

Pre-clearance Survey - Meridian Interconnector, KP243.4
GLNG Pipeline Project

Report prepared for
Santos GLNG
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Executive Summary

Santos GLNG propose the construction of the Meridian Interconnector at KP243.4. This will involve the disturbance of land situated within a high-risk area on the flora trigger map (Department of Environment and Heritage Protection). Ausecology was engaged by Santos GLNG to undertake a detailed pre-clearance survey, including identification of protected plants in the clearing impact area.

The survey area (clearing impact area) comprised the proposed clearing area plus a 100m wide buffer surrounding the extremities of the footprint.

A desktop review of the area revealed the potential presence of *Solanum dissectum*, *Solanum elachophyllum*, *Solanum johnsonianum* and *Xerothamnella herbacea*. These species are listed under the provisions of the *Nature Conservation Act 1992* and/or the *Environment Protection and Biodiversity Conservation Act 1999*. *S. johnsonianum* was of particular emphasis due to previous pre-clearance survey collections (Ausecology, 2012) and a collection record occurring within two kilometres of the site.

All target species were known to be detectable at the time of assessment with the possible exception of *X. herbacea*.

The field survey was carried out by two suitably qualified Ausecology personnel on 12 August 2014 following the recommended timed meander methodology.

No EVNT species or supporting habitat were found in the proposed clearing area.

A population of *S. johnsonianum* was detected within the 100m buffer. The results estimated there to be 9,998 *S. johnsonianum* stems within a narrow mature patch of brigalow woodland along the roadside. The plant species is known to grow multiple stems from underground roots and therefore the actual number of individuals is assumed to be substantially fewer.

The impacts resulting from the construction of the Meridian Interconnector on the population of *S. johnsonianum* are anticipated to be negligible, as all the plants exist within a narrow band of roadside brigalow woodland that will not be interfered with and is separated from the proposed clearing area by the road. As the road is unsealed, the dust from which, coupled with edge effects, are the dominant threats to the plants at this time.

It is recommended that 'no go' bunting be erected to exclude potential impacts on the supporting habitat and species during construction, and that weed management practices be implemented to prevent the introduction of new weed species to the area.

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Glossary of Terms

Acronym	Description
Cwlth	Commonwealth
CSG	Coal Seam Gas
DEHP	Department of Environment and Heritage Protection (Qld)
DE	Department of Environment (Cwlth)
E	Endangered
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESA	Environmentally Sensitive Area
EVNT	Endangered, Vulnerable or Near Threatened
GTP	Gas Transmission Pipeline
GLNG	Gladstone Liquid Natural Gas
Ha	Hectares
KP	Kilometre Point
LC	Least Concern
m	metre
MNES	Matters of National Environmental Significance
NC Act	<i>Nature Conservation Act 1992</i>
NT	Near Threatened
RE	Regional Ecosystem
RoW	Right of Way
TEC	Threatened Ecological Communities
V	Vulnerable
VM Act	<i>Vegetation Management Act 1999</i>

1 Introduction

1.1 Project description

As part of the Santos GLNG project, a high pressure Gas Transmission Pipeline (GTP) of approximately 420km in length is being constructed (the Project) to transport coal seam gas (CSG) from CSG fields near Roma, through Fairview and the Arcadia Valley on to a processing facility on Curtis Island, near Gladstone (Figure 1). The Project is a joint venture between Santos GLNG Pty. Ltd. (Santos), PAPL (Downstream) Pty Ltd (Petronas) and Total GLNG Australia (TOTAL) and Korean GAS (KOGAS).

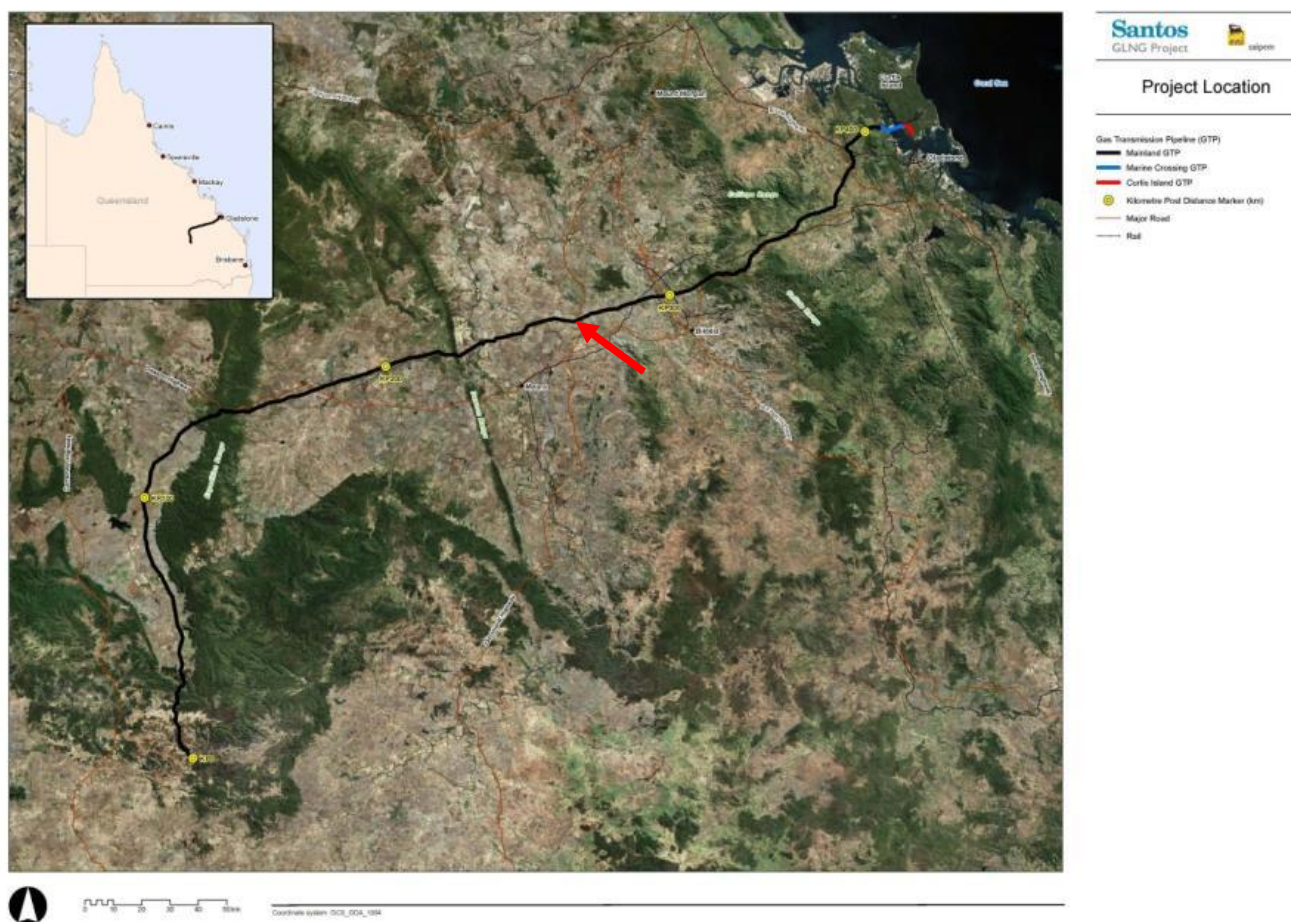


Figure 1 GLNG GTP RoW and survey site (red arrow)

This report details the methodology and results of an ecology survey undertaken in order to meet the requirements of the protected plants legislative framework for the Meridian Interconnector, proposed for construction at KP 243.4, located in the Banana Regional Council.

1.2 Project location

The Project is located on a site in close proximity to the recently constructed GLNG pipeline at the intersection of Theodore-Baralaba Road, Maura. The existing Jemena pipeline is parallel to the Project pipeline and falls within the survey area. The survey area (clearing impact area) subject of this report, includes the proposed

clearing area, plus an additional 100m wide buffer surrounding the proposed clearing area, as per the requirements stipulated under Section 3.2.1 of the *Flora survey guidelines - protected plants* (DEHP, 2014). See map Appendix C.

1.3 Legislative context

In the context of this project, the following legislation and conditions are applicable.

1.3.1 *Environment Protection and Biodiversity Conservation Act 1999*

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) pertains to protection of the environment, especially Matters of National Environmental Significance (MNES), and is controlled by the Commonwealth Department of Environment (DE). Its objective is to provide for the protection of the environment and conservation of biodiversity through the protection of threatened ecological communities and species, migratory species, marine species and other protected species through listing under the EPBC Act. The EPBC Act simplifies the environmental assessment and approvals process, resulting in the protection and management of matters of national environmental significance.

Under the EPBC Act approval (Referral 2008/4096) Conditions 5, 6 and 7, pre-clearing surveys must be undertaken.

1.3.2 *Nature Conservation Act 1992*

The Queensland *Nature Conservation Act 1992* (NC Act) is administered by the Queensland Department of Environment and Heritage Protection (DEHP) and is the primary legislation for the conservation and management of Queensland's native flora and fauna, with the objective of the conservation of nature.

1.3.2.1 *Nature Conservation (Wildlife Management) Regulation 2006 and the Protected Plants Legislative Framework*

The Queensland Government is adopting a risk-based approach to the regulation of protected plants under the *Nature Conservation Act 1992*. The regulatory framework will capture activities that pose a high risk to plant biodiversity. Clearing activities that are outside of an area identified as a high-risk area on the flora survey trigger map will not be subject to flora survey requirements. Regulatory, educational and compliance effort will consequently be focused on high-risk activities. Under the framework, when a non-exempt clearing activity is proposed within a high-risk area, the proponent of that activity is required to complete a flora survey prior to commencement of clearing. The main objective of the flora survey will be to locate any EVNT plants that may be present in the clearing impact area. This will be particularly important for determining the degree of assessment required for a particular clearing activity. For example, if the survey establishes that EVNT plant species are not present within the clearing impact area, the proposed clearing will be exempt and, following notification to the department, a clearing permit will not be required. Alternatively, if EVNT plant species are identified, and clearing is considered to impact on the EVNT plant, (i.e. clearing comes within 100m of the EVNT plant) then an application for a protected plant clearing permit is required.

1.4 Scope of Works

Ausecology was engaged to carry out a detailed pre-clearance survey of the clearing impact area due to the identification of the site being within a 'high risk area' on the DEHP flora survey trigger map (Appendix C).

Ausecology personnel, Bradley Jeffers and Carla Perkins, meet the conditions of 'suitably qualified persons' as stipulated in Section 3.2.2 of the *Flora survey guidelines - protected plants* and as demonstrated in their respective resumes (see Appendix A). Brad Jeffers and Carla Perkins are federally approved to conduct flora and fauna surveys by the Department of the Environment and have observed the four target species in the wild recently due to other relevant EVNT plant projects. Both ecologists know how the plants will appear given dry conditions, in addition to characteristic variations in habitat where they may be present.

As per Section 3.3.2 of the guidelines, the required content presented herein, includes:

- The species of EVNT found, their location on the site, and an estimate of the populations of those species in the clearing impact area.
- A description of the supporting habitat around any EVNTs identified in the buffer area.
- A measure of power or, if not practical, error for the estimates must be included.
- A statement to justify the suitability and qualifications of the person undertaking the flora survey.
- Curricula vitae for the survey team undertaking the flora survey.
- Justification of the timing of the flora survey and detail of any limitations associated with the timing of the survey.
- A GIS shapefile of the area to be cleared.
- A GIS shapefile (map) of the different habitat types identified for the clearing impact area and the GPS data showing the on-ground surveys undertaken.
- A map or plan of the clearing impact area including the locations of all EVNT species or populations of species found.
- A map or plan of the proposed land use requiring the area to be cleared.
- A description of the location.
- The date or dates the clearing is expected to occur.
- A discussion of the potential impacts and mitigation measures.

Section 4 of this report details the methodology underpinning the protected plant survey and analysis. Section 5 of this report provides a desktop analysis of the ecological features that could be present in this section of the GTP RoW. Section 6 provides a detailed summary of the actual ecological features recorded and mapped during the survey of the clearing impact area. For further information about specific species and vegetation communities, refer to the GLNG's Significant Species Management Plan (3380-GLNG-3-1.3-0031) and GLNG's Species Management Plan (3380-GLNG-3-1.3-0036).

The desktop review and field survey also assessed the area for Environmentally Sensitive Areas (ESAs) and Threatened Ecological Communities (TECs) under the EPBC Act.

2 Methodology

2.1 Overview

The survey was undertaken in accordance with the principles and protocols outlined in the *Flora Survey Guidelines – Protected Plants* (DEHP, 2014). Ausecology ecologists Brad Jeffers and Carla Perkins undertook the survey on the 12 August 2014.

In order to determine the relevance of the guidelines to the clearing impact area, a preliminary desktop-based review of existing desktop data concerning EVNT species, location and habitat extent was undertaken for the study area, followed by a detailed botanical survey and habitat assessment to confirm and enhance information collated during the desktop review.

Detailed methods for each of these components are provided below.

2.2 Desktop review

A desktop study was undertaken before conducting the survey using the following databases:

- Existing GLNG pre-clearing survey data
- VM Act Regional Ecosystem and Remnant Map v6.1 (DEHP)
- VM Act Essential Habitat Map v3.1 (DEHP)
- Environmentally Sensitive Areas mapping (DEHP)
- Wildlife Online database search for a 10km and 2 km radius
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search.

A number of existing guidelines, reports and approvals listed in Table 1 were also used as references for the survey, assisted the development of the methodology and provided supporting information for the reporting.

Table 1 Document reference list

Document Title	Source
GLNG Significant Species Management Plan (SSMP) (3380-GLNG-3-1.3-0031)	GLNG 2012
GLNG Species Management Plan (SMP) (3380-GLNG-3-1.3-0036)	GLNG 2012
Pre-clearance Ecological Survey Method (3380-SAIP-4-1.3-1997)	Saipem 2012
Level 1 Environmental Authority #PEN102664411	DERM 2011
EPBC Act Approval #2008/4096	DE 2010
FEED Specification for EPC Contractor Environmental Requirements (#3380-GLNG-3-1.3-008)	GLNG 2010
Coordinator-General's evaluation report for an environmental impact statement - Gladstone Liquefied Natural Gas—GLNG project	QLD Government 2010
GLNG Gas Transmission Pipeline - EPBC Environmental Management Plan Mainland GTP, 2011 3380-GLNG-4-8.2-0020	GLNG 2011

2.3 Field survey methodology

Ausecology ecologists (Brad Jeffers and Carla Perkins) surveyed the 7.44 ha clearing impact area, comprising the proposed disturbance footprint (0.571 ha) and a buffer zone (6.872 ha), on 12 August 2014. The clearing impact area was traversed on foot with emphasis placed on suitable habitat of the target species identified during the desktop process. Due to the small size of the area, the random meander method was used to detect the presence and locations of EVNT species. The random meander and population estimates were carried out from 12:11pm - 2:30pm and continued from 3:00pm - 4:45pm, totalling approximately four hours. The survey was terminated once the search area (including buffer was covered sufficiently, and 30 mins had lapsed with no additional plant species detected. The supporting habitat for the species present was small and so a very high level of confidence is assured on the detection of EVNT species in the clearing impact area.

Two methodologies were used to estimate the number of EVNT specimens in the RoW depending on their densities:

- individual counts of sparse patches and isolated specimens
- extrapolation by sampling
 - clumps/patches were delineated by Trimble GeoExplorer to create GIS polygons
 - area covered by the species within the clearing impact area calculated
 - stem counts within 1m² quadrats to determine an average stem density per m²
 - mean calculated from quadrat data extrapolated to the total area of cover.

Survey quality spatial data for all field observations were recorded using a Trimble GEOXH6000 GPS unit. Data was optimised using the GPS Pathfinder office program and the Ultimate Positioning base station located in Brisbane.

A Garmin GPS 62s was used to capture the path covered during the random meander.

Assessment of the vegetation within the clearing footprint was carried out to confirm no ESAs and TECs will be impacted.

2.4 Survey limitations

Due to the construction schedule requirements and the need for a clearing permit (and associated preparation and assessment timeframes), it was necessitated that the survey was undertaken in August 2014.

It should be noted that not all flora species persist over all seasons, and some flora species are more prominent when flowering and fruiting. The species detected during the desktop review include *Solanum johnsonianum* within the 2km risk area, and *Solanum elachophyllum*, *Solanum dissectum* and *Xerothamnella herbacea* within a 10km Wildnet data search area. Ausecology personnel conducting the field survey are familiar with EVNT species occurring in the region as a result of over 12 months ecology work on the GLNG Project. The ecologists have inspected all of these species in the recent preceding months of dry cold weather and know that the Solanums will be detected without difficulty. *X. herbacea* on the other hand are senescent at present and therefore will be more difficult to detect if present.

For the purposes of the species targeted in the risk map, *S. johnsonianum*, it is demonstrated that sufficient plant material will be present for reliable detection and identification.

2.5 Weeds

Declared and environmental weeds were noted during the survey. Environmental weeds were considered those weeds that may have high invasive capacity upon clearing or other weeds generally considered unfavourable by landholders that are not included in the *Land Protection (Pest and Stock Route Management) Act 2002*.

2.6 Fauna habitat features

Fauna habitat features were noted during the survey. Habitat use at the site may include nesting, shelter, roosting sites and special food sources. Features present may include hollows in standing dead or live trees and fallen logs, log and debris piles, loose surface rocks and boulders, active or inactive nests, terrestrial and arboreal termite mounds, soil piles, and trees with loose bark.

3 Desktop analysis

3.1 Commonwealth and State Government EVNT Species

Under the provisions of the EPBC Act 1999 native species are categorised in one of the following classes, which refers to both flora and fauna species:

- extinct
- extinct in the wild
- critically endangered*
- endangered*
- vulnerable*
- conservation dependent.

Under the provisions of the *Nature Conservation (Wildlife) Regulation 2006* native wildlife is categorised in one of the following classes, which refers to both flora and fauna species:

- extinct in the wild
- endangered (E)*
- vulnerable (V)*
- near threatened (NT)*
- least concern wildlife (LC)
- special least-concern (SLC).

** This report will refer to EVNT species in the context of both the QLD NC Act and the Commonwealth EPBC Act as highlighted.*

3.1.1 Flora

Table 2 lists the EVNT species as recorded in the Wildlife Online database supplemented with data records of surveys undertaken by GLNG.

Table 2 *EVNT species recorded in the Wildlife Online Database*

Scientific Name	NCA	EPBC Act	2 km Radius	10 km Radius
<i>Solanum dissectum</i>	Endangered			✓
<i>Solanum elachophyllum</i>	Endangered			✓
<i>Solanum johnsonianum</i>	Endangered		✓	✓
<i>Xerothamnella herbacea</i>	Endangered	Endangered		✓

Further details for these species can be found in GLNG's Species Management Plan (SMP) 2012 and the GLNG Significant Species Management Plan (SSMP) 2012.




4 Survey results


4.1 EVNT flora species detected

One (1) EVNT species is present within the 100m buffer, though no specimens were found within the proposed clearing area as mapped in Appendix C. A plant profile for the species has been included in Appendix D. Ausecology has detected the species at the site previously, during Saipem pre-clearance surveys for the GLNG pipeline, with specimens confirmed by the Queensland Herbarium.

The three (3) other EVNT species, highlighted during the desktop searches for a 10km radius, were not detected anywhere in the clearing impact area. EVNT species detections are summarised in Table 3 below.

Table 3 EVNT species search results

Scientific name	Presence/Absence	Action	Photograph
<i>Solanum dissectum</i>	Not detected	N/A	
<i>Solanum elachophyllum</i>	Not detected	N/A	
<i>Solanum johnsonianum</i>	Present within 100m buffer only. Not present on construction footprint	Avoid disturbance. Flag as 'no go' and do not enter, park or store materials in area of mapped habitat. Monitor and control dust and weeds. See map in Appendix C for mapped locations. A total number of 11783 stems estimated.	

Scientific name	Presence/Absence	Action	Photograph
<i>Xerothermella herbacea</i>	Not detected	Suitable habitat present within the <i>S. johnsonianum</i> habitat only. Concurrent protection will occur.	

Within the 100m buffer around the clearing impact area, a total of **9,998** (Table 4) individuals of *S. johnsonianum* was estimated to occur in dense vegetation that ran for approximately 400m within the buffer and along the roadside. This narrow remnant patch is fragmented by the Jemena and GLNG pipelines but contained typical brigalow structure and flora diversity including *Eucalyptus cambageana*, *Acacia harpophylla*, *Citrus glauca*, *Alectryon diversifolius* and *Carissa ovata*. This vegetation resembles Regional Ecosystem (RE) 11.4.8 with its Biodiversity Status listed as Endangered under the VM Act.

Table 4 Population estimate

Sample	Stems per m ²
Quadrat 1	30
Quadrat 2	34
Quadrat 3	6
Quadrat 4	14
Quadrat 5	23
Average stems per m ²	21.4
Area inhabited by the species	467.24 m ²
Population estimate	9960 extrapolated from quadrat data + 38 counted manually = 9,998 total



Figure 2 Brigalow patch containing *S. johnsonianum*



Figure 3 *S. johnsonianum* patch mapped in the clearing area



Figure 4 1m² quadrats used to measure stem density



Figure 5 Current condition of *S. johnsonianum*

4.2 EVNT flora species preferred and supporting habitat

4.2.1 Proposed clearing area

The proposed clearing area comprised of cleared pasture with scattered trees and recently cleared easement for the GLNG pipeline construction. The proposed clearing area consisted predominantly of open pasture dominated by buffel grass (*Cenchrus ciliaris*), Queensland blue grass (*Dichanthium sericeum*) and black speargrass (*Heteropogon contortus*) with very sparse regrowth of *Eucalyptus cambageana*, *Acacia harpophylla* and *Casuarina cristata* to 4m.

No EVNT species or supporting habitat were present in the proposed clearing area.

4.2.2 100m buffer

The 100m buffer around the clearing impact area includes additional pasture and isolated paddock trees on the north, west and southern sides, whereas a narrow patch of brigalow woodland occurs in the adjoining road reserve, within the buffer, to the east of the disturbance footprint.

Preferred habitat for *S. johnsonianum* occurs only in the 100m buffer area which included small patches of brigalow woodland (RE 11.4.8) within the road reserve to the east of the disturbance footprint on the eastern side of the road. This patch provides appropriate species assemblage, canopy shelter and an open ground layer necessary for the species. Small regrowth brigalow clumps on the western side of the road, within the buffer area only, may provide sufficient cover for the establishment of small clumps of *S. johnsonianum* in the future.

Within this roadside brigalow woodland, *S. johnsonianum* was detected and mapped. The vegetation community was assessed and can be described as a vegetation canopy 10 - 15m tall with a T1 layer dominated by *Eucalyptus cambageana* (12.6 – 15.4m), *Acacia harpophylla* (5.8 – 9.6m) and *Casuarina cristata* (5.8 – 9.6m). A *Geijera parviflora* and *Carissa ovata* dominated shrub layer to 3m predominates, and a sparse ground layer of *Paspalidium caespitosum*, *Enteropogon acicularis*, *Brunoniella australis* and invasive species *Megathyrus maximus* and *Cenchrus ciliaris* is present. Additional flora species are listed in Appendix B. The vegetation structure and composition was found to be consistent with description for regional ecosystem 11.4.8, remnant vegetation of which appears on the certified DEHP RE maps. The soils are heavy cracking, solodic clay soils and the landform is an undulating plain. The vegetation was generally in poor condition due to dust and dry conditions, however it formed part of a continuous roadside corridor (Figure 6).

4.1 Environmentally Sensitive Areas

No Category A, B or C Ecologically Sensitive Areas (ESAs) occur within the Meridian Interconnector construction footprint. The field survey by Ausecology confirmed that there is no vegetation in the proposed clearing area that resembles remnant vegetation, high value regrowth or essential habitat.

The nearest mapped ESA area is a Category B ESA (remnant endangered vegetation), approximately 100m away on the eastern side of the adjoining road. This ESA is associated with Essential Habitat for endangered *S. johnsonianum* (as listed under the NC Act).

The Meridian Interconnector construction footprint is not traversed by any watercourses as defined under the Water Act 2000.



Figure 6 Patch of brigalow in which *S. johnsonianum* was detected

4.2 EPBC Act Threatened Ecological Communities and Species

No TECs, EPBC Act protected species or habitat for such species were detected in the Meridian Interconnector construction footprint.

4.3 NC Act Special Least Concern Plants

No species listed in Schedule 3a of the *Nature Conservation (Wildlife Management) Regulation 2006* (current as at 25/7/14) were found within the Meridian Interconnector construction footprint. Two species, *Brachychiton australis* and *Brachychiton rupestris* occur in the form of seedlings in the 100m buffer within the brigalow woodland and will not be disturbed by the construction activities.




4.4 Declared and Environmental Weeds Detected




Numerous introduced plant species were detected during the intensive flora survey, including one declared pest plant *Opuntia tomentosa* (velvety tree pear). *O. tomentosa* was only detected in the 100m buffer area, not within the proposed clearing area. Environmental and agricultural weeds detected within the clearing impact area are listed in Appendix B and designated by an asterisk (*).

4.5 Fauna Habitat Features

No significant fauna habitat features were found in the proposed clearing area. Several suitable fauna habitat features were found within the 100m buffer area. Some of these features, including bird nests that may become active during construction, are in close proximity to the margin of the proposed clearing area. Table 5 details habitat features found during the survey, Appendix C provides the location of these features with respect to the proposed clearing area.

Table 5 Fauna habitat features detected

Feature Code	Type	Habitat Value/Action	Photograph
1	Coarse woody debris	Habitat mainly for reptiles (snakes, geckos etc.), amphibians and ground dwelling mammals. Avoid where possible – or if disturbed a DEHP Licensed Fauna spotter required. It is recommended to keep fallen logs intact and place them off the infrastructure footprints where they can continue to provide habitat for fauna species.	
2	Dead standing tree (stag)	Habitat for reptiles (snakes, geckos etc.), mammals (gliders, possums, bats etc.), microbats and birds. Avoid where possible– or if disturbed a DEHP Licensed Fauna spotter required. If trees are to be felled it is recommended to place logs off the infrastructure footprints where they can provide ongoing habitat for fauna species.	
3	Inactive bird's nest in grass.	Nest currently not active but may be used again in future. Avoid where possible or DEHP licensed fauna spotter to relocate.	

Feature Code	Type	Habitat Value/Action	Photograph
4	Fallen log	As per course woody debris	
5	Fallen log	As per course woody debris	
6	Active nest (yellow-rumped thornbill) in <i>Casuarina cristata</i> tree	Nest currently active and may be used again in future. Avoid if possible or DEHP licensed fauna spotter to relocate and/or rehabilitate.	

5 Recommendations

The locations of the endangered species *Solanum johnsonianum* in the clearing impact area have been mapped with a high degree of accuracy. The *S. johnsonianum* population is entirely outside the proposed clearing area. The primary measure of protection of the species at this site will be to avoid disturbance to the preferred and supporting habitat. It should be noted that the preferred habitat is consistent with the regional ecosystem 11.4.8 (Endangered biodiversity status) but is highly fragmented and is not mapped as remnant. Protection measures should also be extended to include smaller stands of trees disjunct from the main remnant brigalow patch on the roadside (supporting habitat). Birds and other fauna may disperse seed of *S. johnsonianum* to these patches where, given shelter from the vegetation, establishment of small patches of *S. johnsonianum* could occur in the future.

Preferred and supporting habitat can be distinguished using the maps and GPS data provided, and flagged as 'no go' i.e. do not enter, park or store materials in area of mapped habitat. Other potential impacts may include dust and weeds. Dust caused by traffic and earthworks may settle on the leaves of the plants, therefore restricting its ability to photosynthesise and thrive. Regular wetting of unsealed surfaces within 500m of the *S. johnsonianum* habitat is recommended during construction. See map in Appendix C for mapped locations of preferred and supporting habitat for *S. johnsonianum*.

Currently there are a number of weeds potentially impacting on the health of the plants at the site. It is advisable that additional impacts are not caused through accidental introduction of new weeds to the area.

Vehicle and machinery hygiene practices, already proven effective during the pipeline construction phase, should be continued throughout the construction and ongoing visitation of the Meridian Interconnector site.

Fauna habitat features were detected and recorded within the 100m buffer area. It is recommended that a licensed fauna spotter/catcher be engaged to pre-clear the habitat features in close proximity and undertake fauna protection and relocation during clearing if necessary. Details of each fauna habitat feature detected are provided in this report and should be provided to the spotter/catcher to assist in finding the features.

6 References and technical resources

Anderson, E. (2003). Plants of Central Queensland; their identification and uses.

Brooker, M.I.H., Kleinig, D.A. (2004). Field guide to Eucalypts, Volume 3, Northern Australia.

Harden, G., McDonald, B., Williams, J. (2007). Rainforest climbing plants; A field guide to their identification.

Harden, G., McDonald, B., Williams, J. (2011). Rainforest trees and shrubs: A field guide to their identification.

Henry, D.R. *et al.* (2007). Pasture plants of Southern Inland Queensland.

Lester, N. (2008). Woodland to Weeds, Southern Queensland Brigalow Belt.

Neldner, V., Wilson, B., Thompson, E., Dillewaard, H. (2005). Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.1), Environmental Protection Agency, Queensland.

Queensland Government Department of Environment and Heritage Protection (2014). Flora Survey Guidelines – Protected Plants, Nature Conservation Act 1992.

7 Appendix A – Curriculum Vitae

BRAD JEFFERS

Principal Ecologist

Brad Jeffers is Principal Ecologist with Ausecology and has over 15 years experience in environmental consulting and the horticulture industry with a strong background in leading and conducting ecological assessments and research across Queensland for a wide range of clients from research institutions to the mining, gas and utility industries. Brad has extensive ecological knowledge of the Brigalow Belt and Southeast Queensland, with a passionate focus on flora and vegetation communities. Furthermore, Brad is an accomplished trainer in horticulture practices, plant identification and conservation and land management.

Qualifications

- Bachelor of Applied Science (Protected Area Management), University of Queensland: 2000
- Certificate III in Horticultural Practices (Nursery), Brisbane Institute of TAFE: 1998
- Statement of Attainment in Landcare and Environmental Studies, North Coast Institute of TAFE Coffs Harbour Campus: 2002
- Certificate IV Workplace Assessment and Training, Enterprise and Training Company of Coffs Harbour: 2002

Affiliations

- Member of Society for Ecological Restoration
- Member of Australian Network for Plant Conservation
- Member of Wildlife Preservation Society Queensland

Career Summary

- 2013-present: Principal Ecologist: Ausecology
- 2012 - 2013: Ecologist: Ecologica Consulting
- 2010-2011, 2012: Ecologist: Boobook Consulting
- 2011: Ecologist: AMEC Earth & Environmental - Canada
- 2009 – 2011: Casual Research Technician: University of the Sunshine Coast
- 2004-2009: Environmental Consultant & Training Coordinator: Greening Australia QLD
- 2003-2004: Horticultural trainer: Axiom College
- 2001-2003: Bushcare Support Project Officer: Greening Australia NSW
- 1997-2004: Baileyana Landscaping and Construction
- 1998: Horticultural tutor: Brisbane Institute of TAFE
- 1997-1998: Nursery hand: Powerful Owl Native Plant Nursery

Expertise

- Flora and fauna surveys, identification and impact assessment
- Vegetation community assessments for construction projects
- Threatened species risk assessments (QLD & Cwlth legislation)
- Vegetation Management Planning and rehabilitation
- Ecological impact assessments and legislative advice and planning
- Geographical Information Systems (GIS)
- Regional Ecosystem assessment and delineation

- Community consultation

Professional development and extracurricular activities

- Biocondition Training, Queensland Government
- Regional Ecosystem Mapping Training, Queensland Government, 2006
- Construction White Card
- Four Wheel Drive Course
- Venomous Snake Handling course
- Apply First Aid
- MapInfo training (GIS), 2006
- Chemical Users Certificate, NSW

Industry Experience:

Energy and resources

Saipem Australia: GLNG Gas Transmission pipeline

- Establishment of analogue sites and collection of baseline data, using Biocondition Assessment Methodology, for future pipeline rehabilitation monitoring. Opportunistic detections were made of EVNT species including *Cycas megacarpa*, *Desmodium macrocarpum*, *Paradelma orientalis* (brigalow scaly-foot) and *Xerothamnella herbacea*.
- *Cycas megacarpa* translocation supervision
- Type A species translocation supervision
- Least concern plants seed collection
- Weed monitoring
- Watercourse rehabilitation tubestock planting supervision
- Pre-clearance surveys
- Installation of nest boxes for EVNT fauna species
- *Xerothamnella herbacea* reinstatement and monitoring

Santos Eastern Pipelines and Origin Energy Upstream Projects: Pre-clearance ecological field surveys of pipelines, well pads, access tracks and infrastructure sites to assist planning, approvals and rehabilitation processes.

Ecological scouting and pre-clearance surveys include, but are not limited to:

EVNT species encountered by Brad throughout this period included *Acacia gittinsii*, *Commersonia argentea*, *Egernia rugosa* (yakka skink), *Elaeocharis blakeii* (jointed clubrush), *Paradelma orientalis* (brigalow scaly-foot), *Rutidosia lanata*, *Strophurus taenicauda* (Golden-tailed gecko), *Wahlenbergia islensis*, and made the discovery of a new genera of snail.

Arrow Energy: Fauna survey and monitoring following an environmental incident.

- Collection of population and ecological monitoring data using terrestrial vertebrate fauna survey guidelines (QLD DEHP) including: pitfall, funnel and Elliott trap lines, active diurnal searches for birds and reptiles, and spotlighting searches for reptiles, mammals and nocturnal birds.

GLNG (Santos) Project: Endangered species assessments

- Detection and identification of threatened flora and fauna species under both the EPBC Act (Cwlth) and Nature Conservation Act 1992 (QLD) as well as Type A species under the NC Act by targeted and active searching, opportunistic sightings, random meander and identification of traces.
- Detection, identification, mapping and population estimate of declared pest species (Land Protection Act and Weeds of National Significance).
- Identification of Threatened Ecological Communities and migratory species under the EPBC Act.
- Ground truthing of high value regrowth and regional ecosystems.
- Ground truthing of category A, B and C Environmentally Sensitive Areas.
- Assessment of the type and ecological value of vegetation not classified as being remnant or high value regrowth vegetation (e.g. standalone paddock trees, stands of apparently intact vegetation).
- Opportunistic observations of fauna or evidence of fauna activity and fauna habitat features.
- Assessment of wetlands, springs, watercourses and ephemeral creeks (*Water Act 2000*).
- Quantification for clearance permits, translocations and/or offsetting purposes of all EVNT and Type A species using direct count, quadrat and transect methodologies.
- Collection of baseline population and ecological data on the EPBC listed endangered plant *Xerothamnella herbacea*. Search effort using 50 metre (m) grid pattern and ecological data capture using quaternary assessments following Nelder et al methodology and 10m x 10m plots with nested 1m quadrats. Provision of a report, population data and GIS spatial data. Opportunistic surveying for other listed species detected in the survey area.
- EVNT plant seed collection, propagation and reinstatement: collecting seed and vegetative material for 11 EVNT species for propagation and future reinstatement.

APLNG (Origin Energy) Project: Ecological assessments

- *Cycas megacarpa* (cycad) translocation recipient site evaluations using Biocondition Assessment Methodology (Queensland Herbarium)
- Salvaged *Cycas megacarpa* (cycad) monitoring at the nursery
- Baseline erosion and landform feature assessments
- Baseline assessment of water course features as defined under the *Water Act 2000*
- Establishment of photo point monitoring sites and baseline image capture
- Environmental pre-clearance surveys

Other linear Infrastructure

Brad has extensive experience working on other linear infrastructure projects including powerlines and roads. He was involved with numerous projects for a range of clients, including conducting desktop (risk) assessments, in-field verifications, data analysis and interpretation, plus client and government reporting.

- *Ecofund*: Ecological assessment for Surat Basin Rail - Queensland. Brad successfully conducted ecological impact assessments and vegetation mapping. EVNT species detected included *Dichanthium queenslandicum*, *Paradelma orientalis* (Brigalow scaly-foot), *Solanum johnsonianum*, *Solanum elachophyllum* and *Xerothamnella herbacea*.
- *Ergon Energy*: Brad successfully developed the *Wide Bay Easement Environmental Management Plans for Protected Areas* focussing on identification of EVNT flora species, conducting pest surveys, EMP reporting, GPS data collection, and spatial data and map production. EVNT species detected include: *Acacia attenuata*, *Acacia baueri*, *Alyxia sharpei*, *Eucalyptus hallii* (Goodwood gum), *Macrozamia lomandroides*, *Macrozamia pauli-guilielmi* and *Melaleuca cheelii*.

- **Ergon Energy:** Brad assisted in the field surveys and mapping for the Proston EVNT *species management profiles* focussing on detection and identification of EVNT flora species, conducting population demographic surveys, GPS data collection, and spatial data and map production. EVNT species detected include: *Denhamia parvifolia*, *Lasiopetalum* sp. (Proston J.A.Baker 17), *Phebalium distans* and *Zieria verrucosa*.
- **Ergon Energy:** Brad assisted in the field surveys and mapping for the Far-north Queensland EVNT *species management profiles* focussing on detection and identification of EVNT flora species, conducting population demographic surveys, GPS data collection, and spatial data and map production. EVNT species detected include: *Denhamia parvifolia*, *Lasiopetalum* sp. (Proston J.A.Baker 17), *Phebalium distans* and *Zieria verrucosa*.
- **Ergon Energy:** Brad was part of the Queensland wide Ergon Energy – Greening Australia Plant Smart team, contributing to vegetation field surveys, data collection, analysis and reporting, plant profiles production and the development of numerous powerline friendly plant brochures. EVNT species detected include: *Strophurus taenicauda* (golden-tailed gecko), *Kunzia flavescens*.
- **ENERGEX:** Brad conducted numerous pre-clearance ecological surveys for the construction of new powerlines (numerous locations throughout southeast Queensland) of various powerline types.
 - Cedar Creek Road, Samsonvale;
 - Purga School Road, Hampstead;
 - Doonan Bridge Road, Doonan;
 - Eumundi-Noosa Road, Eumundi;
 - Crosiers Road, Cootharaba to Pomona-Kin Kin Road, Pinbarren;
 - Buchanan Road to Wilsons Pocket Road, Goomboorian; and
 - Bayside Road, Tin Can Bay to Laminex Road, Toolara Forest during which numerous populations of the endangered *Macrozamia pauli-guilielmi* was detected and successfully avoided.
- **Main Roads Queensland:** Brad provided technical support and advice relating to vegetation and mapping to the Greening Australia extension officer positions.

Mining

Brad has broad-ranging experience with a wide range of mine-related ecological projects, ranging from risk assessments and vegetation assessments.

- **Rio Tinto: Biocondition, quaternary and fauna survey for vegetation offset site monitoring.** Collection of baseline and six monthly monitoring data following the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Department of Science, Information Technology, Innovation and the Arts DSITIA), and Biocondition assessment following Queensland Government Department of Environment and Heritage Protection (DEHP) Biocondition assessment guidelines. The fauna survey component included: hair, pitfall, funnel and Elliott trap lines, morning and evening chorus bird surveys, active diurnal reptile searches, and spotlighting searches for reptiles, mammals and nocturnal birds.
- **Xstrata Coal Queensland: Biodiversity Risk Management Plan for land owned and managed by Xstrata Coal.** Brad was involved in this Queensland wide project and was the ecologist for all the flora & fauna and vegetation community assessments on the Xstrata properties (Mining Leases and Exploration Permit for Coal properties), including those in the Brigalow Belt South and North (Wandoan, Rolleston, Oaky Creek, Newlands, Suttor Creek, Collinsville). The risk assessment was adopted as part of the Xstrata Land Management Plan. EVNT species encountered include: *Cadellia pentastylis* (ooline).
- **Xstrata Coal Queensland: Tieri Regional Ecosystem delineation.**

Research

Brad has participated in a range of threatened species genetics and forestry related research projects including:

- Smart Forests Alliance Queensland: Development of fast-growing high-value hardwood species of Eucalyptus, Corymbia and Khaya for plantation development for forest plantations and carbon sequestration. Assisting with nursery based research and experimentation of root hormones and field based ecological research related to native stingless bees and their association with the trial hardwood species.
- University of the Sunshine Coast: Conservation genetics and population demographics of the endangered *Phaius australis*, *P. tankervilleae* and *P. bernaysii* - Brad assisted the PhD candidate, in a voluntary capacity, during field research throughout Queensland and NSW. Brad assisted with targeted searches, mapping, population estimates, data collection, and genetic sample collection and drying.
- University of the Sunshine Coast, Does a Lord Howe Island palm vary across its altitude distribution? And what are the implications for future persistence? Ecological, genetic and demographic analysis of *Hedyscepe canterburyana* - Brad assisted the Honours student, in a voluntary capacity, in genetic sample processing, technical advice and proof reading of the publication.
- University of the Sunshine Coast: Ground parrot surveys - assisted special research project student Jean Douglas in collecting baseline data to test electronic location detection technology - Peregian beach, QLD.

Other relevant experience

- *AMEC: Windsor- Essex Parkway Species at risk annual monitoring report.* Report on six plant species and two reptile species (colicroot, common hop tree, dense blazing star, dwarf hackberry, kentucky coffee-tree, and willowleaf aster; Butler's gartersnake and eastern foxsnake). Undertook analysis of data collected over five years using MS Excel and POPan data analysis tools. Population estimates using POPan, rate of movement estimates using custom designed spreadsheet formulas comparing radio tracking capture release data. Health assessment, growth and survival rates post translocation for the six plant species.
- *Griffith University: Sexual Dimorphism and Colour Polymorphism in the Wallum Sedge Frog (Litoria olongburensis).* Assisted Dr Katrin Lowe with nocturnal and diurnal field surveys of the species in swamps in the Sunshine Coast region, QLD
- Pre-clearing ecological impact assessment for Fraser Island Great Walk extension - Fraser Island Defenders Organisation and National Parks Assoc. QLD - Fraser Island, QLD. Conducted flora and vegetation community component of the environmental impact assessment. EVNT species detected by Brad included *Archidendron lovelliae*, *Acacia bauera* and *Plectranthus nitida*.
- *Australian Defence Force:* Provision of GIS support and mapping to the invasive weed management contracts held by Greening Australia. Production of spatial data representative of progress towards achievement of project deliverables.
- *Nursery industry experience:* Brad has been involved in facilitation of horticulture trainee education with participating production nurseries in the Redland Bay area. Practical experience was acquired through native plant propagation, dormancy and growing media trials and general production practices at the Greening Australia native plant nursery at The Gap.
- *Vegetation Incentives Program:* Brad managed implementation and facilitation of the program across the northern half of Southeast Queensland. This involved delivering information sessions, conducting ecological assessments and negotiating incentives and conservation agreements with landholders.
- *Identifications/detections across numerous projects:* (Glossy-black cockatoo) *Calyptorhynchus lathamii*, *Cadellia pentastylis* (ooline), Squatter Pigeon (*Geophaps stricta*), *Xerothamnella herbacea*, *Gonocarpus urceolatus* (previously listed as vulnerable).

Referees

A list of referees will be provided on request.

CARLA PERKINS

Ecologist and Environmental Consultant

Carla is an environmental consultant with five years of consulting experience working in a range of sectors, including energy and resources, linear infrastructure, urban development, local and state government and natural resource management (NRM). Areas of specific expertise include GIS-based habitat modelling and population mapping, field surveys and management plans for threatened terrestrial flora species; vegetation community surveys, assessment and mapping (including Regional Ecosystem classification and Biocondition assessment); environmental restoration and rehabilitation as well as project management. Carla has strong botanical, mapping and GIS skills, as well as experience in the preparation of environmental assessment, management and rehabilitation plans, seed collection strategies and environmental landscape plans. She has also written and delivered training workshops in plant identification and seed collection.

Qualifications

- Bachelor of Science, Griffith University.
- Cert IV in Spatial Information Services (Geographic Information Systems), expected completion: June 2014
- Certificate III in Conservation and Land Management.
- Certificate III in Horticulture (Nursery and Landscape).

Career Summary

- 2013: Ecologist, Ausecology
- 2012-2013: Ecologist, RPS Australia East
- 2009-2012: Environmental Consultant, Greening Australia

Expertise

- Flora and vegetation community assessments for construction projects
- Threatened flora species field surveys and management plan development
- Vegetation Management Planning and rehabilitation
- Construction Environmental Management Plans (CEMP)
- Mapping and GIS skills
- Project Management and Training

Professional development and extracurricular activities

- General Construction White Card
- RRTO Mine Induction – Standard 11 Surface Operations
- First Aid - Apply First Aid and Remote First Aid
- 4WD (Low Range Bush) course
- Santos Approved Driver Course (RIIVEH201B Operate Light Vehicle and PMASUP236B Operate Vehicles in the field)
- MapInfo Professional Level I

Industry Experience and Expertise:

Energy and Resources

- *Saipem Australia: GLNG Gas Transmission pipeline*
 - Type A species translocation supervision
 - Least concern plants seed collection
 - Weed monitoring
- *GLNG (Santos) Project: EVNT plant seed collection, propagation and reinstatement: collecting seed and vegetative material for 11 EVNT species for propagation and future reinstatement.*
- *Rio Tinto: Biocondition, quaternary and fauna survey for vegetation offset site monitoring.* Collection of baseline and six monthly monitoring data following the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Department of Science, Information Technology, Innovation and the Arts DSITIA), and Biocondition assessment following Queensland Government Department of Environment and Heritage Protection (DEHP) Biocondition assessment guidelines. The fauna survey component included: hair, pitfall, funnel and Elliott trap lines, morning and evening chorus bird surveys, active diurnal reptile searches, and spotlighting searches for reptiles, mammals and nocturnal birds.
- *Origin Energy – Pre-Clearance Ecological Surveys: 3D Seismic Program, Dalwogan and Condabri QLD (Ecologist, RPS Australia East: May – December 2012).* Preliminary desktop assessments including GIS-based mapping and modelling of threatened flora species' distribution and potential habitat; field-based surveys including tertiary and quaternary flora surveys, targeted threatened flora species searches, Regional Ecosystem (RE) and Threatened Ecological Community (TEC) identification and classification, Biocondition assessment, fauna searches and fauna habitat assessment; vegetation mapping, GIS analysis and writing of ecological assessment reports.
- *WDS (APLNG Project): Pre-clearance ecological assessments*
- *Santos - GLNG Project, The Narrows, Gladstone QLD (Ecologist, RPS Australia East: July - August 2012).* Ecological pre-clearance survey of 7 km of LNG pipeline and associated work pad areas. Preliminary desktop assessment included GIS-based habitat modelling of threatened flora species occurrences and potential habitat; field-based surveys including vegetation survey and community assessment (RE classification, Biocondition and habitat assessment), targeted threatened flora and fauna searches, weed mapping, preparation of ground-truthed RE mapping and associated reporting.
- *Santos - Narrabri West Core Hole, Galathera 1 Core Hole and Kananaskis Workers' Camp, Gunnedah Basin NSW (Ecologist, RPS Australia East: August – December 2012).* Ecological site assessment including flora and fauna surveys, threatened flora species surveys, project Environmental Impact Assessment, EPBC Act assessment, TSC 7-part test; ecological assessment reports and associated mapping.
- *Origin Energy – GIS-based peer review of ground-truthed RE spatial data (Ecologist, RPS Australia East: February – April 2012).* Conducted an external review of ecological assessment reports and field GTRE data to assist in improving the integrity of Origin Energy's spatial data and systems.
- *Peabody Energy Australia, Wilkie Creek Mine (Environmental Consultant – Greening Australia 2009 – 2012).* Preliminary site assessment and flora surveys for the purpose of developing a seed collection strategy for mine rehabilitation and subsequent field trips for seed collection.
- *Stanwell Corporation – Meandu East Expansion Project (Ecologist, RPS Australia East: March – April 2013).* Ecological pre-feasibility assessment for the purposes of identifying Biodiversity Offset sites required under Queensland Biodiversity offset Policy (QBOP), including field assessments (tertiary and quaternary flora surveys, RE classification, Biocondition assessment), associated GIS analysis and mapping and preparation of a field validation assessment report.

Linear Infrastructure

- Ergon Energy and Greening Australia Queensland Plant Smart Partnership - State Technical Coordinator, January 2010 – April 2012. Coordination of, and undertaking preliminary GIS analysis/mapping for a desktop-based spatial risk assessment for threatened flora species, field surveys and mapping of threatened flora species within Ergon Energy easements; provision of threatened species and other vegetation management technical advice through researching and preparing species identification profiles.
- *Energex Limited* (Environmental Consultant - Greening Australia, 2009- 2012) - Pre-clearing vegetation surveys within South-east Queensland (SEQ), including threatened species surveys; reporting, landholder liaison and approvals including obtaining approvals from DERM and DER
- M Forest Products.
Queensland Rail (Environmental Consultant - Greening Australia, 2009 - 2012) – Pre-clearing vegetation surveys of existing rail infrastructure within SEQ, associated reporting.

Urban Development

- EPBC Referral of Proposed Action
 - *East Coast Mortgage Trust, 73 Bakers Flat Road, Beachmere* (RPS Australia East, January 2013).
 - *Stockland Developments, Stone Ridge Estate, Narangba*. Koala Spot Assessment Technique (SAT) surveys and Koala habitat assessment, associated mapping and EPBC Referral of Proposed Action.
- *Rehabilitation Management Plan – Eastlake Street, Carrara* (RPS Australia East, November 2012). Ecological site assessment (flora and fauna survey, vegetation communities assessment), associated mapping and preparation of a Rehabilitation Management Plan.

Development Assessment Applications

- *Brisbane Islamic Centre, 161 Underwood Road, Eight Mile Plains* (RPS Australia East, September 2012). Field assessment, provision of strategic and ecological expert advice concerning a development application for a reconfiguration of a lot, preparation of a Rehabilitation Management Plan and associated mapping.
- *Billabirra Crescent, Nerang* (RPS Australia East, February 2013). Ecological Assessment Report and Vegetation Management Plan for a proposed reconfiguration of lot/subdivision.

NRM

- *Border Rivers – Gwydir Catchment Management Authority (NSW) and Greening Australia Queensland*. Project management, collection and processing of seed for use in revegetation (via direct seeding and propagation of tubestock) and in the establishment of seed production areas (SPAs); records and data management; associated reporting.

Referees

A list of referees will be provided on request.

8 Appendix B – Flora Species List

Family	Taxon and Author	Status (*introduced species)
Acanthaceae	<i>Brunoniella australis</i> (Cav.) Bremek.	
Acanthaceae	<i>Dipteracanthus australasicus</i> F.Muell.	
Acanthaceae	<i>Pseuderanthemum variabile</i> (R.Br.) Radlk.	
Apocynaceae	<i>Carissa ovata</i> R.Br.	
Apocynaceae	<i>Gomphocarpus physocarpus</i> E.Mey.	*
Apocynaceae	<i>Parsonsia lanceolata</i> R.Br.	
Apocynaceae	<i>Sarcostemma viminale</i> subsp. <i>brunonianum</i> (Wight & Arn.) P.I.Forst.	
Asteraceae	<i>Aster subulatus</i> Michx.	*
Asteraceae	<i>Conyza bonariensis</i> (L.) Cronquist	*
Asteraceae	<i>Senecio brigalowensis</i> I.Thomps.	
Asteraceae	<i>Sonchus oleraceus</i> L.	*
Boraginaceae	<i>Ehretia membranifolia</i> R.Br.	
Cactaceae	<i>Opuntia tomentosa</i> Salm-Dyck	*
Caesalpiniaceae	<i>Cassia tomentella</i> (Benth.) Domin	
Caesalpiniaceae	<i>Senna coronilloides</i> (Benth.) Randell	
Capparaceae	<i>Capparis lasiantha</i> R.Br. ex DC.	
Capparaceae	<i>Capparis mitchellii</i> Lindl.	
Casuarinaceae	<i>Casuarina cristata</i> Miq.	
Celastraceae	<i>Denhamia oleaster</i> (Lindl.) F.Muell.	
Chenopodiaceae	<i>Enchylaena tomentosa</i> R.Br.	
Ebenaceae	<i>Diospyros humilis</i> (R.Br.) F.Muell.	
Erythroxylaceae	<i>Erythroxylum</i> sp. (Splityard Creek L.Pedley 5360)	
Fabaceae	<i>Desmodium macrocarpum</i> Domin	1
Fabaceae	<i>Glycine</i> sp. (infertile)	
Fabaceae	<i>Stylosanthes scabra</i> Vogel	*
Hemerocallidaceae	<i>Dianella longifolia</i> R.Br.	
Laxmanniaceae	<i>Lomandra longifolia</i> Labill.	
Malvaceae	<i>Gossypium hirsutum</i> L.	*
Malvaceae	<i>Malvastrum americanum</i> (L.) Torr.	*
Meliaceae	<i>Owenia acidula</i> F.Muell.	

Mimosaceae	<i>Acacia excelsa</i> Benth.	
Mimosaceae	<i>Acacia harpophylla</i> F.Muell. ex Benth.	
Mimosaceae	<i>Acacia melvillei</i> Pedley	
Mimosaceae	<i>Acacia salicina</i> Lindl.	
Mimosaceae	<i>Archidendropsis basaltica</i> (F.Muell.) I.C.Nielsen	
Myoporaceae	<i>Eremophila debilis</i> (Andrews) Chinnock	
Myoporaceae	<i>Eremophila mitchellii</i> Benth.	
Myoporaceae	<i>Myoporum acuminatum</i> R.Br.	
Myrtaceae	<i>Eucalyptus cambageana</i> Maiden	
Oleaceae	<i>Jasminum didymum</i> G.Forst.	
Oleaceae	<i>Notelaea microcarpa</i> R.Br.	
Phyllanthaceae	<i>Breynia oblongifolia</i> (Muell.Arg.) Muell.Arg.	
Pittosporaceae	<i>Pittosporum spinescens</i> (F.Muell.) L.Cayzer, Crisp & I.Telford	
Poaceae	<i>Aristida</i> sp. (infertile)	
Poaceae	<i>Bothriochloa</i> sp. (infertile)	
Poaceae	<i>Calypochloa gracillima</i> C.E.Hubb.	
Poaceae	<i>Cenchrus ciliaris</i> L.	*
Poaceae	<i>Chloris virgata</i> Sw.	*
Poaceae	<i>Cymbopogon refractus</i> (R.Br.) A.Camus	
Poaceae	<i>Cynodon dactylon</i> (L.) Pers. var. <i>dactylon</i>	*
Poaceae	<i>Dichanthium sericeum</i> (R.Br.) A.Camus	
Poaceae	<i>Dinebra decipiens</i> (R.Br.) P.M.Peterson & N.Snow	
Poaceae	<i>Enteropogon acicularis</i> (Lindl.) Lazarides	
Poaceae	<i>Entolasia stricta</i> (R.Br.) Hughes	
Poaceae	<i>Eragrostis</i> sp. (infertile)	
Poaceae	<i>Heteropogon contortus</i> (L.) P.Beauv. ex Roem. & Schult.	
Poaceae	<i>Hyparrhenia rufa</i> (Nees) Stapf	*
Poaceae	<i>Megathyrsus maximus</i> (Jacq.) B.K.Simon & S.W.L.Jacobs	*
Poaceae	<i>Melinis repens</i> (Willd.) Zizka	*
Poaceae	<i>Panicum decompositum</i> R.Br.	
Poaceae	<i>Paspalidium caespitosum</i> C.E.Hubb.	
Poaceae	<i>Sporobolus australasicus</i> Domin	
Poaceae	<i>Thellungia advena</i> Stapf ex Probst	

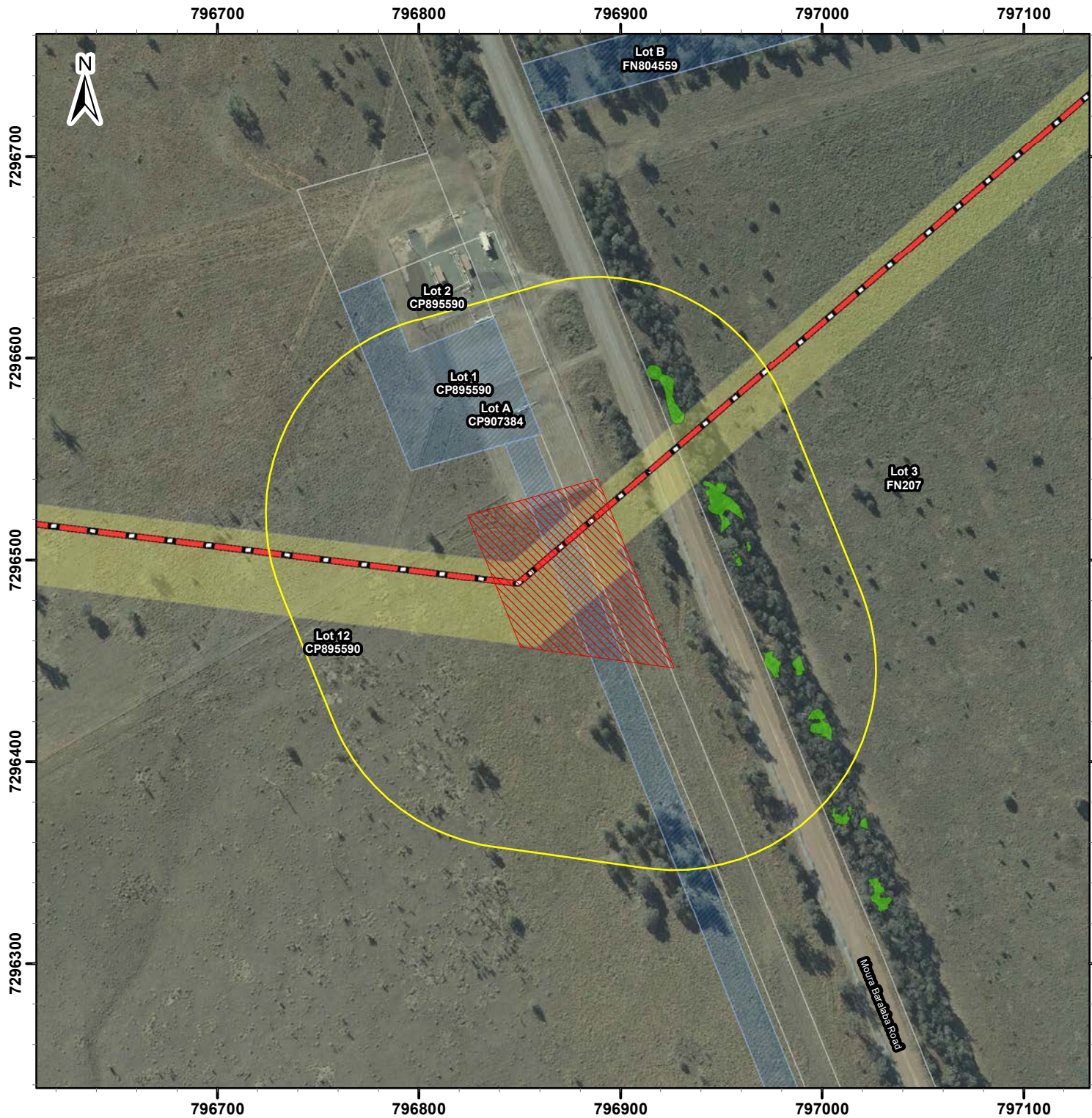
Poaceae	<i>Urochloa mosambicensis</i> (Hack.) Dandy	*
Proteaceae	<i>Hakea lorea</i> subsp. <i>lorea</i> (R.Br.) R.Br.	
Rubiaceae	<i>Psydrax johnsonii</i> S.T.Reynolds & R.J.F.Hend.	
Rubiaceae	<i>Triflorensia ixoroides</i> (F.Muell.) S.T.Reynolds	
Rutaceae	<i>Citrus glauca</i> (Lindl.) Burkill	
Rutaceae	<i>Geijera parviflora</i> Lindl.	
Santalaceae	<i>Exocarpos latifolius</i> R.Br.	
Santalaceae	<i>Santalum lanceolatum</i> R.Br.	
Sapindaceae	<i>Alectryon diversifolius</i> (F.Muell.) S.T.Reynolds	
Sapindaceae	<i>Atalaya hemiglauca</i> (F.Muell.) F.Muell. ex Benth.	
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>viscosa</i> Jacq.	
Solanaceae	<i>Solanum johnsonianum</i> A.R.Bean	E
Sparrmanniaceae	<i>Grewia latifolia</i> F.Muell. ex Benth.	
Sterculiaceae	<i>Brachychiton australis</i> (Schott & Endl.) A.Terracc.	
Sterculiaceae	<i>Brachychiton rupestris</i> (T.Mitch. ex Lindl.) K.Schum.	
Verbenaceae	<i>Glandularia aristigera</i> (S.Moore) Tronc.	*

* *Introduced*

E *Endangered*

1 *Recently delisted under NC Act from Near Threatened to Least Concern*

9 Appendix C – Maps



**SANTOS GLNG PROJECT -
GLNG Gas Transmission Pipeline**

Meridian Interconnector

Location and extent
of *Solanum johnsonianum*
populations within flora survey area.

Legend

- Clearing Impact Area (100m buffer) Rev 003
- Proposed Clearing Area (Rev 003)
- GLNG Gas Transmission Pipeline (Rev. A8)
- Solanum johnsonianum populations
- Existing Easements
- Property Boundaries



Scale: 1:2,750

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
False Easting: 500,000.0000
False Northing: 10,000,000.0000
Central Meridian: 147.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

Data sources:
Clearing and Clearing (Impact Buffer) Area prepared and supplied by Santos GLNG Project.

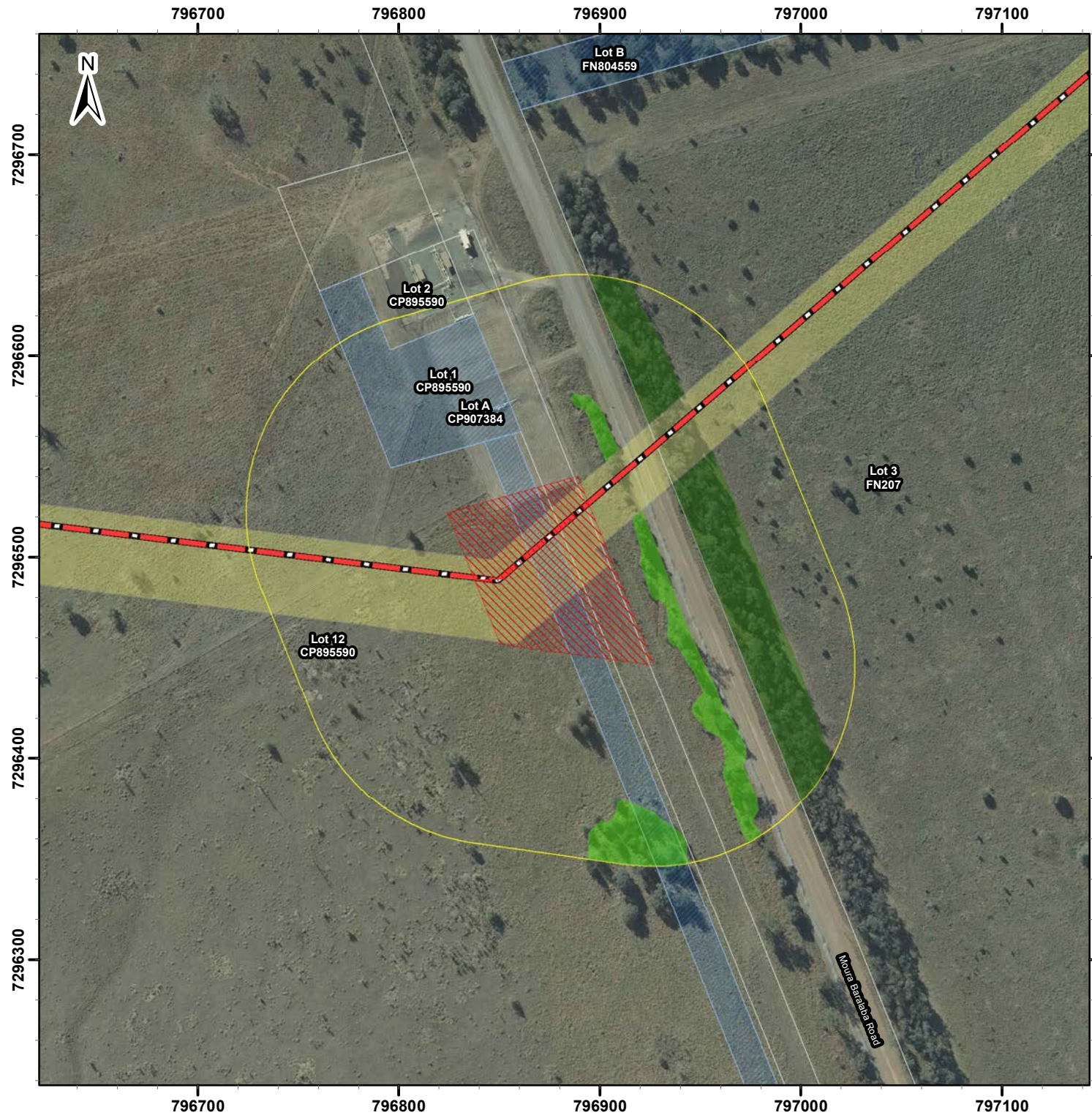
Property and easement boundaries - Cadastral data fortnightly extract Banana Local Government Area © Dept. of Natural Resources and Mines (Qld).

Imagery supplied by Saipem Australia Pty. Ltd.

Author: C. Perkins

Date Modified: 10/09/2014 2:01:42 PM

Client: Santos GLNG Project



SANTOS GLNG PROJECT - GLNG Gas Transmission Pipeline

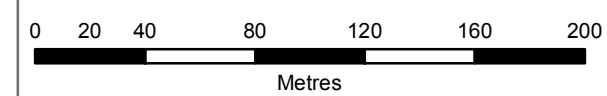
Meridian Interconnector

Preferred and supporting habitat for
Solanum johnsonianum
within the clearing impact area.

Legend

Category

- Preferred Habitat - *E. cambageana*, *A. harpophylla* & *C. cristata* woodland (RE 11.4.8)
- Supporting Habitat - *E. cambageana*, *A. harpophylla* & *C. cristata* non-remnant
- Clearing Impact Area (100m buffer) (Rev 003)
- Proposed Clearing Area (Rev 003)
- GLNG Gas Transmission Pipeline (Rev. A8)
- Existing Easements
- Property Boundaries



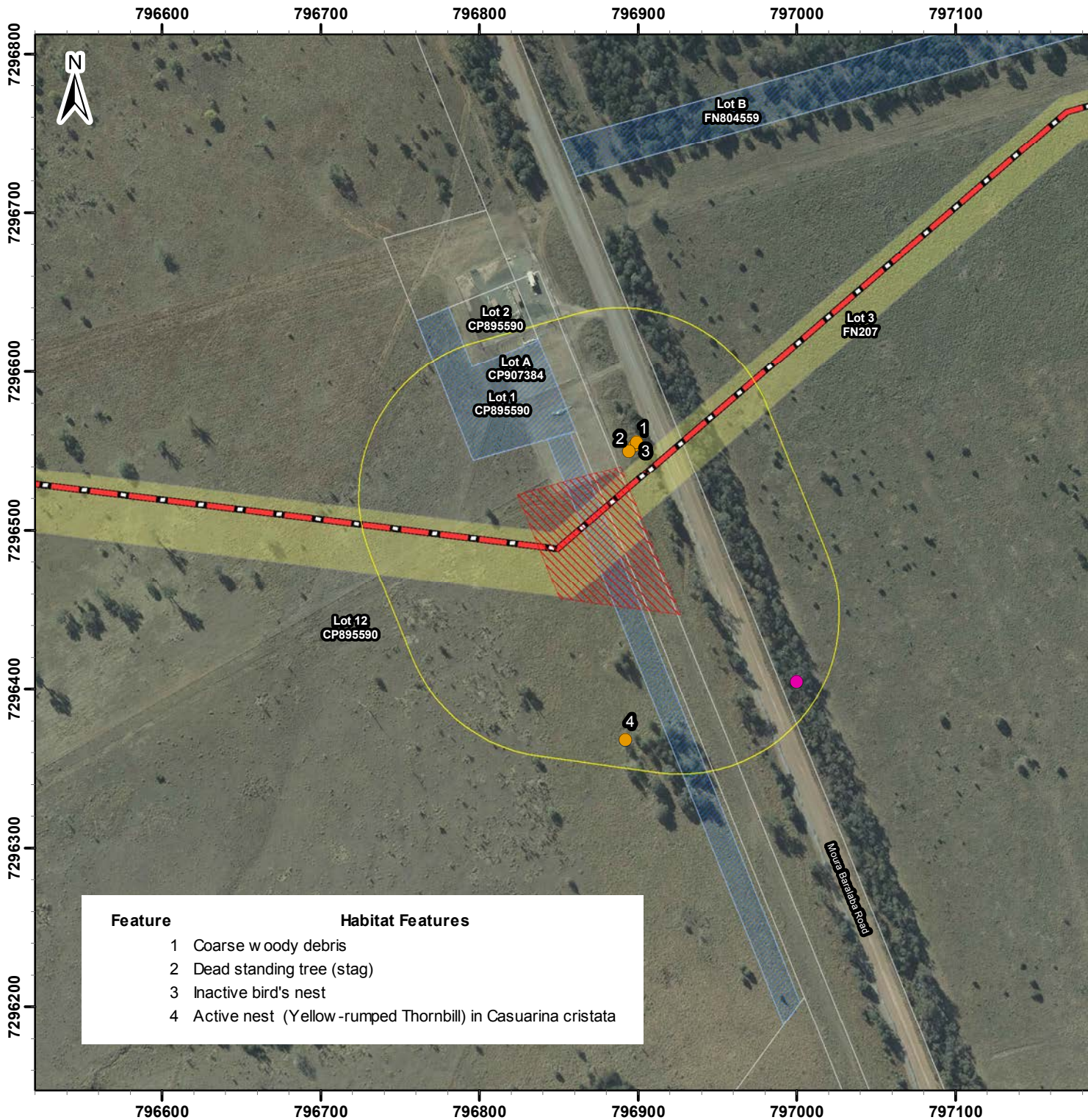
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Coordinate System: GDA 1994 MGA Zone 55
 Projection: Transverse Mercator
 Datum: GDA 1994
 False Easting: 500,000,000.000
 False Northing: 10,000,000,000.000
 Central Meridian: 147.0000
 Scale Factor: 0.9996
 Latitude Of Origin: 0.0000
 Units: Meter

Data sources:
 Clearing and Clearing (Impact Buffer) Area prepared and supplied by Santos GLNG Project.
 Property and easement boundaries - Cadastral data fortnightly extract Banana Local Government Area © Dept. of Natural Resources and Mines (Qld).
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Document Path: G:\Dropbox (Ausecology)\GIS\000_1_PROJECTS\GLNG\Preclearance_Ecological_Surveys\06_Cartography\MXD\GLNG_FloraSurvey_SupportingHabitat.mxd



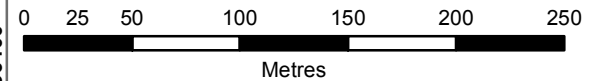
**SANTOS GLNG PROJECT -
GLNG Gas Transmission Pipeline**

Meridian Interconnector

Habitat features recorded
within the flora survey area.

Legend

- Scats (Koala; *Phascolarctos cinereus*)
- Habitat Features (Rev 003)
- Proposed clearing Area (Rev 003)
- Clearing Impact Area (100 m buffer) Rev 003
- GLNG Gas Transmission Pipeline (Rev. A8)
- Existing Easements
- Property Boundaries



Scale: 1:3,500

Coordinate System: GDA 1994 MGA Zone 55
 Projection: Transverse Mercator
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 Scale Factor: 0.9996
 Latitude Of Origin: 0.0000
 Units: Meter

Data sources:
 Clearing area prepared and supplied by Santos GLNG Project.

Property and easement boundaries - Cadastral data fortnightly extract Banana Local Government Area © Dept. of Natural Resources and Mines (Qld).

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Date Modified: 10/09/2014 1:24:28 PM

Client: Santos GLNG Project

Feature	Habitat Features
1	Coarse woody debris
2	Dead standing tree (stag)
3	Inactive bird's nest
4	Active nest (Yellow-rumped Thornbill) in <i>Casuarina cristata</i>

10 **Appendix D – Species Profile *Solanum johnsonianum***

Solanum johnsonianum

Queensland Nature Conservation Act 1992: **ENDANGERED**



(Source: Ausecology)

Description: Erect, perennial shrub to 0.3 m high, densely hairy rusty brown branches with no spines present (Bean 2005).

Leaves: Oval shaped, light green leaves with whitish - green undersides, leaves are densely hairy on both sides with no spines present (Bean 2005).

Flowers: Blue – pale purple, 5 petalled flowers usually borne during Spring (Bean 2005).

Fruit: Globular, red, fleshy fruit 5 – 5.8 mm in diameter (Bean 2005).

Habitat: Observed north of the Theodore to Biloela area on heavy, cracking clay soils, commonly associated with semi evergreen vine thicket (RE 11.9.4) and brigalow/belah (RE 11.9.5) communities (Bean 2005).

References: Bean, A.R. 2005 onwards, *Solanum species of eastern Australia*, version: 8 October 2006. Available at: <http://delta-intkey.com>