

Preliminary documentation for EPBC Act assessment

Santos Towrie Development

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Santos Towrie Development
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Client: Santos Limited

ABN: 80 007 550 923

Prepared by

AECOM Australia Pty Ltd

Level 8, 540 Wickham Street, PO Box 1307, Fortitude Valley QLD 4006, Australia

T +61 7 3056 4800 www.aecom.com

ABN 20 093 846 925

17-May-2022

Job No.: 60626642

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Executive summary

Santos CSG Pty Ltd (Santos), on behalf of joint venture parties PAPL (Upstream) Pty Limited, Total E&P Australia III, KGLNG E&P Pty Ltd, and Australia Pacific LNG (CSG) Pty Limited, is proposing a gas field project to supply natural gas to commercial markets through existing approved infrastructure developed as part of the Santos GLNG and Santos Gas Field Development Projects in the Bowen Basin.

The Project, referred as the Towrie Development (EPBC No. 2021/8979), will involve the construction, operation, decommissioning and rehabilitation of up to 116 gas wells and supporting infrastructure within Petroleum Lease (PL) 1059; currently under application to replace the existing exploration tenure, Authority to Prospect (ATP) 2033.

The Project has authorisation under the Queensland *Environmental Protection Act 1994* (Environmental Authority (EA) EA-P-100130995) and PL 1059 is expected to be granted under the Queensland *Petroleum and Gas (Production and Safety) Act 2004* in early 2022. The Project will utilise capacity approved within existing gas and water management facilities on nearby Santos tenure to limit petroleum activities and associated impacts to the minimum required to access and produce gas (less than 10 percent of the Project Area).

The Project was referred to the Minister for Environment 29 June 2021. On 28 July 2021 the delegate of the Minister for the Environment determined the project is likely to have a significant impact on the following matters protected under Part 3 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- Listed threatened species and communities (section 18 & section 18A)
- A water resource, in relation to coal seam gas development and large coal mining development (section 24D & section 24E).

It was determined that additional information (Preliminary documentation) is required to inform assessment and a decision on the Project under the EPBC Act.

Preliminary documentation has been prepared to address the additional information requirements set out by the Department of Agriculture, Water and the Environment (DAWE) (received 27 August 2021). It consolidates and references:

- The information contained in the original referral
- The further information requested on the impacts of the action and the strategies Santos propose to avoid, mitigate and offset those impacts
- Other relevant information on the matters protected by the EPBC Act as identified in the additional information requirements.

Detailed assessments of these matters provided in Ecology Assessment (Attachment C) and the Water Assessment (Attachment D) are well supported by documentation to demonstrate Santos' commitment to ensure potential impacts will be systematically planned, identified, assessed and adequately managed.

Santos' commitments are outlined in the management plans provided as attachments to this preliminary documentation package. Based on extensive experience in gas field development in the Surat and Bowen Basins, Santos has adapted existing approved management plans to address site-specific MNES values. These management plans are presented as final documents to be approved and conditioned for implementation when construction commences in 2022, including:

- Environmental Protocol for Constraints Planning and Field Development (Environmental Protocol) (Santos, 2021a) – Attachment B
- Ecology Assessment (AECOM, 2021a) – Attachment C
- Water Assessment (KCB, 2021) – Attachment D
- Chemical Risk Assessment (EHS Support, 2021) – Attachment E

- Environmental Management Plan (Santos, 2021b) – Attachment F
- Significant Species Management Plan (Santos, 2021c) – Attachment G
- Rehabilitation Plan (Santos, 2021d) – Attachment H.

Through implementation of the Project in accordance with the management plans and existing approvals, the assessment determined that the Project is unlikely to result in significant impacts to known, likely or potential MNES values within the Project Area. As such, offsets are not required in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012).

1.0 Introduction

1.1 Overview

Santos CSG Pty Ltd (Santos), on behalf of joint venture parties PAPL (Upstream) Pty Limited, Total E&P Australia III, KGLNG E&P Pty Ltd, and Australia Pacific LNG (CSG) Pty Limited, is proposing a gas field project to supply natural gas to commercial markets through existing approved infrastructure developed as part of the Santos GLNG and Santos Gas Field Development Projects in the Bowen Basin.

The Towrie development (the Project, EPBC No. 2021/8979) will involve the construction, operation, decommissioning and rehabilitation of up to 116 gas wells and supporting infrastructure within Petroleum Lease (PL) 1059; currently under application to replace the existing exploration tenure, Authority to Prospect (ATP) 2033. The Project has authorisation under the Queensland *Environmental Protection Act 1994* (Environmental Authority EA-P-100130995) and PL 1059 is expected to be granted under the Queensland *Petroleum and Gas (Production and Safety) Act 2004* in early 2022. Additional information is required for assessment by Preliminary Documentation to inform assessment and decision on the Project under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.2 Project approval background

The EPBC Act establishes a process for environmental assessment and approval of proposed actions that have, will have or are likely to have a significant impact on Matters of National Environmental Significance (MNES) or on Commonwealth land. Under the EPBC Act, a referral to the Commonwealth Department of Agriculture, Water and Energy (DAWE) is required if the Project has the potential to cause a 'significant impact' on MNES.

For MNES assessed in accordance with the Significant Impact Guideline 1.1 – Matters of National Environmental Significance (DotE, 2013a), a 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

The Project was referred on 18 June 2021 for potential impacts to MNES (EPBC No. 2021/8979). On 28 July 2021, the delegate of the Minister for the Environment determined the project a 'controlled action' likely to have significant impact on the following matters protected under Part 3 of the EPBC Act:

- Listed threatened species and communities (section 18 and 18A)
- A water resource, in relation to coal seam gas development and large coal mining (section 24D and 24E).

The proposed action will be assessed by Preliminary Documentation (PD) with further information.

This document, the PD, addresses the additional information required for assessment (Request for Information (RFI), dated 27 August 2021) to allow the Minister (or delegate) to make an informed decision to approve, under Part 9 of the EPBC Act, the taking of the action for the purposes of each controlling provision.

Prior to public notification, the PD was reviewed by the DAWE and Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC). Santos' response to this advice has been incorporated within the PD (refer to Attachment J).

1.3 Project background and site description

Located approximately 90 kilometres (km) south of the township of Rolleston in Central Queensland, the Project Area comprises approximately 87 km² over ten freehold rural properties (Figure 1) and is situated within the Central Highlands Regional Council area, with small sections of the western ridgeline falling within the Maranoa Regional Council area.

Land uses within and surrounding the Project Area are primarily agriculture (cattle grazing, limited cropping) and forestry, with resource exploration and production tenures extensive across the region. The Arcadia Valley State School is located on Arcadia Valley Road within the Public Reserve in the northeast of the Project Area. The state-controlled Carnarvon Highway to the west of the Project Area provides efficient access for local and heavy vehicle traffic.

The Project will supply natural gas to commercial markets through existing gas field infrastructure east of Arcadia Valley Road developed as part of the Santos Gladstone Liquefied Natural Gas (GLNG) Project (EPBC 2008/4059) and GLNG Gas Field Development (GFD) Project (EPBC 2012/6615). PL 1059 is currently under application to replace the existing exploration tenure, ATP 2033. Existing petroleum tenure surrounding the Project includes PL 1062 (under application), PL 220 (granted) and PL 420/PL 421 (granted); Coal exploration permits (EPC 2432 and EPC 1772) overlap the Project Area. Petroleum pipelines (PPL 166 and PPL 30) occur near the Project Area and provide the gas transmission route to Gladstone.

The target gas producing formation for the Project is the Bandanna Formation, of the Permo-Triassic Bowen Basin. Located within the Surat Cumulative Management Area, relevant groundwater systems include Quaternary deposits comprising alluvium associated with the Arcadia Creek, Cenozoic sediments, Triassic Clematis Group and Rewan Group, and Permian coal measures.

Groundwater is predominantly used for stock and domestic purposes within the vicinity of the Project Area. Most of these stock and domestic third-party bores are located approximately 20 km to 30 km north and northwest of the Project Area, typically screened in the Quaternary alluvium of Moolayember Creek and Brown River. One bore (RN 13050003) was previously installed within the Project Area sourcing water from the Rewan Group. The groundwater level recorded in this Rewan Group bore was ~21 m below the ground surface, however, this bore has been abandoned and destroyed.

There are limited potential groundwater dependent ecosystems (GDE) within the vicinity of the Project. Potential terrestrial GDEs (identified from GDE mapping datasets) are located outside the vicinity of the Project Area and are listed as moderate- and low-confidence GDEs. Groundwater depth greater than 21 m below ground level supports the low to moderate-confidence GDE category.

The Project Area occurs in the upper reaches of the Comet River catchment, part of the Fitzroy Basin. Watercourses within the Project Area are ephemeral and only flow during and immediately after significant rain events. Typical of subtropical climate, more than 50 percent of the annual average rainfall (more than 600 millimetres (mm)) falls during late Spring and Summer, which also corresponds with highest evaporation rates (200-300 mm during the Summer period). Farm dams and constructed wetlands across the Project Area capture stormwater runoff from the flood plains during high rainfall events and are routinely accessed for agricultural purposes (e.g. stock watering and irrigation).

The Project Area is mostly within the Arcadia subregion of the Brigalow Belt Bioregion; the terrain of the eastern, southern and western Arcadia subregion is rugged and situated on coarse sandstones with *Eucalyptus* spp. and *Corymbia* spp. Woodland communities. Where clay soils occur, vegetation is dominated by *Acacia harpophylla* (brigalow) and some softwood scrub, and by *Eucalyptus populnea* (poplar box) where soils are alluvial. While the plains are gently undulating at approximately 300-400 metres (m) Australian Height Datum (AHD), the terrain elevates to form Middle Hill and the escarpment on the western boundary (western ridgeline) at approximately 600 m AHD.

Vegetation and habitat within the Project Area vary significantly in quality and extent. The expansive valley floor is dominated by exotic grassland (predominantly buffel grass) and is generally highly disturbed due to historical clearing, incursion of exotic species including cropping plants and agricultural practices such as blade ploughing and cattle grazing. Higher quality remnant vegetation is associated with the western ridgeline (2TR13 and 4SP283873), Middle Hill (4SP283873) the Public Reserve (12CP864585) in the north east of the Project Area.

1.4 Structure and content

The structure and content of the PD is as follows:

Section of document	Content
1. Introduction	Introduces the project and background, briefly describes the site and identifies the structure and content of the document
2. Description of the Project	Describes the Project Addresses Section 1 of the RFI
3. Habitat assessment	Summarises the findings of the Matters of National Significance – Ecology Assessment (AECOM 2021) Addresses Sections 2.1 and 2.2 of the RFI
4. The Protocol	Summarises the Environmental Protocol for Constraints Planning and Field Development (Santos 2021) Addresses Section 2.3 of the RFI
5. Water resources	Summarises the findings of the Water Assessment (Attachment D) Addresses Section 2.4 of the RFI
6. Chemical risk	Summarises the chemical risk assessment framework approach Addresses Section 2.5.1 of the RFI
7. Impact assessment	Addresses Section 3 of the RFI
8. Avoidance, mitigation and management measures	Addresses Section 4 of the RFI
9. Rehabilitation requirements	Addresses Section 5 of the RFI
10. Offsets	Addresses Section 6 of the RFI
11. Ecologically sustainable development	Addresses Section 7 of the RFI
12. Economic and social matters	Addresses Section 8 of the RFI
13. Environmental record	Addresses Section 9 of the RFI
14. Conclusion and recommendations	Summarises the final assessment outcomes for the Project
15. References	Reference list
Attachment A	Cross-reference table of all RFI requirements
Attachment B	Environmental Protocol for Constraints Planning and Field Development (Santos, 2021a) – updated since submission of the referral
Attachment C	Ecology Assessment (AECOM, 2021a) – updated since submission of the referral
Attachment D	Water Assessment (KCB, 2021) – updated since submission of the referral
Attachment E	Chemical Risk Assessment (EHS Support, 2021)
Attachment F	Environmental Management Plan (Santos, 2021b) – updated since submission of the referral
Attachment G	Significant Species Management Plan (Santos, 2021c) – updated since submission of the referral
Attachment H	Rehabilitation Plan (Santos, 2021d) – updated since submission of the referral
Attachment I	Environmental Authority (EA) P-EA-10010995 for PL 1059
Attachment J	Response to IESC advice

2.0 Description of the Project

RFI 1.1

"Include updated information if any changes have been made to the project since the referral documentation was submitted."

There have been no changes to the nature or scale of development since the referral was made in June 2021. Some refinements to proposed mitigation measures and methods used to plan and execute gas field development have been made following the detailed assessment of the Project and in response to the request for further information. The Environmental Protocol for Constraints Planning and Field Development, Environmental Management Plan and other supporting documents have been updated accordingly as outlined in Section 1.4.

The Project description, as described in the referral, is summarised below.

2.1 Proposed infrastructure

The Project will involve the progressive construction, operation, decommissioning and rehabilitation of up to 116 vertical production wells, linear gas and water gathering networks and other supporting infrastructure. It will also include the connection of at least one existing exploration well to gas and water gathering infrastructure and production of gas from that well.

The Project will involve progressive development of typical gas field infrastructure components such as:

- Well leases (from 1 ha for single well lease and up to 2.5 ha for multi-well lease)
- Water and gas gathering lines, trunklines and pipelines (10-25 m wide)
- Roads and access tracks (8-15 m wide)
- Supporting infrastructure, which may include small temporary workers camps (less than 1 ha), power and communications lines (co-located with gas gathering lines, trunklines and pipelines) and other incidental petroleum activities such as borrow pits and laydown areas (less than 1 ha).

Well development will be phased to optimise gas production to meet Santos' gas supply obligations and opportunities. The Project will utilise approved capacity of existing gas compression and water treatment facilities located on adjoining tenures; no new gas compression facilities or water storages are proposed as part of the Project. Once operational, the gas will supply commercial markets.

Progressive decommissioning and rehabilitation of activities and infrastructure will occur over the life of the Project, reducing disturbance footprints of construction for the duration of operation, until final decommissioning and rehabilitation at end of project life.

2.2 Construction

Construction of the initial stage of development is expected to occur from mid-2022. The precise number and timing of wells, and location and configuration of infrastructure components for subsequent project stages, will be determined by a range of considerations including ongoing resource exploration, production results and constraints planning undertaken throughout the life of the proposed action.

2.2.1 Wells

A well lease will be constructed to accommodate drilling and well completion equipment and support services. Typically, well construction will involve a drill rig and other equipment including flare, flare sump and storage for fuel, chemicals, drilling fluids, produced water and raw water supply. Hydraulic fracture stimulation will be used to complete the wells. On well completion, a pump will be installed to depressurise the coal seam and facilitate gas production. An operational production well lease will generally include gas and water metering, separation and filtering equipment, electrical and control systems and water and gas pipeline connections.

Well construction will comply with the *Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland* (DNRME, 2019), which sets minimum standards to achieve long term well integrity.

Well construction will involve the use of drilling muds, and hydraulic fracturing fluids where hydraulic fracturing stimulation is required (refer to section 4.2 of the EMP – Attachment F). Produced water and waste drilling muds/hydraulic fracturing fluids will be generated and managed in accordance with section 4.3 of the EMP (Attachment F).

Operation of wells, including management of produced water, is described in Section 2.3.

2.2.2 Water and gas gathering lines and pipelines

A construction right-of-way approximately 10-25 m wide will be required for standard gathering line/pipeline construction including excavation of a trench, pipeline laying, backfilling the trench, and reinstatement of the right-of-way. Pipelines will transfer gas and water from the wells to existing approved gas and water management facilities on adjoining tenures in Arcadia Valley and utilise available capacity to the limits already authorised by relevant environmental approvals.

No gas compression or treatment facilities will be developed within the Project Area.

No water storages will be developed within the Project Area. Where required, prefabricated water storage tanks will be assembled for temporary storage only.

2.2.3 Roads and access tracks

Construction of a typical access road (8-15 m wide) will accommodate heavy and light vehicles associated with project activities. Wherever practicable, existing access tracks will be upgraded for use and new access roads will be co-located with gas and water gathering networks to reduce the overall construction footprint.

2.2.4 Supporting infrastructure and activities

A small temporary facility may be required to provide accommodation for workers during construction and drilling activities. This facility will be assembled onsite from prefabricated modular units with basic amenities such as water tanks and modular sewage treatment plants.

Other supporting infrastructure and incidental petroleum activities required to support the construction and operation of activities may include:

- Temporary water storage tanks
- Power and communication lines
- Borrow pits
- Fencing
- Environmental monitoring equipment and management controls
- Geophysical, geotechnical, geological, topographic, cadastral and ecological surveys
- Energy supply, water supply and communications.

Landholders use water stored in farm dams on site for agricultural purposes such as stock watering, irrigation and other domestic purposes. These landholders may agree or require Santos to use water sourced on site for construction activities, particularly where a landholder holds organic certification for the property. Water supply will be needed for construction, dust suppression, vehicle wash down, operations and maintenance activities. In accordance with landholder agreements and regulatory approvals, Santos may use water from existing farm dams when supply is abundant and of appropriate quality for the proposed use / activities.

2.3 Operation

2.3.1 Wells

Once completed and connected to gas and water gathering infrastructure, wells will operate continuously on a 24-hour basis for an anticipated 30 years.

An operational production well lease will generally include gas and water metering, separation and filtering equipment, electrical and control systems and water and gas pipeline connections. Operating wells will be monitored and controlled remotely. Each well has an automated shutdown system in the event of non-routine operating conditions.

Ongoing activities at well sites during operations will include routine inspections and maintenance of wellhead infrastructure. Maintenance activities will include repair or replacement of downhole pumps and pump components, clearing of blockages from within the wells that may be limiting production capacity, and other actions as necessary to improve production efficiency. Well maintenance activities usually require the use of a workover rig (which is smaller than a drilling rig) and are contained within the established lease area for the well.

Gas processing

Gas produced by the Project will be processed to commercial quality at gas compression facilities owned and operated by Santos on adjoining tenures in the Arcadia Valley in accordance with existing approved capacity and operating conditions.

Produced water management

The majority of water produced from the Project will be transferred via the gathering / pipeline network to water management facilities on adjoining tenures in Arcadia Valley for management and beneficial reuse in accordance with existing approved capacity and operating conditions as well as Queensland End of Waste Code requirements. Some produced water may be beneficially re-used on PL 1059 for dust suppression or in drilling and construction activities in accordance with any quality criteria and management conditions prescribed in the EA.

Produced water may be stored temporarily on PL 1059 in tanks prior to this beneficial re-use. These tanks would be designed in accordance with relevant Australian Standards and fitted with level sensors (to provide an early warning system against overtopping) and leak detection.

The Project peak water forecast (1.8 Mega Litres per day (ML/day) in October-December 2027) is anticipated to coincide with declining Arcadia field water production ensuring sufficient storage and treatment capacity for combined water production of appropriately 4 ML/day in September 2027.

Produced water beneficially used for irrigation on a third-party property will meet the standards in the Queensland Government's End of Waste Code Irrigation of Associated Water (including coal seam gas water) (ENEW07546918). There is currently 125 hectares of Land Amendment Irrigation (LAI) area available and the potential to expand up to 205 hectares if required.

In addition to the available capacity to accommodate produced water from PL 1059 at existing authorised produced water management facilities, Santos have established procedures to prevent uncontrolled discharge of produced water should the capacity of the produced water management facility be restricted. This includes the restriction of production by "shutting-in" wells.

2.3.2 Water and gas gathering lines and pipelines

Gas and water gathering lines and pipelines will be monitored, inspected and maintained during operation. This will include inspection of low point drains and high point vents as part of routine field maintenance activities, pigging of high-pressure pipelines to remove build-up from within pipelines, and vegetation slashing within operational right-of-ways.

2.3.3 Roads and access tracks

Roads and access tracks will be maintained to allow servicing of well leases and access to other infrastructure within the network. Wherever practical, the Project will use existing tracks or already disturbed areas; where upgrades to existing tracks are required, this will be undertaken in consultation with landholders.

2.3.4 Supporting infrastructure and activities

Once constructed, supporting infrastructure and activities will be maintained to the standards required for operational phase of the Project. As the Project progresses, the requirement for supporting

infrastructure and activities will be reviewed and, where no longer required, scheduled for decommissioning and rehabilitation.

2.4 Decommissioning and rehabilitation

Significantly disturbed areas that are no longer required for ongoing activities will be rehabilitated within 12 months (where possible given external factors such as weather) and maintained to achieve a non-polluting, stable landform (either by groundcover or alternate soil stabilisation method).

Pipeline trenches will be backfilled and topsoils reinstated within three months after pipe laying. Reinstatement and revegetation of the pipeline right-of-way will commence within 6 months of pipeline construction.

Once operations have ceased, infrastructure will be decommissioned unless retention and transfer of ownership of assets is agreed with the landholder. Disturbed areas caused by petroleum activities which are intended to be used by the landholder or overlapping tenure holder will be rehabilitated to meet final acceptance criteria measured either against the highest ecological value adjacent land use or the pre-disturbed land use in accordance with the Rehabilitation Plan (Attachment H) and the requirements of the Queensland *Environmental Protection Act 1994*.

3.0 Habitat assessment

A detailed ecological assessment was prepared by AECOM Australia Pty Ltd (AECOM) (Ecology Assessment) to support referral of the Project to the Commonwealth. The Ecology Assessment was prepared with reference to the 'Significant impact guidelines 1.1 – Matters of National Environmental Significance' (DotE, 2013a), relevant Commonwealth Approved Conservation Advice and the Species Profile and Threat Database (SPRAT).

Following DAWE's decision on the referral (28 July 2021), the Ecology Assessment report was updated to address the additional information requirements. The updated report is attached at Attachment C of the preliminary documentation. Section 3.2 below addresses each information requirement and identifies where in Attachment C these matters are addressed.

3.1 General assessment requirements

The RFI provided background information on requirements for habitat assessments. The Ecology Assessment (Attachment C) has been prepared in consideration of these requirements, as outlined below.

Background

“Based on the information provided in your referral, and other available information, the department considers that the listed species identified below may be significantly impacted by the proposed action.

It is the proponent's responsibility to be aware of any changes to the distribution of listed threatened and migratory species, and information available in the Species Profile and Threats (SPRAT) Database. The proponent must ensure that a recent Protected Matters Search Tool (PMST) report has been generated and considered before finalising the draft preliminary documentation.”

The Ecology Assessment (Attachment C) includes a current report from the EPBC Act Protected Matters Search Tool (PMST) at Appendix A. The PMST dated 8 November 2021 identifies the listed threatened species and ecological communities considered in this preliminary documentation. This PMST identified a change in distribution related to vulnerable Greater Sand Plover (*Charadrius leschenaultia*) assessed as unlikely to occur in the MNES likelihood of occurrence assessment in Section 6.7 of the Ecology Assessment (Attachment C).

The Ecology Assessment has been completed in accordance with current Commonwealth Approved Conservation Advice or SPRAT. References to the guidance considered in the species-specific assessment of likelihood and potential for significant impacts are included in Section 6 (Likelihood of Occurrence), Section 11 (References) and Appendix F (Significant Impact Assessments) of the Ecology Assessment (Attachment C).

“Habitat assessments must be informed by desktop and field surveys (in accordance with departmental guidelines or as defined by best practice surveys), and with reference to relevant departmental documents (e.g. approved Conservation Advices, Recovery Plans, draft referral guidelines and Listing Advices, and SPRAT Database), including published research and other relevant sources.

The department does not accept the consideration of only Queensland Regional Ecosystem (RE) mapping to determine habitat for listed threatened species.

Listed threatened species includes, but is not limited to:

- *Brigalow (Acacia harpophylla dominant and codominant) - Endangered*
- *Poplar Box Grassy Woodland on alluvial plains - Endangered*
- *Semi-Evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions - Endangered*
- *Acacia grandifolia - Vulnerable*
- *Bertya opposens - Vulnerable*
- *Ooline (Cadellia pentastylis) - Vulnerable*
- *Xerothamnella herbacea - Endangered*
- *Australian Painted Snipe (Rostratula australis) - Endangered*

- *Grey Falcon (Falco hypoleucos) - Vulnerable*
- *Painted Honeyeater (Grantiella picta) - Vulnerable*
- *Red Goshawk (Erythrotrorchis radiatus) - Vulnerable*
- *Squatter Pigeon (southern) (Geophaps scripta scripta) - Vulnerable*
- *Greater Glider (petauroides Volans) - Vulnerable*
- *Koala (Phascolarctos cinereus) - Vulnerable*
- *Large-eared Pied Bat (Chalinolobus dwyeri) - Vulnerable*
- *Northern Quoll (Dasyurus hallucatus) - Endangered*
- *South-eastern long-eared Bat (Nyctophilus corbeni) - Vulnerable*
- *Adorned Delma (Delma torquata) - Vulnerable*
- *Dunmall's Snake (Furina dunmalli) - Vulnerable*
- *Ornamental Snake (Denisonia maculata) - Vulnerable*
- *Yakka Skink (Egernia rugosa) – Vulnerable.”*

For the listed threatened species and ecological communities, the Ecology Assessment (Attachment C) details the desktop and field survey methods used to assess habitats in accordance with departmental guidelines, and with reference to relevant departmental documents, including approved Conservation Advices, Recovery Plans, draft referral guidelines and Listing Advices, SPRAT Database), published research and other specialist opinion. Habitat was determined considering Queensland Regional Ecosystem mapping as well as other habitat requirements such as hollow-bearing trees, presence of foraging resources such as mistletoe, and land and soil formations in areas of remnant and non-remnant vegetation. The assessment methodology is detailed in Section 4.0 of the Ecology Assessment (Attachment C).

The extent, classification and condition of ground-truthed vegetation communities within the Project Area was validated in accordance with the Methodology for Surveying and Mapping Regional Ecosystem and Vegetation Communities in Queensland (Neldner, et al., 2019). This included traversing the Survey Area undertaking tertiary and quaternary level assessments.

Regional ecosystem (RE) mapping was sourced through desktop assessment at a scale of 1:100,000. Informed by field validated data, vegetation mapping was further refined to achieve a much finer resolution (1:1000) for habitat assessments.

3.2 Summary of assessment findings

The Ecology Assessment Report identified a total of 28 MNES species or communities as known, likely or potentially occurring within the Project Area based on desktop assessment and field validation surveys. This included three TECs, four threatened flora species, fifteen (15) threatened fauna species and six migratory species.

An impact assessment for known, likely and potentially occurring MNES within the Project Area was completed via a two-step risk assessment process. MNES with a 'potential' risk rating triggered further assessment whilst MNES with a 'low' risk rating require no further assessment.

Based on the findings of the risk assessment, significant impact assessments were undertaken in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance (Department of the Environment, 2013b) for eleven MNES values:

- Brigalow TEC
- Ooline
- *Xerothamnella herbacea*
- Koala
- Painted honeyeater
- Ornamental snake
- Yakka skink
- South-eastern long-eared bat

- Australian painted snipe
- Latham's snipe
- Glossy ibis.

The significant impact assessments concluded that, with the implementation of avoidance and mitigation measures, including strict clearing limits and field development in accordance with the Environmental Protocol (Attachment B), the Project is unlikely to result in a significant impact any of the known or potential MNES values within the Project Area. Accordingly, offsets are not required in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012).

3.3 Additional information requested

3.3.1 Species general information

RFI 2.1.1

"Include an assessment of the adequacy of any surveys undertaken (including survey effort and timing). In particular, the extent to which these surveys were appropriate for the listed species or community and undertaken in accordance with relevant departmental survey guidelines. The referral documentation states that 'there would be potential risk to a number of MNES and further assessment is required'. Provide clarification in the PD if further assessments and/or survey effort have been undertaken for MNES."

Detailed assessment methodology is presented in Section 4.0 of the Ecology Assessment (Attachment C); Section 4.3.3 describes 2020 and 2021 survey effort demonstrating the surveys were appropriate for the listed species and undertaken in accordance with the relevant survey guidelines.

Detailed ecological assessments have been completed across most of the valley floor where infrastructure will occur within the Project Area, except for lot and plan 2SP200046 in the south due to current land access restrictions. As there is less certainty in the habitat mapping, constraint mapping and categorisation for this area, detailed ecological assessments will be completed for lot and plan 2SP200046 in accordance with Section 4.2 of the Environmental Protocol (Attachment B) before any disturbance occurs in that location.

RFI 2.1.2

"Habitat clearance is listed in the referral as the primary impact mechanism to listed threatened species and communities. The department considers the proposed action has the potential of further impacts to listed species and communities that may include habitat degradation, reduction in habitat connectivity, noise, dust and light, changes to hydrological regimes, impacts to water quality and chemical risk. Provide further discussion regarding mitigation and avoidance of other potential impacts to MNES, including but not limited to, the above."

The Ecology Assessment (Attachment C) includes a detailed discussion of potential indirect impacts in Section 7.1.2. Appropriate species-specific mitigation measures relating to identified risks of indirect impacts such as light, noise, etc. to each MNES value are included in Section 8.3.2 of the Ecology Assessment (Attachment C). These measures will be implemented through the Environmental Management Plan (Attachment F) and Significant Species Management Plan (Attachment G).

RFI 2.1.3

"Habitat, particularly Threatened Ecological Communities (TEC), have been characterised within the project site. Clarification is required regarding the extent of the habitat/TEC beyond the project boundaries. For example, if an area of TEC within the project boundary continues beyond the boundary (part of a larger patch), any impacts to that TEC may increase in significance."

Vegetation patches, which form the basis for identification of TEC and potential habitat, were characterised within the Project Area with consideration to the true extent of the patch including beyond the Project Area boundary. Outside of the western ridgeline, patches that occur along the Project Area boundary are generally small or very narrow and isolated; only a small number of these patches were found to continue outside the boundary. When determining potential TEC status, all boundary patches had their true size

considered however all that met diagnostic criteria were found to already meet size thresholds (and thus be considered TEC). This discussion is included in Section 6.6 of the Ecology Assessment (Attachment C).

As detailed in Section 8.3.2 of the Ecology Assessment (Attachment C), specific mitigation measures have been developed to manage impacts to TECs which consider patch dissection. For habitat areas that extend beyond the Project Area boundary, either patch integrity and viability have already been impacted by existing land uses (i.e. already fragmented and isolated) or they are located along drainage lines that are contiguous and connect to other habitat areas within the surrounding area. For these reasons, clearing as a result of the proposed Project in these habitat patches will not significantly result in reduced patch viability for MNES habitat. Nonetheless, also included in Section 8.3.2 is a mitigation measure specific to the management of habitat fragmentation for one potentially occurring MNES that is known to be susceptible to such impacts (greater glider).

3.3.2 Species specific information

Greater Glider (*Petauroides Volans*) - Vulnerable

RFI 2.2.1

“The Greater Glider habitat mapping rules only includes remnant woodland. Greater Glider habitat also occurs in non-remnant woodland with sufficient hollows. This may require a re-assessment of total Greater Glider within the project area.”

Ecology Assessment (Attachment C) includes habitat mapping rules in Appendix D. Greater Glider habitat mapping rules include highly connected eucalypt-dominated woodland containing 2-4 hollows per hectare, medium-large in size as breeding/denning/foraging habitat. All other connected eucalypt-dominated woodlands within 120 metres of breeding/denning habitat are included as foraging/dispersal habitat. Findings of the field survey found that no areas of non-remnant woodland were suitable for the greater glider. This was due to the patches lack of connectivity and / or a suitable density of hollows for greater glider. Within the southern Project Area, all mature vegetation (assessed using LiDAR height) was considered remnant vegetation.

Greater Glider (*Petauroides Volans*) - Vulnerable

RFI 2.2.2

“Pre-clearance survey efforts should include an analysis of tree hollow size and density suitable for use by the Greater Glider (e.g. denning) in the identified areas of Eucalypt forest and woodland containing hollow-bearing trees within and adjacent to the project site.”

The field development planning process is described in the Environmental Protocol (Attachment B). As part of this process, the field scout described in Section 4.1.3 of the Environmental Protocol (Attachment B) provides for recording of site conditions and habitat features such as hollow-bearing trees. This field scout step will allow isolated habitat features (e.g. hollows) not recognised in the ecological assessment to be considered.

Identification of woody vegetation containing suitable habitat features will trigger review of potential design refinements to avoid these features. Where impacts are identified in a low-constraint area, a detailed ecological assessment will be undertaken by a qualified ecologist to confirm if the area supports MNES values and need to be considered as part of the Project's maximum disturbance limits.

For development approved in areas containing woody vegetation, a pre-clearance survey will be undertaken by a qualified fauna spotter catcher. Pre-clearance surveys will be undertaken immediately prior to clearing activities. The fauna spotter catcher will also be present and supervise clearing works. The management and relocation of any captured fauna will be undertaken in accordance with the permits identified in the Significant Species Management Plan (Attachment G).

Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) – Vulnerable

RFI 2.2.3

“Include ‘shelter trees’ in the habitat mapping rules for the Koala.”

Ecology Assessment (Attachment C) includes habitat mapping rules in Appendix D. The definition of Koala refuge/foraging habitat under the mapping rules includes vegetation with at least two koala food trees OR one koala food tree with more than 50% cover, on alluvial substrates OR more than 200 ha contiguous. The definition of foraging/dispersal habitat under the mapping rules includes other vegetation containing at least one koala food tree and/or shelter trees. Shelter trees may include isolated individuals. Based on the findings of field surveys, rare, isolated paddock trees were highly impacted by edge effects and generally average in size; as such, no shelter trees are considered to occur.

Ooline (*Cadellia pentastylis*) - Vulnerable

RFI 2.2.4

“Referral documentation states that Ooline records pre-dating 1980 are determined ‘historical’. Given the longevity of the Ooline, provide clarification regarding the investigation that has occurred into historical records.”

Reference to historical records has been removed from the likelihood of occurrence discussion as this species has been confirmed as known to occur. Section 6.7 of the Ecology Assessment (Attachment C) confirms known habitat for Ooline within the Project Area based on field survey (species identified in the northern Project Area) and nearby records, some as recent as 2014.

Squatter Pigeon (southern) (*Geophaps scripta scripta*) - Vulnerable

RFI 2.2.5

“Habitat mapping rules for the Squatter Pigeon do not include ‘highly modified or degraded habitats’ as dispersal habitat.”

Ecology Assessment (Attachment C) includes habitat mapping rules in Appendix D. Habitat mapping rules for Squatter Pigeon dispersal habitat are defined by:

- any forest or woodland occurring between patches of foraging or breeding habitat, and suitable waterbodies, OR
- woody vegetation (regrowth, HVR or remnant) that facilitates the local movement of the subspecies between patches of foraging habitat, breeding habitat and/or waterbodies, or the wider dispersal of individuals in search of reliable water sources during the dry season or during droughts.

Within the Project Area, cleared exotic pasture occurs as large contiguous patches in which paddock trees are rare and highly isolated. Due to the high exposure to predators in these areas and ability for the bird to instead utilise the wooded vegetation patches to access waterbodies or other suitable habitat, exotic pasture areas are not considered to provide dispersal opportunities. This is in accordance with the species SPRAT profile description for dispersal habitat.

South-eastern long-eared Bat (*Nyctophilus corbeni*) - Vulnerable

RFI 2.2.6

“Referral documentation states 4 ha of roosting and foraging habitat critical for the South-eastern long-eared bat will be directly impacted via clearing, however uncertainty exists as to the density of the population due to minimal survey efforts undertaken.”

Ecology Assessment (Attachment C) details the survey effort as part of the significant impact assessment for South-eastern long-eared bat in Appendix F.

Survey effort, timing and coverage was in line with the minimum survey requirements for one of the recommended methods (unattended bat recorder). *Nyctophilus* sp. was recorded within the Project Area based on bat call analysis; however, calls from this genus cannot be differentiated. To supplement survey effort, roost searches and targeted habitat assessments were undertaken during June and December 2020. This species was not recorded during targeted surveying including harp trapping completed for this species by Terrestria on the adjacent property ‘Bottle Tree’, in 2021, which occurs less than 5 km to the north east of the Project Area – refer Section 4.2 of Ecology Assessment

(Attachment C). 'Bottle Tree' possesses a greater extent of, and better quality habitat than the valley floor in the Project Area.

While no survey has been undertaken on lot and plan 2SP200046 located within the southern Project Area due to land access restrictions; nearby field surveys and habitat modelling indicate this property provides habitat of similar or lesser quality when compared to the rest of the Project Area. A precautionary approach has been adopted in the habitat mapping and the presence of roosting and foraging habitat resources has been assumed in areas of potentially suitable habitat.

A full significant impact assessment was completed for this species as uncertainty exists in population density from the potential calls detected on the bat recorders within the Project Area. Most South-eastern long-eared bat records in Queensland occur in large tracts of relatively undisturbed forest and woodland with very few in highly disturbed landscapes (Ford, G. 2021, pers com, 18 November 2021). It is unlikely narrow linear habitat patches within the Project Area will be suitable to support the species. Any individuals utilising the area are likely to be inhabiting the western ridgeline, Middle Hill or the Public Reserve (Ford, G. 2021, pers com, 18 November 2021); therefore, it is anticipated the potential population of South-eastern long-eared bat within the Project Area is very low.

Direct impacts on potential South-eastern long-eared bat habitat are low (maximum of 4 ha) and will be restricted to degraded and fragmented areas on the valley floor and the Public Reserve edge. High quality habitat within the western ridgeline and Middle Hill will be completely avoided by the Project. Indirect impacts will be actively managed via the Project Environmental Management Plan (Attachment F). Based on this, a significant impact on the South-eastern long-eared bat is not anticipated.

Ornamental Snake (*Denisonia maculata*) - Vulnerable

RFI 2.2.7

"Habitat mapping rules for the Ornamental Snake should be expanded to include; floodplains, undulating clay pans and along the margins of swamps, lakes and watercourses. It also occurs on adjoining areas of elevated ground and has been recorded in woodlands and open woodlands of coolabah, poplar box, and brigalow, and in fringing vegetation along watercourses. Is known to prefer woodlands and open forests associated with moist areas, particularly Gilgais and depressions, but also lake margins and wetlands."

Ecology Assessment (Attachment C) includes habitat mapping rules in Appendix D. Habitat mapping rules for Ornamental Snake include woodlands and open forests associated with moist areas, particularly gilgai and depressions, but also margins of wetlands on clay soils containing sufficient microhabitat features (e.g. soil cracks or fallen woody debris). Ornamental Snake habitat mapped within the Project Area is presented in Figure 24 of the Ecology Assessment (Attachment C). Ornamental Snake habitat is also discussed in the significant impact assessment in Appendix F of the Ecology Assessment (Attachment C).

Adorned Delma (*Delma torquata*) - Vulnerable

RFI 2.2.7

"Suitable habitat can also occur between grazed or cropped areas, along road reserves and travelling stock routes. Maintaining connectivity between habitat patches is important. Habitat description of 'Eucalypt dominated woodland and open forests and exposed rocky areas' are not confined by reference to Remnant or HVR qualifiers."

Ecology Assessment (Attachment C) includes habitat mapping rules for Adorned Delma in Appendix D. Adorned Delma habitat is defined by eucalypt-dominated woodlands and open-forests or non-remnant exposed rocky areas on land zones 3, 9 and 10 containing sufficient microhabitat features (logs, bark and other coarse woody debris as well as mats of leaf litter). Field surveys found the eucalypt woodlands on alluvium and non-remnant rocky areas to be highly impacted by cattle grazing and weeds (except for the Public Reserve) and lacking the required microhabitat features.

4.0 Constraints protocol

An Environmental Protocol for Constraint Planning and Field Development (Environmental Protocol) was prepared to support referral of the Project to the Commonwealth. Following DAWE's decision on the referral (28 July 2021), the Environmental Protocol was updated to clarify constraint planning processes and address specific additional information requirements. The updated Environmental Protocol is attached at Attachment B of the PD. Section 4.1 provides a summary of the protocol and section 4.2 addresses each information requirement and identifies where in Attachment B these matters are addressed.

4.1 Protocol summary

The field development footprint and location of project infrastructure will be defined progressively as the extent and quality of the resource across the entire Project Area is understood. The final location of infrastructure will be determined through the application of development constraints such as proximity to existing infrastructure, cultural heritage and landholder considerations and environmental constraints, particularly MNES.

Recognising the potential for uncertainty, Santos has outlined the field development process for the Project in the Environmental Protocol (Attachment B). The Environmental Protocol will be applied throughout the life of the Project for each phase of development including infrastructure planning and design, construction, operation, and decommissioning and rehabilitation. It is most important during planning and design when development activities are sited.

Through the Environmental Protocol, Santos will implement a field development process to ensure potential impacts on MNES associated with development of any new petroleum activity within the Project Area will be systematically planned, identified, assessed and adequately managed. The field development process will apply a hierarchy of management principles to avoid, minimise and manage land disturbance and impacts on MNES when planning for and implementing new petroleum activities within the Project Area. These principles are:

- Avoid – avoiding direct and indirect adverse environmental impacts where practicable
- Minimise – minimise direct and indirect adverse environmental impacts where these cannot be avoided
- Mitigate – implement mitigation and management measures to minimise direct, indirect and cumulative adverse impacts
- Remediate and rehabilitate – actively remediate and rehabilitate impacted areas to promote and maintain long-term recovery
- Offset (only where required) – provide suitable offsets for activities that result in significant residual impacts to MNES even with the implementation of the above principles.

The Environmental Protocol will ensure Santos plans and locates project infrastructure with strict consideration of relevant MNES identified as having potential, likely or known to occur within the Project Area, preferentially locating infrastructure in the lowest ranked category (AECOM, 2021a). Through implementation of the Protocol, Santos makes a commitment to avoid certain MNES values while minimising cumulative impacts to other MNES within agreed maximum disturbance limits (identified in Table 1 of Attachment B). Maximum disturbance limits for these MNES values in this Protocol will be set and cannot be increased ensuring that the impacts assessed represent a maximum development scenario.

Based on the MNES values and threat status, five hierarchical constraint categories for the Project's field development planning have been defined (Table 1) and discussed below. Permitted activities will avoid potential impacts and threats to the MNES habitat.

Table 1 Constraint categories

Constraint category	Low impact petroleum activities	Linear petroleum activities	All petroleum activities	Water supply for construction purposes
No go				
High constraint	Yes	Yes		
Moderate constraint	Yes	Yes	Yes	
Low constraint	Yes	Yes	Yes	
Dams				Yes

No-go areas are recognised for providing contiguous high-quality areas of MNES habitat and all petroleum activities are strictly prohibited in:

- Western ridgeline – elevated, vegetated plateau (more than 1,000 ha) running north/south on the western edge of the Project Area
- Middle Hill – elevated, vegetated landform (more than 500 ha) in the south-west of the tenure
- TEC, except as listed in Table 1 of Attachment B i.e. Brigalow TEC and Poplar Box TEC.

High constraint areas containing high value habitats comprising remnant and advanced regrowth vegetation vulnerable to habitat fragmentation apply to:

- Public Reserve – restricted to provision of access route at the edge of land within Lot 12CP864585 (92 ha) in the northeast of PL 1059
- TEC listed in Table 1 of Attachment B i.e. Brigalow TEC and Poplar Box TEC.
- MNES habitat, including remnant and advanced regrowth vegetation, along mapped watercourses.

Only low impact petroleum and linear infrastructure are permitted within this constraint area, prioritising avoidance of more sensitive MNES (based on threat status), and implementation of mitigation and monitoring in the Environmental Management Plan (Attachment F).

Moderate constraint areas contain remaining mapped MNES habitat values, largely represented by narrow linear and disconnected vegetation and the margins of the constructed wetland.

All petroleum activities (described in Section 2.1 of Attachment B) are permitted within this constraint area, prioritising avoidance of more sensitive MNES (based on threat status), implementation of mitigation and monitoring in the Environmental Management Plan (Attachment F), and cumulative disturbance not exceeding maximum disturbance limits identified in Table 1 of Attachment B.

Low constraint areas contain cleared/ploughed exotic pastures used for agriculture and other sparse non-remnant vegetation. Low constraint areas apply to:

- Remaining areas validated as unlikely to support a MNES population or suitable habitat
- Existing Santos infrastructure
- Existing roads and other infrastructure.

All petroleum activities are permitted within this constraint area prioritising avoidance of more sensitive MNES (based on threat status) and implementation of mitigation and monitoring in the Environmental Management Plan (Attachment F).

Dams and constructed wetlands include waterbodies within the Project Area used for agricultural water supply where Santos may extract and use water where lawful and permitted by landholder for construction of the Project. The same/single access point will be used to access a waterbody. Take will be directed to the nearest waterbody as the development progresses across the Project Area and limited to the requirements of each gas field development phase. Implementation of mitigation and monitoring in the Environmental Management Plan (Attachment F) will be required.

4.2 General assessment requirements

The RFI included general assessment requirements relating to preparation of a Constraints Protocol. The Constraints Protocol (now referred to as the Environmental Protocol) has been prepared in accordance with these requirements, as outlined below.

Background

“The PD must include a detailed, Environmental constraints planning and field development protocol (constraints protocol), that outlines the process for ensuring the proposed action adequately:

- *considers MNES when siting gas field infrastructure; and*
- *avoids, minimises, mitigates, rehabilitates and/or offsets impacts to MNES.*

The constraints protocol must provide constraints categories for MNES with consideration of their values (e.g. listing status), including proposed constraints, permitted activities and management measures under each category. Detailed discussion must be provided that links field survey, remote sensing data and habitat validation processes with avoidance, mitigation, reporting and offsetting requirements.

The preliminary documentation must address the following matters in addition to the general information listed above.”

The Project’s Environmental Protocol (Attachment B) details the processes to be implemented to ensure the Project systematically identifies, assesses and manages potential impacts on MNES associated with development of any new petroleum activity within the Project Area.

MNES habitat mapping for the Project Area forms the basis of the constraints mapping and includes all potential habitat for MNES identified as known, likely or potentially occurring within the Project Area. It was developed by applying the ecological field validation data and LiDAR results to habitat definitions that were formulated for each of the relevant MNES utilising the relevant guidance (detailed in Section 4 of Attachment C); this included but was not limited to, the Department’s Species Profile and Threats Database (SPRAT) (DAWE, 2021), conservation advice and recovery plans. Further detail on the habitat definitions and corresponding habitat descriptions are provided in Appendix A to the Environmental Protocol (Attachment B).

Through implementation of the Environmental Protocol, Santos makes a commitment to avoid certain high value MNES. Disturbance to remaining MNES habitat will be minimised, and cumulative disturbance will not exceed the maximum limits identified in Table 1 of the Environmental Protocol (Attachment B). Maximum disturbance limits for MNES values in the Environmental Protocol are set and cannot be increased ensuring the impacts assessed represent a maximum development scenario.

Permitted project activities are defined for each constraint category to minimise potential impacts and threats to MNES habitat as recognised in relevant Commonwealth Approved Conservation Advice or SPRAT e.g. habitat fragmentation or connectivity. Petroleum activities are permitted within relevant constraint categories where in accordance with avoidance, minimisation and mitigation requirements specified in Section 3 of the Environmental Protocol (Attachment B) and implemented via the Environmental Management Plan (Attachment F) and Rehabilitation Management Plan (Attachment H).

4.3 Additional information requested

RFI 2.3.1

“Pre-disturbance surveys must be supervised by a suitably qualified person and undertaken in accordance with the department’s survey guidelines in effect at the time of the survey or other equivalent survey methodology. Clarification is required regarding the role and pre-clearance survey procedures undertaken by the field scout.”

The field development planning process described in the Environmental Protocol (Attachment B), includes the field scout (described in Section 4.1.3) and fauna-spotter pre-clearance survey (described in Section 4.1.6).

The field scout involves Santos' representatives and the landholder conducting a review of the feasibility and constructability of the concept infrastructure layout determined from desktop consideration of constraints, including MNES habitat mapping. The field scout also provides an opportunity to record changed site conditions or isolated habitat features, and potentially refine design to avoid impacts, where possible.

Detailed ecological assessment will be required in accordance with Section 4.2 and habitat definitions in Appendix A of the Environmental Protocol (Attachment B) where:

- Changes in site conditions indicate change to habitat mapping may be required.
- Unavoidable impacts to woody vegetation will occur in a low constraint area to confirm if the area supports MNES values and will need to be considered as part of the Project's maximum disturbance limits.

Ecological field assessments on lot and plan 2SP200046 have not yet been conducted due to land access restrictions. Detailed ecological assessment will be completed prior to Project development commencing in this area. To ensure consistency in the methodology utilised and confidence in the accuracy of findings, any future detailed ecological assessments will be completed by a suitably qualified ecologist in accordance with the methods provided in Appendix B to the Environmental Protocol (Attachment B).

RFI 2.3.2

"The southern portion of the project area currently contains both High and Moderate constraints areas and is mapped as suitable habitat for several listed threatened species (Figure 1 – Towrie MNES constraints). This area has been deemed uncertain by the proponent as constraints categories have not been field validated and may be subject to change. Constraints categories are required to be well defined for assessment."

Detailed ecological assessments have been completed across most of the valley floor where infrastructure will occur within the Project Area, except for lot and plan 2SP200046 in the south which has current land access restrictions. As there is less certainty in the habitat mapping for this area and therefore constraints mapping and categorisation, detailed ecological assessments will be completed for lot and plan 2SP200046 before any disturbance can occur in that location in accordance with Section 4.2 and Appendix B of the Environmental Protocol (Attachment B).

In the rare event that MNES values previously identified as unlikely are in fact identified during detailed ecological assessments within lot and plan 2SP200046, future MNES habitat mapping and constraints categorisation is to be in accordance with the habitat descriptions in Appendix A of the Environmental Protocol (Attachment B) and Significant Species Management Plan (Attachment G). Irrespective of the ground-truthed findings on this lot and plan, the direct impacts on potential habitat for the relevant MNES must not exceed the maximum disturbance limits discussed in Section 2.3.1 of the Environmental Protocol (Attachment B).

RFI 2.3.3

"Inconsistencies in the mapping of vegetation communities occur within the project area between desktop RE mapping (figure 6) and assessed RE extent (figure 7) in the MNES – Ecology Assessment Report. Provide clarification of habitat descriptions and vegetation communities."

State Government RE mapping presented in Figure 6 of the Ecology Assessment (Attachment C) is generally completed at a scale of 1:100,000. To enable detailed habitat assessment, vegetation mapping was refined using field validated data to achieve a much finer resolution (1:1000) as presented in Figure 7 of the Ecology Assessment (Attachment C).

Where field surveys have occurred within PL 1059, the extent, classification and condition of ground-truthed vegetation communities was validated in accordance with the Methodology for Surveying and Mapping Regional Ecosystem and Vegetation Communities in Queensland (Neldner, 2019). This included undertaking tertiary and quaternary level assessments.

RFI 2.3.4

“Both of the High and Moderate Constraints areas allow for ‘Linear Infrastructure’, and the Moderate Constraints area additionally allows for ‘all petroleum activities’. Both of these constraints areas contain high quality habitat for MNES, including potential fauna corridors for movement across the project site i.e. riparian vegetation along waterways. Clarification and discussion are required regarding avoidance and mitigation strategies of the potential impacts of habitat fragmentation under the constraints protocol.”

The constraint-based planning approach outlined in the Environmental Protocol (Attachment B) aims to prioritise avoidance of the most sensitive and highest value MNES susceptible to habitat fragmentation, including TEC and higher quality remnant vegetation associated with the western ridgeline, Middle Hill and Public Reserve.

In the High constraint area, the Public Reserve will largely be avoided other than to provide access in the north-east of the tenure for the first phase of development activities. An existing access track will be widened and extended along the southern boundary of the reserve in an area already effected by edge effects resulting in reduced vegetation and habitat condition. No wells will be constructed in the Public Reserve.

Where constraint categories allow for linear infrastructure, development is limited to corridor widths defined in Section 2.1 of the Environmental Protocol (Attachment B), construction impacts are temporary/short-term and quickly reinstated to a reduced right-of-way corridor for operations following rehabilitation in accordance with the Rehabilitation Management Plan (Attachment H). Through these measures, corresponding impacts on relevant MNES values are minimised.

All petroleum activities will be restricted to the valley floor, which is dominated by exotic grassland (predominantly buffel grass) and is generally highly disturbed due to historical clearing, incursion of exotic species including cropping plants and agricultural practices such as blade ploughing and cattle grazing. While all petroleum activities are permitted within this constraint area, disturbance will be limited to the extent of the proposed activities described in Section 2.0 of the Environmental Protocol (Attachment B). Any disturbance to MNES habitat will be minimised and cumulative disturbance will not exceed the maximum limits identified in Table 1 of the Environmental Protocol (Attachment B).

Where petroleum activities are permitted within constraint categories, it must be in accordance with avoidance, minimisation and mitigation requirements specified in Section 3 of the Environmental Protocol (Attachment B) and implemented via the Environmental Management Plan (Attachment F) and Rehabilitation Management Plan (Attachment H).

RFI 2.3.5

“The Low Constraints category is described as areas of ‘non-remnant vegetation without potential to contain MNES and its habitat’. This definition may exclude MNES habitat i.e. squatter pigeon dispersal habitat, Gilgai, isolated Koala food/shelter trees and small patches of habitat that may be used for movement of fauna across the landscape.

The definition of the Low Constraints category needs to include the potential habitat for MNES and clarification is required of the pre-clearance survey effort to be undertaken before any activities occur within the Low Constraints area.”

As described in Section 3.3.4 of the Environmental Protocol (Attachment B), low constraint areas comprise areas unlikely to support a MNES population or suitable habitat, existing infrastructure and roads. Section 4.0 of Environmental Protocol provides a process for capturing unmapped areas of potential MNES habitat within low constraint areas.

On review of the species SPRAT profile description for habitat, habitat mapping rules in Appendix D of the Ecology Assessment (Attachment C) have been updated for:

- Squatter pigeon – no dispersal opportunities provided by exotic pasture areas based on field survey observations of rare, highly isolated paddock trees and high exposure to predators

- Koala – no shelter trees occur to support foraging and dispersal habitat based on field survey findings of rare, isolated paddock trees highly impacted by edge effects and generally average in size.

One MNES value known to occur within the Project Area, *Cadellia pentastylis*, has been recorded as single individuals within areas dominated by exotic pasture. While known and potential locations of this value have been captured in as much detail as possible in the habitat mapping, it must be acknowledged that this value may occur in areas currently considered a low constraint. Although direct impacts on *Cadellia pentastylis* are permissible up to the maximum disturbance limit (see Section 2.3.1 of Attachment B), all direct impacts must be recorded. Section 4.1.3 of Attachment B details the measures in place that will ensure no unintentional impacts to *Cadellia pentastylis* occur.

RFI 2.3.6

“Review the habitat mapping rules and specific survey requirements, informing the Constraints Protocol, to ensure that they contain complete habitat descriptions and survey requirements for each MNES, as outlined in relevant documents, including, but not limited to, SPRAT, conservation advice and recovery plans.”

As detailed in Appendix D of the Ecology Assessment (Attachment C), MNES habitat mapping rules for the Project describes all potential habitat for MNES identified as known, likely or potentially occurring within the Project Area. The habitat mapping was developed by applying the ecological field validation data and LiDAR results to habitat definitions formulated for each of the listed MNES using relevant documents including SPRAT, conservation advice and recover plans (detailed in Section 4 of Attachment C); this included but was not limited to, departmental guidelines, and with reference to relevant departmental documents, including approved Conservation Advices, Recovery Plans, draft referral guidelines and Listing Advices, and SPRAT Database), published research and other specialist opinion. For MNES known, likely or potentially occurring, a list of relevant departmental guidance and supporting evidence is presented in the Significant Impact Assessments in Appendix F of the Ecology Assessment (Attachment C).

RFI 2.3.7

“As vegetation communities/habitat are clarified and further defined within the project site, update all reports, including the Constraints Protocol, as appropriate.”

Section 4.1 of the Environmental Protocol (Attachment B) includes a process for systematic change management related to vegetation communities and habitat mapping and corresponding constraint categorisation, including integrating further definition within the Project Area. This process outlines a range of pre-development steps including preliminary site selection, desktop assessment, field scout and data verification, resulting in the issuing of internal approvals.

Ecological field assessments on lot and plan 2SP200046 have not yet been conducted due to land access restrictions. Detailed ecological assessment will be completed prior to Project development commencing in this area. To ensure consistency in the methodology utilised and confidence in the accuracy of findings, any future detailed ecological assessments will be completed by a suitably qualified ecologist in accordance with the methods provided in Appendix B to the Environmental Protocol (Attachment B).

Detailed ecological assessment will be required to ground-truth proposed changes or unavoidable impacts in accordance with Section 4.2 and habitat definitions in Appendix A of the Environmental Protocol (Attachment B) where:

- Changes in site conditions indicate change to habitat mapping may be required.
- Unavoidable impacts to woody vegetation will occur in a low constraint area to confirm if the area supports MNES values and will need to be considered as part of the Project’s maximum disturbance limits.

Following completion of a field scout and any detailed ecological assessment, the field validated values and any refinements made to the design/layout will be uploaded into the Santos GIS. Where the results of the detailed ecological assessment are significant, Santos may be required to repeat desktop

assessment of infrastructure locations to refine and minimise proposed impacts to identified MNES values and comply with maximum disturbance limits.

The Environmental Protocol constraint categories and maximum disturbance limits are defined and will not change.

5.0 Water resources

A detailed assessment of potential water-related impacts from the Project was prepared by KCB Australia Pty Ltd (KCB) (Water Assessment) to support referral of the project to the Commonwealth. The Water Assessment, attached at Attachment D, was prepared with reference to the 'Significant impact guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources', 'Significant impact guidelines 1.1 – Matters of National Environmental Significance' and the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) information guidelines.

Following DAWE's decision on the referral, the Water Assessment was updated to address the additional information requirements. The updated report is attached at Attachment D of the PD and replaces the previous version submitted with the referral. Sections 5.2 and 5.4 address each information requirement and identifies where in Attachment D these matters are addressed.

5.1 General assessment requirements

The RFI identified general assessment requirements relating to water resources for the PD. The Water Assessment (Attachment D) has been prepared in accordance with these requirements as outlined below.

Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development

"The draft PD must cross-reference the IESC checklist, found in the IESC guidelines, to ensure that the IESC's information guidance has been considered and addressed."

Section 1.2.1 of the Water Assessment (Attachment D), titled "IESC Checklist", provides the checklist in Table 1.1 and identifies the sections of the report where checklist items have been addressed.

"The final PD must include the IESC advice and the proponent's response to that advice in the PD package that will be published for public comment."

The information provided in the draft PD will be reviewed by the IESC and comments/advice provided by the IESC will be addressed as part of the final PD for submission to DAWE.

The hydrology relevant to the proposed action area, including surface water and groundwater

"Provide a regional overview of the proposed action area, including a description of the geological basin, coal resource, surface water catchments, groundwater systems and water-dependent assets."

Requested information has been provided in the Water Assessment (Attachment D). Applicable sections from this report are as follows:

- Regional overview of the proposed action area – Section 3.1 Project Overview
- Description of the geological basin and coal resource – Section 7.1 Geological Setting and Section 7.2 Regional Hydrostratigraphy
- Description of surface water catchments – Section 6 Hydrological Context and Conceptualisation
- Description of groundwater systems – Section 7 Hydrogeological Context and Conceptualisation
- Description of water-dependent assets – Section 7.8 Groundwater-Surface Water Interactions, Section 7.9 Groundwater Dependent Ecosystem and Section 7.10 Existing Third-Party Groundwater Users

“Describe any potential third-party users of water in areas potentially affected by the proposed action, including municipal, agricultural, industrial, recreational and environmental uses of water.”

Requested information have been provided in the Water Assessment (Attachment D) in Section 6.8, titled “Existing Surface Water Users”; and, Section 7.10, titled “Existing Third-Party Groundwater Users”.

“The PD must include a description and assessment of the impacts to water resources giving consideration to relevant departmental policies and guidelines, including the JIF and Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources (2013).”

Requested impact assessment approach has been adopted in the development of the Water Assessment (Attachment D). Referenced departmental policies and guidelines, including the Coal Seam Gas – Joint Industry Framework (JIF) ‘Managing impacts to groundwater resources in the Surat Cumulative Management Area under the EPBC Act approvals’ (Australian Government 2021) and ‘Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources’ (DotE, 2013b) have been provided in Section 2.1.1.

“The PD must provide robust scientific information and supporting evidence for every assertion, assumptions and/or conclusion made in the assessment of potential impacts, or lack of impacts, on water resources (Water Act 2007).”

Assertions and assumptions associated with the assessment and interpretation of potential impact on water resources have been captured in Section 8 Numerical Groundwater Modelling and Section 9 Impact Assessment of the Water Assessment (Attachment D); and, includes the referenced documents provided in these sections, particularly the ‘Underground Water Impact Report for the Surat CMA’ (OGIA 2019) and ‘Groundwater Modelling Report for the Surat Cumulative Management Area’ (OGIA 2016).

Monitoring, mitigating and managing impacts

“The PD must outline methodologies and commitments for ongoing monitoring, identifying, assessing (including incorporation of a risk assessment) and managing impacts to water resources for the life of the project. Methodologies should be specific to particular water resource component.”

Section 10 Mitigation, Management and Monitoring of the Water Assessment (Attachment D) provides a summary of the proposed monitoring, management and mitigation strategies should impacts to water resources as a result of the proposed development be identified. These strategies will be established in accordance with the State regulatory framework, in particular, the ‘Underground Water Impact Report for the Surat CMA’ (OGIA 2019); and, the Joint Industry Framework (JIF) ‘Managing impacts to groundwater resources in the Surat Cumulative Management Area under the EPBC Act approvals’ (Australian Government 2021).

5.2 Summary of assessment findings

The Project is located within the Surat Cumulative Management Area (CMA). The Office of Groundwater Impact Assessment (OGIA), established under the Queensland *Water Act 2000*, is responsible for predicting impacts on water pressures in aquifers within the Surat CMA from resources activities. Outputs from the Surat CMA numerical model, used for the 2019 Surat CMA Underground Water Impact Report, were used to consider potential drawdown impacts to groundwater from the Project and assess the potential impacts on water resources from this drawdown.

Potential long-term impacts to groundwater bores were assessed against the *Water Act 2000* bore trigger threshold of 2 m for an unconsolidated aquifer (e.g. alluvium) and 5 m for a consolidated aquifer (e.g. Bowen Basin units,) using the outputs and drawdown predictions from the UWIR numerical model.

One bore within the vicinity of the Project Area was predicted to have drawdown induced as a result of gas production from the Project. This bore, which is assumed to be screened in the Bandanna Formation, had a predicted drawdown of 3.6 m (95th percentile simulation) which is less than the trigger threshold for consolidated aquifers (>5 m). Given the mandatory requirements under the *Water Act 2000* to 'make good' potential drawdown impacts to bores, impacts to existing groundwater users are considered unlikely.

Impacts to potential terrestrial GDEs are considered unlikely based on the limited and localised magnitude of drawdown predicted in the hydrostratigraphic units that could provide groundwater to the potential GDEs and the low to moderate-confidence status of the GDEs (supported by groundwater level data). Based on the proposed project activities, no discernible impacts to surface water are considered.

The Water Assessment concludes the Project will not have a significant impact on water resources.

5.3 Additional information requested

5.3.1 Groundwater

RFI reference 2.4.1

"The groundwater model uses median hydraulic parameter values for the hydrogeological units in the area. Results from drilling may indicate that different hydraulic parameters should be used which would likely change the predicted drawdown ranges and extents. The department notes further that OGIA also provides 95th percentile predictions, for which impacts will be greater.

The calibrated hydraulic parameters used in the OGIA groundwater model should be validated prior to the commencement of the commercial extraction of gas."

Results from the 95th percentile predictions are provided in Appendix V of the Water Assessment (Attachment D) and have been used as part of the impact assessment (Sections 8.2.1 and 9.2.1), which indicate that there will be no discernible impacts to water resources as a result of the Project.

The OGIA groundwater model is updated every three years as part of the Surat CMA UWIR updates. These periodic model updates include a recalibration of the groundwater model, incorporating groundwater monitoring results from across the model domain, which will include the Project Area, from the period prior to the last model update. If required, a refinement of the model hydraulic parameters is undertaken to support the model calibration. Therefore, as a result of the adaptive process to update OGIA groundwater model, there is no need to ensure the hydraulic parameters at the site are validated prior to Project development.

RFI reference 2.4.2

"Should local-scale data indicate that hydraulic parameters are outside the calibrated values of the OGIA model, provide information outlining how the new local-scale data will affect model predictions."

The OGIA numerical groundwater model of the Surat CMA was developed based on hydraulic parameter data sourced from a range of hydraulic tests comprising core testing, drill stem tests and pumping tests. These tests, which were completed in the vicinity of the Project Area, were presented in Section 7.4 Aquifer / Aquitard Hydraulic Properties of the Water Assessment (Attachment D) and provide a local-scale understanding of hydraulic parameter values.

Further, uncertainty analysis of the hydraulic parameters for the predictive simulations of the groundwater model were completed by OGIA. The 5th and 95th percentile uncertainty analysis results in the predicted drawdown as a result of the proposed development were provided in Appendix V of the Water Assessment (Attachment D), and were used for the assessment of impact on water resources. Therefore, in addition to the application of local-scale hydraulic parameter data as part the model calibration process, the uncertainty of the hydraulic parameters was also assessed and incorporated into the assessment of potential impacts to water resources.

Additionally, as part of the Surat CMA UWIR, and as identified in Section 8.2.1 of *Towrie Development Area – Water Assessment* (KCB 2021) proponents operating within the Surat CMA are required to continually provide monitoring data and field investigation results (e.g. groundwater level monitoring, CSG produced water volumes, geophysical logs etc) during well field construction and operations. This information/data is used to update the Surat CMA groundwater model and support the model calibration. As a result, local data is continuously incorporated into the model.

5.3.2 Groundwater dependent ecosystems

RFI reference 2.4.3

“Given the presence of potential GDEs both within and adjacent to the proposed project area, although not required by the JIF, as a precautionary measure, it may be prudent to assess the groundwater dependency of riparian vegetation, including Gilgai and Brigalow on alluvial sediments using direct techniques (e.g. stable isotopes, leaf and soil water potential). Based on the results of a GDE assessment, an ecohydrological conceptual model should be developed, which outlines the potential hydrogeological connectivity and impact pathways between drawdown within the Rewan Group, alluvium and potential GDEs. The ecohydrological model should also include spring complexes, including those identified 10 to 25km to the west of the project area, associated with the Clematis Group and Precipice Sandstone.”

As discussed in Section 7.9 of the Water Assessment (Attachment D), potential GDEs are acknowledged to be present in the vicinity of the Project Area. These potential GDEs are interpreted to be sourcing from groundwater present within underlying water-bearing aquifer, which may include Quaternary alluvium (Qa); Tertiary sediments (TQr, Tm); Hutton Sandstone, Evergreen Formation and Precipice Sandstone (Jb); Moolayember Formation (Rm); and, Clematis Group (Re).

Mapped spring complexes located to the west of the Project Area, as identified in Section 7.9.1 Spring Complexes of the Water Assessment (Attachment D), are identified to be sourcing water from either the Clematis Group or the Precipice Sandstone.

OGIA modelling results of the maximum drawdown / depressurisation associated with the proposed development, including the 95th percentile maximum drawdown / depressurisation, are presented in the Water Assessment (Attachment D) (Section 8.4 Scenario Results and Appendix V) and have been used to assess impacts to water resources. These results (i.e. median case, 95th percentile case) indicate that the predicted maximum depressurisation is limited to the Rewan Group, with no drawdown predicted for hydrostratigraphic units above the Rewan Group. Therefore, no impacts are predicted for the potential GDEs or spring complexes within the vicinity of the Project Area.

The above interpretation of “no impacts” is also applicable to Gilgai and Brigalow on alluvial sediments, if these regions are interpreted to be dependent on groundwater, as no impacts are predicted for the groundwater in the alluvial sediments as a result of the proposed development. However, and specifically for Gilgais, these landforms are a result of seasonal rainfall (drying – wetting cycles) that cause clayey soil layers to shrink and swell that eventually results in the formation of depressions where water can pool following rainfall events. Therefore, the development of Gilgais and the pooling of water within Gilgai depressions are a result of rainfall and surface water flow mechanisms; and as a result, would not be impacted by the proposed project development. An ecohydrological conceptual model for an example area of Gilgai in the Project Area has been provided in Section 9.2.3 of the Water Assessment (Attachment D), and supports the interpretation of “no impacts” to the areas of Gilgai as a result of the Project.

RFI reference 2.4.4

“Should these potential GDEs be confirmed as groundwater dependent, the ecohydrological conceptual model could be used to inform the locations and screening depths of additional monitoring bores which should be located near these potential GDEs. The Ecohydrological conceptual model should inform a GDE management plan, which includes the mitigation and monitoring measures used to protect the ecological values of these GDEs.”

The response to RFI 2.4.3 identifies that “no impacts” are predicted to the potential GDEs, spring complexes, Gilgai and Brigalow in the vicinity of the Project Area as a result of the proposed

development, therefore the installation of additional monitoring bores adjacent to the potential GDEs are not warranted.

Further, this request for the installation of additional monitoring bores or development of a GDE management plan, does not align with the risk framework presented in the JIF, and discussed in Section 10.2.4 of the Water Assessment (Attachment D). The criteria specified in the JIF identifies a risk threshold for when a proponent must undertake a 'preliminary risk assessment' and 'supplementary risk assessment' for terrestrial GDEs (more than 0.2 of drawdown in the outcrop of the formation); which is based on groundwater model predictions as an initial screening tool.

The predicted groundwater impacts as a result of the Towrie development does not result in the exceedance of the risk threshold, therefore, further risk assessments are not warranted. This will be continually assessed throughout the life of the Project as part of the UWIR process, based on continually refined groundwater model predictions and in accordance with requirements of the JIF.

5.3.3 Modified wetlands

RFI reference 2.4.6

"Modified wetlands have been identified across the project site. A large wetland located adjacent to the public reserve in the northeast portion of the project site, is highlighted as an important habitat. This modified wetland is a confluence of several watercourses, including Station Creek.

Proposed tracks, gas and water flow lines cross these water courses (Figure 6 – Towrie indicative development – first phase). Although these watercourses are ephemeral, they form part of the catchment for the wetland. Should these watercourses be modified or disturbed, the timing, duration, magnitude, and frequency of flows into the wetland may be materially changed.

Narrow riparian vegetation associated with these watercourses may provide a corridor for movement of fauna to higher quality habitat.

Clarification is required regarding the design of this infrastructure, including how impacts to flow and riparian vegetation is avoided or mitigated."

Santos environmental management procedures avoid or mitigate potential impacts to flow and riparian vegetation. These procedures have been identified in Section 10.3 Other Environmental Management Practices of the Water Assessment (Attachment D); specifically the Environmental Management Plan (Attachment F) and the Environmental Protocol (Attachment B). Management plans and previously adopted relevant regulatory guidelines/requirements and accepted design standards from other Santos well field developments in the Surat CMA, specific to ephemeral creek crossing, have been provided in Section 10.3 of the Water Assessment (Attachment D).

5.3.4 Surface water

RFI reference 2.4.7

"Flood modelling maps for a flood extent for 1% Annual Exceedance Probability (AEP) indicates that for a 1 in 100 year flooding event. Flooding may occur within the Brown River, as well as Arcadia Creek, Moolayember Creek and Station Creek.

According to Figure 6 (Towrie indicative development – first phase) at least one proposed well lease and several access roads fall within this flood prediction area.

Clarification is required regarding how potential impacts to project infrastructure, including well pads and storage tanks, caused by a 1% AEP flood event, will be mitigated and managed."

Sections 10.1 and 10.3 of the Water Assessment (Attachment D) identifies that the location of proposed Project infrastructure will be identified in accordance with established procedures and constraints to avoid areas of concern (e.g. flood prediction areas). These procedures and constraints also identify that no project infrastructure will be located within the 1% AEP flood extent and all water course crossing (tracks and pipelines) will be constructed in accordance with the requirements and design standards. All well pads across the Project Area, within and outside of the 1% AEP flood

extent, will be established at the topographic grade of the well location and all associated pipelines will be buried.

5.3.5 Produced water

RFI reference 2.4.8

“The referral documentation notes that site water balances have been undertaken to ensure water management facilities provide adequate storage and treatment capacity.

Water balances need to be provided to the department to enable further assessment.”

Details of the Arcadia water management facility, which will manage the produced water from the Project, and the associated water balance, are provided in Section 3.3.1.2 of the Water Assessment (Attachment D).

5.3.6 Stygofauna

RFI reference 2.4.9

It is stated within the referral guidelines that it is unlikely to be Stygofauna present within the targeted coal seams. However, Stygofauna may be present within the alluvium.

Sampling of Stygofauna within the alluvium should be undertaken in accordance with the Department of Science, Information Technology and Innovation (DSITI) guidelines (2015).

Stygofauna assessment guidance is available through the IESC guidelines explanatory note Assessing groundwater-dependent ecosystems (2019).”

Section 9.2.4 of the Water Assessment (Attachment D) identifies that no impact to subterranean fauna will occur as a result of the proposed development because modelling of the proposed development predicts that no drawdown of groundwater will occur in the hydrostratigraphic units above the Rewan Group, including alluvium, for the median case and 95th percentile case simulations. This is in-line with the risk threshold for Subterranean GDEs identified in the Coal Seam Gas – Joint Industry Framework (JIF) ‘Managing impacts to groundwater resources in the Surat Cumulative Management Area under the EPBC Act approvals’ (Australian Government 2021), which specifies risk thresholds of:

- a long term predicted drawdown of more than 2 m for unconfined hydrogeological units caused by CSG development, or
- a long term predicted drawdown that dewateres the aquifer habitat for confined hydrogeological units.

Therefore, if stygofauna are present within the alluvium they will not be at risk to the proposed development, and further assessment/sampling of stygofauna is not warranted.

5.3.7 Cumulative impacts on water resources

RFI reference 2.4.10

“The proposed action is part of the broader development of CSG resources by the proponent and other developers. The department notes additional individual tenures within the Surat basin from other developers are anticipated in future, including potential future developments by Santos, for example, ATP1191 (PLA1062) located immediately north of Towrie (Attachment A). The department notes cumulative impacts are not discussed in the referral documentation and therefore, the extent of the impacts on water resources are unknown.

The department notes the uncertainty assessment derived from the OGIA modelling appears not to detail the cumulative impact contributions to the maximum predicted draw down from adjacent developments.

The PD must identify and assess the scale and extent of all the potential and likely cumulative impacts on water resources from the proposed action and other nearby resource projects. Where cumulative impacts are predicted, avoidance, mitigation and management measures must be proposed.”

The assessment of cumulative impacts can only be undertaken against approved neighbouring projects. Unapproved, anticipated projects are unable to be assessed as part of a cumulative impact assessment as the descriptions of these unapproved projects are unavailable and speculation of any future and unapproved development is beyond reasonable expectation of any proponent.

Approved CSG developments are captured in the Surat CMA UWIR and are incorporated in the OGIA numerical model for the Surat CMA. The UWIR framework, as described in Section 10 Mitigation, Management and Monitoring of the Water Assessment (Attachment D), assesses cumulative impacts throughout the life of all approved projects, which is updated every three years, and assigns responsibility for management of predicted impacts to relevant tenure holders.

The cumulative impact assessment provided in Section 9.4 of the Water Assessment (Attachment D) has identified that the Project’s contribution to cumulative drawdown / depressurisation at potential water resource receptors is minimal. This is due to the limited drawdown / depressurisation at potential water resource receptors resulting from the Project only; therefore, the contribution to the potential cumulative impact would be minimal.

6.0 Chemical risk

6.1 Assessment summary

A Chemical Risk Assessment Framework (CRAF), and Chemical Risk Assessment (CRA) of chemicals proposed to be used during drilling and hydraulic fracturing based on the CRAF, was prepared to support the referral (EHS Support, 2021).

The Chemical Risk Assessment Santos Towrie Development Petroleum Lease (PL) 1059 (EHS Support, 2021) (included at Attachment E) assesses the drilling, stimulation and completion life cycle specifically for the proposed operations including:

- Storage, usage (e.g., blending, injection), and recovery of chemicals throughout operations
- Beneficial reuse of recovered drilling fluids and cuttings for well lease rehabilitation
- Storage of produced water.

The CRAF (Appendix A of the CRA (Attachment E)) is based on Santos' existing CRAF for the GFD Project which was developed in conjunction with and approved by DAWE. It aligns with the chemical assessment guidance provided by National Industrial Chemicals Notifications and Assessment Scheme (NICNAS).

This section addresses each information requirement and identifies where these matters are addressed in Attachment E.

6.1.1 General terms of CRAF

The terms of the CRAF must include but not be limited to:

“a. Details of how the risks will be assessed consistent with best practice risk assessment methodology, and how for the assessment of the potential impacts of the chemicals proposed to be used in coal seam gas extraction on matters of national environmental significance. Will address:

- i. the process lifecycle for chemicals;*
- ii. how risk from geogenic chemicals in produced water and recovered drilling fluids will be managed to prevent adverse impacts to protected matters; and*
- iii. minimum mitigation and management measures to be undertaken as part of coal seam gas operations.”*

The requested information is provided in the *Chemical Risk Assessment Santos Towrie Development Petroleum Lease (PL) 1059* (EHS Support, 2021) and *Chemical Risk Assessment Framework* (Appendix A to Attachment E). Applicable sections from the CRA and CRAF are as follows:

- *Best practice risk assessment methodologies*
 - CRAF: Section 2 Chemical Risk Assessment Framework and Appendix 9 Summary of Best Practice Methodologies
- *Process lifecycle for chemicals*
 - CRA: Section 3 Conceptual Exposure Model which addresses use of chemicals and treatment/management of waste streams.
 - CRAF: Appendix 1 Chemical Category Classification Matrix, Appendix 8 Exposure Pathways and Appendix 9 Summary of Best Practice Methodologies.

Process lifecycle detailed within Conceptual Exposure Models (Exposure Pathways) and chemicals lifecycle assessment inherent within the PBT assessment. Additional separate full lifecycle assessment including food chain risk assessment completed for higher risk Tier 4 chemicals only (chemicals that have the potential to persist and bioaccumulate in the food chain).

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- *Risk of geogenic chemicals in produced water and recovered drilling fluids*
 - CRA: Section 4.4 Geogenic Screening Risk Assessment
 - CRAF: Section 2.6 Geogenic Screening Risk Assessment
 - *Minimum mitigation and management measures*
 - CRA: Section 5 Risk Management
 - CRAF: Section 4 Mitigation and Management

“b. Details of the criteria by which chemicals will be categorised, based on the properties of each chemical. Criteria must include, but not be limited to:

- i. combined persistence, bioaccumulative and toxicity assessment;*
- ii. chemical database of concern assessment; and*
- iii. specific persistence, bioaccumulative and toxicity assessment.”*

The requested information is included in the CRA and CRAF as follows:

- CRA: Section 2 Risk Assessment Approach and Table 2-1 Chemical Category Classification Matrix
- CRAF: Section 2 Chemical Risk Assessment Framework and Appendix 1 Chemical Category Classification Matrix

c. Detail a risk assessment process for each chemical to determine risk to protected matters from the chemical's use. This process must:

- i. identify the risk assessment requirements based on the chemical's category;*
- ii. consider the chemical's intended use and function, and an estimation of the quantity of the chemical likely to be used, and at what concentration, in a typical year;*
- iii. consider the likely environmental fate of the chemical; and*
- iv. consider what, if any, mitigation and management measures are needed to prevent adverse impacts to protected matters from that chemical for the duration of this approval.*

The requested information is included in the CRA and CRAF as follows:

- *identify the risk assessment requirements based on the chemical's category*
 - CRA: Section 2 Risk Assessment Approach, Table 2-2 Assessment and Reporting Requirements by Tier and Table 2-3 Qualitative and Quantitative Risk Assessment Components
 - CRAF: Section 2 Chemical Risk Assessment Framework and Table 1 Risk Assessment Requirements
- *consider the chemical's intended use and function, and an estimation of the quantity of the chemical likely to be used, and at what concentration, in a typical year*
 - CRA: Section 3 Conceptual Exposure Model
 - CRAF: Section 2 Chemical Risk Assessment Framework and Appendix 8 Exposure Pathways

As per the CRAF and in line with both national guidance as well as other regulatory frameworks, the criteria used in the chemical category classification within the CRAF (CRAF: Appendix 1 Chemical Category Classification Matrix) does not include estimation of the quantity and/or concentration of the chemical when in use. Where required,

estimations of quantity and concentration of chemicals, as provided by the activity vendor, are taken into consideration in the development of both the Tier 2 Qualitative and Tier 3 Quantitative Risk Assessments (e.g. in the development of Predicted No-Effects Concentrations).

- *consider the likely environmental fate of the chemical*
 - CRA: Section 3 Conceptual Exposure Model evaluates general uses of the chemical and potential exposure pathways. The chemical dossiers provide an assessment of the environmental fate of chemicals including degradation half-lives.
 - CRAF: Section 2 Chemical Risk Assessment Framework and Appendix 8 Exposure Pathways
- *consider what, if any, mitigation and management measures are needed to prevent adverse impacts to protected matters from that chemical for the duration of this approval*
 - CRA: Section 5 Risk Management
 - CRAF: Section 4 Mitigation and Management.

d. Details of the process by which risk assessments for low risk chemicals will be peer reviewed by an independent chemical risk assessment expert. This process must:

- i. consider any checklists completed by the independent chemical risk assessment expert, to demonstrate that risks have been adequately assessed; and*
- ii. include provision of a signed and dated statement from the independent chemical risk assessment expert confirming that the chemical has been correctly categorised.*

The requested information is included in the CRA and CRAF as follows:

- CRAF: Section 3 Chemical Risk Assessment Format, Approval Process and Document Control, Table 2 Chemical Risk Assessment Review and Approval Requirements and Appendix 11 Peer Review Checklists.

e. Details of the process for recording each chemical's risk assessment in a register on the approval holder's website and for the provision of each chemical's risk assessment to the Department.

The requested information is included in the CRAF as follows:

- CRAF: Section 3 Chemical Risk Assessment Format, Table 2 Chemical Risk Assessment Review and Approval Requirements and Section 3.3 Register of Assessed Chemicals Chemical Risk Assessment Format, Approval Process and Document Control.
-

f. Details of a process to monitor and report on the implementation of any mitigation and management measures undertaken during use and handling of chemicals, to demonstrate no adverse impacts to protected matters, including:

- i. a monitoring and reporting framework that can measure and monitor the scale of hydraulic fracturing; and*
- ii. to notify the Department if an adverse impact to protected matters is detected.*

The requested information is included in the CRAF as follows:

- *a monitoring and reporting framework that can measure and monitor the scale of hydraulic fracturing*
 - CRAF: Section 4 Mitigation and Management, Section 4.4. Hydraulic Fracturing Monitoring and Reporting
- *to notify the Department if an adverse impact to protected matters is detected.*
 - CRAF: Section 4 Mitigation and Management, Section 4.3 Traffic Management Principles, Section 4.4. Hydraulic Fracturing Monitoring and Reporting and Appendix 10 Contingency Response Actions

g. Details of the process by which information in the risk assessments will be adaptively used to address any accidental release of a chemical to prevent adverse impacts to protected matters.

Refer to section 6.2 below.

6.2 Additional information requested

6.2.1 Accidental release scenarios

RFI reference 2.5.1

The department notes that accidental release scenarios have not been included in the chemical risk assessment and depend upon assessment outcomes to inform emergency response actions.

Santos has agreed in discussions with the Department, for the existing approved CRAFs, only authorised operational activities (i.e. activities that are or will be authorised under state and Commonwealth approvals) have been considered in the assessment of exposure pathways and risks in the Towrie CRAF. Accidental release scenarios have not been included as they are unplanned, hypothetical and unauthorised.

Based on the outcomes of the National Assessment of the Chemicals used in Coal Seam Gas in Australia (DoEE 2016), hypothetical accidental releases associated with delivery truck rollovers, including into watercourses, represent the greatest potential risk to MNES. Given the highly regulated nature of transportation of chemicals (at both a Commonwealth and State level), transport related scenarios and assessment have not been incorporated into the risk assessment process. This position was recognised and agreed by the Department at the time of developing the CRAF.

The movement of chemicals will be performed only by transport contractors with the relevant qualifications and licences required for the movement of each category of goods. Haulage will be performed to the satisfaction of relevant legislative requirements, including but not limited to the Australian Dangerous Goods Code and Queensland Transport Operations (Road Use Management – Dangerous Goods) Regulation 2008, as well as the Santos traffic management principles identified in Section 4.3 of the CRAF. The chemical risk assessment will however be used to inform decisions on a case-by-case basis regarding site assessment, risk management/clean-up and rehabilitation should a transport-related or other accidental release occur, in accordance with Appendix 10 of the CRAF (Appendix A to Attachment E). Appendix 10 of the CRAF outlines Santos Contingency Response Actions for unplanned/accidental releases involving chemicals.

In addition, Santos implements systems and management plans to avoid accidents, to implement during accidents, and to take after accidents; in addition, the plans include procedures to monitor potential chemical-related affects from accidental and intentional releases (use of chemicals during treatment of produced water and beneficial reuse of permeate).

In general, the management practices adopted and implemented by Santos are appropriate and have eliminated or reduced as much as is reasonably practicable the potential risks to MNES associated with the chemicals used in coal seam gas extraction.

7.0 Impact assessment

7.1 Assessment summary

This PD provides further information to inform assessment of the likelihood of Project having a significant impact on the following MNES:

- Listed threatened species and communities (section 18 and 18A)
- A water resource, in relation to coal seam gas development and large coal mining (section 24D and 24E).

Impacts to the following matters were assessed and referred to DAWE for assessment.

Listed threatened species and communities

The PMST (C7LO8J, dated 8 November 2021) identified 27 threatened species and 5 TEC as potentially occurring within the Project area and surrounds to be considered in referring the Project to the DAWE.

As detailed in the Ecology Assessment (Attachment C), field assessments confirmed one threatened flora (Ooline), one threatened fauna (Large-eared pied bat) and three TEC (Brigalow, Poplar box and Semi-evergreen vine thicket) as known to occur. Field survey, Lidar and aerial imagery were used to derive habitat mapping for the remaining three threatened flora and 19 threatened fauna with potential or likely to occur within the Project Area. Field validated habitat mapping underpins the impact assessment in Section 9 and Appendix F of the Ecology Assessment (Attachment C).

Assessments in accordance with the 'Significant Impact Guideline 1.1 – Matters of National Environmental Significance' (DotE, 2013a) and species-specific conservation advice for species having potential to occur concluded the Project is unlikely to significantly impact on a threatened species or TEC; however, the Minister determined the Project likely to have a significant impact and requested additional information for assessment by PD.

Significant impact assessments (Appendix F of Attachment C) undertaken for 11 known or potentially occurring threatened species and TEC in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance (DotE, 2013a) determined no significant impacts from the Project.

Migratory species

Excluding migratory species also listed as critically endangered, endangered or vulnerable, the PMST identified an additional 11 migratory species as potentially occurring within the Project area and surrounds.

Of the 11 migratory species, Glossy ibis was confirmed during field survey and five species were 'potential' or 'likely' to occur within the Project Area.

Assessment of those six migratory species in accordance with the 'Referral guidelines for 14 birds listed as migratory species under the EPBC Act' (DotE, 2015) concluded no significant impact on migratory species. This position was endorsed, with migratory species not being a controlling provision and no further information requested.

Water resource

As a coal seam gas development, the Project triggered assessment of impacts to water resources. This assessment is prepared in accordance with:

- Significant impact guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources' (DotE, 2013b)
- Significant impact guidelines 1.1 – Matters of National Environmental Significance (DotE, 2013a)
- Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) information guidelines (IESC, 2018).

The Water Assessment (Attachment D) concluded the proposed action will not have a significant impact on water resources; however, the Minister determined the Project likely to have a significant impact and requested additional information for assessment by PD.

Additional information provided supports the finding that the Project will not have a significant impact on water resources.

7.2 General assessment requirements

Background

“The proposed action is considered likely to have impacts to listed threatened species and to water resources. The preliminary documentation must describe and assess all relevant impacts (direct, indirect, cumulative and facilitated) including the magnitude, duration and frequency of the impacts, and must be assessed in accordance with relevant departmental policies and guidelines, including the SPRAT Database.

Impacts during the construction, operational and decommissioning stages of the action are to be addressed, and the following information provided.”

Assessment of impacts to MNES, including the Ecology Assessment (Section 7.0 of Attachment C) and Water Assessment (Section 9.0 of Attachment D) describe and assess direct, indirect, cumulative and facilitated impacts with potential to occur during construction, operation and decommissioning. The discussion of potential impacts within these studies considers magnitude, duration and frequency of the impacts in the corresponding risk and impacts assessments in accordance with referenced guidelines.

RFI 3.1.1

“Any technical data and other information used or needed to make a detailed assessment of the relevant impacts.”

Assessment of impacts to MNES, including the Ecology Assessment (Section 7.0 of Attachment C) and Water Assessment (Section 9.0 of Attachment D), describe and assess direct, indirect, cumulative and facilitated impacts with potential to occur during construction, operation and decommissioning. These assessment reports are supported by referenced guidelines to make a

RFI 3.1.2

“Include the direct and indirect loss and/or disturbance of MNES individuals and habitat as a result of the proposed action. This must include the quality of the habitat impacted and quantification of the individuals and habitat area (in hectares) to be impacted.”

Direct and indirect impacts to MNES individuals and habitat are considered in the Ecology Assessment (Section 7.0 of Attachment C). Direct and indirect impacts to MNES are described in the Water Assessment (Section 9.0 of Attachment D). Project impact assessments describe and assess direct, indirect, cumulative and facilitated impacts with potential to occur during construction, operation and decommissioning.

The Ecology Assessment was prepared in accordance with current Commonwealth Approved Conservation Advice or SPRAT. References to the guidance considered in the species-specific assessment of likelihood and potential for significant impacts are included in Section 6 (Likelihood of Occurrence), Section 11 (References) and Appendix F (Significant Impact Assessments) of the Ecology Assessment (Attachment C).

The Environmental Protocol (Attachment B) is a tool designed by Santos to apply the management hierarchy throughout the life of the Project for each phase of development — infrastructure planning and design, construction, operation, and decommissioning and rehabilitation. The Environmental Protocol provides a systema to identify, assess, manage and record loss and/or disturbance to MNES individuals (State conservation listed flora) and habitat. The quality of habitat impacted and quantification of individuals and habitat area to be impacted is managed through the integrated field development process in Section 4.0 of the Environmental Protocol (Attachment B).

RFI 3.1.3

“An assessment of the impacts of habitat fragmentation in the proposed action area and surrounding areas, including consideration of species’ movement patterns.”

Potential impacts resulting from removal of native vegetation can include fragmentation of habitats, increased edge effects, reduced condition and quality of remaining vegetation and habitats, and reduced dispersal opportunities for fauna.

Habitat fragmentation is discussed in Section 7.1 of the Ecology Assessment (Attachment C). MNES that are most susceptible to fragmentation impacts from construction of the Project include Brigalow TEC, Ooline, *Xerothamnella herbacea* and Yakka skink.

The Environmental Protocol (Attachment B) outlines measures to prioritise avoidance of higher quality contiguous remnant vegetation communities and preferential siting to minimise fragmentation and edge effects. Infrastructure siting will preferentially make use of existing gaps between existing vegetation patches; new clearing between narrow linear patches will not create gaps greater than 100 m (usually less than 25 m for linear infrastructure) remaining passable for threatened fauna such as Greater glider, Koala and Northern quoll.

RFI 3.1.4

“An assessment of the likely duration of impacts to MNES as a result of the proposed action; including a detailed assessment of the nature and extent of the likely short-term and long-term relevant impacts.”

Duration of a potential impact is an important consideration in determining whether the impact is significant i.e. important, notable, or of consequence, having regard to its context or intensity.

The Ecology Assessment (Attachment C) discusses potential impacts, including duration, in Section 7.0; generally, duration of impacts at any one location will be limited to the period of construction as the Project progresses in stages across the Project Area. As well as magnitude and frequency, duration was a key factor in the initial risk assessment undertaken in Section 9.0 of the Ecology Assessment (Attachment C) to identify MNES values having elevated potential for significant risks. Significant impact assessments, including further discussion of duration, is presented in Appendix D of the Ecology Assessment (Attachment C).

The Water Assessment (Attachment D) describes and assesses the duration of impacts resulting from groundwater abstraction and produced water management through the impact assessment (Section 4.2), risk assessment (Section 9) and significant impact assessment (Section 11) in accordance with relevant guidance.

RFI 3.1.5

“A discussion of whether the impacts are likely to be repeated, for example as part of maintenance.”

The nature of gas field development involves development of well leases, gathering lines and pipelines, construction of wells and production of gas and abstraction of groundwater as the Project progresses in stages across the Project area. The Project development cycle repeats for each well; however, the location of the Project activity and impacts change location as the Project progresses.

The Ecology Assessment (Section 7.0 of Attachment C) and Water Assessment (Section 9.0 of Attachment D) describe and assess direct, indirect, cumulative and facilitated impacts with potential to occur during construction, operation and decommissioning. Management system documentation will apply to manage Project activities repeated on a routine basis, with mitigation measures related to MNES implemented via the Environmental Management Plan (Attachment F).

RFI 3.1.6

“A discussion of whether any impacts are likely to be unknown, unpredictable or irreversible.”

Potential impacts are generally known, predictable or reversible through implementation of mitigation, management and rehabilitation measures – refer Environmental Management Plan (Attachment F) and Rehabilitation Plan (Attachment H).

Santos has extensive experience in developing gas fields in the Surat and Bowen Basin and is a registered suitable operator for carrying out Environmentally Relevant Activities under the Queensland *Environmental Protection Act 1994*. Santos operates under mature management systems and practices to facilitate the developments in a way that manages potential impacts in compliance with legislative requirements and approvals.

In the event monitoring identifies new or unplanned impacts, updated information will feed into understanding of site conditions (Santos GIS) to inform location of MNES values identified in constraint mapping and preferred infrastructure siting.

Adaptive management processes integrate monitoring into the implementation of avoidance, mitigation and management measures in the following management plans:

- Environmental Protocol (Attachment B)
- Environmental Management Plan (Attachment F)
- Significant Species Management Plan (Attachment G) and
- Rehabilitation Plan (Attachment H).

RFI 3.1.7

“Justification, with supporting evidence, how the proposed action will not be inconsistent with:

- *Australia’s obligations under the Biodiversity Convention, the Convention on Conservation of Nature in the South Pacific (Apia Convention), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); and*
- *a recovery plan or threat abatement plan.”*

Santos has adopted relevant recovery plans and threat abatement plans into assessments and management planning for threatened fauna known, likely or having potential to occur in the Project Area. The only CITES listed species also listed under the EPBC Act and having potential to occur in the Project area is Grey falcon. Peregrine falcon is a CITES listed species also recorded within Project Area but is not listed under the EPBC Act.

Santos supports the full range of domestic measures Australia has adopted for improved conservation and tighter restrictions on trade of CITES listed species. The Project does not involve international trade in wildlife does not threaten wild populations of plants and animals.

8.0 Avoidance, mitigation and management measures

The Environmental Protocol (Attachment B) will ensure Santos plans and locates project infrastructure with strict consideration of relevant MNES identified as having potential, likely or known to occur within the Project Area, preferentially locating infrastructure in the lowest value. Through the Protocol, Santos makes a commitment to avoid certain MNES values while minimising cumulative impacts to other MNES within agreed maximum disturbance limits representing a conservative maximum development scenario for the impact assessments.

Certainty in how risks will be managed and monitored during construction, operation, decommissioning and rehabilitation is given in the form of management plans incorporating Commonwealth and State guidelines and prescribed industry practice, including:

- Environmental Protocol (Attachment B)
- Environmental Management Plan (Attachment F)
- Significant Species Management Plan (Attachment G)
- Rehabilitation Plan (Attachment H).

This section provides additional information requested in relation to the proposed avoidance, mitigation and management measures.

8.1 General assessment requirements

Background

Avoidance and mitigation measures are the primary methods of eliminating and reducing significant impacts on MNES. Where possible and practicable, it is best to avoid impacts. If impacts cannot be avoided, then they should be minimised or mitigated as much as possible. Avoidance and mitigation measures must be investigated thoroughly as a part of the assessment and be supported by evidence to demonstrate likely success.

Management commitments by the person proposing to take the action must be clearly distinguished from recommendations or statements of best practice made by the document author or other technical expert.

The SPRAT Database, and associated statutory documents, may provide relevant mitigation measures for listed threatened species and ecological communities.

The department notes the referral includes a detailed description of the proposed avoidance, mitigation and management measures to be implemented by the proponent during the construction, operation and maintenance stages of the proposed action.

Avoidance and mitigation measures to protect MNES values are identified in Section 8 of the Ecology Assessment (Attachment C) and Section 10 of the Water Assessment (Attachment D). Through these documents, the Project demonstrates how it will adopt a preferred management hierarchy to avoid, minimise or mitigate impacts; examples include:

- A constraint-based framework to implement the hierarchy of management principles to avoid, minimise and manage land disturbance and impacts on MNES when planning for and implementing new petroleum activities within the Project Area – refer to Section 3.0 of the Environmental Protocol (Attachment B)
- Prioritisation hierarchy to manage and use produced water for a purpose beneficial to the environment, water users and water-dependent industries – refer Section 3.3.1.2 of Water Assessment (Attachment D)
- Waste storage, handling, transport and processing in accordance with the Project EAs, and the waste and resource management principles and hierarchy prescribed by the *Waste Reduction and Recycling Act 2011* – refer to Section 7.2.7 of the Environmental Management Plan (Attachment F).

The detailed description of proposed avoidance, mitigation and management measures to be implemented during construction, operation and maintenance stages of the Project respond directly to government and industry recommendations, including but not limited to:

- Department's SPRAT (DAWE, 2021), conservation advice and recovery plans (referenced in Section 4 of Attachment C)
- Code of Practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland Version 2 (DNRME 2019b) (referenced in Section 10 of Attachment D)
- CSG Water Management Policy prioritisation hierarchy (DEHP 2012) (referenced in Section 10 of Attachment D)
- End of Waste (EOW) codes (referenced in Section 10 of Attachment D) for Irrigation of Associated Water (including coal seam gas water) (DES, 2019a), Associated Water (including coal seam gas water) (DES, 2019b) and Coal Seam Gas Drilling Mud (DES, 2019c).

RFI 4.1

"A detailed summary of measures proposed to be undertaken by the proponent to avoid, mitigate and manage relevant impacts of the proposed action on relevant MNES."

Detailed summary of avoidance and mitigation measures proposed to protect MNES values are identified in Section 8 of the Ecology Assessment (Attachment C) and Section 10 of the Water Assessment (Attachment D). Certainty in how risks will be managed and monitored is provided in the form of management plans, including:

- Environmental Protocol (Attachment B)
- Environmental Management Plan (Attachment F)
- Significant Species Management Plan (Attachment G)
- Rehabilitation Plan (Attachment H).

These management plans are presented as final plans to be approved and conditioned for implementation when construction commences in 2022.

RFI 4.2

"The proposed measures must be based on best available practices, appropriate standards, evidence of success for other similar actions and supported by published scientific evidence."

Recommended measures to avoid and minimise risk of significant impacts on MNES identified in Section 8 of the Ecology Assessment (Attachment C) and Section 10 of the Water Assessment (Attachment D) are based on legislative requirements, industry best practice standards, species-specific guidance and Santos proven management systems and processes.

The detailed description of proposed avoidance, mitigation and management measures to be implemented during construction, operation and maintenance stages of the Project respond directly to government and industry recommendations, including but not limited to:

- Department's SPRAT (DAWE, 2021), conservation advice and recovery plans (referenced in Section 4 of Attachment C)
- Code of Practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland Version 2 (DNRME 2019b) (referenced in Section 10 of Attachment D)
- CSG Water Management Policy prioritisation hierarchy (DEHP 2012) (referenced in Section 10 of Attachment D)
- End of Waste (EOW) codes (referenced in Section 10 of Attachment D), including:
 - EOW Code Irrigation of Associated Water (including coal seam gas water) (DES, 2019a)

- EOW Code Associated Water (including coal seam gas water) (DES, 2019b)
- EOW Code Coal Seam Gas Drilling Mud (DES, 2019c).

Through the delivery of preceding gas field development projects, Santos has established a mature management system and operational standards, supported by a strong environmental track record demonstrating evidence of success in support of the proposed measures.

RFI 4.3

“All proposed measures for MNES must be drafted to meet the ‘S.M.A.R.T’ principle:

S – Specific (what and how)

M – Measurable (baseline information, number/value, auditable)

A – Achievable (timeframe, money, personnel)

R – Relevant (conservation advices, recovery plans, threat abatement plans)

T – Time-bound (specific timeframe to complete).”

Avoidance and mitigation measures proposed to protect MNES values are identified in Section 8 of the Ecology Assessment (Attachment C) and Section 10 of the Water Assessment (Attachment D). Certainty in how risks will be managed and monitored is provided in the form of management plans, including:

- Environmental Protocol (Attachment B)
- Environmental Management Plan (Attachment F)
- Significant Species Management Plan (Attachment G)
- Rehabilitation Plan (Attachment H).

These management plans represent Project-specific parts of an overall Santos management system that guide implementation. While the Project will be developed progressively to optimise gas production, the specific and measurable components depend on the programmed work schedule. When works with potential for impacts are planned to occur, implementation of proposed avoidance, mitigation, management and monitoring measures, and corrective actions will be appropriate for the programmed work schedule, location of works and activities being undertaken.

Where practical, the management plans identify timing, frequency and duration of proposed measures – for example, within the Environmental Control Plans in the Environmental Management Plan (Attachment F) and timeframes for rehabilitation monitoring in Rehabilitation Plan (Attachment H).

All of the attached management plans reference relevant references, including Santos approvals and management documentation, Government codes and guidance, and MNES specific advice.

RFI 4.4

“Any management plans as committed by the proponent, are to be provided (in approved or draft format) as appendices to the preliminary documentation.”

Santos’ commitments to be implemented to manage risks to MNES values are outlined in the management plans provided as attachments to this preliminary documentation package. Based on extensive experience in gas field development in the Surat Basin, Santos was able to adapt existing approved management plans to address site-specific MNES values. The management plans are presented as final documents to be approved and conditioned for implementation when construction commences in 2022, including:

- Environmental Protocol (Attachment B)
- Environmental Management Plan (Attachment F)
- Significant Species Management Plan (Attachment G) and
- Rehabilitation Plan (Attachment H).

RFI 4.5

“Details of specific and measurable environmental outcomes to be achieved for relevant MNES. All commitments must be drafted using committal language (e.g. ‘will’ and ‘must’) when describing the proposed measures.”

As per RFI 4.3, the proposed avoidance, mitigation, management and monitoring requirements identified in the supporting documentation represent commitments, including those identified in the Ecology Assessment (Attachment C), Water Assessment (Attachment D), Chemical Risk Assessment (Attachment E), Environmental Management Plan (Attachment F), Significant Species Management Plan (Attachment G) and Rehabilitation Plan (Attachment H).

RFI 4.6

“Details of the proposed measures to be undertaken to avoid, mitigate and manage the relevant impacts of the proposed action, including those required through other Commonwealth, State and local government approvals.”

Recommended measures to avoid and minimise risk of significant impacts on MNES identified in Section 8 of the Ecology Assessment (Attachment C) and Section 10 of the Water Assessment (Attachment D) are based on legislative requirements, industry best practice standards, species-specific guidance and Santos proven management systems and processes.

The detailed description of proposed avoidance, mitigation and management measures to be implemented during construction, operation and maintenance stages of the Project respond directly to government and industry recommendations, including but not limited to:

- Department’s SPRAT (DAWE, 2021), conservation advice and recovery plans (referenced in Section 4 of Attachment C)
- Code of Practice for the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland Version 2 (DNRME 2019b) (referenced in Section 10 of Attachment D)
- CSG Water Management Policy prioritisation hierarchy (DEHP 2012) (referenced in Section 10 of Attachment D)
- End of Waste (EOW) codes (referenced in Section 10 of Attachment D), including:
 - EOW Code Irrigation of Associated Water (including coal seam gas water) (DES, 2019a)
 - EOW Code Associated Water (including coal seam gas water) (DES, 2019b)
 - EOW Code Coal Seam Gas Drilling Mud (DES, 2019c).

Through the delivery of preceding gas field development projects, Santos has established a mature management system and operational standards, supported by a strong environmental track record demonstrating evidence of success in support of the proposed measures

RFI 4.7

“Information on the timing, frequency and duration of the proposed avoidance, mitigation, management and monitoring measures, and corrective actions to be implemented.”

The Project will be developed progressively to optimise gas production to meet Santos’ gas supply obligations and opportunities, the Project will be able to utilise approved capacity of existing gas compression and water treatment facilities located on adjoining tenures.

Accordingly, the timing, frequency and duration for implementation of proposed avoidance, mitigation, management and monitoring measures, and corrective actions to be implemented will depend on the programmed work schedule, location of works and activities being undertaken.

Where practical, the management plans identify timing, frequency and duration of proposed measures – for example, within the Environmental Control Plans in the Environmental Management Plan (Attachment F) and timeframes for rehabilitation monitoring in Rehabilitation Plan (Attachment H).

RFI 4.8

“An assessment of the expected or predicted effectiveness of the proposed measures.”

Santos has adapted existing approved management plans to address site-specific MNES values, which encompasses regulatory approval requirements, extensive experience and learnings in gas field development in the Surat and Bowen basins. Through implementation of similar constraint-based planning frameworks, environmental management and rehabilitation plans, Santos has achieved regulatory compliance, environmental performance outcomes and social-licence to operate.

RFI 4.9

“Any statutory or policy basis for the proposed measures, including reference to the SPRAT Database and relevant approved conservation advice, recovery plan or threat abatement plan, and a discussion on how the proposed measures are not inconsistent with relevant plans.”

As per RFI 4.6. underpinning the Environmental Protocol (Attachment B) and management plans (Attachment F-H), detailed habitat descriptions (included in Appendix A of Attachment B and Appendix D of Attachment C) and species-specific mitigation measures (in Section 8 of Attachment C) make direct reference to the SPRAT Database and relevant approved conservation advice, recovery plan or threat abatement plan. There are no notable inconsistencies with relevant plans.

RFI 4.10

“Details of ongoing management, including monitoring programs to support an adaptive management approach, that validate the effectiveness of the proposed measures and overall demonstrate that environmental outcomes will be achieved.”

Santos management systems apply over all Santos petroleum tenure. These systems are underpinned by management documentation, registers, databases and GIS used to record, track and manage environmental outcomes.

Santos uses a geographic information system (GIS) model that will identify the locations of MNES values identified in constraints mapping. The constraints mapping layer is maintained in this database, or, where data is not directly collected into the Santos GIS database, the information will be supplied to Santos GIS department with confidence or resolution detail to maintain the layer integrity.

Following completion of the field scout and any detailed ecological assessment, the field validated values and any refinements made to the design/layout are uploaded into the GIS. Where the results of the detailed ecological assessment are significant, Santos may be required to repeat desktop assessment of infrastructure locations to refine and minimise proposed impacts to identified MNES values and comply with maximum disturbance limits.

Adaptive management processes integrate monitoring into the implementation of avoidance, mitigation and management measures in the following management plans:

- Environmental Protocol (Attachment B)
- Environmental Management Plan (Attachment F)
- Significant Species Management Plan (Attachment G)
- Rehabilitation Plan (Attachment H).

RFI 4.11

“Details of tangible, on-ground corrective actions that will be implemented in the event the monitoring programs indicate that the environmental outcomes have not or will not be achieved.”

Adaptive management processes integrate monitoring into the implementation of avoidance, mitigation and management measures in the following management plans:

- Environmental Protocol (Attachment B)
- Environmental Management Plan (Attachment F)
- Significant Species Management Plan (Attachment G) and

- Rehabilitation Plan (Attachment H).

Some examples of corrective actions include:

- Findings of incident investigations recorded electronically and managed through the Santos Incident Management System (IMS) in EHS Toolbox and communicated through Toolbox talks.
- Recalculate impacts / deduction from statutory disturbance limits where disturbance has exceeded that approved prior to construction. Reinstate clearing area delineation where it has failed.
- Reinforce need to conduct activity in designated and approved areas during site toolbox / induction meetings.
- Update fauna habitat mapping where fauna identified in unmapped areas. Ensure fauna habitat mapping reflects results of the spotter catcher work.
- Utilise spotter catcher to remove and relocate fauna from construction site prior to recommencement of works.
- Review the circumstances that death or injury occurred and update fauna spotter catcher procedures if death was avoidable.

RFI 4.12

“Details of any measures proposed to be undertaken by Queensland and local governments, including the name of the agency responsible for approving each measure.”

There are no measures proposed to be undertaken by Queensland or local governments. Through the development of the Project, Santos will consult with relevant government agencies and notify/report as required by relevant approvals (Attachment I).

9.0 Rehabilitation requirements

9.1 Overview

The Queensland *Environmental Protection Act 1994* includes requirements for Environmental Authority (EA) holders to rehabilitate disturbed areas, and to provide financial assurance to the government for the cost of rehabilitation in the event that they are unable to satisfactorily meet this requirement. Schedule 9 of the EA for PL 1059 (EA-P-10010995) identifies rehabilitation conditions including the requirement to prepare a Rehabilitation Plan. The EA is included as Attachment I.

The Queensland *Petroleum and Gas (Production and Safety) Act 2004* also includes obligations and responsibilities for petroleum lease holders to decommission petroleum wells and pipelines. These activities are also generally reflected in the conditions of conduct and compensation agreements for entering private land.

Santos prepared a draft Rehabilitation Monitoring Plan for PL 1059 which was appended to the Environmental Management Plan submitted with the referral. This plan has now been updated to address the conditions of the EA EA-P-10010995 (Attachment I) and submitted to the Queensland Department of Environmental and Science. The updated Rehabilitation Plan is attached at Attachment H.

All activities carried out as part of the Project will be rehabilitated in accordance with the Rehabilitation Plan (Attachment H). Further information on rehabilitation requirements is provided in this section.

9.2 Additional information requested

9.2.1 Decommissioning and rehabilitation

RFI Reference 5.1

“Decommissioning and/or rehabilitation that includes, but is not limited to, drilling and well sites, gas and water pipelines, areas of associated infrastructure (including access roads) and water storage sites.”

Decommissioning and rehabilitation will occur progressively until approximately 2077 in accordance with the conditions of the EA EA-P-10010995 (Attachment I) and Queensland regulatory requirements. Specific decommissioning and rehabilitation techniques and activities for infrastructure types are described in Sections 4 and 5 of the Rehabilitation Plan (Attachment H) and summarised below.

9.2.1.1 Drilling and well sites

Wells will be decommissioned in accordance with the mandatory Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland (DNRME, 2019). The primary objective of well decommissioning is to isolate hydrocarbon and water bearing formations and eliminate migration pathways (between the reservoir, other formation / aquifers and surface). This is done using cement or bridge plugs. Wells earmarked for decommissioning are subject to individual evaluation to determine the most appropriate decommissioning program.

Final rehabilitation of the well and lease area will include removing the well head, surface infrastructure and fencing; capping the well; filling in pits; respreading topsoil (after preparation) and revegetating the site to match its pre-disturbance vegetation type. Infrastructure that is useful to the landowner (for example a hardstand area or converted well) may be handed over to the landowner in accordance with EA conditions.

9.2.1.2 Gas and water pipelines

Right-of-ways for gas and water gathering lines and pipelines will be reinstated within three months of completion of construction (weather permitting). This includes replacement of subsoils and topsoils, reprofiling to match the surrounding landform, and revegetation with suitable groundcover species.

At the cessation of production, gas and water gathering lines and pipelines will be isolated from the wellhead and connection points. Once isolated, gathering lines will be drained, vented and capped in accordance with the Australian Pipeline and Gas Association (APGA) Code of Environmental Practice (APGA, 2017) or applicable code in place at the time of decommissioning. Subsurface components of the gathering network will remain in-situ and the operational right-of-way rehabilitated (where required).

9.2.1.3 Areas of associated infrastructure (including access roads)

When no longer required, access tracks will be rehabilitated or handed over to the landowner in accordance with EA conditions. If rehabilitation is required, gravel (if used) will be removed, and the disturbance area ripped, levelled and re-profiled to reinstate natural contours (including watercourses), then revegetated to match the pre-disturbance land-use.

9.2.1.4 Water storage sites

Water will be stored in tanks, which can be decommissioned and removed from site. Tank pads will be ripped, levelled and reprofiled to reinstate natural land contours and then revegetation to match the pre-disturbance land use.

Where Santos accesses water from existing farm dams, these will be retained by the landholder. The Project will not develop any new dams requiring decommissioning or rehabilitation.

9.2.2 Rehabilitation acceptance criteria

RFI Reference 5.2

'Rehabilitation acceptance criteria, including for the restoration of habitat for relevant listed threatened species and communities.'

Transition and final rehabilitation acceptance criteria are identified in Section 6 of the Rehabilitation Plan (Attachment H) and summarised below.

Table 2 Rehabilitation acceptance criteria

Type	Timing	Acceptance criteria
Progressive, partial rehabilitation (pipeline right-of-ways)	Pipeline trenches must be backfilled, and topsoils reinstated within three months after pipe laying. Reinstatement and revegetation of the pipeline right-of-way must commence within 6 months after cessation of petroleum activities for the purpose of pipeline construction.	Backfilled, reinstated, and revegetated pipeline trenches and right-of-ways must be: <ul style="list-style-type: none"> • Stable landform • Re-profiled to a level consistent with surrounding soils • Re-profiled to original contours and established drainage lines Vegetated with groundcover which is not a prohibited or restricted pest species, and which is established and growing.
Transitional Rehabilitation Criteria	Significantly disturbed areas that are no longer required for the on-going petroleum activities, must be rehabilitated within 12 months (unless an exceptional circumstance in the area to be rehabilitated (e.g. a flood event) prevents this timeframe being met)	Contaminated land resulting from petroleum activities is remediated and rehabilitated to be: <ul style="list-style-type: none"> • Non-polluting • Stable landform • Re-profiled to contours consistent with the surrounding landform • Surface drainage re-established • Topsoil reinstated and either: <ul style="list-style-type: none"> - Groundcover, that is not prohibited or restricted pest species, is growing, or - Alternative soil stabilisation methodology that achieves effective stabilisation is implemented and maintained.
Final Rehabilitation Acceptance Criteria	Once areas are assessed as meeting the transitional rehabilitation criteria, they are to be rehabilitated to meet the following final acceptance criteria measured either against the	All significantly disturbed areas caused by petroleum activities which are not being or intended to be utilised by the landholder or overlapping tenure holder, must be rehabilitated to meet the following final acceptance criteria measured either against the highest ecological value adjacent land use or the pre-disturbed land use:

Type	Timing	Acceptance criteria
	highest ecological value adjacent land use or the pre-disturbed land use	<ul style="list-style-type: none"> • Greater than or equal to 70 per cent of native ground cover species richness • Greater than or equal to the total per cent ground cover • Less than or equal to the per cent species richness of prohibited or restricted pest species • Where the adjacent land use contains, or the pre-clearing land use contained, one or more regional ecosystem(s), then: <ul style="list-style-type: none"> - At least one Regional Ecosystem(s) from the same broad vegetation group, as demonstrated by the predominant species in the ecologically dominant layer, must be present; and, - Regional Ecosystem present in (I7)(d)(i) must possess an equivalent or higher conservation value (biodiversity status) than the Regional ecosystem(s) in either the adjacent land or pre-disturbed land.
Final Rehabilitation Acceptance Criteria in Environmentally Sensitive Areas	Once areas are assessed as meeting the transitional rehabilitation criteria, they are to be rehabilitated to meet the following final acceptance criteria measured against the highest ecological value adjacent land use or the pre-disturbed land use	<p>Where significant disturbance to land has occurred in an environmentally sensitive area, the following final rehabilitation criteria as measured against the pre-disturbance biodiversity values assessment (required by conditions (D1) and (D2)) must be met:</p> <ul style="list-style-type: none"> • Greater than or equal to 70% of native ground cover species richness • Greater than or equal to the total per cent ground cover • Less than or equal to the per cent species richness of Prohibited or restricted pest species • Greater than or equal to 50% of organic litter cover • Greater than or equal to 50% of total density of coarse woody material • All predominant species in the ecologically dominant layer, that define the pre-disturbance regional ecosystem(s) are present.

9.2.3 Monitoring and contingency

RFI Reference 5.3

'A summary of the procedures, including contingency measures, that will be undertaken to achieve the rehabilitation acceptance criteria.'

RFI Reference 5.4

'A summary of the monitoring program to determine the success of rehabilitation activities implemented by the proponent.'

Section 4 of the Rehabilitation Plan (Attachment H) identifies rehabilitation techniques to achieve rehabilitation criteria, including:

- Preserving and respreading topsoil
- Soil amelioration
- Treatment to alleviate compacted soils
- Contaminated land management
- Bank and riparian vegetation reinstatement for watercourse crossings
- Landform reprofiling
- Revegetation including reseeded and spreading of mulch
- Weed management
- Livestock exclusion.

Sections 6 and 7 of the Rehabilitation Plan (Attachment H) outline the process for monitoring rehabilitation sites against transitional and final completion criteria, and contingency measures in the event that sites are not on the trajectory to meet criteria.

Transitional rehabilitation criteria must be met within 12 months of decommissioning and abandonment activities. Where criteria are not met, the following contingency actions may be needed:

- Reprofilling soils including capping of exposed subsoils or amelioration if soils are in poor conditions
- Re-seeding in areas of poor groundcover
- Maintenance or rework if erosion present

Once areas have met transitional rehabilitation criteria, a risk-based approach will be used to inform further monitoring and rectification works. High risk areas are those that require rework or rectification in order to meet transitional or final rehabilitation criteria. These sites must be monitored at least annually.

Medium risk areas are those that are meeting the transitional rehabilitation criteria but require time or maintenance works to meet final rehabilitation criteria. These sites will be monitored annually, weather permitting.

Low risk areas are those that have met both transitional and final rehabilitation requirements and are ready to be relinquished.

Monitoring parameters for rehabilitation sites are identified in Tables 6 and 7 of the Rehabilitation Plan (Attachment H).

RFI 5.5

'The details of any rehabilitation activities proposed to be undertaken as required by Commonwealth, State or Territory, and local government legislation. Attach relevant Commonwealth, State or Territory, and local government approvals and permits as supporting documents to the preliminary documentation.'

State rehabilitation requirements are identified in the Rehabilitation Plan (Attachment H) and the Environmental Authority (EA) P-EA-10010995, attached at Attachment I.

10.0 Offsets

RFI 6.1

'An assessment of the likelihood of residual significant impacts occurring on relevant MNES, after avoidance, mitigation and management measures have been applied.'

RFI 6.2

'A summary of the proposed environmental offset and key commitments to achieve a conservation gain for each protected matter.'

RFI 6.3

'If an offset area has not been nominated, include a draft Offset Management Strategy as an appendix to the PD.'

RFI 6.4

'Where offset area/s have been nominated, include a draft Offset Area Management Plan as an appendix to the PD.'

Environmental offsets are measures that compensate for the residual significant impacts of an action on the environment. 'For assessments under the EPBC Act, offsets are only required if residual impacts are significant'.¹

¹ *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (2012), p7.*

The significant impact guidelines define a significant impact as:

'A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on matters of national environmental significance'.²

'Avoidance and mitigation measures are the primary strategies for managing the potential significant impact of a proposed action'.³ 'Offsets are not required where the impacts of a proposed action are not thought to be significant or could reasonably be avoided or mitigated'.⁴

The Project has been designed to prioritise avoidance of impacts on protected matters. The remaining impacts are minimised and mitigated to an extent where residual impacts on protected matters are not considered to be important, notable, or of consequence, having regard to the context or intensity of the project.

Within the Project Area, the areas containing the highest quality habitats, Middle Hill and the western ridgeline, are deliberately avoided and identified as no go zones for proposed petroleum and gas activities within the Environmental Protocol (Attachment B).

The remainder of the proposed action area is predominately highly disturbed, located within the floor of Arcadia Valley. These areas have been subjected to broadscale land clearing in support of ongoing agricultural activities. The values remaining in this area exist as predominantly small, regrowth vegetation communities that are highly fragmented. These are areas of limited ecological value.

Given the limited ecological value of the areas impacted and in consideration of the historic and ongoing agricultural impacts to values, the minor impacts associated with the proposed action are not expected to be important, notable, or of consequence. As detailed in Section 9 and Appendix F of the Ecology Assessment (Attachment C), the project is unlikely to have a residual significant impact on any listed species or community. Therefore, it is not appropriate to draft an Offset Management Strategy or Offset Management Plan as part of this PD.

Santos has two offset properties closely situated to the Project Area and have been used to offset MNES values similar to those identified in the Project Area. The offset area management plans for the Kentucky and Bottle Tree offset properties have been developed using the EPBC Act *Environmental Offsets Policy* (DSEWPaC, 2012). Under these approved plans there remains surplus offset values for the acquittal of future stages of development for the GLNG project. Examples of the surplus offsets available across these two offset properties are shown in Table 3.

² *Matters of National Environmental Significance Significant impact guidelines 1.1 (2013), p2.*

³ *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (2012), p7.*

⁴ *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (2012), p12.*

Table 3 Santos offset properties

Threatened species or ecological community	Status	Project likelihood of occurrence	Project maximum impact (ha)	Project significant impact	Offsets available	Surplus offsets available on Bottletree and Kentucky
Brigalow TEC)	E	Known	2.00	Unlikely	Yes	>100 ha available on Bottle Tree Property
<i>Cadellia pentastylis (Ooline)</i>	V	Known	5.00	Unlikely	Yes	Extension of existing offset planting areas on Bottle Tree are available
<i>Xerothamnella herbacea</i>	E	Likely	2.00	Unlikely	Yes	Extension of existing offset planting areas on Bottle Tree are available
Painted honeyeater (<i>Grantiella picta</i>)	V	Potential	12.00	Unlikely	Yes	>200 ha of suitable habitat is available on Kentucky
Australian painted snipe (<i>Rostratula australis</i>)	E	Potential	0.00	Unlikely	Yes	Wetland areas with fringing vegetation present on Bottle Tree
Glossy ibis (<i>Plegadis falcinellus</i>)	Mi	Known	1.00	Unlikely	Yes	Wetland areas with fringing vegetation present on Bottle Tree
Latham's snipe (<i>Gallinago hardwickii</i>)	Mi	Potential	1.00	Unlikely	Yes	Wetland areas with fringing vegetation present on Bottle Tree
South-eastern long-eared bat (<i>Nyctophilus corbeni</i>)	V	Likely	4.00	Unlikely	Yes	>200 ha of suitable habitat is available on Kentucky
Koala (<i>Phascolarctos cinereus</i>)	V	Potential	2.00	Unlikely	Yes	>200 ha of suitable habitat is available on Kentucky
Ornamental snake (<i>Denisonia maculata</i>)	V	Potential	2.00	Unlikely	Yes	>100 ha available on Bottle Tree Property
Yakka skink (<i>Egernia rugosa</i>)	V	Potential	2.00	Unlikely	Yes	>200 ha of suitable habitat is available on Kentucky

11.0 Ecologically sustainable development

RFI 7.1

'A description of how the proposed action meets the principles of ESD, as defined in section 3A of the EPBC Act.'

Australia's National Strategy for Ecologically Sustainable Development (Ecologically Sustainable Development Steering Committee, 1992) defines ecologically sustainable development (ESD) as: 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'. The EPBC Act (Section 3A) defines principles of ecologically sustainable development as:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- The principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making
- Improved valuation, pricing and incentive mechanisms should be promoted.

Project implementation of the ecologically sustainable development principles are reviewed in Table 4.

Table 4 Project implementation of the principles of ecologically sustainable development

Principle	Project implementation
Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations	<p>Santos maintains an advanced environmental, health and safety management system that comply with Australian Standards AS/NZS4801:2001 and ISO14001:2015.</p> <p>All staff, contractors, and subcontractors, are required to:</p> <ul style="list-style-type: none"> • Comply with all requirements of environmental legislation • Comply with specific requirements of the Environmental Authority and associated approvals/licenses • Undertake all activities in accordance with the agreed management plans, procedures, work method statements and safe work method statements • Ensure that they are aware of the contact person regarding environmental matters • Report any activity that has resulted in, or has the potential to result in an environmental incident or non-compliance • Participate in investigations and undertaking corrective actions (where required) to reduce or remediate environmental harm or to prevent the re-occurrence of an incident • Ensure that they attend any environmental training provided. <p>The following protocol, in order of preference, is used to determine the appropriate course of action when assessing potential impacts and environmental risks. This process is implemented in all stages of construction from conception and design, through site selection and construction and into rehabilitation and decommissioning.</p> <ul style="list-style-type: none"> • Avoid – avoid direct and indirect impacts • Minimise – minimise potential impacts • Mitigate – implement mitigation measures to manage the risks of adverse impacts • Remediate and rehabilitate – actively remediate and rehabilitate impacted areas • Offset – offset residual adverse impacts in accordance with regulatory requirements. <p>Santos is committed to creating a sustainable future for the communities in which it operates, by providing local employment, training, education and enterprise opportunities. This commitment includes partnering with community groups and organisations that contribute to the social vitality of the region and work with local businesses and organisations to create jobs, build diverse skill sets and keep Santos' supply chain local.</p> <p>Keeping Santos' supply chain local is a key enabler for economic, environmental, social and operational sustainability. Hiring and procuring locally is important to Santos because it encourages:</p> <ul style="list-style-type: none"> • A reliable, local supply chain that can be flexible and resilient in times of uncertainty.

Principle	Project implementation
	<ul style="list-style-type: none"> • Long-term socio-economic benefits for smaller regional communities. • Upskilling and educational opportunities. • Local suppliers to source from other local companies. <p>Sharing the positive economic and social benefits of natural gas is critical to ensuring a sustainable future for both Santos and the community.</p>
<p>If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation</p>	<p>The precautionary principal is considered in all phases of Project development from preliminary design, through to construction, decommissioning and rehabilitation. Santos' impact assessment approach assumes that identified impacts will occur, thus enabling worst-case scenarios to be identified, assessed and mitigated within a continuous improvement context.</p> <p>The Environmental Protocol for Constraints Planning and Field Development (the Protocol) will be utilised to provide a framework for the siting of gas wells and associated infrastructure within the Towrie development area. The Protocol is specifically designed to ensure that Project activities takes place in accordance with:</p> <ul style="list-style-type: none"> • relevant legislation such as the EPBC Act • project commitments identified in Project approval documentation, such as Environmental Management Plans, the MNES Report, Water Assessment, Chemical Risk Assessment Report and Significant Species Management Plan. <p>The Protocol sets out the framework for systematically identifying, assessing and managing potential impacts associated with development of any new petroleum activity within PL1059. It will apply through each stage of development, including planning and design, construction, operation, decommissioning and rehabilitation during the project life cycle.</p> <p>Through application of the Protocol, infrastructure siting will:</p> <ul style="list-style-type: none"> • consider MNES when selecting the location of project activities • avoid or minimise disturbance to MNES wherever practicable • ensure that upper disturbance limits for MNES are not exceeded. <p>The constraints analysis is designed to increase certainty in relation to managing potential impacts by identifying those areas that are not amenable to development, or if they were to be developed, how development should proceed. In this way, Santos can optimise environmental outcomes by avoiding sensitive receptors wherever practicable. Where avoidance is not practicable, Santos will implement a range of management and mitigation measures. This approach will be maintained throughout all phases of the Project, providing multiple opportunities for refinement of scope and execution to reduce impacts and scientific uncertainty.</p>
<p>The principle of inter-generational equity - that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations</p>	<p>As stated above, Santos is committed to creating a sustainable future for the communities in which it operates, by providing local employment, training, education and enterprise opportunities. Keeping Santos' supply chain local is a key enabler for economic, environmental, social and operational sustainability. Sharing the positive economic and social benefits of natural gas is critical to ensuring a sustainable future for both Santos and the community.</p> <p>Minimising potential environmental impacts is a key consideration for Project development. This will ensure that environmental values (including MNES and groundwater resources and quality) are conserved for existing and future generations.</p> <p>Whilst recognising that LNG projects are still a contributing factor in total global emissions, Santos believes it can play a key role in driving decarbonisation and aiding the transition into future and renewable sources of energy. Furthermore, Santos has an internal strategy to transform, build and grow in an aim to position the business to achieve its vision to be Australia's leading natural gas company by 2025. To deliver this vision, Santos aims to:</p> <ul style="list-style-type: none"> • Reduce emissions and improve air quality across Asia and Australia, by displacing coal with natural gas and supporting the economic development of combined gas, clean fuels and carbon capture and storage (CCS) solutions. • Be the leading national supplier of domestic gas in Australia <p>When project activities are complete progressive rehabilitation of areas of disturbance will be designed to achieve three overarching objectives. These are:</p> <ul style="list-style-type: none"> • Ensure sites are left as safe, stable, non-polluting landform for humans, native fauna and livestock. • Minimise loss of land capability within agricultural areas. • Assist in the minimisation of long-term impacts to environmentally sensitive areas and MNES including TEC and threatened species habitat <p>Santos will conduct regular monitoring and inspections of rehabilitated and remediated areas to ensure maintain the appropriate trajectory to meet the criteria above and undertake maintenance measures where required.</p>
<p>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making</p>	<p>Santos has developed a comprehensive environmental management and assessment framework to minimise impacts on biological diversity and ecological integrity. This framework remains informs decision regarding proposed Project activities in all phases of the Project.</p> <p>Principally, this is achieved through:</p> <ul style="list-style-type: none"> • designing of the project to avoid or minimise impacts on existing environmental values wherever practicable

Principle	Project implementation
	<ul style="list-style-type: none"> • implementation of the constraints protocol requirements prior to disturbance of new ground and siting or wells • commitment to implement best practice environmental management and mitigation measures through all phases Project (construction, operation and decommissioning) commensurate to the level of risk posed by the Project. <p>In particular site selection protocols are designed to:</p> <ul style="list-style-type: none"> • avoid disturbance to threatened species as far as practicable • minimise fragmentation and habitat disturbance of protected species • implementation of proven management systems and pollution control measures which will be refined overtime based on: <ul style="list-style-type: none"> - pre-disturbance data gathered in the field - experience - monitoring data.
Improved valuation, pricing and incentive mechanisms should be promoted	<p>Consistent with the polluter pays principle, the costs associated with environmental commitments will be incorporated into the overall Project planning and operation costs throughout the full life cycle of the Project. For example:</p> <ul style="list-style-type: none"> • Scientific/engineering studies and surveys, field assessments and further ecological and hydrological assessments as the Project progresses • Development and implementation of constraints protocol requirements including implementation of design changes and changes to the siting of infrastructure to ensure protection of environmental values • Procedures, equipment and resources required to manage and monitor specific environmental risks such as, produced water, air quality chemical risk and erosion and sediment control • Provisions for rehabilitation and implementation of progressive rehabilitation and monitoring programs • Engagement with community members and stakeholders and provisions for making good and implementing negotiated agreements with landowners and relevant indigenous parties • Engagement or staff on contractors to oversee the implementation of Project commitments including legislative and approval requirements <p>A range of mitigation measures will also be implemented to ensure that, during construction and operation, waste is avoided, reused or recycled wherever possible.</p>

Santos supports these principles and is committed to ensuring its activities align with the objectives and principles contained within the strategy. In line with this, Santos has announced ambitious emissions reduction targets in line with global aspirations to limit temperature rises to below 2°C that include:

Scope 1 and 2 emissions reduction targets:

- 2025: Economically reduce emissions by more than five per cent across operations in the Cooper Basin and Queensland (current at the 2016-17 baseline) by 2025.
- 2030: Reduce Scope 1 and 2 emissions and emissions intensity by 26-30 per cent by 2030.
- 2040: Reduce Scope 1 and 2 emissions to net-zero by 2040.

Technology targets:

- 2025: Carbon Capture and Storage (CCS): Pursue step-change emissions reductions technology by assessing the feasibility and, if feasible, invest in technology and innovation which can deliver a step-change in emissions.
- 2030: Once regulatory matters are finalised, use CCS technology to accelerate the economic feasibility of clean hydrogen and deliver a step-change in emissions reduction.

Scope 3 targets:

- 2025: Reduce global emissions through LNG export growth by growing LNG exports to at least 4.5 million tonnes per annum.
- 2030: Work with customers to reduce their Scope 1 and 2 emissions by more than one million tonnes CO₂ equivalent per annum by 2030 through direct fuel switching to cleaner fuels.

Across Santos' operations, emissions are being successfully reduced through a suite of initiatives in energy efficiency, electrification, integration of renewables and nature-based carbon offsets. There is also a clear, tangible pathway to reach new goals, with existing and planned initiatives including the

step-change technology of CCS, integration of renewable energy sources, electrification, world-class nature-based offsets, energy efficiency and eventually, zero emission hydrogen.

12.0 Economic and social matters

12.1 Economic and social impacts

RFI 8.1

'An analysis of the economic and social impacts of the action, both positive and negative.'

A Social Impact Assessment (SIA), a thorough analysis of the economic and social impacts, was undertaken prior to the commencement of the Santos GLNG Project. From the data collected during this process a Social Impact Management Plan was developed and submitted to the Queensland Coordinator General for approval. In May 2012 the Social Impact Management Plan was approved and adopted by Santos. It provides strategic direction for activities undertaken by Santos as the operator in the upstream region of the Project including the Gas Field Development Project and all subsequent approvals within the upstream operational area. If approved, the Social Impact Management Plan will also be extended to include the Project Area.

The Social Impact Management Plan assesses various key topics and identifies potential impacts and mitigations accordingly. Impacts, both positive and negative are categorised into the following interest areas.

- Water and environment
- Community safety
- Social infrastructure
- Local industry participation and training
- Aboriginal engagement and participation

For each of the topics, the following aspects have been considered:

- Understanding the issues and opportunities
- Predicting the likely impacts/contributions
- Developing mitigation/enhancement strategies
- Applying adaptive management practices

Given the relatively remote location of the Project area, the relatively short construction period and that no additional employees will be required for the operations phase of the project (operation of the infrastructure will be absorbed by the current field staff) the social impact of Santos' activities will be very minimal and manageable.

12.2 Public consultation

RFI 8.2

'Details of any public consultation activities undertaken and their outcomes.'

Stakeholder participation and consultation is essential to build mutual respect, trust and acceptance of Santos' activities. Santos conducts extensive community engagement across its operational areas. The closest community in proximity to the Project area is Arcadia Valley. Engagement activities include:

- Regular engagement with the mayors, councillors, CEOs and staff of Central Highlands Regional Council and Maranoa Regional Council
- Representation at the Central Highlands Regional Council Community Reference Group meetings throughout the year

- Hosting of community barbeques, at least twice annually, to provide an opportunity for community members to informally meet and discuss current and proposed activities and raise any issues of concern
- Regular community newsletters
- Maintenance of a company website, free call 1800 community enquiries line, email address and dedicated staffed shopfront in Roma.

Engagement in the region has been well received and help to foster open communication with landholders and the wider community.

12.3 Indigenous engagement

RFI 8.3

'Details of any consultation with Indigenous stakeholders'

Santos aspires to partner with, and be trusted by, Indigenous people and communities where we operate and strives to achieve the following targets:

- Industry best-practice recruitment and development programs for meaningful career opportunities.
- Leader in community engagement and cultural heritage management.
- Support Indigenous businesses through our supply chain.

Santos has mature relationships with both the Karingbal and Bidjara and has determined that no native title rights exist for the Project Area.

Whilst known areas of cultural significance exist within the vicinity of the Project, Santos has negotiated and executed Cultural Heritage Management Plans (CHMP) with relevant indigenous parties for the entire area of the GLNG and GFD projects, including the adjoining Towrie tenure (the Project Area), for the purpose of managing cultural heritage for the life cycle of project activities. These agreements have varying commencement dates and largely follow the same model based on working in partnership with Indigenous parties to ensure best practice management is applied. Cultural heritage management is fundamentally based on the avoidance principle and is defined by the relevant Indigenous party who self-manage this aspect, providing input and advice to Santos. The parties are engaged and informed for each stage of the project. Engagement will continue through the course of the assessment period and the duration of the activity as is required and/or agreed. CHMP are confidential documents, containing culturally sensitive information. Further information regarding CHMPs can be provided to DAWE upon request.

Further to this, cultural awareness sessions are delivered by the cultural heritage parties to contractors and Santos' staff who undertake any activity that is capable of creating ground disturbance and online cultural heritage induction modules are available to Santos' staff and contractors through training portals. During construction the find, stop, notify and manage procedure will be implemented for any suspected or actual unexpected finds of cultural significance.

12.4 Projected economic costs and benefits

RFI 8.4

'Projected economic costs and benefits of the project, including the basis for their estimate through cost/benefit analysis or similar studies.'

The USD \$18.5B Santos GLNG Project was sanctioned in January 2011. It is a joint venture partnership between Santos, Petronas, TotalEnergies and Kogas. It employed approximately 6,000 personnel during construction and approximately 1,000 direct and indirect personnel are currently employed during the operations phase.

The Project has already contributed almost \$300 million in royalties to the Queensland State Government and will continue to deliver these benefits for years to come, providing much needed revenue to fund vital infrastructure, health and education initiatives across the State.

Additionally, since Project commencement in 2011, Santos has directly contributed over \$200 million in social investment to mitigate any of the social impacts that the Project may cause, including road upgrade, LifeFlight aeromedical service, upgrades of airports and medical facilities, housing initiatives, grants for community groups and organisations, delivery of a Science, Technology, Engineering and Maths (STEM) program at Arcadia Valley State and access Santos health and recreation facilities. These initiatives continue to support the communities where Santos operates and promote a vibrant and sustainable future for the regions.

12.5 Employment opportunities

RFI 8.5

'Employment opportunities expected to be generated by the project (including construction and operational phases).'

Full, fair and reasonable opportunities will be provided to local and indigenous individuals and businesses within the region to deliver the Project. The initial development proposed will sustain the employment of approximately 50-75 personnel during drilling and construction for approximately 9-12 months. If the full long-term scope is delivered, the duration of work will consequently extend by approximately 3 to 4 years.

13.0 Environmental record

RFI 9

Include details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:

9.1 the person proposing to take the action;

9.2 for an action for which a person has applied for a permit, the person making the application;

9.3 if the person is a body corporate—the history of its executive officers in relation to environmental matters; and

9.4 if the person is a body corporate that is a subsidiary of another body or company (the parent body)—the history in relation to environmental matters of the parent body and its executive officers.

Under Commonwealth, state or territory law for protection of the environment and/or conservation and sustainable use of resources, Santos (including subsidiary companies) has recorded the following proceedings:

- July 2018, Santos received a \$68,000 fine from the Queensland Department of Environment and Science for the unauthorised release of hydrocarbons to land.
- June 2013, Santos NSW (Eastern) Pty Ltd pleaded guilty in the NSW Land and Environment Court for proceedings relating to breaches of the NSW Petroleum (Onshore) Act 1991 for past reporting failures in the Pilliga forest. Santos NSW (Eastern) Pty Ltd was fined \$52,500.

14.0 Conclusions and recommendations

Santos proposes to develop PL 1059 (the Project Area) to supply natural gas to market and facilitate social and economic benefits for surrounding local and regional areas, including direct employment, increased spending and revenue to government through royalties and income taxes.

The Project will be developed progressively to optimise gas production to meet Santos' gas supply obligations and opportunities, the Project will be able to utilise approved capacity of existing gas compression and water treatment facilities located on adjoining tenures; no new gas compression facilities or water storages are proposed as part of the Project. Disturbance associated with the Project will be mostly limited to well leases and linear infrastructure and will occur on the valley floor of the Project Area, which is generally highly disturbed due to historical clearing, incursion of exotic species including cropping plants and agricultural practices such as blade ploughing and cattle grazing.

The Environmental Protocol (Attachment B) will ensure Santos plans and locates project infrastructure with strict consideration of relevant MNES identified as having potential, likely or known to occur within the Project Area, preferentially locating infrastructure in the lowest value. Through the Protocol, Santos makes a commitment to avoid certain MNES values while minimising cumulative impacts to other MNES within agreed maximum disturbance limits representing a conservative maximum development scenario for the impact assessments.

Where detailed ecological assessments have been completed across most of the valley floor where infrastructure will occur within the Project Area, except for lot and plan 2SP200046 in the south which has current land access restrictions. As there is less certainty in the habitat mapping for this area and therefore constraints mapping and categorisation, detailed ecological assessments will be completed for lot and plan 2SP200046 before any disturbance can occur in that location.

Certainty in how risks will be managed and monitored is provided in the form of management plans incorporating Commonwealth and State guidelines and prescribed industry practice, including:

- Environmental Protocol (Attachment B)
- Environmental Management Plan (Attachment F)
- Significant Species Management Plan (Attachment G)
- Rehabilitation Plan (Attachment H).

These management plans are presented as final documents to be approved and conditioned for implementation when construction commences in 2022.

The additional information provided in the PD support the findings of the Ecology Assessment (Attachment C), Water Assessment (Attachment D) and Chemical Risk Assessment (Attachment E), demonstrating the Project is unlikely to result in significant impacts on known, likely or potential MNES with implementation of Santos' proposed avoidance, minimisation and mitigation measures. As such, offsets are not required in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012).

The additional information presented in this PD fulfils DAWE's request (dated August 2021).

This submission demonstrates and documents how the proposed action will be effectively designed and managed to reasonably avoid, minimise or mitigate impacts to a level that supports an approval decision and conditioning for implementation of the management plans provided.

15.0 References

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- Santos. (2021d). *Rehabilitation Plan*.

Attachment A Additional information requirements

Attachment B Environmental Protocol

Attachment C Ecology Assessment

Attachment D Water Assessment

Attachment E Chemical Risk Assessment

Attachment F Environmental Management Plan

Attachment G Significant Species Management Plan

Attachment H Rehabilitation Plan

Attachment I Relevant approvals

Attachment J Response to IESC advice