



Planning & Environment

**STATE SIGNIFICANT DEVELOPMENT
ASSESSMENT REPORT:
*Bibblewindi Gas Exploration Pilot Expansion
(SSD-5934)***



Secretary's
Environmental Assessment Report
Section 89E of the
Environmental Planning and Assessment Act 1979

May 2014

Cover photograph: Existing Well Pad Area (Bibblewindi 14/Proposed Bibblewindi 31).
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EXECUTIVE SUMMARY

In November 2011, Santos Limited acquired Eastern Star Gas Limited, the previous titleholder of Petroleum Exploration Lease 238, Petroleum Assessment Lease 2 and Petroleum Production Lease 3 and the operator of the Wilga Park Power Station in the Narrabri region. Santos NSW (Eastern) Pty Ltd (Santos) is currently the holder of these petroleum exploration and production titles and Santos NSW (Narrabri Power) Pty Ltd is the operator of the Wilga Park Power Station.

Santos intends to continue exploration, appraisal and evaluation of the coal seam gas (CSG) potential within its local petroleum titles through its Energy NSW CSG Exploration and Appraisal Program (E&A Program). The purpose of this program is to assist Santos in gaining further knowledge of coal fines, gas composition, flow rates and deliverability, well design, drilling and completion technologies over the next two to three years.

Santos proposes to drill two new CSG exploration wells at the site of the existing 12-well Bibblewindi Multi-lateral Pilot in the Bibblewindi State Forest, located approximately 40 kilometres south of Narrabri, in the Narrabri Local Government Area.

The proposed development involves site preparation activities at existing well sites to enable drilling of one vertical pilot well (Bibblewindi 31) and one lateral pilot well (Bibblewindi 32), operating the wells together with the existing wells in the Bibblewindi Multi-lateral Pilot, managing the water and gas produced during operation, and rehabilitation which would involve decommissioning or suspension of the wells.

The proposal is 'State Significant Development', being development for the purpose of drilling or operating petroleum exploration wells that satisfies the criteria in the *State Environmental Planning Policy (State and Regional Development) 2011*. The Department of Planning & Environment (the Department) has carried out a detailed assessment of the merits of the proposed development in accordance with the requirements of Section 79C of the *Environmental Planning & Assessment Act 1979*.

The Department received 185 submissions on the proposal. Of the 173 submissions from special interest groups and the general community, all were objections. None of the 12 State and local Government authority submissions objected to the proposal; however some raised concerns about the potential impacts and recommended conditions to be imposed should the development be approved.

The submissions objecting to the development were concerned with potential impacts on water resources and biodiversity, and cumulative impacts when other nearby mining and energy developments were taken into account. These submissions considered that the threat posed by the development to local communities would far outweigh the benefits it would bring to the local economic and employment sectors.

The proposed development would be located on the existing well sites for Bibblewindi 14 and 19H respectively and construction access for the two proposed wells would be along existing access tracks. The tie-in point to the existing buried gathering system would also be on the existing Bibblewindi 14 and 19H well pad areas. The Department notes there would be no additional/new disturbance beyond the well pad areas and access tracks.

Any potential water impacts would be largely confined to the target coal seams. Water from these seams is unsuitable for drinking or irrigation without treatment. In this regard, the Department is satisfied that no significant impacts on local stock and drinking water supplies are expected.

The Department considers that other impacts of the development (including visual, Aboriginal heritage, traffic, waste management and hazard impacts) would not be significant, and can be minimised and managed through appropriate conditions of consent.

The proposed development is limited to short-term exploration activities. This exploration development, as part of Santos's E&A Program, is an important opportunity to investigate the potential of securing important gas supplies from the region for the NSW industrial and consumer markets and would inform Santos's CSG production planning process. It is also an opportunity to potentially alleviate gas supply shortages which would otherwise potentially lead to significant energy price increases for residents of NSW.

Overall, the Department is satisfied that the proposed development would not result in any significant environmental impacts, and that its impacts can be managed, mitigated or offset through appropriate conditions of consent. The Department is satisfied that, with appropriate restrictions on potential impacts to water resources and biodiversity, the proposed exploration activities can be undertaken with minimal adverse environmental impacts, and hence the proposed development is in the public interest, and should be approved, subject to the recommended conditions of consent.

1. PROPOSED DEVELOPMENT

1.1 Background

In November 2011, Santos Limited acquired Eastern Star Gas Limited (ESG), the previous titleholder of Petroleum Exploration Lease 238 (PEL 238), Petroleum Assessment Lease 2 (PAL 2) and Petroleum Production Lease 3 (PPL 3) and the operator of the Wilga Park Power Station all located in the Narrabri region. Santos NSW (Eastern) Pty Ltd (Santos) is currently the holder of these petroleum exploration and production titles and Santos NSW (Narrabri Power) Pty Ltd is the operator of the Wilga Park Power Station.

At the time of acquisition, ESG's operations included six appraisal pilots, numerous water storage ponds, the Bibblewindi Water Treatment Facility, Wilga Park Power Station and ancillary infrastructure in and around the Pilliga and Bibblewindi State Forests.

Following the acquisition and due to a number of ESG's existing operations being below Santos's operational standards, Santos suspended most of ESG's operations and commenced a program of decommissioning and rehabilitation works. These works have included plugging and abandoning wells, decommissioning and rehabilitating water storage ponds, decommissioning the reverse osmosis plant at the Bibblewindi Water Treatment Facility (now known as the Bibblewindi Water Transfer Facility) and commencing rehabilitation of approximately 30 hectares (ha) of land.

1.2 Exploration and Appraisal Program

Santos intends to continue exploration, appraisal and evaluation of the coal seam gas (CSG) potential within its local petroleum titles through its Energy NSW CSG Exploration and Appraisal Program (E&A Program). The purpose of this program is to assist Santos over the next two to three years in gaining further knowledge of coal fines, gas composition, flow rates and deliverability, well design, drilling and completion technologies.

The total area of land currently proposed for exploration activities within PEL 238 and PAL 2 under the E&A Program is approximately 107 ha, including 28 ha of existing activities and 79 ha of proposed activities. This equates to approximately 0.013% of the land with PEL 238 and PAL 2. A summary of the approved operational programs associated with the E&A Program is provided in **Table 1**.

In March 2013, the Division of Resources and Energy (DRE) of the Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) approved the Leewood Produced Water Facility (Leewood) under Part 5 of the *Environmental Planning & Assessment Act 1979* (EP&A Act). This facility is located on a pastoral holding also known as 'Leewood' which is owned by Santos and is outside of the Pilliga State Forest. The approval allows the construction of a water treatment facility, the transfer of produced water and brine from the Bibblewindi Water Transfer Facility to Leewood and ongoing operation of the facility to store water from future exploration and appraisal activities.

Table 1: Status of approvals for Santos's E&A Program

Development	Description	Approval Authority	Planning Legislation	Status
E&A Program	Includes projects listed below.	Commonwealth	EPBC Act*	Referred June 2013. Determined 1 October 2013 to be not a Controlled Action.
Bibblewindi Gas Exploration Pilot Expansion (also known as the Bibblewindi Multi-lateral Pilot)	See Section 1.3.	DP&E ¹	EP&A Act Part 4 SSD** Part 5 REF***	SSD application subject to this report. Bibblewindi 12 to 19H: approved 8 August 2008. Bibblewindi 21H and 27-29: approved 20 July 2009.

Bibbiewindi West Pilot	Drilling and operation of five appraisal wells.	OCSG ²	EP&A Act Part 5 REF	Approved 30 April 2009.
Dewhurst Gas Exploration Pilot Expansion	Drilling additional laterals from existing Dewhurst 13-18 wells, drilling and operation of two additional wells at the Dewhurst 26-29 pilot.	DP&E OCSG	EP&A Act Part 4 SSD Part 5 REF	SSD application subject to a separate report and approval. Dewhurst 13-18: Approved 21 July 2009
Dewhurst 22-25 Pilot	Drilling four appraisal wells, converting existing corehole to appraisal well and operation.	OCSG	EP&A Act Part 5 REF	Approved 16 August 2013.
Dewhurst 26-29	Drilling of four appraisal wells and operation.	OCSG	EP&A Act Part 5 REF	Approved 16 August 2013.
Dewhurst Northern Flow Lines	22.8 kilometre (km) water and gas flow lines.	OCSG	EP&A Act Part 5 REF	Approved 18 September 2013.
Dewhurst Southern Flow Lines	4.5 km water and gas flow lines.	OCSG	EP&A Act Part 5 REF	Approved 18 September 2013.
Leewood Phase 1	Construction and operation of 300 megalitre (ML) brine pond, 300 ML produced water pond and associated infrastructure.	OCSG	EP&A Act Part 5 REF	Approved 19 March 2013.
Tintfield 2-7 Pilot	Reoperation of existing pilot, construction and operation of flare.	OCSG	EP&A Act Part 5 REF	Approved 12 September 2013.
Fluids Treatment Facility	Treatment and storage of drilling fluids for future re-use in drilling activities.	Narrabri Shire Council EPA	EP&A Act Part 4 SEE**** EPL	Application lodged 1 October 2013, and Awaiting approval
Westport Drillers Camp	Accommodation for between 24 - 64 persons for up to four years.	Narrabri Shire Council	Part 4 SEE	Approved: 19 December 2012.

* Environmental Protection and Biodiversity Conservation Act 1999

** State Significant Development

*** Review of Environmental Factors, under Part 5 of the EP&A Act

**** Statement of Environmental Effects, under Part 4 of the EP&A Act

¹ Department of Planning & Environment

² Office of Coal Seam Gas, part of DTIRIS. Prior to February 2013 these approvals were granted by DRE, and prior to this by the Mineral Resources Division of the Department of Primary Industries (DPI).

On completion of exploration activities, wells and ancillary infrastructure would either be decommissioned and rehabilitated, or else suspended to allow for future production. If the E&A Program confirms a commercially-viable CSG resource and production activities are proposed by Santos, this would be subject to further detailed environmental assessment and approval processes. Santos is conducting initial environmental and technical studies for its proposed Narrabri Gas Project. The results of the E&A Program are vital to Santos in determining whether, and if so how, to proceed to full-scale commercial production within PEL 238 and PAL 2.

1.3 Description of the Proposal

Santos proposes to drill two new CSG exploration wells within the site of the existing 12-well Bibbiewindi Multi-lateral Pilot in the Bibbiewindi State Forest, located approximately 40 kilometres (km) south of Narrabri, in the Narrabri Local Government Area (LGA) (see **Figures 1 and 2**). The proposed development would occur wholly within PAL 2 and would be conducted on behalf of the titleholders of PAL 2, namely Santos NSW Pty Ltd and EnergyAustralia Gas Pty Ltd.

Table 2: Major components of the development

Aspect	Description
Development Summary	- Construction: site preparation activities at existing well pads and establishment of necessary equipment, temporary structures and facilities to enable drilling; drilling one vertical pilot well (Bibbiewindi 31) and one lateral pilot well (Bibbiewindi 32) and connection to the existing Bibbiewindi Multi-Lateral Pilot. - Operation: operating the existing Bibbiewindi Multi-Lateral Pilot with the new Bibbiewindi 31 and 32 wells, management of water and gas produced during operations and general maintenance activities. - Post operation and rehabilitation: decommissioning and rehabilitation of pilot wells and

Aspect	Description
	ancillary infrastructure or suspension of wells for potential future use.
<i>Processing & Waste Management</i>	- Produced water would be pumped through the water gathering system to the Bibblewindi Water Transfer Facility. - The Bibblewindi Water Transfer Tank located at the Bibblewindi Water Transfer Facility would be used to provide a short buffer (up to 24 hours) prior to the produced water being pumped to the Leewood Produced Water Facility via the already approved Leewood Water Pipeline. - Produced water would be stored in one of the 300 megalitre (ML) ponds at the Leewood Produced Water Facility prior to transportation by road tankers to an appropriately licensed facility in the Sydney metropolitan area for treatment, reuse and/or disposal. - Santos is currently developing plans to treat produced water at the Leewood Produced Water Facility by reverse osmosis or other methods instead of transporting produced water from Leewood to a licensed facility.
<i>Water Demand and Supply</i>	During its operation, the Bibblewindi Multi-Lateral Pilot, including the two new wells, is expected to extract a maximum of approximately 285 ML of groundwater over three years from the Gunnedah-Oxley Murray Darling Basin groundwater source.
<i>Development Life</i>	3 years.
<i>Employment</i>	Approximately 7.6 full-time equivalent jobs for the life of the development (5.6 during construction and two during operation).
<i>Capital Value</i>	\$8,079,458.
<i>Hours of Operation</i>	24 hours, 7 days a week.
<i>Access</i>	The proposed wells are located on existing well pads and would be accessed via existing access roads within Bibblewindi State Forest. The well pad areas are connected via a series of access tracks branching off Little Tighes Road.
<i>Clearing and Rehabilitation</i>	There is no clearing associated with the proposed development.

The Department's assessment report does not include any assessment of establishing the well pad areas within the Bibblewindi Multi-Lateral Pilot or the existing water and gas gathering systems, access tracks and partial rehabilitation of the well pad areas. This is because these works have been previously assessed under Part 5 of the EP&A Act by the former Mineral Resources Division of the Department of Primary Industries (see **Table 1**). Nevertheless, the Department's assessment has included consideration of the cumulative impacts of operating the proposed development together with the existing components of the Bibblewindi Multi-Lateral Pilot and the other components of the E&A Program.

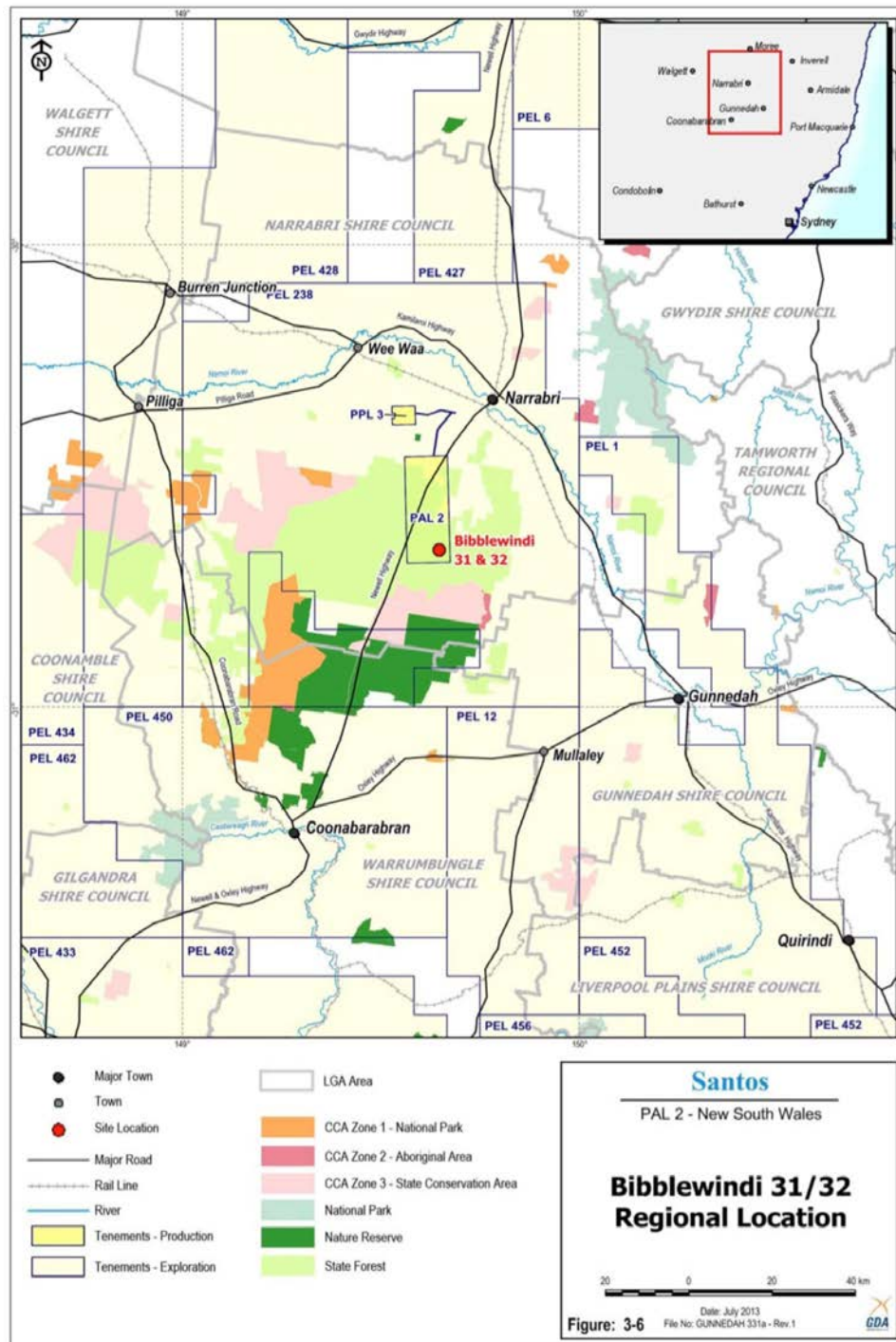
The existing pilot consists of 12 wells (Bibblewindi 12, 13, 14, 15, 16, 17, 18H, 19H, 21H, 27, 28H and 29). Each well is located on a pad area of approximately 100 metres (m) by 100 m, or 1 ha. Surface infrastructure at the pilot site includes well heads, skids, separators, generators, remote telemetry units and a water and gas gathering system.

Bibblewindi 31 and 32 would be located on the existing well pads for Bibblewindi 14 and 19H respectively and construction access for the two proposed wells would be along existing access tracks. The tie-in point to the existing buried gathering system would also be on the existing Bibblewindi 14 and 19H pad areas. The Department notes that hydraulic fracturing would not be used as part of the E&A Program. There would also be no additional/new disturbance beyond the existing well pad areas and access tracks.

The schedule of works proposed is outlined in **Table 3**. Bibblewindi 31 would be drilled first, followed by Bibblewindi 32.

Table 3: Approximate schedule of works associated with the proposed new wells

Activity	Approximate Duration	Estimated Timing
Construction		
Site preparation	20 days	Q2 2014
Drilling and completion	35 days	Q2 2014
Surface facilities	50 days	Q2/3 2014
Operation		
Operation of the pilot	Up to 3 years	2014-2017
Post operation and Rehabilitation		
Post-operational decommissioning and rehabilitation	Approximately six months after well abandonment where practical and considering external factors such as weather, if wells are not suspended to enable future production.	On completion of appraisal activities.

**Figure 1:** Regional location and Santos's petroleum titles

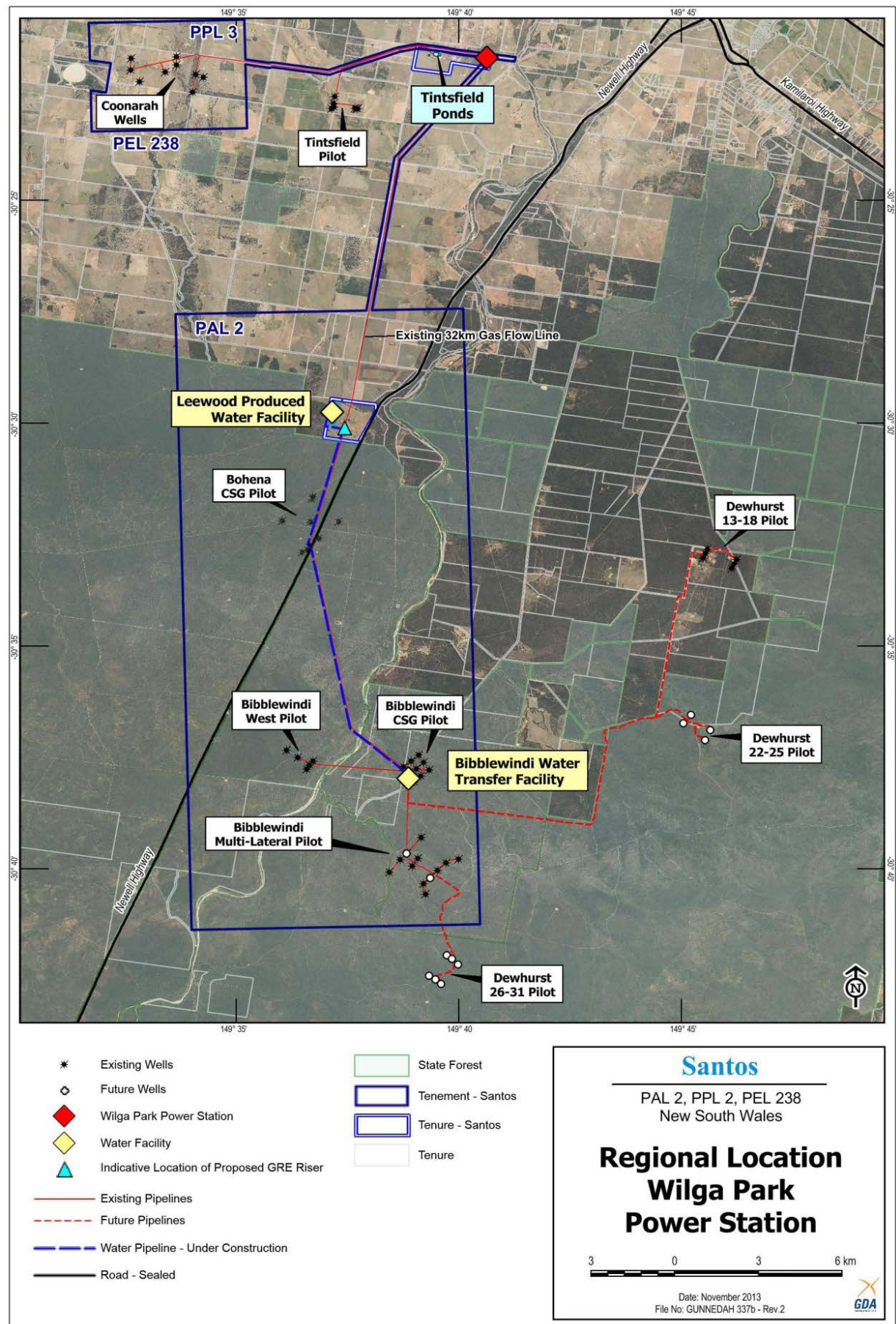


Figure 2: CSG infrastructure and Santos's petroleum titles

2. STRATEGIC CONTEXT

2.1 Land Use

The proposed development area is located within the central portion of the Bibblewindi State Forest on the northwest slopes of NSW. This State forest is bordered by the Pilliga State Forest to the east, west and south. Rural properties are located to the north, including 'Leewood'.

The regional topography is characterised by flat to very flat, gently sloping land with little to no vertical relief. The surrounding land use is dominated by Bibblewindi State Forest, Pilliga State Forest and rural land which is predominantly used for farming.

The surrounding forests are utilised for forestry purposes, including timber harvesting and apiary uses, and recreational activities such as bushwalking, camping and bird watching. Timber harvesting within the Pilliga region has been significantly reduced over recent years due to conservation efforts.

The dominant land use in the Namoi River Catchment is sheep and cattle grazing (51%), with other agricultural activities within the surrounding Narrabri LGA being wheat, cotton and other broad-acre crops which are normally grown only on the alluvial floodplains in the area.

2.2 Natural Environment

The character of the environment in the overall region has been changed dramatically since European settlement, with large areas of land cleared for agricultural activities. However, there are still considerable areas of relatively natural State forest and conservation reserves in the region.

The Bibblewindi State Forest comprises 7,135 ha and forms part of a larger area of remnant vegetation known as the Pilliga Scrub. Other protected areas within the Pilliga Scrub include Pilliga Nature Reserve, Pilliga East State Forest, Pilliga East State Conservation Area, Rutley State Forest, Kerringle State Forest and Willala Aboriginal Area.

The surrounding region is located within the Namoi River Catchment which covers an area of approximately 42,000 km² and is bounded by the Great Dividing Range in the east, the Liverpool Ranges and Warrumbungle Ranges in the south and the Nandewar Ranges and Mount Kaputar to the north. Major tributaries of the Namoi River include Coxs Creek and the Mooki, Peel, Cockburn, Manilla and Macdonald Rivers which all join the Namoi River upstream of Boggabri. Pian, Narrabri, Baradine and Bohena Creeks all join the Namoi River below Boggabri. The proposed development is located within the Bohena Creek sub-catchment of the Namoi River Catchment.

The Bohena sub-catchment is drained by Bohena, Cowallah and Bibblewindi Creeks. Land management issues in the sub-catchment include soil erosion, biodiversity conservation, water quality and riparian management.

The Upper Namoi and Lower Namoi Alluvium are the principal aquifers in the Namoi River Catchment and are both used heavily for irrigation. The proposed development is not located within any mapped Upper Namoi or Lower Namoi Alluvium.

The following Water Sharing Plans (WSPs) apply to water sources beneath or in the vicinity of the proposed development:

- NSW Great Artesian Basin (GAB) Groundwater Sources WSP;
- NSW Murray-Darling Basin (MDB) Porous Rock Groundwater WSP;
- NSW MDB Fractured Rock Groundwater WSP;

- NSW Upper and Lower Namoi Groundwater Sources WSP;
- NSW GAB Shallow Groundwater Sources WSP; and
- Upper Namoi and Lower Namoi Regulated River WSP.

2.3 Geology

The site is located in the central portion of the Gunnedah Basin, where Jurassic and Cretaceous Surat Basin sediments unconformably overlie Gunnedah Basin sediments. The proposed development is underlain by a geological formation known as the Orallo Formation, a part of the Surat Basin sediments which is dominated by sandstones.

The proposed development would primarily target the Bohena Seam, a CSG-bearing coal seam contained in the Maules Creek Formation of the Gunnedah Basin.

2.4 Aboriginal Heritage

Aboriginal people have lived in and around the Narrabri area for many thousands of years. When Europeans arrived in the early 19th Century, the area was occupied by the Gomeroi Aboriginal people. This group is also known as the Kamilaroi, Gamilaroi or Gamilaraay People. Physical evidence of the first people in the Narrabri area can be seen in artefact scatters, scar trees and open campsites. The area is within the coverage of the Narrabri Local Aboriginal Lands Council, which remains active in the identification and management of Aboriginal heritage.

Cultural field surveys for Stage 1 of the Western Regional Assessments in 2002 identified 145 Aboriginal sites of significance, which increased the number of known sites within the Pilliga Scrub to 261. The results indicated that Aboriginal sites occur in all landform categories, but a particular relationship between Aboriginal sites and watered localities was also established.

2.5 Built Environment

The proposed development site is located approximately 9 km from the Newell Highway, a major transport route connecting Coonabarabran with Narrabri. Narrabri is the closest accessible town. Access to the proposed development would be via the Newell Highway, X-Line Road, Tighes Gully Road and Little Gully Road.

Rural properties bound the proposed development area to the north. The nearest residences are over 7 km from the site. Other built infrastructure in the area includes Santos's coal seam gas pilots, gas and water gathering systems, storage ponds, abandoned wells and the Wilga Park Power Station (see **Figure 2**).

2.6 Economic Significance

Narrabri LGA has a population of approximately 13,500 people. The age distribution within the LGA is indicative of a mix of young families with children, as well as an ageing population. There is a lower proportion of residents aged 25 to 54 compared to the NSW average. This age bracket is generally reflective of the working population, ie many people who have sought a range of employment opportunities have left the district.

The development is predicted to generate a total of approximately 7.6 equivalent full-time jobs for varying periods of time (5.6 during construction and 2 during operation). This may be of some significance in the Narrabri region, where the Narrabri LGA has not performed as well as many other parts of NSW in recent measurements of socio-economic indicators. For example, unemployment within the Narrabri LGA is currently higher than the NSW average.

The Narrabri Shire Economic Development Strategy (2011) outlines opportunities that the mining sector would provide in creating investment in the area as well as increasing value adding uses such as mining services businesses in the Shire.

The economic multiplier effect for the local and wider economy is estimated to be \$5.3 - 5.5 million or the creation of up to an additional 16 indirect jobs, based on a capital investment value of \$8.1 - 8.3 million. Materials are expected to be sourced locally, where possible, with an estimated further \$0.8 million spent locally on goods and services including vehicle hire, maintenance and fuel.

No existing agricultural jobs would be lost as a direct result of the proposed development; therefore the proposed development would not result in any loss of agricultural employment opportunities in the Narrabri LGA.

The Department notes that, while the socio-economic benefits of the proposed development are not overly significant, the exploration activities are necessary to guide Santos's ultimate decision of whether to apply for development of commercial CSG production, which would have much more significant regional socio-economic benefits.

The operation of the Bibbiewindi Multi-Lateral Pilot in conjunction with the proposed development, if approved, is estimated to generate approximately 1.2 megawatts (MW) of power through the Wilga Park Power Station. Both conventional and un-conventional gas (including CSG) is being used increasingly for electricity generation in NSW and could increase from approximately 11% to 37% by 2030-31¹.

2.7 Strategic Regional Land Use Policy

In September 2012, the NSW Government released its *Strategic Regional Land Use Policy*, which sets out a range of new policy initiatives aimed at balancing growth in the mining and CSG industries with the need to protect important agricultural land and water resources. The policy package consists of:

- a suite of initiatives to better regulate mining and CSG exploration, including requirements for community consultation at the exploration stage;
- creation of a Land and Water Commissioner to oversee the exploration process;
- preparation of comprehensive Strategic Regional Land Use Plans (SRLUPs) for the Upper Hunter and the New England North West region (which includes the proposed development), which amongst other things identify and map strategic agricultural land, including Biophysical Strategic Agricultural Land (BSAL) and Critical Industry Clusters (CICs) for the equine and viticulture industries;
- introduction of a Gateway process, including establishment of an expert Gateway Panel, to independently assess the impacts of mining and CSG projects on BSAL and CICs before proposals can proceed to the development application stage;
- a Statewide Aquifer Interference Policy (AIP) to protect key groundwater resources across the State;
- the requirement for Agricultural Impact Statements (AISs) for all mining and CSG projects; and
- two new codes of practice for the CSG industry, including a ban on the use of BTEX chemicals in drilling and hydraulic fracturing, and a ban on the use of evaporation ponds for the disposal of water associated with petroleum production.

In February 2013, the NSW Government announced a package of additional measures to protect residential areas and CICs from CSG activity. These include:

- prohibition of new CSG exploration and production within and under residential areas and CICs, and within 2 km of such residential areas;

¹ Australian Energy Market Operator's 2011 *Gas Statement of Opportunities* as cited in the EIS.

- establishing the Environment Protection Authority (EPA) as the lead compliance and enforcement regulator for the environmental and health impacts of CSG activities;
- establishing an Office of CSG regulation (the OCSG) within DTIRIS to manage the grant and regulation of all petroleum titles under the *Petroleum (Onshore) Act 1991*;
- tasking the NSW Chief Scientist and Engineer to conduct an independent review of all CSG activities in NSW; and
- requiring all CSG exploration, assessment and production activities to be subject to an Environment Protection Licence (EPL) under the *Protection of the Environment Operations Act 1997*.

The Secretary's Requirements for the proposed development required that the necessary Environmental Impact Statement (EIS) for the development application is prepared in accordance with these new policy requirements (as applicable), including the need for an AIS and consideration of the development against the AIP (see **Section 5.1**).

The proposed development is not located on or near BSAL and/or a CIC. The nearest mapped BSAL is approximately 15 km away and no CIC has been identified in the New England North West Region. The proposed development is not located on or in the vicinity of any travelling stock route, the nearest being 16 km from the site.

The site is located within the Narrabri Shire LGA and is not located in, or within, two kilometres of a residential zone.

The SRLUP identifies the proposed development area and surrounding land as having high CSG resources and underground coal exploration potential. Both the CSG and coal mining industries are growing in the region, with numerous existing CSG exploration wells and a number of existing coal mines within 100 km of the proposed development.

2.8 Namoi Catchment Water Study

The Namoi River Catchment is recognised as an agricultural area of significance that includes one of the most intensively developed groundwater resources in NSW.

In response to significant levels of concern within the regional community about the potential impacts of the growing mining and CSG industry on these significant groundwater and surface water resources, the NSW Government commissioned the Namoi Catchment Water Study (NCWS) in August 2010. The purpose of the NCWS was to investigate the potential cumulative effects of coal and CSG resource development activities on catchment water resources.

The final NCWS report was published in July 2012 and included catchment-wide modelling of water resource impacts under a number of different coal and CSG development scenarios, as outlined in **Table 4**.

Table 4: Namoi Catchment Water Study Scenarios

Scenario No.	Description	Mines (number)		CSG fields (No.)
		Open-cut	Underground	
0	No current or future mining or CSG	0	0	0
1	Approved mines & CSG production	6	1	Pilot holes only
2	Approved & planned mines & CSG	10	2	2
3	Extensive & widespread mining & CSG	24	7	8
4	Extensive & widespread mining only	24	7	Pilot holes only
5	Extensive & widespread CSG only	6	1	8
6	Half underground mines beneath alluvium	24	7	8

Scenario 2 represents existing known and planned mines in the catchment. Scenario 3 is the most intense future resource development scenario, and reflects extensive CSG production and around 60 million tonnes of coal production a year for 90 years.

Potential Impacts

The NCWS noted that mining and CSG projects have the potential to impact the region's water resources at both the broad and local scales, and that the local scale impacts cannot be determined by a catchment wide study. Accordingly, the NCWS stressed that the model is not designed to replace the need for project-specific detailed investigations, supplemented by comprehensive monitoring and appropriate operational management for approved projects.

The primary broad-scale pathways by which mining and CSG projects can impact water resources are:

1. interception of rainfall and runoff – which can result in:
 - (i) reduced recharge to groundwater systems; and
 - (ii) reduced surface water flows and water quality changes; and
2. flow of groundwater to mining voids/wells – which can result in:
 - (i) leakage from aquifers;
 - (ii) mixing of different quality groundwaters;
 - (iii) reduced flow from groundwater to rivers; and
 - (iv) increased leakage from rivers to groundwater.

NCWS Findings

The NCWS found that coal mining and CSG developments in the Namoi River Catchment are unlikely to have significant regional-scale impacts on water resources. Local scale impacts are more likely, particularly due to cumulative effects should numerous developments occur in close proximity. The impacts would be mainly on groundwater levels in hard rock aquifers in the local vicinity of the mines or CSG fields.

The modelling indicates that both the Lower and Upper Namoi Alluvium will experience a relatively low impact for both Scenario 2 and 3, when compared to existing anthropogenic water use impacts (ie existing water use for irrigation, stock and domestic, and public supply). However, the hard rock groundwater system is likely to experience a high impact relative to existing water use, particularly for Scenario 3.

2.9 Chief Scientist's Review

In February 2013, the Chief Scientist, Prof Mary O'Kane, started her independent review of CSG activities in NSW. An initial report, based on consultation with key stakeholders, site visits, literature review and preliminary expert reports, was completed in July 2013.

The key findings of the report are that:

- there is a high level of distrust in the Government's ability to regulate CSG activities;
- both industry and the community are dissatisfied with the current legislative and policy framework for the industry; and
- there is no central Government registry for information about CSG activities and industry compliance.

The report concluded that most of the potential impacts of CSG activities could be dealt with through the application of best practice technology, operations and maintenance, coupled with rigorous monitoring and enforcement. Nevertheless, the report also indicated further priority research should be carried out to reduce uncertainties around some potential impacts of CSG development. These included the impacts of hydraulic fracturing on groundwater, fugitive emissions and their potential health impacts, and cumulative impacts.

The report contained five recommendations for the future of CSG activities in NSW. The first of these recommendations is that the Government should commit to establishing a world-class regime for CSG extraction. The Chief Scientist acknowledges that it would take time to establish this regime, and suggests that initial actions should concentrate on carrying out further research, improving the collection and storage of data, and requiring mandatory training for all CSG operational staff. The remaining recommendations relate to the implementation of these initial actions. The Chief Scientist's initial report contained no specific findings or recommendations in relation to the assessment or regulation of CSG development under the EP&A Act.

The Chief Scientist is currently completing a more detailed review of the industry, and is expected to hand down her final report in mid-2014. This report is expected to include detailed recommendations to Government on improving regulation of CSG in NSW.

2.10 Strategic Energy Project

On 20 February 2014, the NSW Government signed a Memorandum of Understanding (MoU) with Santos, designating the proposed Narrabri Gas Project as a Strategic Energy Project. Under the MoU, the NSW Government will ensure the highest standard of independent environmental assessment, and provide whole-of-government co-ordination for all relevant agencies involved in the decision making process.

Santos, in turn, will provide baseline monitoring of water level and quality as well as a high-quality EIS and a risk assessment of the potential impacts of the project. Santos will also conduct comprehensive consultation with the local community and stakeholders.

The MoU provides certainty of process, not certainty of outcome, yet recognises that the Narrabri Gas Project has the potential to play an important role in meeting the State's energy needs.

2.11 Justification for the Development

Santos Limited is an Australian petroleum company, established in 1954, which has supplied gas to NSW since 1976. Santos Limited, and associated subsidiary companies, have been conducting CSG activities in Queensland for 20 years and in northwest NSW since 2008.

The proposed development forms part of Santos's larger E&A Program, which has the potential to play a role in the delivery of a secure supply of domestic gas for NSW. Overall, the E&A Program is intended to determine the quality and quantity of CSG within the Narrabri region, which may enable planning of future gas extraction in the area.

The Department considers the proposed development to be generally consistent with the:

- *NSW 2021: A Plan to Make NSW Number One* (2011);
- *New England North West Regional Action Plan* (2012);
- *Strategic Regional Land Use Policy* (2012); and
- *Commonwealth's Energy White Paper 2012* (2012).

The NSW Government considers that an increased use of gas to meet growing energy demand is important to economic growth in the State. Currently, 95% of NSW's gas supply comes from two pipelines – one from South Australia and one from Victoria. The remaining 5% is CSG produced by AGL's Camden Gas Project, which has been in production since 2002. It is generally well accepted that contracted gas supply levels will drop significantly by 2017 due to factors including a strong demand for gas in other states and for export, decreasing reserves and constraints on infrastructure. Low levels of securely-contracted supply are expected to coincide with growth in energy consumption in all sectors.

The use of gas in power stations has the benefit of a significantly lower greenhouse gas emissions profile compared to more traditional coal-fired power stations. The Department notes that substituting coal for gas equates to an annual emissions reduction in the order of 68,500 tonnes of greenhouse gases for each 20 megawatts (MW) of electricity production.

The proposed development, as part of Santos's E&A Program, is an important opportunity to investigate the potential to secure local gas supplies in NSW and inform the CSG production planning process. It is also an opportunity to potentially alleviate gas supply shortages which may lead to significant energy price increases for NSW consumers, including domestic consumers. The Department notes that neither existing approvals nor the proposed development involve full CSG production and any future large-scale CSG production would be subject to an entirely separate application and detailed assessment process.

3. STATUTORY CONTEXT

3.1 State Significant Development

The proposed development is classified as State Significant Development (SSD) under the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). Clause 8 of the SRD SEPP provides that development is SSD if the development is permissible with development consent under Part 4 of the EP&A Act, and the development is specified in Schedule 1 or 2 of the SRD SEPP.

Under clause 7(2) of the *SEPP (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP), development consent is required for the purposes of drilling or operating a set of more than five wells that is more than three kilometres from any other petroleum well (other than an abandoned well) in the same petroleum title.

Under clause 6 of Schedule 1 of the SRD SEPP, development for the purpose of drilling or operating petroleum exploration wells, not including 'a set of 5 or fewer wells that is more than 3 km from any other petroleum well (other than an abandoned petroleum well) in the same petroleum title' is SSD. The proposed development is for the purpose of drilling and operating more than five wells within a 3 km radius within PAL 2 and is therefore SSD under the SRD SEPP.

Consequently, the Minister for Planning is the consent authority for the development. However, the development application falls within the Minister's delegation of 14 September 2011 to the Planning Assessment Commission (PAC), because there were more than 25 public submissions in the nature of objections and also because Santos has made reportable political donations. Consequently, the application must be referred to the PAC for determination.

3.2 Permissibility

The development area is located in the Narrabri LGA. Under the *Narrabri Local Environmental Plan 2012* (Narrabri LEP 2012), the site is zoned RU3 Forestry zone.

The proposed development is a non-forestry use that would not:

- restrict the use of surrounding land for forestry purposes;
- significantly affect the natural resource relied upon by the local forestry industry;
- affect the development of forestry or forestry-related enterprises in the area;
- result in the fragmentation or alienation of forestry resource lands; and
- result in conflict between land uses within the RU3 Forestry zone or land uses within the adjoining zones.

The proposed development is located entirely on land managed by the Forestry Corporation of NSW. Santos holds a permit to occupy the affected land, issued under section 31 of the *Forestry Act 1916*.

The Department is satisfied that the proposed development can be considered to be a suitable activity within the RU3 Forestry zone. Furthermore, the proposed development is also permissible with consent under clause 7 of the Mining SEPP.

3.3 Environmental Planning Instruments

Under Section 79C of the EP&A Act the Minister's delegate is required to consider, amongst other things, the provisions of relevant environmental planning instruments (EPIs), including any exhibited draft EPIs and development control plans.

The Department has considered the proposed development against the relevant provisions of several EPIs (see **Appendix E**) as well as Santos's consideration of these instruments (see **Appendix E**). The key instruments include:

- *NSW Strategic Regional Land Use Policy (2012)*;
- *Narrabri LEP 2012*;
- *SEPP No. 33 – Hazardous and Offensive Development*;
- *SEPP No. 44 – Koala Habitat Protection*;
- *SEPP No. 55 – Remediation of Land*;
- *SEPP (State and Regional Development) 2011*;
- *SEPP (Infrastructure) 2007 (Infrastructure SEPP)*; and
- *SEPP (Mining, Petroleum Production and Extractive Industries) 2007*.

Based on its assessment of these instruments and its broader environmental assessment in **Section 5**, the Department is satisfied that the Bibblewindi Gas Exploration Pilot Expansion can be undertaken in a manner that is consistent with the aims, objectives and provisions of these instruments. However, this satisfaction is subject to a range of mitigation, monitoring and management measures.

3.4 Integrated and Other Approvals

Under Section 89J of the EP&A Act, a number of other approvals are integrated into the SSD approval process, and consequently are not required to be separately obtained for the proposal. These include:

- various approvals relating to heritage required under the *National Parks and Wildlife Act 1974* and the *Heritage Act 1997*;
- an authorisation under the *Native Vegetation Act 2003* for the clearing of native vegetation; and
- certain water approvals under the *Water Management Act 2000*.

Under Section 89K of the EP&A Act, a number of further approvals are required, but must be substantially consistent with any development consent for the proposal. These include:

- an 'exempted area' approval under section 70 of the *Petroleum (Onshore) Act 1991*;
- an EPL under the *Protection of the Environment Operations Act 1997*; and
- approvals for roads and intersection construction under the *Roads Act 1993*.

Santos also requires other approvals for the development which are not integrated into the SSD approval process, including certain water licences under the *Water Act 1912* and the *Water Management Act 2000*.

The Department has consulted with the relevant public authorities responsible for these other approvals (see **Section 4**) and has considered the issues relating to these approvals in

its assessment of the development (see **Section 5**). None of the relevant authorities object to the development on grounds related to these other approvals.

The E&A Program was referred to the Commonwealth's then Department of Sustainability, Environment, Water, Population and Communities (now the Department of the Environment) and was declared to be Not a Controlled Action on 1 October 2013.

3.5 Exhibition and Notification

Under section 89F of the EP&A Act the Secretary is required to publicly exhibit the EIS for the proposed development for at least 30 days. After accepting the EIS (see **Appendix A**) for the development, the Department:

- publicly exhibited the EIS for an extended period of 45 days from 24 September 2013 until 7 November 2013 at:
 - the Department's Information Centre in Sydney;
 - Narrabri Shire Council's Offices in Narrabri;
 - Nature Conservation Council's office; and on
 - the Department's website;
- notified relevant State government authorities and Council by letter;
- notified relevant road authorities, in accordance with the Mining SEPP; and
- advertised the exhibition in the *Narrabri Courier* on 24 September 2013.

In undertaking these processes, the Department satisfied the notification requirements of Section 89F of the EP&A Act, the Mining SEPP, the Infrastructure SEPP and the Narrabri LEP.

During the assessment process the Department also made other documents publicly available on its website, including:

- the development application;
- Santos's political donations disclosure;
- the Secretary's environmental assessment requirements for the EIS;
- submissions received during exhibition of the EIS; and
- Santos's responses to issues raised in submissions (the Response to Submissions, or RTS).

3.6 Objectives of the EP&A Act

The Minister's delegate is required to consider the objects of the EP&A Act when making decisions under the Act. The objects of most relevance to the delegate's decision on whether or not to approve the development are found in section 5(a)(i),(ii),(vi)&(vii) of the Act. They are:

- (a) *to encourage:*
 - (i) *the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,*
 - (ii) *the promotion and co-ordination of the orderly and economic use and development of land,*
 - (vi) *the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and*
 - (vii) *ecologically sustainable development"*

The Department is satisfied that the development encourages the proper use of resources (Object 5(a)(i)) and that the assessment is promoting and co-ordinating the orderly and economic use of land (Object 5(a)(ii)). The encouragement of environmental protection (Object 5(a)(vi)) is considered in **Section 5** of this report. Following this consideration, the Department is satisfied that the potential impacts of the development can be suitably mitigated, managed and/or offset to ensure an acceptable level of environmental performance.

The Department has considered the encouragement of ecologically sustainable development (ESD) (Object 5(a)(vii)) in its assessment of the application. This assessment has sought to integrate all significant economic and environmental considerations, and to avoid any serious or irreversible damage to the environment, based on an assessment of risk-weighted consequences.

4. CONSULTATION

4.1 Submissions

The Department received 183 submissions during the exhibition and submission period:

- 12 from public authorities, including Narrabri Council;
- 8 from special interest groups; and
- 163 from the general public, 89 by way of a form letter.

The Department also received 2 further representations following the close of the submission period. A copy of all submissions and representations is provided in **Appendix B**.

4.2 Agency Submissions

The **Office of Coal Seam Gas** (OCSG) generally supports the proposed development subject to a number of recommended conditions of consent (see **Section 5**). The **Environment Protection Authority** (EPA) did not raise any specific concerns subject to a number of recommended conditions of consent which are addressed in **Section 5**.

The **Office of Environment and Heritage** (OEH), the **Heritage Division** within OEH, **Fisheries NSW** within the Department of Primary Industries, the **Rural Fire Service** and the **Namoi Catchment Management Authority** (Namoi CMA) did not raise any specific concerns regarding the proposed development. The Department notes that the Namoi CMA ceased to exist on 1 January 2014, although its functions continue within **North West Local Land Services** (NWLLS).

While noting that there are no critical agricultural issues for the proposed development (including economic impacts), the **Office of Agricultural Sustainability and Food Security** (OASFS) considered that, from a soils perspective the EIS provided insufficient discussion. Santos addressed this concern in its RTS to the satisfaction of OASFS.

The **Hunter New England Local Health District, NSW Health** (NSW Health) did not raise any specific concerns in regards to groundwater, surface water, noise and vibration, drilling muds and additives provided the proposed development is carried out in accordance with the EIS. NSW Health raised some concern with Santos's assessment of air pollution, psychological impacts and consultation. Santos addressed these concerns to the satisfaction of NSW Health in its RTS.

Narrabri Shire Council (Council) and the **NSW Office of Water** (NOW) raised a number of concerns with regard to water resources and in particular Santos's groundwater model and monitoring. NOW was particularly concerned that it had not been provided with sufficient

information to assess the validity of the model and its suitability in making the required predictions. Santos provided this information to NOW and the Department has since requested that it be made publicly available. The Groundwater Impact Assessment Report and Groundwater Model Peer Review were submitted as supplementary material to the RTS and the Dewhurst Gas Exploration Pilot Expansion EIS and are available on the Department's website. Concerns regarding water resources are addressed in **Section 5.1**.

Roads and Maritime Services (RMS) recommended a number of conditions of consent relating to road and intersection upgrades, particularly around the intersection of X-Line Road and the Newell Highway. Based on additional information provided by Santos in its RTS, RMS removed its recommendation to upgrade the intersection of X-Line Road and Newell Highway to include a Channelised Right Turn Treatment Short, but retained its other recommended road and intersection upgrades. These are further discussed in **Section 5.3**.

Coonamble Shire Council raised a number of concerns regarding water resources, including monitoring and treatment, lack of transparency regarding future development plans, cultural heritage, bushfire risk and health impacts. The Department notes that the proposed development and other activities of the E&A Program are not located within Coonamble LGA. Nevertheless, the Department has addressed these concerns, where appropriate, in **Section 5**.

4.3 Community and Interest Group Submissions

Of the 173 submissions and representations from the community and special interest groups, all objected to the development. The issues raised in general decreasing order of mention are shown in **Figure 3**.

The 8 special interest groups that made submissions were:

- NSW Artesian BoreWater Users Association;
- Wilderness Society;
- Friends of the Pilliga;
- Namoi Water, which comprises local irrigators;
- Northern Inland Council for the Environment;
- Upper Mooki Landcare Group;
- National Parks Association; and
- North Coast Environment Council.

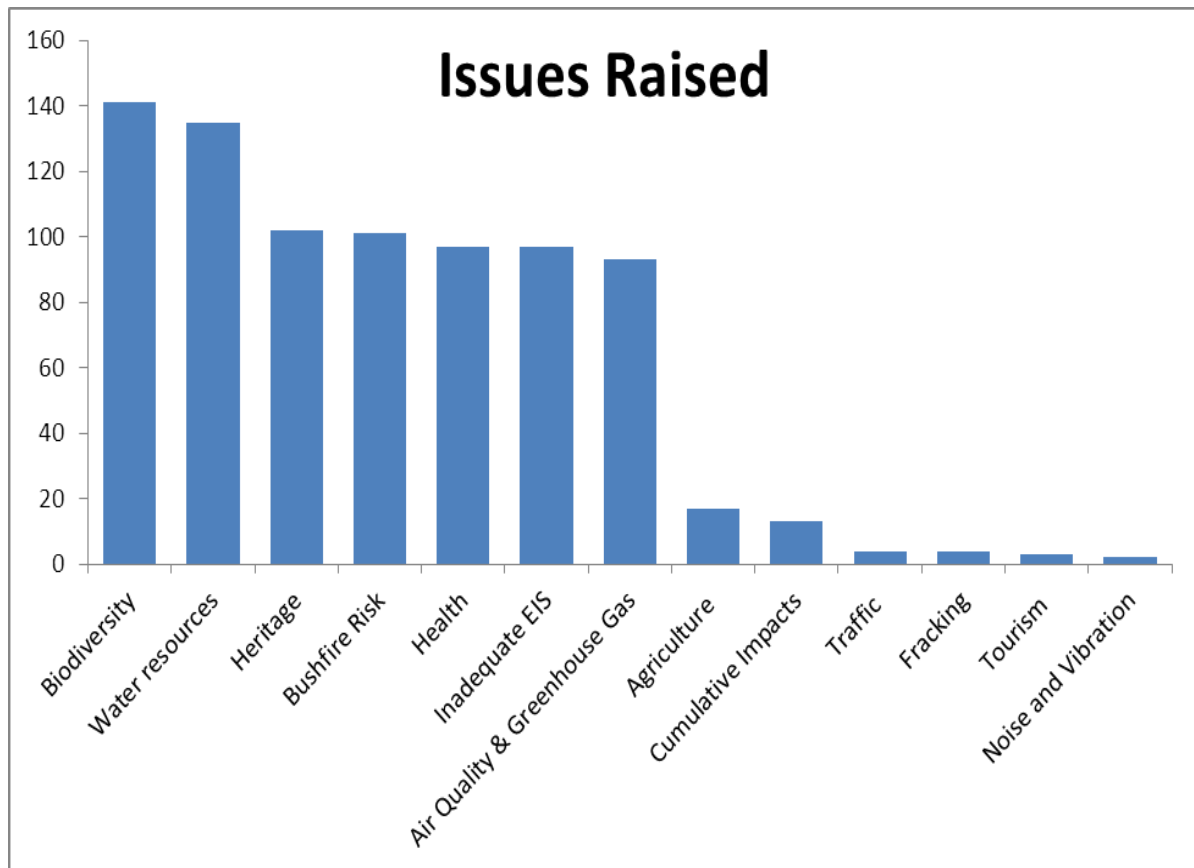


Figure 3: Key issues raised by special interest groups and the general public

The main grounds for objection from both individuals and interest groups were (in decreasing order):

- **Biodiversity:**
 - inadequate baseline monitoring and survey methodology;
 - impacts on threatened species and their habitat, including the Pilliga Mouse and South-eastern Long-eared Bat;
 - lack of offset;
 - potential increase of invasive species and pathogens; and
 - cumulative impacts and general objections to CSG in the Pilliga Scrub;
- **Water Resources:**
 - no adequately explained strategy for produced water management, including its treatment and use or disposal;
 - adequacy of groundwater baseline monitoring;
 - adequacy of groundwater modelling;
 - monitoring bores not established;
 - impacts on other water users, including drawdown of aquifers;
 - leakages of chemicals during drilling and cross-contamination of aquifers; and
 - impacts on stygofauna;
- **Aboriginal Heritage:**
 - the lack of a comprehensive Aboriginal cultural heritage assessment;
- **Bushfire Risk:**
 - the Pilliga Scrub is highly susceptible to fires; and
 - no clear bushfire strategy;
- **Health:**
 - risk of emissions on the health and wellbeing of humans and wildlife; and
 - social disruption to local residents;

- *Inadequate EIS:*
 - cumulative impacts with other CSG pilots;
 - project staging and multiple approvals for numerous wells and pilots does not allow a proper cumulative impact assessment;
 - EIS relies on multiple previous REF documents;
 - EIS fails to address issues raised by Government agencies; and
 - lack of transparency regarding future plans in the region;
- *Air Quality, Greenhouse Gas and Climate Change:*
 - no assessment of fugitive emissions; and
 - cumulative effects of climate change from the carbon emissions of the E&A Program;
- *Agriculture:*
 - threatening existing agricultural activities; and
 - best food-producing lands are at risk.

A number of submissions objected to the CSG industry in general and noted that CSG activities should be put on hold until the Chief Scientist's second report on the CSG industry is complete. The Department notes that nothing in the Chief Scientist's initial report, nor in broader Government policy, suggests that existing or proposed CSG exploration projects should be placed on hold until the second report is complete. On the contrary, the NSW Government has recently announced that it has accorded Santos's proposed SSD application for its Narrabri Gas Project the status of being a 'Strategic Energy Project'. Furthermore, the current legislative framework (the EP&A Act) allows for the lodgement, assessment and determination of the subject application.

4.4 Other Consultation Processes

The Department requested that the company provide a response to public and agency submissions (RTS), which Santos provided in January 2014 (see **Appendix C**). The RTS has been considered in the Department's assessment of the development in **Section 5** below. The Department also requested feedback from Government agencies on the RTS, which is provided in **Appendix D**.

Department officers also inspected the proposed development region with representatives from the OCSG on 13 August 2013. Department officers have also met with officers of other affected agencies and/or Santos representatives a number of times over recent months, primarily in relation to possible assessment requirements and processes for Santos's proposed Narrabri Gas Project.

5. ASSESSMENT

The Department considers the key assessment issues associated with the project are:

- potential impacts to water resources, including:
 - surface water systems and users;
 - groundwater systems and surrounding users;
 - groundwater dependent ecosystems; and
 - cumulative groundwater impacts; and
- the design and integrity of the gas wells.

5.1 Water Resources

5.1.1 Introduction

As outlined in **Section 2.8**, the NCWS was commissioned in response to rising levels of concern within the local community about the potential impacts of the growing mining and CSG industry on the region's significant groundwater and surface water resources.

The NCWS found that mining and CSG developments in the Namoi River Catchment are unlikely to have significant regional scale impacts on water resources, even with very substantial coal and CSG development. Instead, local scale impacts are more likely. The NCWS noted that these local scale impacts cannot be determined by a catchment-wide study (as undertaken in the NCWS), and stressed the need for comprehensive project-specific investigations, supplemented by comprehensive monitoring and operational management plans for approved projects.

In this regard, a number of specialist water resource assessments and reviews have been undertaken for the proposed development, and more broadly the E&A Program, to assess the incremental and cumulative effects of the development.

The EIS includes a specialist Groundwater Impact Technical Report, undertaken by CH2M Hill. Secondly, Santos has also submitted a Groundwater Impact Assessment, prepared by Halcrow Pacific Pty Ltd (a CH2M Hill company), dated December 2013. This report was provided to the Department as a supplement to the RTS and details the development of the Conceptual Hydrogeological Model and contains groundwater modelling. Thirdly, Kalf & Associates undertook a review of the Halcrow Groundwater Impact Assessment to review the models and impact assessment. These three water studies are in addition to previous water studies undertaken by ESG and Santos for other wells in the region.

The body of work undertaken to assess potential surface water and groundwater impacts has been relatively substantial, and has involved a review by one of the State's most respected water specialists (Dr Frans Kalf). Based on these assessments and the recommendations proposed, the Department is satisfied that a thorough and robust prediction of the potential water resource impacts of the development, and more broadly the E&A Program, has been undertaken.

The proposed development has the potential to affect surface water and groundwater resources in a number of ways, including:

- uncontrolled run-off during construction activities;
- release of contaminants, including leakage of produced water during operation and leakages from the gathering system;
- creation of an artificial connection between water-bearing formations that bypasses aquitards or aquicludes, resulting in cross contamination of an aquifer;
- contamination of aquifers by drilling fluids, if lost in the surrounding strata; and
- groundwater discharges to the surface, potentially causing flooding or impacts to surface water quality depending on the discharge and receiving water qualities.

Halcrow's numerical groundwater model covers all of Santos's Narrabri program area and has been used to simulate the potential cumulative impact of the E&A Program on surface and groundwater resources. One of the key issues raised by NOW was that the model is not suitable to make predictions to assess the development's groundwater impacts against the AIP. Halcrow classifies the predictive capability of the groundwater model as low, namely Class 1. Under the Australian Groundwater Modelling Guidelines there is a general expectation that models developed for predicting impacts of water take should have a predictive capability of Class 2 or Class 3. NOW notes that a Class 1 model would only be acceptable where activities are demonstrated to be particularly low risk.

The Department notes that the proposed development and the E&A Program more broadly are appraisal activities and not a CSG production development. One aim of appraisal programs is to collect sufficient data to evaluate the potential groundwater impacts that would occur as a result of CSG production. NOW notes, and the Department concurs, that while Santos's model is not suitable for making the required predictions of groundwater impacts for a larger production project, the risks associated with predicting the impacts of an appraisal pilot are much lower than the risks associated with impacts of full-scale CSG production.

To address this issue, NOW recommends implementing a groundwater monitoring program that has been prepared in consultation with NOW and in accordance with its Groundwater Modelling and Monitoring Guidelines. the Department is of the view that monitoring should be conducted in a manner that is conducive to development of a model with a Class 2 or Class 3 predictive capability rating as would be required for any future CSG production proposal.

Groundwater monitoring is required to confirm the absence or onset (and magnitude) of any impact associated with CSG activities for both deep and shallow aquifers, including the comparison of results against modelled predictions. Santos has been implementing its proposed groundwater monitoring program since submitting the EIS in order to better understand the local groundwater system and pursuant to previous approvals (see **Figure 4**). The program has been and continues to be developed in consultation with NOW and was approved by OCSG on 9 July 2013. The program has been designed to include:

- shallow aquifer monitoring bores (SAMB) which focus on:
 - o demonstrating baseline groundwater levels and background flow patterns within the Pilliga Sandstone;
 - o confirming groundwater pressure in the Purlawaugh Formation; and
 - o verifying the confining characteristics of the Orallo Formation overlying the Pilliga Sandstone; and
- a single deep aquifer monitoring bore (DAMB) which focuses on:
 - o demonstrating baseline groundwater levels, background flow patterns and existing hydraulic gradients in the Gunnedah Basin;
 - o illustrating the absence or otherwise of vertical hydraulic continuity within Gunnedah Basin strata; and
 - o elaboration of the migration of groundwater depressurisation laterally in the target seams and vertically above and below the seams, following the commencement of extraction of produced water.

A number of submissions, including from Council, raised concerns at the proposed use of only one deep aquifer monitoring bore. Santos has informed the Department that the monitoring bore has already been installed at the eastern periphery of gas exploration activities within the Permo-Triassic strata from which depressurisation originates. Data is being collected from strategically targeted formations (ie strata) in likely zones of depressurisation overlying the targeted coal seams. The Department considers this to be acceptable and notes that the Permo-Triassic depressurisation data would complement data derived from the existing pilot wells, which are laterally extensive.

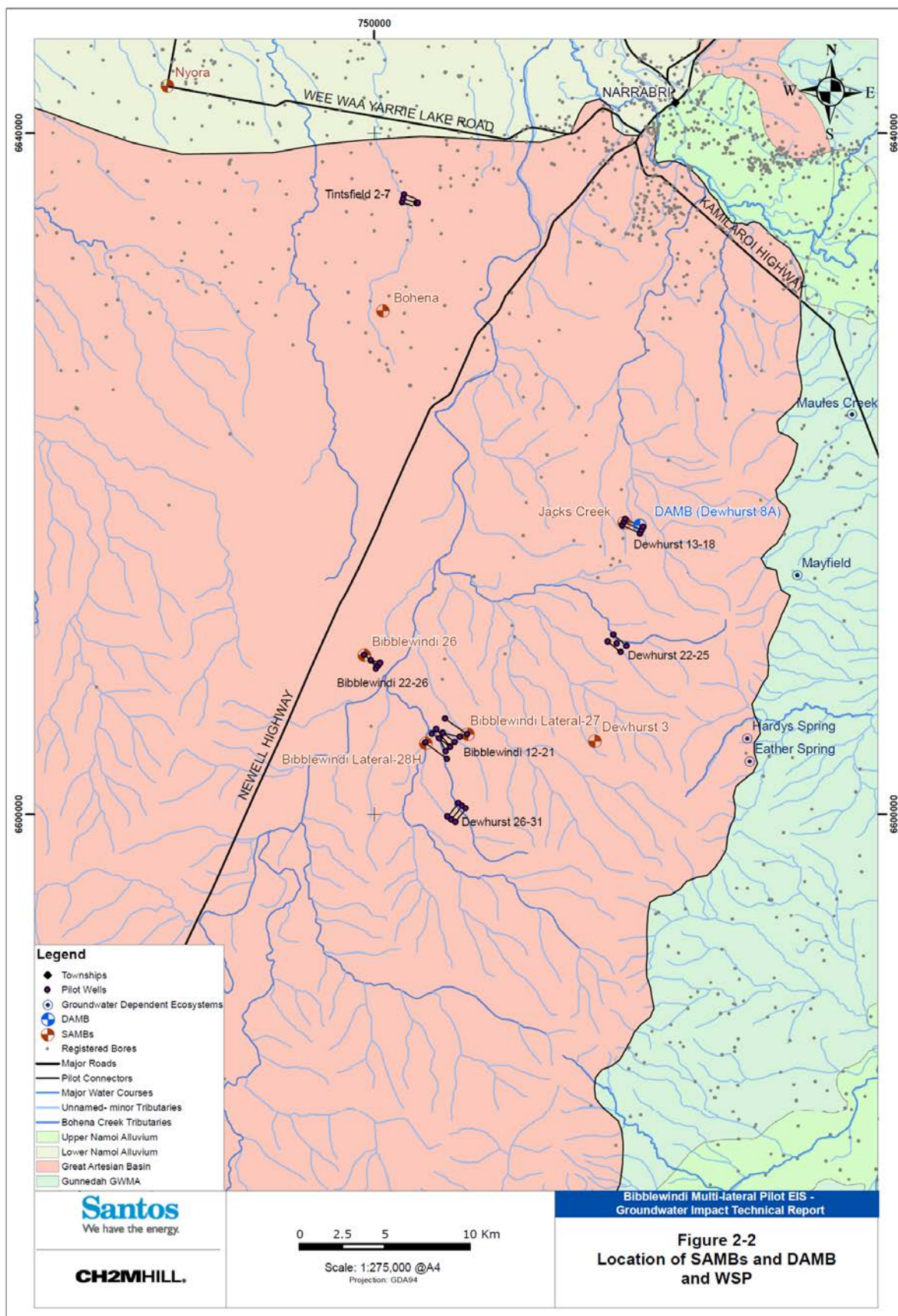


Figure 4: Water resources, monitoring locations and proposed/existing wells near the E&A Program

5.1.2 Surface Catchment Context

The key water resources of the Namoi River Catchment comprise the surface water system of the Namoi River, its tributaries and the alluvial groundwater systems associated with the watercourses. The catchment is shown on **Figure 5**. The Upper Namoi Alluvium and Lower Namoi Alluvium form the principal aquifers. Both are used heavily for agricultural irrigation. There are a total of 700 groundwater licence holders in the Namoi River Catchment, with the catchment itself licensed to provide over 343,000 ML of groundwater entitlement per year. The proposed development does not sit within any mapped Upper Namoi or Lower Namoi Alluvium.

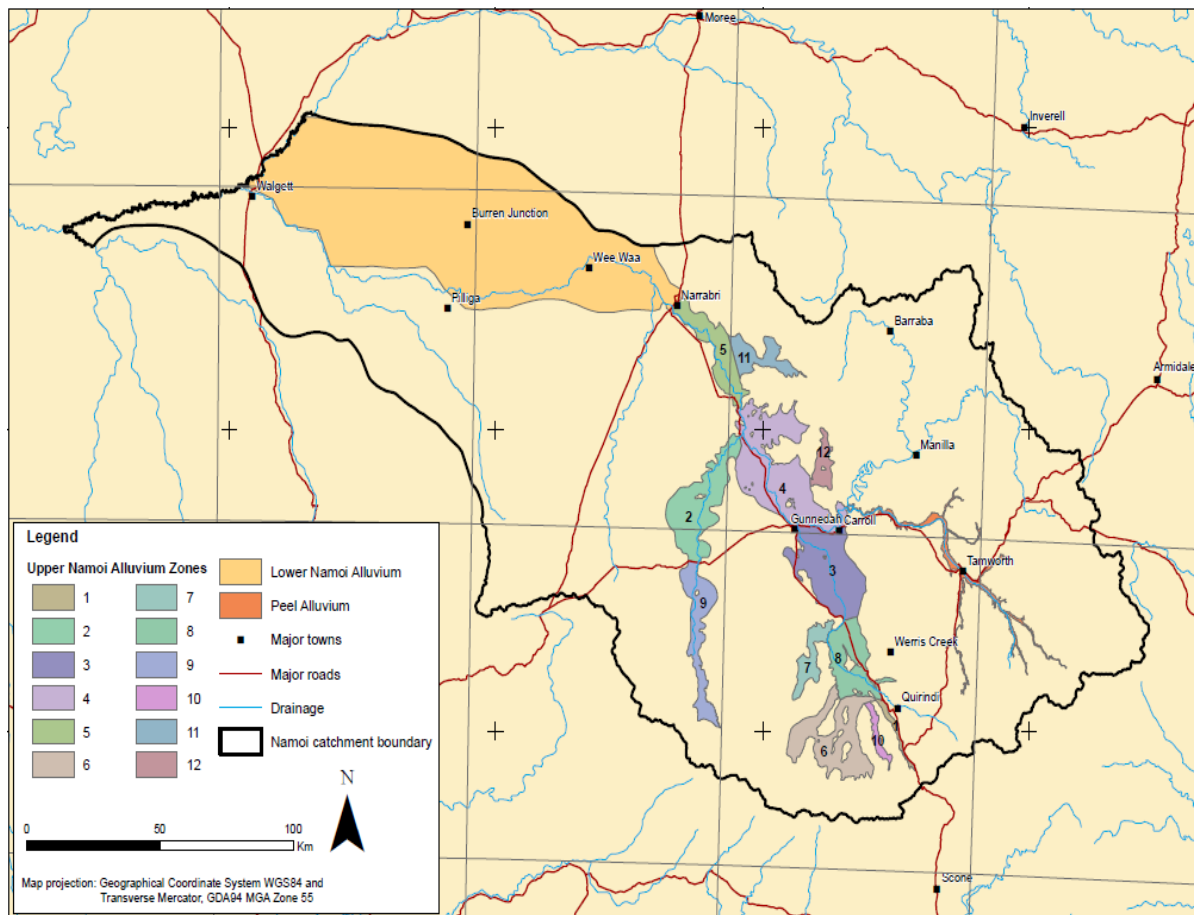


Figure 5: Namoi River Catchment and associated key alluvial aquifers

The proposed development is located within the Bohena sub-catchment of the Namoi River Catchment, which covers an area of approximately 830 km², south of Narrabri. The Bohena sub-catchment is drained by Bohena, Cowallah and Bibbiewindi creeks and forms the Bohena Creek Water Source under the *Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources*. Issues within the sub-catchment include soil erosion, biodiversity conservation, water quality and riparian management.

The proposed development is located in the vicinity of Cowallah Creek and Mount Pleasant Creek, as well as unnamed tributaries of Cowallah Creek and Bohena Creek. All of these watercourses are ephemeral. Drainage in the vicinity of the site is shown in **Figure 6**.

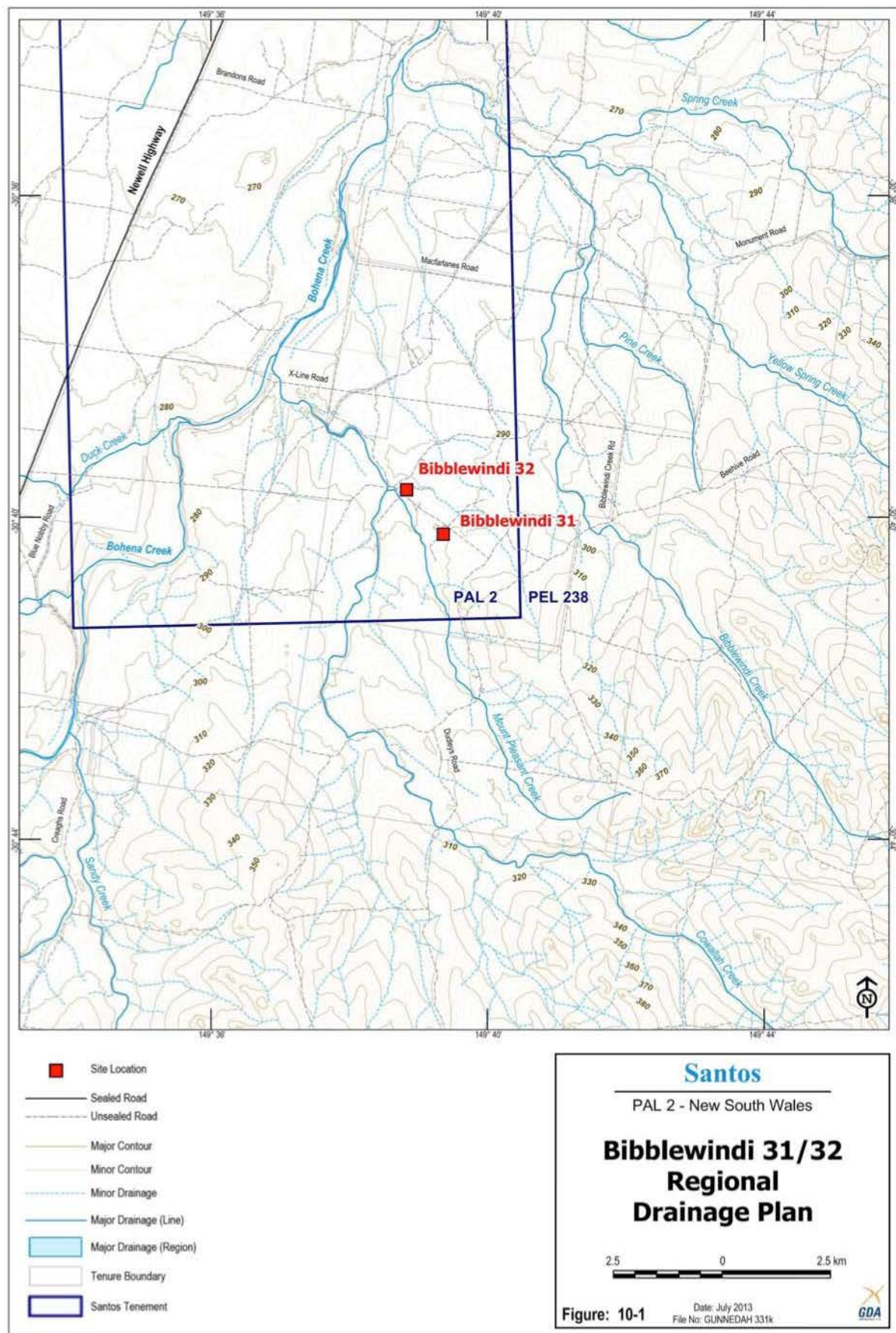


Figure 6: Regional drainage plan

The proximity of the proposed development to drainage lines and creeks is outlined in **Table 5** below.

Table 5: Proximity of proposed wells to drainage lines and creeks

Watercourse	Stream Order	Distance from proposed Bibblewindi 31 (km)	Distance from proposed Bibblewindi 32 (km)
Unnamed tributary of Cowallah Creek	2 nd	0.58	0.125
Mount Pleasant Creek	3 rd	0.5	0.225
Cowallah Creek	4 th	1.5	0.45
Bohena Creek	5 th	5.2	4

The proposed development is not located within a drinking water catchment.

5.1.3 Impacts to Surface Water Systems and Users

No water is proposed to be extracted from Cowallah Creek or Mount Pleasant Creek, or any other nearby watercourse. Furthermore, the proposed development is not expected to cause any impacts or changes to the volume or flow of these water bodies as drilling activities would not be undertaken during prolonged wet periods.

Impacts during well operation are limited to those associated with leakages from the water gathering system, for example a potential line failure. Santos monitors water pressure within the pipes remotely, and should a leak occur, operation of the well would be suspended until rectified. The Department is satisfied that, should this occur, the extent of impact would be small, localised and short-term.

The potential impacts to surface water sources are greatest during construction and drilling. However, the Department notes that the existing well sites and the general vicinity of the proposed new well sites are already highly disturbed due to existing CSG activities. While the well pad areas are located on a relatively flat ground surface, proposed earthworks could increase the potential for local erosion, potentially resulting in a loss of topsoil/spoil and sedimentation of waterways. This risk is greatest during site establishment, drilling and construction phases. The Department notes that during well operation, the pilot sites would be rehabilitated to reduce erosion potential.

The proposed development has limited potential to cause erosion and sedimentation as works would be located entirely on existing and established well pads. However minor earthworks of approximately 30 m² would be required to establish the cellar pit near each well and to install sub-surface infrastructure to connect the well to the existing gas and water gathering systems. Topsoil and spoil would be stockpiled on site. Ongoing erosion impacts during operations have been previously assessed with sediment controls already existing at each well pad area.

The Department is satisfied that the potential for erosion is minimal given that the proposed disturbance occurs predominantly within existing well pad areas, access tracks and roads. Nevertheless, the Department has recommended a condition of consent to ensure Santos continues to implement appropriate erosion and sedimentation management measures.

5.1.4 Groundwater Context

The two principal alluvial aquifers are associated with underlying sedimentary rock units, including the:

- Southern Recharge groundwater source, controlled under the NSW Great Artesian Basin (GAB) Groundwater Sources WSP;
- Gunnedah-Oxley Basin Murray-Darling Basin (MDB) buried groundwater source, controlled under the NSW MDB Porous Rock Groundwater Sources WSP; and

- Lachlan Fold Belt MDB buried groundwater source, controlled under the NSW MDB Fractured Rock Groundwater Sources WSP.

The Southern Recharge source of the GAB directly underlies the proposed development and the other sites of the E&A Program. The GAB covers 1.7 million km² and contains 8,700 million ML of artesian water. Water from aquifers in the GAB is generally suitable for town water and domestic supply and for stock, however is unsuitable for irrigation due to high levels of sodium. However, the Southern Recharge groundwater source is characterised by better quality groundwater than other zones of the GAB.

The Gunnedah-Oxley Basin MDB Groundwater Source covers an area of 28,600 km² and contains interbedded coals, sandstone and siltstones. The Department notes that the aquifers in this formation are not considered to be major groundwater sources.

The proposed development would target the Bohena Seam, a lower Permian-age coal, within the Maules Creek Formation (see **Figure 7**). Impacts would be confined to the WSP wherein the target seam is located, namely the NSW MDB Porous Rock Groundwater Sources WSP. The water to be extracted from this seam is highly brackish and unsuitable for drinking or irrigation without treatment.

The Lachlan Ford Belt MDB Groundwater Source covers an area of 167,220 km² and is located deeper than the targeted CSG bearing formations.

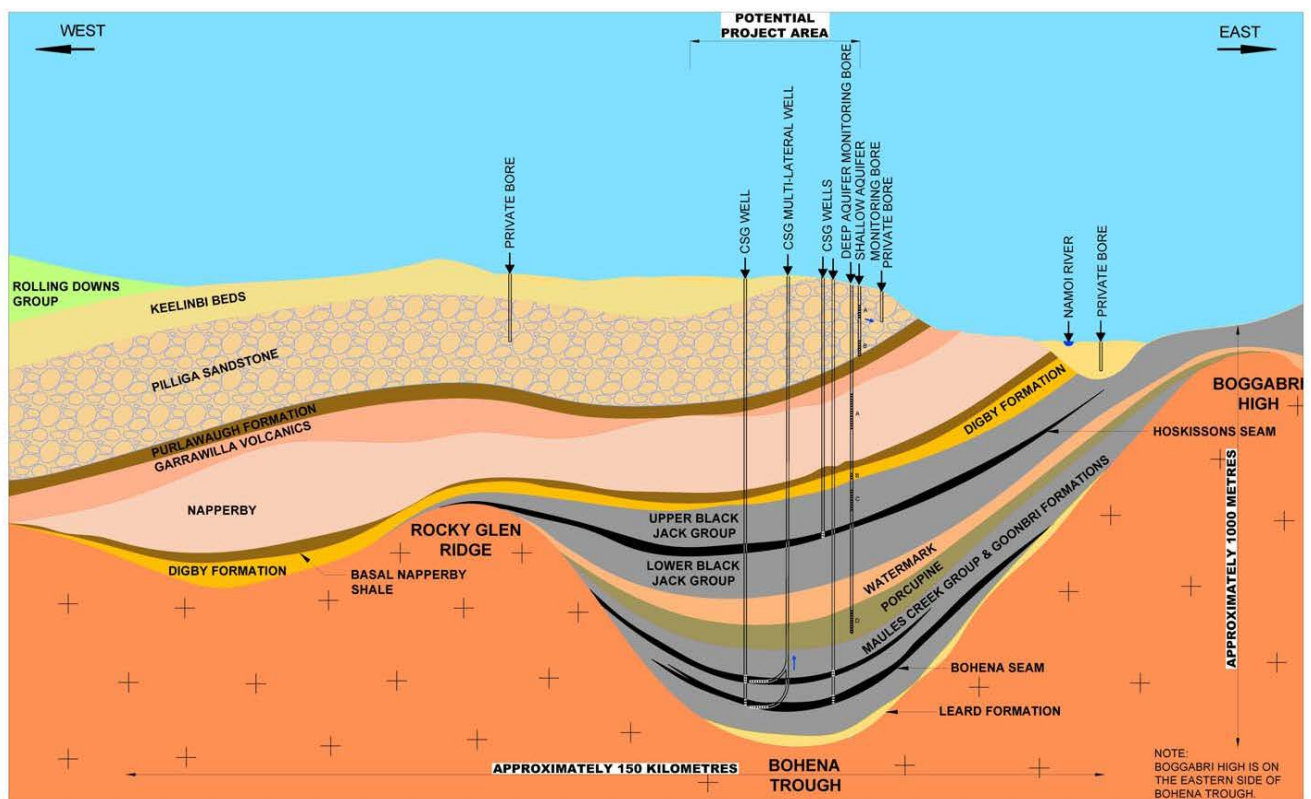


Figure 7: Schematic cross-section through the Bohena trough (not to scale)

5.1.5 Avoidance and Mitigation Measures

Santos has designed the development to reduce impacts on water resources, including:

- nil extraction from nearby watercourses;
- designing and constructing wells in accordance with the *NSW Code of Practice for Coal Seam Gas Well Integrity*;

- the use of loss circulation material (ie cellulose) to ensure that drilling fluids return to the surface in the event of excessive drilling fluid losses;
- maintaining the existing diversion bund to divert clean water around the work area;
- ensuring drilling fluids are contained in surface tanks that are regularly inspected and maintained;
- installation of pressure gauges on the pilot wells which are monitored remotely through a Supervisory Control and Data Acquisition system;
- on-going water resource monitoring, including of nearby private bores;
- maintaining a minimum freeboard of 300 mm for any tanks or pits containing liquid waste;
- storing and handling fuel, equipment and chemicals in accordance with *Australian Standard 1940-2004: The Storage and Handling of Flammable and Combustible Liquids*, or other relevant guidelines;
- employing a driller, holding relevant qualifications as required by NOW, to be on site during drilling of the top hole until surface casing is set, cemented and pressure tested;
- transporting drilling fluids to and from the development area through an appropriately licensed contractor; and
- decommissioning of wells as soon as they are no longer required.

5.1.6 Water Use

The proposed development does not involve extraction of any surface water within the Bohena Creek water source during construction and operation. Consequently, no water access license under the *Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources* is required.

The key licensable water 'used' by the development would be groundwater extracted during the operation of the proposed wells and, more broadly, during the E&A Program. Santos has reported that the future operation of each appraisal well that forms the E&A Program would occur for a period of three years. The estimated extraction rates for the pilots that form the E&A Program are provided in **Table 6**.

Table 6: Estimated extraction rates for the E&A Program pilots

Pilot	Total Extraction (m ³)	Maximum Extraction (m ³ /day)	Average Extraction (m ³ /day)
Dewhurst 13-18	331,121	397	302
Dewhurst 22-25	285,140	273	260
Dewhurst 26-31	413,801	448	378
Bibblewindi Multi-lateral	285,110	581	260
Bibblewindi West	92,940	209	85
Tintfield 2-7	25,162	43	23

As indicated in **Table 6**, the Bibblewindi Multi-Lateral Pilot, including the proposed development, is expected to extract a maximum of 285 ML of groundwater over the proposed three year life-span of appraisal operations. As previously noted, this water would be extracted from the Gunnedah-Oxley Basin MDB groundwater source. This groundwater source comprises a number of formations down to and including the targeted Maules Creek Formation. Within the context of the AIP, this is considered to be a 'less productive' porous rock groundwater source.

The Department notes that, like any other significant water user in the State, access to 'take' this water is a commercial risk for Santos, subject to purchasing the necessary groundwater licences. Like any other significant water user, if Santos is not able to secure enough water to meet its demands (eg if existing licence allocations are reduced due to drought), its extraction operations may need to be reduced. This is consistent with the water sharing principles established under the *Water Management Act 2000* (WMA).

To demonstrate that Santos has access to adequate water allocations, and to ensure that it uses water efficiently, the Department has recommended conditions requiring Santos to ensure that it has sufficient water entitlements for all stages of the development, and if necessary, adjust the scale of operations to match its available licensed water allocations. Santos would also be required to undertake 3-yearly independent environmental audits and annual reviews, as well as ongoing validation of the groundwater model.

A decline in head of over 2 m within the lowest strata of the NSW Murray-Darling Basin Porous Rock Groundwater Source WSP is predicted. This impact on hydraulic (pressure) head and the fluxes in groundwater to meet the requirements of the pilot CSG water demands are interpreted to comprise aquifer interference and would require licensing under the WMA.

5.1.7 Impacts on Surrounding Groundwater Users

There are a total of 700 groundwater licence holders in the Namoi River Catchment, with the total catchment licensed to provide over 343,000 ML of groundwater entitlement per year. Nevertheless, groundwater use within the vicinity of the site is relatively limited due to land use constraints (ie located in the Bibblwindi State Forest) and lower yields associated with the sedimentary rock units.

There are five licensed groundwater bores within five kilometres of the proposed development, of which only one is used for stock and domestic purposes. All these bores extract water from the Pilliga Sandstone and are not predicted to be significantly impacted during construction and operation of the development. The Maules Creek Formation is not currently used for water supply due to depth, water quality and alternate sources of good quality groundwater located nearer to the surface. In fact, there is no known registered extraction from bores in formations deeper than the Pilliga Sandstone across the whole E&A Program.

Santos's modelling indicates that any cumulative impact on registered bores across the E&A Program would not be significant. During operation of the E&A Program, groundwater levels would be monitored by the shallow and deep aquifer monitoring bores (see **Figure 4**). Nevertheless, the Department has included recommended conditions of consent regarding ongoing monitoring of water resources and requiring Santos to provide a compensatory water supply to any landowner whose water entitlements is adversely impacted by the development.

The proposed development and the E&A Program more broadly are not expected to impact on the highly productive Upper Namoi and Lower Namoi Alluvium due to the multiple aquitard layers, including the Purlewaugh Formation, that separate the targeted coal seam from the alluvium (see **Figure 7**). The Department also notes that the zone of influence remains west of the Gunnedah Basin's Permo-Triassic strata and that the registered bores under the relevant WSP would not be impacted.

5.1.8 Impacts on Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems which require access to groundwater (beyond soil-based groundwater from rainfall) to meet all or some of their water requirements. The EIS identified two high priority GDEs, namely Eather Spring and Hardys Spring, both of which are located 18 km east of the site (see **Figure 4**).

Both GDEs are hydrogeologically associated within the Pilliga Sandstone. There are no predicted significant impacts of the development on the Pilliga Sandstone and consequently no predicted impacts to the GDEs. Santos's modelling also indicates that there would be no significant impact on GDEs within the broader E&A Program Area.

The Department is satisfied that the risks to these two high priority GDEs have been adequately addressed and considers that there is likely to be nil to minimal impacts on them. Nevertheless, the Department has recommended a performance measure of 'negligible environmental consequences' for all GDEs.

5.1.9 Cumulative Impacts

The EIS's Groundwater Impact Technical Report provides a detailed discussion of potential cumulative groundwater impacts of the E&A Program. The report concludes that impacts would be largely confined to the NSW MDB Porous Rock Groundwater Source WSP, where the target coal seams are located. Water from these seams is unsuitable for drinking or irrigation without treatment.

The Department notes that the water sharing principles established under the WMA and relevant WSPs provide an equitable and appropriate means for addressing cumulative impacts on the water resources of the Narrabri region, and indeed the rest of the State. The Department also acknowledges the comprehensive assessment undertaken in the NCWS, which indicates that the development of coal and gas projects in the Namoi River Catchment is unlikely to result in significant catchment-wide impacts. Finally, it is important to emphasise that the proposed development and the E&A Program are not located on or very close to the Liverpool Plains.

5.1.10 Conclusion

The Department is satisfied that Santos has designed the proposed development to avoid impacts on key water resources. The Department considers that the proposed development would not significantly impact local and regional groundwater and surface water resources including drinking water. However, the Department recognises the importance of the protection of the region's water resources to the people of the Namoi Valley, and has recommended a broad suite of conditions to ensure that this occurs, including conditions requiring Santos to:

- ensure that it has adequate water access licenses to account for all water used by the development, prior to the construction of wells;
- ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of operations on site to match its available water allocation;
- provide compensatory water supplies to any private landowner whose supply is found to be adversely affected by the development;
- carry out the development in accordance with the *NSW Code of Practice for Coal Seam Gas Well Integrity*;
- not discharge any produced water from the site under any circumstances; and
- in consultation with NOW, revise its Groundwater Monitoring and Modelling Plan to include a description of the monitoring specific to the development and ensure that the groundwater model is upgraded to a Class 2 or 3 model in accordance with the AIP.

NOW and the Department consider that implementation of a revised Groundwater Monitoring and Modelling Plan and the approved Produced Water Management Plan is necessary and would result in a significantly improved understanding of the water management and monitoring system for the E&A Program. This would also provide valuable information to support Santos's proposed CSG development program in a manner that avoids significant impacts on key water resources.

5.2 Well Design and Integrity

Table 7 sets out the key design criteria for each of the two proposed wells. Santos proposes to design and construct the wells and to carry out operations in accordance with the *NSW Code of Practice for Coal Seam Gas Well Integrity*. The wells would be designed to have automated shutdown systems that are triggered by pre-set operating conditions in order to

minimise or prevent environmental, health or safety incidents. Hydraulic fracturing is not proposed as a component of the proposed development.

Table 7: Proposed key design criteria for each new well

Design Criteria	Bibblewindi 31	Bibblewindi 32
Direction	Vertical ¹	Lateral
Approximate depth	1100 m	930-990 m
Well type	Appraisal pilot	Appraisal pilot
Target coal seam	Bohena	Bohena
Drilling technique	Rotary drilling and coring	Rotary drilling
Horizontal length	N/A	Approximately 900 m
Well head pump	Progressive cavity pump or electrical submersible pump ²	Electrical submersible pump

¹ Includes a slight 'S' shape to enable drilling on the existing Bibblewindi 14 well pad area

² Pump type to be confirmed based on the deviation of the well and recommendations from pump vendors

Drilling fluids used for drilling of the two wells would be predominantly water-based, but also contain two main drilling additives, salts and gels. A full list of the chemicals that may be used in the drilling process or held on-site is outlined in the EIS.

It is in Santos's best interests to ensure no drilling fluid is lost as it is the primary means of controlling the drilled hole. In the event that losses are detected, a 'lost circulation' material (which is comprised of cellulose or other natural material and works by blocking the pores in the permeable/fractured rock) would be mixed into the drilling fluid to 'glue' up the permeable zone and prevent further losses.

The Department is satisfied that full compliance by Santos with the *NSW Code of Practice for Coal Seam Gas Well Integrity* would:

- prevent groundwater migration paths and isolate the targeted zone from other formations;
- protect beneficial aquifers from contamination;
- maintain aquifer pressures and quality;
- obtain and maintain well integrity; and
- protect the casing from corrosion.

To ensure this occurs, the Department has included a recommended condition of consent requiring Santos to operate in accordance with this Code.

5.3 Other impacts

Other impacts resulting from the development are not predicted to be significant, and the Department is satisfied that they can be controlled, mitigated or managed through appropriate conditions of consent. These other impacts are addressed in **Table 8** below.

Table 8: Other impacts

Aspect	Issue/Consideration	Management/Mitigation
Biodiversity	• An Ecological Assessment for the proposed development was undertaken by RPS, including database searches, review of relevant documents and a field survey. • The proposed development has the potential to indirectly impact on flora and fauna, including aquatic habitat, through increased vehicle movements, increased noise, dust and light impacts and impacts to water from spills or leaks and sediment laden run-off. • Native vegetation is absent from much of the two 100 m x 100 m well pad sites. Only one vegetation community occurs within the immediate vicinity of the sites, namely	• The proposed wells would be situated on two existing pilot well pad areas and access would be via existing unnamed tracks which join Little Tighes Road. • No additional vegetation clearing is proposed. The development has been designed to avoid any works being undertaken within the adjacent Ironbark Shrubby Woodlands. • While there is potential for a number of threatened fauna species to occur in the adjacent woodlands, the Department is satisfied that the

	<i>Ironbark Shrubby Woodlands of the Pilliga area, Brigalow Belt South</i>. The majority of the vegetation community is young and in poor to moderate condition. - No threatened flora species or Threatened Ecological Communities or Endangered Ecological Communities (TECs or EECs) listed under either the <i>Threatened Species Conservation Act 1995</i> (TSC Act) or the EPBC Act were recorded within the 140 x 140 m study areas around each well pad site. - No threatened fauna species listed under the EPBC Act or the TSC Act were identified during the field surveys, although some are likely to occur. - Stygofauna are known to occur within the Namoi River alluvial aquifer. This aquifer does not underlie the proposed development site. Stygofauna may also be present in the shallower GAB sandstone aquifers present on-site. - The targeted coal seams are unlikely to contain stygofauna as the space available for movement is reduced significantly with increasing depth and there is an overall decline in water quality within the coal seams. - Potential threats to stygofauna include: - penetration of suitable habitat during drilling and subsequent draining of the aquifer or contamination through trans-boundary flow between aquifers; and - depressurisation of underlying aquifers that may result in drainage or contamination of stygofauna habitat from more saline water. - Santos has committed to undertake further sampling for stygofauna within PEL 238 and PAL 2. - EcoLogical has undertaken a study on the cumulative effects of the E&A Program. The cumulative impacts associated with the existing and proposed E&A Program activities include: - loss of 237.36 ha of vegetation, which equates to 0.045% of all vegetation within PEL 238 and PAL 2; - loss of between 26.3 and 237.1 ha of potential threatened fauna foraging habitat (depending on species) which represents between 0.01% and 0.17% of the available habitat within PEL 238 and PAL 2; and - loss of between 12.3 and 159.9 ha of potential threatened fauna species breeding habitat (depending on species) which represents between 0.05% and 0.11% of available breeding habitat within PEL 238 and PAL 2.	existing well pads are of very limited value to fauna species, due to the lack of habitat resources, and that consequently impacts to threatened species are likely to be minimal. - The Department notes that neither Bibblwindi 31 nor 32 would require drilling through alluvial aquifers, significantly reducing the potential to impact stygofauna. The Department is satisfied that the proposed development does not pose a risk to stygofauna populations or habitat provided that it is carried out in accordance with relevant guidelines and legislation. - The Department is satisfied that, provided the mitigation measures proposed by Santos are adhered to, indirect impacts to flora and fauna near to the proposed development would be low. - As no additional clearing is to be undertaken, the Department is satisfied that the cumulative impacts associated with the proposed development are negligible. - Santos proposes to implement the following mitigation measures: - clearly demarking site boundaries to ensure that plant and vehicles keep within the approved area of disturbance; - ensuring construction and operational vehicles only travel on designated access tracks; - enforcing site speed limits; - managing and monitoring weeds; and - rehabilitating the site. - The Department considers the proposed mitigation measures adequate and has included a recommended performance measure to ensure that the development does not cause more than negligible environmental consequences on GDEs and threatened species, TECs or EECs.
Aboriginal Cultural Heritage	Previous assessment of Bibblwindi 14 and 19H included an assessment of the risks to Aboriginal cultural heritage. The assessment included desktop searches of OEH's Aboriginal Heritage Information Management System (AHIMS) and the Aboriginal site	- Santos proposes to implement the following measures to reduce potential impacts on Aboriginal heritage: - ensuring staff and contractors are aware of their statutory obligations

	register maintained by the Pilliga Forest Aboriginal Management Committee (PFAMC) and NSW Forestry and the results of previous surveys of the broader PAL 2 area by PFAMC cultural heritage advisors. • The EIS included an additional AHIMS search. An archaeological inspection of the well pads and surrounding areas was carried out by RPS for due diligence purposes. • No Aboriginal objects, sites, places of significance or culturally modified trees were identified within the sites or immediate surrounds. • No evidence of Aboriginal objects or sites were identified along the closest watercourse (the unnamed tributary of Cowallah Creek). No Aboriginal objects or places recorded in the AHIMS are located within 10 km of the sites. • The potential for any previously unidentified Aboriginal objects or sites to be located within the site or immediate surrounds is considered to be very low. • A number of public submissions raised concern that the requirement for an Aboriginal Cultural Heritage Assessment was removed from the Secretary's requirements (DGRs). • The Department issues DGRs on the basis of the potential risks associated with the proposed development. Given that there were no Aboriginal objects, sites, places of significance or culturally modified trees within the site or immediate surrounds, the Department does not consider that a full comprehensive Aboriginal Cultural Heritage Assessment was (or is) warranted. • Nevertheless, Santos has proposed a range of mitigation measures in the unlikely event of encountering a site of Aboriginal cultural heritage significance.	to protect Aboriginal cultural heritage under the <i>National Parks and Wildlife Act 1974</i> (NPW Act), through site inductions and toolbox talks; - o ensuring any works comply with Part 6 of the NPW Act; - o if previously unidentified Aboriginal heritage sites are identified, works in the immediate area would cease, the area would be cordoned off and the OEH would be contacted. A suitably qualified archaeologist would be contacted so that the site can be assessed and managed in accordance with relevant legislation and policy requirements; and - o in the unlikely event that skeletal remains are uncovered, works in the immediate area would cease, the area would be cordoned off and the NSW Police would be contacted. Should NSW Police determine the remains are not recent, OEH and relevant Aboriginal stakeholders would be contacted to determine an appropriate action plan for the management of the remains prior to work recommencing. • The Department is satisfied that the proposed development would have negligible impacts on Aboriginal cultural heritage and that the management measures proposed by Santos are appropriate and adequate. • The Department has recommended a condition of consent requiring Santos to operate in accordance with its EIS and statement of commitments, which includes the proposed measures to reduce potential impacts on Aboriginal Heritage.
Non-Indigenous Cultural Heritage	• Database searches and an archaeological survey undertaken by RPS indicated that there were no listed items of national, State or local heritage significance within the sites and surrounding areas.	• In the event that any previously unidentified non-Indigenous cultural heritage material is identified during the development, works in the immediate area would cease, the area would be cordoned off and OEH's Heritage Branch would be contacted. A suitably qualified archaeologist would be contacted so that the site can be assessed and managed. • The Department is satisfied that the proposed development would have negligible impacts on non-Indigenous cultural heritage and that the management measures proposed by Santos both appropriate and adequate.
Noise	• The EIS includes a Noise Assessment undertaken by Noise Measurement Services. • The nearest sensitive receiver is located 7.5 km from the proposed development sites. • The EIS indicates that construction works (for	• Santos proposes to implement the following mitigation measures to ensure that any potential noise impacts are minimised: - o a maximum of two drilling rigs

	both sites) would take a total of working 105 days, proposed to be undertaken during the 2nd and 3rd quarters of 2014. • Long-term unattended noise monitoring was conducted at the nearest sensitive receiver (ML1, Receiver 5) and within the forest to establish the existing noise environment. • Noise modelling was undertaken for different weather scenarios both during construction and operations. • During construction, and under all modelled weather scenarios, noise levels would be less than 13 dB(A) beyond 5 km. • During operations, noise levels would also be well below the relevant guideline levels for intrusive noise, noise amenity and sleep disturbance.	would be in operation and be located with sufficient separation distance to eliminate any cumulative noise impacts; - o notifying Forestry Corporation prior to the proposed development commencing, including information regarding the timing and duration of noise generating activities; and - o investigating noise impacts in the event a noise complaint is received. • Given that all sensitive receivers are located over 5 km from the proposed development, the Department is satisfied that construction and operational noise would be inaudible at these locations. • The Department is satisfied that the proposed mitigation and management measures would reduce local impacts to acceptable levels. • The Department has recommended conditions of consent to ensure Santos implements best practice noise management to minimise construction, drilling, operational and traffic noise.
<i>Air Quality and Greenhouse Gases</i>	• The EIS includes an Air Quality Impact Assessment for the proposed development undertaken by Wilkinson Murray. • The nearest sensitive receiver is located 7.5 km from the proposed development sites. • Santos has submitted a modification application to the Department seeking to modify its Narrabri CSG Utilisation Project (MP 07_0023). The modification, if approved, would allow gas collected from the proposed development to be used at the Wilga Park Power Station, during resource appraisal activities (ie for a period of 3 years).	• Santos proposes to implement the following mitigation measures to ensure that air quality and greenhouse gas impacts are minimised: - o dust suppression along access tracks and well pad areas; - o enforcing site speed limits; - o covering loose, dust generating materials when transporting to and from the sites; - o maintaining equipment to ensure good operating conditions; and - o rehabilitation of the sites. • The Department is satisfied that the proposed mitigation and management measures would reduce impacts to acceptable levels. • The Department has recommended conditions of consent to ensure Santos employs all reasonable and feasible avoidance and mitigation measures and implements best management practice to minimise potential air quality impacts. • Combustion of gas in the power station to produce electricity is a beneficial use of the gas generated by the proposed appraisal activities that would otherwise be vented or flared. • Santos notes that beneficially using the gas from wells within PAL 2 to fuel the power station would also mean less power has to be generated elsewhere, thereby assisting to meet demand for electricity in NSW. • Santos also notes that the use of such gas would result in improved environmental outcomes, due to lower greenhouse gas emissions per unit of energy output when compared coal-

		fired power generation. The Department agrees with this analysis.
<i>Traffic and Transport</i>	- The EIS includes a Traffic and Transport Assessment undertaken by GTA. - The existing road network includes the Newell Highway (a State road) a number of unsealed forestry roads (X-Line Road, Tighes Gully Road, Little Tighes Road) and existing unsealed access tracks near the site. - Travel to and from the proposed development site and Narrabri and the Westbourne drillers camp would occur during the development. - The EIS indicates that construction works (for both sites) would take a total of working 105 days, proposed to be undertaken during the 2nd and 3rd quarters of 2014. - In its submission to the RTS, RMS reiterated its previous recommendation for an Auxiliary Left Turn Treatment (AUL(S)) facility at the intersection of X-Line Road and the Newell Highway and sealing a minimum of 30 m from the edge of the southbound travel lane in the Newell Highway for X-Line Road and Westport Road. - During the E&A Program, the X-Line Road and Newell Highway intersection would need to accommodate up to 84 vehicles per day and up to 28 vehicles during a site activity peak hour throughout construction works. This includes approximately 14 vehicles turning left into X-Line Road and 14 vehicles turning right out of X-Line Road. - The <i>Austrroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections</i> determines a range for appropriate left turn treatments. - The Guide recommends an AUL(S) treatment in situations where there are over 80 left turning vehicles per hour. - As Santos would discourage use of Westport Road by construction traffic it does not propose to upgrade this road. The Department is satisfied with this approach given the expected limited and short-term use of this road. - Santos has committed to sealing the first 30 m of X-Line Road at the intersection of X-Line Road and Newell Highway.	- Santos proposes to implement the following mitigation measures to ensure that potential construction traffic and transport impacts are minimised: - vehicles within the Forest would not travel at speeds greater than 80 km/h, unless otherwise signed; - an in-vehicle monitoring system would be fitted to all Santos vehicles; - discouraging access to the Forest via Westport Road; - vehicle movements would be restricted to designated routes to/from the site via the Newell Highway; and - any damage to roads caused by construction activities would be repaired at Santos's cost in accordance with its forestry Permit to Occupy. - No mitigation measures are proposed or required during operations. - The Department is satisfied that the proposed mitigation and management measures would reduce construction-related traffic impacts to acceptable levels and has recommended conditions requiring Santos to: - maintain and manage the unsealed road network in a manner consistent with <i>Managing Urban Stormwater – Soils and Construction Volume 2C Unsealed Roads</i> and <i>Erosion and sediment control on unsealed roads – A field guide for erosion and sediment control maintenance practices</i>; and - seal the first 30 m of X-Line Road at the intersections of X-Line Road and Newell Highway. - The Department is further satisfied that the requirement for an AUL(S) treatment at the intersection of X-Line Road and the Newell Highway is not warranted by the level of construction traffic associated with this short-term activity, which, it must be pointed out, has already occurred a number of times at the same or nearby sites in the recent past. - However the Department would support local road upgrades as recommended by RMS and/or Council during its assessment of any future large-scale production development.
<i>Health</i>	- A number of submissions raised concerns about the potential health impacts of the development that could arise from noise and air quality impacts and contamination of water resources. - A number of submissions raised reference to	- Adverse health-related issues are not anticipated as the scale of the proposed development is small and located well away from public facilities. - The closest residence is located 7.5 km from the proposed development sites.

	allegations of health impacts from CSG operations in Queensland in respect of emissions and the use of produced water for dust suppression.	Air quality issues during both construction and operation are expected to be nil or negligible. • Furthermore, produced water would not be used for dust suppression, therefore it is highly unlikely to contaminate the land and/or water resources. • The use of BTEX chemicals in drilling fluids is also banned and the Department has recommended a condition of consent to this effect. • The Department notes that Queensland Health investigated the Queensland allegations and reported that it found no evidence of any link between CSG operations and the claimed health impacts.
<i>Socio-economic</i>	• Approximately 7.6 equivalent full-time jobs (5.6 during construction and 2 during operations) would be created by the proposed development over its limited life. The construction jobs would be short-term. • Nonetheless, Santos estimates the economic multiplier effect for the local and wider economy to be \$5.3 to \$5.5 million or the creation of up to an additional 16 indirect job (during construction), based on a capital investment value of \$8.1 to \$8.3 million. • On a local scale, Santos takes part in a local scholarship program, contributing approximately \$300,000 annually, towards a mix of programs addressing community wellbeing and health, education and youth, indigenous engagement and industry, and the environment.	• Council noted that there would be few socio-economic benefits realised within the Narrabri LGA. Nevertheless, Council also considered any socio-economic impacts to be small.
<i>Other</i>	• Waste, hazards, agricultural impacts, visual amenity, tourism impacts and bushfire risks were all assessed in the EIS and RTS. • The RFS was satisfied with the proposed bushfire risk management commitments. • The development could result in soil contamination as a result of spilled or leaked chemicals (such as drilling fluid additives), fuels or oils during site establishment, construction or drilling. Spills or leaks could also occur during handling, use, storage, transit, refuelling or maintenance. • There would be minimal risk of soil contamination occurring from drilling fluids which would be water-based and contain non-toxic additives.	• The Department is satisfied that the proposed mitigation and management measures would reduce impacts to acceptable levels and has recommended conditions to ensure these measures are implemented.

6. RECOMMENDED CONDITIONS

The Department has prepared recommended conditions of consent for the proposed development (see **Appendix D**). These conditions are required to:

- prevent, minimise, and/or offset adverse impacts of the development;
- ensure standards and performance measures for acceptable environmental performance;
- ensure regular monitoring and reporting; and
- provide for the ongoing environmental management of the development.

The recommended conditions are consistent with other regulatory restrictions placed on Santos by other Government authorities, and reflect current best practice for the regulation of the CSG industry in NSW.

7. CONCLUSION

The Department has thoroughly assessed the proposed development in accordance with Section 79C and the objects of the EP&A Act, including:

- the environmental, social and economic impacts of the proposed development;
- relevant environmental planning instruments;
- submissions on the proposed development;
- the suitability of the site; and
- the public interest.

The proposed development is limited to exploration and resource appraisal activities over a relatively short period of time (approximately 3 years for each well). This exploration development, as part of Santos's E&A Program, is an important opportunity to investigate the potential of securing local gas supplies in NSW and inform Santos's future production planning process. It is also an opportunity to potentially alleviate gas supply shortages which would likely lead to significant energy price increases for residential and industrial consumers of gas in NSW.

Santos has designed the proposed development to avoid impacts on key water resources. Any potential water resource impacts of the proposed development would be largely confined to the NSW MDB Porous Rock Groundwater Source, wherein the target coal seams are located. Water from these seams is unsuitable for drinking or irrigation without treatment. In this regard, the Department is satisfied that no significant impacts to local water supplies or beneficial aquifers are expected and that the proposed development would not significantly impact local and regional groundwater and surface water resources.

The proposed implementation of a revised Groundwater Monitoring and Modelling Plan and Produced Water Management Plan would result in a significantly improved understanding of the groundwater relationships within the geologic strata overlying the target coal seams and further inform Santos's water management and monitoring system and its potential future plans for CSG production in the Narrabri gas field.

The proposed development would not require any vegetation clearing and would not significantly impact on the biodiversity values within or near to the proposed development.

The Department has assessed the proposed development in accordance with the relevant requirements of the EP&A Act, including the objects of the Act and the principles of ESD, and is satisfied that it is in the public interest and should be approved.

8. RECOMMENDATION

It is **RECOMMENDED** that the Commission, as delegate of the Minister for Planning:

- **considers** the findings and recommendations of this report;
- **approves** the development application, subject to conditions; and
- **signs** the attached instrument of consent (**Appendix D**).

Santos has reviewed and accepted these conditions.


Howard Reed 1.5.14
Manager
Mining Projects

 9/5/14
Daniel Keary
A/Executive Director
Development Assessment Systems and Approvals

APPENDIX A – ENVIRONMENTAL IMPACT STATEMENT

Please see: http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=5934 and attached CD.

APPENDIX B – COPY OF SUBMISSIONS

Please see: http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=5934 and attached CD.

APPENDIX C – RESPONSE TO SUBMISSIONS

Please see: http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=5934 and attached CD.

APPENDIX D – INSTRUMENT OF CONSENT

APPENDIX E – CONSIDERATION OF ENVIRONMENTAL PLANNING INSTRUMENTS

Narrabri Local Environmental Plan 2012

The development is located within the Narrabri LGA. The planning provisions are contained within the Narrabri LEP 2012. Under the LEP, the development is zoned RU3 Forestry. The Department of Planning & Environment is satisfied that the proposed development is generally consistent with the aims and objectives of the LEP and that the proposed development can be considered to be a suitable activity within the RU3 Forestry zone.

SEPP No. 33 – Hazardous and Offensive Development

The Department is satisfied that the development is not potentially hazardous or offensive, and that the proposal is generally consistent with the aims, objectives and requirements of SEPP 33.

SEPP No. 44 – Koala Habitat Protection

The development is generally consistent with the aims, objectives and requirements of SEPP 44. Fauna surveys did not identify any Koalas or signs of Koala activity in the development area. The Department is satisfied that the development is unlikely to significantly affect core Koala habitat, noting that there is no potential Koala habitat proposed to be removed, nor does any occur within close proximity to the site and surrounding area.

SEPP No. 55 – Remediation of Land

The Department is satisfied that the development area does not contain areas of significant risk of land contamination given historical land uses, and that the development is generally consistent with the aims, objectives and provisions of SEPP 55.

SEPP (State and Regional Development) 2011

The proposal meets the criteria for classification as State Significant Development as it is development for the purpose of drilling or operating petroleum exploration wells, not including 'a set of 5 or fewer wells that is more than 3 km from any other petroleum well (other than an abandoned petroleum well) in the same petroleum title' which is specified in clause 6 of Schedule 1 to the SRD SEPP (see **Section 3.1** of this report). The Department is satisfied that the development can be undertaken in a manner that is generally consistent with the aims, objectives, and provisions of the SEPP.

SEPP (Infrastructure) 2007

In accordance with clause 104 of the SEPP, the application was referred to the RMS. The matters raised in RMS's submission were considered by the Department and conditions of consent in relation to approvals under the *Roads Act 1993* have been recommended by the Department.

SEPP (Mining, Petroleum Production and Extractive Industries) 2007

Under clause 7(2) of the Mining SEPP, development consent is required for the purposes of drilling or operating a set of more than five wells that is more than three km from any other petroleum well (other than an abandoned well) in the same petroleum title. The Department is satisfied that the development is permissible with consent.

Part 3 of the SEPP lists a number of matters that a consent authority must consider before determining an application for consent for development for the purposes of mining, including:

- significance of the resource;
- compatibility with other land uses;
- natural resource management and environmental management;
- resource recovery;
- transport; and
- rehabilitation.

The Department has considered these matters in its assessment of the development (see especially **Section 5**). The Department is satisfied that the development is able to be managed in a manner that is generally consistent with the aims, objectives, and provisions of the Mining SEPP.