



Appendix W

Decommissioning report



Santos Ltd
Narrabri Gas Project - Environmental Impact Statement
Decommissioning Report

August 2016

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1. Introduction

1.1 Overview

The Proponent is proposing to develop natural gas in the Gunnedah Basin in New South Wales (NSW), southwest of Narrabri (refer Figure 1-1).

The Narrabri Gas Project (the project) seeks to develop and operate a gas production field, requiring the installation of gas wells, gas and water gathering systems, and supporting infrastructure. The natural gas produced would be treated at a central gas processing facility on a local rural property (Leewood), approximately 25 kilometres south-west of Narrabri. The gas would then be piped via a high-pressure gas transmission pipeline to market. This pipeline would be part of a separate approvals process and is therefore not part of this development proposal.

The primary objective of the project is to commercialise natural gas to be made available to the NSW gas market and to support the energy security needs of NSW. Production of natural gas from coal seams under the project would deliver economic, environmental and social benefits to the Narrabri region and the broader NSW community. The key benefits of the project can be summarised as follows:

- Development of a new source of gas supply into NSW would lead to an improvement in energy security and independence to the State. This would give NSW gas markets greater choice when entering into gas purchase arrangements. Potential would also exist for improved competition on price. Improved competition on price would have flow on benefits for NSW's economic efficiency, productivity and prosperity.
- The provision of a reduced greenhouse gas emission fuel source for power generation in NSW as compared to traditional coal-fired power generation.
- Increased local production and regional economic development through employment and provision of services and infrastructure to the project.
- The establishment of a regional community benefit fund equivalent to five per cent of the royalty payment made to the NSW Government within the future production licence area. If matched by the NSW Government, the fund could reach \$120 million over the next two decades.

1.2 Description of the project

The project would involve the construction and operation of a range of exploration and production activities and infrastructure including the continued use of some existing infrastructure. The key components of the project are presented in Table 1-1 and are shown on Figure 1-1.

Table 1-1 - Key project components

Component	Infrastructure or activity
Major facilities	
Leewood	<ul style="list-style-type: none"> ● a central gas processing facility for the compression, dehydration and treatment of gas ● a central water management facility including storage and treatment of produced water and brine ● optional power generation for the project ● a safety flare ● treated water management infrastructure to facilitate the transfer of treated water for irrigation, dust suppression, construction and drilling activities ● other supporting infrastructure including storage and utility buildings, staff amenities, equipment shelters, car parking, and diesel and chemical storage ● continued use of existing facilities such as the brine and produced water ponds ● operation of the facility
Biblewindi	<ul style="list-style-type: none"> ● in-field compression facility ● a safety flare ● supporting infrastructure including storage and utility areas, treated water holding tank, and a communications tower ● upgrades and expansion to the staff amenities and car parking ● produced water, brine and construction water storage, including recommissioning of two existing ponds ● continued use of existing facilities such as the 5ML water balance tank ● operation of the expanded facility
Biblewindi to Leewood infrastructure corridor	<ul style="list-style-type: none"> ● widening of the existing corridor to allow for construction and operation of an additional buried medium pressure gas pipeline, a water pipeline, underground (up to 132 kV) power, and buried communications transmission lines
Leewood to Wilga Park underground power line	<ul style="list-style-type: none"> ● installation and operation of an underground power line (up to 132 kV) within the existing gas pipeline corridor
Gas field	
Gas exploration, appraisal and production infrastructure	<ul style="list-style-type: none"> ● seismic geophysical survey ● installation of up to 850 new wells on a maximum of 425 well pads <ul style="list-style-type: none"> – new well types would include exploration, appraisal and production wells – includes well pad surface infrastructure ● installation of water and gas gathering lines and supporting infrastructure ● construction of new access tracks where required ● water balance tanks ● communications towers ● conversion of existing exploration and appraisal wells to production

Component	Infrastructure or activity
Ancillary	<ul style="list-style-type: none"> • upgrades to intersections on the Newell Highway • expansion of worker accommodation at Westport • a treated water pipeline and diffuser from Leewood to Bohena Creek • treated water irrigation infrastructure including: <ul style="list-style-type: none"> – pipeline(s) from Leewood to the irrigation area(s) – treated water storage dam(s) offsite from Leewood • operation of the irrigation scheme

The project is expected to generate approximately 1,300 jobs during the construction phase and sustain around 200 jobs during the operational phase; the latter excluding an ongoing drilling workforce comprising approximately 100 jobs.

Subject to obtaining the required regulatory approvals, and a financial investment decision, construction of the project is expected to commence in early 2018, with first gas scheduled for 2019/2020. Progressive construction of the gas processing and water management facilities would take around three years and would be undertaken between approximately early/mid-2018 and early/mid-2021. The gas wells would be progressively drilled during the first 20 or so years of the project. For the purpose of impact assessment, a 25-year construction and operational period has been adopted.

1.3 Project location

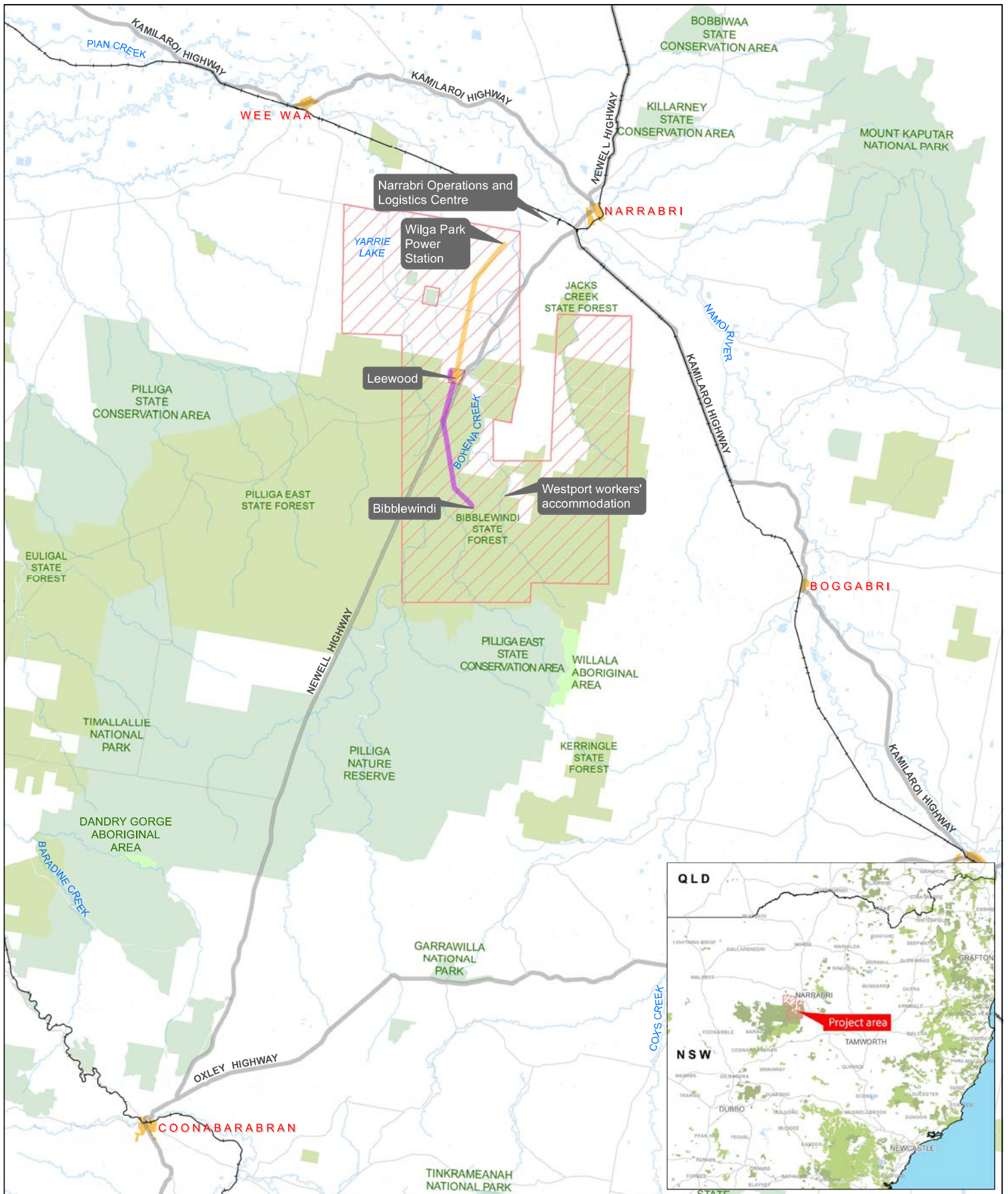
The project would be located in north-western NSW, approximately 20 kilometres south-west of Narrabri, within the Narrabri local government area (LGA) (see Figure 1-1).

The project area covers about 950 square kilometres (95,000 hectares), and the project footprint would directly impact about one per cent of that area.

The project area contains a portion of the region known as ‘the Pilliga’, which is an agglomeration of forested area covering more than 500,000 hectares in north-western NSW around Coonabarabran, Baradine and Narrabri. Nearly half of the Pilliga is allocated to conservation, managed under the NSW *National Parks and Wildlife Act 1974*. The Pilliga has spiritual meaning and cultural significance for the Aboriginal people of the region.

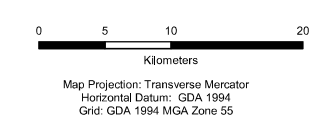
Other parts of the Pilliga were dedicated as State forest, and set aside for the purpose of ‘forestry, recreation and mineral extraction, with a strategic aim to “provide for exploration, mining, petroleum production and extractive industry” under the *Brigalow and Nandewar Community Conservation Area Act 2005*. The parts of the project area on state land are located within this section of the Pilliga.

The semi-arid climate of the region and general unsuitability of the soils for agriculture have combined to protect the Pilliga from widespread clearing. Commercial timber harvesting activities in the Pilliga were preceded by unsuccessful attempts in the mid-1800s to establish a wool production industry. Resource exploration has been occurring in the area since the 1960s; initially for oil, but more recently for coal and gas.



LEGEND

Project area	Lakes and dams	Leewood to Wilga Park infrastructure corridor
Leewood	Watercourses	Bibblewindi to Leewood infrastructure corridor
Urban	Highways	
State forest	Major Roads	
Parks and reserves	Train line	
Aboriginal areas		



Narrabri Gas Project
EIS Technical Appendix

Job Number | 21-22463
Revision | A
Date | 12 Mar 2015

Regional context
and location of key infrastructure

Figure 1-1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydney@ghd.com.au W www.ghd.com.au
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Data source: NSW Department of Lands: DTDB and DCDB - 2012-13, Santos: Operational and Base Data - 2013, Created by: afoddy

The ecology of the Pilliga has been fragmented and otherwise impacted by commercial timber harvesting and related activities over the last century through:

- the establishment of more than 5,000 kilometres of roads, tracks and trails
- the introduction of pest species
- the occurrence of drought and wildfire.

The project area avoids the Pilliga National Park, Pilliga State Conservation Area, Pilliga Nature Reserve and Brigalow Park Nature Reserve. Brigalow State Conservation Area is within the project area but would be protected by a 50 metre surface exclusion zone.

Agriculture is a major land use within the Narrabri LGA; about half of the LGA is used for agriculture, split between cropping and grazing. Although the majority of the project area would be within State forests, much of the remaining area is situated on agricultural land that supports dry-land cropping and livestock. No agricultural land in the project area is mapped by the NSW Government to be biophysical strategic agricultural land (BSAL) and detailed soil analysis has established the absence of BSAL. This has been confirmed by the issuance of a BSAL Certificate for the project area by the NSW Government.

1.4 Planning framework and structure of this report

1.4.1 Planning Framework

The project is permissible with development consent under the *State Environmental Planning Policy (Mining, Petroleum and Extractive Industries) 2007*, and is identified as 'State significant development' under section 89C(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *State Environmental Planning Policy (State and Regional Development) 2011*.

The project is subject to the assessment and approval provisions of Division 4.1 of Part 4 of the EP&A Act. The Minister for Planning is the consent authority, who is able to delegate the consent authority function to the Planning Assessment Commission, the Secretary of the Department of Planning and Environment or to any other public authority.

The project is also a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The project was declared to be a controlled action on 5 December 2014, to be assessed under the bilateral agreement between the Commonwealth and NSW Governments, and triggering the following controlling provisions:

- listed threatened species and ecological communities
- a water resource, in relation to coal seam gas development and large coal mining development
- Commonwealth land.

This decommissioning report identifies the potential environmental issues associated with construction and operation of the project and addresses the Secretary's environmental assessment requirements for the project. The assessment will be used to support the EIS for the project.

1.4.2 Structure of report

The report is structured as follows:

- **Chapter 1 – Introduction** - This chapter introduces the proposed development and the proponent and describes the project area.
- **Chapter 2 – Legislative context** - This chapter outlines the relevant Commonwealth and State legislation relating to the assessment. Guidelines and assessment criteria (where applicable) relevant to the gasfield decommissioning are also identified.
- **Chapter 3 – Decommissioning objectives** - This chapter describes the broad decommissioning methodology, environmental impacts associated with the decommissioning and establishes decommissioning objectives.
- **Chapter 4 – Decommissioning mitigation measures** - This chapter outlines the proposed decommissioning mitigation measures to be implemented for each asset type to manage the potential environmental impacts.

2. Legislative context

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of the following nine matters of national environmental significance.

The EPBC Act also protects the environment where actions will affect Commonwealth land or where the Commonwealth is proposing to take the action.

A person must refer a proposed action to the Commonwealth Minister for the Environment if it has, will have, or is likely to have a significant impact on Matters of National Environmental Significance (MNES). The referral must include a description of the proposed action and a description of the likely impacts on MNES. An action that the Minister decides is likely to have a significant impact on MNES is deemed a 'controlled action' and requires assessment under the provisions of the EPBC Act.

The project was referred to the (then) Commonwealth Minister for the Environment in October 2014. The referral concluded that the project is a controlled action due to potential impacts to listed threatened species, ecological communities and water resources. The referral acknowledged that further work would be undertaken to quantify potential impacts and develop mitigation measures during the detailed impact assessment phase.

2.2 State

2.2.1 Petroleum (Onshore) Act 1991

The *Petroleum (Onshore) Act 1991* (Petroleum Act) regulates the onshore exploration for and production of petroleum.

Part 6 Division 2 of the Act provides for protection of the environment specifically related to decommissioning and rehabilitation:

76. (1) the conditions subject to which a production lease is granted or renewed may include such conditions related to:

- a. the rehabilitation, levelling, regressing, reforesting or contouring of any part of land the subject of the lease that may have been damaged or adversely affected by operations, and*
- b. the filling in or sealing of excavations and drill holes*

as may be prescribed by the regulations or as the Minister may, in any particular case, determine.

The project would be undertaken in accordance with a Petroleum Production Lease (PPL), provided that development consent has been obtained. Conditions related to decommissioning in the PPL would be incorporated into the Decommissioning Management Plan.

2.2.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) establishes, amongst other things, the procedures for issuing of licences for environmental protection on aspects such as waste, air, water and noise pollution control. The occupier of premises at which any scheduled activities are carried out is required to hold an environment protection licence (EPL) and comply with the conditions of that licence.

Decommissioning activities would be subject to the conditions of any EPL for the project as detailed in the mitigation measures provided in Section 4.

2.3 Secretary's requirements

The Secretary's Environmental Assessment Requirements include the NSW Trade and Investment requirements related to preparing a rehabilitation strategy as detailed below.

Final Land Use

Describe the preferred land use goal for disturbed areas including an evaluation of alternatives. This should include a discussion of how the final land use(s) are aligned with relevant local and regional strategic land use objectives as well as the benefits of the post production land to the surrounding environment, a subsequent landowner, the local community and the state of NSW.

Rehabilitation Objectives

Provide a set of clear rehabilitation objectives and completion criteria for rehabilitation of the production well sites and associated infrastructure / auxiliary sites. Consideration should be given to the identification of project domains when proposing rehabilitation objectives and completion criteria. The rehabilitation objectives should make reference to capability class targets for agricultural land use and habitat / vegetation types for natural / bushland land use.

The completion criteria must be specific, measurable, achievable, realistic, and time-bound. If necessary, objective criteria may be presented as ranges rather than finite indicator levels. Subjective criteria may also apply where a gap in technical knowledge exists. Further refinement of these criteria will be undertaken and included in the Rehabilitation Management Plan (RMP) should the project be approved.

Rehabilitation Methodology

Provide details regarding the rehabilitation methods to be used for disturbed areas and expected time frames for each stage of the rehabilitation process. Provide details on proposed rehabilitation monitoring and an outline of proposed rehabilitation research programs and trials.

The EIS should also include an evaluation of current rehabilitation techniques and performance against existing rehabilitation objectives and completion criteria.

Conceptual Final Landform Plan

Provide a final landform plan showing final contours and the target vegetation / habitat outcomes for the project. Any infrastructure associated with the project that is proposed to remain as part of the final land use must be identified in this plan or a clear statement provided where this is not practical (i.e. gas and water gathering lines).

Post-closure Maintenance

Describe how post-closure rehabilitation areas will be actively managed and maintained in accordance with the intended land use(s) in order to demonstrate progress towards meeting the closure objectives and completion criteria in a timely manner.

While the requirements are generally related to rehabilitation rather than decommissioning, the objectives for decommissioning include preparation of disturbed areas to allow rehabilitation to commence.

2.4 Guidelines and codes of practice

At the time of writing, the guidelines shown below were applicable to the decommissioning of the gas field assets. Decommissioning of the project would be undertaken consistent with applicable statutes and guidelines of the day.

NSW Code of Practice for Coal Seam Gas Well Integrity (DTIRIS 2012)

This code of practice provides a guide for coal seam gas (CSG) titleholders on how to comply with a condition of title for CSG exploration, extraction or production under the Petroleum (Onshore) Act 1991 (PO Act) and the Petroleum (Onshore) Regulation 2007 to ensure that well operations are carried out safely, without risk to health and without detriment to the environment.

Section 4.9 of the code of practice outlines the mandatory requirements for well abandonment which have been referenced in this document, specifically in Section 4.2 – Gas field mitigation measures.

Australian Pipeline Industry Association (APIA) Code of Environmental Practice for Onshore Pipelines, 2013

This code of practice provides a guide for the construction, operation and decommission of onshore pipelines in Australia to ensure that pipelines are managed without detriment to the environment.

Section 8 of the code of practice outlines the minimum acceptable environmental management standards for decommissioning of pipelines including preparation, product removal and pipe cleaning, removal of pipeline, removal of above-ground infrastructure, and in-situ abandonment which have been referenced in this document, specifically in Section 4.3 – Gas and water gathering lines.

Mine Closure & Completion – Leading Practice Sustainable Development Program for the Mining Industry (Department of Industry, Tourism and Resources, 2006)

This program identifies the key issues affecting sustainable development in the mining industry and guidance for the mining industry to enable sustainable operations.

Appendix A of these guidelines provide a broad assessment of the risks associated with decommissioning and options to mitigate these risks, which have been considered in the development of mitigation measures provided in Section 4.

3. Decommissioning objectives

3.1 Decommissioning objectives

The decommissioning objectives are aligned with the rehabilitation objectives detailed in the Rehabilitation Strategy (Ecological Australia 2015).

The objectives of the decommissioning strategy are to:

- Undertake decommissioning of assets and rehabilitation in a manner that complies with legislative requirement and approvals
- Undertake decommissioning activities and rehabilitation in a manner that meets stakeholder expectations
- Leave a landform that is safe, stable and non-polluting and compatible with the intended post closure land use to enable effective transfer to third parties
- Provide for the retention and beneficial reuse of infrastructure constructed by Santos to third parties (i.e. landholders and local authorities), where there is an appropriate agreement in place and regulatory authorities are satisfied.

Evaluation of performance against decommissioning objectives can be measured by:

- Monitoring results showing that rehabilitation has been successful and that a sustainable and stable landform has been achieved
- Written agreement from the landholder and the regulatory authority as necessary.

It is anticipated that decommissioning of surface infrastructure, with subsequent rehabilitation, would be undertaken at the end of the gas field life.

3.2 Decommissioning methodology

3.2.1 Gas field

At completion of exploration and appraisal, all wells would either be:

- plugged and decommissioned and the drill pad rehabilitated to comply with NSW Government guideline documentation (DTIRIS 2012);
- converted to monitoring bores; or
- converted to production wells.

Once the wells have reached the end of their functional lives, they would be plugged and decommissioned in accordance with NSW Code of Practice for Coal Seam Gas Well Integrity (DTIRIS 2012b) and final rehabilitation would take place. This would include removing the well head, surface infrastructure and fencing, capping the well at a minimum depth of 1.5 metres, revegetation of the lease site, and weed control.

Plug and decommissioning works would not require significant additional surface disturbance and presents a lower risk that the original drilling and production operations, as the well characteristics are fully understood and documented.

Plant and equipment would include:

- a workover rig to retrieve production equipment from the well, and to install tubulars required to place cement plugs
- a cement unit to transport, mix and pump cement plugs

- a wireline truck to run casing, cement and formation evaluation logs to confirm isolation and well integrity.

A detailed methodology would be prepared for each well that considers the drilling reports detailing the cementing and casing characteristics and wireline logs detailing the well integrity status. The operation would typically involve the following steps:

- removal of the production equipment including tubing and the bottom hole pump
- verification of the isolation of hydrocarbon formations and aquifers
- identification of required remedial works where cement placement or zonal isolation behind the casing is at risk
- undertaking the remedial works where required
- Pumping cement plugs to isolate the well in 200 metre sections, with a 6 hour wait period between placement.

Contamination of groundwater resources is primarily mitigated through the implementation of the well decommissioning methodology to prevent cross flow or potential invasion from hydrocarbon or water bearing formations.

Works associated with well decommissioning activities are restricted to the existing well pad area and do not require additional significant vegetation clearing or significant ground disturbance.

3.2.2 Gas and water gathering lines

At the cessation of production, the gas and water gathering lines would be isolated at the well head and also at their connection point at both the water treatment plant and the gas processing facility. The gathering systems would then be isolated, drained, vented and capped in accordance with the Australian Pipeline Industry Association (APIA) Code of Environmental Practice for Onshore Pipelines (2013).

After the well sets are decommissioned, the subsurface components of the gathering system would remain in situ as described above, and vegetation maintenance within the gathering system corridor would cease. All above ground components of the gathering system would be removed, including all pipeline marker signs.

Non-operational infrastructure (i.e. pipeline access tracks, clean water dams) may remain in place subject to an agreement with the appropriate stakeholder.

Surface works associated with pipeline decommissioning activities would be primarily associated with locations where pipe infrastructure is above ground, such as at either end of the pipeline and at locations of highpoint vents and low point drains. As these locations would be within the existing cleared pipeline right of way, no significant ground disturbance or additional vegetation clearance is expected to be required to undertake these decommissioning works.

All products used in the cleaning of pipelines (i.e. water and cleaning products) are captured and disposed of appropriately to manage impacts to local water resources.

3.2.3 Leewood

Gas processing facilities

The compression system, dehydration system and ancillary equipment would be isolated and drained of all accumulated liquids, then purged and vented to remove traces of gas or other potentially hazardous materials.

All above ground interconnecting pipe work would be removed and dismantled into transportable lengths and would be transported off-site. The compressor and after-cooler packages and other process equipment would be disassembled and removed.

Ancillary equipment installed at the site, including the plant air system, flare system, various tanks, and other utility systems would be individually isolated and secured before being disassembled and removed.

Power plant

Power generation and distribution equipment would be individually isolated and secured before being disassembled and removed.

Once the generators are no longer needed, the power input to the switchgear would be isolated and both the generators and switchgears would be removed at the end of the project. The remaining earthing grid and other buried cables would be removed during the site clearance operations, as required.

Where the alternative grid sourced power connection to Wilga Park is adopted, power transmission cabling would be disconnected and above ground connection infrastructure removed.

Prior to the commencement of decommissioning planning, Santos would consult with local stakeholders to determine the potential retention of power generating infrastructure and the transfer of ownership to local electricity retailers.

Water treatment plant

Water treatment plant infrastructure would be individually isolated and disassembled into the original modular components and removed from site.

All above ground interconnecting pipework would be removed and dismantled into transportable lengths and would be transported off-site.

Ponds

Stored production water would be tested to establish the water treatment process required for discharge. Water would be discharged at a rate which would not disrupt normal environmental flows of receiving drainage lines.

3.2.4 Bibblewindi

Gas compression facilities

The compression system would be isolated and drained of all accumulated liquids, then purged and vented to remove traces of gas or other potentially hazardous materials.

All above ground interconnecting pipe work would be removed and dismantled into transportable lengths and would be transported off-site. The compressor and after-cooler packages and other process equipment would be disassembled and removed.

Ancillary equipment installed at the site, including the safety flare system, storage and other utility systems would be individually isolated and secured before being disassembled and removed.

Ponds and water balance tanks

Stored production water would be tested to establish the water treatment process required for discharge. Water would be discharged at a rate which would not disrupt normal environmental flows of receiving drainage lines.

Two existing produced water ponds (Ponds 2 and 3) at Bibblewindi would be recommissioned having double lining installed along with leak detection systems also installed. The existing pilot flare would be decommissioned and replaced with a safety flare.

3.2.5 Infrastructure corridors

At the cessation of production, the Bibblewindi to Leewood gas pipeline would be isolated at its connection points. The pipeline would then be isolated, drained, vented and capped in accordance with the Australian Pipeline Industry Association (APIA) Code of Environmental Practice for Onshore Pipelines (2013).

The Bibblewindi to Leewood HDPE water pipelines would be isolated at their connection points and drained of water to the water storage ponds at Leewood. The pipelines would then be isolated and capped, and above ground infrastructure for the pipeline removed.

The 132 kV power transmission cabling between Bibblewindi and Wilga Park, and the communications cabling between Bibblewindi and Leewood would be disconnected and above ground connection infrastructure removed.

At project decommissioning, the subsurface components of the infrastructure corridor including the gas pipelines, water pipelines, power and communications cabling would remain in situ, and vegetation maintenance within the infrastructure corridor would cease. All above ground components of the infrastructure corridor would be removed, including all pipeline marker signs.

The risk profile of the infrastructure corridor is consistent with the gas and water gathering lines and the associated mitigation measures would be adopted for the infrastructure corridor.

3.2.6 Westport workers' accommodation

Camp infrastructure would be disassembled with skid mounted buildings (sleeping quarters, kitchen and dining room facilities, recreation room, utility rooms) disconnected from services and removed from site. Other constructed infrastructure (plank walkways, shelters) and in ground services would be disassembled and removed from site as construction waste. Tanks supporting camp operations including septic waste, water, grey water and fuel would be drained of remaining product and removed from site.

4. Decommissioning mitigation measures

Decommissioning of the project has the potential to cause environmental impacts similar to those expected during construction. These include potential impacts to:

- land and water resources through erosion, sedimentation, leaks or spills
- biodiversity through clearing, weed invasion or fauna strike
- air quality through exhaust and dust generation
- noise through operation of plant and equipment.

To manage the environmental risks associated with decommissioning, specific mitigation measures have been developed with reference to:

- legislative requirements detailed in Section 2
- the decommissioning objectives outlined in Section 3.1
- the decommissioning methodology detailed in Section 3.2.

4.1 General decommissioning

The mitigation measures for the general overarching decommissioning works are designed to provide the environmental protection requirements that arise from general construction works. Detailed decommissioning requirements for each infrastructure type is detailed in other sections.

Table 4-1 - Mitigation measures - general decommissioning

Aspect	Mitigation measures
Overall	<ul style="list-style-type: none"> • The wells would be decommissioned when they are no longer required. • Rehabilitation works at the well head would occur in accordance with the decommissioning and rehabilitation plan. • Progressive partial rehabilitation would occur where practical. • The decommissioning, demolition and rehabilitation plan (The Plan) would be implemented to mitigate and manage impacts resulting from the cessation of petroleum activities. The Plan: <ul style="list-style-type: none"> ○ identifies objectives and completion criteria ○ includes guidelines for the progressive removal or reuse of infrastructure where gas field operations cease during the project life ○ establishes management practices and safeguards to minimise environmental impact ○ defines rehabilitation actions to achieve the completion criteria ○ outlines an effective and appropriate audit program according to the activity or site ○ is consistent with land owner and permit to occupy agreements and relevant legislation
Land Resources	<ul style="list-style-type: none"> • A Soil and Water Management Plan would be prepared and implemented in accordance with the requirements outlined in <i>Urban Stormwater: Soils and Construction, Vol 1, 4th Edition</i> (Landcom, 2004). • The quantity of chemicals, fuels and oils stored on site would be minimised, where practicable. • All additives, chemicals, fuels and oils stored on site would be kept in an appropriately secured, bunded storage facility in accordance with the relevant Safety Data Sheets. • A Safety Data Sheet register of all chemicals used or stored on site would be maintained. • An Emergency Response Plan would be developed which documents the procedure to deal with all types of incidents (eg. spill, explosions, fire) that may

Aspect	Mitigation measures
	<p>occur at the premises or outside of the premises which are likely to cause harm to the environment.</p> <ul style="list-style-type: none"> Spills or leaks would be contained, assessed and cleaned up appropriately. Contaminated material would be isolated and treated in accordance with legislative requirements. Except as may be expressly provided in conditions of the Environmental Protection Licence, there would be no pollution of waters. When re-instating linear infrastructure trenches, soils would be replaced so that topsoils and subsoils are consistent with the immediately surrounding area.
Hazards	<ul style="list-style-type: none"> Dangerous goods would be transported according to regulatory requirements under the Dangerous Goods (Road and Rail Transport) Act 2008 or other relevant legislation. Equipment and Personal Protective Equipment would be adequately maintained/used as per the Occupational Health and Safety Regulations.
Biodiversity	<ul style="list-style-type: none"> The site boundary would be clearly demarcated to ensure that plant and vehicles keep within the approved area of disturbance. Where required, fencing would be designed and installed to be stock proof. Weed management measures would be undertaken. This would include weed monitoring and weed removal as necessary. Construction and operational vehicles/plant would only travel on the designated access tracks and haulage routes. Site speed limits would be imposed to reduce the potential of fauna strike and to reduce dust generation.
Community	<ul style="list-style-type: none"> All community enquiries and complaints would be responded to promptly in accordance with the complaint management protocol outlined in the EIS. Construction activities would be undertaken in a careful and proper manner and with a minimum disturbance to the adjoining owners and to the public.
Waste	<ul style="list-style-type: none"> Management of waste, including its transport, would comply with the POEO Act 1997 and POEO (Waste) Regulation 2005. The Waste Management Plan would be implemented, would be based on the waste reduction hierarchy of avoid, reduce, reuse, recycle, recover, treat and dispose. Waste identified for recycling would be stored separately from other waste. Liquid and / or non-liquid waste would be assessed and classified in accordance with the DECC Waste Classification Guidelines as in force from time to time.
Water Resources	<ul style="list-style-type: none"> During construction in the event that prolonged, severe wet weather or flooding is predicted, appropriate measures would be put in place to mitigate impacts of the wet weather. Pond levels would be monitored through operational procedures with appropriate controls in place to minimise the risk of discharge.
Air Quality	<ul style="list-style-type: none"> All areas would be maintained in a condition that prevents or minimises the emission into the air of dust. Decommissioning activity would be carried out by such practicable means as to prevent or minimise the emission into the air of dust. Plant or equipment used in decommissioning would be operated by such practicable means as to prevent or minimise the emission into the air of dust.
Noise	<ul style="list-style-type: none"> Standard construction hours and exceptions detailed in the EPL would apply to decommissioning activities. All plant and equipment associated with decommissioning activities would be maintained and operated in a proper and efficient condition / manner.

4.2 Gas field

The mitigation measures for the decommissioning of gas field infrastructure are designed to:

- minimise the risk of groundwater contamination by implementing a detailed plug and abandonment (P&A) methodology

- manage the decommissioning site in a manner that minimises impacts to the local environmental from decommissioning activities
- reduce the potential for residual environmental impacts from in-situ decommissioned infrastructure.

Mitigation measures specific to gas field infrastructure are shown in Table 4-2.

Table 4-2 - Mitigation measures - gas field

Aspect	Mitigation measures
General	<ul style="list-style-type: none"> • The general mitigation measures outlined in Table 4-1 would be implemented. • Once the wells have reached the end of their functional lives, they would be plugged and decommissioned in accordance with <i>NSW Code of Practice for Coal Seam Gas Well Integrity</i> (DTIRIS 2012b). This includes: <ul style="list-style-type: none"> ○ A well must not be decommissioned or suspended without prior departmental approval. ○ The titleholder must ensure that a decommissioned well is sealed by filling the near-vertical section from total depth to top with cement or other sealing program as approved by the department. There is to be no open annulus to the surface. ○ Wells or drill holes that are to be decommissioned shall be sealed and filled in such a manner to prevent leak of gas and/or water. ○ Cement shall be used as the primary sealing material. Cement testing should be carried out as per requirements set out in Section 4.3 - "Cementing" of the <i>NSW Code of Practice for Coal Seam Gas Well Integrity</i> (DTIRIS 2012b). ○ The titleholder must ensure that a decommissioned well is sealed by filling from total depth to top with cement of at least 24-hour laboratory strength of at least 500 psi (3.5 MPa). In near-vertical open hole sections of the well, cement is to be placed in plugs of not more than 200 m lengths with a wait on cement (WOC) period of six hours between placement. The first plug across the surface casing is to be tested to 500 psi (3.5 MPa) above the estimated or previously recorded limit of proportionality (LOP). ○ Blowout preventers and/or wellhead must not be removed until the cement plug across the surface casing shoe or plug across the uppermost perforations has been physically tagged for correct location and pressure tested. ○ Once all cement plugs are pumped and pressure tested, the wellheads must be removed, and casing must be cut greater than 1.5m below surface. A wellhead marker plate must be installed and must be placed and marked with details as per the department's requirements. ○ Complete and accurate records of the entire abandonment procedure must be kept, with these records submitted as part of the titleholder's legislative reporting requirements for the abandonment of CSG wells. ○ If a CSG well intended for abandonment is proposed for conversion to a water well, necessary approvals and licences must be obtained. • Well abandonment procedures would address the potential for contamination of groundwater resources during the decommissioning process.
Land Resources	<ul style="list-style-type: none"> • All well infrastructure would be drained of hazardous substances prior to removal where practicable. • Decommissioned well infrastructure temporarily stored on the site prior to removal would be appropriately contained to prevent residual contamination. • Soil testing would be conducted in accordance with relevant site assessment guidelines upon removal of above ground infrastructure. Where contaminated materials are found, a remediation program would be prepared and implemented prior to finalisation of decommissioning works. • Disturbed land would be re-contoured to a stable landform consistent with the local topography and drainage characteristics.
Beneficial Water Use	<ul style="list-style-type: none"> • Infield balance tanks and produced water dams would be retained in an operational condition where an agreement has been reached with the landholder.

Aspect	Mitigation measures
	<ul style="list-style-type: none"> Access tracks would be retained in an operational condition where an agreement has been reached with the landholder.
Biodiversity	<ul style="list-style-type: none"> Vegetation clearing would be limited to the original well pad construction area to prevent the destruction of established mature vegetation communities. Where clearing is required for decommissioning purposes, a pre-clearing survey would be undertaken and areas to be cleared would be demarcated to ensure that plant and vehicles keep within the approved area of disturbance.
Waste	<ul style="list-style-type: none"> All foundation (concrete pads) and ground stabilisation products (gravel, asphalt) would be classified in accordance with the NSW waste classification guidelines and disposed of at a facility licensed to accept the waste. All waste gas well infrastructure material would be classified in accordance with the NSW waste classification guidelines and disposed of at a facility licensed to accept the waste.
Water Resources	<ul style="list-style-type: none"> Water remaining in <i>in situ</i> pipelines, balance tanks and dams would be purged from the infrastructure and disposed of in accordance with the EPL.

4.3 Gas and water gathering lines / infrastructure corridors

The mitigation measures for the decommissioning of gas and water gathering lines and the infrastructure corridor are designed to:

- manage decommissioning activities in a manner that minimises impacts to the local environmental
- reduce the potential for residual environmental impacts from in-situ decommissioned infrastructure.

Mitigation measures specific to gas and water gathering lines and the infrastructure corridor are shown in Table 4-3.

Table 4-3 - Mitigation measures - gas and water gathering lines

Aspect	Mitigation measures
General	<ul style="list-style-type: none"> The general mitigation measures outlined in Table 4-1 would be implemented. The <i>in situ</i> decommissioning of gathering systems and water pipelines would be in accordance with the Australian Pipeline Industry Association (APIA) Code of Environmental Practice for Onshore Pipelines (2013). This includes: <ul style="list-style-type: none"> Venting of residual gas at a location that minimises the risk of ignition and under favourable meteorological conditions Purging of the pipeline using steam, water or inert gas Cleaning of the pipeline by progressive pigging which uses chemical cleaning agents and flush water to remove all contaminants Capture, treatment and disposal of pipeline wastewater Filling of the cleaned pipe with cement or other appropriate material where there is a risk of surface subsidence and to prevent the pipe acting as a water conduit Removal of pipeline signage. The <i>in situ</i> decommissioning of power cabling and communications cabling would include: <ul style="list-style-type: none"> Disconnecting the cabling at all connection points Removal of supporting above ground infrastructure Removal of cabling signage.
Land Resources	<ul style="list-style-type: none"> Soil testing would be conducted in accordance with relevant site assessment guidelines upon removal of above ground infrastructure. Where contaminated materials are found that are a result of project activities, a remediation program would be prepared and implemented prior to finalisation of decommissioning works.

Aspect	Mitigation measures
Beneficial Reuse	<ul style="list-style-type: none"> Pipeline access tracks would be retained in an operational condition where an agreement has been reached with the landholder.
Biodiversity	<ul style="list-style-type: none"> Vegetation clearing would be limited to the original pipeline construction area to prevent the destruction of established mature vegetation communities. If clearing is required for decommissioning purposes, a pre-clearance survey would be undertaken and areas to be cleared would be demarcated to ensure that plant and vehicles keep within the approved area of disturbance.
Waste	<ul style="list-style-type: none"> Waste water from pipeline cleaning would be captured, classified in accordance with the NSW waste classification guidelines and disposed of at a facility licensed to accept the waste. Where pipelines are being removed, pipe material would be classified in accordance with the NSW waste classification guidelines and disposed of at a facility licensed to accept the waste.
Air Quality	<ul style="list-style-type: none"> Pipeline venting locations would be selected away from potential sensitive receivers, including residents, livestock locations (troughs, yards) and vegetated areas.

4.4 Leewood / Bibblewindi

The mitigation measures for the decommissioning of the Leewood and Bibblewindi facilities are designed to manage decommissioning activities in a manner that minimises impacts to the local environment.

Mitigation measures specific to Leewood and Bibblewindi are shown in Table 4-4.

Table 4-4 – Mitigation measures – Leewood / Bibblewindi

Aspect	Mitigation measures
General	<ul style="list-style-type: none"> The general mitigation measures outlined in Table 4-1 would be implemented. The pipeline decommissioning mitigation measures outlined in Table 4-3 would be implemented for pipelines on the site.
Land Resources	<ul style="list-style-type: none"> All facility infrastructure would be drained of hazardous substances and dangerous goods prior to removal where practicable. Removed infrastructure temporarily stored on the site would be contained in sealed containers to prevent residual contamination. Soil testing would be conducted in accordance with relevant site assessment guidelines upon removal of above ground infrastructure. Where contaminated materials are found, a remediation program would be prepared and implemented prior to finalisation of decommissioning works. Disturbed land would be re-contoured to a stable landform consistent with the local topography and drainage characteristics.
Beneficial Reuse	<ul style="list-style-type: none"> Produced water dams would be retained in an operational condition where an agreement has been reached with the landholder.
Biodiversity	<ul style="list-style-type: none"> Vegetation clearing would be limited to the original construction area to prevent the destruction of established mature vegetation communities. Where clearing is required for decommissioning purposes, a pre-clearing survey would be undertaken and areas to be cleared would be demarcated to ensure that plant and vehicles keep within the approved area of disturbance.
Waste	<ul style="list-style-type: none"> All foundation (concrete pads) and ground stabilisation products (gravel, asphalt) would be classified in accordance with the NSW waste classification guidelines and disposed of at a facility licensed to accept the waste. Where ponds are being demolished, contaminated soil and pond lining material would be classified in accordance with the NSW waste classification guidelines and disposed of at a facility licensed to accept the waste.
Water Quality	<ul style="list-style-type: none"> Water from production water ponds and sedimentation ponds would be tested in accordance with relevant water quality guidelines and treated to meet discharge

4.5 Westport workers' accommodation

The mitigation measures for the decommissioning of Westport workers' accommodation are designed to manage decommissioning activities in a manner that minimises impacts to the local environment.

Mitigation measures specific to Westport workers' accommodation are shown in Table 4-5.

Table 4-5 – Mitigation measures – worker accommodation

Aspect	Mitigation measures
General	<ul style="list-style-type: none">The general mitigation measures outlined in Table 4-1 would be implemented.
Land Resources	<ul style="list-style-type: none">Disturbed land would be re-contoured to a stable landform consistent with the local topography and drainage characteristics.
Waste	<ul style="list-style-type: none">All foundation (concrete pads) and ground stabilisation products (gravel, asphalt) would be classified in accordance with the NSW waste classification guidelines and disposed of at a facility licensed to accept the waste.

4.6 Post-decommissioning

In order to minimise environmental impacts associated with the excavation and removal of buried infrastructure, pipelines, water and gas gathering lines and subsurface well infrastructure would be left in place following the decommissioning process.

At the cessation of production the gas and water gathering lines would be disconnected, drained, cleaned and capped in accordance with the relevant Code of Practice. All above ground components of the gathering system would be removed including pipeline marker signs and high point vents and corridors would be allowed to revegetate.

Erosion control measures would be implemented where required for buried infrastructure at waterway crossings to ensure the risk of erosion is minimised.

Wells would be decommissioned in accordance with the *Code of Practice for Coal Seam Gas Well Integrity* (DTIRIS 2012) or as in place at the time. The Code of Practice includes requirements for the sealing and filling of the well from top to bottom with cement and a rigorous pressure testing program to ensure isolation. Wellhead infrastructure is required to be removed and well casing is cut off at least 1.5 metres below the surface with a wellhead marker installed on top of the casing below the surface. Records of each well's decommissioning process are submitted to the Government as part of the reporting requirements.

The rehabilitation of access tracks would be undertaken in consultation with the landholder. If the landholder does not require the track for future use, the natural contours would be reinstated and tracks would be ripped and mulched and any drainage infrastructure removed in accordance with the landholder's requirements.

5. References

Australian Pipeline Industry Association (2013). *Code of Environmental Practice for Onshore Pipelines*

Department of Industry, Tourism and Resources (Commonwealth) (2006). *Mine Closure & Completion – Leading Practice Sustainable Development Program for the Mining Industry*

Department of Planning and Environment (NSW) (2014). *Secretary's Environmental Assessment Requirements*

Department of Trade and Investment, Regional Infrastructure and Services (NSW) (2012). *NSW Code of Practice for Coal Seam Gas Well Integrity*

Ecological Australia (2015). Narrabri as Project Rehabilitation Report. Technical Appendix V.

NSW Government Chief Scientist & Engineer (2014). *Independent Review of Coal Seam Gas Activities in NSW, Information Paper – Abandoned Wells*

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