

## Santos GLNG

## **Gas Fields**

## Significant Species Management Plan

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## List of Abbreviations

Abbreviation	Meaning
APIA	Australian Pipeline Industry Association
APPEA	Australian Petroleum Production and Exploration Association
AV CSG WMP	Arcadia Valley CSG Water Management Plan
ASS	Acid Sulfate Soils
ATP	Authority To Prospect
AVPA	Arcadia Valley Project Area
CG	Coordinator-General
CG Conditions	Conditions of the Coordinator-General's evaluation report for an environmental impact statement – GLNG project dated May 2010
CS	Compressor Station
CSG	Coal Seam Gas
CSG WMMP	CSG Water Monitoring and Management Plan
CSG WMMP SP	CSG Water Monitoring and Management Plan Summary Plan
DDMP	Decommissioning and Demolition Management Plan
DEEDI	Department of Employment, Economic Development and Innovation
DERM	Department of Environment and Resource Management
E	Endangered
EA	Environmental Authority
EA Conditions	Conditions of EA PEN 101578919 (Roma Project Area), EA PEN 100178208(Fairview Project Area) and EA PEN 102125611 (Arcadia Valley Project Area)
EHS	Environmental, Health and Safety
EHSMS	Environmental Health and Safety Management System
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EP	Equivalent Persons (for sewage treatment plants)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
EPBC Approval	EPBC Act Approval dated 22 October 2010 in respect of referral EPBC No 2008/4059
EQ	Environmental Quality

# Santos GLNG

Abbreviation	Meaning
ER	Environmental Representative
ESA	Environmentally Sensitive Areas
ESCM	Erosion and Sediment Control Manual
FV CSG WMP	Fairview CSG Water Management Plan
FDP	Field Development Plan
Field MP	Field Management Procedures
FMP	Fauna Management Plan
FPA	Fairview Project Area
GAB	Great Artesian Basin
GDE	Groundwater Dependent Ecosystems
GIS	Geographic Information System
GLNG	Gladstone Liquefied Natural Gas
GPS	Global Positioning System
GQAL	Good Quality Agricultural Land
GTP	Gas Transmission Pipeline
HDD	Horizontal Directional Drilling
HDPE	High-density Polyethylene
HVR	High Value Regrowth
IBRA	Interim Biogeographic Regionalisation of Australia
CSG WM MNES	GLNG Project CSG Fields Impacts of CSG Water Management on Matters of National Environmental Significance
kL	Kilolitres
LC	Least Concern
LNG	Liquefied Natural Gas
М	Migratory
ML	Megalitres
MNES	Matters of National Environmental Significance
MSDS	Material Safety Data Sheet
NC Act	Nature Conservation Act 1992
NCN	No Common Name
NT	Near Threatened

# Santos GLNG

Abbreviation	Meaning
OC	Of Concern
PL	Petroleum Lease
PPL	Petroleum Pipeline Licence
PWMP	Pest and Weed Management Plan
QFRS	Queensland Fire and Rural Service
QLD	Queensland
RE	Regional Ecosystem
RFDA	Reasonably Foreseeable Development Area
RMA CSG WMP	Roma Shallow Gas Area CSG Water Management Plan
RO	Reverse Osmosis
RoW	Right of Way
RRRMP	Remediation, Rehabilitation, Recovery and Monitoring Plan
RSGPA	Roma Shallow Gas Project Area
SEIS	Supplementary Environmental Impact Statement
SEVT	Semi-evergreen Vine Thicket
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
SLC	Special Least Concern
SMP	Soil Management Procedure
SSMP	Significant Species Management Plan
TAR	Type A Restricted Plant
TEC	Threatened Ecological Community
The Project	The GLNG Project
The Protocol	The Environmental Protocol for Constraints, Planning and Field Development
UBMS	Upstream Brine Management Strategy
V	Vulnerable
VM Act	Vegetation Management Act 1999



#### 1. Introduction

#### 1.1. Background

The Gladstone Liquefied Natural Gas (**GLNG**) Project (the **GLNG** Project) involves the construction and operation of coal seam gas fields (**CSG Fields**) in the Bowen and Surat Basins, a gas transmission pipeline (**GTP**) and an LNG liquefaction and export facility (**LNG Facility**) in Gladstone, Queensland. The CSG fields component of the Project is operated by Santos Limited (**Santos**) on behalf of the GLNG joint venture.

The Minister for Sustainability, Environment, Water, Populations and Communities (**SEWPaC**) (**Commonwealth Minister**) granted conditional approvals to the Project under the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* (**EPBC Act**) on 22 October 2010. These include approval no. 2008/4059 which relates to the GSG Fields component of the Project (**EPBC Approval**). Condition 7 of the EPBC Approval provides that:

"Before commencement of each major stage of gas field development the proponent must develop management plans for that area addressing each listed species and listed ecological community that, as indicated through assessment or more recent information, may be potentially impacted by gas field development within the Project Area (defined by condition 1), or external to the Project Area as a result of gas field development".

Conditions 8 – 12 of the EPBC Approval specify the required contents of the management plans, the requirements to obtain the approval of the Commonwealth Minister for the management plans, and requirements for the review of the management plans.

The evaluation report for the Project under the State Development and Public Works Organisation Act 1971 (Qld) (SDWPO Act) was prepared by the Co-ordinator General and published in May 2010 (CG Report). The CG Report included an evaluation of the CSG Fields. The development of the CSG fields will be undertaken pursuant to petroleum authorities under the Petroleum and Gas (Production and Safety) Act 2004, and the Petroleum Act 1923, environmental authorities under the Environment Protection Act 1994 (Qld) (EP Act), the EPBC Approval and in accordance with the requirements of the Nature Conservation Act 1992 (Qld) (NC Act).

#### 1.2. Purpose of this Plan

The purpose of this Significant Species Management Plan (SSMP) is to address the requirements of conditions 5, 8 - 12 and 25 of the EPBC Approval requiring preparation of management plans relating to listed threatened species, populations and communities under the EPBC Act.

This SSMP provides specific management measures to be implemented prior to, during and post construction / development activities within the CSG fields for threatened and significant species as well as threatened ecological communities (TEC).

This plan has been designed to:

- Detail actions and procedures to be followed during the pre-construction, construction and operational phases of the Project in order to mitigate adverse impacts to significant species and ecological communities; and
- Ensure compliance with relevant approval conditions specified by SEWPaC, the Queensland CG, the Queensland Department of Environment and Resource Management (DERM) and the Queensland Department of Employment, Economic Development and Innovation (DEEDI) so far as they relate to species listed under the EPBC Act.



#### 1.3. SSMP Review

The SSMP will be routinely reviewed during the construction and operational phases of the Project by a qualified ecologist to take into account new information and advice from both the Commonwealth and Queensland government agencies or from other CSG proponents. Reviews will be aligned to occur at least every three years in line with other key documents including the Operational Plans, Environmental Constraints Planning and Field Development Protocol (**the Protocol**) (Santos 2011a) and the Remediation, Rehabilitation, Recovery and Monitoring Plan (**RRRMP**) (Santos 2011b). The SSMP will also be updated in response to new information becoming available, for example, where a new flora or fauna species or threatened ecological community is listed under the EPBC Act. Commencement of each major stage of the development within the CSG fields will not occur without written approval of the SSMP from the Department or the Minister. Development activities are to be undertaken in accordance with the guidelines in the current version of the SSMP.

If a material revision of the SSMP is required the management of change (**MOC**) process will be implemented to ensure that all relevant stakeholders are engaged and aware of the review process. A full list of examples of changes that will require a revision of the SSMP and the implementation of the MOC process is provided in Section 8.1.

#### 1.4. Scope of SSMP

This SSMP relates to the Roma Shallow Gas, Fairview and Arcadia Valley Project Areas referred to as the Reasonably Foreseeable Development Area (RFDA) for the GLNG Project.

The development of the GLNG CSG fields will involve a rolling program of construction, operation, decommissioning and rehabilitation of GLNG CSG infrastructure over a large area for a significant length of time. Planning for field development, including the specific locations of exploration and development wells and associated infrastructure, is determined incrementally based on the outcome of ongoing exploration programs.

Condition 8 of the EPBC Approval requires the management plans to be prepared for each major stage of the CSG fields. This SSMP has been prepared for Stage 1 of development and to provide guidelines for future infrastructure locations within the RFDA. Stage 1 involves the first phase of CSG field development within the RFDA. The Stage 1 development is described in more detail in Section 1.7 of this SSMP.

#### 1.5. Quality Control

This plan was developed and written by qualified and experienced ecologists with knowledge of the flora, fauna and TEC within the CSG development area and experience in CSG operations. Qualifications, experience and the contributions of all persons involved in the writing and development of this plan are detailed in the Document Control table at the beginning of this document.

#### **1.6. Site Description**

The CSG fields consists of three major gas fields which are described in the following sections.

#### 1.6.1. Fairview Project Area

The Fairview Project Area (FPA) is located to the north-east of Injune, and spans approximately 116 000ha. It incorporates an area of Expedition National Park, Stephenton, Hallett, Beilba, and Doonkuna State Forests and Expedition Resource Reserve. This field encompasses six petroleum leases (PL 90, PL 91, PL 92, PL 99, PL 100 and PL 232), two existing pipelines (PPL 76 and PPL 92) and two proposed pipelines (PPL 147 and 164).



In addition to conservation areas, landuse within the FPA includes grazing and existing CSG extraction activities associated with exploration and development activities. Santos also has a number of pre-existing or "legacy sites" within Fairview, including decommissioned CSG wells and dams. These sites were operational when Santos acquired the Fairview CSG Field in 2006. The FPA is currently operational, with several compressor stations, camps, CSG wells and associated infrastructure within the area.

#### 1.6.2. Roma Shallow Gas Project Area

The Roma Shallow Gas Project Area (RSGPA) is centered around three townships; Roma, Wallumbilla and Yuleba, and spans approximately 259,652ha. The RSGPA encompasses Authority to Prospect (ATP) 336P, eleven petroleum leases (PL 309, PL 310, PL 313 – PL 319, PL 322 and PL 323) and one proposed pipeline (PPL 148). The field encompasses portions of Brucedale, Gubberamunda, Inglebogie, Tinowon, Trinidad, Wallabella, and Yalebone State Forests. Additionally, the RSGPA comprised large tracts of grazing lands, with minor cropping areas. Due to historical agricultural activities, remnant vegetation in the RSGPA is limited.

The RSGPA is currently operational, with limited CSG production and conventional gas production occurring.

#### 1.6.3. Arcadia Valley Project Area

The Arcadia Valley Project Area (AVPA) is located to the west of Taroom, and spans approximately 318, 800ha. The AVPA comprises ATP 526P, four petroleum leases (PL 233, PL 234, PL 235, and PL 236) and three petroleum lease applications (PLA 420, PLA 421 and PLA 440). The field encompasses portions of Expedition National Park and Resources Reserve, as well as Belington, Beilba, Stephenton, and Presho State Forests. This field includes portions of the Arcadia Valley as well as Expedition Range. In addition to conservation purposes, land use within the AVPA includes cattle grazing, forestry and existing CSG infrastructure.

The AVPA is currently operational, with limited exploration and appraisal activities occurring.

#### 1.7. Stage 1 of CSG Fields Development

The development of the CSG fields is authorised under:

- Environmental Authority (EA) PEN101578910 for the RSGPA;
- EA PEN100178208 for the FPA; and
- EA PEN102125611 for the AVPA.

Activities undertaken within the CSG fields will be a staged process. The stages are defined within Operational Plans which are required to be prepared on a 3 year basis pursuant to conditions of the EAs for each of the CSG fields. The current Operational Plans for the FPA, RSGPA and the AVPA apply to the first three year period of the relevant EA. Figure 1.1, Figure 1.2 and Figure 1.3 show the field development for the first stage of the FPA, RSGPA and AVPA respectively. The development identified in the Operational Plans for the first three year period is the Stage 1 development the subject of this SSMP.

This SSMP will be updated for further stages of the CSG fields.

The purpose of the Operational Plan is to document the nature and extent of activities and disturbances relative to existing landforms, land uses and sensitive environmental settings during the three year period of the plan. The figures that have been provided within the Operational Plans depict the existing and proposed petroleum activities. Santos is currently conducting field surveys ('ground truthing') to confirm the locations of environmental constraints and quantify disturbances. The figures and text of the Operational Plans will be updated to reflect the results of the ground truthing.



Activities covered by the three year operational period of the plans include all petroleum activities associated with the appraisal, installation, development, operation and rehabilitation of CSG field assets, including wells, pipelines, dams, compressor stations, associated water amendment facilities and reverse osmosis plants. In addition to the operational assets, a range of ancillary facilities will be developed within the CSG fields, including:

- Roads;
- Electrical generation and reticulation infrastructure;
- Communications infrastructure;
- Laydown yards; and
- Accommodation camps.

The Operational Plans provide a summary of the existing and proposed petroleum activities and associated infrastructure within the CSG Fields. To facilitate review, the activities and infrastructure have been divided into categories based on the nature of the activity. Summary tables are provided with specifications on the number and size of both existing and proposed disturbances. In addition, constraints maps are provided showing the number, location and categories of existing and proposed disturbances relative to surrounding land uses and sensitive environments.

Development of the CSG fields includes a range of activities from geophysical investigations and appraisal activities through to production and finally decommissioning and rehabilitation. Project phases for the CSG assets include:

- Exploration, including geophysical surveys and drilling of exploration wells;
- Appraisal, including drilling and testing of appraisal wells (also called pilot holes);
- Development, including:
  - o Drilling and completion of production wells (wells drilled to enable gas production);
  - Well stimulation (if required);
  - o Installation of infield infrastructure, including dams and flow lines for gas and CSG water;
  - Construction of centralised compression and water treatment facilities, CSG water management facilities and other related infrastructure; and
  - o Production / operation, including:
    - Operation of CSG wells and well head infrastructure;
    - Operation of underground gas storage wells and associated infrastructure;
    - Operation of existing gas compression and water treatment facilities; and
    - Commissioning and subsequent operation of the new assets that will be constructed during this operational period.
- Decommissioning and demolition of assets not required for proposed future activities; and
- Rehabilitation of past disturbances or disturbances associated with development activities during the
  operational period.

The activities authorised under the RSGPA EA (DERM Permit Number: PEN101578910), existing and proposed for the period of this Operational Plan, are listed below in Table 1.



#### Tenure **Petroleum Activities** Number of Number of Maximum Maximum Number/s and Infrastructure Existing Proposed Capacity (where Disturbance Activities Activities applicable) (ha) PL 309 Seismic 2D (kms) 0 300 300 N/A PL 310 Seismic 3D (km<sup>2</sup>) 0 0 N/A 0 PL 313 **Total Wells** 161 1299 N/A PL 314 **Exploration Wells** PL 314 5 10 N/A (indicative) PL 315 2190 Appraisal Wells PL 316 5 25 N/A (indicative) PL 317 **Development Wells** PL 318 146 1264 N/A (indicative) PL 319 Gas Injection Wells 0 49 N/A 73.5 PL 322 Water Injection Wells 0 N/A 12 PL 323 8 ATP 336P Compressor 1 0 N/A 50 Station(s) R-HCS-02 LPG Plant 0 1 N/A 7 Regulated Dam(s) > 0 2 N/A 90 401 megalitres Regulated Dam(s) < 9 N/A 10 160 400 megalitres Non-Regulated 161 3000 N/A 20 Dam(s) Water Treatment 0 N/A 3 4 **Facilities total** Reverse Osmosis 2 Plant(s) 0 R-HCS-02 2 x 5 ML/day 1.5 Mt Hope Associated Water 2 Amendment 0 R-HCS-02 2 x 5 ML/day 1.5 Facility(ies) Mt Hope Brine Encapsulation 0 0 0 0 Facility(ies) Sewage Treatment 2 x 30 kL/Day peak Plant(s) x 85 EP 2 x 402 12 0 4 kL/day peak design capacity x 450 EP

#### Table 1 - Existing And Proposed Petroleum Activities within the RSGPA



The activities authorised under the FPA EA (DERM Permit Number: PEN100178208), both existing and proposed for the period of this Operational Plan, are listed below in Table 1.2.

Table 2 - Existing	and Propos	ed Petroleum	Activities	within tl	he FPA
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Tenure Number/s	Petroleum Activities and Infrastructure	Number of Existing Activities	Number of Proposed Activities	Maximum Capacity (where applicable)	Maximum Disturbance (ha)
PL 90	Seismic 2D (kms)	0	1200	N/A	1200
PL 91	Seismic 3D (km <sup>2</sup> )	0	80	N/A	80
PL 92	Total Wells	220	694	N/A	
PL 100	Exploration Wells (indicative)	35	20	N/A	
PPL 76	Appraisal Wells (indicative)	5	5	N/A	2190
	Development Wells (indicative)	180	669	N/A	
	Gas Injection Wells	2 FV77 FV82	0	N/A	6
	Compressor Station(s)	4 CS1 CS2 CS3	2 F-HCS-04 F- HCS-05	N/A	140
	LPG Plant	1	0	N/A	7
	Regulated Dam(s) > 401 megalitres	0	5	N/A	250
	Regulated Dam(s) < 400 megalitres	2	35	N/A	220
	Non-Regulated Dam(s)	500	4000	N/A	30
	Water Treatment Facilities total	2	3	N/A	10.5
	Reverse Osmosis Plant(s)	1 ROP1	1 ROP @ F-HSC- 04	ROP1 – 6 ML/d ROP @ F-HSC-04 – 25 ML/d	3
	Associated Water Amendment Facility(ies)	1 AWAF1	2 AWAF2 AWAF3	AWAF1 = 10 ML/d AWAF2 = 2 ML/d AWAF3 = 4 ML/d (1 x 3ML + 1 x 1 ML)	7.5
	Brine Encapsulation	0	0	0	0



Tenure Number/s	Petroleum Activities and Infrastructure	Number of Existing Activities	Number of Proposed Activities	Maximum Capacity (where applicable)	Maximum Disturbance (ha)
	Facility(ies)				
	Sewage Treatment Plant(s)	2	5	3 x 30 kL/Day peak x 80 EP 2 x 402 kL/day peak design capacity x 450 EP	20

The activities authorised under the AVPA EA (DERM Permit Number: PEN102125611), both existing and proposed for the period of this Operational Plan, are listed below in Table 1.3.

Tenure Number/s	Petroleum Activities and Infrastructure	Number of Existing Activities	Number of Proposed Activities	Maximum Capacity (where applicable)	Maximum Disturbance (ha)
PL 233	Seismic 2D (kms)	0	1350	N/A	1650
PL 234	Seismic 3D (km2)	0	300	N/A	300
PL 235	Total Wells	69	432	N/A	
PL 236 PL 420 PL 421	Exploration Wells (indicative)	69	20	N/A	
PL 421 PL 440 ATP 526P	Appraisal Wells (indicative)	0	21	N/A	231
	Development Wells (indicative)	0	391	N/A	
	Compressor Station(s)	0	0	N/A	0
	Regulated Dam(s) > 401 megalitres	0	0	N/A	0
	Regulated Dam(s) < 400 megalitres	0	6	N/A	50
	Non-Regulated Dam(s)	0	1032	N/A	200
	Water Treatment Facilities total	0	6	N/A	12
	Reverse Osmosis Plant(s)	0	3	x 2 ML/day x 5 ML/day	6

#### Table 3 - Existing and Proposed Petroleum Activities within the AVPA



Tenure Number/s	Petroleum Activities and Infrastructure	Number of Existing Activities	Number of Proposed Activities	Maximum Capacity (where applicable)	Maximum Disturbance (ha)
	Associated Water Amendment Facility(ies)	0	3	x 2 ML/day x 5 ML/day	6
	Brine Encapsulation 0 0 0	0			
	Sewage Treatment Plant(s)	0		2 x 402 KL/Day peak design capacity x 450 EP	12

#### **1.8. Field Development**

#### 1.8.1. Management Plan

The SSMP forms part of a suite of management plans, which are required to be prepared under the EPBC Approval and the Queensland State approvals. As with the SSMP, these plans and procedures will be updated as part of future CSG field development. In particular, the SSMP is closely related to the following documentation, which is referred to within the SSMP as required:

- FPA Operational Plan (Santos Document Number 0020-GLNG-4-1.3-0018);
- RSGPA Operational Plan (Santos Document Number 0020-GLNG-4-1.3-0017);
- AVPA Operational Plan (Santos Document Number 0020-GLNG-4.1.3-0089);
- Environmental Constraints Planning and Field Development Protocol (the Protocol), prepared for the RFDA, specifically Stage 1 (Santos Document Number 0020-GLNG-3-3.3-0063);
- Remediation, Rehabilitation, Recovery and Monitoring Plan (RRRMP), prepared for the RFDA, specifically Stage 1 (Santos Document Number 0020-GLNG-4-1.3-0012);
- Pest and Weed Management Plans (PWMP), prepared for the RSGPA and FPA CSG fields (Santos Document Numbers 0020-GLNG-4-1.3-0074, and 0020-GLNG-4-1.3-0015);
- Fauna Management Plans (FMP), prepared for the FPA and RSGPA (Santos Document Numbers 0020-GLNG-4-1.3-0014 and 0020-GLNG-4-1.3-0073);
- Soil Management Procedure (SMP) prepared for the RFDA, specifically Stage 1 (Aurecon 2011a);
- Erosion and Sediment Control Manual (ESCM) prepared for the RFDA, specifically Stage 1 (Aurecon 2011b);
- CSG Water Monitoring and Management Plan (CSG WMMP) (Golder Associates, Report Number: 117636002-3000-001-Rev1) and the Stage 1 CSG WMMP Summary Plan prepared for the RFDA (CSG WMMP SP), specifically Stage 1;
- CSG Water Managment Plan prepared for the AVPA (AV CSG WMP)( 0020-GLNG-3-1.3-0021), FPA (FV CSG WMP, Santos Document Number 0020-GLNG-3-1.3-0016 Rev 0) and the RSGPA (RMA CSG WMP, Santos Document Number 0020-GLNG-3-1.3-0017 Rev 0) specifically for Stage 1;
- GLNG Project CSG Fields Impacts of CSG Water Management on Matters of National Environmental Significance for the RFDA (I CSG WM MNES), specifically Stage 1; and



 Upstream Brine Management Strategy (UBMS) for the RFDA, specifically Stage 1 (Santos, 2010) (Santos Document Number 0020-GLNG-3-1.3-0016 Rev 0).

#### 1.8.2. Operational Plan

An Operational Plan has been developed for each of the CSG fields to comply with the conditions of the EAs. A detailed review of the existing and proposed infrastructure is included within the relevant Operational Plans.

#### **1.8.3.** Environmental Constrains Planning and Field Development

Conditions 3 - 5 of the EPBC Approval require the preparation and approval of an Environmental Constraints Planning and Field Development Protocol (the Protocol) (Santos 2011a). The Protocol outlines the approach Santos will take in identifying, managing and mitigating the potential impacts to matters of national environmental significance (MNES) when undertaking development of the CSG fields. This SSMP is linked to the operation of the Protocol.

The Protocol is required under the conditions of the EPBC Approval to be developed prior to the commencement of CSG field development and must apply for the life of the Project. It is required to include the principles of conducting the CSG field operations so as to avoid direct and indirect adverse impacts on MNES, mitigate and manage direct and indirect impacts to minimise cumulative adverse impacts on MNES and active site remediation and rehabilitation of impacted areas to promote and maintain long-term recovery of MNES.

The Protocol divides the CSG fields areas into five constraints classes (A to E). The Protocol sets out:

- The nature of the development which is proposed to be undertaken within each constraints class;
- The process to be undertaken to determine the specific location of the development within each constraints class having regard to the local ecological values of the area; and
- The mitigation measures that will be implemented to minimise the impact of the development on the ecological values of the area.

The Protocol details the requirements for:

- Obtaining internal approval for any new CSG activity;
- Ensuring that appropriate planning is undertaken prior to conducting any new land disturbance associated with the authorised CSG activities;
- Conducting CSG activities in a way that avoids or minimises land disturbance and potential impacts to MNES; and
- Compliance monitoring and reporting requirements to SEWPaC, DERM and the CG.

Condition 5(a) provides that the Protocol must classify in the high environmental constraints class B, amongst other things, the listed threatened and migratory fauna species habitats as identified in the management plans required under condition 8 of the EPBC Approval. Condition 5(a) relevantly provides that:

"The Protocol must:

- (a) classify the following as being within the proponent's high environmental constraints class B (or should the proponent's classification be revised, an equivalent high environmental constraints class):
  - (i) all listed threatened ecological communities;
  - (ii) all listed flora species; and



(iii) those listed threatened and migratory fauna species habitats as identified in management plans required under these conditions, which were relevant may be described in terms of specific niche habitat types".

Condition 25 of the EPBC Approval sets maximum disturbance limits for the habitat type for list threatened species. The habitat for each of the threatened species is required to be described in the management plan for each species required under condition 8.

This SSMP identifies the species habitats for the purposes of conditions 5(a) and 25 of the EPBC Approval.

Condition 5(h) of the EPBC Approval states that the Protocol must require species and ecological community management plans which include:

- (i) "relevant avoidance and mitigation measures to be applied;
- (ii) measures for protecting each listed threatened species and migratory species and their habitat, and each listed threatened ecological community not previously assessed by the proponent, should one or more be found in the Project Area at any time over the life of the project. Any such management plans must be developed in a timeframe to be approved by the Department. Notification of additional MNES found must be provided to the Department in writing within 10 business days. Measures must include the development of a management plan consistent with requirements under condition 8".

This SSMP also forms the species and ecological community management plans for the purposes of condition 5(h) of the EPBC Approval.

#### 1.8.4. Offsets Plan

Condition 26 of the EPBC Approval requires Santos to prepare an offsets plan to provide an offset area for the approved disturbance limits relating to MNES within the CSG Fields (Offsets Plan). An Environmental Offsets Plan for the CSG fields has been developed by Ecofund Queensland on behalf of Santos. Environmental offsets for the gas fields are described further in the *Santos GLNG Gas Fields and Mainland Gas Transmission Pipeline Offset Plan (0007-560-PLA-0014)*. The Offsets Plan outlines the environmental offset requirements for each component of the Project under the Australian Government offset policy and in accordance with the relevant approvals. The Plan also included options for offset delivery and properties that are suitable to meet the identified offset requirements.

#### 1.8.5. Salvage Management Plan

Santos has developed a Salvage Management Plan for the Type A Restricted (TAR) plant species in the CSG fields to satisfy the requirements of the NC Act and Nature Conservation (Protected Plants) Conservation Plan 2000. A consistent methodology will be adopted for the translocation of EPBC listed flora species identified within the impact area, where those species are suitable for translocation.

The act of translocation will be considered to be the "deliberate transfer of plants or regenerative plant material from an ex situ collection or natural population to a location in the wild, including existing or new sites or those where the taxon is now locally extinct" (Santos 2011c). This definition of translocation is based on the Guidelines for the Translocation of Threatened Plants in Australia (Vallee et al 2004). Relocation will mirror the definition of translocation, being the deliberate transfer of plants or regenerative plant material from an ex situ collection or natural population to another location. Relocation methodology will be primarily focused around the transplantation of seedlings or mature plants.

The plan establishes a clear and transparent management hierarchy to facilitate the safe and efficient management of MNES within the CSG fields.



#### 1.8.6. Cumulative Impact Assessment Report

The Cumulative Impact Assessment Report (CIA Report) assessed the potential for impacts from the Santos GLNG Project CSG field development activities to have compounding or synergistic interactions with the potential impacts from other third party projects identified as being within the 'sphere of influence' of the Santos GLNG Project. Due largely to Santos GLNG's proposed environmental management strategies, the CIA Report identified potential cumulative impacts to terrestrial ecology and aquatic ecology as low impact significance and medium impact significance respectively. A brief summary of the potential cumulative impacts to these environmental aspects and how their management has been addressed in the SSMP is summarised below.

Values	Potential Impacts	Santos GLNG Management / Mitigation Measures to address CIA		
Terrestrial Ecology		Significant ecological features including listed flora, fauna		
Listed threatened flora and/or ecological		identified as part of project planning (desktop and field based) and avoided where possible.		
communities		where avoidance cannot be achieved, Santos GLNG will seek to minimise the areas directly impacted and mitigate the		
Listed threatened fauna species	Cumulative impacts were considered limited due to the general lack of common species across the multiple project sites assessed.	disturbance wherever possible. This avoidance and minimisation process is firstly addressed through the implementation of the <i>Environmental Protocol for Constraints</i> <i>Planning and Field Development</i> and associated procedures (a description is provided in Section 3.0 of this SSMP).		
Aquatic Ecology		Where avoidance is not possible and minimisation has occurred as far as practicable, mitigation measures to further		
Murray River Cod	The potential cumulative impacts to these species were increased due to the location of the projects being	reduce impacts to identified values are implemented. These measures are described in detail in the following sections of this SSMP:		
	in the Dawson River Catchment (habitat for the Fitzroy river turtle) and the Murray Darling Basin (habitat for the Murray River Cod).	Section 4.0 – Significant Threatened Flora and mitigation measures		
		Section 5.0 – Significant Terrestrial Fauna and associated mitigation measures		
		Section 6.0 – Threatened Ecological Communities and associated mitigation measures		
		Where the project disturbance still causes a residual adverse impact on an environmental value, an offset relative to the impact will be achieved. Offsets are described further in the Santos GLNG Gas Fields and Mainland Gas Transmission Pipeline Offset Plan (0007-560-PLA-0014).		

Table 4 – Cumulative Impact Assessment Report Outcomes Addressed in SSMP

#### **1.8.7.** Rehabilitation and Decommissioning Requirements

Upon cessation of a petroleum activity(ies), relevant petroleum infrastructure will be decommissioned in accordance with the approved Decommissioning Plans and in accordance with the requirements of the Petroleum and Gas (Production and Safety) Act 2004 (Qld). A Decommissioning and Demolition Management Plan (DDMP) has been developed and provides discussion regarding future decommissioning and demolition activities, focusing on the process of decommissioning and demolition and the mitigation of environmental impacts. The DDMP:

• Includes the progressive removal or reuse of infrastructure where CSG field operations cease during the project life;



- Establishes management practices and safeguards to minimise environmental disturbance;
- Ensures that MNES are not impacted by progressive decommissioning, or final decommissioning of gas field infrastructure;
- Defines rehabilitation actions for the infrastructure sites following decommissioning;
- Optimises habitat and habitat connectivity for MNES; and
- Enhances pre-construction environmental quality.

Santos will commence rehabilitation as soon as practicable, in accordance with the relevant statutory requirements and approvals, unless an agreement is in place with the relevant administering authority and relevant landholder. This agreement may allow the disturbance to be beneficially re-used, for example conversion to farm dams and roads. Where a direct or indirect impact has occurred to a MNES, Santos will apply remediation, rehabilitation, recovery and monitoring measures appropriate for each MNES to restore connectivity or rehabilitate disturbed areas to pre-clearance quality or better, and to minimise cumulative impacts throughout the life of the project. Additionally, where significantly disturbed lands are rehabilitated, Santos will meet its obligation to ensure that maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities. Where regulated dams are constructed, site specific decommissioning and rehabilitation plans will be prepared.

Condition 15 of the EPBC Approval requires Santos to develop a Remediation, Rehabilitation, Recovery and Monitoring Plan (RRRMP). The RRRMP is required to include measures for site remediation, measures for support recovery of listed species habitat and communities affected by the CSG fields, responses to threats to MNES from operations, fire prevention and management regimes and reference to species management plans.

Santos has prepared the RRRMP for Stage 1 (Santos Document Number 0020-GLNG-4-1.3-0012).

#### 1.9. Threatened Ecological Communities within the CSG Fields

The presence and spatial extent of TEC has been determined for the majority of the CSG fields by Regional Ecosystems (RE) mapping (Version 6, DERM 2011), as well as from the previous Environmental Impact Statement (EIS), Supplementary Environmental Impact Statement (SEIS) and local knowledge. Detailed flora surveys will be undertaken ahead of each major development stage to refine TEC mapping. Detailed TEC mapping has been prepared for the first major development stage of the CSG fields (Figures 1.4 to 1.6).

Four EPBC listed TEC are known to occur within the CSG Fields. Table 1.4 outlines the TEC that are known to occur within the CSG fields. Maximum limits of disturbance for the four EPBC listed TEC resulting from authorised, unavoidable, adverse impacts on MNES as a result of exploration, development, operation and decommissioning within the CSG fields, have been established in the EPBC Approval. These disturbance limits are listed in Table 1.4.

Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions was declared Endangered under the EPBC Act in March 2011, post the EPBC Approval for this development. While this TEC is not likely to be impacted on as part of the CSG field development, it has been included within Section 6.0. Similarly, Weeping Myall has been included within Section 6.0, as it is likely to occur within the CSG fields, but outside of Stage 1 of the development area.



## Table 5 - Threatened Ecological Communities (TEC) within Stage 1 of the Development and their status as listed under the Environmental Protection and Biodiversity Act 1999

Threatened Ecological Community Description	CSG Fields with known occurrences in Stage 1	Maximum Disturbance Limit	EPBC Status
Natural grasslands of the Queensland Central Highlands and northern Fitzroy Basin	Ανρα	5.2 ha	Endangered
Brigalow (Acacia harpophylla dominant &sub-dominant)	FPA RSGPA AVPA	19.6 ha	Endangered
Semi-evergreen Vine Thicket of the Brigalow Belt (North and South) and Nandewar Bioregions	FPA RSGPA AVPA	0.8 ha	Endangered
The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin	-	None allowed	Endangered

#### 1.10. Significant Species within the CSG Fields

Numerous flora and fauna species listed under the EPBC Act and NC Act potentially occur within the CSG fields (Table 1.5 and Table 1.6). Detailed flora surveys will be undertaken ahead of each major development area to refine habitat mapping for threatened fauna as well as the presence of threatened flora. Detailed flora mapping has been prepared for Stage 1 of the CSG fields (Figures 1.4 to 1.6). Habitat mapping for threatened fauna species has also been prepared for Stage 1 of the CSG fields. This was based on State RE mapping (Figures 1.7 to 1.18).

Maximum limits of disturbance of habitat type resulting from authorised, unavoidable, adverse impacts on MNES as a result of exploration, development, operation and decommissioning of the CSG fields within the CSG fields, have been established for 12 listed fauna species in the EPBC Approval. These habitat type disturbance limits are listed in Table 1.6. Once these disturbance limits have been reached, no further disturbance of the habitat of these listed fauna is allowable. No disturbance limits have been nominated for threatened flora species.



## Table 6 - Significant Flora Species within Stage 1 of the Development and their status as listed under the Environmental Protection and Biodiversity Act 1999

Description	Common Name	CSG fields with	Status		
		Known Occurrences in Stage 1	EPBC Act	NC Act	
Terrestrial Flora					
Acacia wardellii	Thomby Range wattle	-	V	V	
Bertya opponens	NCN	FPA AVPA	V		
Cadellia pentastylis	Ooline	FPA AVPA	V	V	
Commersonia argentea	NCN	-	V	LC	
Dichanthium queenslandicum	King bluegrass	-	V	V	
Dichanthium setosum	Bristly bluegrass	-	V	NT	
Eucalyptus virens	Shiny-leaved ironbark	-	V	V	
Homopholis belsonii	Belson's panic or Belson's couch	-	V	E	
Macrozamia fearnsidei	Curly zamia	FPA AVPA	V	LC	
Swainsona murrayana	Slender darling pea	-	V	V	
Xerethamnella herbacea	NCN	AVPA	E	E	
Aquatic Flora					
Eriocaulon carsonii	Salt pipework	-	E	E	

Table notes:

NCN= No common name

EPBC Act= (Environmental Protection and Biodiversity Conservation Act 1999)

NC Act= (Nature Conservation Act 1992)

E= Endangered, V= Vulnerable, NT= Near Threatened, LC= Least Concern, TAR = Type A Restricted Plant

## Table 7 - Significant Fauna and Migratory Bird Species within Stage 1 of the Development and their status as listed under the Environmental Protection and Biodiversity Act 1999

Description	Common	CSG fields with Known Occurrences in Stage 1	Disturbance Limit	Status	
	Name		(ha)	EPBC Act	NC Act
Invertebrates					
Adclarkia dawsonensis	Boggomoss snail, Dawson Valley snail	-	N/A	CE	-



Description	Common	CSG fields with	Disturbance Limit	Status		
	Name	Known Occurrences in Stage 1	(ha)	EPBC Act	NC Act	
Birds						
Erythrotriorchis radiatus	Red goshawk	- 139.4ha of habitat V type		V	E	
Geophaps scripta scripta	Squatter pigeon	FPA AVPA	199.2ha of habitat type	V	V	
Rostratula australis	Australian painted snipe	RSGPA	11.2ha of habitat type	V/M	V	
Turnix melanogaster	Black-breasted button-quail	-	0.1 ha of habitat type	V	V	
Reptiles						
Furina dunmalli	Dunmall's snake	-	205.3ha of habitat type	V	V	
Denisonia maculata	Ornamental snake	-	44.0ha habitat type	V	V	
Delma torquata	Collared delma	-	41.6ha of habitat type	V	V	
Egernia rugosa	Yakka skink	-	119.9ha of habitat type	V	V	
Paradelma orientalis	Brigalow scaly- foot	FPA RSGPA AVPA	205.3ha of habitat type	V	V	
Mammals	nals					
Chalinolobus dwyeri	Large-eared pied bat	-	108.1 ha of habitat type	V	V	
Nyctophilus corbeni	South-eastern long-eared bat	-	275.4 ha of habitat type	V	V	
Dasyurus hallucatus	Northern quoll	-	100.1ha of habitat type	E	LC	
Aquatic Fauna						
Maccullochella peelii	Murray cod	-	N/A	V	E	
Rheodytes leukops	Fitzroy River Turtle	-	N/A	V	V	
Migratory Birds						
Apus pacificus	Fork-tailed swift		-	М	-	
Ardea modesta	Eastern great egret	FPA RSGPA	-	М	-	



Description	Common	CSG fields with	Disturbance Limit	Status		
	Name	Known Occurrences in Stage 1	(ha)	EPBC Act	NC Act	
		AVPA				
Ardea ibis	Cattle egret	RSGPA	-	М	-	
Gallinago hardwickii	Latham's snipe, Japanese snipe	FPA RSGPA AVPA	-	М	-	
Haliaeetus leucogaster	White-bellied sea eagle	FPA RSGPA AVPA	-	М	-	
Hirundapus caudacutus	White-throated needletail	FPA RSGPA AVPA	-	М	-	
Hirundo rustica	Barn swallow	-		М	-	
Merops ornatus	Rainbow bee- eater	FPA RSGPA AVPA	-	М	-	
Monarcha melanopsis	Black-faced monarch	- FPA RSGPA AVPA	-	М	-	
Monarcha trivirgatus	Spectacled monarch	FPA RSGPA AVPA	-	М	-	
Myiagra cyanoleuca	Satin flycatcher	FPA RSGPA AVPA	-	М	-	

Table notes:

EPBC Act= (*Environmental Protection and Biodiversity Conservation Act 1999*) NC Act= (*Nature Conservation Act 1992*) E= Endangered, V= Vulnerable, NT= Near Threatened, M= Migratory, LC= Least Concern, SLC= Special Least Concern

#### 1.11. Threats to Significant Species and Threatened Ecological Communities

The development of the CSG fields will see a diversity of activities occurring concurrently throughout the CSG fields. The development is summarised in Section 1.7. Activities that will occur in the CSG fields include, but are not limited to:

- Establishment of access tracks and road construction;
- Seismic and geophysical surveys;
- Corehole drilling;
- Construction of pilot wells and their upgrade to production wells;
- Development of gas and water pipelines and gas processing facilities;



- Development of water infrastructure;
- Development of accommodation facilities and associated infrastructure; and
- Creation of borrow pits and their use.

#### 1.11.1. Clearing and Loss of Habitat

The clearing of vegetation for creation of access tracks and roads, installation of core drilling sites and other construction activities has the potential to result in some direct losses of significant flora species, TEC and the habitat for significant fauna. Linear corridor clearing in particular has the potential to create some fragmentation of habitats and edge effects impacting listed species and TEC. Clearing will predominantly occur during the exploration and construction phases. Only essential clearing will occur and clearing will be limited to that which is essential to allow construction and operations (e.g. in some cases trees may be lopped and not felled to allow construction vehicle access and, in other instances slashing or mulching of shrubs and grasses may occur where the removal of trees is not required).

Clearing will be limited to small areas and the width of linear cleared corridors for tracks/roads and pipelines minimised whereever possible as outlined in the EPBC Approval. To mitigate the impacts of clearing and habitat loss, existing tracks and roads will be used where possible, the extent and vegetation types cleared will be limited, remnant vegetation avoided and habitat trees retained. Specific management controls are also outlined in the relevant FMPs. Progressive rehabilitation and revegetation of cleared areas, particularly linear corridors, will also aid in minimising the impacts of clearing during the development as outlined in the RRRMP.

These activities required for the development of the CSG fields pose a potential threat to significant flora, fauna and TEC. Potential threats to MNES posed by this development are summarised in Table 1.7.

#### 1.11.2. Fragmentation

Clearing required for the construction of infrastructure within the CSG fields has the potential to result in fragmentation of habitat and contiguous vegetation. Much of the CSG fields is highly fragmented due to clearing associated with grazing practices, however intact stands of contiguous vegetation remain. To prevent further fragmentation, only essential clearing will occur and clearing will be limited to that which is essential to allow construction and operations.

Proposed offsets have been sited to enhance connectivity throughout the landscape.

#### 1.11.3. Injury/Mortality

The development of track and road networks during the construction phase and their continued use throughout operations has the potential to result in injury / mortality of fauna. In most cases fauna will avoid areas directly impacted by tracks and roads. The use of sequential clearing methods will be used to minimise injuries during initial clearing activities. There is the potential for some injuries resulting from road strikes as construction and operational vehicles use tracks and roads. Injury and mortality is likely to be limited to smaller, less mobile fauna such as reptiles, amphibians and mammals, and some birds such as Squatter Pigeon, Bush Stone-curlew, Australian Bustard and Wedge-tailed Eagle. Other infrastructure left in place, including markers, has the potential to prove an injury risk for some fauna when unattended. To limit injuries

/ mortalities of fauna, vehicle speed limits will be enforced and driver education provided. The Environmental Representative (ER) will be notified if an animal is injured and the ER will arrange for the appropriate course of action such as euthanasia or rehabilitation by trained wildlife carers. Injured animals will only be handled by persons trained to do so in order to avoid injuries to persons and further injury to the animal. The handling of injured animals is also outlined in the relevant FMPs.



#### 1.11.4. Introduction of Pest and Weed Species

Poor weed hygiene practices and the movement of vehicles and people throughout the CSG fields could result in the introduction or spread of declared weeds, other weeds and pathogens that pose a threat to sensitive environments. The proposed development is unlikely to result in the proliferation of most pest species already present in the CSG fields (e.g. pigs, mice, rats, rabbits, hares, red fox, cane toads, feral cats and dogs). There is potential for increased movement of house geckos (Hemidactylus frenatus) which are already present in the CSG fields.

Measures will be taken to limit the availability of infrastructure that provides nest / shelter / foraging sites for common starlings, domestic pigeon, house sparrow and Indian mynah in the RSGPA, where infrastructure will be in close proximity to existing populations of these species (e.g. Roma, Wallumbilla and Yuleba). There is a potential risk that exotic ant fauna, including the yellow crazy ant (Anoplolepis gracilipes) and the fire ant (Solenopsis invicta), could be introduced, particularly by construction vehicles. Should such species be accidentally introduced, they could seriously impact native flora, fauna and TEC. Implementation of the Pest and Weed Management Plans will minimise the risk of pest and weed introductions.

#### 1.11.5. Disturbance of Behaviour/Movement

Construction and operations have the potential to disturb the behaviour and movements of some fauna. Most disturbances are expected to be short-term and occur predominantly during construction. Disturbances may include some disruption of breeding activities. On its own, some disturbance of fauna movement and behaviour is likely to have minimal impact on populations. However, when combined with the loss of habitat, changes in behaviour may increase the risk of predation and the sustainability of populations. Measures to minimise impacts of construction and operations on fauna behaviour include the avoidance of breeding sites and the restriction of activities at breeding sites where they cannot be avoided, enforcement of vehicle speed limits and the provision of wildlife corridors to encourage movement of fauna between habitat patches. Specific management controls are also outlined in the relevant FMPs.

#### 1.11.6. Dust

Potential impacts associated with dust are most likely to occur during the construction phase and will be minimal during operation. Construction and clearing activities have the potential to create small areas of relatively high but localised airborne dust loads with implications for bordering flora and fauna. Areas impacted by dust will be small (i.e. areas directly bordering construction and clearing activities) and impacts will be short term. Dust generated via vehicle use of tracks and roads will be minimal and restricted to the track or road verge. Dust is only likely to threaten some sensitive flora, some bordering TEC and fauna with minimal mobility (e.g. aquatic fauna, amphibians and small reptiles) and is not likely to be a significant threat. Enforcement of vehicle speed limits, dampening of soil during clearing and other dust minimisation strategies outlined in the SMP will be used to limit potential dust impacts.

#### 1.11.7. Noise, Lighting and Vibration

Excessive noise, bright lighting and vibration may be problematic for fauna inhabiting the immediate vicinity of construction activity. Potential impacts of noise, lighting and vibration will be more prevalent during the construction phase and will therefore be relatively short-term in any single location. Sensitive fauna are likely to temporarily leave impacted areas, but some acclimation may occur. Fauna are likely return to impacted areas on cessation of these impacts. Buffers are likely to protect most fauna from disturbance by noise, lighting and vibrations. Appropriate noise attenuation will be designed and engineered for every operational facility associated with the gas fields. Noise, lighting and vibration are only likely to impact sensitive birds and mammals within buffer



areas that are typically highly mobile and can generally move from the area of impact. Impacts of noise, lighting and vibration will be mitigated through the implementation and appropriate maintenance of mufflers and noise control measures and the use of only essential lighting to minimise light disturbances. Potential impacts from noise / lighting and vibrations are summarised in the relevant FMPs.

#### 1.11.8. Erosion

Clearing and construction activities have the potential to result in localised erosion where it occurs on slopes or in the vicinity of landform features such as gullies, outcrops and drainage lines. Limited build up of sediment in watercourses and waterholes following rain events may occur with runoff from disturbed areas. The build up of sediments in aquatic environments may smother flora and impact associated fauna, including those dependent on water courses for drinking water. Many surface water features and waterways in this region have naturally high turbidity after significant rain events and under normal flow conditions, due to the nature of the soils and the existing disturbed nature of landscapes.

Soil erosion with sediment deposition to land or waterways has the potential to have limited impact on flora, with some potential impact on aquatic fauna possible. Erosion is not expected to impact most terrestrial fauna. Erosion is likely to be less significant upon the completion of construction and the installation of permanent erosion and stormwater control measures. Erosion will be mitigated through the implementation of the ESCM. Strategies to minimise erosion will include the use of existing tracks, limiting the extent of areas to be cleared and types of vegetation cleared in accordance with the EPBC Approval, and to the greatest extent possible avoidance of features such as gullies, streams and outcrops during road construction and progressive rehabilitation (as detailed in the RRRMP).

#### 1.11.9. Fire

Fire is unlikely to occur as a result of development activities. Should a fire occur, terrestrial flora, fauna and TEC are at the greatest potential risk due to potential loss (either temporary or permanent) of vegetative cover or microhabitat. Fire will be mitigated via the development and implementation of the Emergency Response Plan. Fire prevention measures are also detailed in the relevant FMPs.

#### 1.11.10. Soil Contamination

Soil contamination has the potential to occur during the construction phase as result of spillage of hydrocarbons from construction machinery, particularly during refuelling, or from fuel or chemical storage tanks. Flora can be adversely affected by soil contamination. Safe storage of chemicals and fuel and refueling by construction machinery and regular maintenance of machinery offsite will minimise potential for contamination of soil. Fuels, chemicals and hazardous substances will be stored in accordance with the relevant Australian Standard and conditions of the relevant authorities. Specific management controls to minimise the likelihood of contamination are summarised in the relevant FMPs.

#### 1.11.11. Surface and Groundwater Values

Construction and operations near waterways and in particular the construction of roads / tracks in the vicinity of waterways may result in alteration of flows and impact on aquatic and terrestrial flora and fauna. Construction activities also have the potential to increase soil erosion and sedimentation of water courses, increasing turbidity and reducing flow rates. Potential impacts of increased erosion to groundwater values are further discussed in Section 1.11.8. Impacts to waterways are most likely to occur during construction phase and would impact only small areas. The avoidance of waterways during construction and the minimisation of changes to landscape



features which might lead to changes in waterflows (outcrops, gullies etc) and progressive rehabilitation as per the RRRMP will minimise the likelihood of changes to waterways.

CSG water is a by-product of the extraction of CSG and may pose a threat to flora and fauna. The key potential impacts from CSG water include:

- Changes to groundwater levels in shallow and deep groundwater aquifers, including the Great Artesian Basin (GAB) aquifers;
- Changes to groundwater quality in GAB aquifers resulting from contamination via:
  - o induced inter-aquifer drawdown;
  - o seepage of CSG water, brine and / or fraccing fluids into GAB aquifer; or
  - o the loss of containment from storage ponds / turkey nests;
- Impacts on GAB discharge springs or GAB-fed Ground Dependent Ecosystems (GDE), anotherwords impacts on springs supplied by deep underground water from a confined GAB aquifer, including mound springs;
- Impacts on GAB recharge springs or related GDE, including impacts on springs supplied by rainfall water which has infiltrated the soil and underlying shallow aquifer (rather than GAB aquifers) and is then locally discharged into creeks and springs; and
- Impacts on species and threatened ecological communities listed in the EPBC Act 1999 potential for impacts on the distribution, health or life cycle of listed flora and fauna (I CSG WM MNES).

The main components of CSG water management comprise:

- Gathering- Infrastructure (e.g. pipelines and ponds) required to transfer CSG water from CSG producing wells to the CSG water treatment plants;
- Treatment- CSG water is and will be treated, based on its proposed use, to meet specific water quality objectives as defined by DERM;
- Brine Management- Water treated through reverse osmosis (RO) produces a brine concentrate as a byproduct. Brine will be injected into depleted coal seams or deeper basement formations. Where injection is not feasible, brine will be temporarily stored in containment ponds followed by solar evaporation / crystallisation to concentrate the brine for disposal at a registered or purpose built repository, or for commercial production of mineral salt (Santos 2010); and
- Beneficial use- The selection of beneficial use options are guided by DERM's preferred CSG water management options and are specific to each CSG field. Santos is committed to treating the water to the requisite level prior to beneficial use.

Contamination of groundwater has the potential to occur during the construction phase as result of spillage of hydrocarbons from construction machinery, particularly during refuelling, or from fuel or chemical storage tanks. Contamination of waterways is unlikely, although some flow into waterways may occur following a large spill. Contamination of waterways may pose a risk to aquatic flora and fauna. Safe storage of chemicals and fuel and refuelling, avoidance of waterways by construction machinery and regular maintenance of machinery offsite will minimise potential for contamination of water. Fuels, chemicals and hazardous substances will be stored in accordance with the relevant Australian Standard and conditions of the relevant authorities. Specific management controls to minimise the likelihood of contamination of waterways in particular are summarised in the relevant FMPs.

Santos has prepared a Stage 1 CSG Water Monitoring and Management Plan (CSG WMMP Golder Associates, Report Number: 117636002-3000-001-Rev1) as required by Condition 49 of the EPBC Approval. This plan relates



to groundwater monitoring and management, hydraulic fracturing, surface water monitoring and management, response actions and reporting. Santos has also prepared Water Management Plans for the AVPA, FPA and RSGPA. The GLNG Project CSG Water Monitoring and Management Plan Summary Plan (CSG WMMP SP) provides a summary of these plans. An Upstream Brine Management Strategy (Santos 2010, I CSG WM MNES) has also been prepared and Santos will manage brine in accordance with the CSG water management policy (DERM 2010) and in accordance with the conditions imposed under the EPBC Approval relating to salt management.

The potential risk posed by the extraction and management of CSG water to surface and groundwater quality and quantity is expected to be low. The potential impacts of groundwater extraction on MNES are also expected to be low. Detailed hydraulic modelling shows that the estimated minor changes in water levels resulting from the addition of treated CSG water to waterways will not adversely impact upon riparian habitat during low, normal or high flow conditions (CSG WMMP Golder Associates, Report Number: 117636002-3000-001-Rev1).

All activities will be carried out in compliance with the RSGPA, FPA and AVPA EMPs that include surface water monitoring plans. Details of surface water monitoring to be undertaken are also detailed in Appendix B of the EMP. The CSG WMMP (CSG WMMP Golder Associates, Report Number: 117636002-3000-001- Rev1) also outlines water treatment methods, identification of risks to and the vulnerability of MNES, risk

control and mitigation. CSG water will be treated, based on its proposed use, to meet specific water quality objectives as defined by DERM. The potential risk of the CSG development to water quality and dependent MNES are therefore expected to be low (Santos 2010, I CSG WM MNES).

Detailed modelling of the potential impacts of development for groundwater are detailed in the CSG WMMP (CSG WMMP Golder Associates, Report Number: 117636002-3000-001-Rev1). Modelling indicates that:

- The GLNG project can be undertaken without compromising the viability of the GAB;
- The groundwater quality of the GAB aquifers is unlikely to be affected;
- No impacts to groundwater availability are expected in the AVPA;
- Impacts to groundwater availability are likely to be minimal in the FPA and contained in the RSGPA; and
- There are no expected impacts to MNES, and specifically TEC dependent on groundwater and the community of native species dependent on natural discharge of groundwater from the GAB (CSG WMMP SP).

Potential impacts to MNES posed by groundwater extraction and CSG water management are generally nil to low. Remaining risks will be appropriately managed via rigorous management protocols implemented by Santos throughout operations (Santos 2010, I CSG WM MNES). These include:

- The Protocol– will be implemented prior to undertaking any CSG water management activities that may result in land disturbance and impact an environmentally sensitive area, including MNES;
- Brine Management Strategy- to ensure that brine, produced as a by-product of RO, is managed safely throughout the project through to decommissioning;
- Dust Management Strategy- to ensure that the application of treated or untreated CSG water to unpaved roads within lease areas, as one component of the overall Dust Management Strategy, is undertaken on a sustainable basis with minimal impact on the receiving environment;
- Resource Utilisation Plans- to ensure that all irrigation activities are undertaken in accordance with the conditions of approval, thus minimising potential impacts on the receiving environment; and



 Water and Soil Monitoring Strategy
– applied to the entire water cycle to detect potential impacts on groundwater and surface water resources and allow timely contingency and adaptive management measures to be implemented (I CSG WM MNES).

#### 1.11.12. Fauna Entrapment

The entrapment of fauna in pits and trenches dug for the installation of ponds, pipelines and well head cellars are expected during the construction phase only. Entrapment of fauna in ponds is possible throughout operations. Entrapments are expected to be limited to small amphibians, reptiles and mammals. To limit injury and mortality of fauna following pit / trench digging, pits and trenches will be inspected at least once per day (preferably in the morning) in accordance with the FMP to ensure no entrapment has occurred. Ponds will be fenced to limit fauna entry to ponds while fauna ladders will be installed to allow fauna to escape from ponds. Where fauna are injured or killed, the ER will be notified and rehabilitation of injured fauna organised with wildlife carers. The relevant FMPs also provide specific management controls to minimise fauna entrapment in dams / ponds and borrow pits.



Table 8 - Summary of Threats Posed to Significant Flora, Fauna and Threatened Ecological Communities by CSG Field Development

Signif	icant species an ecological comn	nd threatened nunities	Clearing / habitat loss	Injury / Mortality	Introduction of pest / weed species	Alteration of waterway and water table	Fire	Disturbance of behavior / movement including breeding	Contamination	Dust	Erosion	Noise	Entrapment of Fauna
Flora	Terrestrial flora	l	х		х	Х	Х		Х	х	х		
	Aquatic flora		х		x	Х	Х		Х	x	х		
Fauna	Terrestrial fauna	Amphibians	х	X	x	Х	Х	Х	Х	x	х	Х	Х
		Birds	Х	X	x	Х	Х	Х				Х	
		Reptiles	Х	Х	x	х	x	x			Х	Х	x
		Mammals	Х	Х	x	х	x	x				Х	x
	Aquatic fauna		х	X	x	Х	Х	Х	x		Х	Х	
Threatened ecological communities		munities	Х		x	Х	Х		x		х		
Mitigation	measures		Use of existing tracks, limiting extent of clearing, clear only essential vegetation, avoid remnant vegetation and timber stands where possible, retain hollow- bearing trees to the greatest extent practicable, progressive rehabilitation and revegetation	Enforced vehicle speed limits, driver education, rehabilitation of injured wildlife by carers	Implementation of Weed and Pest Management Plans	Minimise to the greatest extent practicable, construction near waterways, during rain events, avoid changes to landscape features, progressive rehabilitation	Development and implementation of the Bushfire Management Plan	Minimise to the greatest extent practicable disturbance of breeding sites, restrict where practicable the activities at breeding sites, enforcement of vehicle speed limits, provision of wildlife corridors.	Minimise to the greatest extent practicable construction activities within or near waterways, regular machinery maintenance off site.	Enforcement of vehicle speed limits, dampen soil during clearing, progressive rehabilitation	Minimise to the greatest extent practicable construction on sloping ground or around features, avoid construction during significant rain events, progressive rehabilitation	Implementation and appropriate maintenance of mufflers and noise control measures	Regular inspection of pits / trenches. Minimise to the greatest extent practicable the time pits/trenches are open. Rehabilitation of injured fauna, progressive rehabilitation. Pond fencing, fauna ladders.














	Sealed Road
	Unsealed Road
	Track
۰	Existing Conventional Well
•	Existing CSG Well
188_OB1	Existing Observation Well
•	Proposed Wells
	Well Pads - EPC Scope (GLNG)
•	Well Pads - Santos Early Works (GLNG)
	Existing Compressor Station
	Proposed Compressor Station (GLNG)
	Proposed Construction Facilities (GLNG)
	Existing Gas Gathering Line
	Proposed Gathering Line in EPC Scope (GLNG)
	Proposed Gathering Line in Santos Early Works Scope (GLNG)

# EPBC Threatened Ecological Communities and EPBC Protected Flora Field Survey Mapping

- Bertya opponens Aurecon EVNT and BOOBOOK Field Survey
- Cadellia pentastylis Aurecon EVNT and BOOBOOK Field Survey
- Macrozamia fearnsidei Aurecon EVNT and BOOBOOK Field Survey
- Xerothamnella herbacea Aurecon EVNT and BOOBOOK Field Survey
- Spring Location
- Brigalow (Acacia harpopphylla dominant and co-dominant)
- Semi-evergreen vine thickets



Eastern Queensland

Fairview Project Area CSG Well Locations and Key Gas Infrastructure with EPBC Threatened Ecological Communities and Potential EPBC Threatened Flora

> 1 2 3 4 5 km Scale 1:50,000 SKM\QASCO Aerial Photography, June 2010 October 2011, File No. GLNG 179 SSMP FV EPBC TEC

GDA

Figure: 1.4



![](_page_40_Figure_0.jpeg)

![](_page_41_Picture_0.jpeg)

![](_page_41_Figure_3.jpeg)

![](_page_41_Figure_5.jpeg)

	Sealed Road
	Unsealed Road
	Track
٥	Existing Conventional Well
•	Existing CSG Well
188_OB1	Existing Observation Well
٠	Proposed Wells
	Well Pads - EPC Scope (GLNG)
	Well Pads - Santos Early Works (GLNG)
	Existing Compressor Station
	Proposed Compressor Station (GLNG)
	Proposed Construction Facilities (GLNG)
	Existing Gas Gathering Line
	Proposed Gathering Line in EPC Scope (GLNG)
	Proposed Gathering Line in Santos Early Works Scope (GLNG)

# EPBC Protected Fauna Mapping

<b>V</b>	Squatter Pigeon - Aurecon EVNT and BOOBOOK Field Survey
	Australian Painted Snipe Habitat based on Landzones and Primary RE associations
	Squatter Pigeon Habitat based on Landzones and Primary RE associations
	Red Goshawk Habitat based on Landzones and Primary RE associations

![](_page_41_Picture_9.jpeg)

Eastern Queensland

Fairview Project Area **CSG Well Locations and Key Gas Infrastructure with Potential EPBC Threatened Fauna** 

# Map 1 of 4

5 km	4	3	2	1	0	
$\sim$		1:50,000	Scale			
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![](_page_42_Picture_0.jpeg)

![](_page_42_Figure_1.jpeg)

![](_page_42_Figure_3.jpeg)

	Sealed Road
	Unsealed Road
\	Track
٥	Existing Conventional Well
•	Existing CSG Well
188_OB1	Existing Observation Well
•	Proposed Wells
	Well Pads - EPC Scope (GLNG)
	Well Pads - Santos Early Works (GLNG)
	Existing Compressor Station
	Proposed Compressor Station (GLNG)
	Proposed Construction Facilities (GLNG)
	Existing Gas Gathering Line
	Proposed Gathering Line in EPC Scope (GLNG)
	Proposed Gathering Line in Santos Early Works Scope (GLNG)

# EPBC Protected Fauna Mapping

	Large-eared Pied Bat Habitat based on Landzones and Primary RE associations
	South-eastern Long-eared Bat Habitat based on Landzones and Primary RE associations
1	Black-breasted Button Quail Habitat based on Landzones and Primary RE associations

![](_page_42_Picture_7.jpeg)

Eastern Queensland

Fairview Project Area **CSG Well Locations and Key Gas Infrastructure with Potential EPBC Threatened Fauna** 

# Map 2 of 4

5 km	4	3	2	1	0	
-		50,000	Scale 1:			
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Figure: 1.	Taunaz		THE NO. GENG			)

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![](_page_43_Figure_2.jpeg)

![](_page_43_Figure_4.jpeg)

	Sealed Road
	Unsealed Road
	Track
٥	Existing Conventional Well
•	Existing CSG Well
188_OB1	Existing Observation Well
•	Proposed Wells
	Well Pads - EPC Scope (GLNG)
	Well Pads - Santos Early Works (GLNG)
	Existing Compressor Station
	Proposed Compressor Station (GLNG)
	Proposed Construction Facilities (GLNG)
	Existing Gas Gathering Line
	Proposed Gathering Line in EPC Scope (GLNG)
	Proposed Gathering Line in Santos Early Works Scope (GLNG)

# EPBC Protected Fauna Mapping

	Ornamental Snake Habitat based on Landzones and Primary RE associations
/////	Dunmall's Snake Habitat based on Landzones and Primary RE associations
	Northern Quoll Habitat based on Landzones and Primary RE associations

![](_page_43_Picture_8.jpeg)

Eastern Queensland

Fairview Project Area **CSG Well Locations and Key Gas Infrastructure with Potential EPBC Threatened Fauna** 

# Map 3 of 4

	0	1	2	3	4	5 km	
			Scale 1	50,000			
		SKM October 2011	QASCO Aerial Ph , File No. GLNG	otography, June 20 179 SSMP FV EPE	10 3C Fauna3		GDA
Rev. 0						Figu	re: 1.9

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![](_page_44_Figure_1.jpeg)

![](_page_44_Figure_3.jpeg)

	Sealed Road
	Unsealed Road
	Track
٥	Existing Conventional Well
٠	Existing CSG Well
188_OB1	Existing Observation Well
•	Proposed Wells
	Well Pads - EPC Scope (GLNG)
	Well Pads - Santos Early Works (GLNG)
	Existing Compressor Station
	Proposed Compressor Station (GLNG)
	Proposed Construction Facilities (GLNG)
	Existing Gas Gathering Line
	Proposed Gathering Line in EPC Scope (GLNG)
	Proposed Gathering Line in Santos Early Works Scope (GLNG)

# EPBC Protected Fauna Mapping

0	Brigalow Scaly-foot - Aurecon EVNT and BOOBOOK Field Survey
	Yakka Skink Habitat based on Landzones and Primary RE associations
	Collared Delma Habitat based on Landzones and Primary RE associations
÷.,	Brigalow Scaly-foot Habitat based on Landzones and Primary RE associations

![](_page_44_Picture_7.jpeg)

Eastern Queensland

Fairview Project Area CSG Well Locations and Key Gas Infrastructure with Potential EPBC Threatened Fauna

# Map 4 of 4

0	1	2	3	4	5 km	
		Scale 1	:50,000			
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	October 201	I, Flie No. GLNG	179 SSIMP FV EP	BC Fauna4	Figure:	1.10

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# 2. Legislative and Regulatory Framework

# 2.1. Applicable Legislation

Key environmental legislation relating to the significant species and ecological communities management includes the following:

- Environment Protection and Biodiversity Conservation Act 1999;
- Nature Conservation Act 1992;
- Nature Conservation (Wildlife) Regulation 2006;
- Nature Conservation (Protected Plants) Conservation Plan 2000;
- Nature Conservation (Protected Areas) Regulation 1994;
- Nature Conservation (Macropod) Conservation Plan 2005;
- Nature Conservation (Koala) Conservation Plan 2005;
- Nature Conservation (Forest Reserves) Regulation 2000;
- Vegetation Management Act 1999;
- Land Protection (Pest and Stock Route Management) Act 2002;
- Fisheries Act 1994;
- Fisheries Regulation 2008;
- Animal Care and Protection Act 2001;
- Coastal Protection and Management Act 1995;
- Environmental Protection Act 1994;
- Forestry Act 1959;
- Sustainable Planning Act 2009;
- Water Act 2000; and
- Petroleum and Gas (Production and Safety) Act 2004.

# 2.1.1. Standards and Guidelines

Activities will be undertaken in consideration of the relevant components of the following guidelines, recovery plans and industry Codes of Practice. This plan has been prepared in accordance with these; where practical:

- National Multi-species Recovery Plan for the Cycads, Cycas megacarpa, Cycas ophioplitica, Macrozamia cranei, Macrozamia Iomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrachis (Queensland Herbarium 2007);
- National Recovery Plan for the Bertya sp. (Cobar-coolabah) (this recovery plan encompasses Bertya opponens) (NPWS 2002a);
- National Recovery Plan for the Red Goshawk (Erythrotriorchis radiatus) (DERM 2009);
- Recovery plan for the Brigalow (Acacia harpophylla) dominant and co-dominant endangered ecological community (Butler 2007b);
- (Draft) National Recovery Plan for the South-eastern Long-eared Bat (Nyctophilus corbeni) (Schulz & Lumsden 2010);
- Draft Queensland Brigalow Belt Reptile Recovery Plan 2008-2012 (Richardson 2008);

![](_page_54_Picture_0.jpeg)

- National recovery plan for the Black-Breasted Button-quail Turnix melanogaster (Mathieson and Smith 2009);
- National recovery plan for the "Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions" ecological community (McDonald 2010);
- The Action Plan for Australian Bats (Environment Australia 1999);
- The Action Plan for Australian Birds (Garnett et al 2010);
- BONN Convention (1983);
- Australian Petroleum Production and Exploration Association (APPEA) Code of Environmental Practice (APPEA 2008);
- Australian Pipeline Industry Association (APIA) Code of Environmental Practice (Operations) (APIA 2009);
- Survey guidelines for Australia's threatened bats (DEWHA 2010a);
- Survey guidelines for Australia's threatened birds (DEWHA 2010b);
- Survey Guidelines for Australia's threatened mammals (DEWHA 2011a);
- Survey Guidelines for Australia's threatened reptiles (DEWHA 2011b); and
- Recovery plan for the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin (Fensham et al, 2010).

Relevant standards include:

- AS/NZS 4801:2001 Occupational health and safety management systems Specification with guidance for use; and
- AS/NZS ISO 14001:2004 Environmental Management Systems Requirements with guidance for use; and
- AS2885.1-2007 Gas and Liquid Petroleum Design and Construction.

# 2.2. Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth EPBC Act protects MNES, including World Heritage properties, National heritage places, Ramsar wetlands of international importance, listed threatened species and ecological communities and listed migratory species.

Activities undertaken to develop the CSG fields have been approved under the EPBC Approval. The EPBC Approval was necessary due to potential impacts to:

- Listed Threatened Species and Communities (Sections 18 and 18a); and
- Listed Migratory Species (Sections 20 and 20a).

Appendix A sets out the relevant requirements of the EPBC Approval and where they are addressed in this SSMP.

# 2.3. Environmental Authorities

The SSMP has been developed to be consistent with the requirements of the relevant environmental authorities. The EAs for the CSG fields include:

- PEN101578910 for the RSGPA;
- PEN100178208 for the FPA; and
- PEN102125611 for the AVPA.

![](_page_55_Picture_0.jpeg)

# 2.4. Approvals, Licences and Permits

Additional approvals / permits that may be applicable to flora and fauna and required during construction and development of the CSG fields are as follows:

- Permit to relocate and/or interfere with native animals (NC Act 1992);
- Permit to clear native vegetation (NC Act 1992);
- Licence to construct a waterway barrier within a defined watercourse (Fisheries Act 1994);
- Riverine Protection Permit (Water Act 2000); and
- Development Approval including Material change of use (Sustainable Planning Act 2009).

# 2.5. Environmental Offsets Plan

An Environmental Offsets Plan for the CSG Fields has been developed. The Plan outlines the environmental offset requirements for each component of the GLNG Project under the Australian Government offset policy and/or in accordance with the relevant approvals. The Plan also includes options for offset delivery and properties that are suitable to meet the identified offset requirements.

![](_page_56_Picture_0.jpeg)

# 3. Constraints-Based Management of Ecological Impacts

# 3.1. Constraints Planning

In accordance with the relevant approvals, Santos has submitted the Environmental Protocol for Constraints Planning and Field Development (the Protocol) which was approved by SEWPaC on 29/9/2011 (Santos 2011a). The Protocol outlines the approach Santos will take in identifying, assessing and managing potential impacts to MNES and State related matters through the use of Field Management Procedures (Field MPs). The specific Field MP will be implemented for the five identified constraints classes and include:

- The nature of the development which is proposed to be undertaken within each constraints class;
- The process to be undertaken to determine the specific location of the development within each constraints class having regard to the local ecological values of the area; and
- The mitigation measures that will be implemented to minimise the impact of the development on the ecological values of the area.

Santos will adopt the following management principles when planning for and implementing new CSG activities for the CSG fields:

- Avoidance Avoiding direct and indirect impacts to environmentally sensitive areas, including MNES;
- Minimise Minimise potential impacts on environmentally sensitive areas, including MNES;
- Mitigate Implement mitigation measures to reduce impacts where operating in environmentally sensitive areas cannot be avoided; and
- Remediation and Rehabilitation Actively remediate and rehabilitate impacted areas to promote and maintain long-term recovery of environmentally sensitive areas, including MNES.

Where impacts are unavoidable and result in a permanent loss of an environmental value Santos will provide secured environmental offsets in accordance with both Queensland and Commonwealth government requirements.

Santos has prepared detailed Ecological Constraints Mapping over the entire RFDA. The Ecological Constraints mapping includes the following data sets based on five classes of land with graduated levels of ecological sensitivity (or constraint classes). The five classes include:

- Constraints Class A Contains QLD State government listed Category A Environmentally Sensitive Areas (ESAs) (e.g. National Parks) and the communities of native species dependant on natural discharge of groundwater from the GAB;
- Constraints Class B Contains all QLD State government listed Category B ESAs which includes EPBC Act threatened ecological communities, all listed flora species and those listed threatened and migratory fauna species habitats as identified in management plans required under condition 8 of the EPBC Approval. It also includes the primary protection zone (DERM) or impact risk zone (SEWPaC) which is the area within 200 m from the perimeter of Constraints Class B and the secondary protection zone (DERM) which is the area within a 800 m buffer from the boundary of a primary protection zone of a Category A ESA (Constraints Class A) or 300 m buffer from the boundary of a primary protection zone of a Category B ESA;
- Constraints Class C Contains all QLD State government listed Category C ESAs. Also contains the primary
  protection zone (DERM) which is an area within 200 m from the perimeter of Constraints Class C and the
  secondary protection zone which is the area within a 300 m buffer from the boundary of a primary protection
  zone of a Category C ESA;
- Constraints Class D Contains QLD State government listed "Not of concern" Regional Ecosystems under the VM Act; and

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• Constraints Class E – Contains QLD State government listed "Non-remnant" vegetation - generally modified habitats such as agricultural lands, grazing lands, residential lands or regrowth vegetation.

Impacts to MNES and specifically the habitat of the twelve EPBC listed fauna species and the four TEC listed in Table 3 and 4 of the EPBC Approval will be avoided, minimised and mitigated to the greatest extent practicable. The EPBC Approval does however allow disturbance or clearing of these habitats or TEC up to a maximum disturbance limit. Disturbance limits are provided in Table 1.4 and Table 1.6. Note that there is no disturbance allowed to the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin.

The following steps will be followed to ensure clearing of TEC and habitat for the listed species in the EPBC Approval remains within the prescribed disturbance limits:

- Pre-clearance surveys will be used to identify the location of TEC, EPBC listed flora and the habitat of the EPBC listed fauna species listed in Table 3 and 4 of the EPBC Approval;
- Ecological Constraints Mapping will identify where TEC and listed fauna habitat overlap;
- Areas to be cleared / disturbed will be minimised to the greatest extent practicable through field development planning and design;
- Areas that must be cleared to allow development (i.e. where pipelines, roads, camps etc cannot be placed elsewhere), will be identified up to the maximum disturbance limits set in the EPBC Approval; and
- Once the maximum prescribed disturbance limits have been reached for TEC / habitats of listed fauna species, all remaining areas of these TEC / habitats of listed fauna species will be protected from further clearing.

The cumulative areas of TEC and threatened species habitat impacted by the development are therefore tracked via the ecological constraint mapping process.

If threatened species habitat and TEC are discovered during construction in areas not previously mapped as containing threatened species or TEC during preclearance surveys, this variation will be reported to the ER. The area will then be avoided until:

- The extent of TEC and threatened species habitat can be confirmed by a suitably qualified and experienced ecologist;
- Confirmed sightings of threatened species is recorded in the CSG Fields Ecological Constraints Database;
- All mapping is updated; and
- The Santos management hierarchy, outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation), is applied, including the use of a 200m buffer where practicable.

In accordance with the Protocol, land disturbance information, including the findings of field verification and / or detailed ecological surveys, will be recorded and tracked in the Santos Environmental Disturbance Inventory Database (EDIDB) Geographic Information System (GIS). The EDIDB is a database developed to assist in the management of land disturbance sites.

# 3.2. Fauna Habitat Assessment

Habitat mapping for threatened fauna species has been prepared for Stage 1 of the CSG fields and was based on RE mapping (Figures 1.7 to 1.18), published knowledge of suitable habitat for each species and technical advice from suitably qualified ecologists. Not all of this mapped habitat is likely to be suitable for use by populations and particularly breeding populations of the listed fauna. As part of the pre-clearing assessment, habitat value for threatened fauna species will be assessed to ensure the correct constraints class is identified, and appropriate mitigation measures are implemented. Implementation of the Protocol and information from preclearance surveys

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will allow the constraints database and habitat mapping to be updated for adaptive management. Preclearance assessments will:

- Be undertaken by a qualified ecologist approved by SEWPaC to confirm that vegetation mapping associated with the planned sites is accurate and to confirm the localised ecological values, as outlined in the Protocol;
- Be undertaken in accordance with the most current SEWPaC survey guidelines (http://www.environment.gov.au/epbc/guildelines-policies.html#threatened);
- Take account of and reference previous ecological surveys undertaken in the area and relevant new information on likely presence or absence of MNES;
- Document the survey methodology, results and significant findings in relation to MNES; and
- Apply best practice (including optimum timing and frequency) site assessment and ecological survey methods appropriate for each listed threatened species, migratory species, their habitat and listed ecological communities.

The survey report will detail the location and extent of the proposed disturbance to each relevant ESA, including MNES. The report will also document the current cumulative disturbance extent for each environmentally sensitive area, including MNES.

General / indicative habitat and essential microhabitat of listed species have been described to support field identification and environmental constraints decision making. The habitat descriptions can be meaningfully applied in constraints planning and be used in field ecological surveys.

In accordance with the Protocol, a 200m buffer zone will be established around any identified habitats (which includes general / indicative and essential microhabitats) of the listed species during the planning phase of gas field development. Any works within the habitat area or buffer zone of a listed species will require assessment and advice from a suitably qualified ecologist.

Figure 3.1 outlines a process for the assessment of habitats and constraints planning for two levels of habitat value (General / Indicative Habitat and Essential Microhabitat).

General / indicative habitat is defined as habitat that meets the broad needs of the species and is typically described using a combination of aspects of geology, soil, landscape, water and vegetation features. The general / indicative habitat of a species will generally contain a number of Regional Ecosystems, the descriptions of which can be useful in describing the range of environs a species might be found within. General / indicative habitat indicates broadly where species might occur, however breeding populations of a species are unlikely to be found throughout all areas of general / indicative habitat, due to the absence of essential microhabitat features (e.g. hollow bearing logs, rocky outcrops, mature trees to support nests etc) from some areas. A proportion of general / indicative habitat would therefore only provide foraging, dispersal or temporary roosting functions only. Pastures, areas of regrowth and farm dams would typically qualify as general / indicative habitat, but may be in poor condition or of insufficient quantity to realistically support a species. Given that many species do not use this habitat for breeding, certain species are able to coexist without a significant impact with specific types of gas field infrastructure.

Where gas field infrastructure is to be located within general / indicative habitat, it will be located in areas with less habitat values or in previously disturbed areas wherever possible and practicable.

Essential microhabitat is defined as areas of quality habitat, within general / indicative habitat, containing the specific microhabitat elements (e.g. elements that are needed to support populations of the species). Areas of essential microhabitat would typically include relatively undisturbed ecosystems. Clearing of essential microhabitat will be avoided wherever possible. Additional buffer zones around active nesting or den sites will be established and activities will be excluded, restricted or minimised.

![](_page_59_Picture_0.jpeg)

Regional Ecosystems (REs) that constitute the general / indicative habitat of a species are listed and described in species profiles in Section 4 and Section 5. Table 3.1 provides a summary description of the two levels of habitat value for the threatened species included within this plan. Detailed descriptions of habitats are provided for each species profile.

Taxonomic Group	Species	General/Indicative habitat	Essential microhabitat
Invertebrates	Boggomoss Snail	Intact drainage lines	<ul> <li>Intact drainage lines with intact overstorey vegetation</li> </ul>
			- Fallen logs, well developed leaf litter later maintaining moist microclimate
Birds	Red Goshawk / Squatter Pigeon	Woodlands Grazing paddocks / natural grasslands	Woodlands, grazing paddocks and natural grasslands with mature trees for nesting Active nesting site
	Australian Painted Snipe	Wetlands and grazing paddocks	Intact natural wetland habitats, with extensive macrophyte vegetation Active nesting site
	Black-breasted Button Quail	Semi-evergreen vine thicket, low thickets or woodlands	Suitable RE / intact semi- evergreen vine thicket, low thickets or woodland Active nesting site
Reptiles	Yakka Skink / Brigalow Scaly-foot / Collared Delma / Dunmall's Snake	Woodlands and forests	Woodlands and forests with limited ground vegetation and grassy tussocks Large hollow logs / tree stumps / root cavities / loose rocks Dense ground cover and many grass tussocks Active nesting site
	Ornamental Snake	Moist areas within woodlands and open forests	Intact moist areas, including melon holes, depressions, wetlands and lakes in woodland and open forests Ample ground cover, fallen timber, thick shrub cover and small tussock grass Active nesting site
Mammals	Large-eared Pied Bat / South-eastern Long- eared Bat	Remnant vegetation and regrowth woodland	Remnant vegetation and regrowth woodland with hollow-bearing trees Cavities, overhangs, caves and holes among sandstone outcrops/escarpment Active roost site
	Northern Quoll	Eucalypt woodlands, shrublands or grasslands	Intact Eucalypt woodlands and shrublands with rocky areas and/or hollow logs/trees Active den site

#### Table 9 - Habitat Descriptions for Threatened Fauna Species

![](_page_60_Picture_0.jpeg)

Taxonomic Group	Species	General/Indicative habitat	Essential microhabitat
Aquatic Fauna	Murray Cod	Waterways	Intact waterway habitat with complex structural cover (large rocks, snags, overhanging vegetation) Main channel or high flow area Area is known or likely to support a natural population
	Fitzroy River Turtle	Waterways	Good condition flowing stream or permanent waterbody (may be non- flowing in the dry season Ribbonweed present Gravelly or sandy substrate Area is highly likely or known to support a population
Migratory Birds	Great Egret/ Black-faced Monarch/ Speckled Monarch/ Satin Flycatcher/ Little Curlew/	Swampy woodland or mangrove	Good condition swampy woodlands or mangrove Active nesting site
	Cattle Egret	Swampy woodlands Grazing paddocks / natural grasslands	Good condition swampy woodlands, meadows and swamps Active nesting site
	Lathan's Snipe	Wetlands	Good condition open, freshwater wetlands with low, dense vegetation Active nesting site
	White-bellied Sea Eagle	Rivers, lakes and nearby woodlands	Remnant woodland nearby rivers and inland lakes Tall trees near water, with suitable breeding resources Rocky cliffs Active nesting site
	Barn Swallow/Rainbow Bee-eater	Woodland, open country, pastures, farm crops, near margins of wetlands and human settlements	Riparian woodlands Sandy creek banks Intact wetlands Active nesting site
	White-throated Needletaile	Forest, woodlands, pastoral areas, floodplains, lakes and coastlines	Forests, woodlands, floodplains, lakes and coastlines Active nesting site
	Rufous Fantail	Rainforests/wetter eucalypt forests, gullies, monsoon forests, gardens	Rainforests/wetter eucalypt forests, gullies, monsoon forests, gardens Close proximity to gullies or watercourse Active nesting site

![](_page_61_Picture_0.jpeg)

![](_page_61_Figure_1.jpeg)

![](_page_61_Picture_3.jpeg)

Figure 3.19- Fauna Habitat Assessment Process

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![](_page_62_Picture_0.jpeg)

# 4. Significant Flora

This Section includes detailed information in the form of species profiles for all flora of Commonwealth significance and protected pursuant to the EPBC Act that are present or likely to be present within the CSG fields. Many of these species are also protected pursuant to the NC Act. Additional species listed under the NC Act will be addressed within an updated SSMP.

Each species profile contains the following information:

- Species name;
- Protection status under the EPBC Act and NC Act;
- Distribution;
- Known populations and relationships with stage 1 of the CSG field;
- Description (e.g. form, flower, fruit and reproductive traits);
- Habitat;
- Regional Ecosystems associations;
- Threats;
- Management level;
- Specific management requirements;
- Monitoring processes;
- Species specific performance criteria; and
- Key reference documents.

It should be noted that pre-construction surveys undertaken in accordance with the Protocol for the CSG fields development will aim to confirm the presence or absence of a significant species within all CSG development areas to be disturbed. This information will assist in developing appropriate mitigation measures to avoid and / or minimise impact from the development on these species. Santos GIS databases and mapping will be updated to reflect the findings of pre-construction surveys. Additionally, this Plan will be amended upon completion of annual reporting to take into consideration the findings of pre-construction surveys.

# 4.1. Threatened Flora Species

Numerous flora species listed under the EPBC Act occur within the CSG fields, several of which are also listed under the NC Act. Profiles for the following EPBC Act listed species are included in this section:

- Acacia wardellii (Thormby Range wattle);
- Bertya opponens (Coolabah bertya);
- Cadellia pentastylis (Ooline);
- Commersonia argentea;
- Dichanthium queenslandicum (King bluegrass);
- Dichanthium setosum (Bristly bluegrass);
- Eriocaulon carsonii (Salt pipewort);
- Eucalyptus virens (Shiny-leaved ironbark);
- Homopholis belsonii (Belson's panic);
- Macrozamia fearnsidei (Curly zamia);

![](_page_63_Picture_0.jpeg)

- Swainsona murrayana (Slender darling pea); and
- Xerothamnella herbacea.

![](_page_64_Picture_0.jpeg)

# 4.2. Terrestrial Flora

# 4.2.1. Acacia wardellii (Thomby Range Wattle)

![](_page_64_Picture_3.jpeg)

Plate 1 - Thomby Range Wattle. Source: Santos 2007 (Warby, B & Hubbard, L)

# Status:

EPBC Act = Vulnerable NC Act = Vulnerable

# **Distribution:**

![](_page_64_Figure_8.jpeg)

Plate 2 - 4.2.1b: Distribution. Source: SEWPaC, 2011a.

Acacia wardellii is known from south of Roma, south-west of Chinchilla and the Thomby Range in south-east Queensland. It has also been collected near Binjour south-east of Eidsvold and Rockwood Station. The species was rare when collected near Binjour in 1997. In recent years, numbers have decreased in some known populations (TSSC 2008a).

# Known Populations and Relationships within Stage 1 of the CSG Fields:

*A. wardellii* has been observed with the Roma area (Santos 2007); however it is unclear if these observations were from within the current development. Pre-clearance surveys are required to confirm the location of this species.

![](_page_65_Picture_0.jpeg)

### **Description of the Species:**

Slender shrub / tree between 5–7 m tall with smooth, silvery grey or white bark (base is rough on older specimens). The trunk and branches may have a powdery coating of white, pink or silver which gives it a shiny appearance. Phyllodes are dark, glossy green, narrowly elliptic, falcately recurved, have two prominent nerves and are 10-17.5 cm long x 1.5-3.0 cm wide (WWW 2009). Two or three glands are often prominent on triangular projections along the margin of the phyllodes.

Inflorescences are racemose with racemes 1.0-4.5 cm long and often glabrous fruit. The flower heads are perfumed, cream to pale yellow in colour and globular with up to 20-35 flowers. Flowering has been recorded between April and July (Santos 2007, WWW 2009).

Little published information is available on the fruiting bodies of A. wardellii however the pods are linear, slightly curved and approx. 80 mm long x 6 mm wide; recorded as maturing between October and November (Santos 2007, SEWPaC 2011a).

### Habitat for the Species:

Acacia wardellii grows in shallow gravelly, weathered sandstone soils in eucalypt woodland and has been recorded from disturbed and recently burnt areas (TSSC 2008a). This species commonly occurs with Dusky-leaved Ironbark (*Eucalyptus fibrosa* subsp. *nubila*), Narrow-leaved Ironbark (*E. crebra*), Queensland Peppermint (*E. exserta*), White Cypress Pine (*Callitris glaucophylla*), Smooth-barked Apple (*Angophora leiocarpa*), Quinine Tree (*Petalostigma pubescens*), Bull Oak (*Allocasuarina luehmannii*) and other wattles (Santos 2007).

Published habitat details for this species are limited. Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project

#### Regional Ecosystems Associations:

RE associations within the RSGPA are unknown, however, in other parts of its range it occurs within the following RE's:

RE	Short Description
11.7.2	Acacia spp. woodland on lateritic duricrust. Scarp retreat zone.
11.7.4	Eucalyptus decorticans and / or Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius on lateritic duricrust.
11.7.5	Shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks.
11.7.6	Corymbia citriodora or Eucalyptus crebra woodland on lateritic duricrust.
11.7.7	Eucalyptus fibrosa subsp. nubila +/- Corymbia spp. +/- Eucalyptus spp. on lateritic duricrust.
11.5.1	Eucalyptus crebra, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii woodland on Cainozoic sand plains / remnant surfaces.

RE associations will be refined for this species during the course of the project following the results of pre- clearance surveys.

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7(Section 1.11). Core threats include vegetation clearing for quarries, roads, and infrastructure associated with industry activities. Additional threats include clearing for agriculture and grazing, however it is noted that this species generally occurs in areas that are very poor for agricultural purposes. Frequent burning may also be detrimental to this species (TSSC 2008a).

![](_page_66_Picture_0.jpeg)

### Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.

## Specific Management Requirements:

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		DERM's Wildlife Online (Wildnet) Records;
		Queensland Museum database;
		Consultation with Queensland Parks and Wildlife Service;
		DERM's RE, Regrowth and Essential Habitat Mapping;     Agriel and / or optallite imagenty and
		Aerial and / or satellite imagery, and     Discussion with land managers, site manager and / or the EP
		Discussion with land managers, site manager and / or the ER.
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).

![](_page_67_Picture_0.jpeg)

Project Phase	Activity	Management Practices
Site preparation		Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
	Where individual species are proposed for retention within disturbance areas, they will be appropriately flagged or fenced.	
		Where translocation or seed collection is identified by the Ecologist as a suitable mitigation measure, it is to be conducted prior to site works.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.

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Project Phase	Activity	Management Practices
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

## Monitoring Process:

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. This species is detectable year round, however it may be slightly more obvious throughout the flowering period. Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works.

### **Species Specific Performance Criteria:**

In accordance with NC and EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG Field development.

Where rehabilitation of this species is required, tube stock is to be used that is of local provenance.

## Key Reference Documents:

- Santos 2007;
- SEWPaC 2011a;
- TSSC 2008a;
- Vallee et al 2004; and
- WWW 2009.

![](_page_69_Picture_0.jpeg)

# 4.2.2. Bertya opponens (Coolabah Bertya)

![](_page_69_Picture_2.jpeg)

Plate 3 - Coolabah Bertya. Source: Wain, A, 2011.

# Status:

EPBC Act = Vulnerable NC Act = N/A

# **Distribution:**

![](_page_69_Figure_7.jpeg)

Plate 4 - Distribution. Source: SEWPaC, 2011b

*Bertya opponens* occurs in a range of habitats ranging from stony mallee ridges and cypress pine forest on red soils, to coastal cliff edges in open eucalypt forest (NPWS 2002a). The wide variation in habitat type between the populations makes the identification of critical habitat very difficult (NPWS 2002a).

# Known Populations and Relationships within Stage 1 of the CSG Fields:

*Bertya opponens* is known to occur in the FPA (Figure 1.4). Ecological surveys are required to confirm exact locations within all relevant fields.

# **Description of the Species:**

*Bertya opponens* is a slender shrub or small tree to 4m high and consists of either slender, multiple stems or a single trunk. The branches and stems are covered with whitish to brown, dense, intertwined hairs. The upper surface is dark-green and hairless and the under-surface is velvety-woolly (NSW 2002a).

![](_page_70_Picture_0.jpeg)

Flowers lack stalks and have 1-3 female and male flowers clustered together and surrounded by four thick, yellowish to golden brown, hairy bracts. Flowering is thought to primarily occur between July and August however, this may be dependent on the individual site characteristics (NPWS 2002a).

The fruit capsule is ovoid to globose, 8-9 mm long with dense, long weak hairs and contains two to three seeds. The fruiting period is currently unknown, however the population identified from within the Santos gas transmission pipeline corridor was fruiting in August / September.

### Habitat for the Species:

Associated species include Callitris glaucophylla and Eucalyptus fibrosa (NPWS 2002a).

The disturbance agents of fire and mechanical disturbance appear to trigger germination and / or suckering in Bertya opponens (NPWS 2002a).

Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

### **Regional Ecosystems Associations:**

*Bertya opponens* is known to inhabit remnant vegetation on land zone 10 (especially RE 11.10.4), described as Eucalyptus decorticans, Lysicarpus angustifolius +/- Eucalyptus spp, Corymbia spp., Acacia spp. woodland on coarse-grained sedimentary rocks. Crests and scarps.

RE associations will be refined for this species during the course of the project.

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). The major threats to *Bertya opponens* are grazing from livestock, habitat clearing and disturbance, inappropriate fire regimes, landslides and drought (NPWS 2002a).

#### Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.

#### **Specific Management Requirements:**

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> </ul>

![](_page_71_Picture_0.jpeg)

Project Phase	Activity	Management Practices		
		<ul> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and / or satellite imagery; and</li> <li>Discussion with land managers, site manager and / or the ER.</li> </ul>		
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.		
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.		
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.		
		Infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.		
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).		
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.		
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).		
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.		
		Where individual species are proposed for retention within disturbance areas, they will be appropriately flagged or fenced.		
		Where translocation or seed collection is identified by the Ecologist as a suitable mitigation measure, it is to be conducted prior to site works.		
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).		

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Project Phase	Activity	Management Practices
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non- compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).



In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. Searches should be designed around the time that this species is most readily detected (i.e. the growing season – October to March). Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works.

# **Species Specific Performance Criteria:**

In accordance with the EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG field development.

Where rehabilitation of this species is required, tube stock is to be used that is of local provenance.

- SEWPaC 2011b;
- NPWS 2002; and
- Vallee et al 2004.



# 4.2.3. Cadellia pentastylis (Ooline)



Plate 5: Cadellia pentastylis. Source: Santos, 2007.

# Status:

EPBC Act = Vulnerable NC Act = Vulnerable

#### **Distribution:**



Plate 6: Distribution. Source: SEWPaC, 2011c

Cadellia pentastylis occurs on the western edge of the NSW north-west slopes, from Gunnedah to west of Tenterfield, and extends into Queensland to Carnarvon Range and Callide Valley, south-west of Rockhampton.

# Known Locations within Stage 1 of the CSG Fields:

Cadellia pentastylis has been observed within the AVPA and RSGPA (Santos 2007). Further ecological surveys are required to confirm additional locations within the fields.



## **Description of the Species:**

Cadellia pentastylis is a medium-sized spreading tree growing to 25 m high. Leaves are glossy green, paler and dull underneath, 1–7 cm long, 1.5–2 cm wide, with broad rounded tips. Leaf venation is prominent on both leaf surfaces when dry (TSSC 2008b). Star-shaped flowers may be greenish-cream, straw or reddish coloured. Flowers are five petaled and approx. 20mm in diameter. Main flowering period is thought to occur between October and November (Santos 2007). Cluster of up to five balls (drupes) at the centre of the old flower, each segment is 3-5mm in diameter, surrounded by papery, red sepals (Santos 2007).

#### Habitat for the Species:

Cadellia pentastylis grows in dry rainforest, semi-evergreen vine thickets and sclerophyll woodlands of Bendee (Acacia catenulata), Brigalow (A. harpophylla) and Mountain Yapunyah (Eucalyptus thozetiana), often locally dominant or as an emergent (TSSC 2008b). Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

## Regional Ecosystems Associations:

Cadellia pentastylis is known to inhabit remnant vegetation on land zones 7, 9 and 10, in particular the following REs:

RE	Short Description
11.7.1	Acacia harpophylla and / or Casuarina cristata and Eucalyptus thozetiana or Eucalyptus microcarpa woodland on lower scarp slopes on lateritic duricrust.
11.7.2	Acacia spp. woodland on lateritic duricrust. Scarp retreat zone.
11.9.4	Semi-evergreen vine thicket on fine-grained sedimentary rocks.
11.9.5	Acacia harpophylla and / or Casuarina cristata open forest on fine-grained sedimentary rocks.

RE associations will be further refined for this species during the course of the project.

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). The main identified threats to Ooline are localised extinction due to small and scattered populations; inbreeding which threatens genetic diversity in small populations; low seed viability which threatens breeding success; clearing for agriculture; grazing and soil compaction by domestic stock, feral goats (Capra hircus) and pigs (Sus scrofa); invasion of habitat by weeds, such as Tiger Pear (Opuntia aurantiaca); frequent fires;

tunnel and sheet erosion; damage to roadside populations during roadworks; and high insect attack (TSSC 2008b).

# Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.



# **Specific Management Requirements:**

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and / or satellite imagery; and</li> <li>Discussion with land managers, site manager and / or the ER.</li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
		Where individual species are proposed for retention within disturbance areas, they will be appropriately flagged or fenced.



Project Phase	Activity	Management Practices
		Where translocation or seed collection is identified by the Ecologist as a suitable mitigation measure, it is to be conducted prior to site works.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissionin g and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).



In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. This species is detectable year round, however it may be slightly more obvious throughout the flowering period. Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works.

#### **Species Specific Performance Criteria:**

In accordance with NC and EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG field development.

Where rehabilitation of this species occurs, tube stock is to be used, and growth rates outlined in the RRRMP should be monitored.

- SEWPaC 2011c;
- Santos 2007;
- TSSC 2008b; and
- Vallee et al 2004.



# 4.2.4. Commersonia argentea



Plate 7: Commersonia argentea. Source: Wain, A, 2011

# Status:

EPBC Act = Vulnerable NC Act = N/A

# **Distribution:**



Plate 8: Distribution. Source: SEWPac, 2011d

This species occurs between Chinchilla and Injune and then west along the Great Dividing Range towards Tambo in central Queensland (TSSC 2008c).

# Known Populations and Relationships within Stage 1 of the CSG Fields:

Commersonia argentea has not been observed within any of the CSG fields, however, the CSG fields are within the broader range of this species.

Ecological surveys are required to confirm exact locations within the fields.

# **Description of the Species:**

Commersonia argentea is a shrub that grows to 1.5 to 4 m with densely hairy (silvery stellate (star-shaped) hairs) stems and suckering from rhizomes (Threatened Species Scientific Committee 2008c). The leaves are ovate and 2.5–13 cm long by 1–8 cm wide, have fine toothed leaf margin and are also densely hairy with silvery stellate hairs (TSSC 2008c). Inflorescences are 2–5cm long and contain 10–30 flowers, which are white to cream in colour and 9–10mm in diameter (TSSC 2008c).

The biology of this species is poorly known, however, its main method of reproduction may be from spreading underground stems (TSSC 2008c).



#### Habitat for the Species:

Limited information is available for the habitat for this species however, collections in Queensland have been from sandstone scarps and gorges, ironbark woodland and alluvial woodlands within sandstone range environments (SEWPaC 2011d).

Published habitat details for this species are limited. Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

## **Regional Ecosystems Associations:**

RE associations are unknown for the CSG fields, however, REs occurring on land zone 10 are likely to be important.

RE associations will be refined for this species during the course of the project.

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11).

## Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.

#### **Specific Management Requirements:**

Project Phase	Activity	Management Practices
Pre-construction Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:	
		<ul> <li>DERM's Wildlife Online (Wildnet) Records:</li> </ul>
		<ul> <li>Queensland Museum database;</li> </ul>
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>
		DERM's RE, Regrowth and Essential Habitat Mapping;
		Aerial and / or satellite imagery; and
		<ul> <li>Discussion with land managers, site manager and / or the ER.</li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.



Project Phase	Activity	Management Practices
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
		Where individual species are proposed for retention within disturbance areas, they will be appropriately flagged or fenced.
		Where translocation or seed collection is identified by the Ecologist as a suitable mitigation measure, it is to be conducted prior to site works.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.



Project Phase	Activity	Management Practices
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. Searches should be designed around the time that this species is most readily detected (i.e. the growing season – October to March). Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works, incorporating site specific performance criteria outlined below.

# **Species Specific Performance Criteria:**

In accordance with EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG field development.

Where rehabilitation of this species is required, tube stock is to be used that is of local provenance.

- Santos 2010;
- SEWPaC 2011d;
- TSSC 2008c; and
- Vallee et al 2004.



# 4.2.5. Dichanthium queenslandicum (King Bluegrass)



Plate 9: Dichanthium queenslandicum. Source: Queensland Herbarium, 2002

# Status:

EPBC Act = Vulnerable NC Act = Vulnerable

# **Distribution:**



Plate 10: Distribution. Source: SEWPaC, 2011e

This species is endemic to Queensland where it is usually observed in black clay soils around the Darling Downs, Leichhardt and Port Curtis (Stanley and Ross 1989; Sharp and Simon 2002).

# Known Locations within Stage 1 of the CSG Fields:

Dichanthium queenslandicum has been observed within the Denison CSG fields (Santos, 2007). Ecological surveys are required to confirm exact locations within the fields.

# **Description of the Species:**

Dichanthium queenslandicum is a perennial, tufted, erect grass up to 80cm tall. Clumes rarely branched, nodes bearded (Stanley and Ross 1989). Leaf sheaths with long spreading tubercular-based hairs; ligules up to 1.5mm long; leaf blades linear, apex attenuate, with long spreading tubercular-based hairs (Stanley and

Ross 1989). Racemes soliatary, rarely paired, up to 10cm long, rachis and pedicels with long spreading hairs; sessile spikelet 7.5-8.5mm long, lower glume as long as spikelet, glabrous, scabrid on margin, upper glume as long as spikelet, glabrous (Stanley and Ross 1989).



#### Habitat for the Species:

This species is usually observed in black clay soils. It is also considered to be a valuable fodder species. Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

## **Regional Ecosystems Associations:**

RE associations are unknown for the CSG fields, however, grassland REs occurring on land zone 3, 8 and 9 are likely to be important.

RE associations will be refined for this species during the course of the project.

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). Specific threats include weed invasion especially by Parthenium (Parthenium hysterophorus), inappropriate roadside management, grazing and fire.

#### Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200 m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.

#### **Specific Management Requirements:**

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		Santos CSG Fields Ecological Constraints Database;
		DERM's Wildlife Online (Wildnet) Records;
		Queensland Museum database;
	Consultation with Queensland Parks and Wildlife Service;	
		DERM's RE, Regrowth and Essential Habitat Mapping;
		Aerial and / or satellite imagery; and
		Discussion with land managers, site manager and / or the ER.
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.



Project Phase	Activity	Management Practices
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
Construction Cle	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
		Where small populations are proposed for retention within disturbance areas, they will be appropriately fenced.
		Where seed collection is identified by the Ecologist as a suitable mitigation measure, it is to be conducted prior to site works.
	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).



Project Phase	Activity	Management Practices
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. Searches should be designed around the time that this species is most readily detected (i.e. the growing season – October to March). Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works.

# Species Specific Performance Criteria:

In accordance with NC and EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG Field development.

Where rehabilitation occurs, care will be required to ensure that rehabilitating grasses are not impacted by surrounding grazing activities. Similarly, rehabilitation must ensure exotic grasses are controlled.

- Santos 2007;
- SEWPaC 2011e;
- Sharp and Simon 2002;
- Stanley and Ross 1989; and
- Vallee et al 2004.



# 4.2.6. Dichanthium setosum (Bristly Bluegrass)



Plate 11: *Dichanthium setosum*. Source: QLD Herbarium, 2002

# Status:

EPBC Act = Vulnerable NC Act = Near Threatened

# **Distribution:**



Plate 12: Distribution. Source: SEWPaC

In Queensland, this species has been recorded from the Leichhardt, Moreton, North Kennedy and Port Curtis pastoral districts.

# Known Locations within Stage 1 of the CSG Fields:

Dichanthium setosum has not been observed within the CSG fields. However, this species has been located within adjacent habitats (Santos 2007). Ecological surveys are required to confirm exact locations within the fields.



# **Description of the Species:**

Dichanthium setosum is an upright perennial grass to 1m tall, with mostly hairless leaves 2-3mm wide. The flowers are densely hairy and clustered together along a cylinder shape stalk and appear mostly during summer (TSSC 2008d).

## Habitat for the Species:

Dichanthium setosum is associated with heavy basaltic black soils and stony red-brown loam with clay subsoil and has been observed in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pastures (TSSC 2008d). Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

## **Regional Ecosystems Associations:**

RE associations are unknown for the CSG fields, however, grassland REs occurring on land zone 3, 8 and 9 are likely to be important, including:

RE	Short Description
11.3.21	Dichanthium sericeum and / or Astrebla spp. grassland on alluvial plains. Cracking clay soils.
11.8.11	Dichanthium sericeum grassland on Cainozoic igneous rocks.
11.9.3	Dichanthium spp., Astrebla spp. grassland on fine-grained sedimentary rocks.

RE associations will be refined for this species during the course of the project.

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). The main identified threats to Bristly Bluegrass are: invasion by introduced plants, such as Coolatai grass (Hyparrhenia hirta), Lippia (Phyla canescens) and African Lovegrass (Eragrostis curvula); heavy grazing by domestic stock; and road widening. Frequent fires are also a major threat with fire frequency of greater than five years to be appropriate for the species (TSSC 2008d).

# Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.

# **Specific Management Requirements:**

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:

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Project Phase	Activity	Management Practices
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and / or satellite imagery; and</li> <li>Discussion with land managers, site manager and / or the ER.</li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
		Where small populations are proposed for retention within disturbance areas, they will be appropriately fenced.
		Where seed collection is identified by the Ecologist as a suitable mitigation measure, it is to be conducted prior to site works.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.



Project Phase	Activity	Management Practices
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the Decommissioning and Demolition Management Plan (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. Searches should be designed around the time that this species is most readily detected (i.e. the growing season – October to March). Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works.

#### Species Specific Performance Criteria:

In accordance with NC and EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG Field development.



Where rehabilitation occurs, care will be required to ensure that rehabilitating grasses are not impacted by surrounding grazing activities. Similarly, rehabilitation must ensure exotic grasses are controlled.

# **Key Reference Documents:**

- SEWPaC 2011f;
- Santos 2007;
- TSSC 2008d; and
- Vallee et al 2004.

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# 4.2.7. *Eucalyptus virens* (Shiny-leaved Ironbark)



Plate 13: Eucalyptus virens. Source: Santos, 2007

# Status:

EPBC Act = Vulnerable NC Act = Vulnerable

# **Distribution:**



Plate 14: Distribution. Source: SEWPaC, 2011



*Eucalyptus virens* is endemic to south-east Queensland and is known from near Inglewood, Tara, north-east of Eidsvold and the scarp on approach to the Maranoa River near Mt Moffat. This species occurs in Burnett– Mary, Border Rivers Maranoa–Balonne, Fitzroy, Condamine and South West Queensland Natural Resource Management Regions.

# Known Locations within Stage 1 of the CSG Fields:

Eucalyptus virens has been observed in habitats contiguous with the FPA (Santos, 2007); potentially present within AVPA and FPA.

Ecological surveys are required to confirm exact locations within the fields.

## **Description of the Species:**

Shiny-leaved Ironbark is a small to medium sized ironbark tree growing to 25m. The bark is rough on the trunk and all branches, deeply furrowed, hard and dark grey in colour. The bark on small branchlets is soft and corky. Adult leaves are stalked, lance-shaped, 6–11.5 cm long and 1–2 cm wide, dark green on both surfaces, and very glossy (TSSC 2008e; Santos 2007).

White flowers of 6-7mm in clusters of up to 7 will occur between November to February (Santos 2007).

Hemispherical / cup shaped 0.4-0.6cm long and 0.4-0.7cm wide with 4-6 valves (chambers) at rim level or enclosed (Brooker & Kleinig 1994).

#### Habitat for the Species:

This species occurs on rocky slopes of sandstone ridges where it is associated with Budgeroo, Thready-bark Sheoak, Smooth-barked Apple, Brown Bloodwood, Tumbledown Ironbark, Inland White Mahogany and Queensland Peppermint (Santos 2007).

Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

#### **Regional Ecosystems Associations:**

Eucalyptus virens is known to inhabit remnant vegetation on land zone 10 (especially RE 11.10.4, described as Eucalyptus decorticans, Lysicarpus angustifolius +/- Eucalyptus spp., Corymbia spp., Acacia spp. woodland on coarse-grained sedimentary rocks. Crests and scarps.).

RE associations will be refined for this species during the course of the project.

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). The key potential threats to E. virens include timber harvesting of the species, disturbance of habitat during timber harvesting operations, and loss of habitat due to vegetation clearing (TSSC 2008e).

#### Management Level:

If this species is located within a CSG field development site, a buffer of 200m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.



# **Specific Management Requirements:**

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and (or actellite imaganar) and</li> </ul>
		<ul> <li>Discussion with land managers, site manager and / or the ER.</li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact
		must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).



Project Phase	Activity	Management Practices
:	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
		Where individual species are proposed for retention within disturbance areas, they will be appropriately flagged or fenced.
		Where translocation or seed collection is identified by the Ecologist as a suitable mitigation measure, it is to be conducted prior to site works.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non- compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.



Project Phase	Activity	Management Practices
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. Searches should be designed around the time that this species is most readily detected (i.e. the growing season – October to March). Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works.

## **Species Specific Performance Criteria:**

In accordance with NC and EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG field development.

Where rehabilitation of this species occurs, tube stock of a local provenance is to be used. Performance criteria for revegetation outlined in the RRRMP are to be monitored.

- Santos 2007;
- Santos 2007;
- SEWPaC 2011g;
- TSSC 2008e; and
- Vallee *et al* 2004.



# 4.2.8. Homopholis belsonii (Belson's panic)



Plate 15: Homopholis belsonii. Source: Tropical Grassland Society of Australia Inc,1996

#### Status:

EPBC Act = Vulnerable NC Act = Endangered

# **Distribution:**







In Queensland, this species is known to occur within the southern Brigalow Belt within the Border Rivers Maranoa– Balonne and Condamine (Queensland) Natural Resource Management Regions and has been recorded as far west as the area between Miles and Roma (TSSC 2008f).

## Known Locations within Stage 1 of the CSG Fields:

This species has not been recorded from the GLNG CSG fields, however HERBRECS data identifies this species from habitats to the north of Warrego Highway between the townships of Miles and Roma.

Ecological surveys are required to confirm presence / absence on the site of the proposed development.

## **Description of the Species:**

Homopholis belsonii is an erect perennial grass growing up to 40 cm tall (Stanley & Ross 1989). Leaves with ligule up to 1.5 mm long; blade 2-4.5 mm wide, glabrous (Stanley & Ross1989). Inflorescence not fully exserted, common axis 8-15 cm long; primary branches 8-15 cm long, with hairy axils (TSSC 2008f).

Panicles up to 25 cm long, up to 20 cm broad, with primary and secondary branching; spikelets 4.5-6 mm long; lower glume with sparse minute hairs, upper glume minutely hairy (Stanley & Ross1989).

#### Habitat for the Species:

Homopholis belsonii is usually found in dry woodland habitats at elevations ranging from 200-520m altitude including rocky hills supporting White Box (Eucalyptus albens) and in Wilga (Geijera parviflora) woodland; flat to gently undulating alluvial areas supporting Belah (Casuarina cristata) forest ; soils and plant communities of Poplar Box (Eucalyptus populnea) woodlands and shadier areas of Brigalow (Acacia harpophylla), Yarran (A. melvillei), and Weeping Myall (A. pendula) communities; in Mountain coolibah (Eucalyptus orgadophila) communities; and on roadsides (TSSC 2008f). Within these habitats, the species is associated with fallen timber at the base of trees or shrubs, among branches and leaves of trees hanging to ground level or along the bottom of netting fences (TSSC 2008f).

Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

#### **Regional Ecosystems Associations:**

RE associations are unknown for the CSG fields, however, woodland and open woodland REs occurring on land zone 3, 4, 8 and 9 are likely to be important, including:

RE	Short Description
11.3.2	Eucalyptus populnea woodland on alluvial plains
11.4.3	Acacia harpophylla and / or Casuarina cristata shrubby open forest on Cainozoic clay plains.
11.9.5	Acacia harpophylla and / or Casuarina cristata open forest on fine-grained sedimentary rocks.
11.9.6	Acacia melvillei +/- Acacia harpophylla open forest on fine-grained sedimentary rocks.

RE associations will be refined for this species during the course of the project.

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). The main identified threats to Homopholis belsonii are clearing of habitat for agriculture, development or pasture improvement; overgrazing of habitat by domestic stock; invasion of habitat by introduced weeds; and clearing of habitat for mining (TSSC 2008f).



#### Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.

# **Specific Management Requirements:**

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		DERM's Wildlife Online (Wildnet) Records;
		Queensland Museum database;
		Consultation with Queensland Parks and Wildlife Service;
		DERM'S RE, Regrowth and Essential Habitat Mapping;     Aorial and (or satellite imagen/; and
		<ul> <li>Discussion with land managers, site manager and / or the ER</li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.



Project Phase	Activity	Management Practices
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
		Where small populations are proposed for retention within disturbance areas, they will be appropriately fenced.
		Where seed collection is identified by the Ecologist as a suitable mitigation measure, it is to be conducted prior to site works.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.

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Project Phase	Activity	Management Practices
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

## **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. Searches should be designed around the time that this species is most readily detected (i.e. the growing season – October to March). Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works.

# **Species Specific Performance Criteria:**

In accordance with NC and EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG field development.

Where rehabilitation occurs, care will be required to ensure that rehabilitating grasses are not impacted by surrounding grazing activities. Similarly, rehabilitation must ensure exotic grasses are controlled.

- TSSC 2008f;
- Santos 2007;
- SEWPaC 2011h;
- Stanley & Ross 1989; and
- Vallee *et al* 2004.



# 4.2.9. Macrozamia fearnsidei (Curly Zamia)



Plate 17: Macrozamia fearnsidei. Source: Santos, 2011

# Status:

EPBC Act = Vulnerable NC Act = N/A

# **Distribution:**



Created 03 May 2011, © CHAH 2011

Plate 18: Distribution. Source: SEWPaC, 2011

*Macrozamia fearnsidei* is known from the sandstone escarpments of the Great Dividing Range north of Injune and Taroom, in central Queensland. Most populations occur within National Park or State Forest e.g. Carnarvon NP, Expedition (Limited Depth) NP, Presho SF and Boxvale SF (DERM 2011a). This species occurs within the Fitzroy (Queensland) Natural Resource Management Region (DERM 2011a).



## Known Locations within Stage 1 of the CSG Fields:

*Macrozamia fearnsidei* has been observed within the FPA (Santos 2007) at Kentucky and Lonesome Holdings. It also occurs in areas of Expedition (Limited Depth) NP in areas contiguous with the AVPA. Ecological surveys are required to confirm exact locations within the fields.

# **Description of the Species:**

*Macrozamia fearnsidei* has an underground trunk that may reach 1m in height, occurring as patchy clusters (Santos 2007). Curly Zamia produces between 5 - 20 fronds from the crown at ground level which spirally twist up to 4 times. Each leaf has between 55 - 120 narrow leaflets which are dark green and shiny above and paler beneath (SEWPaC 2011i).

Male and female cones are borne on separate plants. The male cone is cylindrical, often curved and up to 300mm long. The female cone is oblong (to 180 mm long), on a stalk, and contains glossy, orange-red shaped seeds (Santos 2007).

## Habitat for the Species:

*Macrozamia fearnsidei* occurs in open woodlands of Large-fruited Yellow Jacket (*Corymbia watsoniana*), Lemon-scented Gum (*C. citriodora*), Smooth-barked Apple (*Angophora leiocarpa*) and Budgeroo (*Lysicarpus angustifolius*). It grows on flat-topped or undulating sandstone ridges with sandy or loamy substrate.

Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

#### **Regional Ecosystems Associations:**

RE	Short Description
11.10.1	Corymbia citriodora open forest on coarse-grained sedimentary rocks.
11.10.4	Eucalyptus decorticans, Lysicarpus angustifolius +/- Eucalyptus spp., Corymbia spp., Acacia spp. woodland on coarse-grained sedimentary rocks. Crests and scarps
11.10.3	Eucalyptus spp. and/or Corymbia spp. open forest on scarps and sandstone tablelands.

Macrozamia fearnsidei is known to inhabit remnant vegetation on land zone 10, including:

RE associations will be refined for this species during the course of the project.

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). The main potential threats include destruction in areas managed for grazing, as the plant is toxic to stock; and removal for the horticultural trade and cycad enthusiasts. Furthermore, inappropriate fire regimes and forest operations may also affect the species (Queensland Herbarium 2007).

#### Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200 m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area



will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.

# **Specific Management Requirements:**

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and / or satellite imagery; and</li> <li>Discussion with land managers, site manager and / or the ER.</li> </ul> </li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.

# Santos GLNG

		Where individual species are proposed for retention within disturbance areas, they will be appropriately flagged or fenced.
Construction	Translocation	Any translocations required as part of the approval conditions will be performed as per the Species Salvage Management Plan (Santos 2010), which was prepared in accordance with the Guidelines for the Translocation of Threatened Species in Australia (Vallee <i>et al</i> 2004) and relevant conditions of this approval.
	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.



Deco	ommissionin	Decommissioning and demolition will be conducted as per the
g an	d Demolition	Decommissioning and Demolition Management Plan (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. Searches should be designed around the time that this species is most readily detected (i.e. the growing season – October to March). Monitoring of retained and replanted species will be conducted in accordance with the RRRMP and SMP after the commencement of site rehabilitation works.

#### **Species Specific Performance Criteria:**

In accordance with NC and EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG field development.

- DERM 2011a;
- Santos 2007;
- SEWPaC 2011i;
- TSSC 2008g; and
- Vallee et al 2004.



# 4.2.10. Swainsona murrayana (Slender darling pea)



Plate 19: Swainsona murrayana. Source: DECC, 2005 (Alexander Knight)

#### Status:

EPBC Act = Vulnerable NC Act = Vulnerable

# **Distribution:**



Plate 20: Distribution. Source SEWPaC, 2011.


In Queensland the species is known from near Surat in the Border Rivers Maranoa-Balonne catchment (SEWPaC 2011j). Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

#### Known Locations within Stage 1 of the CSG Fields:

The single Queensland record of Swainsona murrayana lies to the south of the RSGPA field (Santos, 2007). Ecological surveys are required to confirm exact locations within all relevant fields.

#### **Description of the Species:**

Swainsona murrayana is a slender herb to 25 cm tall. Leaves are 5–10 cm long and grow on a slender stem with dense hairs (TSSC 2008h). It has pink or purple flowers, which appear between spring and early summer (SEWPaC 2011j). It produces leathery elliptical seed pods 20-65mm long (SEWPaC 2011j).

#### Habitat for the Species:

Swainsona murrayana is found in grassland, herbland, and open Black-box woodland, often in depressions. This species grows in heavy grey or brown clay, loam, or red cracking clays. It is often associated with low chenopod shrubs (Maireana spp.), wallaby-grass (Austrodanthonia spp), and spear grass (Austrostipa spp). The species may require some disturbance and has been known to occur in paddocks that have been moderately grazed or occasionally cultivated (TSSC 2008h).

Regional Ecosystems Associations: RE associations within the CSG fields are unknown for this species, however, REs likely to be of importance may potentially include:

RE	Short Description
11.3.28	Casuarina cristata +/- Eucalyptus coolabah open woodland on alluvial plains.
11.4.4	Dichanthium spp., Astrebla spp. grassland on Cainozoic clay plains.
11.9.3	Dichanthium spp., Astrebla spp. grassland on fine-grained sedimentary rocks.
11.9.14	Lysiphyllum carronii, Atalaya hemiglauca +/- Eucalyptus melanophloia +/- Acacia excelsa open woodland.

RE associations will be refined for this species during the course of the project.

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). These include:

Habitat destruction by goats (*Capra hircus*), rabbits (*Oryctolagus cuniculus*), feral pigs (*Sus scrofa*), and domestic stock (TSSC 2008h);

- Grazing from domestic stock and rabbits especially in the flowering season when grazing could influence the soil seed bank and hence future abundance of the species (TSSC 2008h);
- Loss of habitat to cultivation particularly rice crops, weed invasion, increased salinisation, frequency of fires and urban development (TSSC 2008h); and
- This species should not be burnt more frequently than once every ten years (TSSC 2008h).



#### Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.

#### **Specific Management Requirements:**

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		DERM's Wildlife Online (Wildnet) Records;
		Queensland Museum database;
		Consultation with Queensland Parks and Wildlife Service;
		<ul> <li>DERMIS RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and (or satellite imagen); and</li> </ul>
		<ul> <li>Discussion with land managers, site manager and / or the ER.</li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Where individuals or small populations are observed, infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.



	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
		Where individual species are proposed for retention within disturbance areas, they will be appropriately flagged or fenced.
		Where translocation or seed collection is identified by the Ecologist as a suitable mitigation measure, it is to be conducted prior to site works.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.



	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissionin g and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

#### **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. Searches should be designed around the time that this species is most readily detected (i.e. the growing season – October to March). Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works.

#### **Species Specific Performance Criteria:**

In accordance with NC and EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG field development.

Where rehabilitation of this species is required, tubestock of local provenance is to be used where possible.

- DERM 2011a;
- SEWPaC 2011j;
- TSSC 2008h; and
- Vallee et al 2004.



#### 4.2.11. Xerothamnella herbacea



Plate 21: Xerothamnella herbacea. Source: Queensland Herbarium, DERM, 2007

#### Status:

EPBC Act = Endangered NC Act = Endangered

#### **Distribution:**



Plate 4.2.11b: Distribution. Source SEWPaC, 2011.



This species occurs within the Condamine, Border Rivers Maranoa–Balonne and Fitzroy (Queensland) Natural Resource Management Regions and is known from two sites north east of Chinchilla, a single record from near Theodore and a record near Yelarbon east of Goondiwindi, Queensland (TSSC 2008i). More recently this species has been recorded from the Arcadia Valley. Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

#### Known Locations within Stage 1 of the CSG Fields:

Xerothamnella herbacea has been recorded from the southern end of the Arcadia Valley. Ecological surveys are required to confirm exact locations within all relevant fields.

#### **Description of the Species:**

Xerothamnella herbacea, is a sparse, sprawling, matt forming, perennial herb that grows to a height of 30 cm. Stems arise from a central point but can root at nodes where in contact with soil. Leaves are soft, linear to narrowly ovate in outline, dark green above and paler beneath, growing in opposite pairs. Flowers are small, two lipped, bright pink to mauve, growing to 6.5cm occur in the upper leaf axils (Barker, 1986).

#### Habitat for the Species:

Xerothamnella herbacea occurs in Brigalow (Acacia harpophylla) dominated communities in shaded situations, often in leaf litter and in shallow ground depression (gilgais). This species is associated with heavy, grey to dark brown clays (TSSC 2008i). This species is not known to occur in any conservation reserves and three of the four known populations occur in cleared areas or non- remnant vegetation not protected under the VM Act. The distribution of this species overlaps with the following EPBC Act-listed TEC: Brigalow (Acacia harpophylla dominant and co-dominant), Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions, and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (TSSC 2008i).

#### **Regional Ecosystems Associations:**

RE associations within the CSG fields are unknown for this species, however, REs likely to be of importance may potentially include:

RE	Short Description
11.3.1	Acacia harpophylla and / or Casuarina cristata open forest on alluvial plains
11.4.3	Acacia harpophylla and / or Casuarina cristata shrubby open forest on Cainozoic clay plains
11.4.7	Open forest to woodland of <i>Eucalyptus populnea</i> with <i>Acacia harpophylla</i> and / or <i>Casuarina cristata</i> on Cainozoic clay plains
11.9.5	Acacia harpophylla and / or Casuarina cristata open forest on fine-grained sedimentary rocks
11.8.3	Semi-evergreen vine thicket on Cainozoic igneous rocks. Steep hillsides
11.9.4	Semi-evergreen vine thicket on fine-grained sedimentary rocks
11.9.8	Macropteranthes leichhardtii thicket on fine grained sedimentary rocks
11.10.8	Semi-evergreen vine thicket in sheltered habitats on medium to coarse-grained sedimentary rocks

RE associations will be refined for this species during the course of the project.



#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). Additional threats to this species include:

- Competition from invasive plant species including, Green Panic (*Megathyrsus maximus* var. *pubiglumis*) and to a lesser extent Buffel Grass (*Cirsium ciliare*). Both of these introduced grasses threaten *X. herbacea* either by direct competition or by increasing the fuel load and altering fire regimes (TSSC 2008i);
- Grazing and trampling by cattle and native macropods (McDonald, 2010); and
- Destruction of habitat resulting from road widening and maintenance activities as well as surface erosion (TSSC 2008i).

#### Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to Section 1.8.2) during the initial planning phase of the development.

Where disturbances within the 200 m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.

#### Specific Management Requirements:

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and / or satellite imagery; and</li> <li>Discussion with land managers, site manager and / or the ER.</li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.
		works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.



Project Phase	Activity	Management Practices
		Where individuals or small populations are observed, infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
		Where individual species are proposed for retention within disturbance areas, they will be appropriately flagged or fenced.
		Where translocation or seed collection is identified by the Ecologist as a suitable mitigation measure, it is to be conducted prior to site works.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.



Project Phase	Activity	Management Practices
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

#### Monitoring Process:

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. Searches should be designed around the time that this species is most readily detected (i.e. the growing season – October to March). Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works.

#### **Species Specific Performance Criteria:**

In accordance with NC and EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG field development.

Where rehabilitation of this species is required, tubestock of local provenance is to be used where possible.

- Barker, 1986;
- McDonald, 2010;
- SEWPaC, 2011k;
- TSSC 2008i; and
- Vallee et al 2004.



## 4.3. Aquatic flora

4.3.1. Eriocaulon carsonii (Salt pipewort)



Plate 22: Eriocaulon carsonii. Source: DECC, 2005 (Geoff Carr)

#### Status:

EPBC Act = Endangered NC Act = Endangered

Habitat & Distribution:



Plate 23: Distribution. Source: SEWPaC, 2011

*E. carsonii* is an aquatic plant only found on permanent, spring-fed wetlands with a groundwater source from the Great Artesian Basin. Populations generally occur on relatively flat landscapes in Queensland, NSW and SA. In Queensland *E. carsonii* is known from 12 spring complexes (group of springs on similar landforms located no more than 6km apart) (DERM 2011). With the exception of two populations in the Einasleigh Uplands region of north Queensland, the Great Artesian Basin sustains the wetlands which support this species.

Spring wetlands in the Great Artesian Basin have been well surveyed and there is a high level of certainty that no further complexes containing *E. carsonii* will be found (DERM 2011). Two populations are known to have become extinct as a consequence of Great Artesian Basin springs becoming inactive, one of these is in southern Queensland and is in the largest spring of the Eulo region (Wiggera Springs) (Fensham & Fairfax 2003). Results



of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project.

#### Known Populations and Relationships within Stage 1 of the CSG Fields:

*E. carsonii* has been observed within the FPA at Spring Rock Holding (Herbrecs data, Santos, 2007). It is also known to occur within boggomoss environments in the Taroom district which are in close proximity to CSG fields.

Ecological surveys are required to confirm exact locations within the fields.

#### **Description of the Species:**

*E. carsonii* is a hairless, perennial, aquatic herb that has a circular cluster of leaves at its base and clustered flowers (DERM 2011a). *E. carsonii* usually forms mat-like colonies and can vary in appearance. For example, smaller plants (up to 10 cm tall) with hairless flower heads are found in western Queensland, while larger plants (up to 50 cm tall) with hairy flower heads occur in southern, eastern and northern Queensland (DERM 2011a).

Flowers are tiny (3-4mm in diameter) and white in colour, with female flowers forming first, followed by the male flowers. Flowering is known to occur between summer and late autumn.

Fruit a membranous, swollen, 3-celled capsule.

#### **Regional Ecosystems Associations:**

This species is virtually confined to RE 11.3.22, described as Springs associated with recent alluvia, but also including those on fine-grained sedimentary rocks, basalt, ancient alluvia and metamorphic rocks.

#### Threats:

Common threats affecting this species from gas field development are outlined in **Table 1.7** (**Section 1.11**). SEWPaC (2011k) states that threats to *E. carsonii* and other native species dependent on natural discharge of groundwater from the Great Artesian Basin include:

- The artificial removal of groundwater which reduces spring flows into wetlands can leave many spring complexes completely inactive;
- Damage to spring wetlands through excavation;
- The introduction of exotic species such as para grass and hymenachne in ponded pastures can compete with and may exclude native plant species from their habitat;
- Trampling by grazing animals around the edges of spring wetlands which disturbs vegetation and native species populations; and
- The removal and destruction of vegetation by pig rooting (extensive digging to find food such as tubers, worms and soil invertebrates).

#### Management Level:

If this species is located within a CSG field development site, a buffer of 200 m will be applied as per the protocol (refer to **Section 1.8.2**) during the initial planning phase of the development.

Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened flora species.



#### **Specific Management Requirements:**

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and / or satellite imagery; and</li> <li>Discussion with land managers, site manager and / or the ER.</li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence / absence, population status and area extent of this species prior to any clearing or associated works occurring. The surveys will target suitable habitat for this species within and directly adjacent to the active CSG development area.
		Where this species is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where this species occurs within the TEC community of native species depended on natural discharge of groundwater from the Great Artesian Basin, no clearing is to occur. Disturbances to this TEC are not authorised under the EPBC Approval condition.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		In the unlikely event that this species is located outside of the TEC, infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of individual species, approval conditions will be complied with as per the Protocol (i.e. – clearing of species must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, locations of individual species, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.

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Project Phase	Activity	Management Practices
		In the unlikely event of individual species occurring, fencing shall be installed prior to the commencement of site works, in conjunction with signage.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint and all measures to identify individual species and buffer areas remain adequately marked for the duration of clearing activities.
		Clearing activities adjacent to buffer areas and protected individual species will be supervised by the ER.
		Dust suppression mechanisms outlined in the SMP and ESCM will be put in place to ensure excessive dust deposition does not occur on the foliage and affect the plants ability to photosynthesise.
		In the event of a non-compliance, Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring.
		DERM and SEWPaC will be notified of locations where this species has been observed. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
	Management	Sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).



#### **Monitoring Process:**

In areas where this species has been recorded, and disturbance is allowable, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches. Searches should be designed around the time that this species is most readily detected (i.e. the growing season – October to March). Monitoring of retained and replanted species will be conducted in accordance with the RRRMP after the commencement of site rehabilitation works.

#### **Species Specific Performance Criteria:**

In accordance with NC and EPBC Approval conditions, no individuals outside the approval area(s) are damaged or destroyed during the construction / operational phases of the CSG field development.

This species is likely to only occur within the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin TEC. Disturbances to this community are not approved under the EPBC Approval conditions. Where rehabilitation is required due to accidental disturbance, consultation with SEWPaC will be required.

- NPWS 2002b;
- Fensham et al 2010
- SEWPaC 2011k; and
- Vallee et al 2004.



# 5. Significant Fauna

## 5.1. Introduction

This Section includes detailed information on all Commonwealth significant fauna that is protected pursuant to the EPBC Act that are known to utilise habitat within and / or directly adjacent to the CSG fields. Several species are also listed under the NC Act.

Each species profile contains the following information:

- Current legal status;
- Species name;
- Known distribution, populations and relationships with the region;
- Description of the species (e.g. type of animal / distinguishing features);
- Description of habitat, including general / indicative and essential microhabitat features;
- Known Regional Ecosystems associations;
- Biology;
- Threats to the species;
- Management level;
- Specific Field Management Procedures;
- Monitoring processes;
- Species specific performance criteria; and
- Key reference documents.

## 5.2. Pre-construction Survey

Pre-construction surveys undertaken for the development of the CSG fields will aim to confirm the presence / absence of a significant species within the CSG fields and associated micro-habitat. This information will be used to update the constraints database in accordance with the Protocol as well as developing appropriate mitigation measures to avoid and / or minimise impacts from the development on these species. This plan will be amended to reflect the findings of these surveys as part of the annual review process.

An authorised person must be present where there is a risk to native fauna present within the clearing site. An authorised person is a person who is permitted to tamper and interfere with a protected animal or a protect animal's breeding place, and hold appropriate licences issued by DERM to undertake such work.

Should tampering with an animal breeding place be required, the following information will be provided to the administering authority:

- Information regarding the type(s) of animals;
- The number(s) of animals affected;
- Their conservation status; and
- Advice from experts relating to the species behavioural ecology and population dynamics.

Further information regarding tampering with animal breeding places is covered in the Species Management Program under the NC Act.



## 5.3. Threatened Fauna Species

Numerous fauna species listed under the EPBC Act and NC Act may occur within the CSG fields. Maximum disturbance limits for typical habitat for all EPBC listed fauna apply to all authorised unavoidable adverse impacts of MNES resulting from exploration, development, operation and decommissioning of the CSG fields, as outlined in the Protocol. Specific management, monitoring and species specific performance criteria have been established to ensure disturbance limits are not exceeded for the following EPBC listed fauna species which may be impacted by gas field development in the CSG fields:

- Adclarkia dawsonensis (Boggomoss Snail);
- Erythrotriorchis radiatus (Red Goshawk);
- Geophaps scripta scripta (Squatter Pigeon (southern subspecies));
- Rostratula australis (Australian Painted Snipe);
- Turnix melanogaster (Black-breasted Button-quail);
- Furina dunmalli (Dunmall's Snake);
- Denisonia maculata (Ornamental Snake);
- Delma torquata (Collared Delma);
- Egernia rugosa (Yakka Skink);
- Paradelma orientalis (Brigalow Scaly-foot);
- Chalinolobus dwyeri (Large-eared Pied Bat);
- Nyctophilus corbeni (South-eastern Long-eared Bat);
- Dasyurus hallucatus (Northern Quoll); and
- Maccullochella peelii (Murray Cod).

## 5.4. Migratory Bird Species

Numerous migratory bird species listed under the EPBC Act and NC Act may occur at times within the CSG fields. Maximum disturbance limits for these species have not been set in the EPBC Approval. The following migratory bird species which may be impacted by gas field development in the CSG fields:

- Apus pacificus (Fork-tailed swift);
- Ardea modesta (Eastern great egret);
- Ardea ibis (Cattle egret);
- Gallinago hardwickii (Latham's snipe, Japanese snipe);
- Haliaeetus leucogaster (White-bellied sea eagle);
- Hirundapus caudacutus (White-throated needletail);
- Hirundo rustica (Barn swallow);
- Merops ornatus (Rainbow bee-eater);
- Monarcha melanopsis (Black-faced monarch);
- Monarcha trivirgatus (Spectacled monarch); and
- Myiagra cyanoleuca (Satin flycatcher).



## 5.5. Terrestrial Fauna

#### **INVERTEBRATES**

## 5.5.1. Adclarkia dawsonensis (Boggomoss Snail)



Plate 24: Boggomoss Snail. Source: Wildlife Preservation Society of QLD, 2006 (Robert Standish White).

#### Status:

EPBC Act = Critically Endangered NC Act = N/A

#### **Distribution:**





#### Plate 25: Distribution. Source: Stainisnic, 2008

The Boggomoss Snail is found in the greater Taroom area of south-eastern Queensland. It occurs in the Dawson Valley, north-east of Taroom, on the Dawson River. There are two main subpopulations of the snail. One subpopulation is found in boggomoss (artesian spring) habitat on private property on the Dawson River near Taroom. The other population occurs on a camping and water reserve between Tarooma and Theodore, at the Isla-Delusion crossing of the Dawson River (SEWPaC 2011I). Several small populations have also been discovered in the greater Taroom area in recent years.

#### Known Populations and Relationships within the CSG Fields:

This species is not known to occur within the CSG fields, however may potentially occur in the AVPA and FPA within eucalypt and Brigalow woodland vegetation communities on floodplains and along major watercourses (e.g. Dawson River).

#### **Description of the Species:**

The helicoid shell of the Boggomoss Snail is light brown, becoming greenish-yellow towards the apex, with a white lip. It is thin and semi-transparent, with an average diameter of about 2.3cm, and is made up of 5 1/8 - 55/8 whorls. The shell is 1.5cm high with a slightly elevated spire and a very small central depression. The animal itself is light brown to white, with the amount of grey around the neck, on the sides of the foot and above the tail differing between specimens. Black blotches on the lung roof are visible through the shell (SEWPaC 2011I). The species may potentially be confused with several other species of camaenid land snails

#### Habitat for the Species:

#### General / Indicative Habitat:

Based on knowledge of the species' current distribution in the Taroom area, the Boggomoss Snail prefers grassy eucalypt woodlands on alluvial flats along drainage lines. This species typically occurs on Gilgai black soils within Eucalypt and Brigalow communities. General / indicative habitat is defined as intact drainage lines.

#### **Regional Ecosystems Associations:**

RE	Short Description
11.3.1	Acacia harpophylla and / or Casuarina cristata open forest on alluvial plains.
11.3.3	Eucalyptus coolabah woodland on alluvial plains.
11.3.4	Eucalyptus tereticornis and / or Eucalyptus spp. tall woodland on alluvial plains.
11.3.25	Eucalyptus tereticornis or Eucalyptus camaldulensis woodland fringing drainage lines.

This species is associated with Eucalpyt and Brigalow communities, and may occur within the following REs:

#### **Essential Microhabitat Features:**

Essential microhabitat for the Boggomoss Snail includes intact drainage lines where populations are known or highly likely to occur. This species is dependent upon an intact overstorey, which retains sufficient moisture for the snails to survive. This species is also expected to occur in non-remnant areas adjoining watercourses where there are suitable microhabitat features including fallen logs, leaf litter and other cover (Stanisic 2008). Essential microhabitat requirements for the Boggomoss Snail are a well-developed leaf litter layer for food, shelter (e.g. logs, fallen bark) and breeding sites, and a good coverage of vegetation to support the leaf litter environment and maintain a moist microclimate (Stanisic 2008).



Refer to Figure 3.1 for habitat assessment process.

#### Biology:

Little is known about the breeding biology of this species. As with most land snails it is likely to breed opportunistically after rain.

#### Threats:

Common threats affecting this species from gas field development from gas field development are outlined in Table 1.7 (Section 1.11). Other threats include:

- The small size of the boggomoss remnant vegetation makes them more vulnerable to the effects of fire, and particularly sensitive to hot fires;
- Predation by feral predators (e.g. pigs, mice, rats);
- Disturbance of habitat by feral pigs;
- Stock grazing has a detrimental effect on the Boggomoss Snail's habitat by introducing weeds to the area and causing compaction of the soils and leaf-litter; and
- Boggomoss Snails may also be directly trampled by livestock (SEWPaC 2011I).

#### Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

#### Specific Field Management Procedures:

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		DERM's Wildlife Online (Wildnet) Records;
		Queensland Museum database;
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>
		<ul> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> </ul>
		Aerial and / or satellite imagery; and
		<ul> <li>Discussion with land managers, site manager and / or the ER.</li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of the Boggomoss Snail, or suitable habitat to support this species



Project Phase	Activity	Management Practices
		(Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$ (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where a breeding site is located a 200 m buffer zone will be established around the site.
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management processed to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around known breeding sites, no construction activities will occur during breeding.
		Within all areas of identified habitat, microhabitat features will be relocated to areas of vegetation to be retained prior to vegetation clearing.
		All fencing / flagging tape / barricade webbing is to remain in place, and regularly checked.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.



Project Phase	Activity	Management Practices
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced entomologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields. DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of egg clutches or known breeding sites that contain egg clutches.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of egg clutches or known breeding sites. that contain egg clutches.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

#### Monitoring Process:

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches (e.g. searches for dead shells under logs and other ground debris). Searches for live individuals should be conducted when there is a higher chance of detecting this species (e.g. after rain). Appendix B details survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

Monitoring will be undertaken in accordance with the RRRMP to ensure rehabilitation success criteria is met.



#### **Species Specific Performance Criteria:**

- Active habitat areas are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species are to occur as a result of construction and operation activities;
- Sightings of individuals are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- SEWPaC 2011l;
- Stanisic 2008;
- Stanisic 2010; and
- TSSC 2003a.



## BIRDS

5.5.2. *Erythrotriorchis radiatus* (Red Goshawk)



Plate 26: Red Goshawk. Source: Baker-Gabb, 2008

#### Status:

EPBC Act = Vulnerable NC Act = Endangered

## **Distribution:**



Plate 27: Distribution. Source: SEWPaC 2011m

The Red Goshawk is endemic to northern and eastern Australia, extending from the Kimberley in Western Australia and historically to central coastal New South Wales. Within southern Queensland they have been recorded inland to west of Mitchell, the Springsure-Rolleston area and from Chesterton Range (SEWPaC 2011m).

## Known Populations and Relationships within the CSG Fields:

There are no known resident or breeding populations of Red Goshawk within the CSG fields. The CSG fields are within the known distribution of the species; however, it is a vagrant within southern inland Queensland. The species is not expected to occur within the RSGPA Field, however, potentially suitable foraging and nesting habitat occurs within or near the sandstone ridges, gorges and escarpments of the FPA and AVPA fields, and along



watercourses including the Dawson River, Baffle Creek, Lake Nuga Nuga, Hutton Creek, Palm Tree and Robinson Creek.

#### **Description of the Species:**

The Red Goshawk is a large, reddish-brown hawk with long and broad wings, deeply 'fingered' wing-tips, and heavy yellow legs. The upperparts are largely grey-brown, heavily scaled with rufous, and the underparts are rufous heavily streaked darker; the head is pale streaked with black. Females are paler than males below, with a whitish lower underbody. In flight from below, the underwing and undertail appear largely white with black barring, and with a rufous panel on the leading edge of the innerwing, and blackish wing-tip. The flight is fast with strong wing-beats interspersed with glides. It also soars, showing a distinctive underwing pattern of rust-red wing-lining contrasting with whitish, heavily barred flight-feathers. The male's call is a series of high pitched, strident yelps and the female's call is harsher. When perched it sits upright (Pizzey and Knight 2007).

Habitat for the Species: General / Indicative Habitat:

Inhabits open forests, woodlands especially near rivers, wetlands and rainforest fringes in coastal and subcoastal north and northeast Australia from the Kimberley (WA) to the Queensland / New South Wales border (Pizzey and Knight 2007). Refer to Figure 1.7, 1.11 & 1.15 for habitat mapping. General / indicative habitat also includes grazing paddocks and natural grasslands, as well as disturbed remnant vegetation.

#### **Regional Ecosystems Associations:**

REs of importance within the CSG Fields include all REs on Land zones 3, 4, 5, 7, 8, 9, 10 and 11. Non- remnant and regrowth vegetation is also likely to be utilised for foraging. The following REs are likely to be of particular importance for nesting:

RE	Short Description
11.3.2	Eucalyptus populnea woodland on alluvial plains.
11.3.25	Eucalyptus tereticornis or Eucalyptus camaldulensis woodland fringing drainage lines.

#### **Essential Microhabitat**

The Red Goshawk occurs in woodlands and forests, ideally with a mosaic of vegetation types and permanent water, particularly riverine forests. The species also occurs in natural grasslands and open paddocks, but avoids both very dense and very open habitats (SEWPaC 2011m). Essential microhabitat includes any active nests.

Refer to Figure 3.1 for habitat assessment process.

#### Biology:

The breeding season of the Red Goshawk is from April to September. The age at which Red Goshawks first breed is not known, nor is the life expectancy. The nest is made of sticks found in a heavy fork of live Eucalyptus or Melaleuca spp., usually within 1 km of a watercourse or wetland. They may also use old nests of crows or magpies. One to two eggs are laid and young remain with their parents for at least 70 – 80 days after they leave the nest and may remain with their parents for 4 – 5 months (Pizzey and Knight 2007; SEWPaC 2011m).

#### Threats:

Common threats affecting this species from gas field development from gas field development are outlined in Table 1.7 (Section 1.11). Other threats include:



- Intentional shooting by pigeon and poultry owners, and possibly secondary poisoning through pest-control activities, are thought to kill a few individuals and may cause local scarcity;
- Use of persistent pesticides may result in pesticide contamination sufficient to cause eggshell thinning and breeding failure;
- Inappropriate fire and land management regimes may have altered the availability of prey for this species;
- Genetic bottlenecks may restrict gene flow affecting an already small population;
- Clearing and fragmentation of riparian forests and woodlands. Nests are particularly vulnerable to clearing of habitat, and even where riparian strips are not cleared, Red Goshawks usually nest in the tallest trees, which are exposed to storm damage and other disturbance when surrounding vegetation is removed; and
- Disturbance of nesting sites and breeding failure from illegal egg-collecting (SEWPaC 2011m).

#### Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around active nests.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

#### **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction Infrastructure planning / siting	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Birds Australia Birdata Atlas;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and / or satellite imagery; and</li> <li>Discussion with land managers, site manager and / or the ER.</li> </ul> </li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of the Red Goshawk, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$ (i.e. will include non-remnant and regrowth areas – Class E).



Project Phase	Activity	Management Practices
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constrains class mapping updates.
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests, no construction activities will occur during breeding.
		The status of active nests will be regularly checked in a way that does not risk the nest being abandoned by the breeding pair by the licensed spotter-catcher.
		All fencing / flagging tape / mesh webbing is to remain in place, and regularly checked.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Access	Access is to occur along designated access tracks only.



Project Phase	Activity	Management Practices
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Lighting	The use of lighting will be minimised within areas of essential microhabitat.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields. Nest locations will remain confidential except to QPWS and the Queensland Museum.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the Decommissioning and Demolition Management Plan (DDMP).

#### **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.



#### **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species are to occur as a result of construction and operation activities;
- The location of Red Goshawk nests should remain confidential except to Queensland Parks and Wildlife Service (QPWS) and Queensland Museum. Any definite sightings of Red Goshawks or their nests should be reported to QPWS as soon as possible; and
- Rehabilitation of associated habitat areas has been completed.

- DEWHA 2010b;
- Marchant & Higgens 1993;
- Pizzey and Knight 2007; and
- SEWPaC 2011m.



## 5.5.3. Geophaps scripta scripta (Squatter Pigeon (southern subspecies))



Plate 28: Squatter Pigeon. Source: B Dreis, 2010

#### Status:

EPBC Act = Vulnerable NC Act = Vulnerable

#### **Distribution:**



Plate 29: Distribution. Source: SEWPaC, 2011n

The Squatter Pigeon (southern) occurs on the inland slopes of the Great Dividing Range. Its distribution extends from the Burdekin-Lynd divide in central Queensland, west to Charleville and Longreach, east to the coastline between Proserpine and Port Curtis near Gladstone, and south to scattered sites thoughout south- eastern Queensland (SEWPaC 2011n). Squatter Pigeons (southern) are regularly recorded from the FPA and parts of the



AVPA. They are frequently observed in Hallet SF, Beilba SF and Expedition (Limited Depth) NP, and in the private lands surrounding Hutton Creek, Baffle Creek and the Dawson River. Although the RSGPA is within the historical range of this species, they are now absent from this area. Refer to Figure 1.7, 1.11 & 1.15 for observed species.

#### **Description of the Species:**

The Squatter Pigeon (southern) is a medium-sized ground dwelling pigeon approximately 30cm long. Adults of both sexes are generally grey-brown with black and white stripes on the face and throat, iridescent green or violet patches on the wings, a blue-grey lower breast and white flanks and lower belly (SEWPaC 2011n).

#### Habitat for the Species: General / Indicative Habitat:

The Squatter Pigeon (southern) is never far from water in grassed woodlands; foothills, watercourses, riverflats, grassy plains; environs of homesteads (Pizzey and Knight 2007). At the FPA, Squatter Pigeons inhabit woodlands dominated by Poplar Box (Eucalyptus populnea), Narrow-leaved Ironbark (E. crebra), Spotted Gum (Corymbia citriodora subsp. variegata), Dusky-leaved Ironbark (E. fibrosa) and White Cypress Pine (Callitris glaucophylla). The Squatter Pigeon has been observed foraging along roads and railway lines (DEWHA 2010a) and is known to inhabit other disturbed habitats associated with CSG infrastructure e.g. gas wells, flowlines and camps. Refer to Figure 1.7, 1.11 & 1.15 for habitat mapping.

#### **Regional Ecosystems Associations:**

RE	Short Description
11.3.2	Eucalyptus populnea woodland on alluvial plains.
11.3.3	Eucalyptus coolabah woodland on alluvial plains.
11.3.4	Eucalyptus tereticornis and / or Eucalyptus spp. tall woodland on alluvial plains.
11.3.14	Eucalyptus spp., Angophora spp., Callitris spp. woodland on alluvial plains. Sandy soils.
11.3.18	Eucalyptus populnea, Callitris glaucophylla, Allocasuarina luehmannii shrubby woodland on alluvium.
11.3.19	Callitris glaucophylla, Corymbia spp. and / or Eucalyptus melanophloia woodland on Cainozoic alluvial plains.
11.3.25	Eucalyptus tereticornis or Eucalyptus camaldulensis woodland fringing drainage lines.
11.3.27	Freshwater wetlands.
11.3.39	Eucalyptus melanophloia + / - Eucalyptus chloroclada woodland on undulating plains and valleys with sandy soils.
11.10.1	Corymbia citriodora open forest on coarse-grained sedimentary rocks.
11.10.3	Acacia catenulata or Acacia shirleyi open forest on coarse-grained sedimentary rocks. Crests and scarps.
11.10.4	Eucalyptus decorticans, Lysicarpus angustifolius +/- Eucalyptus spp., Corymbia spp., Acacia spp. woodland on coarse-grained sedimentary rocks. Crests and scarps.
11.10.9	Callitris glaucophylla woodland on coarse-grained sedimentary rocks.
11.10.11	Eucalyptus populnea, Eucalyptus melanophloia +/- Callitris glaucophylla woodland on coarse- grained sedimentary rocks.
11.10.13	Eucalyptus spp. and / or Corymbia spp. open forest on scarps and sandstone tablelands.

In the AVPA and FPA the species is associated with the following REs:



11.10.14	Springs associated with sandstone.

Non-remnant and regrowth areas are also utilised by this species, particularly in areas on land zone 3 and / or near permanent water.

#### Essential Microhabitat:

The species occurs in open dry sclerophyll woodland with grassy understorey, near permanent water (DEWHA 2010a).

Essential microhabitat for this species is defined as sites that are highly likely or known to be actively utilised for breeding.

Refer to Figure 3.1 for habitat assessment process.

#### **Biology:**

This species will breed throughout the year however breeding is influenced by heavy rainfall and most commonly occurs during the dry season between May – June. Their nests are usually shallow depressions in the ground lined with grass and leaves. Two eggs are laid at a time (Pizzey and Knight 2007).

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, excessive predation by cats, foxes, birds of prey, dingos and snakes are impacting Squatter Pigeon (southern) populations. However, cats and foxes are likely to have the greatest impact upon populations. For example, cats were blamed for declines in Squatter Pigeon (southern) populations in the Duaringa and Murphy's Creek districts in south-eastern Queensland. Most declines in Squatter Pigeon (southern) numbers have occurred in areas where foxes are highly abundant (SEWPaC 2011n). Habitat degradation can occur through overgrazing by livestock and feral herbivores and propagation of Buffel Grass for pasture improvement.

Increased human activities that result in increases in feral animals and predation on of this species could impact local populations of Squatter Pigeons. Impacts of linear clearance corridors on this species are expected to be small and short-term given the mobility of this species and progressive rehabilitation of clearance corridors.

#### Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around active nests or known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

#### Specific Field Management Procedures:

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction		A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely

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Project Phase	Activity	Management Practices
	Infrastructure planning / siting	<ul> <li>presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Birds Australia Birdata Atlas;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and / or satellite imagery; and</li> <li>Discussion with land managers, site manager and / or the ER.</li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of the Squatter Pigeon, active nest sites, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$ (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
Site         Work         Site         Work         Site         Construction         Clear		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and / or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and / or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.



Project Phase	Activity	Management Practices
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding.
		The status of active nests will be regularly checked in a way that does not risk the nest being abandoned by the breeding pair by the licensed spotter-catcher.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Access	Access is to occur along designated access tracks only. Reduced speed limits are to be implemented throughout areas of habitat, given the tendency for Squatter Pigeon to utilise disturbed areas for foraging.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Lighting	The use of lighting will be minimised within areas of essential microhabitat habitat.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance
	Access	Access is to occur along designated access tracks only. Reduced speed limits are to be implemented throughout areas of habitat, given the tendency for Squatter Pigeon to utilise disturbed areas for foraging.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.

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Project Phase	Activity	Management Practices
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

#### **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and Birds Australia's website detail survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

#### **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species are to occur as a result of construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- DEWHA 2010b;
- SEWPaC 2011n;
- TSSC 2008i; and
- Pizzey and Knight 2007.



## 5.5.4. *Rostratula australis* (Australian Painted Snipe)



Plate 30: Australian Painted Snipe. Source: Herrod.

#### Status:

EPBC Act = Vulnerable NC Act = Vulnerable

### **Distribution:**



Plate 31: Distribution. Source: SEWPaC, 2011o.

Australian Painted Snipe occur in northern Western Australia, the northern part of the Northern Territory and across eastern Australia. In Queensland, the majority of sightings are from the Channel Country, south-east Queensland and the Fitzroy Basin of central Queensland. There have also been sporadic records from inland and sub-coastal North Queensland (SEWPaC 2011o).

#### Known Populations and Relationships within the CSG Fields:

This species has been recorded on an infrequent basis from wetland habitats within and around the townships of Roma, Springsure and Taroom. It is likely to occur in low numbers in suitable habitats within all of the GLNG CSG Fields.



#### **Description of the Species:**

The Australian Painted Snipe is a stocky wading bird around 220 - 250 mm in length with a long pinkish bill. The adult female, more colourful than the male, has a chestnut-coloured head, with white around the eye and a white crown stripe, and metallic green back and wings, barred with black and chestnut. There is a pale stripe extending from the shoulder into a V down its upper back. The adult male is smaller and duller with buff spots on the wings and lacks the chestnut hood (SEWPaC 2011o).

#### Habitat for the Species: General / Indicative Habitat:

The Australian Painted Snipe occurs in shallow inland wetlands, both ephemeral and permanent, usually freshwater but occasionally brackish, inundated grasslands, saltmarsh, dams, rice crops, sewage farms and bore drains (Rogers et al., 2005). This species is cryptic and is known to inhabit shallow, vegetated, temporary or infrequently filled wetlands, sometimes where there are trees such as Eucalyptus camaldulensis (River Red Gum) or E. populnea (Poplar Box), shrubs such as Muehlenbeckia florulenta (Lignum) or Halosarcia spp. (Samphire) or other cover such as Eragrostis australisica (Canegrass) and sedges (e.g. Eleocharis spp.). Wetlands within and adjacent non-remnant and regrowth areas may also be utilised including the margins of well vegetated farm dams and sewage treatment ponds (Pizzey and Knight 2007). General / indicative habitat that provide limited foraging resources and temporary refuge only, including grazing paddocks and highly disturbed wetland habitat. Refer to Figure 1.7, 1.11 & 1.15 for habitat mapping.

#### **Regional Ecosystems Associations:**

RE	Short Description
11.3.2	Eucalyptus populnea woodland on alluvial plains.
11.3.3	Eucalyptus coolabah woodland on alluvial plains.
11.3.4	Eucalyptus tereticornis and/or Eucalyptus spp. tall woodland on alluvial plains.
11.3.22	Springs associated with recent alluvia, but also including those on fine-grained sedimentary rocks, basalt, ancient alluvia and metamorphic rocks.
11.3.25	Eucalyptus tereticornis or Eucalyptus camaldulensis woodland fringing drainage lines.
11.3.27	Freshwater wetlands.
11.3.17	Eucalyptus populnea woodland with Acacia harpophylla and/or Casuarina cristata on alluvial plains.
11.4.3	Acacia harpophylla and/or Casuarina cristata shrubby open forest on Cainozoic clay plains.
11.4.7	Open forest to woodland of <i>Eucalyptus populnea</i> with <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> on Cainozoic clay plains.
11.4.8	Eucalyptus cambageana woodland to open forest with Acacia harpophylla or Acacia argyrodendron on Cainozoic clay plains.
11.9.1	Acacia harpophylla, Eucalyptus cambageana open forest to woodland on fine-grained sedimentary rocks.
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks.

This species may occur at wetlands associated with the following REs:


#### **Essential Microhabitat:**

The Australian Painted Snipe occurs in shallow inland wetlands, both ephemeral and permanent. Emergent tussocks of grass, sedges, rushes or reeds, or samphire are essential microhabitat features. Nest records are almost all from or near small islands in freshwater wetlands, provided that these islands are a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover (Rogers et al., 2005).

Essential microhabitat for this species is defined as intact wetlands having extensive macrophyte vegetation that are highly likely to support, or are known to support breeding populations.

Refer to Figure 3.1 for habitat assessment process.

#### **Biology:**

The Australian Painted Snipe nests on the ground amongst tall vegetation such as grass tussocks and reeds. Nests, which consist of a scrape in the ground lined with grass and leaves, are often located on small islands. The Australian Painted Snipe breeds predominantly from August to February and lays three to six eggs (Marchant and Higgins 1996).

### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In particular, the alteration and degradation of wetland habitats is likely to have led to the decline of Australian Painted Snipe and is the primary threat to this species.

#### Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around active nests or known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

#### **Specific Field Management Procedures:**

Project Phase	Activity	Management Practices	
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:	
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>	
		<ul> <li>DERM's Wildlife Online (Wildnet) Records;</li> </ul>	
			Birds Australia Birdata Atlas;
		Queensland Museum database;	
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>	
		<ul> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> </ul>	



		Aerial and/or satellite imagery; and
		Discussion with land managers, site manager and/or the ER.
Site		Prior to construction commencing, a survey will be undertaken to assess for the presence of the Australian Painted Snipe, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management processed to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests, no construction activities will occur during breeding.
		The status of active nests will be regularly checked in a way that does not risk the nest being abandoned by the breeding pair by the licensed spotter-catcher.
		Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.



	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

#### **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species (August to February). The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and Birds Australia's website detail survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

# **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species are to occur as a result of construction and operation activities;
- Sightings of individuals/nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.



# **Key Reference Documents:**

- DEWHA 2010b
- Pizzey and Knight 2007;
- Marchant and Higgins 1996; and
- SEWPaC 2011o.



# 5.5.5. *Turnix melanogaster* (Black-breasted Button-quail)



Plate 32: Black-breasted Button quail. Source: Department of Environment and Resource Management, 1996 (Luke Hogan).

# Status:

EPBC Act = Vulnerable NC Act = Vulnerable

# **Distribution:**



Plate 33: Distribution. Source: SEWPaC, 2011p

The Black-breasted Button-quail is endemic to eastern Australia. It is restricted to coastal and near-coastal regions of south-eastern Queensland and north-eastern New South Wales. In Queensland, this species is found from near Byfield in the north, south to the New South Wales border and westwards to Palmgrove National Park and Barakula State Forest. The most significant populations appear to be in the Yarraman- Nanango, Jimna-Conondale and Great Sandy regions (SEWPaC 2011p).

# Known Populations and Relationships within the CSG Fields:

This species has not been formally identified from the CSG fields; however the species has been recorded from contiguous habitats adjacent to the CSG fields (i.e. Palmgrove National Park). Potentially suitable habitat, in the



form of semi-evergreen vine thicket (SEVT) occurs within the FPA and AVPA; however, no targeted surveys have been undertaken to confirm their presence.

#### **Description of the Species:**

The Black-breasted Button-quail is a large, plump, pale-eyed button-quail. It is similar in size to the Painted Button-quail. The male Black-breasted Button-quails are about 18 cm long, with a wingspan of 32-35 cm, and weighing 65g. The females are larger, weighing 100g.

The sexes differ in plumage, and there is no seasonal variation. Males have finely patterned backs and wings with brown, black, grey and white mottling. The face and throat are whitish and the breast is black with numerous white half-moon markings. The female is similar in all respects except for having a black face and throat, a larger dark area over the upper and lower breast and heavier white half-moon markings on the upper and lower breast. The bill is grey and the legs are pale yellow. Juveniles resemble males but are duller (Marchant & Higgins 1993).

#### Habitat for the Species: General / Indicative Habitat:

The Black-breasted Button-quail inhabits microphyll and notophyll vine forest, semi-evergreen vine thickets and coastal scrubs. Within the Brigalow Belt, SEVT is the core habitat for this species, however, it is also known to utilise low thickets or woodlands with a dense understorey but little ground cover, typically dominated by Acacia species, including Acacia harpophylla (Brigalow) (SEWPaC 2011p). Refer to Figures 1.8, 1.12 & 1.16 for habitat mapping.

#### **Regional Ecosystems Associations:**

RE	Short Description
11.9.4	Semi-evergreen vine thicket on fine-grained sedimentary rocks.
11.3.11	Semi-evergreen vine thicket on alluvial plains.
11.8.3	Semi-evergreen vine thicket on Cainozoic igneous rocks. Steep hillsides.
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks.
11.9.8	Macropteranthes leichhardtii thicket on fine grained sedimentary rocks.

Within the CSG fields, this species is associated with the following REs:

Other REs, including dry sclerophyll woodlands, non-remnant and regrowth areas are also utilised for foraging where they occur in close proximity to the SEVT communities.

#### **Essential Microhabitat:**

Restricted to rainforests and forests, mostly in areas with 720mm to 1200mm of rainfall per annum; prefers drier, low, closed forests, particularly SEVT that have a largely closed canopy and deep leaf litter layer (3cm to 10cm deep). Presence is often indicated by distinctive, crater-like depressions (platelets) that foraging birds create in leaf litter (SEWPaC 2011p).

Essential microhabitat for this species is defined as in-tact semi-evergreen vine thicket that is highly likely to, or known to, support this species.

Refer to Figure 3.1 for habitat assessment process.



# **Biology:**

The breeding season generally occurs from September to April / May. The onset and finish of the breeding season may be affected by climatic factors such as minimum daily temperature and rainfall, e.g. a reduction in the amount of food available, caused by dropping temperatures, probably causes the breeding season to end.

Nests consist of a scrape in the ground, lined with leaves, grass or moss. Nests are well-concealed and placed in the buttress root of a tree or sapling, the base of a fern or under a low bush or grass tussock. Nests are often in areas where the common understorey plants include species such as Bracken (Pteridium esculentum), Rasp Fern (Doodia aspera) and Lantana (Lantana camara) (SEWPaC 2011p).

# Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). Other threats include:

- Frequent fires coupled with consistent heavy grazing are likely to reduce the dispersal capabilities of buttonquail through grass and shrub understorey; and
- Although the impact of feral predation on the species is not well known, it is likely that predation (i.e. wild dogs, cats and foxes) is a threat. This may be particularly true where birds are forced to disperse through unsuitable habitat (SEWPaC 2011p).

#### Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

here disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around active nests or known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

#### **Specific Field Management Procedures:**

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		<ul> <li>DERM's Wildlife Online (Wildnet) Records;</li> </ul>
		Birds Australia Birdata Atlas;
		Queensland Museum database;
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>
		<ul> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> </ul>
		Aerial and/or satellite imagery; and
		<ul> <li>Discussion with land managers, site manager and/or the ER.</li> </ul>



Project Phase	Activity	Management Practices
		Prior to construction commencing, a survey will be undertaken to assess for the presence of the Black-breasted Button-quail, or suitable habitat to support this species, including targeted searched for platelets (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management processed to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests, no construction activities will occur during breeding.
		The status of active nests will be regularly checked in a way that does not risk the nest being abandoned by the breeding pair by the licensed spotter-catcher.
		All fencing / flagging tape / mesh webbing is to remain in place, and regularly checked.



Project Phase	Activity	Management Practices
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Lighting	The use of lighting will be minimised within areas of essential microhabitat.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissionin g and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

# **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and Birds Australia's website detail survey methods for detecting this species.



The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

# **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species are to occur as a result of construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

# **Key Reference Documents:**

- DEWHA 2010b,
- Marchant and Higgins 1993;
- Mathieson and Smith 2009; and
- SEWPaC 2011p.



# REPTILES

# 5.5.6. *Furina dunmalli* (Dunmall's Snake)



Plate 34: Dunmall's Snake and Distribution. Source: ABC, 2009 (Steve Wilson); SEWPaC, 2011q

# Status:

EPBC Act = Vulnerable NC Act = Vulnerable

# **Distribution:**



Plate 35: Distribution. Source: SEWPaC, 2011q

This species is found in the south-eastern interior of Queensland, especially the Darling Downs. Most records are from the southern half of the Brigalow Belt bioregion. The range extends from Yeppoon and the Charters Towers area in the north, to Oakey, Glenmorgan and Inglewood in the south. Most locality records are between 200 and 500 metres in altitude (SEWPaC 2011q).



#### Known Populations and Relationships within the CSG Fields:

Dunmall's Snake is known from remnant vegetation communities, which are contiguous with the communities within the gas fields, including Expedition (Limited Depth) National Park. This species has also been recorded from Taroom area near Isla Gorge National Park (SEWPaC 2011q). It may potentially occur in all CSG fields.

#### **Description of the Species:**

Dunmall's Snake is potentially dangerous. This species is uniform dark grey-brown colour above, fading to white on lower flanks. The scales of the body are smooth and light-edged with mid-body scales in 21 rows. Most of the upper lip scales have pale blotches in the centre or on the posterior edge. This species reaches a total length of about 60cm (Cogger 2000; Wilson and Swan 2008).

#### Habitat of the Species:

#### General / Indicative Habitat:

Dunmall's Snake has been found in a broad range of habitats, including:

Forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow, other Wattles (Acacia. burrowii, A. deanei, A. leiocalyx), White Cypress Pine (Callitris glaucophylla) or Bull-oak (Allocasuarina luehmannii); and

Various Spotted Gum (Corymbia citriodora), Ironbark (Eucalyptus crebra and E. melanophloia), White Cypress Pine (Callitris glaucophylla) and Bulloak open forest and woodland associations on sandstone derived soils (SEWPaC 2011q).

Refer to Figure 1.9, 1.13, & 1.17 for habitat mapping.

#### **Regional Ecosystems Associations:**

Dunmall's Snake is likely to inhabit remnant vegetation on land zone 4, 5, 7, 9 and 10. This species is associated with the following REs:

RE	Short Description
11.5.1	Eucalyptus crebra, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii woodland on Cainozoic sand plains/remnant surfaces.
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks.
11.10.1	Corymbia citriodora open forest on coarse-grained sedimentary rocks.
11.3.2	Eucalyptus populnea woodland on alluvial plains.
11.3.14	Eucalyptus spp., Angophora spp., Callitris spp. woodland on alluvial plains. Sandy soils.
11.3.17	Eucalyptus populnea woodland with Acacia harpophylla and/or Casuarina cristata on alluvial plains.
11.3.18	Eucalyptus populnea, Callitris glaucophylla, Allocasuarina luehmannii shrubby woodland on alluvium.
11.3.19	Callitris glaucophylla, Corymbia spp. and/or Eucalyptus melanophloia woodland on Cainozoic alluvial plains.
11.3.39	Eucalyptus melanophloia, +/- Eucalyptus chloroclada woodland on undulating plains and valleys with sandy soils.
11.4.3	Acacia harpophylla and/or Casuarina cristata shrubby open forest on Cainozoic clay plains.



RE	Short Description
11.4.10	Eucalyptus populnea or Eucalyptus pilligaensis, Acacia harpophylla, Casuarina cristata open forest to woodland on margins of Cainozoic clay plains.
11.4.12	Eucalyptus populnea woodland on Cainozoic clay plains.
11.5.4	Eucalyptus crebra, Callitris glaucophylla, Callitris endlicheri, Eucalyptus chloroclada, Angophora leiocarpa on Cainozoic sand plains/remnant surfaces. Deep sands.
11.5.5	Eucalyptus melanophloia, Callitris glaucophylla woodland on Cainozoic sand plains/remnant surfaces. Deep red sands.
11.7.1	Acacia harpophylla and/or Casuarina cristata and Eucalyptus thozetiana or Eucalyptus microcarpa woodland on lower scarp slopes on lateritic duricrust.
11.7.2	Acacia spp. woodland on lateritic duricrust. Scarp retreat zone.
11.7.4	Eucalyptus decorticans and/or Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius on lateritic duricrust.
11.7.7	Eucalyptus fibrosa subsp. nubila +/- Corymbia spp. +/- Eucalyptus spp. on lateritic duricurst.
11.9.7	Eucalyptus populnea, Eremophila mitchellii shrubby woodland on fine-grained sedimentary rocks.
11.10.9	Callitris glaucophylla woodland on coarse-grained sedimentary rocks.

Non-remnant and regrowth areas may also be utilised by this species.

#### **Essential Microhabitat:**

The species has been found sheltering under fallen timber and ground litter and may use cracks in alluvial clay soils (SEWPaC 2011q).

Essential microhabitat is defined as intact, remnant vegetation with limited ground cover vegetation and grassy tussocks and extensive microhabitat features such as large hollow logs, root cavities, or tree stumps that are highly likely or known to support this species.

Refer to Figure 3.1 for habitat assessment process.

#### **Biology:**

The breeding season and clutch size of this species has not been recorded, however it is known that the species lays eggs rather than live young (TSN 2008).

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). Additional threats include:

- Extensive overgrazing of habitat by domestic stock; and
- Loss of fallen timber and ground litter, e.g. fuel reduction burns and firewood collection (SEWPaC 2011q).

#### Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.



Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around egg clutches or known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

#### Specific Field Management Procedures:

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		DERM's Wildlife Online (Wildnet) Records;
		Queensland Museum database;
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>
		<ul> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> </ul>
		<ul> <li>Aerial and/or satellite imagery; and</li> </ul>
		Discussion with land managers, site manager and/or the ER.
		Prior to construction commencing, a survey will be undertaken to assess for the presence of Dunmall's Snake, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$ (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
	The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management processed to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.	



Project Phase	Activity	Management Practices
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals;
		Microhabitat for this species, including hollow logs and fallen timber will be salvaged where possible and relocated to an adjacent uncleared area prior to vegetation clearing.
		Pipelines and other linear infrastructure will be co-located where possible to minimise loss of habitat and fragmentation.
		Cleared vegetation will be mulched, however large logs (especially containing hollows) will be raked into piles to provide fauna habitat.
		Double handling of stockpiled vegetation will be minimised, as cleared vegetation is likely to be used by this species if not used for an extended period.
		Measures shall be adopted to prevent entrapment within any trenches, such as: Minimising the period of time any trenches are open, particularly in fauna habitat areas;
		Constructing trench plugs with slopes less than 45° to provide exit ramps for fauna;
		Installing additional trench plugs at greater than normal frequencies in areas identified as known or potential wildlife habitat (e.g. native forest areas);
		Branches, hessian sacks, ramped gangplanks or similar to be used to create
		'ladders' to enable fauna to exit any trenches; surveillance of any open trenches in sensitive areas and the removal of wildlife from any trenches by appropriately trained personnel; and
		Any open trenches shall be checked for fauna prior to backfill, and any trapped animals removed.



Project Phase	Activity	Management Practices
		Woody debris will be located within the cleared areas to create stepping stones between areas of remnant vegetation.
		Install appropriate covers to prevent entrapment in well head cellar pits.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of essential microhabitat that contains egg clutches.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of essential microhabitat that contains egg clutches.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissionin g and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).



#### **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches for individuals and skins. Searches should be conducted when there is a higher chance of detecting this species (Spring / Summer). The Commonwealth Government's Survey Guidelines for Australia's Threatened Reptiles (DEWHA 2011b) and detail survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

#### **Species Specific Performance Criteria:**

- Individuals or populations are not destroyed or injured as a result of construction and operation activities
- (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- Sightings of individuals are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

#### **Key Reference Documents:**

- Cogger 2000;
- SEWPaC 2010f;
- DEWHA 2011b;
- TSN 2008b; and
- Wilson and Swan 2008.



# 5.5.7. Denisonia maculata (Ornamental Snake)



Plate 36: Ornamental Snake. Source: World Wildlife Fund, 2008 (Steve Wilson).

# Status:

EPBC Act = Vulnerable NC Act = Vulnerable

# **Distribution:**



Plate 37: Distribution. Source: SEWPaC, 2011r.

The species is known only from the Brigalow Belt North and parts of the Brigalow Belt South biogeographical regions. The core of the species' distribution occurs within the drainage system of the Fitzroy and Dawson Rivers (SEWPaC 2011r).



#### Known Populations and Relationships within the CSG Fields:

This species is known from remnant vegetation communities within and around Lake Nuga Nuga and Mount Panorama adjacent to the AVPA. The FPA is within the range of the species but there are no known records to date. Ornamental Snake is not likely to occur in the RSGPA.

#### Description of the Species:

Ornamental Snakes are potentially dangerous. This species is a stout bodied snake which grows to a total length of about 50cm. The overall body colour is brown, greyish brown or almost black, undersurfaces are cream, often with darker streaks or flecks on the outer edges of the belly. The skin between the scales is black. The entire head and at least the forebody is very finely peppered with dark brown or black. Lips are distinctly barred. The scales are smooth in 17 rows at mid-body (Cogger 2000).

#### Habitat of the Species:

#### General / Indicative Habitat:

The Ornamental Snake's habitat is within, or close to habitat that is favoured by its prey, frogs. The species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions, but also lake margins and wetlands. Ornamental Snake habitat is likely to be found in Brigalow, Gidgee (Acacia cambagei), Blackwood (Acacia argyrodendron) or Coolibah (Eucalyptus coolabah) dominated vegetation communities, or pure grassland associated with gilgais (SEWPaC 2010d). Refer to Figure 1.9, 1.13, & 1.17 for habitat mapping.

#### **Regional Ecosystems Associations:**

The Ornamental Snake is associated with the following REs:

RE	Short Description
11.3.3	Eucalyptus coolabah woodland on alluvial plains
11.3.25	Eucalyptus tereticornis or Eucalyptus camaldulensis woodland fringing drainage lines.
11.3.27	Freshwater wetlands.
11.3.2	Eucalyptus populnea woodland on alluvial plains
11.3.4	Eucalyptus tereticornis and/or Eucalyptus spp. tall woodland on alluvial plains.
11.3.17	Eucalyptus populnea woodland with Acacia harpophylla and/or Casuarina cristata on alluvial plains.
11.3.21	Dichanthium sericeum and/or Astrebla spp. grassland on alluvial plains. Cracking clay soils.
11.3.22	Springs associated with recent alluvia, but also including those on fine-grained sedimentary rocks, basalt, ancient alluvia and metamorphic rocks.
11.4.3	Acacia harpophylla and/or Casuarina cristata shrubby open forest on Cainozoic clay plains.
11.4.7	Open forest to woodland of <i>Eucalyptus populnea</i> with <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> on Cainozoic clay plains.
11.4.8	<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>Acacia argyrodendron</i> on Cainozoic clay plains.
11.9.1	Acacia harpophylla, Eucalyptus cambageana open forest to woodland on fine-grained sedimentary rocks.



RE	Short Description
11.9.3	Dichanthium spp., Astrebla spp. grassland on fine-grained sedimentary rocks.
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks.

Non-remnant and regrowth areas, in particular areas near watercourses with cracking clays and/or natural levees may also be utilised by this species.

#### Essential Microhabitat:

Ornamental Snake show a preference for moist areas and need ample ground cover in the form of fallen timber, thick shrub and ground cover and dense tussock grasses. They also show a preference for melon holes and depressions (SEWPaC 2010d).

Essential microhabitat is defined as intact moist areas, including wetlands and lakes, in suitable vegetation communities that are known or highly likely to support this species.

Refer to Figure 3.1 for habitat assessment process.

#### **Biology:**

This species bears live young and the litter size ranges between six and eight (SEWPaC 2011r). Sexually mature females are a minimum of 24.7 cm and males are 23 cm (SEWPaC 2011r).

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). Additional threats include:

- Habitat degradation by overgrazing by stock, especially cattle, or grazing of gilgais during the wet season leads to soil compaction and compromising of soil structure;
- Alteration of landscape hydrology in and around gilgai environments;
- Contact with the Cane Toad;
- Direct persecution by humans;
- Illegal collection; and
- Predation by feral species (SEWPaC 2011r).

#### Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around egg clutches or known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

#### Specific Field Management Procedures:



Project Phase	Activity	Management Practices	
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Queensland Museum database;</li> </ul> </li> </ul>	
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat</li> </ul>	
		Mapping;	
		Aerial and/or satellite imagery; and     Discussion with land managers, site manager and/or	
		the ER.	
		Prior to construction commencing, a survey will be undertaken to assess for the presence of Ornamental Snake, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).	
		Where habitat (refer to Figure 3.1) is identified during the pre- clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.	
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active breeding site is located a 200 m buffer zone will be established around the site.	
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.	
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.	
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of	

# Santos GLNG

Project Phase	Activity	Management Practices
		Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around egg clutches or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals;
		Microhabitat for this species, including hollow logs and fallen timber will be salvaged where possible and relocated to an adjacent uncleared area prior to vegetation clearing.
		Pipelines and other linear infrastructure will be co-located where possible to minimise loss of habitat and fragmentation.
		Cleared vegetation will be mulched, however large logs (especially containing hollows) will be raked into piles to provide fauna habitat.
		Double handling of stockpiled vegetation will be minimised, as cleared vegetation is likely to be used by this species if not used for an extended period.
		Measures shall be adopted to prevent entrapment within any trenches, such as:
		Minimising the period of time any trenches are open, particularly in fauna habitat areas;
		Constructing trench plugs with slopes less than 45° to provide exit ramps for fauna;
		Installing additional trench plugs at greater than normal frequencies in areas identified as known or potential wildlife habitat (e.g. native forest areas);
		Branches, hessian sacks, ramped gangplanks or similar to be used to create 'ladders' to enable fauna to exit any trenches; surveillance of any open trenches in sensitive areas and the



Project Phase	Activity	Management Practices
		removal of wildlife from any trenches by appropriately trained personnel; and
		Any open trenches shall be checked for fauna prior to backfill, and any trapped animals removed.
		Woody debris where possible will be located within the cleared areas to create stepping stones between areas of remnant vegetation.
		Install appropriate covers to prevent entrapment in well head cellar pits.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of egg clutches or known breeding sites that contain egg clutches.



Project Phase	Activity	Management Practices	
	Pest Management	All requirements outlined within the PWMP will be implemented.	
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of egg clutches or known breeding sites that contain egg clutches.	
	Pest Management	All requirements outlined within the PWMP will be implemented.	
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).	

#### Monitoring Process:

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches for individuals, skins, tracks and scats during morning and dusk. Searches should be conducted when there is a higher chance of detecting this species (Spring / Summer). The Commonwealth Government's Survey Guidelines for Australia's Threatened Reptiles (DEWHA 2011b) and detail survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

#### Species Specific Performance Criteria:

- Individuals or populations are not destroyed or injured as a result of construction and operation activities
- (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- Sightings of individuals are appropriately documented, submitted to relevant authorities and recorded within the Santos CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

#### Key Reference Documents:

- Cogger 2000;
- DEWHA 2011b;
- DERM 2011b; and
- SEWPaC 2011r;



# 5.5.8. Delma torquata (Collared Delma)



Plate 38: Collared Delma. Source: Department of Environment and Resource Management, 2006 (Stephen Peck).

# Status:

EPBC Act = Vulnerable NC Act = Vulnerable

# **Distribution:**



Plate 39: Distribution. Source: SEWPaC, 2011s

Collared Delma is endemic to Queensland and has been recorded at the Bunya Mountains, Blackdown Tableland National Park, Expedition (Limited Depth) National Park, Western Creek, near Millmerran and the Toowoomba Range. A large concentration of records are from the western suburbs of Brisbane, including Kenmore, Pinjarra Hills, Anstead, Mt Crosby, Lake Manchester and Karana Downs (SEWPaC 2011s).

# Known Populations and Relationships within the CSG Fields:

This species has been recorded from remnant vegetation communities which are contiguous with the AVPA. Based on known distribution it is possible that this species may also occur in RSGPA and FPA.



#### **Description of the Species:**

Delma torquata, commonly known as the Collared Delma, is the smallest of the legless lizards. It is brown to reddishbrown in colour, becoming grey to bluish-grey on the tail with a slightly paler belly. The scales are in 14 - 16 rows (usually 16) at mid-body. It has large black bands across the head and nape interspaced with four cream-yellow stripes. The species has a maximum total length of about 11 cm (Cogger 2000).

Habitat of the Species: General / Indicative Habitat:

This species has been recorded in eucalypt-dominated woodlands and open-forests, within remnant and disturbed habitats. It occurs in a variety of woodland types, with dominant species often including Spotted Gum, Narrow-leaved Ironbark, Smooth-barked Apple, and Poplar Box. It is found under rocks, logs and other ground cover. The Collared Delma is a burrowing species, found about 15cm below the ground (SEWPaC 2011s; Cogger 2000). Refer to Figure 1.10, 1.14, & 1.18 for habitat mapping.

#### **Regional Ecosystems Associations:**

The Collared Delma is likely to inhabit vegetation with suitable cover (e.g. rocks, leaf litter and grass tussocks) in RE 11.3.2 in the RSGPA, as described below. This species is also likely to be found on land zone 10 within the Arcadia and FPA in the following REs:

RE	Short Description
11.10.1	Corymbia citriodora open forest on coarse-grained sedimentary rocks.
11.10.3	Acacia catenulata or Acacia shirleyi open forest on coarse-grained sedimentary rocks. Crests and scarps.
11.10.4	<i>Eucalyptus decorticans, Lysicarpus angustifolius</i> +/- <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp. woodland on coarse-grained sedimentary rocks. Crests and scarps.
11.10.7	Eucalyptus crebra woodland on coarse-grained sedimentary rocks.
11.10.9	Callitris glaucophylla woodland on coarse-grained sedimentary rocks.
11.10.11	Eucalyptus populnea, Eucalyptus melanophloia +/- Callitris glaucophylla woodland on coarse- grained sedimentary rocks.
11.10.13	Eucalyptus spp. and/or Corymbia spp. open forest on scarps and sandstone tablelands.
11.3.2	Eucalyptus populnea woodland on alluvial plains.

#### **Essential Microhabitat:**

This species favours open eucalypt forest with a shrub and tussock grass understorey. The soil of these communities are usually shallow and deep-cracking or stony. This species prefers areas with loose surface

rocks, including rocky slopes and ridge tops. It shelters under weathered loose rocks, flattish bedrock outcroppings, logs or mats of leaf litter, or in soil cracks and crevices among tussock grasses (SEWPaC 2011s).

Essential microhabitat for the Collared Delma includes woodlands and forests with large hollow logs, tree stumps, root cavities, loose rocks, dense ground cover and many grass tussocks within intact RE's that are known or highly likely to support this species.

Refer to Figure 3.1 for habitat assessment process.



# **Biology:**

Knowledge of Collared Delma reproduction is limited; however they are believed to lay two small, white, elongated eggs around December with hatching during February or March (SEWPaC 2011s).

### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). Additional threats include:

- Removal of rocks, course woody debris and ground litter;
- Habitat degradation by overgrazing by stock;
- Linear clearance corridors given small isolated populations living in small restricted areas;
- Predation by Feral Cat (Felis catus) and Fox (Vulpes vulpes);
- Inappropriate fire regimes; and
- Weed invasion, particularly by Dwarf Lantana (Lantana montividensis).

#### Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around egg clutches or known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

#### **Specific Field Management Procedures:**

Project Phase	Activity	Management Practices
Pre-construction Ir p	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		DERM's Wildlife Online (Wildnet) Records;
		Queensland Museum database;
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>
		DERM's RE, Regrowth and Essential Habitat Mapping;
		<ul> <li>Aerial and/or satellite imagery; and</li> </ul>
		Discussion with land managers, site manager and/or the ER.
		Prior to construction commencing, a survey will be undertaken to assess for the presence of Collared Delma, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be



Project Phase	Activity	Management Practices
		restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals;
		Microhabitat where possible for this species, including hollow logs and fallen timber will be salvaged where possible and relocated to an adjacent uncleared area prior to vegetation clearing.
		Pipelines and other linear infrastructure will be co-located where possible to minimise loss of habitat and fragmentation.



Project Phase	Activity	Management Practices
		Cleared vegetation will be mulched, however large logs (especially containing hollows) will be raked into piles to provide fauna habitat.
		Double handling of stockpiled vegetation will be minimised, as cleared vegetation is likely to be used by this species if not used for an extended period.
		Measures shall be adopted to prevent entrapment within any trenches, such as: Minimising the period of time any trenches are open, particularly in fauna
		habitat areas;
		fauna;
		Installing additional trench plugs at greater than normal frequencies in areas identified as known or potential wildlife habitat (e.g. native forest areas);
		Branches, hessian sacks, ramped gangplanks or similar to be used to create 'ladders' to enable fauna to exit any trenches; surveillance of any open trenches in sensitive areas and the removal of wildlife from any trenches by appropriately trained personnel; and
		Any open trenches shall be checked for fauna prior to backfill, and any trapped animals removed.
		Woody debris will be located within the cleared areas to create stepping stones between areas of remnant vegetation.
		Install appropriate covers to prevent entrapment in well head cellar pits.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and	Erosion and sediment control measures will be implemented as per the Erosion
	Sediment Control	and Sediment Control Manual (Aurecon, 2011).
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.

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Project Phase	Activity	Management Practices
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of egg clutches or known breeding sites that contain egg clutches.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of egg clutches or known breeding sites that contain egg clutches.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissionin g and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

#### Monitoring Process:

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches for individuals and traces during the warmest part of the day. Searches should be conducted when there is a higher chance of detecting this species (Spring / Summer). The Commonwealth Government's Survey Guidelines for Australia's Threatened Reptiles (DEWHA 2011b) and detail survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

# Species Specific Performance Criteria:

- Individuals or populations are not destroyed or injured as a result of construction and operation activities
- (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- Sightings of individuals are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

#### Key Reference Documents:

- Cogger 2000;
- DEWHA 2011b; and
- SEWPaC 2011s.



# 5.5.9. Egernia rugosa (Yakka Skink)



Plate 40: Yakka Skink. Source: SEWPaC, 2011t.

# Status:

EPBC Act = Vulnerable NC Act = Vulnerable.

# **Distribution:**



Plate 41: Distribution. Source: SEWPaC, 2008.

The species is known from isolated populations throughout subhumid to semi-arid areas in the interior of Queensland from Hebel in the south to Coen and Cape York Peninsula in the north (SEWPaC 2011t). The core range of this species is within the Mulga Lands and Brigalow Belt South Bioregions.

# Known Populations and Relationships within the CSG Fields:

This species is known from the AVPA and RSGPA. It is also likely to occur in the FPA.



#### **Description of the Species:**

The Yakka Skink is a large, robustly built skink with a notably thick tail. It grows to a total length of about 40cm and has short legs and claws. The body is generally brown with a broad, dark brown to black stripe usually extending along the back from the nape to the tail. The dark stripe is bordered on either side by a narrow, pale fawn stripe. The upper lips are whitish to reddish brown, contrasting with darker adjacent scales. The belly and ventral surfaces are cream to yellowish orange. The throat often contains blackish flecks. Scales are in 26-30 rows at mid-body (Cogger 2000, DERM 2007a, Richardson 2008).

#### Habitat of the Species:

The Yakka Skink is known to occur in open dry sclerophyll forest, woodland and scrub. This species often takes refuge in large hollow logs and has been known to excavate deep burrow systems, sometimes under dense ground vegetation. The Yakka Skink has also been found sheltering under sheds and loading ramps (Cogger 2000; DERM 2007a, Richardson 2008, SEWPaC 2011t). Refer to Figure 1.10, 1.14, & 1.18 for habitat mapping.

#### **Regional Ecosystems Associations:**

The species is associated with the following REs:

RE	Short Description
11.3.2	Eucalyptus populnea woodland on alluvial plains
11.4.3	Acacia harpophylla and/or Casuarina cristata shrubby open forest on Cainozoic clay plains.
11.4.10	Eucalyptus populnea or Eucalyptus pilligaensis, Acacia harpophylla, Casuarina cristata open forest to woodland on margins of Cainozoic clay plains.
11.4.12	Eucalyptus populnea woodland on Cainozoic clay plains.
11.5.1	Eucalyptus crebra, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii woodland on Cainozoic sand plains/remnant surfaces.
11.5.4	Eucalyptus crebra, Callitris glaucophylla, Callitris endlicheri, Eucalyptus chloroclada, Angophora leiocarpa on Cainozoic sand plains/remnant surfaces. Deep sands.
11.5.5	Eucalyptus melanophloia, Callitris glaucophylla woodland on Cainozoic sand plains/remnant surfaces. Deep red sands.
11.7.1	Acacia harpophylla and/or Casuarina cristata and Eucalyptus thozetiana or Eucalyptus microcarpa woodland on lower scarp slopes on lateritic duricrust.
11.7.2	Acacia spp. woodland on lateritic duricrust. Scarp retreat zone.
11.7.4	Eucalyptus decorticans and/or Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius on lateritic duricrust.
11.7.6	Corymbia citriodora or Eucalyptus crebra woodland on lateritic duricrust.
11.7.7	Eucalyptus fibrosa subsp. nubila +/- Corymbia spp. +/- Eucalyptus spp. on lateritic duricrust.
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks.
11.9.7	Eucalyptus populnea, Eremophila mitchellii shrubby woodland on fine-grained sedimentary rocks.
11.10.1	Corymbia citriodora open forest on coarse-grained sedimentary rocks.
11.10.9	Callitris glaucophylla woodland on coarse-grained sedimentary rocks.



RE	Short Description
11.10.11	Eucalyptus populnea, Eucalyptus melanophloia +/- Callitris glaucophylla woodland on coarse- grained sedimentary rocks.
11.3.6	Eucalyptus melanophloia woodland on alluvial plains.
11.3.14	Eucalyptus spp., Angophora spp., Callitris spp. woodland on alluvial plains. Sandy soils.
11.3.17	Eucalyptus populnea woodland with Acacia harpophylla and/or Casuarina cristata on alluvial plains.
11.3.18	Eucalyptus populnea, Callitris glaucophylla, Allocasuarina luehmannii shrubby woodland on alluvium.
11.3.19	Callitris glaucophylla, Corymbia spp. and/or Eucalyptus melanophloia woodland on Cainozoic alluvial plains.
11.3.39	Eucalyptus melanophloia +/- Eucalyptus chloroclada woodland on undulating plains and valleys with sandy soils.
11.9.1	Acacia harpophylla, Eucalyptus cambageana open forest to woodland on fine-grained sedimentary rocks.
11.9.2	Eucalyptus melanophloia +/- Eucalyptus orgadophila woodland on fine-grained sedimentary rocks.
11.9.13	Eucalyptus moluccana or Eucalyptus microcarpa open forest on fine grained sedimentary rocks.

However, non-remnant and regrowth areas may also be utilised by this species where they contain suitable shelter sites such as hollow logs, sink holes, rocky crevices and abandoned rabbit warrens.

# **Essential Microhabitat:**

Yakka Skinks are often found in cavities under and between partly buried rocks, hollow logs or tree stumps, root cavities and abandoned animal burrows. In cleared habitat, Yakka Skinks can persist where there are shelter sites such as raked log piles, deep gullies, tunnel erosion / sinkholes and rabbit warrens (Cogger 2000; DERM 2007a, Richardson 2008, SEWPaC 2011t).

Essential microhabitat for the Yakka Skink includes intact RE's comprising large hollow logs, tree stumps, root cavities, loose rocks, dense ground cover and many grass tussocks that are known or highly likely to support this species.

Refer to Figure 3.1 for habitat assessment process.

#### **Biology:**

The breeding season for this poorly known species has not been recorded (DERM 2007a, Richardson 2008) but is assumed to be spring-summer. A gregarious species, Yakka Skink populations occur primarily as colonies or aggregations. These groups consist of both adults and juveniles. The Yakka Skink produces live young, with around six per litter. A colony of Yakka Skinks may use several sites during the year with the occupied burrow sometimes identified by scat piles near the entrance. Individuals are active during the morning and from dusk through to the early evening (SEWPaC 2011t).

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). Additional threats include:

- Inappropriate roadside management;
- Inappropriate fire regimes;



- Ripping of rabbit warrens;
- Removal of buried rocks, fallen logs and leaf litter; and
- Predation from introduced species (SEWPaC 2011t).

CSG specific threats include increased road mortality and potential mortality within pipeline trenches and well head cellars.

# Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around egg clutches or known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

# **Specific Field Management Procedures:**

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> <li>Prior to construction commencing, a survey will be undertaken to assess for the presence of this species, or suitable habitat, including wetlands to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non- remnant and regrowth areas – Class E).</li> </ul>
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be



Project Phase	Activity	Management Practices
		limited, and clearing footprint minimised Where an active breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in adjacent areas will be regularly checked in a way that does not risk abandonment by individuals.
		Co-locate any pipelines and other linear infrastructure to minimise loss of habitat and fragmentation.
		Cleared vegetation will generally be mulched, however large logs (especially containing hollows) will be raked into piles to provide fauna habitat.
		Minimise the double handling of stockpiled vegetation as cleared vegetation is likely to be used by this species if not used for an extended period.
		Measures shall be adopted to prevent entrapment within any trenches, such as: Minimising the period of time any trenches are open, particularly in fauna habitat areas;
		Constructing trench plugs with slopes less than 45° to provide exit ramps for fauna;
		Installing additional trench plugs at greater than normal frequencies in areas identified as known or potential wildlife habitat (e.g. native forest areas);



Project Phase	Activity	Management Practices
		Branches, hessian sacks, ramped gangplanks or similar to be used to create 'ladders' to enable fauna to exit any trenches; surveillance of any open trenches in sensitive areas and the removal of wildlife from any trenches by appropriately trained personnel; and
		Any open trenches shall be checked for fauna prior to backfill, and any trapped animals removed.
		Locating woody debris within the cleared areas to create stepping stones between areas of remnant vegetation.
		Install appropriate covers to prevent entrapment in well head cellar pits.
		Lighting disturbances will be reduced especially near habitat areas.
		Microhabitat where possible will be relocated to areas of vegetation to be retained prior to vegetation clearing.
		All fencing / flagging tape is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance
	Access	Access is to occur along designated access tracks only
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors.
		Work with the local landowner to minimise impact on known populations, including fencing to exclude cattle, weed and pest management and also clearing and fire regimes where possible.
		Lighting disturbances will be reduced especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.


Project Phase	Activity	Management Practices
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of egg clutches or known breeding sites that contain egg clutches.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of egg clutches or known breeding sites that contain egg clutches.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches for individuals, burrow systems and communal defecation sites during morning and dusk. Searches should be conducted when there is a higher chance of detecting this species (Spring / Summer).

Note that in much of the Brigalow Belt, this species does not burrow if the substrate is not suitable (e.g. in many areas they are in large hollow logs and are more difficult to detect). The Commonwealth Government's Survey Guidelines for Australia's Threatened Reptiles (SEWPaC 2011b) detail survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

## **Species Specific Performance Criteria:**

- Individuals or populations are not destroyed or injured as a result of construction and operation activities
- (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- Sightings of individuals/burrows are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Cogger 2000;
- DEWHA 2011b;
- DERM 2007a;
- Richardson 2008; and
- SEWPaC 2011t.



# 5.5.10. *Paradelma orientalis* (Brigalow Scaly-foot)



Plate 42: Brigalow Scaly-foot and. Source: World Wildlife Fund, 2008 (Steve Wilson)

## Status:

EPBC Act = Vulnerable NC Act = Vulnerable

## Distribution:



Plate 43: Distribution. Source: SEWPaC, 2011u.

The known range for this species extends from Nebo in the north, Boyne Island in the east, Wyaga, New South Wales in the south and Ulcanbah Station and Idalia National Park in the west (SEWPaC 2011u).

## Known Populations and Relationships within the CSG Fields:

This species has been recorded from Brigalow regrowth near the Dawson River in the AVPA and from Ironbark / Cypress woodland in the FPA. It has been recorded from Brigalow woodland adjacent the RSGPA. The species has also been recorded from vegetation communities contiguous with habitats within the CSG fields, including areas within Expedition (Limited Depth) National Park and Carnarvon National Park.

## **Description of the Species:**

The Brigalow Scaly-foot is a legless lizard with a lead grey to greyish brown colour. It grows to approximately 16cm with the tail about twice the length of the body. The base of the head is cream to pale brown, darkening toward the



snout and contrasting sharply with a black bar on the nape. This species is robust with a round snout and moderately large limb-flaps. The scales are smooth and glossy in 18, or occasionally 20 rows (Wilson and Swan 2008).

## Habitat for the Species: General / Indicative Habitat:

Found on sandstone ridges, woodlands and vine thickets, including communities dominated by Brigalow, Narrowleaved Ironbark, Lancewood, Spotted gum, White Cypress Pine and Bulloak (Wilson & Swan 2008). Refer to Figure 1.10, 1.14, & 1.18 for habitat mapping.

#### **Regional Ecosystems Associations:**

This species is likely to inhabit remnant vegetation with suitable cover (e.g. rocks, fallen bark and logs) on land zones 4, 5, 7, 9 and 10.

RE	Short Description
11.4.3	Acacia harpophylla and/or Casuarina cristata shrubby open forest on Cainozoic clay plains.
11.5.1	Eucalyptus crebra, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii woodland on Cainozoic sand plains/remnant surfaces.
11.5.4	Eucalyptus crebra, Callitris glaucophylla, Callitris endlicheri, Eucalyptus chloroclada, Angophora leiocarpa on Cainozoic sand plains/remnant surfaces. Deep sands.
11.9.4	Semi-evergreen vine thicket on fine-grained sedimentary rocks.
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks.
11.10.1	Corymbia citriodora open forest on coarse-grained sedimentary rocks.
11.10.3	Acacia catenulata or Acacia shirleyi open forest on coarse-grained sedimentary rocks. Crests and scarps.
11.10.4	Eucalyptus decorticans, Lysicarpus angustifolius +/- Eucalyptus spp., Corymbia spp., Acacia spp. woodland on coarse-grained sedimentary rocks. Crests and scarps.
11.10.7	Eucalyptus crebra woodland on coarse-grained sedimentary rocks.
11.10.9	Callitris glaucophylla woodland on coarse-grained sedimentary rocks.
11.10.11	Eucalyptus populnea, Eucalyptus melanophloia +/- Callitris glaucophylla woodland on coarse- grained sedimentary rocks.
11.10.13	Eucalyptus spp. and/or Corymbia spp. open forest on scarps and sandstone tablelands.

#### **Essential Microhabitat:**

Important microhabitats include sandstone slabs, loose rocks, fallen bark sheets, logs, dense leaf litter and grass tussocks (Wilson & Swan 2008).

Essential microhabitat includes intact RE's comprising large hollow logs, tree stumps, root cavities, loose rocks, dense ground cover and many grass tussocks that are known or highly likely to support this species.

Refer to Figure 3.1 for habitat assessment process.

#### Biology:

Females are thought to lay up to two eggs between late spring and early summer. Studies on a captured female species from Boyne Island recorded the species laying two eggs in captivity in early November with the eggs hatching in late January (DERM 2011c).



## Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Predation by Feral Cat, pigs and foxes;
- Habitat modification and degradation through grazing of livestock, pasture improvement activities, inappropriate roadside management and increased frequency and intensity of fires;
- Death by humans due to misidentification with snakes; and
- Death by vehicle strike (SEWPaC 2011u).

#### Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around egg clutches or known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

#### **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		Santos CSG Fields Ecological Constraints Database;
		<ul> <li>DERM's Wildlife Online (Wildnet) Records;</li> </ul>
		Queensland Museum database;
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>
		<ul> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> </ul>
		<ul> <li>Aerial and/or satellite imagery; and</li> </ul>
		• Discussion with land managers, site manager and/or the ER.
		Prior to construction commencing, a survey will be undertaken to assess for the presence of Brigalow Scaly-foot, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$ (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.



Project Phase	Activity	Management Practices
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals;
		Microhabitat where possible for this species, including hollow logs and fallen timber will be salvaged where possible and relocated to an adjacent uncleared area prior to vegetation clearing.
		Pipelines and other linear infrastructure will be co-located where possible to minimise loss of habitat and fragmentation.
		Cleared vegetation will be mulched, however large logs (especially containing hollows) will be raked into piles to provide fauna habitat.
		Double handling of stockpiled vegetation will be minimised, as cleared vegetation is likely to be used by this species if not used for an extended period.
		Measures shall be adopted to prevent entrapment within any trenches, such as:



Project Phase	Activity	Management Practices
		Minimising the period of time any trenches are open, particularly in fauna habitat areas;
		Constructing trench plugs with slopes less than 45° to provide exit ramps for fauna;
		Installing additional trench plugs at greater than normal frequencies in areas identified as known or potential wildlife habitat (e.g. native forest areas);
		Branches, hessian sacks, ramped gangplanks or similar to be used to create 'ladders' to enable fauna to exit any trenches; surveillance of any open trenches in sensitive areas and the removal of wildlife from any trenches by appropriately trained personnel; and
		Any open trenches shall be checked for fauna prior to backfill, and any trapped animals removed.
		Woody debris will be relocated within the cleared areas to create stepping stones between areas of remnant vegetation.
		Install appropriate covers to prevent entrapment in well head cellar pits.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of egg clutches or known breeding sites that contain egg clutches.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).



Project Phase	Activity	Management Practices
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of egg clutches or known breeding sites that contain egg clutches.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissionin g and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches for individuals and traces during the warmest period of the day. Searches should be conducted when there is a higher chance of detecting this species (Spring / Summer). The Commonwealth Government's Survey Guidelines for Australia's Threatened Reptiles (DEWHA 2011b) and detail survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

#### **Species Specific Performance Criteria:**

- Individuals or populations are not destroyed or injured as a result of construction and operation activities
- (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- Sightings of individuals are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- DEWHA 2011b;
- DERM 2011c;
- SEWPaC 2011u; and
- Wilson and Swan 2008.



## MAMMALS

## 5.5.11. *Chalinolobus dwyeri* (Large-eared Pied Bat)



Plate 44: Large-eared Pied Bat. Source: SEWPaC, 2011v

## Status:

EPBC Act = Vulnerable NC Act = Vulnerable

## **Distribution:**



Plate 45: Distribution. Source: SEWPaC, 2011v)

The species is found in eastern Australia from central Queensland (Rockhampton) to southern New South Wales (Ulladulla). In southern Queensland, it has been recorded inland to the Carnarvon and Expedition Ranges (SEWPaC 2011v).

#### Known Populations and Relationships within the CSG Fields:

This species is known to occur in the Expedition Range, which is contiguous with habitats in the AVPA and FPA. Documented records of this species from the southern Brigalow Belt are scant, but there have been few targeted



surveys. Both the AVPA and FPA provide many potentially suitable roost sites (i.e. rocky overhangs and caves). The Large-eared Pied Bat is unlikely to occur in the RSGPA due to a lack of suitable roost sites.

#### **Description of the Species:**

Large-eared Pied Bats measure 100mm long from head to tail, with the tail accounting for almost half of their total length. Their coat is shiny and black with a white stripe on the flank (underside) of each wing. Their ears are large and their facial lobes are located on the lower lip and between the corner of the mouth and the bottom of the ear (Churchill 2010, Van Dyck and Strahan 2008).

## Habitat of the Species: General / Indicative Habitat:

Known foraging habitat includes Cypress-pine dominated forest, tall open eucalypt forest with a rainforest subcanopy, sub-alpine woodland, and sandstone outcrop country. In southeast Queensland the species has primarily been recorded from higher altitude, moist, tall, open forest adjacent to rainforest (SEWPaC 2011v).

Recent habitat modelling, based on surveys in the southern Sydney region, suggests that the Large-eared Pied Bat is largely restricted to the interface of sandstone escarpment (for roost habitat) and relatively fertile valleys (for foraging habitat). Recent survey work in the Brigalow Belt South region of NSW supports this modelling (SEWPaC 2011v). Refer to Figure 1.8, 1.12 & 1.16 for habitat mapping.

## Regional Ecosystems Associations:

This species is associated with the sandstone landscapes of land zone 10. However, the species is also likely to forage in a range of adjoining habitats, as well as regrowth and non-remnant areas. This species is likely to be found in the following REs:

RE	Short Description
11.10.1	Corymbia citriodora open forest on coarse-grained sedimentary rocks.
11.10.2	Tall open forest in sheltered gorges on coarse-grained sedimentary rocks.
11.10.3	Acacia catenulata or Acacia shirleyi open forest on coarse-grained sedimentary rocks. Crests and scarps.
11.10.4	Eucalyptus decorticans, Lysicarpus angustifolius +/- Eucalyptus spp., Corymbia spp., Acacia spp. woodland on coarse-grained sedimentary rocks. Crests and scarps.
11.10.13	Eucalyptus spp. and/or Corymbia spp. open forest on scarps and sandstone tablelands.
11.3.2	Eucalyptus populnea woodland on alluvial plains
11.3.25	Eucalyptus tereticornis or Eucalyptus camaldulensis woodland fringing drainage lines.
11.3.39	Eucalyptus melanophloia +/- Eucalyptus chloroclada woodland on undulating plains and valleys with sandy soils.
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks.

#### **Essential Microhabitat:**

Roosts are primarily in cavities, overhangs, caves and holes among sandstone outcrops / escarpments, however this species has been observed roosting in disused mine shafts and disused Fairy Martin (Hirundo ariel) nests. It also possibly roosts in the hollows of trees in dry and wet sclerophyll forest (SEWPaC 2011v).



Essential microhabitat for the Large-eared Pied Bat includes cavities, overhangs, caves and holes among sandstone outcrops / escarpments and remnant vegetation with hollow-bearing trees that are known, or highly likely to support this species.

Refer to Figure 3.1 for habitat assessment process.

## Biology:

Mating is thought to occur during early winter with two young usually born during November / December. The nursery colony is established during September by both adult females and males. Juveniles are thought to leave the roost during February / March with the adult females leaving the roost after the juveniles (SEWPaC 2011v). Not all nursery colonies are abandoned after the juveniles have left.

## Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). The main threats to Large-eared Pied Bat come from altered fire regimes, damage to roosting sites by mining, quarrying and recreational caving activities, predation by feral animals and the use of pesticides (SEWPaC 2011v).

## Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around known roosts and active breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		Santos CSG Fields Ecological Constraints Database;
		DERM's Wildlife Online (Wildnet) Records;
		Queensland Museum database;
		Consultation with Queensland Parks and Wildlife Service;
		DERM's RE, Regrowth and Essential Habitat Mapping;
		Aerial and/or satellite imagery; and
		Discussion with land managers, site manager and/or the ER.
		Prior to construction commencing, a survey will be undertaken to assess for the presence of South-eastern Long-eared Bat and suitable roost sites to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$
		(i.e. will include non-remnant and regrowth areas – Class E).

## Specific Field Management Procedures:



Project Phase	Activity	Management Practices
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active roost or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active roosts or known breeding sites, no construction activities will occur during breeding.
		Blasting should be avoided, where possible, around sandstone ridges with caves, overhangs or old mine shafts.
		Vegetation clearing in and around cave structures should be avoided, where possible.
		Altering the hydrology of subterranean waters will be avoided.
		Lighting disturbances will be reduced especially near roost sites and habitat areas.

# Santos GLNG

Project Phase	Activity	Management Practices
		Microhabitat where possible will be relocated to areas of vegetation to be retained prior to vegetation clearing.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around roost site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
		Lighting disturbances will be reduced especially near roost sites and habitat areas.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active breeding sites .
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active breeding sites .
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the



Project Phase	Activity	Management Practices
		Decommissioning and Demolition Management Plan (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area surveys utilising expert analysis of Anabat recordings made over multiple nights. Surveys should be conducted when there is a higher chance of detecting the species (Spring / Summer). The Commonwealth Government's Survey Guidelines for Australia's Threatened Bats (DEWHA 2010a) detail survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

#### **Species Specific Performance Criteria:**

- Caves or overhangs are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species are to occur as a result of construction and operation activities;
- Sightings of individuals/roosts are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- SEWPaC 2011v;
- Van Dyck and Strahan 2008;
- Churchill 2010;
- DEWHA 2010a; and
- Environment Australia 1999.



# 5.5.12. *Nyctophilus corbeni* (South-eastern Long-eared Bat)



Plate 46: South-eastern Long-eared Bat. Source: Office of Environment and Heritage, 2005 (Michael Murphy).

## Status:

EPBC Act = Vulnerable NC Act = Vulnerable

## **Distribution:**



Plate 47: Distribution. Source: SEWPaC 2011w

The South-eastern Long-eared Bat has a limited distribution that is restricted around the Murray-Darling Basin in south-eastern Australia. Even in this region its distribution is scattered and it is rarely recorded. In Queensland, this species is mainly recorded in the Brigalow Belt South Bioregion, extending eastwards to the Bunya Mountains National Park. It has been recorded as far north as the Expedition Range and Dawson River areas. Its westerly range extends into the Mulgalands Bioregion and west of Bollon (SEWPaC 2011w).

## Known Populations and Relationships within the CSG Fields:

This species has been recorded from habitats contiguous with the FPA. Potentially suitable roosting and foraging habitat occurs throughout the FPA, AVPA and RSGPA.



## **Description of the Species:**

Its head and body length is approximately 50 - 75 mm in length with a tail length of approximately 35 - 50 mm. The weight varies between genders with females (14 - 21g) being heavier than males (11 - 15g). The South-eastern Long-eared Bat is distinguishable from other Long-eared Bats (Nyctophilus spp.) by its larger size as well as a broader skull and jaw. It is also geographically separated from other Long-eared Bats (SEWPaC 2011w).

Habitat for the Species: General / Indicative Habitat:

This species occurs in a range of inland woodland vegetation types, including Box, Ironbark, Cypress Pine, Mallee, Bulloak, Brigalow and Belah woodlands / forests and will roost in tree hollows, crevices and under loose bark within these communities. The South-eastern Long-eared Bat forages within 3 km from the roost in the understorey of the abovementioned communities, including the ground (Churchill 2010, SEWPaC 2011w). Refer to Figure 1.8, 1.12 & 1.16 for habitat mapping.

#### **Regional Ecosystems Associations:**

This species is found roosting and/or foraging in the following REs:

RE	Short Description
11.3.2	Eucalyptus populnea woodland on alluvial plains
11.3.39	Eucalyptus melanophloia +/- Eucalyptus chloroclada woodland on undulating plains and valleys with sandy soils.
11.5.1	Eucalyptus crebra, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii woodland on Cainozoic sand plains/remnant surfaces.
11.10.1	Corymbia citriodora open forest on coarse-grained sedimentary rocks.
11.10.9	Callitris glaucophylla woodland on coarse-grained sedimentary rocks.
11.3.3	Eucalyptus coolabah woodland on alluvial plains.
11.3.25	Eucalyptus tereticornis or Eucalyptus camaldulensis woodland fringing drainage lines.
11.5.4	Eucalyptus crebra, Callitris glaucophylla, Callitris endlicheri, Eucalyptus chloroclada, Angophora leiocarpa on Cainozoic sand plains/remnant surfaces. Deep sands.
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks.
11.10.1	Corymbia citriodora open forest on coarse-grained sedimentary rocks.
11.10.4	Eucalyptus decorticans, Lysicarpus angustifolius +/- Eucalyptus spp., Corymbia spp., Acacia spp. woodland on coarse-grained sedimentary rocks. Crests and scarps.
11.10.7	Eucalyptus crebra woodland on coarse-grained sedimentary rocks.
11.10.13	Eucalyptus spp. and/or Corymbia spp. open forest on scarps and sandstone tablelands.

However, roosting sites will be dependent on the availability of hollow bearing trees.

#### **Essential Microhabitat:**

Microhabitat for the South-eastern Long-eared Bat includes tree hollows, crevices and loose bark for roosting purposes (Churchill 2010, SEWPaC 2011w).

Essential microhabitat includes cavities, overhangs, caves and holes among sandstone outcrops / escarpments and remnant vegetation with hollow-bearing trees that are known or highly likely to support this species.



Refer to Figure 3.1 for habitat assessment process.

## Biology:

There is little information currently available on this species' reproductive biology; however mating is thought to take place during Autumn with up to two young born during late Spring / early Summer (DEC 2005).

## Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). Other threats include bushfire, forestry activities, predation by introduced species and exposure to agrichemicals (SEWPaC 2011w).

## Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around known roosts and breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

## Specific Field Management Procedures:

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		<ul> <li>DERM's Wildlife Online (Wildnet) Records;</li> </ul>
		Queensland Museum database;
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>
		<ul> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> </ul>
		<ul> <li>Aerial and/or satellite imagery; and</li> </ul>
		<ul> <li>Discussion with land managers, site manager and/or the ER.</li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of South-eastern Long-eared Bat and suitable roost sites to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.



Project Phase	Activity	Management Practices
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active den or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active or known breeding sites, no construction activities will occur during breeding.
		Blasting should be avoided, where possible, around sandstone ridges with caves, overhangs or old mine shafts.
		Vegetation clearing in and around cave structures should be avoided, where possible.
		Altering the hydrology of subterranean waters will be avoided.
		Lighting disturbances will be reduced especially near roost sites and habitat areas.
		Microhabitat where possible will be relocated to areas of vegetation to be retained prior to vegetation clearing.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.



Project Phase	Activity	Management Practices
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around roost site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
		Lighting disturbances will be reduced especially near roost sites and habitat areas.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active breeding sites .
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active breeding sites .
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissionin g and Demolition	Decommissioning and demolition will be conducted as per the Decommissioning and Demolition Management Plan (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area surveys utilising expert analysis of Anabat recordings made over multiple nights. Surveys should be conducted when there is a higher chance of detecting the species (Spring



/ Summer). The Commonwealth Government's Survey Guidelines for Australia's Threatened Bats (DEWHA 2010a) detail survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

## Species Specific Performance Criteria:

- Caves or overhangs are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species are to occur as a result of construction and operation activities;
- Sightings of individuals / roosts are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- DEWHA 2010a;
- DEC 2005; and
- Churchill 2010; and
- SEWPaC 2011w.



# 5.5.13. Dasyurus hallucatus (Northern Quoll)



Plate 48: Northern Quoll. Source: SEWPaC, 2011x.

## Status:

EPBC Act = Endangered NC Act = N/A

## **Distribution:**



Plate 49: Distribution. Source: SEWPaC 2011x.

The Northern Quoll currently occurs in five regional populations across Queensland, the Northern Territory and Western Australia both on the mainland and on offshore islands. The Queensland population is highly fragmented and occurs as far south as Gracemere and Mt Morgan, south of Rockhampton, as far north as Cooktown in Queensland and extends as far west into central Queensland to the vicinity of Carnarvon National Park. In northern Queensland recent Northern Quoll records exist from Mareeba, Mount Carbine, Tolga and around Cooktown (SEWPaC 2011x).

## Known Populations and Relationships within the CSG Fields:

The species has been historically recorded from the Carnarvon, Bigge and Expedition Ranges including habitats that are contiguous with the AVPA and FPA (e.g. Lonesome Holding). Over the past three decades, the Northern



Quoll has undergone serious population declines and it now appears to be absent or extremely rare within the Expedition Range and parts of the Carnarvon Range. Local declines are suspected to have been caused primarily by ingestion of cane toads but other causal factors could potentially be involved (e.g. changed fire regimes).

## **Description of the Species:**

The Northern Quoll is the smallest of the four Australian Quoll species. It has reddish brown fur, with its underside cream, white spots on its back and rump with the tail unspotted, and a pointy snout. Northern Quolls can weigh up to 1.2 kg, with the males being larger than the females (SEWPaC 2011x). They have a distinctive pungent odour (Menkhorst and Knight 2004).

## Habitat for the Species: General / Indicative Habitat:

The Northern Quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. Northern Quoll are also known to occupy non rocky lowland habitats such as beach scrub communities in Queensland and are more likely to be present in high relief areas that have shallower soils, greater cover of boulders, less fire impact and closer to permanent water (SEWPaC 2011x). They make dens in rock crevices and tree hollows (Menkhorst and Knight 2004). Refer to Figure 1.9, 1.13, & 1.17 for habitat mapping.

## **Regional Ecosystems Associations:**

This species is associated with the following REs:

RE	Short Description
11.8.3	Semi-evergreen vine thicket on Cainozoic igneous rocks. Steep hillsides.
11.9.4	Semi-evergreen vine thicket on fine-grained sedimentary rocks.
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks.
11.10.1	Corymbia citriodora open forest on coarse-grained sedimentary rocks.
11.10.2	Tall open forest in sheltered gorges on coarse-grained sedimentary rocks.
11.10.3	Acacia catenulata or Acacia shirleyi open forest on coarse-grained sedimentary rocks. Crests and scarps.
11.10.4	<i>Eucalyptus decorticans, Lysicarpus angustifolius</i> +/- <i>Eucalyptus</i> spp., <i>Corymbia</i> spp., <i>Acacia</i> spp. woodland on coarse-grained sedimentary rocks. Crests and scarps.
11.10.13	Eucalyptus spp. and/or Corymbia spp. open forest on scarps and sandstone tablelands.
11.3.2	Eucalyptus populnea woodland on alluvial plains
11.3.39	Eucalyptus melanophloia +/- Eucalyptus chloroclada woodland on undulating plains and valleys with sandy soils
11.7.1	Acacia harpophylla and/or Casuarina cristata and Eucalyptus thozetiana or Eucalyptus microcarpa woodland on lower scarp slopes on lateritic duricrust.
11.7.2	Acacia spp. woodland on lateritic duricrust. Scarp retreat zone.
11.7.4	Eucalyptus decorticans and/or Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius on lateritic duricrust.
11.7.6	Corymbia citriodora or Eucalyptus crebra woodland on lateritic duricrust.
11.7.7	Eucalyptus fibrosa subsp. nubila +/- Corymbia spp. +/- Eucalyptus spp. on lateritic duricrust.



11.9.8	Macropteranthes leichhardtii thicket on fine grained sedimentary rocks.
11.10.7	Eucalyptus crebra woodland on coarse-grained sedimentary rocks.
11.10.8	Semi-evergreen vine thicket in sheltered habitats on medium to coarse-grained sedimentary rocks.
11.10.9	Callitris glaucophylla woodland on coarse-grained sedimentary rocks.
11.10.11	Eucalyptus populnea, Eucalyptus melanophloia +/- Callitris glaucophylla woodland on coarse- grained sedimentary rocks.

This species is also likely to disperse and/or forage in non-remnant and regrowth areas.

## **Essential Microhabitat:**

Microhabitat includes rocky habitats such as ranges, escarpments, mesas, ranges, gorges, breakaways, boulder fields, major drainage lines or treed creek lines; structurally diverse woodland or forest areas containing large trees, termite mounds or hollow logs (SEWPaC 2011x, Menkhorst and Knight 2004).

Essential microhabitat for the Northern Quoll includes Intact Eucalypt woodlands, shrublands or grasslands with rocky areas including mesas, gorges, boulder fields or breakaways that are known or highly likely to support this species.

Refer to Figure 3.1 for habitat assessment process.

#### **Biology:**

Northern Quolls breed once each year between June and September and bear on average seven young which are born after a gestation of 21–26 days. Females wean two to three young which become reproductively mature at 11 months. Northern Quolls have a short life span with most females only surviving one breeding season (Menkhorst and Knight 2004, SEWPaC 2011x).

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). Other threats include:

- Inappropriate fire regimes;
- Vehicle mortality;
- Predation by introduced predators; and
- Poisoning from ingesting Cane Toads (DERM 2011d).

#### Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around active dens or known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.



## Specific Field Management Procedures:

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of Northern Quoll, dens, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$ (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active den or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.



Project Phase	Activity	Management Practices
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat t may include both linear and non linear infrastructure. Within the buffer zone around active dens or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
		Night works within the vicinity (200m) of active dens areas known to support this species will not occur.
		Microhabitat where possible will be relocated to areas of vegetation to be retained prior to vegetation clearing.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
		Pipe string ends will be capped nightly to prevent access.
		Where possible, temporary exclusion fencing to exclude fauna from trenches. Open trenches will be checked twice daily each day, regardless of whether fencing has been used.
		Prior to backfilling, trenches are to be checked by fauna spotters.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around dens / habitat area(s). This will also include briefing all relevant staff and contractors.



Project Phase	Activity	Management Practices
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
		Lighting disturbances will be reduced, especially near active dens.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active dens or known breeding sites that contain active dens.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active dens or known breeding sites that contain active dens.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissionin g and Demolition	Decommissioning and demolition will be conducted as per the Decommissioning and Demolition Management Plan (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted surveys for individuals and dens. Surveys should be conducted between May and August to avoid any disturbance during the reproductive period. The EPBC Survey Guidelines for Australia's Threatened Mammals (DEWHA 2011a) details survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

## **Species Specific Performance Criteria:**

- Den sites are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species are to occur as a result of construction and operation activities;
- Sightings of individuals / dens are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- DERM 2011c;
- DEWHA 2011a;
- Menkhorst and Knight 2004; and
- SEWPaC 2011x.



## **AQUATIC FAUNA**

## 5.5.14. Maccullochella peelii (Murray Cod)



Plate 50: Murray Cod. Source: Environmental Protection and Biodiversity Conservation Act, 2003 (Gunther Schmida) Status:

EPBC Act = Vulnerable NC Act = N/A

## **Distribution:**



Plate 51: Distribution. Source: SEWPaC, 2011y

The Murray Cod is found extensively throughout the Murray Darling Basin in the south-eastern region of Australia. Both hatchery-bred and wild caught fish have been translocated outside the natural range. The species has been introduced in the Cooper Creek system in Queensland and South Australia. In Queensland it has also been introduced to the Burnett and Fitzroy River systems (SEWPaC 2011y).

## Known Populations and Relationships within the CSG Fields:

Due to the ephemeral nature of the watercourses within the CSG fields, this will limit the species distribution



(i.e. during the dry season, suitable habitat is limited as the watercourses will be dry). This species may occur within the RSGPA, as this area is within the Murray-Darling Basin.

## Description of the Species:

The Murray Cod is the largest freshwater fish found in Australia, growing up to 1.8 m in length and weighing over 100 kg, although most commonly weighing 10 kg. It possesses a broad, depressed head with a rounded snout and a concave forehead profile. It has a large mouth and jaws that are approximately equal in length. The caudal fin is rounded and 65 - 81 scales are present in the lateral line. It is olive-green with small brown spots, rounded pectoral fins, creamy white undersides and sometimes with red on fin edges (SEWPaC 2011y).

This species is a long-lived predator that is highly territorial and will aggressively attack any fish entering its area. The species rate of growth varies probably due to temperature, habitat and food availability; however, it does not vary between sexes. Murray Cod older than five years gain 1 - 1.5 kg per year in rivers and 2 - 2.5 kg per year in warm impoundments (SEWPaC 2011y).

#### Habitat for the Species:

## General / Indicative Habitat:

The Murray Cod has the ability to live in a diverse range of habitats, including clear rocky streams to slow flowing, turbid rivers and billabongs. The Murray Cod is considered a main channel specialist as it is frequently found in the main river channel and larger tributaries. It is found in floodplain channels when they contain water; although this usage appears limited. Juveniles are most commonly found in the main river channel until about one year of age, after which they branch out (National Murray Cod Recovery Team 2010).

#### **Regional Ecosystem Associations:**

The only RE within the CSG Gas Fields that may support this species is described below:

RE	Short Description
11.3.25	Eucalyptus tereticornis or Eucalyptus camaldulensis woodland fringing drainage lines.

#### **Essential Microhabitat:**

The Murray Cod is usually found near complex structural cover such as large rocks, snags, overhanging vegetation and other woody structures (National Murray Cod Recovery Team 2010).

Essential microhabitat for the Murray Cod includes intact waterway habitat with complex structural cover (large rocks, snags, overhanging vegetation), main channel or high flow areas that are known or highly likely to support natural populations of this species.

Refer to Figure 3.1 for the habitat assessment process.

## Biology:

The Murray Cod reaches sexual maturity at 4 - 5 years of age and at 2 - 3kg in weight. The species has relatively low fertility compared to many other freshwater fish. A female weighing around 3kg can produce approximately 10 000 eggs whereas a female around 23kg produces up to 90 000 eggs (Kearney and Kildea 2001).

The species migrates upstream prior to spawning in late spring and early summer when the water reaches a temperature of between 16 - 21°C. Murray Cod form pairs prior to breeding. A spawning site is selected, usually a sunken red gum log in lowland rivers, or a submerged rock in upland streams, although Murray Cod have been recorded excavating and laying eggs in depressions in clay banks as well. The female is believed to clean the



breeding site with her tail before laying her large adhesive eggs as a large mat on the spawning surface. The male then squirts his milt over the eggs fertilising them. Hatching usually occurs 5 - 7 days after fertilisation, and a batch of eggs takes 3 - 4 days to hatch. The larvae then drift downriver, prior to the fry settling out in suitable protected habitat (TSSC 2003c).

## Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). Other threats include:

- There are more than 3600 structures in the Murray Darling Basin that act as barriers to native fish species. These barriers may interfere with spawning movements and isolate populations, causing genetic drift and a loss of genetic variability;
- Impacts of introduced species include predation, competition, habitat alteration, diseases and parasites;
- Commercial fishing;
- Recreational fishing; and
- Illegal fishing (SEWPaC 2011y).

## Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

## **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		<ul> <li>DERM's Wildlife Online (Wildnet) Records;</li> </ul>
		Queensland Museum database;
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>
		<ul> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> </ul>
		<ul> <li>Aerial and/or satellite imagery; and</li> </ul>
		• Discussion with land managers, site manager and/or the ER.
		Prior to construction commencing, a survey will be undertaken to assess for the presence of Murray Cod, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys



Project Phase	Activity	Management Practices
		associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class A $-$ D (i.e. will include non-remnant and regrowth areas $-$ Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.



Project Phase	Activity	Management Practices
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (100m) will be established around any habitat area(s). This will also include briefing all relevant staff and contractors.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active breeding sites.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active breeding sites.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted surveys for individuals. Surveys should be conducted when there is a higher chance of detecting the species. The EPBC Survey Guidelines for Australia's Threatened Fish (SEWPaC 2011z) details survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.



## **Species Specific Performance Criteria:**

- Waterways are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, run-off, contamination);
- No injury or fatalities of this species are to occur as a result of construction and operation activities;
- Sightings of individuals are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Kearney and Kildea 2001;
- National Murray Cod Recovery Team 2010;
- TSSC 2003c; and
- SEWPaC 2011y; and
- SEWPaC 2011z.



# 5.5.15. *Rheodytes leukops* (Fitzroy River Turtle)



Plate 52: Fitzroy River Turtle Source: DERM 2007b

## Status:

EPBC Act = Vulnerable NC Act = Vulnerable

## **Distribution:**



Plate 53: Fitzroy River Turtle. Source: SEWPaC, 2011aa

The Fitzroy River Turtle is only found in the drainage system of the Fitzroy River, Queensland. Known sites include Boolburra, Gainsford, Glenroy Crossing, Theodore, Baralba, the Mackenzie River, the Connors River, Duaringa, Marlborough Creek, and Gogango (SEWPaC 2011aa).

## Known Populations and Relationships within the CSG Fields:

This species is known to occur within the Fitzroy River catchment, including the Dawson River. Due to the ephemeral nature of the watercourses within the CSG fields will limit the species distribution (i.e. during the dry season, suitable habitat is limited as most watercourses will be dry). However, watercourses with large permanent pools of water during the dry season such as Hutton and Baffle Creeks could provide potential refuge habitat for



this species during the dry season. This species is unlikely to occur within the RSGPA as the majority of this area is in the Maranoa-Balonne River catchment (outside the known distribution of this species).

## **Description of the Species:**

The Fitzroy River Turtle is a medium to dark brown turtle growing to 25 cm (shell length) with scattered darker spots and blotches on the upper shell surface. It has a pale yellow or cream belly and dull olive-grey exposed fleshy parts. The shell is broadly oval and the neck is covered with large, pointed conical tubercles. The back edge of the shell on hatchlings is serrated (Cogger 2000).

The Fitzroy River Turtle has distinctive eyes with black pupils surrounded by a narrow white inner ring (adults) or a metallic silvery-blue iris (hatchlings). The Fitzroy River Turtle has relatively long forelimbs with five long claws and a large cloacal bursae which has a respiratory function (SEWPaC 2011aa).

## Habitat of the Species:

#### General / Indicative Habitat:

The Fitzroy River Turtle is found in flowing streams and permanent waterbodies. In the dry season it may be found in large slow-flowing pools and non-flowing permanent water holes (DERM 2007b). Their habitat is often associated with Vallisneria spp. (Ribbonweed) beds (SEWPaC 2011aa).

Common riparian trees associated with the Fitzroy River Turtle habitat include Eucalyptus tereticornis (Queensland Blue Gum), Casuarina cunninghamiana (River She-oak), Melaleuca viminalis (Weeping Bottlebrush) and Melaleuca linariifolia (Snow-in-Summer) / M. trichostachya (Western Tea-tree). Home ranges for both sexes overlap riffle zones, with a maximum distance to the nearest riffle zone averaging approximately 494–613m (SEWPaC 2011aa).

#### **Regional Ecosystems Associations:**

The only RE which is likely to provide suitable habitat for this species is described below:

RE	Short Description
11.3.25	Eucalyptus tereticornis or Eucalyptus camaldulensis woodland fringing drainage lines.

#### **Essential Microhabitat :**

Microhabitat for the Fitzroy River Turtle include rivers with large, deep, well oxygenated pools with rocky, gravelly or sandy substrates, connected by shallow riffles (SEWPaC 2011aa). The presence of ribbonweed is also a feature of essential microhabitat of this species.

Essential microhabitat is defined as rivers with microhabitat features that are known or highly likely to support this species.

Refer to Figure 3.1 for the habitat assessment process.

## **Biology:**

Nesting occurs during the spring months (September to October) where females lay eggs in sand and gravel bars adjacent to the river and usually between 1 - 4 m above the water level. It is important to note that nests have been found up to 15m from water on flat sandbanks (SEWPaC 2011aa).

Annual reproductive potential of females is 46 - 59 eggs laid in three to five clutches. This species can take between 15 - 20 years to reach sexual maturity (SEWPaC 2011aa).



## Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, egg predation threatens the population of the Fitzroy River Turtle (SEWPaC 2011aa).

## Management Level:

Where habitat (including general / indicative and essential microhabitats) occurs a buffer of 200m will be applied as per Section 1.7.2 during the initial planning phase of the development.

Where disturbance is proposed within habitat (Refer to Figure 3.1) for this species, the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol. Additional buffer zones will be established around active or known breeding sites.

Preclearance surveys will confirm the presence and quality of habitat and the likelihood that it is suitable to support a population of the species.

## **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> <li>Prior to construction commencing, a survey will be undertaken to assess for the presence of Fitzroy River Turtle, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Procedures (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).</li> </ul>
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active breeding site is located a 200 m buffer zone will be established around the site.



Project Phase	Activity	Management Practices
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database, and used for future assessment to allow for adaptive management to be implemented. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals;
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.



Project Phase	Activity	Management Practices
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors.
		Lighting will be reduced at night, especially near wetlands / habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active breeding sites
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Water quality management	All activities will be carried out in compliance with EMP's that include surface water monitoring regimes.
	Erosion and Sediment Control	Erosion and sediment control measures will be implemented as per the Erosion and Sediment Control Manual (Aurecon, 2011).
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active breeding sites
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted surveys for individuals. Surveys should be conducted when there is a higher chance of detecting the species (Spring / Summer). The EPBC Survey Guidelines for Australia's Threatened Reptiles (SEWPaC 2011ab) details survey methods for detecting this species.

The results and observations made throughout monitoring will be used to update the SSMP as part of the annual review process to ensure management processed and procedures are adapted as required.

#### **Species Specific Performance Criteria:**

- Waterways are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, run-off, contamination);
- No injury or fatalities of this species are to occur as a result of construction and operation activities;
- Sightings of individuals are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.


- DERM 2007b;
- DEWHA 2011b;
- SEWPaC 2011aa; and
- SEWPaC 2009.



# **MIGRATORY SPECIES**

# 5.5.16. Ardea modesta (Great Egret)



Plate 54: Great Egret. Source: Folini, 2006.

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**



Plate 55: Distribution. Source: SEWPaC 2011ab

This species is a local migrant throughout Australia and inhabits shallow points of rivers, estuaries, mudflats, freshwater wetlands, irrigated pastures, dams and sewerage ponds. In eastern and northern Australia, the breeding period for this species is between November – February (Pizzey and Knight 2007).

# Known Populations and Relationships within the CSG Fields:

This species is known to utilise habitats within and adjacent the CSG fields, including palustrine wetland alongside roads, in wet gullies and farm dams.



# **Description of the Species:**

The Great Egret's plumage is predominately white, and for most of the year when not breeding, the bill and facial skin are yellow. The feet and legs are dark olive-grey or sooty black. During the breeding season, the bill turns mostly black and the facial skin becomes green. Also at this time, long hair-like feathers (nuptial plumes) hang across the lower back, and the legs become pinkish-yellow at the top. Young Great Egrets are similar to the adults, but have a blackish tip to the bill (Birds in Backyards 2006).

## Habitat for the Species:

## **General / Indicative Habitat**

The Great Egret general habitat includes swampy woodlands and mangrove communities.

## **Essential Microhabitat**

Essential microhabitat is defined as includes swampy woodlands and mangrove communities which are in good condition and active nesting sites. The Great Egret usually nests in colonies and builds its nest as a platform of sticks in treetops over water in swampy woodlands and mangrove communities (Pizzey and Knight 2007).

Refer to Figure 3.1 for habitat assessment process.

## **Biology:**

The Great Egret breeds in colonies, and often in association with cormorants, ibis and other egrets. Both sexes contribute to nest construction, which is a large platform of sticks, in a tree over the water. The previous years' nest is often re-used. Both sexes incubate eggs and care for the young (usually two or three per clutch) (Birds in Backyards 2006).

### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Predation of nests and incubating birds by feral animals;
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011ab).

### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.

# **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction		A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development.

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Project Phase	Activity	Management Practices
	Infrastructure planning / siting	<ul> <li>The likely presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Birds Australia Birdata Atlas;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>DERM's Referrable Wetland mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).
Construction		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management



Project Phase	Activity	Management Practices
		Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nestsor known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).
		Lighting disturbances will be reduced, especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites. that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).



## **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

## **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species occur as a result of construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Birds in Backyards 2006;
- DEWHA 2010b;
- Pizzey and Knight 2007; and
- SEWPaC 2011ab.



# 5.5.17. Ardea ibis (Cattle Egret)



Plate 56: Cattle Egret. Source: Garg 2008a & Vaidyanathan 2007.

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**



### Plate 57: Distribution. Source: SEWPaC, 2011ac.

This species is a local migrant throughout Australia and inhabits paddocks, pastures, croplands, garbage tips, wetlands, mudflats and drainage areas. This species is frequently associated with cattle. In northern Australia, the breeding period for this species is between March – May (Pizzey and Knight 2007).

# Known Populations and Relationships within the CSG Fields:

This species has been recorded within the RSGPA. However, this species is a rare vagrant to the area and specific measures are not required.

# **Description of the Species:**

The Cattle Egret is a relatively small snowy-white egret distinguished during breeding season by its orange crown, neck and breast, with similarly tinted long loose neck plumes. The long sharp, slightly down-curved bill is yellow to pinkish yellow, but becomes bright red during breeding season. The legs are normally grey- green out of breeding season, turning bright red or orange-brown during breeding. It is a gregarious species and is most commonly seen foraging with grazing stock and in wetland areas (Birds in Backyards 2008).



### Habitat for the Species:

# General / Indicative Habitat:

The Cattle Egret usually nests in colonies and builds its nest as a small, untidy platform of sticks in foliage in swampy woodlands (Pizzey and Knight 2007). Indicative habitat includes swampy woodlands, grazing paddocks and natural grasslands.

## **Essential Microhabitat**

It uses predominately shallow, open and fresh wetlands, including; meadows and swamps with low emergent vegetation and abundant aquatic flora. They have sometimes been observed in swamps with tall emergent vegetation (SEWPaC 2011ac) It is commonly associated with the habitats of farm animals, particularly cow (Bos taurus), but also feral pigs, sheep (Ovis spp), horse (Equus spp) and deer (various species).

Essential microhabitat is defined as good condition swampy woodlands, meadows and swamps and active nesting sites.

Refer to Figure 3.1 for habitat assessment process.

## Biology

Cattle Egret pairs are monogamous for the breeding season and breed in colonies, usually with other waterbirds. Their shallow platform nests are made in wetland areas in trees and bushes, usually as high up as possible. Both parents build the nest and incubate the eggs, with one brood per season being raised (Birds in Backyards 2008).

### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral Pigs;
- Predation of nests and incubating birds by feral animals
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011ac).

### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.

### **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:



Project Phase	Activity	Management Practices
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Birds Australia Birdata Atlas;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>DERM's Referrable Wetland mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.



Project Phase	Activity	Management Practices
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).
		Lighting disturbances will be reduced, especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

### **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey



Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

# **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species occur as a result of construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Birds in Backyards 2008;
- Pizzey and Knight 2007; and
- SEWPaC 2011ac.



# 5.5.18. *Gallinago hardwickii* (Latham's Snipe, Japanese Snipe)



Plate 58: Latham's Snipe and. Source: Birds in backyards, 2010.

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**



Plate 59: Distribution. Source: SEWPaC, 2011ad

This bird is a summer migratory bird which breeds in Japan and migrates to the coastal and sub-coastal areas of South East Australia, also moving to areas of the Murray-darling region. Latham's Snipe appears in Australia during the warmer months generally arriving in September and leaving by the end of February northwards along the coast (Pizzey and Knight, 2007)

# Known Populations and Relationships within the CSG Fields:

This species is known to utilise habitats within and adjacent the CSG fields; however these habitats are limited (i.e. wetlands).



## **Description of the Species:**

Latham's Snipe is the largest snipe in Australia, with cryptic, mainly brown, plumage. The bill is long and straight, the wings rather short and pointed and the tail is long. Legs are short and when folded, the wings project well past the tail, giving a pointed look. The upper body is boldly patterned with black, brown and white. There is a bold narrow dark brown cheek stripe and dark line through the eye. Sexes appear similar and unlike most migratory waders, do not show a lot of seasonal variation in appearance. Eyes are set well back on the distinctive rounded head (Birds in Backyards 2009).

### Habitat for the Species:

### General / Indicative Habitat:

In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies) (SEWPaC 2010ad).

### **Essential Microhabitat:**

The structure and composition of the vegetation that occurs around these wetlands is not important in determining the suitability of habitat. As such, snipe may be found in a variety of vegetation types or communities including tussock grasslands with rushes, reeds and sedges, coastal and alpine heathlands, lignum or tea-tree scrub, buttongrass plains, alpine herb fields and open forest (SEWPaC 2010ad).

Essential microhabitat is defined as good condition open, freshwater wetlands with low, dense vegetation and active nesting sites.

Refer to Figure 3.1 for habitat assessment process.

### **Biology:**

Latham's Snipe breeds in Japan and on the East Asian mainland, on dry ground such as grassy hillsides and forest clearings. The males have spectacular display flights, rising in the air and then diving to the ground, in courtship or to defend territory. The female incubates in a shallow depression lined with grasses and leaves (Birds in Backyards 2009).

## Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Predation of nests and incubating birds by feral animals
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011ad).

### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.



# **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Birds Australia Birdata Atlas;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>DERM's Referrable Wetland mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> <li>Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).</li> </ul>
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.



Project Phase	Activity	Management Practices
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).
		Lighting disturbances will be reduced, especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.



Project Phase	Activity	Management Practices
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissionin g and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

## **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

## **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species resulting from construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Birds in Backyards 2009;
- DEWHA 2010b;
- Pizzey and Knight 2007; and
- SEWPaC 2011ad.



# 5.5.19. *Haliaeetus leucogaster* (White-bellied Sea-eagle)



Plate 60: White-bellied Sea-eagle. Source: Issadeen, 2009.

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**



Plate 61: Distribution. Source: SEWPaC, 2011ae

Primarily distributed along the coastline of mainland Australia In northern Australia, its distribution is influenced by climatic conditions (Pizzey and Knight 2007).

# Known Populations and Relationships within the CSG Fields:

This species is known to utilise habitats within and adjacent the CSG fields, however, it is an uncommon visitor.

# **Description of the Species:**

The White-bellied Sea-Eagle has white on the head, rump and underparts and dark grey on the back and wings. In flight the black flight feathers on the wings are easily seen when the bird is viewed from below. The large, hooked bill is grey with a darker tip, and the eye is dark brown. The legs and feet are cream-white, with long black talons. The sexes are similar.



Males (2.5 - 3.7 kg) are slightly smaller than females (2.8 - 4.2 kg). The wingspan is about 1.8 m - 2 m. Young Sea-Eagles are brown as juveniles than slowly become to resemble adults in a patchwork manner, acquiring the complete adult plumage by their fourth year (Birds in Backyards 2006).

## Habitat for the Species:

## General / Indicative Habitat:

This species is a local migrant throughout Australia and inhabits coastal areas, islands, estuaries, inlets, rivers, inland lakes and nearby woodlands. The nest of the White-bellied Sea eagle is quite large and often found in tall trees near water, remote coastal cliffs or on the ground on islands (Pizzey and Knight 2007).

## **Essential Microhabitat:**

Essential microhabitat is defined as remnant woodland nearby to rivers and inland lakes, tall trees near water with suitable breeding resources, rocky cliffs and active nesting sites.

Refer to Figure 3.1 for habitat assessment process.

### **Biology:**

The breeding period for this species is between May – August. White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession. The nest can be located in a tree up to 30m above the ground, but may also be placed on the ground or on rocks, where there are no suitable trees. At the start of the breeding season, the nest is lined with fresh green leaves and twigs. The female does most incubation of the white eggs, but the male performs this duty from time to time (Birds in Backyards 2006).

### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Predation of nests and incubating birds by feral animals
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011ak).

### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.

### **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction		A desktop study will be undertaken to identify the likely occurrence of this
		species within and directly adjacent to the site of the proposed development.



Project Phase	Activity	Management Practices
Project Phase	Activity Infrastructure planning / siting	Management Practices         The likely presence of the species will be established through a review of the following ecological and environmental databases:         Santos CSG Fields Ecological Constraints Database;         DERM's Wildlife Online (Wildnet) Records;         Birds Australia Birdata Atlas;         Queensland Museum database;         Consultation with Queensland Parks and Wildlife Service;         DERM's RE, Regrowth and Essential Habitat Mapping;         DERM's Referrable Wetland mapping;         Aerial and/or satellite imagery; and         Discussion with land managers, site manager and/or the ER.         Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).         Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the
		200m buffer will require further assessment and advice from a qualified ecologist.
Construction		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management



Project Phase	Activity	Management Practices
		Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).
		Lighting disturbances will be reduced, especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).



## **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

## **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species occur as a result of construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Birds in Backyards 2006;
- DEWHA 2010b;
- Pizzey and Knight 2007; and
- SEWPaC 2011ae.



# 5.5.20. Hirundo rustica (Barn Swallow)



Plate 62: Barn Swallow. Source: Ozanimals, 2010 (Jörg Hempel).

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**



Plate 63: Distribution. Source:SEWPaC, 2011af

The Barn Swallow usually occurs in northern Australia, on Cocos-Keeling Island, Christmas Island, Ashmore Reef and patchily along the north coast of the mainland from the Pilbara region, Western Australia, to Fraser Island in Queensland. Vagrants have also been recorded as far south as Sydney (SEWPaC 2011af).

# Known Populations and Relationships within the CSG Fields:

This species is not known to utilise habitats within the CSG fields, however, they are within its potential range.

# **Description of the Species:**

The Barn Swallow has a dark chestnut face and throat, separated from pure white underparts by black breastband. The upperparts are glossy, blue-black, the wing linings are white and the tail is deeply forked, with lace-like white spots on the inner tail feathers (Pizzey and Knight 2007).



### Habitat for the Species:

# General / Indicative Habitat:

This species occurs over open country with water or low moist green vegetation, such as pastures and farm crops, near margins of wetlands and human settlements. The species usually avoids densely populated areas (Pizzey and Knight 2007). General / indicative habitat includes woodland, open country, pastures, farm crops, near margins of wetlands and human settlements.

## **Essential Microhabitat:**

This species prefers areas with a good supply of accessible artificial structures, such as barns, sheds and bridges for nesting and plenty of overhead wires or bare branches and twigs for perching, sunning and preening (SEWPaC 2011af).

Essential microhabitat is defined as riparian woodlands, sandy creek banks, intact wetlands and active nesting sites.

Refer to Figure 3.1 for habitat assessment process.

## **Biology:**

Breeding takes place from August to December. The nest is an open cup of mud-pellets bound with grass and deeply lined with feathers, fur, hair and grass. Two to five eggs are laid per clutch (Pizzey and Knight 2007).

## Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Predation of nests and incubating birds by feral animals
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011al).

### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.

### **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>



Project Phase	Activity	Management Practices				
		<ul> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Birds Australia Birdata Atlas;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>DERM's Referrable Wetland mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul>				
		Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).				
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.				
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 200 m buffer zone will be established around the site.				
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.				
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.				
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).				
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.				
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).				
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.				



Project Phase	Activity	Management Practices					
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding.					
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.					
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.					
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.					
	Access	Access is to occur along designated access tracks only.					
	Pest Management	All requirements outlined within the PWMP will be implemented.					
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.					
	Access	Access is to occur along designated access tracks only.					
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.					
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).					
		Lighting disturbances will be reduced, especially near habitat areas.					
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.					
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.					
	Pest Management	All requirements outlined within the PWMP will be implemented.					
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.					
	Pest Management	All requirements outlined within the PWMP will be implemented.					
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).					

# **Monitoring Process:**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey



Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

# **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species as a result of construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- DRWHA 2010b;
- Pizzey and Knight 2007; and
- SEWPaC 2011af.



# 5.5.21. *Merops ornatus* (Rainbow Bee-eater)

Marine and Migratory (JAMBA)

## **Biology and ecology**

## Characteristics

The Rainbow bee-eater (*Merops ornatus*) is the only species of bee-eater in Australia. The males measure 25 cm in length and the females 22 cm, including the central tail-streamers, which project 2 to 6 cm beyond the rest of the tail in the male and 1 to 2 cm in the female. The wingspan is 34 cm in the male and 31 cm in the female (DSEWPaC 2011g).

Rainbow bee-eaters have a long, slender and decurved black bill, a red iris, dark grey skin around the eye and blackish legs and feet. The adults have green or blue-green colouring on the forehead and chestnut on the back of the head. There is a bold black stripe across the eye that is bordered below by a narrower blue stripe and bright yellow colouring on the chin and cheeks that changes to chestnut around the throat and that is bordered by a conspicuous, crescent-shaped black patch on the front of the neck. The upper part of the back is bright green, merging to light blue on the lower part of the back to the base of the tail. There is bright green and light blue colouring on the upper surface of the wings, with chestnut colouring on the secondary feathers and dark brown primary feathers, light green colouring on the breast that becomes paler on the belly and that changes to light or pale blue from the lower belly to the base of the tail (DSEWPaC 2011g).

The tail is black with blue edging on the upper surface and two long, wire-like central feathers (termed streamers) that project beyond the tip of the tail. There is some slight seasonal variation in the appearance of the plumage (DSEWPaC 2011g).



Plate 64: Rainbow bee-eater (Source: Aviceda 2007)



## Known distribution

It is not known if the total population of the Rainbow bee-eater is divided into a series of discrete sub-populations. Analyses have indicated that there has been little or no change in the total population size of the Rainbow beeeater, but that there have been shifts in local abundances and, possibly, in local distributions. The mobility of the species suggests that it is unlikely that any local or regional population would be genetically isolated from the remainder of the Australian population (DSEWPaC 2011ag).

The Rainbow bee-eater can be found throughout much of mainland Australia and near-shore islands. The occurrence and occupancy of the species within Australia have not been estimated (DSEWPaC 2011ag).



Plate 65: Mapped distribution range of Rainbow bee-eater (Source: DSEWPaC 2011ag)

### Known species populations and their relationship within Stage 1 of the CSG fields

This species is known to utilise a diverse array of habitats within and adjacent the CSG fields. The species is known to breed in the GLNG CSG Fields and any active nests detected will be avoided.

### **Biology and reproduction**

The movement patterns of the Rainbow bee-eater are complex, and are not fully understood. Populations that breed in southern Australia are migratory (ie after breeding, they move north and remain there for the winter). However, populations that breed in northern Australia are considered to be resident, and in many northern localities the Rainbow bee-eater is present throughout the year (DSEWPaC 2011ag).

The Rainbow bee-eater is primarily insectivorous usually foraging from open perches. The species may also feed on the ground, preying on worms and tadpoles (DSEWPaC 2011ag).

The Rainbow bee-eater is capable of living for up to 24 years; however there is no information on the ages of sexual maturity. The breeding season extends from August to January. Nests are located in a chamber at the end of a burrow or tunnel in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel or cliff faces (DSEWPaC 2011ag).

The species breeds in socially monogamous pairs that are sometimes assisted by a varying number of auxiliary birds or 'helpers'. The female lays a clutch of two to eight, but normally four or five, eggs which are incubated by both sexes. Incubation is for a period of 22 to 31 days. The young remain in their burrows for a period of 23 to 36



days and will continue to be fed by the adults for another two to four weeks after their first departure from the nest (DSEWPaC 2011ag).

## Table 10: Breeding periods (Orange indicates breeding period)

Species name	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Merops ornatus</i> (Rainbow bee-eater)												

# Habitat

This species inhabits open woodlands with sandy/loamy soils, sand ridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves and rainforest communities. On migration, the Rainbow bee-eater may also fly over the top of non-preferred habitats such as rainforest or treeless plains (DSEWPaC 2011ag, Pizzey & Knight 1997).

Refer to Figure 3.1 of the CSG Fields SSMP for habitat assessment process.

## Habitat assessment

Information obtained from BPA (i.e. Brigalow Belt South Fauna Expert Panel Report (EPA 2006)), together with expert advice, site based species records and pre-clearance survey data have been used to define a set of assumptions that have been used to identify areas of habitat that are consistent with the definitions of 'core habitat', 'essential habitat' and 'general habitat' that have been presented in CSG Fields SSMP. The Rainbow bee-eater habitat assumptions are presented below.

### General assumptions

The following habitat assumptions have been made based on current scientific knowledge of this species:

- Occurs mainly in open forests and woodlands, shrub lands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation (DSEWPaC 2011ag). These areas are considered to constitute habitat for this species
- It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close
  proximity to permanent water (DSEWPaC 2011ag). It is assumed that areas that are located within but not
  necessarily limited to 3 km of a stream-order 3 or greater watercourse (as indicated on DEHP's mapping)
  provide potential habitat for this species

### Core habitat

'Core habitat' consists of 'essential habitat' in which the species is known and the habitat is recognised under relevant recovery plans or other relevant plans/policies/regulations. Also included within this category are populations that are limited geographically within the region.

For the Rainbow bee-eater, all REs that contain a specimen backed record (from any data source), which overlap with areas identified in the BPA mapping that have been identified as containing a 'State' or 'Regional' 'Corridor' (J-Rating) and/or 'Core Habitat' (H-Rating) and/or 'Habitat for EVR Taxa' (A-Rating) have been mapped as 'core habitat'.

As the Rainbow bee-eater is a ubiquitous species with an extensive distribution both within, and outside of Australia, it is not considered that 'core habitat' exists for this species within the Project footprint.



## **Essential habitat**

'Essential habitat' is an area containing resources that are considered essential for the maintenance of populations of the species (eg potential habitat for breeding, roosting, foraging, shelter, for either migratory or non-migratory species). 'Essential habitat' is defined from known records and/or expert advice (including the findings of preclearance surveys).

As the Rainbow bee-eater is a ubiquitous species with an extensive distribution both within, and outside of Australia, it is not considered that 'essential habitat' exists for this species within the Project footprint.

### General habitat

'General habitat' consists of areas or locations that are used by transient individuals or where species have been recorded but there is insufficient information to assess the area as essential/core habitat. 'General habitat' may be defined from known records or habitat that is considered to potential support a species according to expert knowledge of habitat relationships, despite the absence of specimen backed records. 'General habitat' may include areas of suboptimal habitat for species.

For the Rainbow bee-eater, all areas that meet the assumptions presented above are included within the 'general habitat' category.

## Unlikely habitat

'Unlikely habitat' areas are those areas that do not contain records of the particular species and do not contain sufficient habitat features to support the species (ie areas that do not meet the habitat assumptions identified above).

### Anticipated threats and potential impacts from the Project

Common threats affecting this species from gas field development are outlined in Table 1.7 (refer Part 1, Section 1.11) of the CSG Fields SSMP. In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Loss and degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Predation of nests and incubating birds by feral animals;
- Frequent burning of wetlands;
- Reduced water quality through siltation, salinity and chemical pollution;
- Direct impacts to nest sites, with walls of trenches potentially providing desirable nesting opportunities for individuals;
- Changes to foraging patterns as a result of increases in noise, vibration, vehicle movement and dust; and
- Stress, injury and death to animals due to anthropogenic activities.

### Unavoidable impact from the Project

Where habitat (which includes general/indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.



## Management practices and methods

# **Pre-construction mitigation measures**

### Measures to avoid impact

• All reasonable and practical measures will be taken to locate site offices, construction camps, stockpiling/lay down areas and plant and equipment storage areas (including heavy machinery) on existing cleared lands

## Measures to minimise impacts

- A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
  - o Santos CSG Fields Ecological Constraints Database
  - o DEHP's Wildlife Online (Wildnet) Records
  - o Birds Australia Birdata Atlas
  - Queensland Museum database
  - o Consultation with Queensland Parks and Wildlife Service
  - o DEHP's RE, Regrowth and Essential Habitat Mapping
  - DEHP's Referrable Wetland mapping
  - o Aerial and/or satellite imagery
  - $\circ$   $\,$  Discussion with land managers, site manager and/or the ER  $\,$
- Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (refer Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E)
- Where habitat (refer Figure 3.1) is identified during the pre-clearing assessment, a 50 m buffer will be identified. Any clearing works within the 50 m buffer will require further assessment and advice from a qualified ecologist.
- Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 50 m buffer zone will be established around the site.
- Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
- The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DEHP and DOTE as part of Annual Reporting.
- Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Part 1, Section 4).
- The extent of disturbance/clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.



 Where appropriate, signage will be erected to increase personnel awareness of nesting locations and/or 'No Go' zones within and adjacent the Project footprint.

### **Construction phase mitigation measures**

#### Measures to avoid impact

• Access is to occur along designated access tracks only.

### Measures to minimise impacts

- All vegetation clearing within known habitat of this species must comply with clearing approval conditions (eg EPBC Act, EP Act, NC Act and other statutory approvals).
- A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DEHP will be notified within 24 hours of any native animal injuries or deaths.
- Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non-linear infrastructure. Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding unless authorised by the Department.
- The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
- Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
- All fencing/flagging tape/barrier webbing is to remain in place, and regularly checked.
- All requirements outlined within the PWMP will be implemented.
- All waste/rubbish will be correctly disposed of so as to not pose a risk to local fauna
- All reasonable efforts will be made to minimise night work, wherever possible. Wherever constructability
  allows, measures to limit light pollution spilling onto mapped roosting areas will be implemented (e.g. light
  guards, etc).
- Noise and vibration measures such as regular maintenance of equipment will be adopted.
- Clearing will be conducted in a sequential manner and in a way that directs escaping wildlife away from the clearing activities and into adjacent natural areas. With the exception of the spotter catcher, no migratory birds will physically be moved on at any time.
- Prior to backfilling trenches, the spotter catcher will check trench walls in all areas to ensure no Rainbow bee-eater nests have been constructed.
- Weather permitting, rehabilitation of all habitats impacted as a result of construction works, will commence immediately after construction (refer RRRMP).

### **Operational phase mitigation measures**

### Measures to avoid impact

Access is to occur along designated access tracks only

### Measures to minimise impacts

• Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.



- Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
- An exclusion zone (50 m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).
- Lighting disturbances will be reduced, especially near habitat areas.
- DEHP and DOTE will be notified of any confirmed sightings as part of annual reporting.
- Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation
  activities will not be undertaken within 50 m of active nests or known breeding sites that contain active nests
  unless authorised by the Department.
- All requirements outlined within the PWMP will be implemented

## Decommissioning phase mitigation measures

### Measures to minimise impacts

- Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 50 m of active nests or known breeding sites that contain active nests unless authorised by the Department.
- All requirements outlined within the PWMP will be implemented.
- Decommissioning and demolition will be conducted as per the Decommissioning and Demolition Management Plan (DDMP).

### **Monitoring process**

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

## Species specific performance criteria

- Active nests are not destroyed as a result of construction and operation activities (eg construction clearing, pedestrian, vehicle and machinery movements)
- No injury or fatalities of this species as a result of construction and operation activities
- Sightings of individuals/nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database
- Rehabilitation of associated habitat areas has been completed

- DEWHA 2010b
- Pizzey and Knight 2007; and
- SEWPaC 2011ag.



# 5.5.22. *Hirundapus caudactus* (White-throated Needletail)



Plate 66: White-throated Needletail. Source: Bridger, 2010.

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**



Plate 67: Distribution. Source: SEWPaC, 2011ah.

The White-throated Needletail is usually a summer migrant to Australia and is widespread in eastern Queensland. Migration usually occurs from the breeding grounds of the Northern Hemisphere (Pizzey and Knight 2007).

# Known Populations and Relationships within the CSG Fields:

This species is known to overfly habitats within and adjacent the CSG fields.



# **Description of the Species:**

This large swift has long curved wings and white markings. The plumage of the White-throated Needletail is predominantly grey-brown, glossed with green and the wings are long and pointed. The tail is short and square, with the protruding feather shafts giving a spiky appearance. The throat and undertail are white (Birds in Backyards 2006).

### Habitat for the Species:

### **General / Indicative Habitat**

This species is regularly observed flying over forests, woodlands, pastoral areas, floodplains, lakes and coastlines (Pizzey and Knight 2007). Indicative habitat also includes near margins of wetlands and human settlements.

## **Essential Microhabitat:**

This species occurs over most types of habitat, as described above and may also fly between trees or in clearings, below the canopy, but are less commonly recorded flying above woodland (SEWPaC 2011ah).

Essential microhabitat is defined as forests, woodlands, lakes, coastlines and active nesting sites. Refer to Figure 3.1 for habitat assessment process.

### **Biology:**

White-throated Needletails are non-breeding migrants in Australia. Breeding takes place in northern Asia. The eggs are laid on a platform of sticks placed in a hollow or similar crevice high in a tall conifer. Little else is known of the breeding behaviour of this species except that courtship displays consist of a series of vertical flights and that copulation is believed to take place in flight (Birds in Backyards 2006).

### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Predation of nests and incubating birds by feral animals
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011ah).

### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.

### Specific Field Management Procedures:

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.



Project Phase	Activity	Management Practices					
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Birds Australia Birdata Atlas;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's Referrable Wetland mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> </ul>					
Site		Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$ (i.e. will include non-remnant and regrowth areas – Class E).					
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.					
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 200 m buffer zone will be established around the site.					
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.					
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.					
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).					
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.					
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).					


Project Phase	Activity	Management Practices
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).
		Lighting disturbances will be reduced, especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).



In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

#### **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species as a result of construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Birds in Backyards 2006;
- DEWHA 2010b
- Pizzey and Knight 2007; and
- SEWPaC 2011ah.



# 5.5.23. *Monarcha melanopsis* (Black-faced Monarch)



Plate 68: Black-faced Monarch. Source: Armbrust, 1998.

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**



#### Plate 69: Distribution. Source: SEWPaC, 2011ai.

This species is a local migrant along the east coast of Australia and inhabits rainforest, eucalypt woodland/forest, coastal scrub and rainforest gullies. The Black-faced monarch breeds between October – January and nests in slender forks of juvenile trees and shrubs at least 1m off the ground (Pizzey and Knight 2007).



## Known Populations and Relationships within the CSG Fields:

This species has been recorded from habitats within and adjacent the CSG fields. However, it is a rare vagrant to the area and specific measures are not required. If encountered during survey works, the location of the species will be reported in the Species of Conservation Interest Logbook.

## **Description of the Species:**

The Black-faced Monarch has a distinctive black face that does not extend across the eyes, grey upperparts, wings and upper breast, contrasting with a rufous (red-orange) belly. The dark eye has a thin black eye ring and a lighter area of pale grey around it. The blue-grey bill has a hooked tip. Young birds are similar but lack the black face, have a black bill and tend to have a brownish body and wings. The Black-faced Monarch is one of the monarch flycatchers, a forest and woodland-dwelling group of small insect-eating birds, and is strictly arboreal (Birds in Backyards 2005).

#### Habitat for the Species:

#### General / Indicative Habitat:

This species is a local migrant along the east coast of Australia and inhabits rainforest, eucalypt woodland / forest, coastal scrub and rainforest gullies. Indicative habitat includes swampy woodland and mangrove communities.

#### **Essential Microhabitat**

Essential microhabitat includes good condition swampy woodlands, mangrove communities and active nesting sites.

Refer to Figure 3.1 for habitat assessment process.

#### Biology:

Breeding occurs from October to January. The Black-faced Monarch builds a deep cup nest of Casuarina needles, bark, roots, moss and spider web in the fork of a tree, about 3-6 m above the ground. The female builds the nest, but both sexes incubate the 2-3 eggs and feed the young (Birds in Backyards 2005).

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Predation of nests and incubating birds by feral animals;
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011ai).

#### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.



# **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.



Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Birds Australia Birdata Atlas;</li> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>DERM's Referrable Wetland mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).



Project Phase	Activity	Management Practices
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).
		Lighting disturbances will be reduced, especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).



In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

#### **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species as a result of construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Birds in Backyards 2005;
- DEWHA 2010b;
- Pizzey and Knight 2007; and
- SEWPaC 2011ai;



# 5.5.24. Symposiachrus trivirgatus (Spectacled Monarch)



Plate 70: Spectacled Monarch. Source: Armbrust, 1998

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**



Plate 71: Distribution. Source: SEWPaC, 2011aj

This species is a local migrant along the east coast of Australia and inhabits the understorey of mountain / lowland rainforests, densely wooded gullies and riparian vegetation. The Spectacled Monarch breeds between October – February and nests often near water in the forks of open trees, shrubs and vines at least 1m off the ground (Pizzey and Knight 2007).

# Known Populations and Relationships within the CSG Fields:

This species has been recorded from habitats within and adjacent the CSG fields. However, this species is a rare vagrant to the area and specific measures are not required. If encountered during survey works, the location of the species will be reported in the Species of Conservation Interest Logbook.

# **Description of the Species:**

The Spectacled Monarch is blue-grey above, with a black face mask that extends across both eyes in a 'cloverleaf' pattern, rufous (red-orange) breast, white underparts and a black tail with white outer tips. Immature birds



lack the black face and have a grey throat. The north Queensland subspecies albiventris has a rufous upper breast sharply defined from more extensive white underparts (Birds in Backyards 2005).

#### Habitat for the Species:

#### General / Indicative Habitat:

This species inhabits the understorey of mountain / lowland rainforests, densely wooded gullies and riparian vegetation, including mangroves.

#### **Essential Microhabitat:**

Essential microhabitat for this species includes rainforests with a thick understorey, riparian vegetation and active nesting sites.

Refer to Figure 3.1 for habitat assessment process.

#### **Biology:**

Breeding occurs from October to February. They build a small cup nest of fine bark, plant fibres, moss and spider web in a tree fork or in hanging vines, 1 - 6 m above the ground, often near water. Two eggs are laid per clutch (Birds in Backyards 2005).

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Predation of nests and incubating birds by feral animals;
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011aj).

#### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.

#### **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>DERM's Wildlife Online (Wildnet) Records;</li> <li>Birds Australia Birdata Atlas;</li> </ul> </li> </ul>



Project Phase	Activity	Management Practices
		<ul> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>DERM's Referrable Wetland mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$ (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding.



Project Phase	Activity	Management Practices
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).
		Lighting disturbances will be reduced, especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissionin g and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.



# **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species as a result of construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Birds in Backyards 2005;
- DEWHA 2010b;
- Pizzey and Knight 2007; and
- SEWPaC 2011aj



# 5.5.25. Myiagra cyanoleuca (Satin Flycatcher)



Plate 72: Satin Flycatcher. Source: Birds Australia, 2010

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**





This species inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests (SEWPaC, 2011ak)

# Known Populations and Relationships within the CSG Fields:

Species has been recorded from habitats adjacent the CSG fields. However, this species is a rare vagrant to the area and specific measures are not required. If encountered during survey works the location of the species will be reported in the Species of Conservation Interest Logbook.

# **Description of the Species:**

The Satin Flycatcher is a small blue-black and white bird with a small crest. The sexes are dimorphic (have two forms). Males are glossy blue-black above, with a blue-black chest and white below, while females are duskier blue-black above, with an orange-red chin, throat and breast, and white underparts and pale-edged wing and tail feathers. Young birds are dark brown-grey above, with pale streaks and buff edges to the wing feathers, and a mottled brown-orange throat and chest (Birds in Backyards 2005).



#### Habitat for the Species:

## General / Indicative Habitat:

This species inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests (SEWPaC 2010). Indicative habitat also includes swampy woodlands and mangrove communities.

#### **Essential Microhabitat:**

Essential microhabitat includes woodlands and mangrove communities which are in good condition and active nesting sites.

Refer to Figure 3.1 for habitat assessment process.

#### **Biology:**

This species breeds from October-November. Nests are built is on a horizontal dead branch above live foliage with 2-3 eggs per clutch (Pizzey and Knight 2007).

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Predation of nests and incubating birds by feral animals;
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011ak).

#### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.

#### **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		<ul> <li>DERM's Wildlife Online (Wildnet) Records;</li> </ul>
		Birds Australia Birdata Atlas;
		Queensland Museum database;
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>
		<ul> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> </ul>



Project Phase	Activity	Management Practices
		<ul> <li>DERM's Referrable Wetland mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$ (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure. Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.

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Project Phase	Activity	Management Practices
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).
		Lighting disturbances will be reduced, especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

# **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species as a result of construction and operation activities;



- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Birds in Backyards 2005;
- DEWHA 2011ak;
- Pizzey and Knight 2007;
- SEWPaC, 2011ak;



# 5.5.26. Numenius minutus (Little Curlew)



Plate 74: Little Curlew. Source: Birds Australia 2010

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**



Plate 75: Distribution. Source: SEWPaC, 2011al

This species is known to inhabit dry grasslands, floodplains, margins of swamps and crop areas. Breeds in Arctic Siberia and migrates to Australia in September (Pizzey and Knight 2007).

# Known Populations and Relationships within the CSG Fields:

This species has been recorded from the RSGPA. However, this species is a rare vagrant to the area and specific measures are not required. If encountered during survey works, the location of the species will be reported in the Species of Conservation Interest Logbook.

# **Description of the Species:**

The Little Curlew's bill is shortish and slightly down curved, with a drak grey tip and pink base. The crown is peaked at the rear, dark brown and divided by a central fawn stripe. The broad buffish eyebrow widens behind



the eye and a subtle dark eyeline runs back from bill, dividing buffish eyebrow from similarly coloured cheek. It has diamond-shaped brown centers to feathers with pale edges on back and wings. Underparts are fawn and lightly streaked. At rest the wing tips equal the tail length (Pizzey and Knight, 2007).

#### Habitat for the Species:

#### General / Indicative Habitat:

This species is known to inhabit dry grasslands, floodplains, margins of swamps and crop areas. It breeds in Arctic Siberia and migrates to Australia in September (Pizzey and Knight 2007). Indicative habitat includes swampy woodlands and mangrove communities.

#### **Essential Microhabitat:**

Essential microhabitat includes intact floodplain and swamps, with dense grassy tussocks, good condition swampy woodlands, good condition mangroves and active nest sites.

Refer to Figure 3.1 for habitat assessment process.

#### **Biology:**

Little Curlews breed in Siberia and are not known to breed in Australia. Males have display flights like other curlews, giving their distinctive calls (Birds in Backyards 2006).

#### Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011al).

#### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.

#### **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:
		<ul> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>
		DERM's Wildlife Online (Wildnet) Records;
		Birds Australia Birdata Atlas;



Project Phase	Activity	Management Practices
		<ul> <li>Queensland Museum database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> <li>DERM's Referrable Wetland mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul>
		Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class A – D (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.



Project Phase	Activity	Management Practices
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		Lighting disturbances will be reduced, especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the Decommissioning and Demolition Management Plan (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.

# **Species Specific Performance Criteria:**

- No injury or fatalities of this species as a result of construction and operation activities;
- Sightings of individuals are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.



- Birds in Backyards 2006;
- DEWHA 2010b;
- Pizzey and Knight 2007; and
- SEWPaC 2011al.



# 5.5.27. Rhipidura rufifrons (Rufous Fantail)



Plate 76: Rufous Fantail. Source: Birds Australia, 2010

# Status:

EPBC Act = Migratory NC Act = N/A

# **Distribution:**



Plate 77: Distribution. Source: SEWPaC, 2011am

Commonly found occupying the northern and eastern coastal areas of Australia; however more predominantly found within the northern parts of Australia. Also found in New Guinea, Solomon Islands, Guam and Sulawesi (Pizzey and Knight 2007).

# Known Populations and Relationships within the CSG Fields:

This species is known to utilise habitats within and adjacent the CSG fields predominantly within semi- evergreen vine thickets. If encountered during survey works, the location of the species will be reported in the Species of Conservation Interest Logbook.

# Description of the Species:

The Rufous Fantail is a small, active bird, which has a distinctive reddish brown rump and continuously fanned tail. The crown, face, neck and shoulders are grey-brown, shading to reddish brown on the lower back, rump and upper tail. The eyebrow is reddish-brown, the chin and throat are white, grading into a dappled black and white



breast, and the rest of the underparts are white tinged red-brown. The wings are grey-brown and the tail feathers have red-brown bases, but are otherwise dark grey, tipped white. Young birds are similar in appearance but dull, with less distinct markings on the breast (Birds in Backyards 2008).

#### Habitat for the Species:

#### General / Indicative Habitat:

This species is known to inhabit the undergrowth of rainforests / wetter eucalypt forests / gullies, monsoon forests, gardens. During migration it will also inhabit disturbed areas (Pizzey and Knight 2007).

#### **Essential Microhabitat:**

Essential microhabitat is defined as rainforests, wetter eucalypt forests, gullies, monsoon forests and gardens in close proximity to gullies or watercourses and active nesting sites.

Refer to Figure 3.1 for habitat assessment process.

#### Biology:

The Rufous Fantail builds a small compact cup nest, of fine grasses bound with spider webs, that is suspended from a tree fork about 5 m from the ground. The bottom of the nest is drawn out into a long stem. Both sexes share nest-building, incubation and feeding of the young. One or two broods may be raised in a season (Birds in Backyards 2008).

## Threats:

Common threats affecting this species from gas field development are outlined in Table 1.7 (Section 1.11). In addition, the following also effect this species population:

- Disturbance from human activity;
- Loss and alteration of wetlands;
- Degradation of habitat through inappropriate grazing by livestock and feral pigs;
- Predation of nests and incubating birds by feral animals;
- Frequent burning of wetlands; and
- Reduced water quality through siltation, salinity and chemical pollution (SEWPaC 2011am).

#### Management Level:

Where habitat (which includes general / indicative and essential microhabitats) occurs the Santos management hierarchy will be applied (avoidance, minimise, mitigate, remediation and rehabilitation), as per the Protocol.

#### **Specific Field Management Procedures:**

Field management procedures have been included in the Protocol (avoidance, minimise, mitigate, remediation and rehabilitation) for each phase of the development.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this species within and directly adjacent to the site of the proposed development. The likely presence of the species will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> </ul>



		DERM's Wildlife Online (Wildnet) Records;
		Birds Australia Birdata Atlas;
		Queensland Museum database;
		<ul> <li>Consultation with Queensland Parks and Wildlife Service;</li> </ul>
		<ul> <li>DERM's RE, Regrowth and Essential Habitat Mapping;</li> </ul>
		<ul> <li>DERM's Referrable Wetland mapping;</li> </ul>
		<ul> <li>Aerial and/or satellite imagery; and</li> </ul>
		Discussion with land managers, site manager and/or the ER.
		Prior to construction commencing, a survey will be undertaken to assess for the presence of individuals, or suitable habitat to support this species (Refer to Figure 3.1). This survey will form part of the pre-clearing surveys associated with the Field Management Protocols (Section 1.7.2) and will not be restricted to areas mapped as Class $A - D$ (i.e. will include non-remnant and regrowth areas – Class E).
		Where habitat (refer to Figure 3.1) is identified during the pre-clearing assessment, a 200m buffer will be identified. Any clearing works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Any clearing works within areas of habitat will require assessment and advice from a qualified ecologist. Where infrastructure is to be located within habitat (refer to Figure 3.1), infrastructure will be sited in habitat that does not contain microhabitat where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised. Where an active nest or breeding site is located a 200 m buffer zone will be established around the site.
		Where a Constraint Class B area is identified, it is to be incorporated into future constraints class mapping updates.
		The location of the species and/or habitat will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the species and/or habitat site will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the potential for threatened species to occur, locations of Constraint Class B areas and locations of buffers (refer Section 7).
	Site preparation	The extent of disturbance / clearing is to be clearly demarcated with fencing, flagging tape, barricade webbing or similar.
Construction	Clearing	All vegetation clearing within known habitat of this species must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		A licensed spotter-catcher is required to monitor all clearing works in habitat. Wildlife encountered during clearing operations will be managed in accordance with the procedures outlined in the relevant Fauna Management Plan. DERM will be notified within 24 hours of any native animal injuries or deaths.
		Within areas of habitat, works will be conducted following consultation with a suitably qualified ecologist, and under supervision as required. Appropriate works within habitat may include both linear and non linear infrastructure.

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		Within the buffer zone around active nests or known breeding sites, no construction activities will occur during breeding.
		The status of known populations in areas adjacent to disturbances will be regularly checked in a way that does not risk abandonment by individuals.
		Microhabitat where possible will be relocated prior to vegetation clearing, where possible.
		All fencing / flagging tape / barrier webbing is to remain in place, and regularly checked.
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Operation	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
	Access	Access is to occur along designated access tracks only.
	Management	Potential sightings of this species will be reported to the ER and confirmed by a suitably qualified and experienced ecologist for verification. Confirmed sightings will be recorded in the CSG Fields Ecological Constraints Database. These records will assist in future planning and management activities with the CSG Fields.
		An exclusion zone (200m) will be established around nest site(s). This will also include briefing all relevant staff and contractors and erecting visual barriers around the nest site(s).
		Lighting disturbances will be reduced, especially near habitat areas.
		DERM and SEWPaC will be notified of any confirmed sightings as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP. Rehabilitation activities will not be undertaken within 200m of active nests or known breeding sites that contain active nests.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

In areas where this species has been recorded, monitoring will be conducted during the construction and operational phases and be comprised of targeted area searches during dawn and dusk. Searches should be conducted when there is a higher chance of detecting this species. The Commonwealth Government's Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b) and the Birds Australia website detail survey methods for detecting this species.



# **Species Specific Performance Criteria:**

- Active nests are not destroyed as a result of construction and operation activities (e.g. construction clearing, pedestrian, vehicle and machinery movements);
- No injury or fatalities of this species as a result of construction and operation activities;
- Sightings of individuals / nests are appropriately documented, submitted to relevant authorities and recorded within the Santos's CSG Fields Ecological Constraints Database; and
- Rehabilitation of associated habitat areas has been completed.

- Birds in Backyards, 2008;
- DEWHA 2010b;
- Pizzey and Knight 2007; and
- SEWPaC, 2011am.



# 6. Significant Ecological Communities

# 6.1. Introduction

This section includes detailed information on all Commonwealth TECs and State RE's present within the CSG fields (e.g. critically endangered, endangered and vulnerable under the EPBC Act). Management profiles for State RE's will be provided in an updated SSMP to cover species/ecosystems protected under State legislation, but not protected under the EPBC Act.

Pre-construction surveys undertaken for the development of the CSG fields will confirm the presence / absence and distribution extent of TECs and REs. This information will be used to update the constraints database in accordance with the Protocol as well as assist in developing appropriate mitigation measures to avoid and / or minimise impacts from CSG field activities on these species. This plan will be amended to reflect the findings of these surveys.

# 6.2. Conservation of Threatened Ecological Communities

This Section includes detailed information on the four TEC for which disturbance limits have been set in the EPBC Approval. Each community profile contains the following information:

- Status;
- Distribution;
- Known populations and relationships within Stage 1 of the CSG fields;
- Description;
- Habitat;
- Regional Ecosystems associations;
- Patch size criteria (where available);
- Threats;
- Management Levels;
- Specific management requirements;
- Monitoring process;
- Community specific performance criteria; and
- Key reference documents.

Pre-construction surveys undertaken in accordance with the Protocol for the CSG fields development will confirm the presence / absence of significant ecological communities on the development site. This information will assist in developing appropriate mitigation measures to avoid and / or minimise impact from the development on these communities. This Plan will be amended to reflect the findings of these surveys upon completion of the above-mentioned surveys.

TEC approved for disturbance under the EPBC Approval, as part of Stage 1 of the RFDA, include:

- Natural Grasslands of the Queensland Central highlands and northern Fitzroy Basin;
- Semi-evergreen Vine Thicket of the Brigalow Belt (North and South) and Nandewar Bioregions; and
- Brigalow (Acacia harpophylla dominant and co-dominant).



Note that no disturbance of the TEC community of native species dependent on natural discharge of groundwater from the great artesian basin is allowed during this development.

Additionally, profiles have been included for Weeping Myall and Coolibah-Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions, however Stage 1 of the CSG fields development is unlikely to impact upon these TEC.



# 6.2.1. Natural Grasslands of the Queensland Central Highlands and the Northern Fitzroy Basin

## Status:

EPBC Act = Endangered

# **Distribution:**



Plate 78: Distribution. Source: SEWPaC, 2011an

This ecological community is endemic to Queensland. It occurs where the Fitzroy River Basin and the Brigalow Belt North coincide, extending from Collinsville in the north to Carnarvon National Park in the south, bounded to the south by the Expedition, Carnarvon, Great Dividing, Drummond and Narrien ranges; and to the north by the Clark, Denham, Connors and Broadsound ranges (SEWPaC 2011an). It occurs within IBRA subregions 6, 9, 10, 11, 12 and 13 of the Brigalow Belt North and subregions 1 and 9 of the Brigalow Belt South subregions.

# Known Locations within the CSG Fields:

Mapping indicates that grasslands are present in the AVPA (Figure 1.6). Recent mapping indicates that this TEC will not be impacted by this development.

Mapping will be updated on the completion of preclearance surveys.

# **Key Diagnostic Characteristics:**

The Natural Grasslands are typically composed of perennial native grasses on soils that are fine textured (often cracking clays) derived from either basalt or fine-grained sedimentary rocks, on flat or gently undulating rises. These grasslands occur in areas with relatively high summer rainfall. The tree canopy is usually absent however where trees persist, the projective crown cover is < 10%. Tree species that may be present as scattered individuals include: Corymbia erythrophloia (Gum-topped Bloodwood), Eucalyptus coolabah (Coolibah), E. crebra (Narrow-leaved Ironbark), E. melanophloia (Silver-leaved Ironbark), E. orgadophila (Mountain Coolibah), E. populnea (Poplar Box), and Melaleuca bracteata (Black Tea-tree).

The ground layer is typically dominated by perennial native grasses and contains at least three of the following indicator species: Aristida latifolia (Feather-top Wiregrass), Aristida leptopoda (White Speargrass), Astrebla elymoides (Hoop Mitchell Grass), Astrebla lappacea (Curly Mitchell Grass), Astrebla squarrosa (Bull Mitchell



Grass), Bothriochloa erianthoides (Satin-top Grass), Dichanthium queenslandicum (King Bluegrass), Dichanthium sericeum (Queensland Bluegrass), Eriochloa crebra (Cup Grass), Panicum decompositum (Native Millet), Panicum queenslandicum (Yabila Grass), Paspalidium globoideum (Shot Grass) and/or Thellungia advena (Coolibah Grass). In a poor season (hot summer or drought), the only visible evidence of natural grassland may be scattered tussocks that are difficult to identify. Identification and assessment of the community should therefore be made during a good season. If it can be demonstrated beyond reasonable doubt, that the grassland was derived from cleared woodland, then it is not considered a part of this TEC (SEWPaC 2011an).

EPBC TEC	RE	VM Status	Biodiversity Status	CSG Field	RE Description
Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin	11.3.21	E	E	RSGPA	<i>Dichanthium sericeum</i> and/or <i>Astrebla</i> spp. grassland on alluvial plains. Cracking clay soils
	11.8.11	OC	E	RSGPA	<i>Dichanthium sericeum</i> grassland on Cainozoic igneous rocks
	11.9.3	LC	E	RSGPA	<i>Dichanthium</i> spp., <i>Astrebla</i> spp. grassland on fine-grained sedimentary rocks
	11.9.3a	LC	E	RSGPA	<i>Dichanthium</i> spp., <i>Astrebla</i> spp. grassland on fine-grained sedimentary rocks

#### **Regional Ecosystems Associations:**

# Threats:

Common threats affecting this community from gas field development are outlined in Table 1.7 (Section 1.11). Project specific threats include clearing associated with the development of infrastructure leading to loss of the TEC as well as fragmentation. Additionally, retained grasslands within the CSG fields may be exposed to increased edge effects such as potential weed invasion resulting from project activities. Management measures are outlined below to mitigate potential threats to this TEC.

# Patch Size Criteria:

- Most patches of Grasslands have some degree of disturbance or degradation;
- Best quality patches should maintain a patch size of 1 ha containing 4 native perennial grass species from the list of perennial species above, at least 200 native grass tussocks, a total projected canopy cover of woody shrubs of less than 30%, and perennial non-woody introduced species cover of less than 5% of the total projected perennial plant cover;
- Good quality patches should maintain a patch size of 5 ha containing at least 3 native perennial grass species from the list of perennial native grass indicator species, at least 200 native grass tussocks, a total projected canopy cover of shrubs of less than 50%, and perennial non-woody introduced species cover of less than 30% of the total projected perennial plant cover; and
- The shrub layer is typically absent. However, where shrubs are present, they are defined as woody plants, more than 0.5 m tall that occupy the mid vegetation layer. The upper, or tree canopy, layer is typically absent but may comprise scattered trees to less than 10% projective crown cover (SEWPaC 2011an).



#### Management Level:

If this community is located within a CSG field development site, a buffer of 200m will be applied as per the Protocol during the initial planning phase of the development.

The management hierarchy outlined in the Protocol (Avoid, Minimise, Mitigate, Take and then Offset) will then be applied.

Where this community occurs, all efforts to protect this community will be undertaken where possible, as outlined in the below sections. Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened ecological communities.

Unavoidable clearing will be within the disturbance limits stipulated for this TEC (5.2 ha) under the EPBC Approval and in accordance with the Protocol.

#### **Specific Management Requirements:**

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this community within and directly adjacent to the site of the proposed development. The likely presence of the community will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE and Regrowth mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence/absence, population status and area extent of this community prior to any clearing or associated works occurring. The surveys will target areas of mapped remnant and regrowth RE's directly adjacent to the active CSG development area.
		Where this community is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Where disturbed, isolated and small patches are observed, infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of this community, approval conditions will be complied with as per the Protocol (i.e. – clearing must be unavoidable and the impact must be minimal, short-term, and recoverable).



Project Phase	Activity	Management Practices
		The location of this community will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the community will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, of TEC, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
Construction	Clearing	All vegetation clearing must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint remains adequately marked for the duration of clearing activities.
		Clearing activities within and adjacent to buffer areas will be supervised by the ER.
		DERM and SEWPaC will be notified of locations where this TEC has been recorded. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
		DERM and SEWPaC will be notified of new locations, as well as disturbances to this TEC as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

- Monitoring will be completed by suitably qualified ecologist/s;
- Monitoring methods for both flora and fauna are outlined in Appendix B; and



• Monitoring and rehabilitation of grasslands will be completed as outlined in the RRRMP.

## **Community Specific Performance Criteria:**

- Authorised, unavoidable, adverse impacts to this grassland TEC resulting from exploration, construction and decommissioning of the CSG fields do not exceed 5.2 ha, as per the EPBC Approval; and
- Rehabilitation of adversely impacted areas of grassland are complete in accordance with the RRRMP.

- Butler 2007a; and
- SEWPaC 2011an;
- TSSC 2008j;
- TSSC 2008k.



# 6.2.2. Brigalow (Acacia harpophylla dominant and sub-dominant)

# Status:

EPBC Act = Endangered

# **Distribution:**



Plate 79: Distribution. Source: SEWPaC, 2011ao.

Brigalow is located primarily in south and central eastern Queensland, extending north to approximately Charters Towers and west to Blackall. Brigalow is also found in central northern NSW, but only extends south just past Narrabri (SEWPaC 2011ao).

The extent of Brigalow throughout the region has been significantly reduced through clearing for agricultural land uses which has resulted in approximately 90% loss and high fragmentation of this community (Butler, 2007b).

# Known Locations within the CSG Fields:

Brigalow is located within the AVPA, FPA and RSGPA (Figures 1.4 to 1.6).

# Key Diagnostic Characteristics:

Brigalow (*Acacia harpophylla* dominant and co-dominant) is characterised by the presence of Brigalow (*Acacia harpophylla*) as one of the three most abundant tree species (Butler 2007). Brigalow is dominant in the tree layer or co-dominant with species such as *Casuarina cristata* (Belah), other species of *Acacia*, or species of *Eucalyptus*. Occasionally Belah, or species of *Acacia* or *Eucalyptus* may be more common than Brigalow within the broad matrix of Brigalow vegetation.

The structure of the vegetation ranges from open forest to open woodland. The height of the tree layer varies from about 9 m in low rainfall areas to around 25 m in higher rainfall areas (Butler 2007b). A prominent shrub layer is usually present. Brigalow ecological community typically has a sparse ground layer. In Queensland, the soils are predominantly cracking clays where Brigalow is dominant, however where *Eucalyptus* species are co-dominant, texture contrast soils are common (Benson *et al.* 2006).

Throughout the Brigalow Belt South Bioregion, Brigalow occurs in both remnant and regrowth states with varying degrees of ecological condition. RE mapping identifies remnant patches of Brigalow as well as 'High

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Value Regrowth' which is defined as vegetation that has not been cleared since 31st December 1989. For the purposes of the EPBC Act, the Brigalow (Acacia harpophylla dominant and co-dominant) ecological community includes Brigalow regrowth that retains the species composition and structural elements of the corresponding RE's listed below but excludes:

- Patches of vegetation smaller than 0.5 ha;
- Vegetation that is less than 15 years of age;
- Vegetation that is of poor quality; and
- Areas greater than 0.5ha that contain more than 50% cover of exotic perennial plants.

#### **Regional Ecosystems Associations:**

EPBC TEC	RE	VM Status	Biodiversity Status	CSG field	RE Description
Brigalow ( <i>Acacia</i> <i>harpophylla</i> dominant and co-dominant);	11.3.1	E	E	FPA, RSGPA, AVPA	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains
	11.4.3	E	E	RSGPA	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> shrubby open forest on Cainozoic clay plains
	11.4.7	E	E	RSGPA	Open forest to woodland of Eucalyptus populnea with Acacia harpophylla and/or Casuarina cristata on Cainozoic clay plains
	11.9.5	E	E	FPA, RSGPA, AVPA	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks

#### Threats:

Common threats affecting this community from gas field development are outlined in **Table 1.7** (Section **1.11**). Project specific threats include clearing associated with the development of infrastructure leading to loss of the TEC as well as fragmentation. Additionally, retained stands of Brigalow within the CSG fields may be exposed to increased edge effects such as potential weed invasion resulting from project activities. Management measures are outlined below to mitigate potential threats to this TEC.

#### Patch Size Criteria:

While no patch size criteria is defined under the EPBC Act, 0.5 ha is considered to be minimum patch size to viably function (Butler 2007b)).

#### Management Level:

If this community is located within a CSG field development site, a buffer of 200m will be applied as per the Protocol during the initial planning phase of the development.

The management hierarchy outlined in the Protocol (Avoid, Minimise, Mitigate, Take and then Offset) will then be applied.

Where this community occurs, all efforts to protect this community will be undertaken where possible, as outlined in the below sections. Where disturbances within the 200 m buffer cannot be avoided, the Santos



management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened ecological communities.

Unavoidable clearing will be within the disturbance limits stipulated for this TEC (19.6 ha) under the EPBC Approval and in accordance with the Protocol.

#### Specific Management Requirements:

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this community within and directly adjacent to the site of the proposed development. The likely presence of the community will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE and Regrowth mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> <li>Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to</li> </ul>
		determine the presence/absence, population status and area extent of this community prior to any clearing or associated works occurring. The surveys will target areas of mapped remnant and regrowth RE's directly adjacent to the active CSG development area.
		Where this community is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Where disturbed, isolated and small patches are observed, infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where clearing within this community is required, all efforts to retain mature Brigalow trees will be taken.
		Where there is an unavoidable loss of this community, approval conditions will be complied with as per the Protocol (i.e. – clearing must be unavoidable and the impact must be minimal, short-term, and recoverable).
		The location of this community will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the community will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, of TEC, and buffer areas (refer Section 7).



Project Phase	Activity	Management Practices
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
Construction	Clearing	All vegetation clearing must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint remains adequately marked for the duration of clearing activities.
		Clearing activities within and adjacent to buffer areas will be supervised by the ER.
		DERM and SEWPaC will be notified of locations where this TEChas been recorded. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
		DERM and SEWPaC will be notified of new locations, as well as disturbances to this TEC as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

#### Monitoring Process:

- Monitoring will be completed by suitably qualified ecologist/s;
- Monitoring methods for both flora and fauna are outlined in Appendix B; and
- Monitoring and rehabilitation of grasslands will be completed as outlined in the RRRMP.

#### **Community Specific Performance Criteria:**

- Authorised, unavoidable, adverse impacts to this Brigalow TEC resulting from exploration, construction and decommissioning of the CSG fields do not exceed 19.6 ha, as per the EPBC Approval; and
- Rehabilitation of adversely impacted areas of Brigalow are completed in accordance with the RRRMP.



#### **Key Reference Documents:**

- Benson *et al*. 2006;
- Butler 2007b; and
- SEWPaC 2011ao.



# 6.2.3. Semi-evergreen Vine Thicket of the Brigalow Belt (North and South) and Nandewar Bioregions

#### Status:

EPBC Act = Endangered

#### **Distribution:**



Plate 80: Distribution. Source: SEWPaC, 2011ap

Semi-evergreen vine thicket (SEVT) is found in central- and south-eastern QLD and in central northern NSW extending south to Narrabri (SEWPaC 2011ap).

#### Known Locations within the CSG Fields:

SEVT occurs throughout the RSGPA, AVPA and FPA (Figures 1.4 to 1.6). RE 11.9.8 (Macropteranthes leichhardtii thicket on fine grained sedimentary rocks) may occur in the AVPA but is yet to be ground-truthed and is outside of the Stage 1 Development Area.

It should be noted that RE mapping is not sufficiently robust to capture all the area of this community (i.e. RE mapping is based on a minimum area of 2 ha, community characteristics) and that this community may occur in areas mapped as regrowth and non-remnant under DERM's mapping.

#### Key Diagnostic Characteristics:

SEVT is considered an extreme form of dry seasonal subtropical rainforest and is generally characterised by the prominence of trees with microphyll sized leaves (i.e. leaves usually 2.5–7.6 cm long), the presence of Brachychiton spp. as emergents from the vegetation, and the thickets occurring in areas with a subtropical, seasonally dry climate on soils of high to medium fertility. The SEVT ecological community in Queensland is most common on undulating plains on fine grained sedimentary rocks (frequently shale) and on basalt hills and plains, occurring less often on coastal dunes, Quaternary alluvium, Tertiary clay plains, old loamy and sandy plains, or hills and lowlands on metamorphic rocks (SEWPaC 2011ap).



#### **Regional Ecosystems Associations:**

EPBC TEC	RE	VM Status	Biodiversity Status	CSG field	RE Description
Semi-evergreen Vine Thickets of the Brigalow Belt (north	11.8.3	LC	E	RSGPA	Semi-evergreen vine thicket on Cainozoic igneous rocks. Steep hillsides
and south) and Nandewar Regions	11.9.4	OC	E	FPA, RSGPA, AVPA	Semi-evergreen vine thicket on fine- grained sedimentary rocks
	11.9.8	LC	E	AVPA	Macropteranthes leichhardtii thicket on fine grained sedimentary rocks
	11.10.8	OC	E	FPA, RSGPA, AVPA	Semi-evergreen vine thicket in sheltered habitats on medium to coarse-grained sedimentary rocks

#### Threats:

Common threats affecting this community from gas field development are outlined in Table 1.7 (Section 1.11). Project specific threats include clearing associated with the development of infrastructure leading to loss of the TEC. Additionally, areas of retained SEVT within the CSG fields may be exposed to increased edge effects such as potential weed invasion resulting from project activities. Management measures are outlined below to mitigate potential threats to this TEC.

#### Patch Size Criteria:

While no minimum patch size criteria is defined under the EPBC Act, 1ha is considered to be the minimum for a viable patch of SEVT, given that it may naturally occur in small and isolated patches on areas such as rocky knolls and outcrops.

#### Management Level:

If this community is located within a CSG field development site, a buffer of 200m will be applied as per the Protocol during the initial planning phase of the development.

The management hierarchy outlined in the Protocol (Avoid, Minimise, Mitigate, Take and then Offset) will then be applied.

Where this community occurs, all efforts to protect this community will be undertaken where possible, as outlined in the below sections. Where disturbances within the 200m buffer cannot be avoided, the Santos management hierarchy outlined in the Protocol (Avoidance, Minimise, Mitigate, Remediation and Rehabilitation) will be applied. Works within this area will require further assessment and advice from an Ecologist to ensure that there will be minimal, short term, recoverable and no adverse impacts on threatened ecological communities.

Unavoidable clearing will be within the disturbance limits stipulated for this TEC (0.8 ha) under the EPBC Approval and in accordance with the Protocol.

#### Specific Management Requirements:

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.



Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this community within and directly adjacent to the site of the proposed development. The likely presence of the community will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE and Regrowth mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence/absence, population status and area extent of this community prior to any clearing or associated works occurring. The surveys will target areas of mapped remnant and regrowth RE's directly adjacent to the active CSG development area.
		Where this community is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		Where disturbed, isolated and small patches are observed, infrastructure will be sited to avoid the need to clear where possible. Where this is not possible, disturbances will be limited, and clearing footprint minimised.
		Where there is an unavoidable loss of this community, approval conditions will be complied with as per the Protocol (i.e. – clearing must be unavoidable and the impact must be minimal, short-term, and recoverable).
		Where clearing is required within this TEC, all efforts to retain or translocate key species will be made.
		The location of this community will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the community will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, of TEC, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
Construction	Clearing	All vegetation clearing must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint emains adequately marked for the duration of clearing activities.
		Clearing activities within and adjacent to buffer areas will be supervised by the ER.



Project Phase	Activity	Management Practices
		DERM and SEWPaC will be notified of locations where this TEC has been recorded. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
		DERM and SEWPaC will be notified of new locations, as well as disturbances to this TEC as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the Decommissioning and Demolition Management Plan (DDMP).

#### **Monitoring Process:**

- Monitoring will be completed by suitably qualified ecologist/s;
- Monitoring methods for both flora and fauna are outlined in Appendix B; and.
- Monitoring and rehabilitation of SEVT will be completed as outlined in the RRRMP.

#### **Community Specific Performance Criteria:**

- Authorised, unavoidable, adverse impacts to this community resulting from exploration, construction and decommissioning of the CSG fields do not exceed 0.8 ha, as per the EPBC Approval; and
- Rehabilitation of adversely impacted areas of Brigalow are completed in accordance with the RRRMP.

#### **Key Reference Documents:**

- McDonald 2010; and
- SEWPaC 2011ap.



# 6.2.4. The Community of Native Species Dependent on Natural Discharge of Groundwater from the Great Artesian Basin

Status:

EPBC Act = Endangered

#### **Distribution:**



Plate 81: Distribution. Source: SEWPaC, 2011aq

The Great Artesian Basin underlies an area approximately 1.7 million square kilometres primarily beneath arid and semi-arid regions of Queensland, New South Wales, South Australia and the Northern Territory (Cox & Barron 1998).

#### Known Locations within the CSG Fields:

A review by Golder Associates (2010) found that the nearest discharge springs to the RSGPA, FPA and AVPA are located approximately 300 km to 400 km to the south west of the CSG fields and outside the zone of groundwater drawdown.

#### Key Diagnostic Characteristics:

The Great Artesian Basin (GAB) is a hydrogeological basin that underlies an area of about 1.7 million square kilometres, primarily beneath arid and semi-arid regions of Queensland, New South Wales, South Australia and the Northern Territory (Cox and Barron 1998). The groundwater comes to the surface at points within Great Artesian Basin discharge areas which are the natural surface discharge points of aquifers. The discharge points and their associated wetland areas are variously called springs, artesian springs, mound springs, mud springs, boggomoss springs (springs with raised mounds of organic matter), spring pools and groundwater seeps (TSSC 2001). The size of discharge spring wetlands in Queensland range from 100cm2 to 3ha, with most spring wetlands < 0.05ha in area (Fensham and Fairfax 2003).

The native species that comprise the ecological community are assemblages of plant and animal taxa associated with and dependent on the springs and wetland areas located at points where the Great Artesian Basin groundwater is discharged naturally. The species include plants and animals that are endemic to one or more springs / wetlands



and species that occur more widely in the Great Artesian Basin (TSSC 2001) or beyond it. Springs in South Australia and New South Wales appear to be floristically similar, but distinct from those in Queensland. Species in common include Cyperus laevigatus, Phragmites australis and Eriocaulon carsonii. Species apparently restricted to Great Artesian Basin discharge spring wetlands in Queensland include Eragrostis fenshamii (previously known as Eragrostis sp., Myriophyllum artesium, Pennisetum alopecuroides, Schoenus falcatus and Sporobolus pamelae (Fensham et al. 2004).

#### **Regional Ecosystems Associations:**

Discharge springs do not occur in the CSG fields.

#### Threats:

Common threats affecting this community from gas field development from gas field development are outlined in Table 1.7 (Section 1.11). Project specific threats include increased edge effects such as potential weed invasion resulting from project activities. Management measures are outlined below to mitigate potential threats to this TEC.

#### Patch Size Criteria:

Unavailable

#### Management Level:

If this TEC is located within a proposed development site, a buffer of 200m will be applied as per the Protocol during the initial planning phase of the development.

No disturbance of this community is allowable under the EPBC Approval.

#### **Specific Management Requirements:**

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase	Activity	Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this community within and directly adjacent to the site of the proposed development. The likely presence of the community will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE and Regrowth mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence/absence, population status and area extent of this community prior to any clearing or associated works occurring. The surveys will target areas of mapped remnant and regrowth RE's directly adjacent to the active CSG development area. Where this community is identified, a 200m buffer will be implemented and no works are permitted within this area.



Project Phase	Activity	Management Practices
		The location of this community will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the community will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, of TEC, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
Construction	Clearing	All vegetation clearing must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint remains adequately marked for the duration of clearing activities.
		DERM and SEWPaC will be notified of locations where this TEC has been recorded. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.
		DERM and SEWPaC will be notified of new locations, as well as disturbances to this TEC as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

#### **Monitoring Process:**

- Monitoring will be completed by suitably qualified ecologist/s; and
- Monitoring methods for both flora and fauna are outlined in Appendix B.

#### **Community Specific Performance Criteria**

• No disturbance of this community is approved under the EPBC Approval.



#### **Key Reference Documents:**

- Cox and Barron 1998;
- Fensham and Fairfax 2003;
- Fensham et al. 2004;
- TSSC 2001; and
- SEWPaC 2011aq.



#### 6.2.5. Weeping Myall Woodlands

Status:

EPBC Act = Endangered

**Distribution:** 



Plate 82: Distribution. Source: SEWPaC, 2011ar

In Queensland, Weeping Myall Woodlands occur on the inland alluvial plains west of the Great Dividing Range in Queensland, within the Brigalow Belt South and Nandewar bioregions (DEWHA, 2009),

The extent of Weeping Myall Woodlands in Queensland is thought to have declined by approximately 75% (DEWHA, 2009).

#### Known Locations within the CSG Fields:

Weeping Myall Woodlands are not known to occur within Stage 1 of the CSG field development.

#### Key Diagnostic Characteristics:

Weeping Myall Woodlands occur in a range of forms, including Woodlands and Open-woodlands, or as a shrubby or grassy Woodland. While Weeping Myall (Acacia pendula) must be the dominant overstorey species, other tree species may also occur in the canopy layer. This community often includes Western Rosewood (Alectryon oleifolius subs. Elongates), Poplar Box (Eicalyptus populnea), and Black Box (Eucalyptus largiflorens). Grey Mistletoe (Amyema quandang) regularly occurs within Weeping Myall communities.

The structure of this community varies throughout it's range. Within the CSG fields, the community is restricted to sparse or scattered stands along floodplains or minor depressions. It generally occurs in areas with a flat topography, shallow depressions or gilgais on raised alluvial plains. Generally these areas are not associated with active draingage channels. This community is associated with black, bow, red-brown or gre clay and clay-loam soils.

To be considered a TEC, the following condition thresholds apply (DEWHA, 2009):

• The patch of woodland must be at least 0.5ha in size;



- The overstorey must have at least 5% tree canopy cover, or at least 25 dead or defoliated nature Weeping Myall trees per hectare;
- The tree canopy comprises at least 50% of living, dead, or defoliated Weeping Myall, and
- The patch has more that two layers or regenerating Weeping Myall present, or the tallest layer of living, dead or defoliated Weeping Myall trees are at least 4m tall and the vegetative cover is comprised of 50% native species.

Where there is a total absence of native species in the understorey, the community is considered to be so highly degraded that it could not be returned to a state which is considered part of a TEC.

#### **Regional Ecosystems Associations:**

Weeping Myall woodlands are restricted to small stands that occur within the following two REs:

EPBC TEC	RE	VM Status	Biodiversity Status	CSG Field	RE Description
Weeping Myall Woodlands	11.3.2	OC	OC	N/A	<i>Eucalyptus populnea</i> woodland on alluvial plains
	11.3.28	OC	OC	N/A	Casuarina cristata +/- Eucalyptus coolabah open woodland on alluvial plains

#### Threats:

Common threats affecting this community from gas field development are outlined in **Table 1.7** (Section 1.11). Project specific threats include clearing associated with the development of infrastructure leading to loss of the TEC as well as fragmentation. Additionally, retained stands of Weeping Myall within the CSG fields may be exposed to increased edge effects such as potential weed invasion resulting from project activities. Management measures are outlined below to mitigate potential threats to this TEC.

#### Patch Size Criteria:

Under the EPBC Act, 0.5ha is considered to be minimum patch size for Weeping Myall (DEWHA, 2009).

#### Management Level:

Stage 1 of the CSG fields development will not result in the removal of this TEC. Where this TEC is observed, a buffer of 200m will be applied as per the Protocol during the initial planning phase of the development. The management hierarchy outlined in the Protocol (Avoid, Minimise, Mitigate, Take and then Offset) will then be applied.

Where this community occurs, all efforts to protect this community will be undertaken where possible, as outlined in the below sections. Works within this area will require further assessment and advice from an Ecologist, and consultation with SEWPaC.

#### Specific Management Requirements:

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase	Activity	Management Practices
Pre-construction		A desktop study will be undertaken to identify the likely occurrence of this
		community within and directly adjacent to the site of the proposed

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Project Phase	Activity	Management Practices
	Infrastructure planning / siting	<ul> <li>development. The likely presence of the community will be established through a review of the following ecological and environmental databases:</li> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE and Regrowth mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence/absence, population status and area extent of this community prior to any clearing or associated works occurring. The surveys will target areas of mapped remnant and regrowth RE's directly adjacent to the active CSG development area.
		Where this community is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist, and consultation with SEWPaC.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		The location of this community will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the community will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, of TEC, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
Construction	Clearing	All vegetation clearing must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint remains adequately marked for the duration of clearing activities.
		Clearing activities within and adjacent to buffer areas will be supervised by the ER.
		DERM and SEWPaC will be notified of locations where this TEC has been recorded. This will be done as part of the annual reporting required as per the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).
	Access	Access is to occur along designated access tracks only.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.
Operation	Access	Access is to occur along designated access tracks only.

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Project Phase	Activity	Management Practices
		DERM and SEWPaC will be notified of new locations as part of annual reporting.
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.
	Pest Management	All requirements outlined within the PWMP will be implemented.
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).

#### **Monitoring Process:**

- Monitoring will be completed by suitably qualified ecologist/s;
- Monitoring methods for both flora and fauna are outlined in Appendix B; and
- Monitoring and rehabilitation of grasslands will be completed as outlined in the RRRMP.

#### **Community Specific Performance Criteria:**

• Rehabilitation of adversely impacted areas of Weeping Myall Woodland are completed in accordance with the RRRMP.

#### **Key Reference Documents:**

- DEWHA, 2009;
- TSCC, 2008l; and
- SEWPac 2011ar.



# 6.2.6. Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions

Status:

EPBC Act = Endangered

#### **Distribution:**



Plate 83: Distribution. Source: SEWPaC, 2011as

The Coolibah-Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregion (Coolibah-Black Box Woodlands) are associated with the floodplains and drainage areas of the Darling Riverine Plains and the Brigalow Belt South bioregions (TSSC, 2011a).

The extent Coolibah-Black Box Woodlands in Queensland is thought to have declined by approximately 82% (TSSC 2011b).

#### Known Locations within the CSG Fields:

Coolibah-Black Box Woodlands are not known to occur within Stage 1 of the CSG field development.

#### Key Diagnostic Characteristics:

Coolibah-Black Box Woodlands are defined by a canopy of *Eucalyptus coolabah* subs. *Coolabah* (Coolibah) and / or *Eucalyptus largiflorens* (Black Box). The structure ranges from tall woodland to very open woodland with sparse midlayers, and grassy ground layers. Canopy height ranges from five to 15m.

This TEC occurs on grey, self-mulching clays associated with periodically waterlogged floodplains, swamp margins, ephemeral wetlands, and stream levees, generally on a landscape with flat topography (TSSC, 2011b). To be a TEC, this community must comprise at least 50% Coolibah in the tree canopy, or where Black Box cooccurs, Coolibah and Black Box must comprise 50% of the tree canopy when combined. Additionally, the following condition thresholds apply (TSSC 2011b):

- The community must comprise a patch of at least 5ha; and
- The crown cover of trees must be greater than 8%; and



- Coolibah and/or Black Box myst be present in the patch that are either:
- Mature trees with a diameter at breast height (DBH) of greater than 30cm; or
- Hollow bearing trees (live or dead); or
- Coppiced trees with a main stem that has a DBH of greater than 20cm; and
- 10% or more of the ground cover must comprise native species; and
- The percentage on non-native perennial plant species does not exceed the percentage cover of native plant species (annual or perennial).

#### Regional Ecosystems Associations:

This TEC is associated with the following REs:

EPBC TEC	RE	VM Status	Biodiversity Status	CSG Field	RE Description
Coolibah- Black Box Woodlands	11.3.3	OC	OC	N/A	<i>Eucalyptus coolabah</i> woodland on alluvial plains
	11.3.15	OC	OC	N/A	Eucalyptus coolabah, Acacia stenophylla, Muehlenbeckia cunninghamii fringing woodland on alluvial plains
	11.3.16	LC	NC	N/A	<i>Eucalyptus largiflorens +/- Acacia cambagei +/- A. harpophylla woodland to low open woodland on alluvial plains</i>
	11.3.28	OC	OC	N/A	Casuarina cristata +/- Eucalyptus coolabah open woodland on alluvial plains
	11.3.37	LC	NC	NA	<i>Eucalyptus coolabah</i> fringing woodland on alluvial plains

#### Threats:

Common threats affecting this community from gas field development are outlined in **Table 1.7** (Section 1.11). Project specific threats include clearing associated with the development of infrastructure leading to loss of the TEC as well as fragmentation. Additionally, retained stands of Coolibah-Black Box Woodlands within the CSG fields may be exposed to increased edge effects such as potential weed invasion resulting from project activities. Management measures are outlined below to mitigate potential threats to this TEC.

#### Patch Size Criteria:

Under the EPBC Act, 5ha is considered to be minimum patch size for this TEC (TSSC 2011b).

#### Management Level:

Stage 1 of the CSG development will not result in the removal of this TEC. Where this TEC is observed, a buffer of 200m will be applied as per the Protocol during the initial planning phase of the development.

The management hierarchy outlined in the Protocol (Avoid, Minimise, Mitigate, Take and then Offset) will then be applied.



Where this community occurs, all efforts to protect this community will be undertaken where possible, as outlined in the below sections. Works within this area will require further assessment and advice from an Ecologist, and consultation with SEWPaC.

#### **Specific Management Requirements:**

Measures outlined below comply with the general guidelines of the EPBC Approval conditions, as well as EA conditions, and will be adhered to.

Project Phase Activity		Management Practices
Pre-construction	Infrastructure planning / siting	<ul> <li>A desktop study will be undertaken to identify the likely occurrence of this community within and directly adjacent to the site of the proposed development. The likely presence of the community will be established through a review of the following ecological and environmental databases: <ul> <li>Santos CSG Fields Ecological Constraints Database;</li> <li>Consultation with Queensland Parks and Wildlife Service;</li> <li>DERM's RE and Regrowth mapping;</li> <li>Aerial and/or satellite imagery; and</li> <li>Discussion with land managers, site manager and/or the ER.</li> </ul> </li> </ul>
		Pre-clearing surveys will be undertaken by a suitably qualified ecologist(s) to determine the presence/absence, population status and area extent of this community prior to any clearing or associated works occurring. The surveys will target areas of mapped remnant and regrowth RE's directly adjacent to the active CSG development area.
		Where this community is identified, a 200m buffer will be implemented. Any works within the 200m buffer will require further assessment and advice from a qualified ecologist, and consultation with SEWPaC.
		Where a Constraint Class B area is identified, it is to be incorporated on future constraints mapping.
		The location of this community will be recorded in Santos's CSG Fields Ecological Constraints Database. In addition, the community will be reported to DERM and SEWPaC as part of Annual Reporting.
	Site Induction / Work Instruction	Prior to site entry, all relevant site personnel including contractors shall be appropriately trained and made aware of the sensitive environs in which they will be working, including the extent of works, of TEC, and buffer areas (refer Section 7).
	Site preparation	Prior to the commencement of site works, the limits of clearing will be clearly marked out. Temporary fencing, such as barricade webbing or similar, should be used to define the extent of clearing.
Construction	Clearing	All vegetation clearing must comply with clearing approval conditions (e.g. EPBC Act, EP Act, NC Act and other statutory approvals).
		Ensure that the clearing footprint remains adequately marked for the duration of clearing activities.
		Clearing activities within and adjacent to buffer areas will be supervised by the ER.
		DERM and SEWPaC will be notified of locations where this TEC has been recorded. This will be done as part of the annual reporting required as per

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Project Phase	Activity	Management Practices	
		the Protocol or via the Return of Operations required under the NC Act Clearing Permit (project reporting (refer Section 9).	
Access		Access is to occur along designated access tracks only.	
	Pest Management	All requirements outlined within the PWMP will be implemented.	
	Exclusion Zones	Where required, fencing, flagging tape or similar will remain in place to clearly identify the extent of disturbance.	
Operation	Access	Access is to occur along designated access tracks only.	
		DERM and SEWPaC will be notified of new locations as part of annual reporting.	
	Rehabilitation	Progressive habitat rehabilitation of disturbed areas will be conducted as per the RRRMP.	
	Pest Management	All requirements outlined within the PWMP will be implemented.	
Decommissioning	Rehabilitation	Rehabilitation of disturbed areas will be conducted as per RRRMP.	
	Pest Management	All requirements outlined within the PWMP will be implemented.	
	Decommissioning and Demolition	Decommissioning and demolition will be conducted as per the <i>Decommissioning and Demolition Management Plan</i> (DDMP).	

#### **Monitoring Process:**

- Monitoring will be completed by suitably qualified ecologist/s;
- Monitoring methods for both flora and fauna are outlined in Appendix B; and
- Monitoring and rehabilitation of grasslands will be completed as outlined in the RRRMP.

#### **Community Specific Performance Criteria:**

 Rehabilitation of adversely impacted areas of Weeping Myall Woodland are completed in accordance with the RRRMP.

#### **Key Reference Documents:**

- SEWPaC 2011as;
- TSSC 2011a; and
- TSSC 2011b



# 7. Training and Awareness

All relevant personnel, contractors and visitors are required to undertake appropriate environmental training and induction programs prior to working within the CSG fields.

As part of the training program, all relevant project personnel are required to complete site specific environmental awareness training which is to be conducted by the ER and will address the following:

- Species targeted by the SSMP (awareness training);
- Location of sensitive areas (e.g. wetlands and habitat trees);
- Vegetation protection areas and no go zones;
- Procedures and actions associated with encountering fauna;
- Threatened species habitat areas;
- Weed identification and control; and
- Responses and reporting of environmental issues.

This training will be developed with the assistance of a suitably qualified ecologist and delivered by the ER. This will be undertaken within the initial induction process and ongoing toolbox meetings.

Where possible, relevant personnel will also be shown photographs and given general information on significant species and ecological communities identified within and adjacent to the CSG fields, which will enable them to identify some key threatened species should they be encountered.



# 8. SSMP Revision and Reporting

#### 8.1. Revision

If a material change of the SSMP is required, the GLNG Management of Change (MOC) Process will be utilised, as per the Protocol. Examples of changes that will require the implementation of the MOC Process and a revision of the SSMP include:

- an unauthorised impact occurring on a MNES as a direct or indirect result of CSG development undertaken by Santos or other operators;
- identification of a new listed species or communities within the CSG fields;
- a change in the protection status of a listed species or ecological community;
- a change in relevant approval conditions for the project;
- planning for the commencement of a new major stage of the CSG field development (review 6 months before);
- reaching the three year review period; and
- a written request from the Minister.

The SSMP will be updated by an ecologist approved by the Commonwealth. Updates will take into account information provided by the Commonwealth or Queensland Government agencies, information made available by other CSG proponents and input from independent reviews. All relevant stakeholders will be engaged to review changes. Updates of this SSMP will be at the financial cost of Santos. The revised SSMP will be submitted to the Minister for approval.

During the project the ER will regularly review the conservation status of flora and fauna species by keeping abreast of relevant literature and through consultation with DERM and SEWPaC.

A record of all documentation required by the relevant EA will be kept for a minimum of five years and be made available to an authorised person upon request.

## 8.2. Reporting

GLNG are required to produce Annual Environmental Returns to satisfy the EPBC Approval. The Annual Environmental Return for the EPBC Approval will:

- Address compliance with the conditions;
- Include records of any unavoidable adverse impacts on MNES, mitigation measures applied to avoid adverse impacts on MNES, and any rehabilitation work undertaken in connection with unavoidable adverse impacts on MNES;
- Identify all non-compliance with the conditions and provide details regarding complaints; and
- Identify any amendments needed to plans to achieve compliance with the conditions.

**Table 8.1** outlines a review and reporting program for the SSMP. The program includes provision for periodic review as required, as well as revision as part of the Protocol and Operational Plans. A revision register has been included at the beginning of this document to ensure all amendments are documented.



#### Table 8.1: Review/revision of SSMP after Pre-construction Surveys

Timing	Requirement	Responsibility			
Review					
Annual	<ul> <li>Revision of SSMP to ensure:</li> <li>additional requirements / amendments to conditions are updated;</li> <li>changes in protection status, recovery plans and action statements are included; and</li> <li>Additional listed species and communities are incorporated where applicable.</li> </ul>	Santos Suitably Qualified Ecologist			
With revised FDP	Where The Protocols are updated, the SSMP is to be reviewed to ensure compliance	Santos			
With revised Operational Plan	Where Operational Plans are updated, the SSMP is to be reviewed to ensure compliance. Operational Plans are reviewed every three years.	Santos			
Written request of Minister	Incorporate all reasonable requests of the minister.	Santos			
Reporting					
Annual Return to SEWPaC as per Commonwealth conditions	<ul> <li>Annual Environmental Return:</li> <li>Address compliance with the conditions;</li> </ul>	Santos Suitably Qualified Ecologist			
Return of Operations as per Coordinator-General conditions	<ul> <li>Include records of any unavoidable adverse impacts on MNES, mitigation measures applied to avoid adverse</li> </ul>				
Annual Return for EA to DERM	impacts on MNES, and any rehabilitation work undertaken in connection with unavoidable adverse impacts on MNES;				
	Identify all non-compliance with the conditions and provide details regarding complaints; and				
	<ul> <li>Identify any amendments needed to plans to achieve compliance with the conditions.</li> </ul>				



# 9. Correction and Prevention

#### 9.1. Preventative Actions

Preventative actions will be managed as follows:

- Environmental incidents along with their corrective and preventative actions will be recorded in the Santos Incident Management System (IMS). Corrective and preventative actions will be updated in the Field MP, FMPs and this SSMP. Future audits will check for compliance to ensure necessary preventative actions are in place;
- Reviews of environmental performance will be undertaken through consideration of key performance indicators, objectives and targets, and benchmark performance; and
- Where assessed by the ER (as necessary), a preventative action will be raised and action undertaken as a Corrective Action. Preventative actions may include changes to specific procedures or training requirements, or other management areas.

#### 9.2. Non-compliance

An environmental non-compliance with conditions will be detected through verification processes such as monitoring, inspections, audits and receipt of complaints.

The process for managing environmental non-compliance will be in accordance with Santos' Internal Project Policies and Procedures. When an environmental issue is detected, the following actions will occur:

- The incident will be recorded in the Santos IMS;
- The nature of the event will be investigated by the ER;
- Advice may be sought from a specialist where the extent of the issue is beyond the expertise of the in- house resource;
- Monitoring will be undertaken where the issue is complaint driven and the impact may be outside the project parameters;
- The effectiveness or need for new / additional controls will be reviewed;
- Appropriate preventative and corrective action/s will be entered into the environmental IMS and implemented;
- Strategies will be identified to prevent reoccurrence and will be implemented;
- The IMS record will be closed-out; and
- Environmental documentation (i.e. FMPs and SSMP) will be reviewed and revised.

Where the non-compliance issue impacts on a third party (i.e. is outside the CSG fields or in breach of regulatory conditions) the ER will also issue a Non-compliance Incident Report. In addition to the above, where a non-compliance issue of a more serious nature has been identified, the following will apply:

- Stop work;
- Implement an immediate action to rectify the incident and stop further damage;
- Report the incident to the ER;
- Identify corrective and preventative actions;



- If the incident impacts upon state or commonwealth interests, the incident report will be forwarded to the relevant authority by the ER;
- The incident will be reported in monthly management reports; and
- Associated environmental issues and corrective actions will be tracked.

Unauthorised impacts to MNES will be recorded by a suitably qualified ecologist within five business days of Santos becoming aware of the impact. The name and qualifications of the person undertaking the assessment will be recorded on the report.

### 9.3. Contingency Measures

Santos recognises that contingency measures and adjustments to the management strategies may need to be considered in the event that a detrimental impact is recorded, and/or performance measures or targets are not met.

In the event that additional conservation-significant species (other than identified in this plan) are identified within the CSG fields during pre-clearance surveys or construction activities, SEWPaC and DERM will be consulted and contingency measures determined and implemented, where required. If the SSMP is required to be changed in any way, the MOC Process will be utilised as per the Protocol to ensure their immediate implementation.

In the event that aquatic or terrestrial fauna are injured or killed during works or where there is illegal clearing of native vegetation, the current mitigation strategies outlined in this SSMP will be reviewed in conjunction with a suitably qualified ecologist. New mitigation measures will be discussed with SEWPaC and DERM prior to implementation. If the SSMP is required to be changed in any way, the MOC Process will be utilised as per the Protocol to ensure their immediate implementation.

#### 9.4. Environmental Incidents and Corrective Actions

All incidents in breach of state or commonwealth law, regulation or policy will be reported to the relevant regulatory authority in accordance with the conditions of the statutory approval. Non-specific environmental incidents are discussed in detail in the EMP. The incident reporting form is included in the EMP.

Detailed below are actions that will be taken should an incident occurt relating directly to flora and fauna.

#### 9.4.1. Flora

All EPBC listed plant species will be managed as per this SSMP (Section 4). Where practicable, plants will be relocated prior to clearing works commencing. All plant species listed as Type A under the NC Act will be managed as per the Type A Restricted Plant Species Salvage Management Plan (Santos 2011g). If a plant that has been identified as threatened or significant, is suspected of being so or is unintentionally uprooted during clearing operations, the following actions will occur:

- The ER shall be notified and advice sought as to appropriate measures to ensure successful transplantation
  of the plant (Dependant on the species type and size, plants can generally be replanted straight away in an
  area marked as a 'No Go' or rehabilitation zone);
- If the species can be replanted in its original location, monitoring and follow up management (including watering) of the species should occur over the duration of the construction period to ensure it has successfully re-established;



- If the species cannot be replanted (e.g. is too damaged or habitat has been destroyed) a solution will be reached with SEWPaC;
- Current mitigation strategies outlined in this SSMP will be reviewed in conjunction with a suitably qualified ecologist;
- If the SSMP requires amending, the MOC Process will be utilised as per the Protocol to ensure changes are implemented; and
- Refer to the RRRMP for detailed rehabilitation and revegetation measures.

If vegetation outside the approved clearing footprint within the CSG fields development area is incorrectly cleared:

- The ER must be notified immediately and a stop work must occur until the situation has been assessed and is given approval to proceed by Santos;
- The Spotter catcher(s) will conduct a search for any injured or orphaned wildlife; and
- If native vegetation was impacted a report will be provided to SEWPaC and management measures agreed.

#### 9.4.2. Fauna

If a native animal is injured on site the ER or Fauna / Spotter Catcher will be immediately notified to attend and handle the animal. The animal will be bundled in a dry warm blanket or jacket and taken to a vet or approved wildlife carer (do not attempt to handle snakes or platypus). If it is unsafe or not possible to bundle the animal then:

- The location of the injured animal will be identified/marked so it can be found again. If the animal is moving, a note will be made of the direction in which it was headed;
- The species of animal will be identified if possible and its approximate size determined;
- The type of injury sustained will be identified if possible (without handling or causing the animal further stress); and
- The ER will be contacted immediately to capture or organise the possible capture of the animal for transportation to a specialist veterinarian or wildlife carer. The ER shall immediately contact the following organisations listed in Table 9.1 and provide details of the last known location of the injured/dead animal.

#### Table 11: Contact Details in the Event of an Injury to or Death of Native Wildlife (incl. marine)

Organisation	Contact Details
QPWS Office or DERM	1300 130 372

Following the capture/recovery of the animal, an investigation into the cause of the event will be undertaken within 72 hours including an assessment of the effectiveness of corrective and preventative actions currently in place.

Any corrective and preventative actions identified will be implemented. The risk register, relevant procedures and documentation (including this plan) will be reviewed and revised as is necessary.

The SSMP will be reviewed in conjunction with a suitably qualified ecologist. New mitigation measures will be discussed with SEWPaC and DERM prior to implementation. If the SSMP is required to be changed in any way to reflect changes to control measures, the MOC Process will be utilised as per the Protocol to ensure their implementation.

Prior to construction, a list of suitably licensed and experienced wildlife carers, hospital and/or vets local to the development area will be compiled and included within this Plan.



#### 9.4.3. Threatened Ecological Communities

All TEC are protected under the EPBC Act and VM Act and will have management plans, including allowable disturbance limits, in place. Where possible the disturbance of TEC should be avoided and cleared or previously cleared areas utilised.

If a TEC that has been identified as threatened or significant, is suspected of being so or is unintentionally cleared during construction or operations, the following actions will occur:

- Santos will issue a "stop work" order, upon which all work will cease until the non-compliance has been rectified and measures implemented to prevent the breach re-occurring;
- If plants have been damaged, refer to the flora section of this plan for actions;
- If fauna have been injured or killed, refer to the fauna section of this plan for actions;
- Current mitigation strategies outlined in this SSMP will be reviewed in conjunction with a suitably qualified ecologist;
- If the SSMP requires amending, the MOC Process will be utilised as per the Protocol to ensure changes are implemented; and
- Refer to the RRRMP for detailed rehabilitation and revegetation measures.

If vegetation outside the approved clearing footprint within the CSG fields development area is incorrectly cleared:

- The ER must be notified immediately and a stop work must occur until the situation has been assessed and is given approval to proceed by Santos;
- The Spotter catcher(s) will conduct a search for any injured or orphaned wildlife; and
- If native vegetation was impacted a report will be provided to SEWPaC within one business day of Santos becoming aware of the impact and management measures agreed.

#### 9.4.4. Rehabilitation, Remediation, Recovery and Monitoring

Where a direct or indirect impact has occurred to an environmental sensitive area, including MNES, Santos will apply remediation, rehabilitation and recovery measures appropriate for each environmental sensitive area, including MNES to minimise cumulative impacts throughout the life of the project. Rehabilitation of the gas fields will allow for the maximum re-establishment of native vegetation including the shrubby understorey and ground cover, providing habitat for small ground dwelling fauna species and restoration of landscape connectivity. Santos has prepared a Remediation, Rehabilitation, Recovery and Monitoring Plan (RRRMP, Santos Document Number: 0020-GLNG-4-1.3-0012). The RRRMP enables Santos to implement a staged rehabilitation program in line with the proposed development of the CSG fields.

The RRRMP addresses all relevant rehabilitation conditions that are outlined in the EPBC Approval, the CG Report and the relevant environmental authorities for the development of the CSG fields. The RRRMP:

- Includes site remediation measures including timeframes and standards for preventing erosion and stabilising disturbed soil in impact areas;
- Includes measures to support recovery of listed species' habitat and recovery of listed ecological communities affected by the gas field development;
- Includes responses to threats to environmental sensitive areas, including MNES from Santos' operational
  activities and land management activities including the disposal and use of CSG water, damage by livestock
  and impacts from weeds and pest animals;



- Provides for fire management regimes appropriate for the rehabilitation of areas, including MNES;
- Includes performance measures and related monitoring to assess site remediation, rehabilitation and recovery;
- Provides for reporting on the implementation of the RRRMP, including monitoring and performance to a standard that can be independently audited; and
- Refers to relevant conservation advice, recovery plans, species management plans, or policies, practices, standards or guidelines endorsed or approved from time to time by the Department or the Minister.

Progressive rehabilitation of disturbed sites will occur as soon as practicable following the completion of works, as required State and Commonwealth approval. Upon cessation of the petroleum activities, the CSG infrastructure will be decommissioned in accordance with the statutory requirements outlined in the Petroleum and Gas Act 2004 (P&G Act) and other relevant State approvals. Final rehabilitation will then commence as soon as practicable.

Benchmark guidelines have been developed for a range of broad ecosystem groups, including three TEC, to be supplemented with pre-clearing data. The benchmark guidelines provide an indicative list of threatened species occurring in each broad ecosystem group, based on the SSMP. Rehabilitation schedules have been developed to guide rehabilitation within the three TEC to which disturbance is allowed under EPBC Approval. Rehabilitation schedules have been developed for each disturbance type that is authorised for disturbance as part of the Stage 1 development of the RFDA, and address a range of broad ecosystem groups. Performance criteria to monitor the progress of each rehabilitation site have been included within each benchmark schedule. The performance criteria relate to targets included within the benchmark guidelines that have been set based on pre-clearing data.

Species specific rehabilitation management actions have been developed for all listed threatened fauna (Appendix 4 of the RRRMP). Additionally, rehabilitation schedules developed as part of the RRRMP outline broad fauna management actions including the need for sequential clearing, and the use of fauna spotters to ensure the welfare and safe handling of fauna. Fauna management actions are reflective of the FMPs prepared for the CSG fields, the SSMP, and the Protocol.

Regular monitoring over a 3 to 5 year period will be required at the completion of the rehabilitation works to ensure that the objectives of the rehabilitation schedule are being achieved, as per EA conditions. Monitoring will be undertaken by a suitably qualified person (e.g. restoration ecologist). A detailed monitoring plan is included within Appendix 5 of the RRRMP, and includes reference to monitoring requirements listed within the SSMP.

It is noted that while 3 years is insufficient time for rehabilitation to meet the benchmark guidelines, it is sufficient to ensure that rehabilitation is well established and regenerating, as an improvement in BioCondition scoring should be clearly evident. The progression and improvement of key rehabilitation indicators such as species composition and diversity, weed cover, and plant densities will be evident over a three year period. Rehabilitation is considered complete when all performance criteria outlined in the rehabilitation schedules are met at the completion of the monitoring period, generally 5 years for erosion and subsidence, and 3 years for ecological characteristics.

Monitoring periods may require extension in the case of ineffective rehabilitation or natural disasters impeding rehabilitation efforts. Where monitoring extensions are required, it will be recorded and implemented by Santos, as outlined in the Protocol. In circumstances where the rehabilitation does not meet performance criteria following an extension of monitoring and maintenance, DERM will be notified. SEWPaC will be notified where TECs have failed to meet performance criteria.



## 9.5. Emergency Preparedness and Response

An Incident Response Plan will be prepared for the project and will be outlined in the EMP. This plan will document suitable incident procedures to ensure effective response in the event of an emergency (including environmental emergencies such as fire, flood and large fuel spills).

The emergency procedures shall be tested on a six-monthly basis. Records of all site emergencies will be maintained (including results of emergency practice drills). The Emergency Response Controller for the project will be defined within the Incident Response Plan.

An up-to-date list of emergency response personnel and organisations will be maintained at each site office and compound.



## **10. Compliance and Evaluation**

The compliance component of this Plan has been developed in accordance with the EMP, State and Commonwealth approvals to ensure auditing is possible by a third party. Santos will undertake internal auditing on a regular basis. Third party audits will be undertaken annually to comply with the CG Report and on a three yearly basis for the EAs. Third party audits will also be undertaken to ensure compliance with the EPBC Approval upon request by the Department. Where the auditing process identifies any improvements, the SSMP may be updated to reflect any changes.

As outlined in **Section 8.0**, this plan will be periodically reviewed by a qualified ecologist approved by the Commonwealth, to take into account any new information and advice provided by Commonwealth or Queensland Government agencies, or available from other CSG proponents. Events triggering a review of this plan are listed in **Section 8.0**.

### 10.1. Ecological Performance Auditing

The regulatory agencies associated with environmental matters may also conduct regular works inspections. The relevant ER shall attend these inspections

- Santos will conduct internal compliance audits of the implementation of environmental management commitments during the construction and operational phases, including:
- On-site audits of compliance with this management plan;
- Audits of contractors' environmental management; and
- Work area inspections and monitoring.

Non-conformances identified during inspections will be documented, addressed with appropriate corrective and preventive actions and rectified within an agreed time frame.

External audits will be undertaken on an annual basis by an independent auditor. The audits will be conducted in accordance with AZ/NZ ISO9011:2003 Guidelines for Quality and/or Environmental Systems Auditing.



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