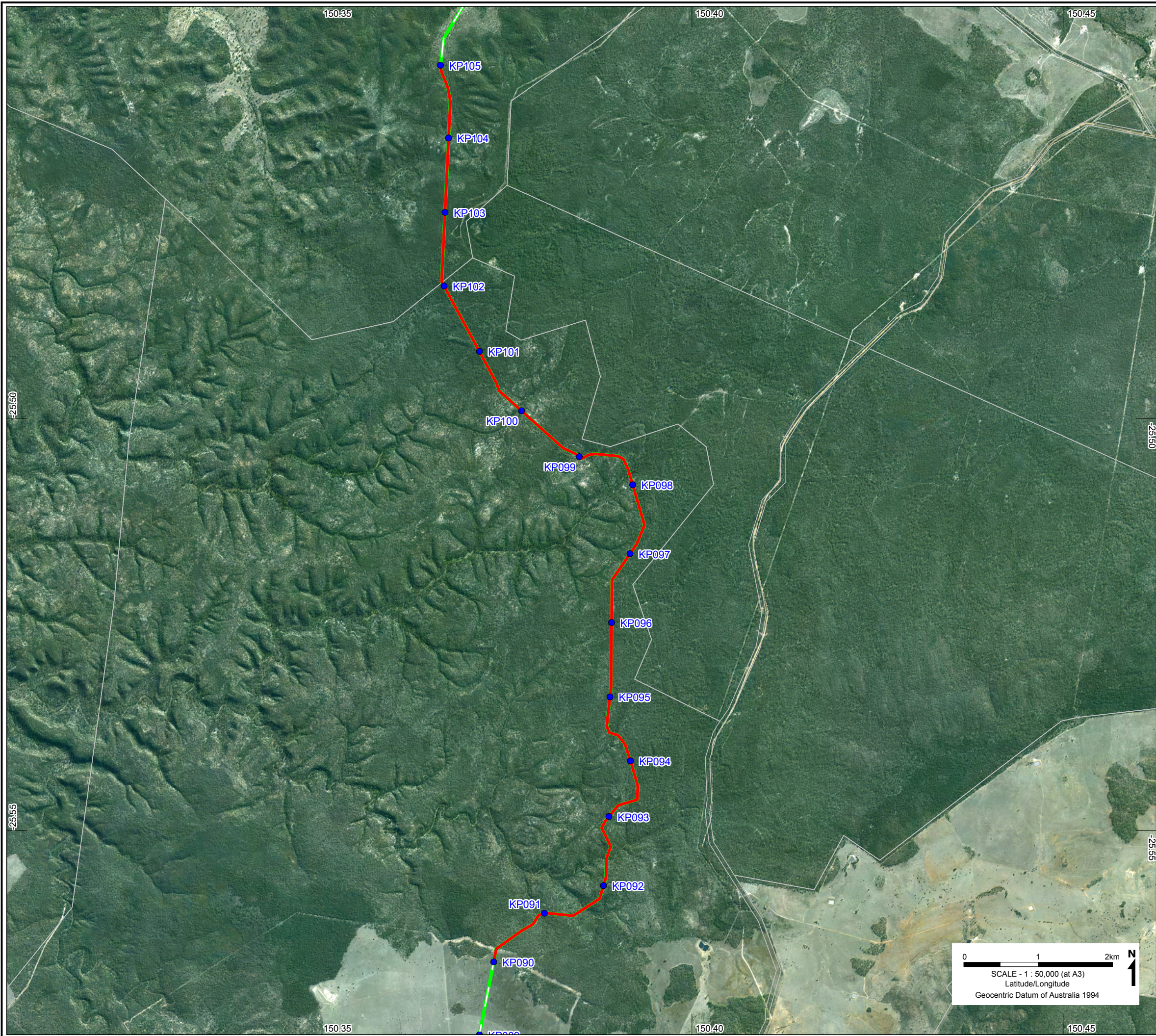
### **2.2.4 Interpretation and documentation**

Using the habitat assessment and field observation data, a determination was made as to whether or not preferred habitat for EVR or other significant fauna species was present along the alignment. Likely impacts to those EVR species for which preferred habitat was found to be present were analysed based upon the known ecology of each species.

A precautionary approach has been adopted throughout this assessment. In other words, any species that could potentially occur within the study area (identified through desktop review and habitat assessment, coupled with knowledge of the fauna by the fauna ecologist), have been assumed to occur in the study area. The presence or otherwise of a particular fauna species within the pipeline alignment can only be confirmed by detailed targeted field surveys.



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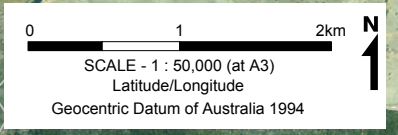
**LEGEND**

- Pipeline kilometre points
- Rockybar and Fairyland Targeted Flora search
- Gas pipeline route
- Cadastral parcels

**Source Information**  
Cadastral  
Department of Environment and Resource Management (DERM) 2009  
Indicative Gas Pipeline  
Supplied by Origin Energy 17/05/2010  
Kilometre Points  
Supplied by Origin Energy 04/06/2010  
Satellite Imagery  
Supplied by Origin Energy 09/01/2009  
Flora Search  
Collected by WorleyParsons 2010

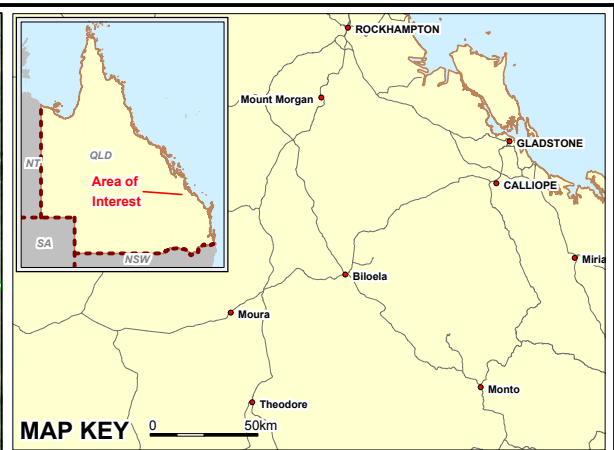
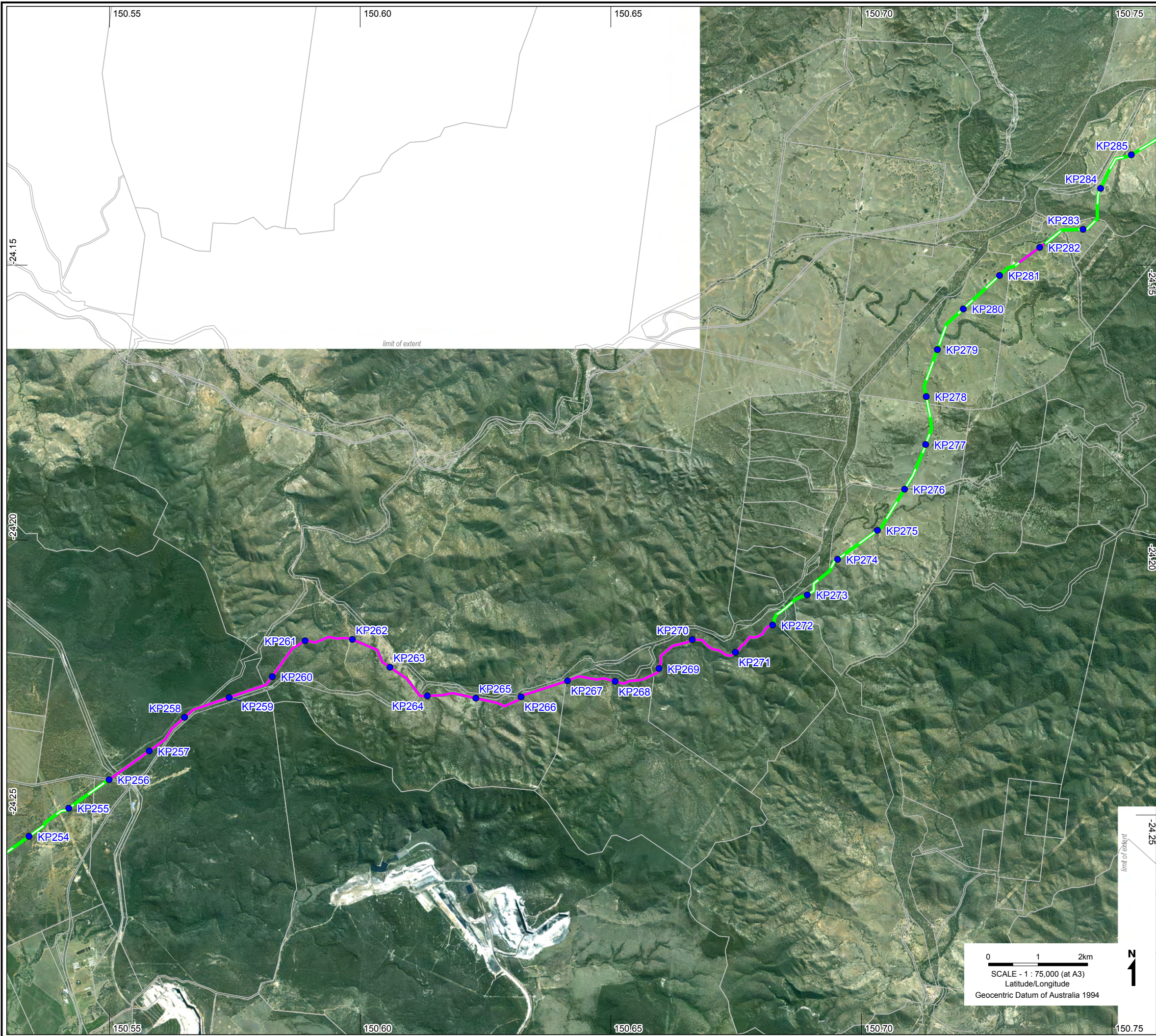


**Figure 1**  
**Rockybar and Fairyland**  
**Targeted Flora Searches**





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LEGEND

- Pipeline kilometre points
- Callide Range and Calliope Range Targeted Flora search
- Gas pipeline route
- Cadastral parcels

**Source Information**  
Cadastral  
Department of Environment and Resource Management (DERM) 2009  
Indicative Gas Pipeline  
Supplied by Origin Energy 17/05/2010  
Kilometre Points  
Supplied by Origin Energy 04/06/2010  
Satellite Imagery  
Supplied by Origin Energy 09/01/2009  
Flora Search  
Collected by WorleyParsons 2010



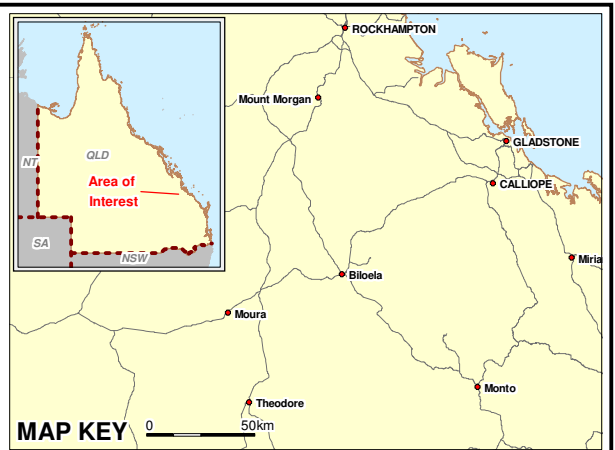
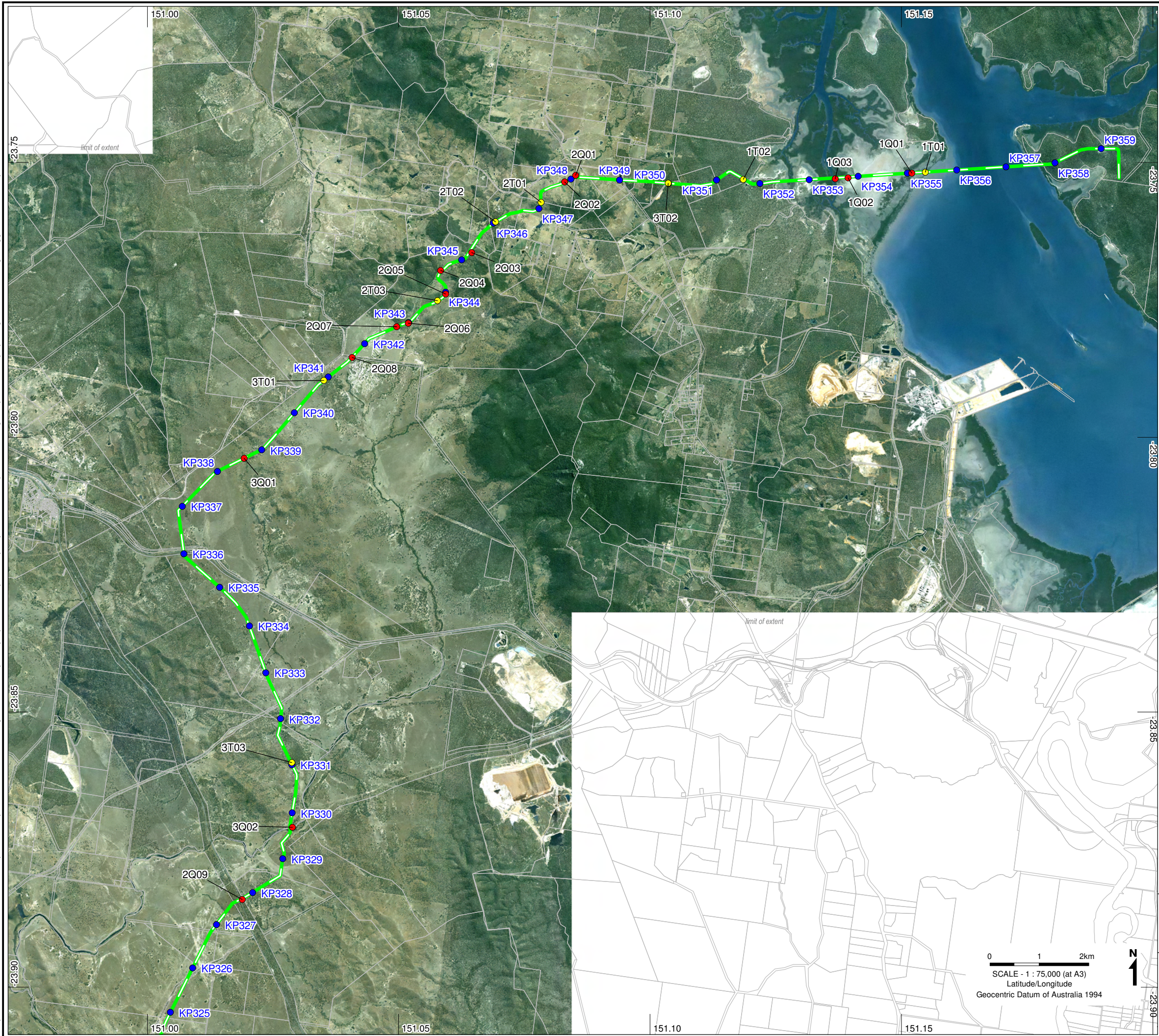
**Figure 2**  
**Callide Range and Calliope Range**  
**Targeted Flora Searches**







Department of Environment and Resource Management (DERM) 2009  
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#### LEGEND

- Flora Quaternary sites
- Flora Tertiary sites
- Pipeline kilometre points
- Gas pipeline route
- Cadastral parcels

#### Source Information

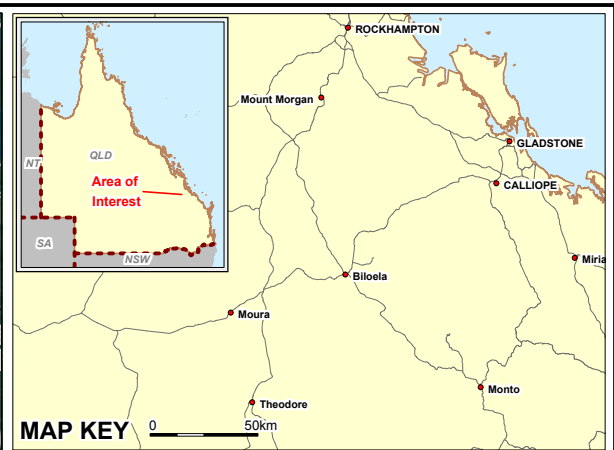
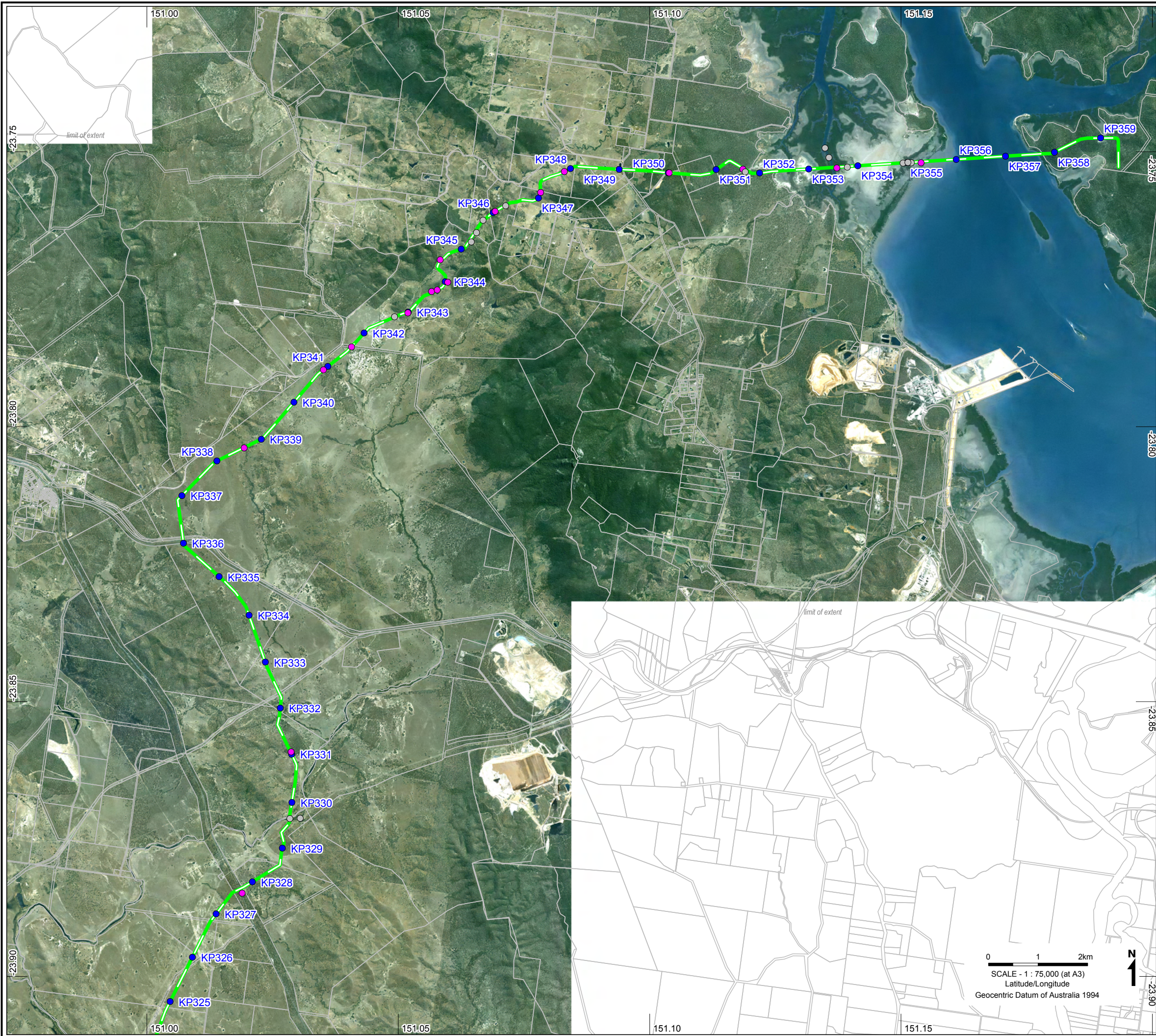
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Department of Environment and Resource Management (DERM) 2009  
Indicative Gas Pipeline  
Supplied by Origin Energy 17/05/2010  
Kilometre Points  
Supplied by Origin Energy 04/06/2010  
Satellite Imagery  
Supplied by Origin Energy 09/01/2009  
Flora Sites  
Collected by WorleyParsons 2010



Figure 4  
Additional Flora Survey Locations



Department of Environment and Resource Management (DERM) 2010  
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**LEGEND**

- Fauna Habitat sites
- Fauna Habitat observations
- Pipeline kilometre points
- Gas pipeline route
- Cadastral parcels

**Source Information**


Cadastral  
Department of Environment and Resource Management (DERM) 2009

Indicative Gas Pipeline  
Supplied by Origin Energy 17/05/2010

Kilometre Points  
Supplied by Origin Energy 04/06/2010

Satellite Imagery  
Supplied by Origin Energy 09/01/2009

Fauna Sites  
Collected by WorleyParsons 2010

 **AUSTRALIA PACIFIC LNG PROJECT**

**Figure 5**  
**Additional Fauna Survey Locations**



### 3. Results – Flora

#### 3.1 *Nature Conservation (Wildlife) Regulation 2006* Amendments

Legislative amendment occurred to the *Nature Conservation (Wildlife) Regulation 2006* on the 21<sup>st</sup> of May 2010. These amendments involved the removal of the status of “Rare”. The purpose of this change was to align the status of biodiversity in Queensland to the statuses used in the commonwealth EPBC Act and the international IUCN Red List. The flora species identified from database searches as potentially occurring in the wider study area and the relevant status changes under the regulation are shown in Table 1.

**Table 1 *Nature Conservation (Wildlife) Regulation 2006* Amendments for Flora**

Common Name	Scientific Name	EPBC Status	Old NCA Status	New NCA Status	Under Review
Chinchilla Wattle	<i>Acacia chinchillensis</i>	V	V	LC	
Large-leaf Chainfruit	<i>Alyxia magnifolia</i>		R	LC	
Isla Gorge Fringe Myrtle	<i>Calytrix islensis</i>		R	LC	
Isla Gorge Mahogany	<i>Eucalyptus rubiginosa</i>		R	LC	
Bailey’s Indigo	<i>Indigofera baileyi</i>		R	LC	
Cracow Wattle	<i>Acacia calantha</i>		R	NT	
Biggenden Wattle	<i>Acacia pubicosta</i>		R	NT	Y
Sharpe’s Chainfruit	<i>Alyxia sharpei</i>		R	NT	Y
Sandstone Prickle Bush	<i>Apatophyllum teretifolium</i>		R	NT	Y
Long-stalked Bertya	<i>Bertya pedicellata</i>		R	NT	
Miniature Moss-orchid	<i>Bulbophyllum globuliforme</i>	V	R	NT	Y
Native Frangipani	<i>Cerbera dumicola</i>		R	NT	
Giant Ironwood	<i>Choricarpia subargentea</i>		R	NT	
Silky Cryptandra	<i>Cryptandra ciliata</i>		R	NT	Y
Dansiea	<i>Dansiea elliptica</i>		R	NT	Y
Large-podded Tick-trefoil	<i>Desmodium macrocarpum</i>		R	NT	Y
Finger Panic Grass	<i>Digitaria porrecta</i>	E	R	NT	Y
Plunkett Mallee	<i>Eucalyptus curtisii</i>		R	NT	
Castletower Ironbark	<i>Eucalyptus decolor</i>		R	NT	
Scarlet Fuchsia	<i>Graptophyllum excelsum</i>		R	NT	

Common Name	Scientific Name	EPBC Status	Old NCA Status	New NCA Status	Under Review
Grease Nut	<i>Hernandia bivalvis</i>		R	NT	
Large-flowered Bearded-heath	<i>Leucopogon grandiflorus</i>			NT	Y
Carnarvon Palm	<i>Livistona nitida</i>		R	NT	Y
Northern Bonewood	<i>Macropteranthes fitzalanii</i>		R	NT	Y
Smooth-barked Bonewood	<i>Macropteranthes leiocaulis</i>		R	NT	
Yellow Bottlebrush	<i>Melaleuca formosus</i>		R	NT	
Grove's Paperbark	<i>Melaleuca groveana</i>		R	NT	Y
Pungent Olive	<i>Notelaea pungens</i>		R	NT	Y
Rough-leaved Paspalum	<i>Paspalidium scabrifolium</i>		R	NT	Y
Glossy-leaved Spurge	<i>Phyllanthus sauropodoides</i>		R	NT	Y
Sannantha	<i>Sannantha brachypoda</i>		R	NT	Y
Rainforest Cassia	<i>Senna acclinis</i>		R	NT	Y
Australian Bluebell	<i>Wahlenbergia islensis</i>		R	NT	Y
Pedley's Wattle	<i>Acacia pedleyi</i>		R	V	
Butterfly Homoranthus	<i>Homoranthus papillatus</i>		R	V	
Nightshade	<i>Solanum lyrthcarpum</i>			V	

## 3.2 Additional Flora Surveys

### 3.2.1 Surveys of the Gladstone State Development Area and Kangaroo Island wetlands

The flora characteristics and values of the proposed alignment were identified and are described in the Vegetation Assessment Proformas provided in Appendix 1.

The proposed alignment predominantly transverses cleared areas interspersed with patches of remnant vegetation. The majority of the areas traversed by the proposed alignment within the GSDA consist of open areas of non-remnant vegetation. The majority of the vegetation traversed by the alignment consists of mostly eucalypt-dominated woodlands and the vegetation communities of the Kangaroo Island intertidal wetlands, associated with the large intertidal marine clay plain areas located on the western side of The Narrows.



## Ecological communities/regional ecosystems

Field surveys found that the vegetation communities present are generally consistent with current DERM mapping. Minor accuracy corrections were made within the vicinity of the proposed alignment in the GSDA and Kangaroo Is wetlands. These inaccuracies generally related to the scale of DERM mapping (1:100,000) not recognising small scale variation in RE boundaries and the dissolving of mosaic polygons. The discrepancies observed while conducting field surveys are discussed in detail later in this chapter.

The proposed alignment predominantly transverses cleared areas non-remnant vegetation interspersed with patches of remnant vegetation. The majority of remnant vegetation traversed by the alignment in this area consisted of eucalypt-dominated woodlands and the vegetation communities associated with the large intertidal marine clay plain areas located in the Kangaroo Is wetlands on the western side of The Narrows.

The major waterways traversed by this alignment include the estuarine waterways of Humpy Creek and Targinie Creek as well as the freshwater system of Larcom Creek which flows in the south westerly direction where it joins the Calliope River and the. At the time of the survey Larcom Creek contained pools of water following the significant rainfall event that occurred over the summer.

The pipeline alignment has been selected to avoid major watercourses and wetlands. No Ramsar wetlands occur along or adjacent to the proposed alignment. However, two wetland areas listed on the DOI wetlands database, Port Curtis and The Narrows, are transected by the proposed alignment.

### ***EPBC Act listed Threatened Ecological Communities and VMA Listed Endangered Regional Ecosystems***

The only area mapped as endangered RE located within the ROW is the area between KP 345.8 – 346.2. This community is mapped as an endangered sub-dominant mosaic (RE 11.11.15 / 11.11.18 / 11.11.3) containing the endangered semi-evergreen vine thicket RE 11.11.18. A tertiary survey was conducted in this area (Sup 2T02) and the entire length of ROW located within this community was traversed. This RE was shown to be RE 11.11.3 which is a Least Concern RE.

Using the RE mapping methodology the minimum size limits of remnant vegetation that can be mapped are > 2 ha in area or greater than 35 m wide for linear features (Neldner et al. 2005). Using these criteria the proposed alignment does not traverse any endangered REs. However, two small patches of good quality semi-evergreen vine thicket communities exist within the RoW in areas currently mapped as high quality regulated regrowth. Whilst these small patches are not recognised as RE within the VMA framework they do exhibit the same floristic structure and composition of the EPBC listed endangered - *Semi-evergreen vine thicket in the Brigalow Belt South and Nandewar bioregions* Threatened Ecological Community (TEC).

No other VMA listed endangered REs or EPBC listed TECs are traversed by this section of pipeline.

### ***VMA listed Of Concern regional ecosystems***

A relatively large of concern remnant patch is located to the landward side of the high tide mark at KPs 350.5 – 352.4. This area is mapped as mosaic 11.3.26/11.3.4/11.11.15a. However, where the pipeline traverses this patch it is better described as RE 11.3.4, which is an of concern RE.

A small isolated remnant patch dominated by *Eucalyptus moluccana* is located between KPs 331 – 331.4. The patch is mapped as an of concern sub-dominant mosaic (RE 11.3.26/11.3.4) containing the of concern RE 11.3.4. The section of ROW traversing this remnant patch contains only RE 11.3.26. This RE is a least concern RE.

#### **VMA Listed Least Concern Regional Ecosystems**

The only areas of RE mapped by DERM as being least concern regional ecosystem exist in the intertidal areas located on the western side of The Narrows where the proposed alignment transects a large marine clay plain between KPs 352.3 – 355.3. This area is dominated by RE 11.1.2 (bare mudflats with very isolated individual stunted mangroves) and RE 11.1.4 (*Rhizophora* spp. or *Ceriops tagal* open forest) mainly fringing Targinie and Humpy Creeks. The location and extent of these vegetation communities was confirmed during the supplementary survey effort.

Other least concern REs were observed in areas mapped by DERM as mosaic with of concern REs. These areas are discussed above.

The locations of mapped and ground-truthed remnant vegetation transected the alignment within the GSDA and the Kangaroo Is wetlands are summarised in Table 2.

**Table 2 Locations of remnant vegetation transected by the alignment within the GSDA and Kangaroo Is wetlands**

Mapped RE	Ground-truthed RE	KPs
11.11.15 (LC) / 11.11.18 (EN) / 11.11.3 (LC)	11.11.3 (LC)	345.8 – 346.2
11.3.26 (LC) / 11.3.4 (OC) / 11.11.15a (LC)	11.3.4 (OC)	350.4 – 352.3
11.3.26 (LC) / 11.3.4 (OC)	11.3.26 (LC)	331.0 – 331.4
11.1.2 (LC)	11.1.2 (LC)	352.3 – 352.5 352.7 – 353.2 353.7 – 354.9 355.1 – 355.3
11.1.4 (LC)	11.1.4 (LC)	352.5 – 352.7 353.2 – 353.7 354.9 – 355.1

#### **DERM High Quality Regulated Regrowth**

The High Quality Regulated Regrowth mapping does not identify the individual REs that the regrowth represents but indicates the expected conservation status of the regrowth community and have three categories (containing endangered regional ecosystems, containing of concern regional ecosystems and is a least concern regional ecosystem).

Whilst certain areas of high quality regulated regrowth can be identified as a particular RE, it is not possible at all locations to determine the likely resultant remnant communities. The location and extent of vegetated areas mapped as High Quality Regulated Regrowth was generally confirmed when groundtruthed during the supplementary survey. The locations of High Quality Regulated Regrowth transected by the alignment within the GSDA are listed in Table 3.

**Table 3 Locations of Regulated Regrowth transected by the alignment within the GSDA**

High Quality Regulated Regrowth	KPs
Regrowth containing endangered RE	342.8 – 344 344.3 – 344.4 345.0 – 345.6 345.2 346.3 346.9 – 347.2
Regrowth containing of concern RE	327.8 – 328.5 328.9 – 329.2 329.6 – 329.7 330.2 – 330.4 330.9 – 331.0 331.2 – 331.5 332.0 – 332.3 335.7 – 336.5 336.8 – 337.0 337.3 – 337.7 338.1 – 338.2 338.5 – 339.5 340.6 – 341.0 341.5 – 341.6 342.7 – 342.8
Regrowth that is a least concern RE	349.0 – 349.3 350.2 – 350.4

## Marine Flora Species

Marine plants protected under the *Fisheries Act 1994* were recorded in association with the Kangaroo Is wetlands. These species include eastern white mangrove (*Avicennia marina* ssp. *australasica*), large-leaved orange mangrove (*Bruguiera gymnorhiza*), yellow mangrove (*Ceriops tagal*), long-styled stilt mangrove (*Rhizophora stylosa*), salt couch (*Sporobolus virginicus*), prickly couch (*Zoysia macrantha*), beaded glasswort (*Sarcocornia quinqueflora* ssp. *quinqueflora*), sea purslane (*Sesuvium portulacastrum*) and seablite (*Suaeda australis*).

## Weed Species

A total of 10 non-native flora species were identified along the proposed alignment during the field survey. This included four declared plants and, three Weeds of National Significance (WONS), which were observed at scattered locations along the proposed alignment. All weed species observed during this survey effort predominantly occurred in low densities.

Anecdotal evidence suggesting that parthenium is present in Collards Creek in the north of the alignment, which was reported in the EIS, was confirmed by a positive identification at KP 264.1. It is likely this species was flowering following the significant rainfall prior to the survey. Non-declared weeds were also observed along the proposed alignment generally in low densities, although some denser patches of Balloon Cotton Bush (*Gomphocarpus fruticosus*) were observed. A full list of the declared weeds and the location of them in relation to the pipeline is shown in Table 4.

**Table 4 Declared plants observed along the proposed alignment**

Botanical Name	Common Name	CTH*	QLD*	Site Observed (KP)
<i>Cryptostegia grandiflora</i>	rubber vine	WONS	2	Isolated scattered examples located at KPs 348, 342.1 and 347.2.
<i>Lantana camara</i>	common lantana	WONS	3	Occurs throughout. Prevalent in riparian vegetation north of Mt Larcom.
<i>Parthenium hysterophorus</i>	parthenium	WONS	2	Collards Creek in the Callide Range KP 264.1
<i>Sporobolus pyramidalis</i>	giant rats tail grass	---	2	Scattered throughout western sections of the study area. Dense infestations identified between KPs (329 – 340).

\*CTH (Australian Weeds Strategy): WONS = Weeds of national significance; QLD (Land Protection [Pest and Stock Route Management] Act 2002): 1 = Class 1 declared plant, 2 = Class 2 declared plant, 3 = Class 3 declared plant.

### 3.3 Targeted Threatened Flora Searches

#### 3.3.1 Rockybar and Fairylands

Populations of Cracow Wattle (*Acacia calantha*) were observed and in some areas the abundance of this species was greater than 1,000 individuals. Small populations were observed at KPs (90.5, 90.7, 90.8 – 91.4, 92.9, 94.2 – 94.5, 97.9) and one large population of this species with over 1000 individuals was located between 99 – 100.5. Prior to the legislative amendment that occurred to the *Nature Conservation (Wildlife) Regulation 2006* on the 21<sup>st</sup> of May 2010 this species was listed as Rare. Following the changes to the Regulation this species is now listed as a Near Threatened species.

A small population of Silky Cryptandra (*Cryptandra ciliata*) was observed in the centre sections of the Rockybar and Fairylands area. This population of approximately 30 individuals was observed along 200m of the alignment (KPs 95.5 – 95.7). Prior to the legislative amendment that occurred to the *Nature Conservation (Wildlife) Regulation 2006* on the 21<sup>st</sup> of May 2010 this species was listed as Rare. Following the changes to the Regulation this species is now listed as a Near Threatened species.

#### 3.3.2 Callide Range and Calliope Range

Several small population of the endangered large-fruited zamia palm (*Cycas megacarpa*) were observed along both of the Callide and Calliope Ranges. This species was generally observed on ridges, steep hills and weather drainage lines. In A total of 130 individuals were observed within the vicinity of the alignment. Individuals were generally grouped together in areas with a steep gradient groups generally contained between 5 and 30 individuals and are located between KPs (261.5 – 261.7, 263.6 – 263.7, 263.9 – 264.1, 270.7 – 271.7, 272 – 272.3, 273 – 273.1, 273.9, 277.2 – 277.4, 283.4 – 283.6, 283.6 – 284). This species is listed as Endangered under both Queensland and Commonwealth legislation and no change was made to the status of this species during to legislative amendment made to the *Nature Conservation (Wildlife) Regulation 2006* on the 21<sup>st</sup> of May 2010.

A total of 81 Pedley's wattle (*Acacia pedleyi*) were observed in several locations the vicinity of the alignment. These observations were dominated by one large area located just north of the Dawson Highway (KPs 258.4 – 259.5). In addition to this individuals were located 250m west of the alignment at KP260, three individuals were observed at KP 26.5 and seven individuals were located between KPs 264 – 264.1. Prior to the legislative amendment that occurred to the *Nature Conservation (Wildlife) Regulation* 2006 on the 21<sup>st</sup> of May 2010 this species was listed as Rare. Following the changes to the Regulation this species is now listed as a vulnerable species.

The locations of the recorded large-fruited zamia palm are shown in Figure 6 and locations of the recorded Pedley's wattle observed are shown in Figure 7.

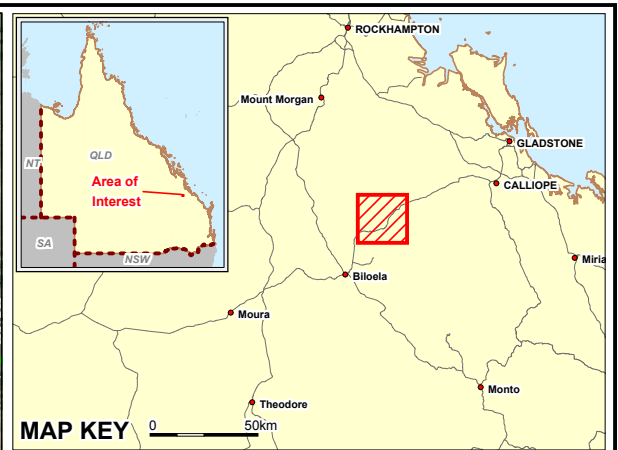
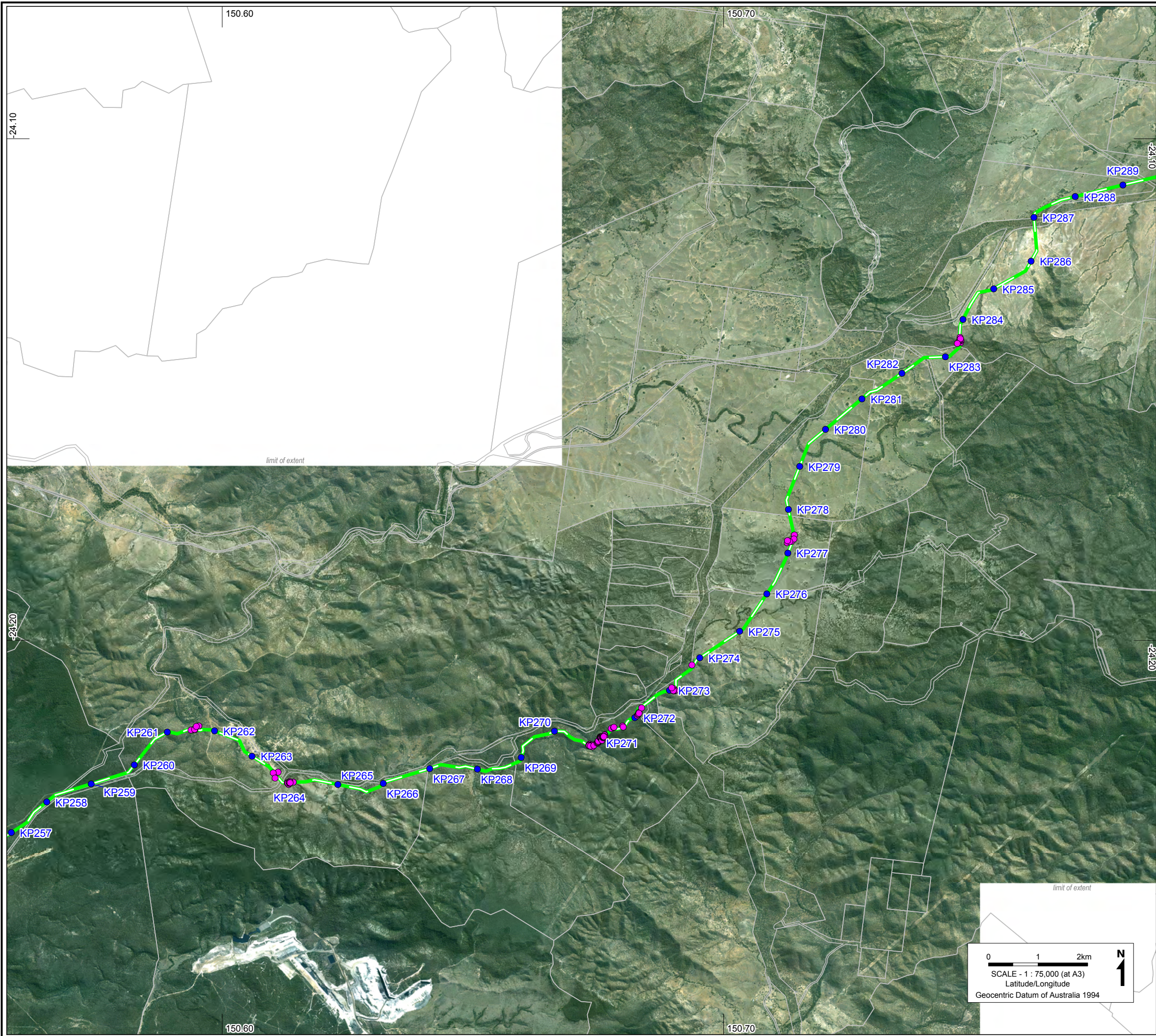
### 3.3.3 Vine thicket environments of the Gladstone State Development Area

One individual of the Wedge-leaf tuckeroo (*Cupaniopsis shirleyana*) was observed in a small but relatively good patch of semi-evergreen vine thicket located at KP 343.5. This species is listed as Vulnerable under both Queensland and Commonwealth legislation and no change was made to the status of this species during to legislative amendment made to the *Nature Conservation (Wildlife) Regulation* 2006 on the 21<sup>st</sup> of May 2010. The location of the identified Wedge-leaf tuckeroo individual is shown in Figure 8.

One individual of the Smooth-barked bonewood (*Macropteranthes leiocaulis*) was observed in a small stand of regrowth semi-evergreen vine thicket located at the far eastern edge of the targeted search (KP 346). Prior to the legislative amendment that occurred to the *Nature Conservation (Wildlife) Regulation* 2006 on the 21<sup>st</sup> of May 2010 this species was listed as Rare. Following the changes to the Regulation this species is now listed as a Near Threatened species.



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**LEGEND**

- *Cycas megacarpa*
- Pipeline kilometre points
- Gas pipeline route
- Cadastral parcels

**Source Information**


Cadastral  
Department of Environment and Resource Management (DERM) 2009

Indicative Gas Pipeline  
Supplied by Origin Energy 17/05/2010

Kilometre Points  
Supplied by Origin Energy 04/06/2010

Satellite Imagery  
Supplied by Origin Energy 09/01/2009

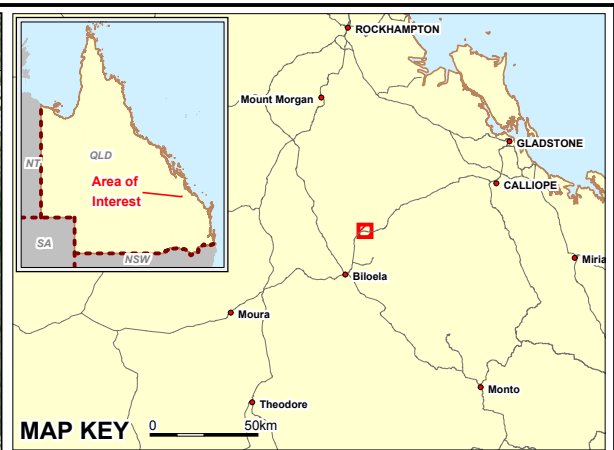
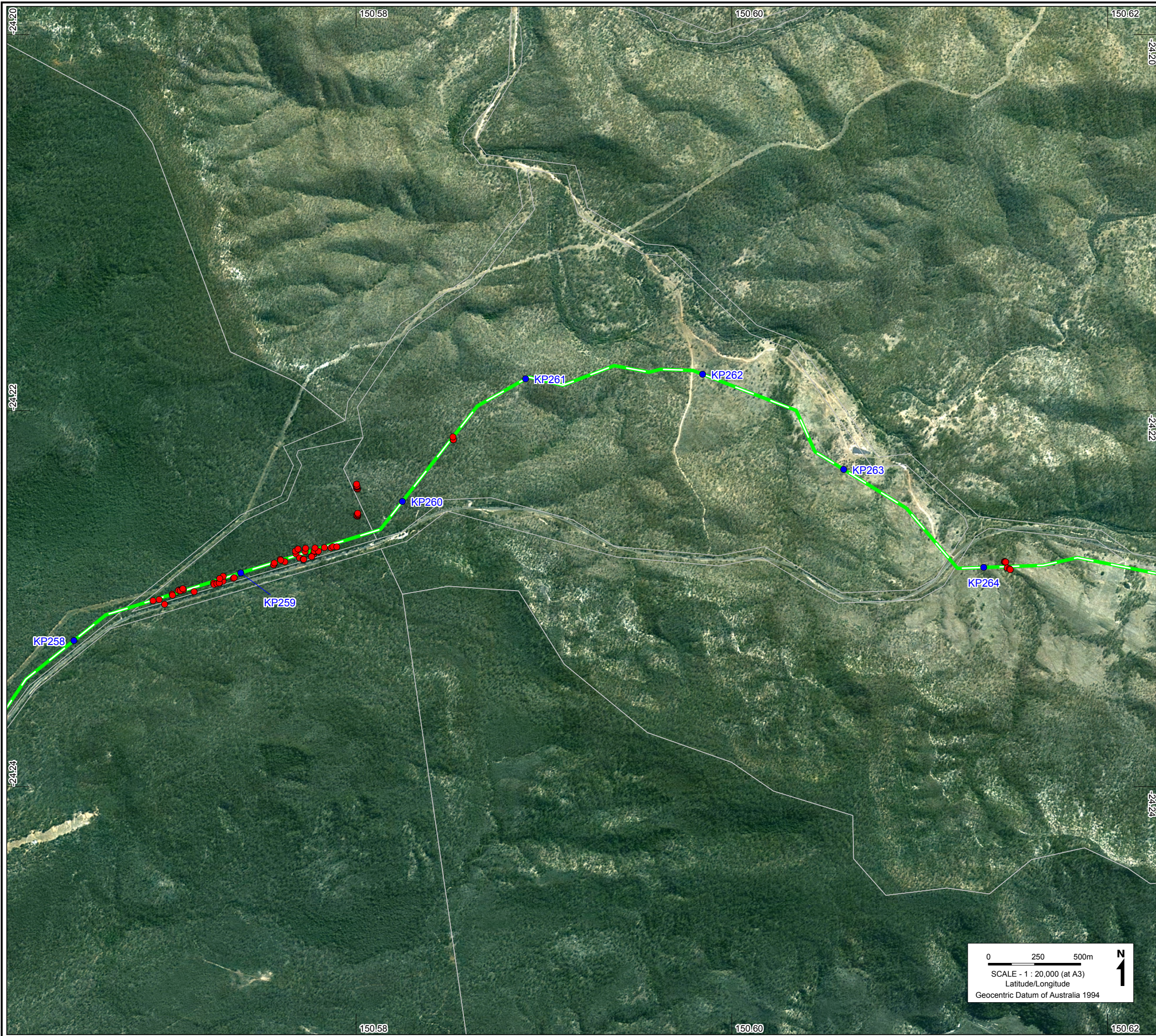
Vegetation locations  
Collected by WorleyParsons 2010

 **AUSTRALIA PACIFIC LNG PROJECT**

**Figure 6**  
**The locations of the**  
**endangered large-fruited zamia palm**  
**(*Cycas megacarpa*)**



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- LEGEND**
- *Acacia Pedleyi*
  - Pipeline kilometre points
  - Gas pipeline route
  - Cadastral parcels

**Source Information**

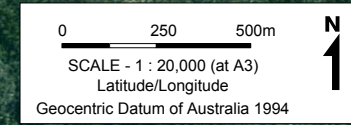
Cadastral  
Department of Environment and Resource Management (DERM) 2009

Indicative Gas Pipeline  
Supplied by Origin Energy 17/05/2010

Kilometre Points  
Supplied by Origin Energy 04/06/2010

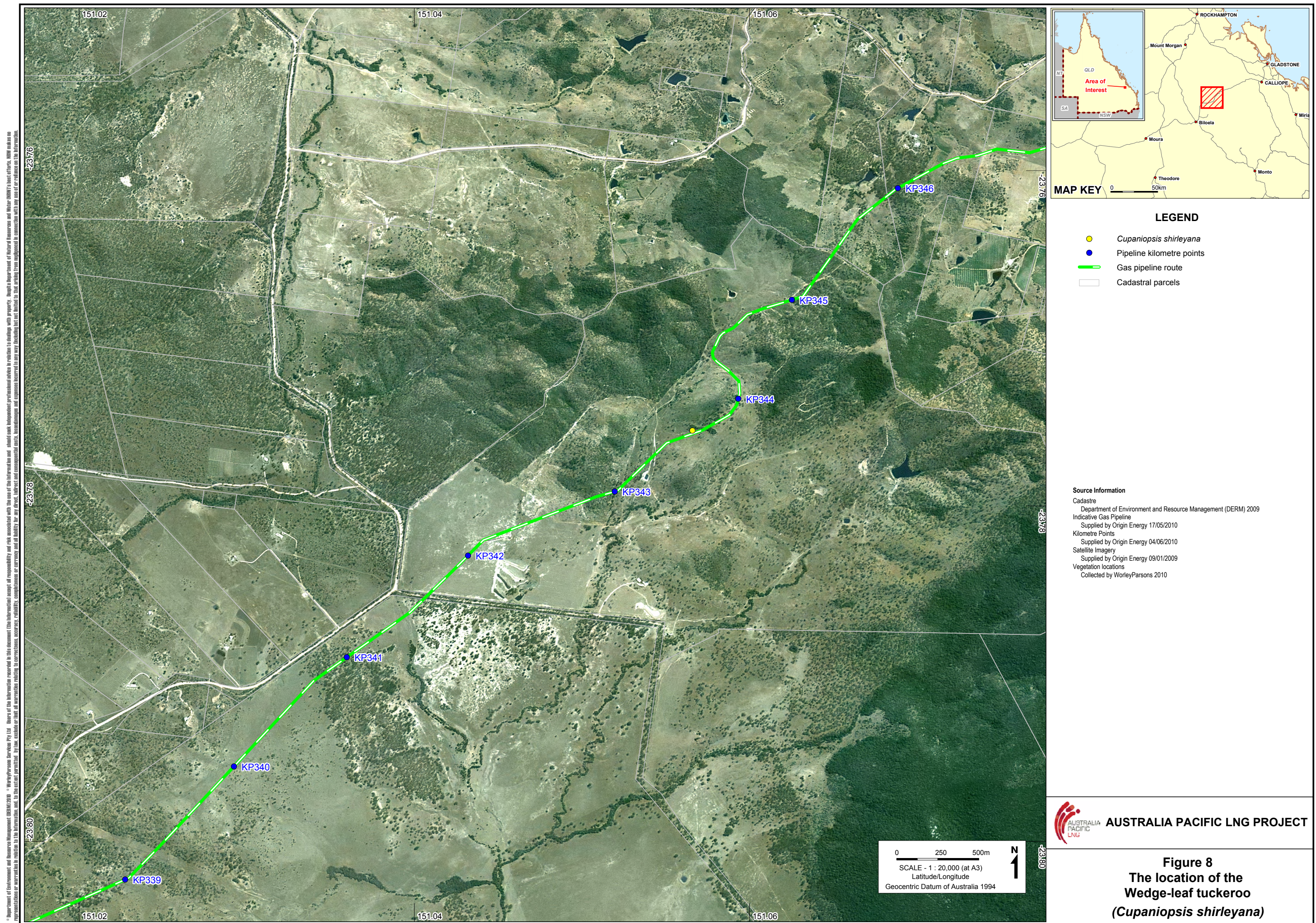
Satellite Imagery  
Supplied by Origin Energy 09/01/2009

Vegetation locations  
Collected by Worleyparsons 2010



**Figure 7**  
**The location of the**  
**Vulnerable Pedley's wattle**  
**(*Acacia pedleyi*)**







## 4. Results – Fauna

### 4.1 Nature Conservation (Wildlife) Regulation 2006 Amendments

Legislative amendment occurred to the *Nature Conservation (Wildlife) Regulation 2006* on the 21<sup>st</sup> of May 2010. These amendments involved the removal of the status of “Rare”. The purpose of this change was to align the status of biodiversity in Queensland to the statuses used in the commonwealth EPBC Act and the international IUCN Red List. The listed fauna species identified from database searches as potentially occurring in the wider study area and the relevant status changes under the regulation are shown in Table 5.

**Table 5 Nature Conservation (Wildlife) Regulation 2006 Amendments for Fauna**

Common Name	Scientific Name	Old NCA Status	New NCA Status	Under Review	Back on Track
<b>Frogs</b>					
rough collared frog	<i>Cyclorana verrucosa</i>	R	NT	Y	
<b>Reptiles</b>					
common death adder	<i>Acanthophis antarcticus</i>	R	NT	Y	
woma	<i>Aspidites ramsayi</i>	R	NT		High
yellow-naped snake	<i>Furina barnardi</i>	R	NT	Y	
Cooloolo snake-skink	<i>Ophioscincus cooloolensis</i>	R	NT	Y	
short-limbed snake-skink	<i>Ophioscincus truncatus</i>	R	LC		
rusty monitor	<i>Varanus semiremex</i>	R	LC		High
<b>Birds</b>					
grey goshawk	<i>Accipiter novaehollandiae</i>	R	NT	Y	
Australian swiftlet	<i>Aerodramus terraereginae</i>	R	NT	Y	
black-necked stork	<i>Ephippiorhynchus asiaticus</i>	R	NT	Y	
grey falcon	<i>Falco hypoleucos</i>	R	NT	Y	
painted honeyeater	<i>Grantiella picta</i>	R	V		High
sooty oystercatcher	<i>Haematopus fuliginosus</i>	R	NT	Y	
Lewin's rail	<i>Lewinia pectoralis</i>	R	NT	Y	
square-tailed kite	<i>Lophoictinia isura</i>	R	NT	Y	
black-chinned honeyeater	<i>Melithreptus gularis</i>	R	NT	Y	
turquoise parrot	<i>Neophema pulchella</i>	R	NT	Y	

Common Name	Scientific Name	Old NCA Status	New NCA Status	Under Review	Back on Track
cotton pygmy-goose	<i>Nettapus coromandelianus</i>	R	NT	Y	
eastern curlew	<i>Numenius madagascariensis</i>	R	NT	Y	
freckled duck	<i>Stictonetta naevosa</i>	R	NT	Y	
radjah shelduck	<i>Tadorna radjah</i>	R	NT	Y	
sooty owl	<i>Tyto tenebricosa</i>	R	NT	Y	
<b>Mammals</b>					
little pied bat	<i>Chalinolobus picatus</i>	R	NT	Y	
golden-tipped bat	<i>Phoniscus papuensis</i>	R	NT	Y	

## 4.2 Fauna Assessment of the GSDA and Kangaroo Is wetlands

### 4.2.1 Fauna species recorded

During the field assessment 35 terrestrial fauna species were recorded, comprising two amphibians, 31 birds and two mammals (Appendix 3). No EVR fauna species were recorded.

One regionally significant fauna species was observed: grey-crowned babbler (*Pomatostomus temporalis*) adjacent to Targinie Creek. This species was also recorded at 15 locations along the alignment during field studies for the EIS.

Three EPBC-listed migratory bird species were recorded:

- white-bellied sea-eagle (*Haliaeetus leucogaster*) over the mudflats at Friend Point (KP 355.3)
- rainbow bee-eater (*Merops ornatus*) beside the Bruce Highway (KP 327.7)
- satin flycatcher (*Myiagra cyanoleuca*) in SEVT regrowth (KP 345.5)

These three migratory species were also recorded during field studies for the EIS. No migratory shorebirds were observed during ground-truthing at Friend Point, although May is outside the season.

Two introduced fauna species were observed: cane toad (*Rhinella marina*) at five locations and European cattle (*Bos taurus*) at five locations (Appendix 3). Both of these species are non-declared under the *Land Protection (Pest and Stock Route Management) Act 2002* and both were recorded during field studies for the EIS.

### 4.2.2 Fauna habitats

The majority of the alignment through the GSDA is made up of cleared land. The main areas of remnant habitat consist of saltpan and mangrove habitats in the intertidal sections of the Kangaroo Island wetlands west of Friend Point (KP 352.3-355.3) and floodplain eucalypt woodland in the vicinity of Targinie State Forest (KP 350.5-352.4). Two isolated patches of mixed eucalypt woodland & open forest are transected by the alignment 331.0-331.4 and 345.8-346.2. Table 6 summarises the

locations and areas of remnant habitat proposed to be cleared along the alignment within the GSDA and the Kangaroo Is wetlands, based on a 40m RoW.

In addition, various areas along the alignment within the GSDA are vegetated with high-value regrowth (i.e. not cleared for at least 20 years). In total, approximately 31.2 ha of high-quality regrowth is transected by the proposed alignment within the GSDA (Table 3). This consists of

- 20.4 ha of eucalypt regrowth in the west of the GSDA (15 patches) between KPs 327.8-342.8
- 8.8 ha of SEVT regrowth in the Mt Larcom foothills (4 patches) between KPs 342.8-347.2
- 2.0 ha of eucalypt regrowth near Targinie State Forest (2 patches) between KP 349.0-350.4

High-quality regrowth vegetation will have some habitat value for a wide range of fauna, potentially including some EVR species.

**Table 6 Remnant fauna habitat transected by the alignment within the GSDA and the Kangaroo Is wetlands**

Habitat	KPs	Area (ha)
Mixed eucalypt woodland & open forest	331.0 – 331.4 345.8 – 346.2	3.2
Floodplain eucalypt woodland	350.5 – 352.4	7.6
Saltpan	352.3 – 352.5 352.7 – 353.2 353.7 – 354.9 355.1 – 355.3	8.4
Mangroves	352.5 – 352.7 353.2 – 353.7 354.9 – 355.1	3.6

#### 4.2.3 Essential Habitat

Since the EIS was completed, additional Essential Habitat has been mapped by DERM within the GSDA. The pipeline alignment transects one additional area of Essential Habitat not described in the EIS, between KPs 350.6-352.8 (just east of Targinie State Forest). This area of Essential Habitat is mapped for the Coastal Sheath-tail Bat (*Taphozous australis*), a small bat listed as vulnerable under the NC Act that roosts in sea caves, rock crevices and disused mines within a few kilometres of the coast. No potential roost habitat for this species was observed on or in the vicinity of the alignment. Assuming a RoW of 40m, the pipeline alignment would disturb approximately 8.8 ha of this Essential Habitat area.

#### 4.2.4 Migratory Shorebirds

The *Curtis Coast Regional Coastal Management Plan* (EPA 2003) identified major shorebird feeding grounds and roost sites within the greater Port Curtis area. Tidal mudflats immediately east of the Kangaroo Island intertidal wetlands, extending south from Friend Point, were identified as a major shorebird feeding ground. The pipeline alignment transects the northern section of this shorebird feed site.

A major shorebird roost site was identified by EPA (2003) on Friend Point. This high tide roost was also identified during targeted bird surveys conducted in early and late 2009 for the QCLNG EIS and supplementary EIS (Sandpiper 2009a, 2009b) and was occupied by considerable numbers of shorebirds during each survey. The alignment passes through or very close to this major shorebird roost.

In addition, two roosts identified on the saltpan are utilised by shorebirds during spring high tides. Both of these spring tide roosts are on or very close to the alignment (Sandpiper 2009a: Figure 6b).

### Important Habitat for Migratory Shorebirds

The recently-released *Draft Significant Impact Guidelines for 36 Migratory Shorebirds* (DEWHA 2009a) provide a framework for assessing the level of significance of shorebird sites under the EPBC Act. Under the draft guidelines, a site is considered important habitat for migratory shorebirds if:

- The site is identified as internationally important, or
- The site supports at least 0.1% of the flyway population of a single species, or
- The site supports at least 2000 migratory shorebirds, or
- The site supports at least 15 of the identified shorebird species

Under these guidelines, a 'site' is defined for migratory shore birds as 'the entire (discrete) area of contiguous habitat used by the group of migratory shorebirds, which may include multiple roosts and feeding areas'. Bamford *et al.* (2008) note "the Ramsar Convention recommends that a wetland site should form an ecological unit, and can therefore be (for example) an entire bay". For permanent wetlands (such as the intertidal Kangaroo Island wetlands), 'support' is defined as 'migratory shorebirds are recorded during surveys and/or known to have occurred at the site within the previous five years' (DEWHA 2009a).

Recent surveys of the Narrows and Curtis Island Industrial Precinct for the various LNG projects have found significant numbers of shorebirds utilising feeding habitat and the high tide and spring tide roosts on and adjacent to Friend Point and the Kangaroo Island wetlands. The highest species numbers recorded utilising the high tide roost at Friend Point at any one time during 2009 surveys were 299 whimbrels (*Numenius phaeopus*) and 56 eastern curlews (*Numenius madagascariensis*) (Table 7, Sandpiper 2009a, 2009b). The 0.1% flyway population thresholds for these two species are 100 for whimbrel and 38 for eastern curlew (DEWHA 2009b). Therefore, the Friend Point high tide roost meets the criteria for important habitat for these two listed migratory shorebirds under the draft EPBC guidelines.

A total of 304 red-necked stints (*Calidris ruficollis*) were recorded utilising the neap tide roost on the Kangaroo Island claypan during surveys in early 2009 (Table 7, Sandpiper 2009b), just less than the 325 (0.1% flyway population threshold) required to qualify as important habitat for his species. In addition, 105 terek sandpipers (*Xenus cinereus*) were recorded using a high tide roost on South Passage Island (Table 7, Sandpiper 2009b), more than the 60 threshold for important habitat for this species. Both of these species are likely to utilise the tidal mudflats adjacent to Friend Point for foraging.



Thirteen of the 36 EPBC-listed migratory shorebirds identified by the draft guidelines have been recently recorded in the vicinity of the Narrows crossing (Table 7), although surveys of the Kangaroo Island wetlands have been relatively limited. Additional survey may add to the number of shorebird species known to utilise the area. For example, another three shorebird species have been recently recorded at roosts near South End on southeast Curtis Island (Sandpiper 2009b, BAAM 2010) and are considered likely to utilise habitat in the vicinity of Friend Point (Table 7, Appendix 4), while a further two species have been recorded in the Port Curtis area by the Shorebirds 2020 project conducted by Birds Australia (Sandpiper 2009b). Therefore, the known utilisation by migratory shorebirds of Friend Point and the Kangaroo island wetlands area currently falls short of the 15 shorebird species required to constitute important habitat for migratory shorebirds. Nevertheless, it is likely that additional shorebird species utilise habitat in this area at least occasionally.

**Table 7 Migratory shorebirds recorded in the Friend Point / Kangaroo Is wetlands / Narrows area during recent surveys**

Common Name	Highest count	Location of highest count	0.1% of EAA Flyway*	Important Habitat
<b>Known</b>				
common sandpiper	1	Narrows / Curtis Is	25	
sharp-tailed sandpiper	5	Saltpan	160	
red-necked stint	304	Saltpan	325	
great knot	15	Saltpan, Friend Pt	375	
greater sand plover	14	Narrows / Curtis Is	110	
lesser sand plover	25	Saltpan	140	
bar-tailed godwit	74	Friend Pt	325	
eastern curlew	56	Friend Pt	38	✓
whimbrel	299	Friend Pt	100	✓
Pacific golden plover	12	Saltpan	100	
grey-tailed tattler	7	Saltpan	50	
common greenshank	1	Saltpan	60	
terek sandpiper	105	South Passage Is	60	✓
<b>Likely</b>				
red knot	5	South End	220	
curlew sandpiper	2	South End	180	
black-tailed godwit	4	Port Curtis	160	
grey plover	1	South End	125	
marsh sandpiper	63	Port Curtis	100	

\* Threshold numbers (0.1% of the East Asian-Australasian flyway population) taken from Appendix 1 of DEWHA (2009b).

Sources: Sandpiper 2009a, 2009b, BAAM 2009, 2010

## 5. Potential Impacts

### 5.1 Potential Impacts on Flora

Within the GSDA the majority of the alignment traverses cleared, non-remnant land dominated by pasture grasses. As a result of this the impacts such as edge effects and fragmentation are generally minimised in this area.

It is important to reiterate that natural regrowth will be encouraged over much of the area disturbed by construction. In addition, the gas pipeline decommissioning will not take place for several decades. Decommissioning will involve the pipeline being left in the ground, such that further disturbance will not be necessary following construction. Provided that natural regrowth is encouraged by future landholders, the impacts associated with clearing for construction and maintenance of the gas pipeline are considered to be reversible within all REs.

#### Proposed clearing of remnant vegetation and Threatened Ecological Communities

Throughout the GSDA the gas pipeline alignment avoids endangered regional ecosystems listed under the VMA by positioning the alignment through existing cleared areas adjacent to or within these remnants. Although pipeline option 3H within the GSDA does avoid endangered regional ecosystems, it is expected to disturb two small patches of vegetation corresponding to EPBC Act-listed threatened ecological community. These small patches are not recognised as RE within the VMA framework due to the size of the patches being too small to be recognised. However these small patches exhibit the same floristic structure and composition of the EPBC listed endangered - *Semi-evergreen vine thicket in the Brigalow Belt South and Nandewar bioregions* Threatened Ecological Community (TEC) and are located at KPs (343.7 and 343.9). These areas of TEC are easily avoided by a minor realignment.

Although these two patches are too small to be mapped as RE, the importance of these areas as potential habitat for threatened species is highlighted by the identification of the Wedge-leaf tuckeroo (*Cupaniopsis shirleyana*) (KP 343.7), which is listed as vulnerable under both state and commonwealth legislation. These two areas of TEC identified during the field survey should be avoided by minor realignments which will result in little or no impact to these communities.

The locations and areas impacted of RE community's ground-truthed by field surveys transected by pipeline option 3H within the GSDA and the Kangaroo Is wetlands are shown in Table 8.

**Table 8 Proposed remnant vegetation impacts on the pipeline right of way within the GSDA and the Kangaroo Is wetlands**

VMA status	KPs	Area (ha)
Endangered Regional Ecosystem	None	0.0
Of concern Regional Ecosystem	350.4 – 352.3	7.6
Least concern Regional Ecosystem	331.0 – 331.4 345.8 – 346.2 352.3 – 355.3	22.8

## Impact on Threatened Flora Species

Impacts on threatened species are discussed for each of the threatened species observed during this targeted survey effort. These impacts should be read in conjunction with the information supplied in the *Volume 5: Attachments to EIS - Attachment 15: Terrestrial Ecology – Pipeline*.

### Large-fruited zamia palm (*Cycas megacarpa*)

EPBC      Endangered  
NCA      Endangered

Trunked cycad to 5 m tall and 14 cm diameter with green, densely hairy, orange-brown new growth. Leaves are bright green, highly glossy to semi-glossy, moderately keeled and pinnate to 110 cm long. Leaflets are 120-170-numbered, simple, strongly discolourous and flat to slightly keeled to 200 mm long and 7.5 mm wide with basal leaflets not gradually reducing to spines. Pollen cones (flowers) are ovoid and orange to 18 cm long and 7 cm diameter and seed cones (fruit) are grey to brown to 25 cm long and are produced in early autumn (Botanic Gardens Trust 2010; Queensland Herbarium 2007).

The large-fruited zamia palm is beetle pollinated and restricted to south-eastern Queensland where it is found in woodlands and open woodlands dominated by lemon-scented/spotted gum (*Corymbia citriodora*), narrow-leaved red ironbark (*Eucalyptus crebra*), gum-topped bloodwood (*C. erythrophloia*), silver-leaved ironbark (*E. melanophloia*) and brush box (*Lophostemon confertus*), on rocky substrates derived from acid volcanics, ironstone and mudstone and rarely alluvium and at 40-680 m altitude (Botanic Gardens Trust 2010; Queensland Herbarium 2007).

Forty-six populations have been recorded across its distribution range totalling 372,964 individuals and including several populations from national parks. Important populations have been identified at Biloela, Kroombit and Wonbah and threats have been identified as include destruction due to land clearing, legal harvesting and commercial salvage, illegal harvesting, loss of genetic variation and insect pollinators, inappropriate fire regimes, timber harvesting and drought. Species is declining (Queensland Herbarium 2007).

A total of 130 large-fruited zamia palms were observed during the targeted flora surveys. This species is known to occur over the Callide and Calliope Ranges and the entire length of the pipeline was traversed in these areas. The location of 130 individuals is known following the survey; however, following good summer rains the height of the grass in these areas may have inhibited the identification of some younger (shorter) individuals.

Known and potential threats include destruction of habitat and individuals due to land clearing, legal harvesting and commercial salvage, illegal destruction and harvesting, loss of genetic variation, loss of insect pollinators, inappropriate fire regimes, timber harvesting and drought (Queensland Herbarium 2007).

The locations of individuals of the large-fruited zamia palm were collected using a hand held GPS unit. This information can be utilised for the planning the construction of the pipeline corridor and to narrow the corridor in areas containing this species. Knowing where this species occurs prior to the construction planning period will reduce the impact on this species. Where individuals cannot be avoided they will be translocated to nearby suitable habitat. For individuals and populations that cannot be avoided.

### Wedge-leaf tuckeroo (*Cupaniopsis shirleyana*)

EPBC      Vulnerable  
NCA      Vulnerable

Small tree to 10 m tall with compound, alternate and pinnate leaves and greenish to cream flowers that are held on slender axillary or terminal racemes and appear from mid autumn to mid winter. Leaflets are 6-15-paired, stiff, leathery and glossy green above and hairy below with triangular to wedge-shaped bases and toothed or sometimes entire margins. Orange, hairy, spherical to egg-shaped fruit are produced mid winter (DEWHA 2010).

This species is restricted to south-eastern Queensland, from Brisbane to Curtis Island and is found in dry rainforests and scrubby urbanised areas on moderate to very steep slopes, screeslope gullies and rocky stream channels at 60-550 m altitude and in association with white booyong (*Argyrodendron trifoliatum*), hoop pine (*Araucaria cunninghamii*), rough-leaved elm (*Aphananthe philippensis*), white bean (*Ailanthus triphysa*), native holly (*Alchornea ilicifolia*), broad-leaved whitewood (*Atalaya multiflora*), python tree (*Gossia bidwillii*), thick-leaved croton (*Croton acronychioides*), black plum (*Diospyros australis*), hard quandong (*Elaeocarpus obovatus*), southern fitzalanian (*Fitzalanian heteropetala*), blush coondoo (*Planchonella laurifolia*), blunt-leaved coondoo (*P. myrsinifolia*), Burdekin plum (*Pleiogynium timorense*), red-fruited kurrajong (*Sterculia quadrifida*) and strychnine tree (*Strychnos axillaris*) (DEWHA 2010; DNR 1999).

Wedge-leaf tuckeroo is protected at Mount Larcom and in the Sankey Scrub and threats have been identified as clearing and disturbance from activities such as roadworks and other infrastructure works, including associated drainage works, weed infestations (DEWHA 2010).

The Approved Conservation Advice for *Cupaniopsis shirleyana* (Wedge-leaf Tuckeroo) states that the main identified threats to Wedge-leaf tuckeroo are clearing and disturbance from activities such as roadworks and other infrastructure works, including associated drainage works. These activities can impact directly on the species and also promote canopy gaps which are readily colonised by weed species, such as Lantana (*Lantana camara*), which forms dense thickets in the Mt Larcom area.

One Wedge-leaf tuckeroo was identified in a small patch of quality vine thicket regrowth. The vine thicket environments of the GSDA highly disturbed and fragmented and targeted surveys for threatened species in these areas is difficult due to the steep terrain in which these vegetation communities exist and the characteristic thick vine understorey (DEWHA 2008).

Avoiding the removal of the vine thicket vegetation communities for the construction of the pipeline in the small areas of high quality vine thicket regrowth discussed in section 3.3.1.1 would be the best conservation outcome for this threatened flora species. In any case the control of weeds in regrowth areas is important for the conservation of this species.



### **Pedley's wattle (*Acacia pedleyi*)**

EPBC        -  
NCA        Vulnerable

Slender, erect tree to 10m tall with smooth, greenish bark and terete, angled, brown to greenish brown branchlets. Young foliage tips are pale yellow to golden and silky and leaves are herbaceous, feathery and bipinnate with 5-8-paired pinnae to 7cm long. Pale yellow, globular flowerheads are produced from mid autumn to late spring in axillary racemes or terminal or axillary false-panicles. Fruit pods are straight-sided to constricted between the seeds, straight or slightly curved, leathery and dull brownish black to 13cm long and 6.5mm wide (Maslin 2001).

Restricted to the Callide and Calliope Ranges in the Port Curtis District of central Queensland, Pedley's wattle is found in eucalypt open forests and woodlands in alluvial loams to red clayey loams derived from sandstone and basalt rocks on alluvial flats, hill slopes and on the tops of ridges. Eleven populations have been recorded in the distribution range although none are in protected reserves. Threats include destruction of habitat by clearing, inappropriate fire regimes and inappropriate grazing regimes (DNR 1999; Maslin 2001).

A total of 81 Pedley's wattle individuals were observed during the targeted flora surveys. This species was observed along the central and western areas of Callide Range in eucalypt woodland and some scrubby vine forest.

Threats to the survival of this species are relatively poorly known; however, they are likely to include land clearing, weed invasion, grazing, inappropriate fire regimes and a relatively small range which is restricted to the Calliope and Callide Range.

The locations of populations of Pedley's wattle were collected using a hand held GPS unit. This information can be utilised for the planning the construction of the pipeline corridor and to narrow the corridor in areas containing this species. Knowing where this species occurs prior to the construction planning period will reduce the impact on this species.

### **Impact on other flora of Conservation Significance observed**

#### **Silky Cryptandra (*Cryptandra ciliata*)**

NCA        Near Threatened

A small shrub to 0.5m tall with lateral branchlets to 15mm long that lack terminal spines. Branchlets are hairy becoming glabrous with age. Leaves are green and glabrous above and white and hairy below and are terete and linear to 2.6mm long and 0.5mm wide with strongly rolled margins. Silky cryptandra flowers and fruits from mid winter to early September. Flowers are white to brown and tubular with hairy lobes to 2.0mm long and fruit capsules are ellipsoidal to 2.9mm long (bean 2004; DNR 1999).

Restricted to the Barakula-Theodore region of south-eastern Queensland, the silky cryptandra is found in lemon-scented/spotted gum (*Corymbia citriodora*) and narrow-leaved red ironbark (*Eucalyptus crebra*) dominated woodlands with tall *Acacia* spp. understorey on lateritic duricrusts and eucalypt woodlands on rocky and sandy loam soils and lancewood (*Acacia shirleyi*) scrublands and forests and *Triodia* grasslands. Little is known about the total population size and extent of occurrence of this species with representation populations recorded in the Barakula State Forest. Silky cryptandra is not

known to any protected reserve and is under threat from destruction of habitat due to clearing and habitat disturbance (Bean 2004; DNR 1999).

This species was observed in association with *Hibbertia vestita*. Threats to this species are relatively poorly known however it is likely to be listed as near threatened due to its relatively small range being restricted to the Barakula-Theodore region of south-eastern Queensland.

#### **Smooth-barked bonewood (*Macropteranthes leiocaulis*)**

##### **NCA            Near Threatened**

Tree to 25m tall with pink to green white, smooth bark and erect, hairy branchlets. Leaves are broadly elliptic to circular, opposite, hairless, glossy green above and paler below leaves to 8cm long and 2.3cm wide. Flowers are paired and hairy to 7mm long and 5mm wide and are produced early to mid summer. Fruit are straw coloured and hairless and appear mid to late summer (DNR 1999).

Restricted to eastern Queensland from Mingela Bluff near Townsville, to Binjour Plateau near Mundubbera, this species is found in deciduous vine thickets, semi-evergreen vine thickets and araucarian microphyll vine forests and occasionally forest and woodland habitats in red eucrozems (red, strongly structured clay soils) or sandstone talus. Smooth-barked bonewood is represented in Dipperu National Park and threats include destruction of habitat due to clearing and habitat disturbance by timber harvesting in sclerophyll forests and woodlands (DNR 1999).

The location of this species in a small area of semi-evergreen vine thicket community located in the eastern sections of the GSDA targeted flora searches. Threats to this species are relatively poorly known; however, they are expected to include land clearing of the semi-evergreen vine thicket communities to which it belongs, weed invasion and grazing.

#### **Cracow Wattle (*Acacia calantha*)**

##### **NCA            Near Threatened**

Shrub to 3m tall with slender, moderately dense, glabrous and somewhat resinous branchlets and erect to patent, filiform, shallowly incurved and green to grey green leaves to 15cm long and 1mm wide with prominent midribs. Flowerheads are bright golden, showy and globular and are held in simple inflorescences in the leaf axils. Fruit are narrowly oblong, leathery and slightly raised over the seeds to 6cm long and 6mm wide (Maslin 2001).

This species is restricted to the Dawson River Basin near Cracow in southern Queensland, where it is found in eucalypt open forests and acacia woodlands with a dense understorey in sands, loams and light clay soils on sandstone ridges, rocky hillsides and shallow valleys (DNR 1999; Maslin 2001).

Given the 1000's of individuals observed, this species is likely to be listed as Near Threatened due to the relatively small range in which it occurs. This species was observed in shallow sandy soil on sandstone hills, in woodland and open forest dominated by *Corymbia* species and was observed forming thickets in places where no canopy trees occurred.

### **5.1.1 Measures to Avoid Reduce and Offset Impacts**

The mitigation measures discussed in this report focus on the flora species identified in the targeted flora searches and the TECs and REs located with the GSDA.



Table 9 discusses each impact and the relevant avoidance, mitigation and offset measure for the scope of works covered in this report. Where an impact cannot be managed through avoidance then a mitigation measure is provided which refers to the range of actions that can be undertaken to reduce the level of impacts of the development (typically undertaken on-site). Where this mitigation measure is considered insufficient or inadequate to mitigate the impacts of the development an environmental offsets will be provided to compensate for the impacts which can not be adequately reduced through avoidance and mitigation.

**Table 9 Potential impacts and mitigation measures for EVR flora species and threatened ecological communities**

Impact	Avoid	Mitigate	Offset
<p><b><i>Semi-evergreen vine thicket in the Brigalow Belt South and Nandewar bioregions</i></b></p> <p>Removal of this Threatened Ecological Community (TEC)</p>	<p>Pipeline route 3H within the GSDA is expected to disturb two small patches of vegetation corresponding to this TEC. These small patches are not recognised within the VMA framework; however, they do exhibit the same floristic structure and composition as this TEC. Avoiding these two small patches (KPs 343.7 and 343.9). will eliminate any impact to this TEC.</p>	<p>Provided the Impacts are avoided as discussed no mitigation measures will be required.</p>	<p>Provided the Impacts are avoided as discussed no offsetting for this TEC will be required for areas impacted within the GSDA.</p>
<p><b>Large-fruited zamia palm (<i>Cycas megacarpa</i>)</b></p> <p>Removal of this endangered species</p>	<p>A total of 130 individuals were observed within the vicinity of pipeline option 3H. Reducing the width of the RoW around populations and avoidance where possible of individuals within the RoW between KPs (261.5 – 261.7, 263.6 – 263.7, 263.9 – 264.1, 270.7 – 271.7, 272 – 272.3, 273 – 273.1, 273.9, 277.2 – 277.4, 283.4 – 283.6, 283.6 – 284) will avoid loss of significant numbers of individuals.</p>	<p>Where individuals within the RoW are unavoidable impacts would be somewhat mitigated through translocation of affected individuals. All species of Cycad have undergone some degree of harvesting or salvage in the past (Forster 2004). This indicates that this species is capable of translocation.</p>	<p>To account for impacts which can not be adequately reduced through avoidance and mitigation a detailed offsets plan will be completed in conjunction with DEWHA and DERM.</p>



Impact	Avoid	Mitigate	Offset
<p><b>Wedge-leaf tuckeroo (<i>Cupaniopsis shirleyana</i>)</b></p> <p>Removal of this vulnerable species</p>	<p>Only one individual was identified in a small patch of reasonable quality vine thicket regrowth (KPs 343.7). Avoiding the removal of the small areas of quality vine thicket vegetation communities between (KPs 343.7 - 343.9) will affectively avoid impacts on this threatened species.</p>	<p>Provided the Impacts are avoided as discussed no mitigation measures will be required.</p>	<p>Provided the Impacts are avoided as discussed, no offsetting for this threatened species will be required.</p>
<p><b>Pedley's wattle (<i>Acacia pedleyi</i>)</b></p> <p>Removal of this vulnerable species</p>	<p>A total of 81 Pedley's wattle (<i>Acacia pedleyi</i>) was observed in the central and western sections of the Callide Range within the vicinity of pipeline option 3H. Reducing the width of the RoW around populations and avoidance where possible of individuals within the RoW between KPs (258.4 – 259.5, KP260, 260.5 and 264 – 264.1) will avoid loss of significant numbers of individuals.</p>	<p>Where individuals within the RoW are unavoidable impacts may be somewhat mitigated through translocation of smaller individuals. Pedley's wattle is a slender, erect tree to 10m tall so translocation of mature individuals may be relatively unsuccessful. However, as there are numerous size classes of individuals in this population translocation of smaller individuals should be utilised as a mitigation measure.</p>	<p>To account for impacts which can not be adequately reduced through avoidance and mitigation a detailed offsets plan will be completed in conjunction with DEWHA and DERM.</p>

Impact	Avoid	Mitigate	Offset
<p><b>Silky Cryptandra (<i>Cryptandra ciliata</i>)</b></p> <p>Removal of this Near Threatened species</p>	<p>A small population was observed in the centre sections of the Rockybar and Fairylands area. This population of approximately 30 individuals was observed along 200m of the alignment (KPs 95.5 – 95.7).</p>	<p>Where individuals within the RoW are unavoidable impacts would be somewhat mitigated through translocation of affected individuals. This is a small herbaceous species and translocation using a large root-ball is likely to be successful</p>	<p>To account for impacts which can not be adequately reduced through avoidance and mitigation a detailed offsets plan will be completed in conjunction with DEWHA and DERM. However, it is expected that the proposed avoidance and mitigation measures are considered adequate for this species.</p>
<p><b>Smooth-barked bonewood (<i>Macropteranthes leiocaulis</i>)</b></p> <p>Removal of this Near Threatened species</p>	<p>One individual was observed in a small stand of regrowth semi-evergreen vine thicket located at the far eastern edge of the targeted search (KP 346). This individual is not located within the RoW.</p>	<p>Provided the Impacts are avoided as discussed no mitigation measures will be required.</p>	<p>Provided the Impacts are avoided as discussed, no offsetting for this threatened species will be required.</p>
<p><b>Cracow Wattle (<i>Acacia calantha</i>)</b></p> <p>Removal of this Near Threatened species</p>	<p>In some areas the abundance of this species was greater than 1,000 individuals and they were observed at KPs (90.5, 90.7, 90.8 – 91.4, 92.9, 94.2 – 94.5, 97.9) and one large population of this species with over 1000 individuals was located between KPs 99 – 100.5.</p>	<p>Like many Acacia species that have naturally adapted to respond to disturbances such as fire the Cracow Wattle likely to respond well to the disturbances associated with the construction of the pipeline. The natural regeneration of the RoW is likely to encourage the reestablishment of this species.</p>	<p>To account for impacts which can not be adequately reduced through avoidance and mitigation a detailed offsets plan will be completed in conjunction with DEWHA and DERM.</p>

## 5.2 Potential Impacts on Fauna

### 5.2.1 Potential Impacts on Fauna in General

The EIS identified a number of potential impacts on fauna in general resulting from the construction of the pipeline, including:

- removal of habitat such as mature vegetation, hollow-bearing trees and fallen logs, and therefore loss of shelter, breeding, nesting, perching and foraging resources
- disturbance to rocky outcrops and therefore shelter for reptiles and small mammals
- disturbance to fauna movement corridors and dry season fauna refuges (predominantly associated with creeks and seasonal wetland / waterway areas)
- Unearthing of burrowing fauna species during construction
- Trenchfall - the potential for fauna to fall into and become trapped in the open pipeline trench during construction

Each of these impacts is discussed in the EIS. No additional fauna concerns or potential impacts were identified by habitat assessment and ground-truthing through the GSDA and the Kangaroo Is wetlands sections of the alignment.

No EVR fauna species were recorded during the field assessment, and ground-truthing of fauna habitat through the GSDA and the Kangaroo Is wetlands did not indicate the potential presence of any additional EVR fauna not discussed in the EIS.

### 5.2.2 Potential Impacts on Migratory Shorebirds

The alignment passes through or close to important shorebird roost habitat on Friend Pt and on the saltpan between Targinie Creek and Friend Pt, and through major shorebird feeding habitat on the tidal mudflats. Disturbance to roosting and feeding habitat will occur as a result of construction, with potential for significant impact on the Friend Point high tide roost.

Direct impact to shorebird populations from construction disturbance is likely to occur. Disturbance has the potential to have a significant impact on migratory shorebirds and some EVR threatened birds. Shorebirds have limited opportunity for foraging during the low tide, and disturbance during this period can prevent these birds from foraging effectively (Bamford et al. 2008). Disturbance from construction activities may force migratory shorebirds to increase the time devoted to vigilance and anti-predator behaviour, or may force them to move to less favourable feeding areas. These activities can prevent the birds from using part of the habitat and therefore have a significant impact on migratory shorebirds (DEWHA 2009b). In addition, both of the EVR threatened birds Little Tern and Beach Stone-curlew are sensitive to human disturbance on beaches when nesting (Garnett and Crowley 2000).

Intertidal habitat is not utilised evenly by shorebirds: mudflats with exposed sea grass beds are more intensely utilised and close proximity to a high-tide roost site is identified as one of the most important factors in determining the distribution of shorebirds on an intertidal flat. Of critical importance for shorebird roosting sites is the few roost sites that are available during the particularly high or spring tides when many alternative sites are inundated (Geering et al. 2007).

Construction of a pipeline along the proposed alignment will result in sustained disturbance over a lengthy period of the Friend Point high tide and spring tide roost sites, as well as the potential for



altered hydrology of the roost sites. The activity associated with the construction of the pipelines is likely to result in significant disturbance to important habitat for migratory shorebirds, including known roosts and a major shorebird feeding area. The duration of this disturbance activity is likely to result in construction disturbance during the period November to March when migratory shorebirds utilise the feeding and roosting sites within the study area.

Additionally, increased worker numbers and increased access to the wider area arising from the project have the potential to result in increased disturbance across a wider area of the Kangaroo Island wetlands, particularly from recreational activities such as fishing and four-wheel driving. Public access to Friend Point may be enhanced post-construction, with potential for improved access possible along the permanent RoW and any access tracks remaining following construction.

## Mitigation measures

Ideally, pipeline construction should be timed to avoid the seasons during which migratory shorebirds will be present in the study area (September to March), and the pipeline alignment should be realigned to avoid the important shorebird roost on Friend Point. Construction limitations may mean that these measures are not practicable.

If pipeline construction is to continue year-round (as seems likely), and the alignment needs to pass through or close to Friend Point, consideration should be given to offsetting disturbance and loss of important shorebird roost habitat through shorebird roost augmentation. Construction of a shorebird roost near Friend Point was recommended by Sandpiper (2009a) in a supporting technical report for the QCLNG EIS. Potential actions recommended included modifying the existing roost to form a neap tide roost by depositing dredge spoil and installing small rock groynes to minimise erosion. Alternatively, a neap-tide roost could be constructed on the tidal mudflats just offshore (e.g. using dredge spoil and rock groynes).

Other mitigation measures include:

- Where practicable, time construction through the Friend Point roost to avoid the September to March migratory shorebird season, so that any roost disturbance (and any subsequent roost augmentation) is completed prior to the return of the shorebirds
- Where practicable, restrict unnecessary access to important migratory shorebird feeding and roosting areas and beach nesting areas during October to March, to minimise disturbance to shorebirds and to nesting little terns and beach stone-curlews
- Implement an education program for workforce members regarding the importance of these areas and the need for disturbance to be minimised
- Prevent workforce members from bringing firearms or dogs onto the site

Controlling public access is likely to be difficult, particularly post construction. Measures that may assist with controlling access include:

- Maintaining any required access tracks as private roads, with locked gates and permits required for the lifetime of the project

- 
- Making impassable any access roads that are no longer required at the completion of construction (e.g. ripping, rock placement, dismantling of bridges)
  - Allowing as much of the ROW as practicable to regenerate

## 6. References

- Bamford, M., Watkins, D., Bancroft, W., Tischler, G. and Wahl, J. 2008. *Migratory Shorebirds of the East Asian – Australasian Flyway; Population Estimates and Internationally Important Sites*. Wetlands International – Oceania, Canberra.
- BAAM 2009. *Gladstone LNG Plant and Pipeline Curtis Island: Water Mouse, Powerful Owl and Wading Bird Investigations*. Report prepared by Biodiversity Assessment and Management for URS, January 2009.
- BAMM 2010. *APLNG Project Area Curtis Island Wader Bird Surveys*. Report prepared by Biodiversity Assessment and Management for WorleyParsons, April 2010.
- Botanic Gardens Trust 2010. *PlantNET - The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia* (V4.2). <http://plantnet.rbgsyd.nsw.gov.au>
- DNR 1999. *Species Management Profiles: Flora and Fauna Information System 2*. Department of Natural Resources, Brisbane.
- DEWHA 2009a. *Significant impact guidelines for 36 migratory shorebird species: Draft EPBC Act Policy Statement 3.21*. Department of Environment, Water, Heritage and the Arts, Canberra.
- DEWHA 2009b. *Significant impact guidelines for 36 migratory shorebird species: Background paper to EPBC Act policy statement 3.21*. Department of Environment, Water, Heritage and the Arts, Canberra.
- EPA 2003. *Curtis Coast Regional Coastal Management Plan*. Environmental Protection Agency, Brisbane.
- Forster, P. and Holland, A. 2006. *National Multi-species Recovery Plan for the cycads, Cycas megacarpa, Cycas ophiolitica, Macrozamia cranei, Macrozamia lomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrhachis*. Queensland Herbarium, Environmental Protection Agency, Brisbane.
- Garnett, S.T., and Crowley, G.M. 2002. *The Action Plan for Australian Birds*. Commonwealth of Australia. Published by Environment Australia.
- Geering, A., Agnew, L. and Harding, S. 2007. *Shorebirds of Australia*. CSIRO Publishing, Collingwood.
- Maslin, B. 2001. *Wattle: Acacias of Australia*. CD-ROM. Australian Biological Resource Study and CSIRO, Canberra.
- Queensland Herbarium 2007. *National Multi-species Recovery Plan for the Cycads, Cycas megacarpa, Cycas ophiolitica, Macrozamia cranei, Macrozamia lomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrhachis*. DEWHA, Canberra.
- Sandpiper 2009a. *QGC Queensland Curtis LNG project: Curtis Island Supplementary Targeted Bird Survey*. Report prepared by Sandpiper Ecological Surveys for the Queensland Curtis LNG Project, March 2009.
- Sandpiper 2009b. *QGC Queensland Curtis LNG project: Supplementary surveys for powerful owl and migratory shorebirds*. Report prepared by Sandpiper Ecological Surveys for the Queensland Curtis LNG Project, November 2009.