



Dewhurst Exploration and Appraisal Activities – PEL 238, Gunnedah Basin, NSW

Request for DGRs supporting documentation

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Executive summary

Background

Santos NSW (Eastern) Pty Ltd (Santos), a wholly owned subsidiary of Santos Limited, is planning to undertake the Energy NSW Coal Seam Gas (CSG) Exploration and Appraisal Program within Petroleum Exploration Licence (PEL) 238 and Petroleum Assessment Lease (PAL) 2 in and around the Pilliga forest near Narrabri, NSW (the program).

The program is scheduled to commence in 2013 and will extend for about two to three years. The program includes recommencing operation of a number of existing petroleum exploration (pilot) wells, drilling and operating new pilot wells and constructing and operating water and gas management facilities to support the program.

As part of the program, Santos, on behalf of the titleholders of PEL 238, is seeking consent to undertake works to expand and operate the existing Dewhurst 13-18H Pilot and future Dewhurst 26-31 Pilot (proposed activity) within PEL 238. Depending on the appraisal outcome the data collected from these wells will either inform placement of additional exploration wells or inform placement of future wells for a commercial production project. Santos remains committed to exploring CSG reserves in the area to support the future demands for energy within NSW.

Dewhurst exploration and appraisal activities

The Dewhurst 13-18H Pilot is an existing pilot well set that comprises three vertical wells (Dewhurst 13, 14 and 15) and three single lateral wells (16H, 17H and 18H) located on private freehold land and Crown Land, approximately 25 kilometres south of Narrabri. The proposed activity includes drilling an additional two lateral wells at each of the Dewhurst 16H, 17H, and 18H pilot wells to target additional coal seams, installing surface infrastructure and operating the whole pilot set for up to three years.

Dewhurst 26-29 is a proposed four-well pilot located within the Pilliga East State Forest approximately 44 kilometres from Narrabri, and is scheduled to be drilled late 2013 or early 2014. It is proposed to add two additional wells, Dewhurst 30 and 31, to this pilot. The additional wells are proposed to be drilled around mid-2014. The proposed activity includes drilling the two additional pilot wells (Dewhurst 30 and 31), installing surface infrastructure and operating the six pilot well set for up to three years. A Review of Environmental Factors (REF) for Dewhurst 26-29 pilot wells was submitted to the Department of Resources and Energy (DRE) for approval under Part 5, of the *Environmental Planning and Assessment Act 1979* in March 2013.

Need for proposed activity

The purpose of the proposed activity is to investigate and analyse the CSG resource of the Gunnedah Basin within Petroleum Exploration Lease (PEL) 238 and to further develop and investigate lateral well design. It is proposed to expand existing or planned pilot well sets to capitalise on existing infrastructure, land access agreements and minimise the need for additional land clearing and disturbance.

The proposed activity is necessary for the ongoing exploration, appraisal and evaluation of the CSG hydrocarbon potential in PEL 238. The proposed activity will assist in gaining further knowledge of coal fines, gas composition, flow rates and the deliverability of the reservoir, and investigating well design, drilling and completion technologies. This information is essential to determine whether a commercial gas production project is viable and would be used in development planning for a potential commercial gas production project within the area.

The development of the gas industry in the region would bring capital investment and economic benefits, and has the potential to play a significant role in the delivery of a secure supply of domestic gas for NSW and alleviate the States' reliance on imported gas.

Proposed activity scope

The proposed works at Dewhurst 13-18H would include:

- re-drilling within the existing Dewhurst 16H, 17H and 18H wells to establish two additional lateral wells at each of those wells to intersect the corresponding Dewhurst 13, 14 and 15 vertical wells, converting each well from a single lateral to a tri-stacked lateral well
- installing additional surface facilities and equipment at the existing Dewhurst 16H, 17H and 18H well lease areas
- replacing the existing water gathering system connecting Dewhurst 13, Dewhurst 14 and Dewhurst 15 and constructing a new gas and water gathering system connecting all the wells to the existing Dewhurst 14 well lease area
- installing and operating a gas flare and water balance tank at the existing Dewhurst 14 to manage water and surplus gas during operation of the Dewhurst 13-18H Pilot
- operating the Dewhurst 13-18H Pilot for up to three years.

The proposed works at Dewhurst 30 and Dewhurst 31 would include:

- clearing two 10 metre wide service corridors between Beehive Road and the Dewhurst 30 and 31 lease areas
- constructing access roads within the service corridors
- establishing the Dewhurst 30 and Dewhurst 31 lease areas each up to approximately one hectare in size
- setting up temporary equipment on each lease area.
- drilling one vertical (Dewhurst 30) and one triple-stacked lateral (Dewhurst 31) pilot well to target coal seams within the Maules Creek Formation
- installing infrastructure to connect the wells to the gas and water gathering system for the Dewhurst 26-31 Pilot
- operating the Dewhurst 26 - 31 Pilot for up to three years.

Planning and permissibility

Under clause 6 of Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011* (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 kilometres from any other petroleum well (other than an abandoned petroleum well) in the same petroleum title' is State Significant Development (SSD).

Works and modifications to the existing Dewhurst 13-18H Pilot, including the two additional lateral wells, is development for the purpose of drilling and operation of a set of more than five wells located within a three-kilometre radius within the same petroleum title. The establishment of the Dewhurst 30 and 31 pilot wells, as part of the Dewhurst 26-31 Pilot would create in excess of five wells within a three-kilometre radius. As such, the proposed activity (expansion of the Dewhurst 13-18H and Dewhurst 26-31 Pilots) is SSD under the SRD SEPP and approval for the proposed activity is required under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979*.

Preliminary environmental assessment

A preliminary environmental risk analysis was carried out for the proposed activity to identify and prioritise issues requiring assessment in the Environmental Impact Statement (EIS). Issues relating to groundwater, biodiversity, hazard and risk (including bushfire risk), noise impacts, air quality and emissions and community relations have been identified as key issues for the proposed activity. Detailed assessment of these issues would be carried out during preparation of the EIS. Other issues that would be investigated and documented in the EIS include geology and soils, surface water, waste and emissions, traffic and transport, natural resources, Aboriginal heritage and non-Indigenous heritage.

Next steps

This report has been prepared by RPS Australia East Pty Ltd (RPS) to support a request for Director-General Requirements (DGRs) for the proposed activity. Once the Director-General of the Department of Planning and Infrastructure (the Department) has issued the environmental assessment requirements for the proposed activity, an EIS would be prepared and submitted to the Department. The EIS would assess the key environmental issues and other issues identified in the preliminary environmental assessment. A range of stakeholders would be consulted during preparation of the EIS. Once submitted to the Department, the EIS would be placed on public exhibition for a minimum period of 30 days, during which time the Department would invite the public and government agencies to make submissions.

I.0 Introduction

I.1 Background

Santos NSW (Eastern) Pty Ltd (Santos), a wholly owned subsidiary of Santos Limited, is planning to undertake the Energy NSW Coal Seam Gas (CSG) Exploration and Appraisal Program within PEL 238 and PAL 2 in and around the Pilliga forest near Narrabri, NSW (the program).

The program is scheduled to commence in 2013 and will extend for about two to three years. The program includes recommencing operation of a number of existing petroleum exploration (pilot) wells, drilling and operating new pilot wells and constructing and operating water and gas management facilities to support the program.

Much research, modelling and consideration of community and environmental issues has taken place in the development of the program. This has informed decisions about where to place wells, using existing infrastructure where possible.

In November 2011, Santos acquired Eastern Star Gas Limited (ESG). At the time of acquisition, ESG was conducting exploration and appraisal activities within PEL 238 and PAL 2 in the area around Narrabri. These activities included the establishment and operation of a series of pilot wells and associated infrastructure for the storage and treatment of water produced by the operation of the pilot wells in and surrounding the Pilliga forest.

After the acquisition of ESG, Santos suspended operations while it undertook a review of asset condition and commenced a rehabilitation program. Santos has also moved towards a centralised water management approach and is working to relocate produced water facilities to a new purpose built site on a Santos owned property titled 'Leewood' located outside of the State Forest. The 'Leewood Produced Water Facility' is approved to hold produced water from ESG's previous operations currently stored in ponds at an existing facility, known as the 'Bibblewindi Water Transfer Facility', as well as produced water from the operation of future pilots.

As part of the exploration and appraisal program, Santos on behalf of the titleholders of PEL 238, is seeking consent to undertake works to expand and operate the existing Dewhurst 13-18H Pilot and future Dewhurst 26-31 Pilot (proposed activity). Depending on the appraisal outcome the data collected from these wells will either inform placement of additional exploration wells or inform placement of future wells for a commercial production project. Santos remains committed to exploring CSG reserves in the area to support the future demands for energy within NSW.

Figure 1-1 outlines where this project sits within the exploration, appraisal and production process.

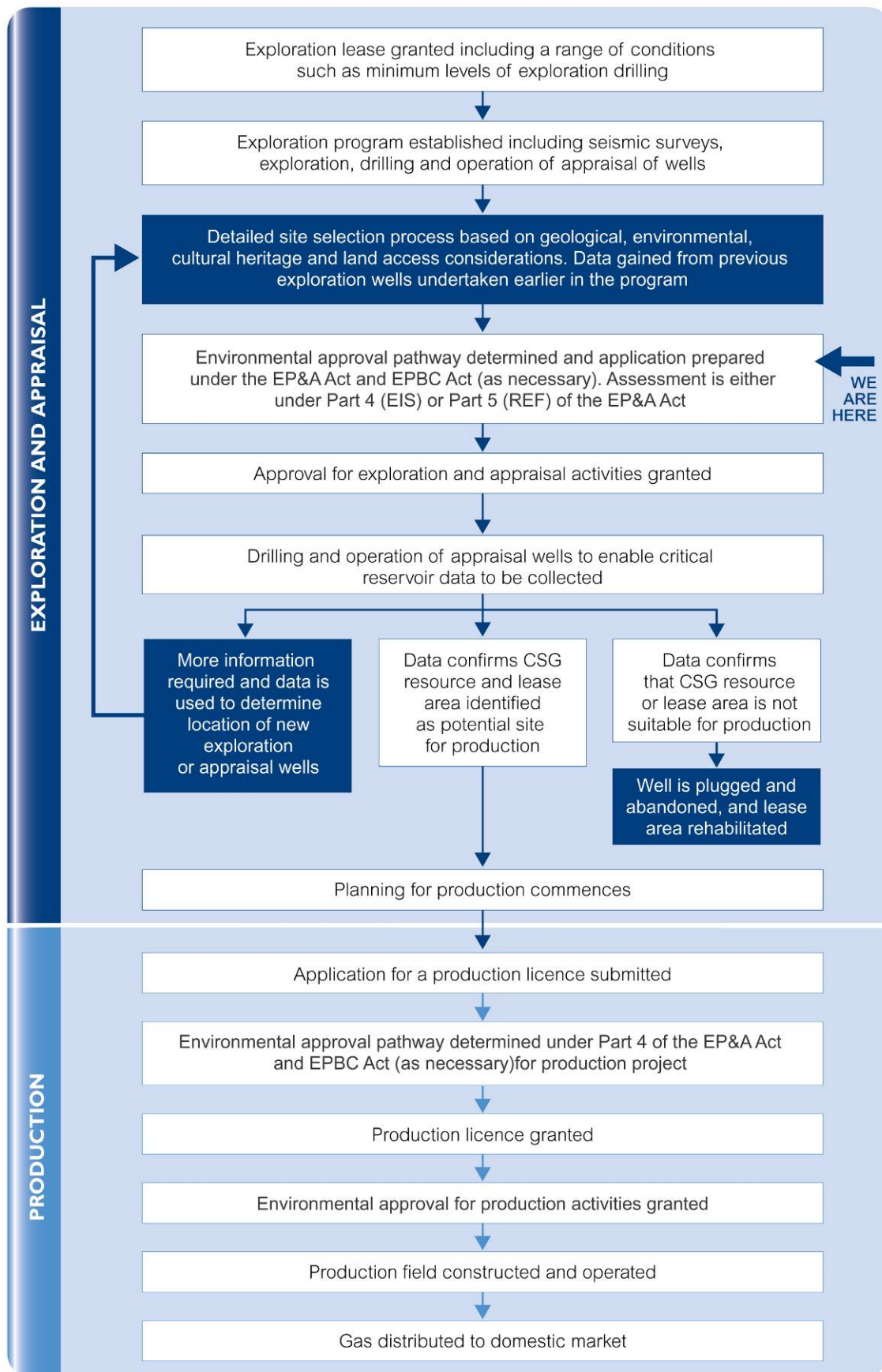


Figure 1-1 Exploration, appraisal and production process

1.2 Dewhurst exploration and appraisal activities

The proposed activity includes the expansion and operation of the Dewhurst 13-18H Pilot and Dewhurst 26-31 Pilot.

The Dewhurst 13-18H Pilot is an existing pilot well set that comprises three vertical wells (Dewhurst 13, 14 and 15) and three single lateral wells (16H, 17H and 18H) located on private freehold land and Crown Land, approximately 25 kilometres south of Narrabri. The proposed activity includes drilling an additional two laterals within the existing Dewhurst 16H, 17H, and 18H pilot wells to target additional coal seams, installing surface infrastructure and operating the whole pilot set for up to three years.

Dewhurst 26-29 is a proposed four-well pilot located within the Pilliga East State Forest approximately 44 kilometres south of Narrabri, and is scheduled to be drilled late 2013 or early 2014. Santos is seeking consent to add two additional wells, Dewhurst 30 and 31, to this set around mid-2014. The proposed activity includes drilling the two additional pilot wells, installing surface infrastructure and operating the whole pilot set for up to three years.

Other exploration and appraisal activities subject to separate approvals, and in various stages of assessment and planning, include:

- Dewhurst 22-25 Pilot
- Dewhurst 26-29 Pilot
- Dewhurst Northern Water and Gas Flow Lines
- Dewhurst Southern Water and Gas Flow Lines
- Leewood Produced Water Facility.

1.3 Proponent

Santos NSW (Eastern) Pty Ltd is the proponent for the proposed activity. Santos acts as the CSG operator on behalf of the titleholders of PEL 238, Santos NSW (Eastern) Pty Ltd and EnergyAustralia Narrabri Gas Pty Ltd.

1.4 Purpose of this report

This report has been prepared by RPS Australia East Pty Ltd (RPS) to support a request for Director-General Requirements (DGRs) for the proposed activity. The report:

- describes the site and local and regional context
- describes the proposed activity
- discusses the strategic and statutory planning policies and instruments applicable to the proposed activity
- provides a preliminary environmental assessment and strategies to manage potential environmental issues
- outlines the justification for the proposed activity, including why the proposed sites were selected
- identifies consultation activities
- provides an estimated capital investment value for the proposed activity.

2.0 Site and context

2.1 Location

The proposed activity would take place at two pilot sites, on land located within PEL 238 in the Narrabri Shire local government area (LGA) of NSW. The regional context is displayed in Figure 2-1.

The Dewhurst 13-18H Pilot is approximately 25 kilometres south of Narrabri. The wells are located on existing leases approximately 0.8 hectares in area. The existing wells and proposed gas and water gathering system are/would be located on freehold land (Lot 32, DP 757104) and partly within Crown Land road reserve. Coordinates for Dewhurst 16H, 17H and 18H, within which the additional lateral wells would be established, are listed in Table 2-1. The overall site plan for the Dewhurst 13-18H Pilot is shown in Figure 2-2.

The Dewhurst 26-31 Pilot will be located in the Pilliga East State Forest, approximately 44 kilometres south of Narrabri. The site plan for the pilot is shown in Figure 2-4. The Dewhurst 30 and 31 pilot wells would be located in the centre of a one-hectare lease area each to be established during construction. The approximate coordinates of the Dewhurst 30 and 31 wells are identified in Table 2-1 and the proposed lease areas are shown in Figure 2-5 and Figure 2-6.

Table 2-1 Approximate well locations (MGA 94 Zone 55)

Well	Easting	Northing
Dewhurst 16H	765592	6616503
Dewhurst 17H	765681	6616690
Dewhurst 18H	765766	6616870
Dewhurst 30	755385	6600331
Dewhurst 31	754759	6599547

2.2 Local and regional context

2.2.1 Dewhurst 13-18H

The Dewhurst 13-18H Pilot is located on land that has been mostly cleared for low intensity stock grazing activities. No commercial farming activity currently takes place on the site but some grazing of domestic stock still occurs. The Dewhurst 13-18H is adjacent to the Jacks Creek State Forest and small areas of uncleared land comprise vegetation that is consistent with the Pilliga Scrub bush land.

The unnamed road to the north of the site, along which the gathering system will run parallel, is an unsealed vehicle track that connects to Killara Road and then Rockdale Road heading south. These roads eventually link in to X-Line Road which connects to the east with the Newell Highway, approximately 20 kilometres from the site.

The nearest watercourses to the site include an unnamed tributary of Tuppiari Creek flowing from east to west across the site. However this drainage line was not observed during site investigations. Jacks Creek, an ephemeral system, is also located approximately 500 metres north-east of the site.

The Dewhurst 13-18H Pilot is not located in, or within, two kilometres of a residential zone. There is a residential dwelling located approximately 500 metres south of the Dewhurst 13 lease area, however the dwelling is being leased by Santos until December 2015, and will remain vacant until that time. This dwelling has not been considered as a sensitive receiver for the purposes of the preliminary assessment during the construction phase. The closest sensitive receiver is a residence situated approximately 1.8 kilometres south-west of the Dewhurst 13 lease area.

2.2.2 Dewhurst 30-31

The Dewhurst 26-31 Pilot will be located in the Pilliga East State Forest which forms part of a large tract of bushland referred to as the Pilliga Scrub, which encompasses numerous protected areas.

Access to the Dewhurst 26-31 Pilot is via Beehive Road that runs in a north-south direction through this section of the Pilliga East State Forest. Beehive Road is an unsealed vehicle track that connects to Garlands Road and the Newell Highway (approximately 12 kilometres west of the site). Dewhurst 30 is about 100 metres east of Beehive Road. Dewhurst 31 is about 300 metres south-east of Beehive Road.

An unnamed drainage line is mapped across the southern section of the proposed lease area for Dewhurst 30. The closest watercourse is Mt Pleasant Creek that extends between Dewhurst 30 and 31. The creek is 200 metres south-west of Dewhurst 30, and 700 metres north-east of Dewhurst 31.

The Dewhurst 26-31 Pilot is not located in, or within, two kilometres of a residential zone. The nearest residences are located north of the Pilliga East State Forest, outside the forested area, approximately 11 kilometres from the site.

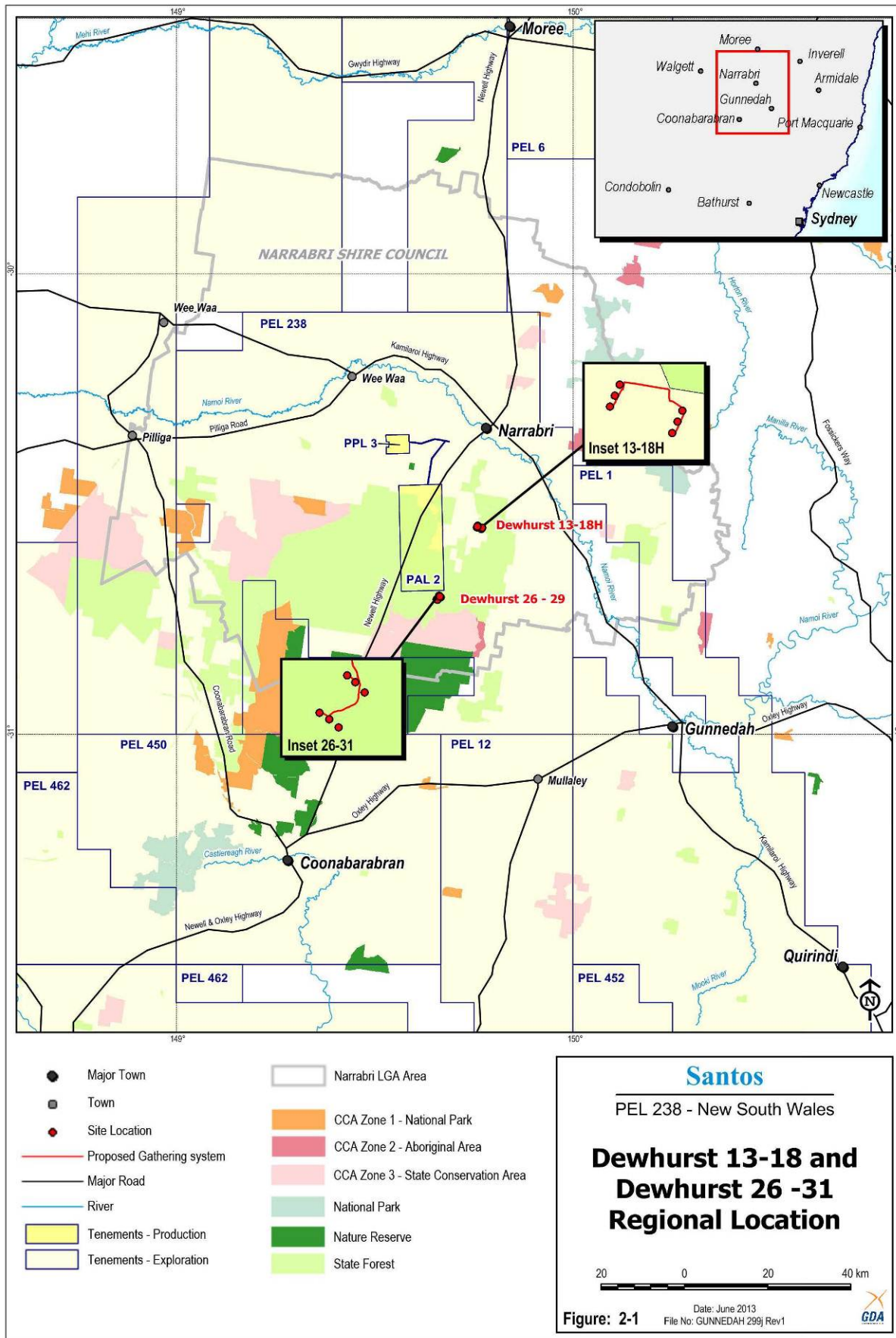


Figure 2-1 Dewhurst regional context

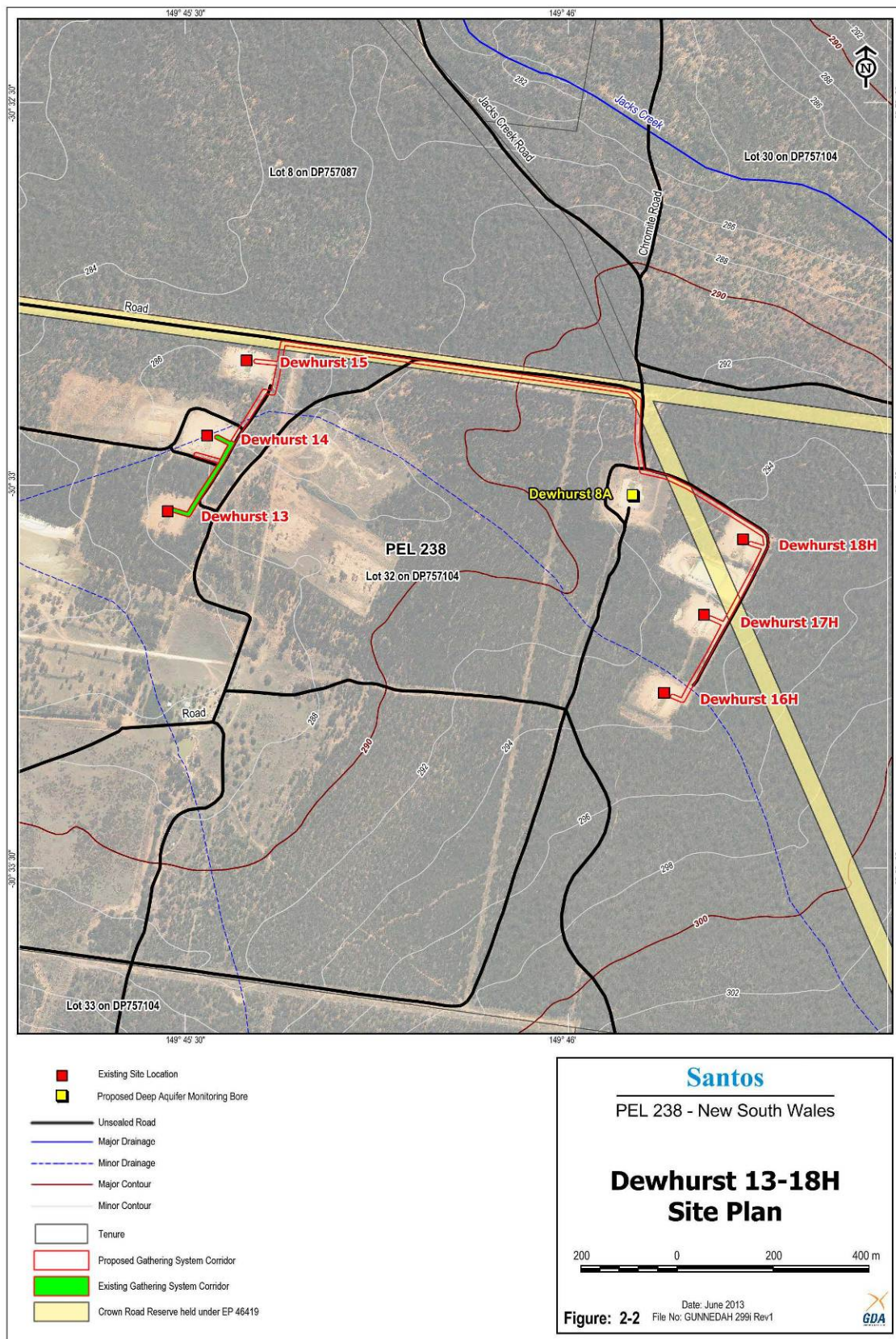


Figure 2-2 Dewhurst 13-18H Pilot site plan

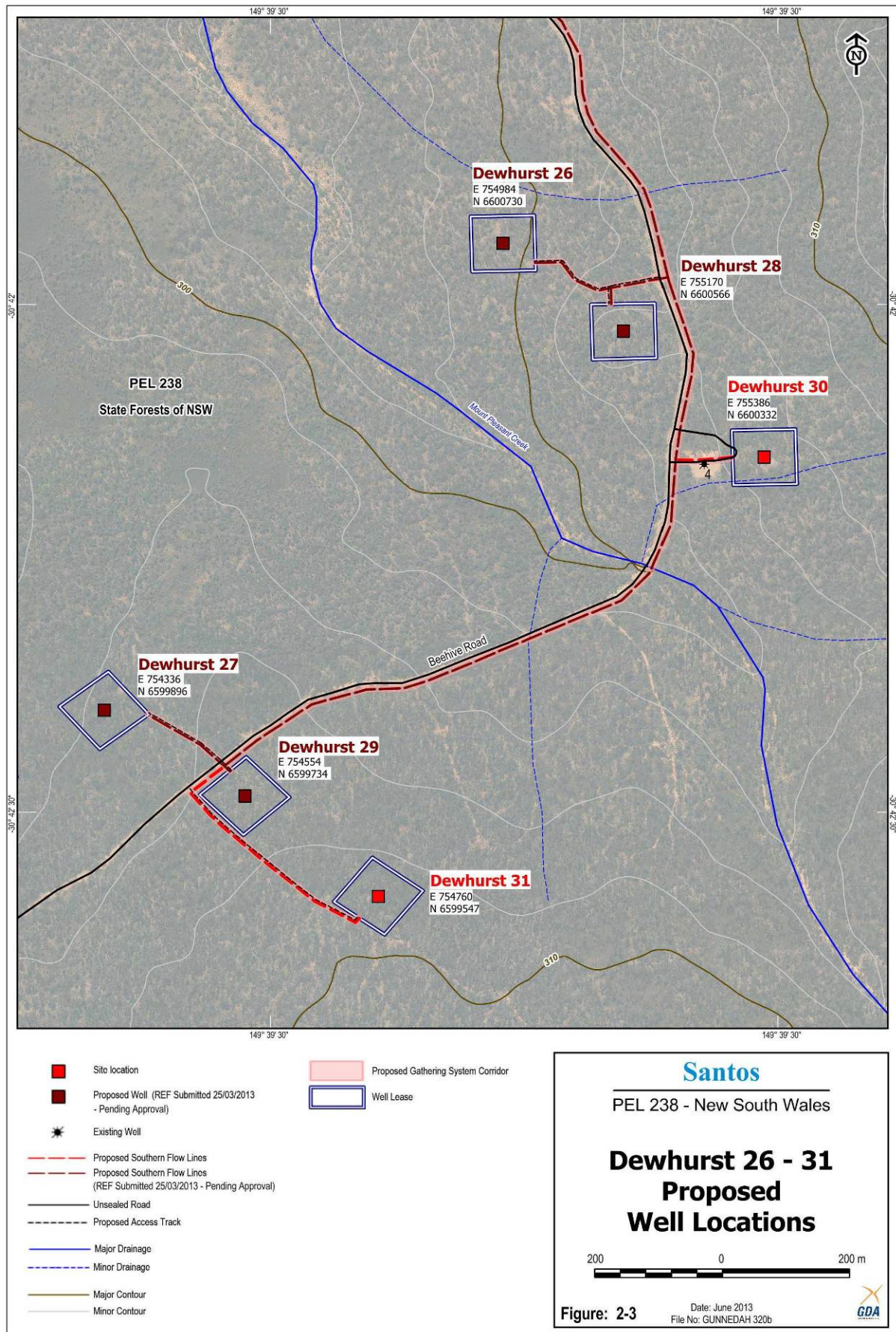


Figure 2-3 Dewhurst 26-31 Pilot site plan

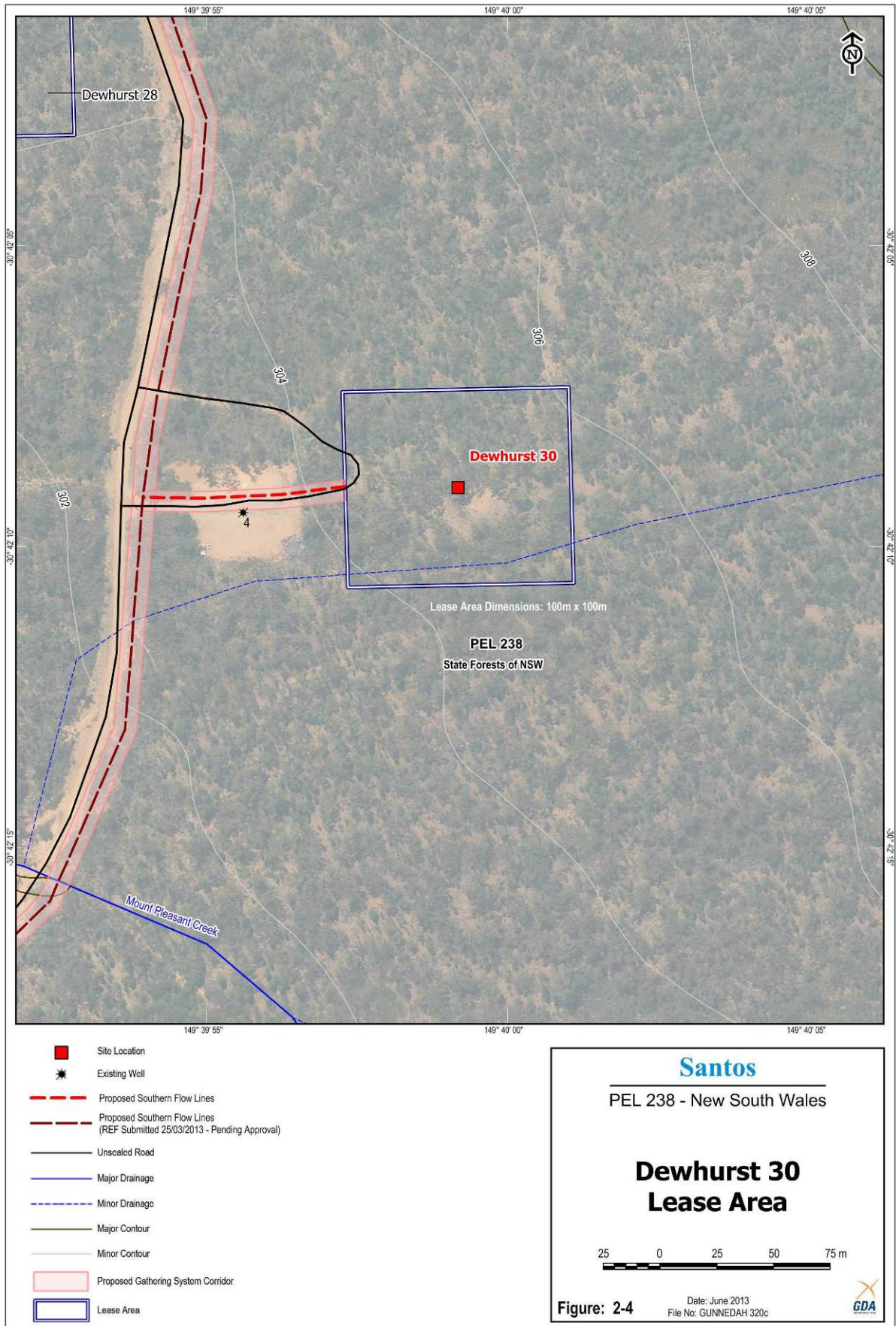


Figure 2-4 Dewhurst 30 lease area

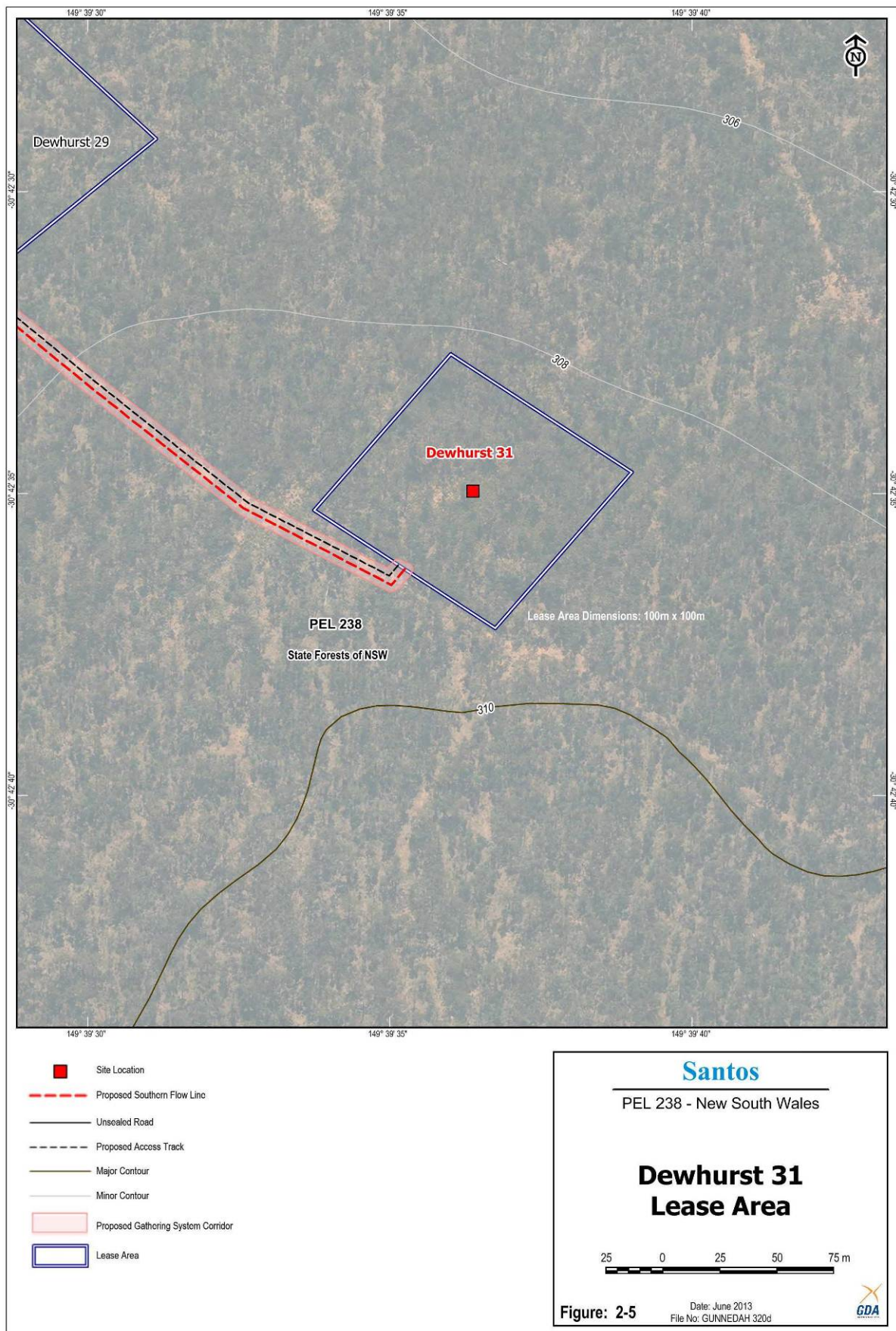


Figure 2-5 Dewhurst 31 lease area

2.3 CSG infrastructure

2.3.1 Dewhurst 13–18H

2.3.1.1 Pilot

The existing Dewhurst 13-18H pilot well set consists of six pilot wells, which are currently not operational. They were constructed and previously operated by ESG. A Review of Environmental Factors (REF) for the pilot was submitted and approved by the Department of Primary Industries on 21 July 2009.

The pilot set established as part of this previous approval includes:

- three single lateral wells (Dewhurst 16H, 17H and 18H)
- three vertical wells (Dewhurst 13, 14, and 15).

Each well is situated on a lease area approximately 0.8 hectares (100 by 80 metres) with an additional four hectares adjoining the Dewhurst 14 lease area to accommodate infrastructure for gas and water management facilities (refer Figure 2-4). The lease areas are fenced and have been partially rehabilitated.

Existing surface infrastructure on the Dewhurst 13 to 18H lease areas is minimal and generally includes a wellhead at each lease area. Subsurface infrastructure includes a set of dual pipes as part of the gas and water gathering system that extends from Dewhurst 13, Dewhurst 14 and Dewhurst 15 wellheads connecting to a central facility at Dewhurst 14. From there gas has been used to power onsite equipment and produced water has been treated through an onsite RO plant and stored in ponds located in the vicinity. The RO plant and ponds have been decommissioned and the site is in the process of being rehabilitated.

The existing wells are connected via a series of access tracks branching off an unnamed road to the north of the lease areas. The wells remain able to operate, but have been temporarily shut-in and are not currently pumping gas or water.

Approval was granted as part of the original pilot to establish a flare to manage excess gas. This was not built as part of the original construction program.

2.3.1.2 Surrounding wells

Other CSG infrastructure in the nearby surrounds includes a plugged and abandoned petroleum exploration core hole known as Dewhurst 8 located in the centre of the Dewhurst 13-18H Pilot. A second core hole, known as Dewhurst 8A, is approved to be drilled on the existing well lease for Dewhurst 8. Once drilled, this core hole will be converted to a deep aquifer monitoring bore for baseline and long term monitoring of deep groundwater.

There are two other Santos-owned petroleum wells in the area. Dewhurst 11 is approximately 2.1 kilometres west from the Dewhurst 13-18H site and Gorman 1 is approximately 2.7 kilometres north. Neither operates as a pilot well or part of a pilot well set. It is proposed to plug and abandon these wells in the near term.

2.3.2 Dewhurst 26-31

2.3.2.1 Pilot

In addition to the two new proposed wells (Dewhurst 30 and 31), the Dewhurst 26-31 Pilot will consist of four wells, two vertical wells (Dewhurst 26 and 28) and two triple-stacked lateral wells (Dewhurst 27 and 29). The establishment of the Dewhurst 26-29 wells is planned for late 2013/early 2014 and is subject to a separate environmental assessment and approval process. A REF was submitted to the Division of Resources and

Energy (contained with the Department of Trade, Investment, Regional Infrastructure and Services (DTIRIS)) on 25 March 2013 and is pending approval.

The Dewhurst 26-29 wells will be located on either side of Beehive Road, connected via a series of access tracks branching off Beehive Road (refer Figure 2-7). Gas and water collected from the wells will be transferred via pumps and sub-surface piping to an associated water balance tank and flare adjacent to Dewhurst 28.

2.3.2.2 Surrounding wells

An old core hole, previously drilled by ESG ('Dewhurst 4') is located immediately south-west of the proposed Dewhurst 30 well. It is no longer in use and has been plugged and abandoned. Rehabilitation of the site has commenced; however, mature vegetation has not yet established. Dewhurst 4 would not impact on the construction or operation of the Dewhurst 26-31 Pilot. It is located outside the lease area for Dewhurst 30; however the proposed access track would extend through the Dewhurst 4 lease area.

Dewhurst 9, located approximately 900 metres from the proposed Dewhurst 31 is a suspended appraisal well. This well was drilled in the third quarter of 2007.

The existing Bibblewindi Multi-Lateral Pilot is located approximately three kilometres north of Dewhurst 30 and 31. This pilot is currently suspended; however, in April 2013, Santos submitted a request for Director General's Requirements to drill two additional wells at this pilot and recommence operation of the pilot.

2.3.3 **Water management infrastructure**

Santos plans to centralise its water management operations outside of the State Forest. Existing water management infrastructure in PEL 238 and PAL 2 in the vicinity of the proposed activity includes the Bibblewindi Water Transfer Facility and water flow lines between existing pilots and this facility.

Santos is working to centralise its water management operations outside of the Pilliga forest and received approval to construct and operate new water management infrastructure under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A) by the NSW Division of Resources and Energy, DTIRIS in March 2013. This infrastructure includes:

- Bibblewindi Water Transfer Tank – a tank (approximate capacity of 5 ML) which will be used to accept produced water from existing and proposed pilots, as well as existing stored water at Bibblewindi, prior to transfer to the Leewood Produced Water Facility. The tank's control system will be designed with a target tank level and desired water flow that determines the pump's operation; pumps will speed up or slow down to maintain the target level. The facility will be monitored using a supervisory control and data acquisition (SCADA) telemetry system which includes high level and pump fault alarms.
- Leewood Produced Water Facility located on a Santos owned property approximately 24 kilometres from Narrabri (refer Figure 2-7) – the facility will include two 300 megalitre (ML) double lined ponds with leak detection system, and additional surface infrastructure, including a water distribution manifold, water pump skids, local power supply and water holding tanks. The facility has been designed with capacity to accept existing water stored at Bibblewindi Water Transfer Facility from ESG's previous operations, as well as future water produced during operation of pilots for the program.
- Leewood Water Pipeline – a produced water flow line and return flow line of approximately 16 kilometres in length, linking the Bibblewindi Water Transfer Tank to the Leewood Produced Water Facility.

Santos also plans to construct and operate water flow lines, known as the Dewhurst Northern Water Flow Line and Dewhurst Southern Water Flow Line, to transfer water from existing and proposed pilots to the Bibblewindi Water Transfer Tank (before being transferred to Leewood). The Dewhurst Northern Water Flow

Line will be 22.8 kilometres in length between the Dewhurst 13-18 and 22-25 pilot wells and the Bibblewindi Water Transfer Facility. The Dewhurst Southern Water Flow Line will be approximately 4.5 kilometers in length between the Dewhurst 26-31 Pilot and a tie-in point at the existing Bibblewindi Multi-lateral Pilot. These flow lines are subject to assessment under Part 5 of the EP&A Act. Reviews of Environmental Factors are currently being prepared for these flow lines.

Produced water from Dewhurst 13-18H will be captured at the well head and transferred by the proposed gathering system to a water balance tank located at Dewhurst 14. From the tank, water would then travel along the proposed Dewhurst Northern Water Flow Line to the existing Bibblewindi Water Transfer Facility where a new transfer tank is to be constructed. From this tank, water will travel along the proposed Leewood Water Pipeline to the Leewood Produced Water Facility.

Similarly, produced water from Dewhurst 30 and 31 will be captured at the well head and transferred by the proposed gathering system to a water balance tank located at the Dewhurst 28 lease area. From the tank, water will then travel along the proposed Dewhurst Southern Water Flow Line to the existing Bibblewindi multi-lateral pilot where it will tie-in to an existing flow line connecting to the Bibblewindi Water Transfer Facility. It will then be transferred via the Leewood Water Pipeline to the Leewood Produced Water Facility.

No produced water from the proposed activity from will be transferred to the existing ponds at the Bibblewindi Water Transfer Facility.

Produced water from the Leewood Produced Water Facility will be transported by road tankers to an appropriately licensed facility in the Sydney metropolitan area for treatment, reuse and/or disposal.

Santos is currently investigating the economic and technical feasibility of treating the produced water at the Leewood Produced Water Facility by reverse osmosis or other methods instead of transporting produced water from the Leewood Water Facility to a licensed facility. If Santos decides to operate a water treatment facility at Leewood, this would be the subject of further applications for approvals from the NSW Government.

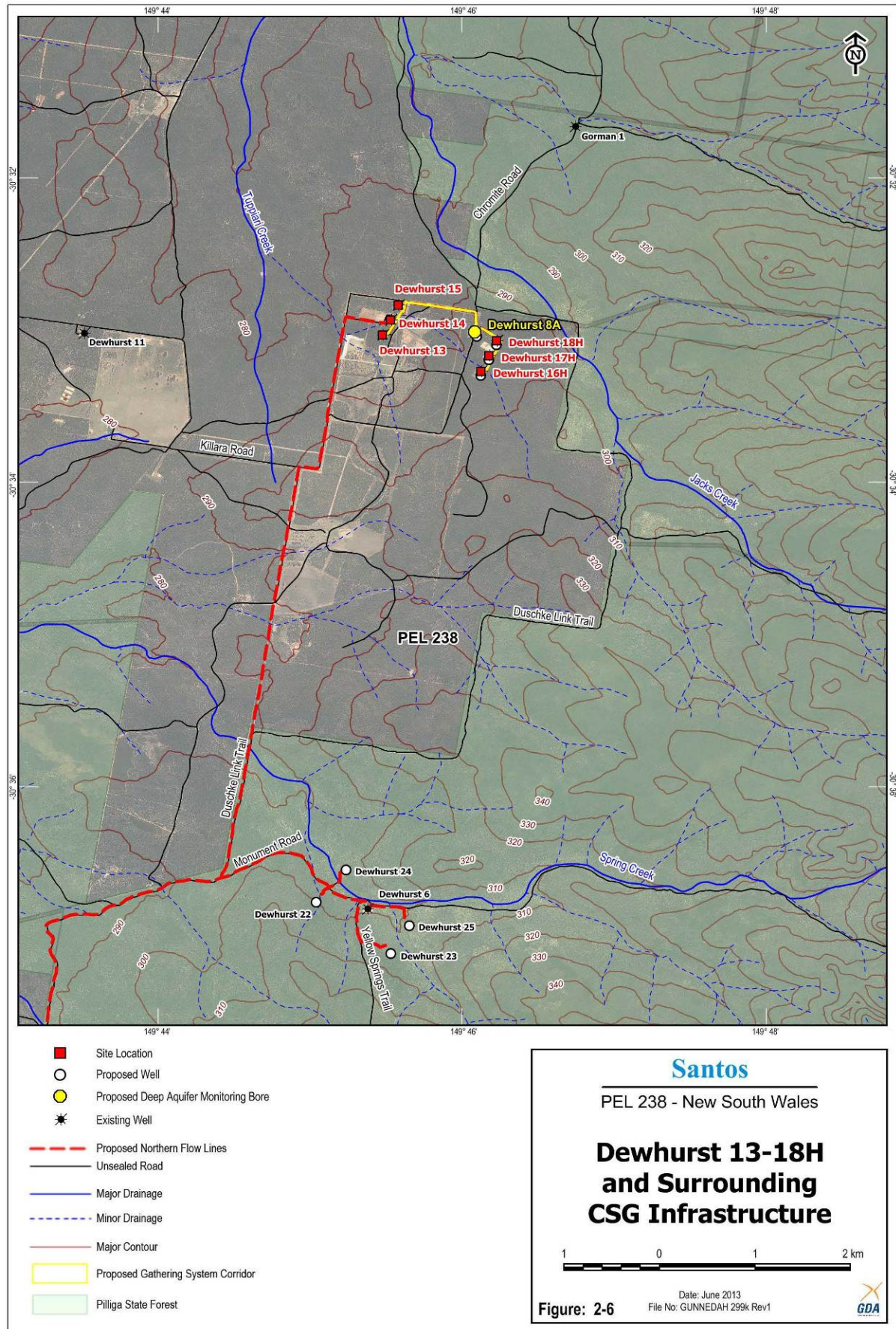


Figure 2-6 Dewhurst 13-18H Pilot and surrounding CSG infrastructure

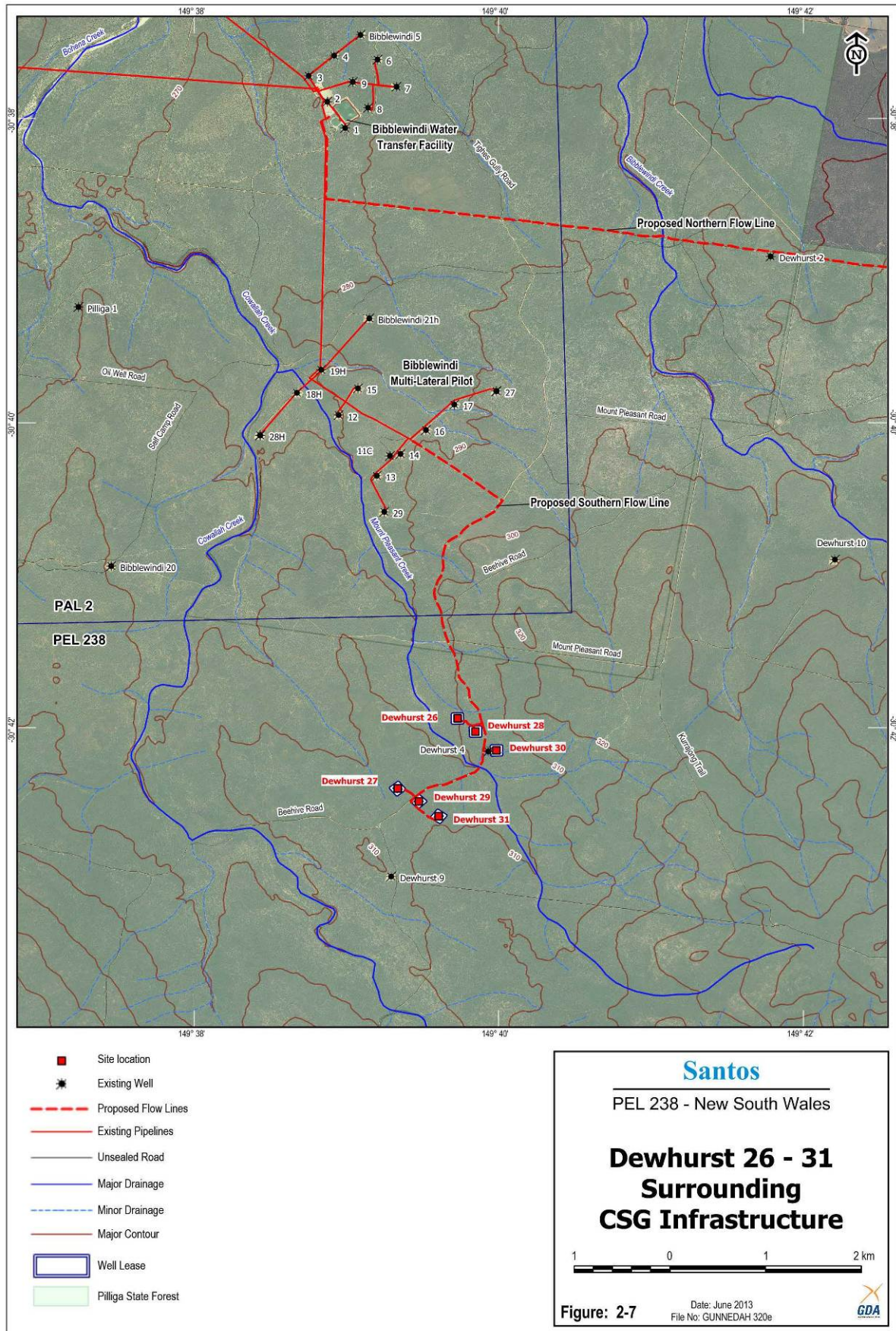


Figure 2-7 Dewhurst 26-31 Pilot and surrounding CSG infrastructure

3.0 Project description

3.1 Overview

Santos is seeking consent to undertake works to expand operations of two petroleum exploration (pilot) well sets (referred to as Dewhurst 13-18H and Dewhurst 26-31) as part of its coal seam gas (CSG) explorations in the Narrabri region of NSW.

The proposed works at Dewhurst 13-18H would include:

- drilling an additional two laterals from existing casing within Dewhurst 16H, 17H and 18H to convert each well from a single lateral to a tri stacked multi-lateral well targeting the Bohenia, Namoi and Rutley coal seams
- installing additional surface facilities and equipment at the existing Dewhurst 16H, 17H and 18H well lease areas
- replacing the existing water gathering system connecting Dewhurst 13, Dewhurst 14 and Dewhurst 15 and constructing a new gas and water gathering system connecting all the wells to the existing Dewhurst 14 well lease area (including clearing of approximately 0.3 hectares of vegetation)
- installing and operating a gas flare and water balance tank at the existing Dewhurst 14 lease area to manage water and surplus gas during operation of the Dewhurst 13-18H Pilot
- operating the Dewhurst 13-18H Pilot for up to three years.

The proposed works at Dewhurst 26-31 would include:

- establishing two 10 metre wide service corridors between Beehive Road and the Dewhurst 30 and 31 lease areas (including clearing of approximately 0.2 hectares of vegetation)
- constructing access roads within the service corridors
- establishing the Dewhurst 30 and Dewhurst 31 lease areas each up to approximately one hectare in size (including clearing of approximately two hectares of vegetation)
- setting up temporary equipment on each lease area.
- drilling one vertical (Dewhurst 30) and one tri-stacked lateral (Dewhurst 31) well to target coal seams within the Maules Creek Formation
- installing infrastructure to connect the wells to the gas and water gathering system for the Dewhurst 26-31 Pilot
- operating the Dewhurst 26 - 31 Pilot for up to three years.
- Hydraulic fracturing (fracking) is not part of the proposed activity.

3.2 Site selection

Both proposed works have been located to minimise surface impacts.

An Ecological Sensitivity Analysis (ESA) has been prepared by consultants, EcoLogical to map areas of 'very high', 'high', 'moderate' and 'low' areas of ecological sensitivity in the Narrabri area (EcoLogical, 2013). The analysis used available spatial data as well as data collected through field investigations to develop initial ecological sensitivity. Criteria and weighting for available data were specifically developed for the process.

The ESA was taken into consideration in the siting of the Dewhurst 30 and 31 pilot wells where efforts have been made to locate wells within an area outside of 'very high' and 'high' sensitivity. In addition, there will be

future opportunities for the micro-siting of the lease areas during detailed design to potentially avoid habitat features such as hollow bearing trees, etc.

Redrilling existing wells for Dewhurst 13-18H has eliminated the need to establish new lease areas and associated surface infrastructure.

3.3 Construction works at Dewhurst 13-18H

3.3.1 Site preparation

Drilling and surface facility construction activities would take place on the existing lease areas at Dewhurst 13, 14, 15, 16H, 17H and 18H. No further ground disturbance or vegetation clearance is required. The existing access track and road network would be used for access during construction.

Various works would be undertaken to prepare the site for the proposed activity, including re-establishing temporary buildings, above-ground storage tanks and other facilities on the lease areas, and positioning the drill rig. Temporary venting and flaring facilities would be located at each site during drilling and pump testing, but would be removed at the end of drilling activities.

3.3.2 Drilling, casing and completion

3.3.2.1 Drilling and equipment set up

The primary plant, equipment and temporary buildings to be used during drilling activities includes:

- drilling rig and supporting equipment (such as pipe handler and drilling fluid pump)
- surface tanks
- metal bins, baskets, skids and sea containers to house equipment
- mechanical vibrating screens
- vent tank
- power generator units
- lighting towers
- site offices.

Other equipment required onsite during the course of the drilling activities would include wireline trucks (at the receiving vertical well), cementing trucks and service company vehicles. These vehicles would exit and enter the site via the access tracks as required.

3.3.2.2 Well design

The augmented wells will be designed and constructed in accordance with the *NSW Code of Practice for Coal Seam Gas Well Integrity* (DTIRIS 2012). Table 3-1 summaries the key parameters for each lateral well.

Table 3-1 Well design parameters (indicative)

Design criteria	Dewhurst 16H	Dewhurst 17H	Dewhurst 18H
Approximate true vertical depth	No change (897 – 975m)	No change (897 – 975m)	No change (897 – 975m)
Well type	Horizontal Pilot	Horizontal Pilot	Horizontal Pilot
Additional target coal seam	Namoi, Rutley	Namoi, Rutley	Namoi, Rutley
Drilling technique	Rotary drilling	Rotary drilling	Rotary drilling

Design criteria	Dewhurst 16H	Dewhurst 17H	Dewhurst 18H
Well pair	Dewhurst 13	Dewhurst 14	Dewhurst 15
Number of horizontal lateral wells	3 (including 1 existing)	3 (including 1 existing)	3 (including 1 existing)
Horizontal length	1000 – 1200 m	1000 – 1200 m	1000 – 1200 m
Well head pump	Electrical submersible pump (ESP)	Electrical submersible pump (ESP)	Electrical submersible pump (ESP)

3.3.2.3 Drilling process

Re-entry drilling would involve the milling of two holes in the casing at each of the Dewhurst 16H, 17H and 18H wells to facilitate the drilling of two additional lateral wells towards their respective targets of Dewhurst 13, 14 and 15. Each pair of additional horizontal wells would be drilled in the Namoi and Rutley coal seams of the Maules Creek Formation, approximately 65 and 80 metres vertically above the existing horizontal well in the Bohena coal seam, respectively. Figure 3-1 shows the interaction between a vertical and horizontal well.

The drilling technique proposed for the wells is rotary drilling.

During the drilling process, water-based drilling fluid would be used to clear rock fragments and other solids, ensure sufficient pressure is maintained to prevent fluids and gases from flowing into the well, prevent clays from swelling and lubricate the drilling equipment.

Drilling fluid would mix with naturally occurring rock and soil and return these to the surface. The drilling fluid would pass through mechanical vibrating screens to separate out drill cuttings. The liquid component of the drilling fluid would flow into the surface tanks for recirculation throughout the drilling process. The drill cuttings would be transferred to a waste fluid tank and stored onsite.

Losing drilling fluid is undesirable as it is the primary means of controlling the hole. In the event that losses are detected, a lost circulation material (LCM) would be mixed in to prevent further losses. LCM is made of cellulose or other natural material and works by blocking the pores in the permeable/fractured rock. Once drilling is complete, drilling fluid would be transported to an approved treatment and processing facility so it can be reused in future drilling.

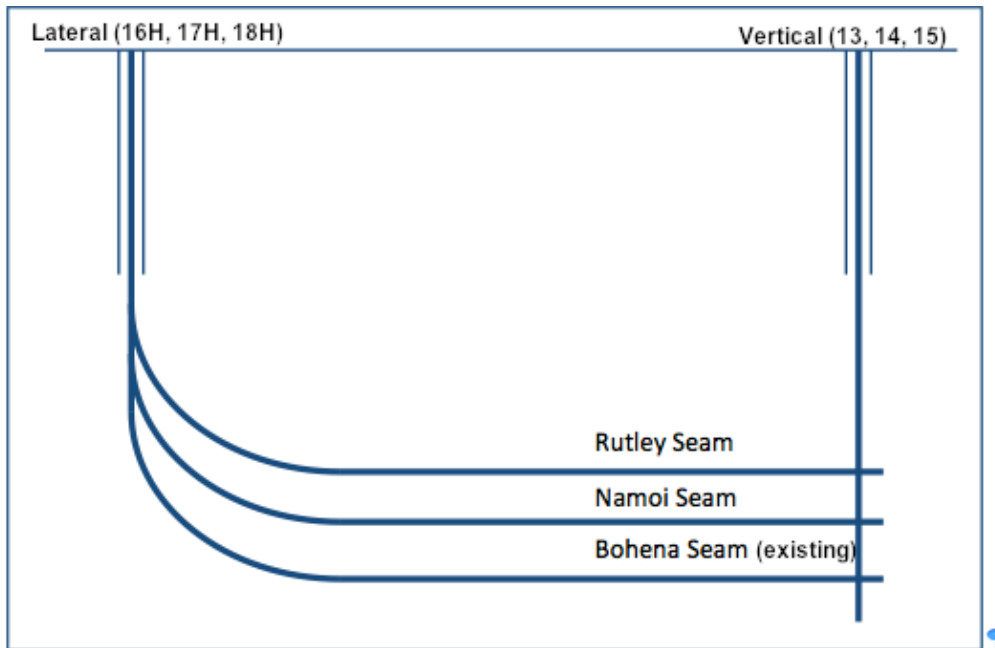


Figure 3-1 Well schematic – example of interaction of directional and vertical pilot wells at Dewhurst 13-18H Pilot

3.3.2.4 Well casing and completion

The horizontal wells drilled from Dewhurst 16H, 17H and 18H would intercept the existing steel casing in the corresponding vertical wells over the target coal sequences. The horizontal wells would be completed using a smaller workover rig and involves installing the pumps and hydraulic drive head (wellhead) with additional support and monitoring equipment.

3.3.3 **Surface equipment and tie-in to gathering system**

A wellhead separator and metering skids with associated power generation equipment (gas and diesel), motor control centre, pump and telemetry units would be installed at each well. The wellhead separator at each well would be connected to the proposed gas and water gathering system. A typical wellhead separator is shown in Plate 3-1.

It is proposed to modify the existing gas and water gathering system, as the existing gas and water gathering system does not meet Santos standards. The upgraded gathering system would consist of separate buried water and gas flow lines between the Dewhurst 16H, 17H and 18H wells and a central gas and water facility (including a new water balance tank and flare) to be installed at Dewhurst 14.

Figure 2-1 shows the route for the proposed gathering system, which would extend parallel to the existing access tracks and roads and would reduce the area of vegetation requiring removal. The total area to be disturbed for the gathering system is estimated to be up to 2.2 hectares with the extent of vegetation clearance estimated to be up to 0.3 hectares.

Specifically, the construction of the gathering system between the wells would include:

- surveying the gas and water gathering system corridor by a registered surveyor before any preparatory activities take place
- clearing and stockpiling vegetation at agreed locations determined during the negotiation of the access agreement with the landowner
- removal of the existing water gathering system between Dewhurst 16H, 17H and 18H

- trenching and installation of new gas and water pipes.

The proposed gathering system would most likely be installed using a ploughing machine (the alternative would be traditional open trenching). The benefits of ploughing is that it reduces the width of the corridor and top soil disturbance, as the soil plough machine pushes the spoil removed by the plough back into the trench as the machine feeds the new pipe into the hole.



Plate 3-1 Typical wellhead separator

3.3.4 Installing the water storage tanks and flare

The new water storage tank would be approximately 40 cubic metres in size and installed aboveground, with connecting pipe work, inside the existing lease area for Dewhurst 14.

Works for the flare would involve installing a HDPE liner over a five metre sterile zone surrounding the proposed flare, and covered with 300 millimetres of compacted soil and blue metal aggregate (to ensure protection against heat). Topsoil would be left in place where practicable.

The flare assembly would then be installed and aboveground piping installed to connect the flare to the existing wellhead separator. The flare and associated exclusion zone would be fenced with a chain wire fence approximately 1.8 metres high, for the duration of operation.

3.4 Construction works at Dewhurst 26-31

3.4.1 Site preparation

3.4.1.1 Service corridor and access track establishment

Two service corridors would need to be established between Beehive Road and the lease areas for Dewhurst 30 and 31 to provide vehicular access during drilling/construction and operation, and for the installation of the gas and water gathering system infrastructure. This would involve clearing vegetation within a 10-metre wide corridor between Beehive Road and the lease areas. A six-metre wide access track would then be established within each service corridor to allow vehicle and equipment access to each lease area from Beehive Road. Approximately 0.2 hectares of vegetation would be cleared for the service corridors.

3.4.1.2 Lease establishment and drilling rig set up

Each lease area would be established in an area approximately 100 x 100 metres and involve some vegetation clearing (up to two hectares in total). Given the flat nature of the site, the lease areas would likely be established using industrial matting. The industrial matting consists of impervious, non-absorbent material, which could be placed directly onto slashed vegetation. This would reduce the need for topsoil removal and earthworks.

Other activities during establishment of the lease area would include:

- marking out the extent of the lease areas
- installing bunds, drainage diversions and erosion and sediment controls where required
- setting up portable amenities onsite
- excavating a standard cellar pit in the location of the pilot hole to allow for the drilling rig
- installing and cementing a conductor casing
- transporting and establishing the drilling rig, drilling fluid tanks, generators, lighting towers, vibrating screens, waste fluid tank and other containers and sheds
- fencing the lease areas.

3.4.2 Drilling, casing and completion

3.4.2.1 Well design

The wells would be designed and constructed in accordance with the *NSW Code of Practice for Coal Seam Gas Well Integrity* (DTIRIS 2012). Table 3-2 summarises the key design criteria for each of the wells.

Table 3-2 Well design parameters (indicative)

Design criteria	Dewhurst 30	Dewhurst 31
Direction	Vertical	Directional
Approximate Depth	1050 m TVD ¹	940-1000 m TVD 2100 m MD ²
Well type	Pilot	Pilot
Target coal seam	Bohena, Namoi and Rutley	Namoi, Bohena and Rutley
Drilling technique	rotary drilling	rotary drilling
Well pair	NA	Dewhurst 30
Number of directional lateral wells	NA	3
Wellhead pump	progressive cavity pump	electrical submersible pump

Notes: 1. m TVD = metres True Vertical Depth
2. m MD = metres Measured Depth

3.4.2.2 Drilling process

Dewhurst 30 (vertical) would be drilled first followed by Dewhurst 31 (triple lateral). Dewhurst 31 would have up to three lateral wells drilled into three different coal seams of the Maules Creek Formation to then intercept the Dewhurst 30 well (refer Figure 3-2). Drilling and construction of the two wells would involve:

- drilling an open hole about 30 centimetres in diameter
- installing steel casing inside the hole and cementing it in place
- installing a blow-out preventer (BOP) on top of the casing

- drilling out from inside the casing to the planned depth (refer Table 3-2)
- installing production casing to the planned total depth just above the Maules Creek Formation.

The drilling technique then proposed for the wells is rotary drilling which is the same as for Dewhurst 13-18H (refer Section 3.2.2.3 for more information).

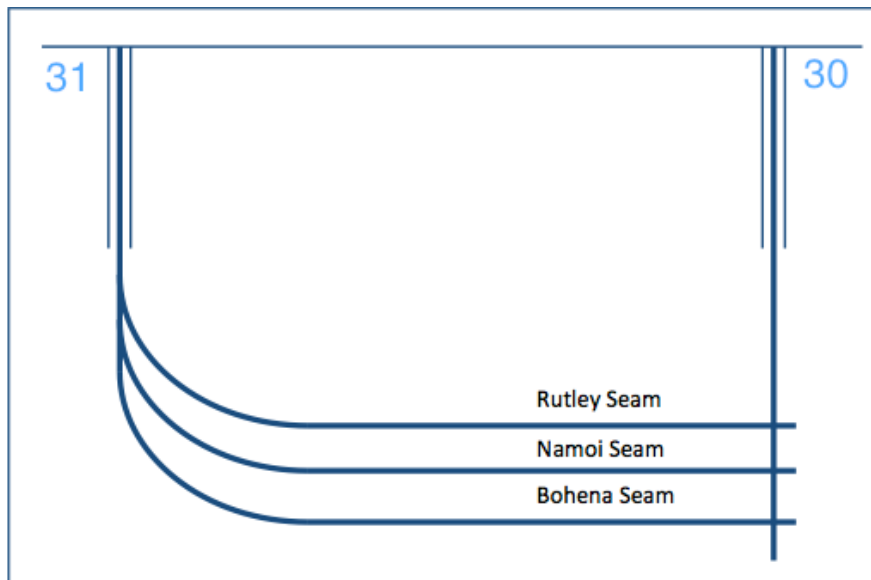


Figure 3-2 Well schematic – indicative example of directional and vertical pilot well interception

During the drilling process, water-based drilling fluid would be used to clear rock fragments and other solids, ensure sufficient pressure is maintained to prevent fluids and gases from flowing into the well, prevent clays from swelling and lubricate the drilling equipment.

3.4.2.3 Well casing and completion

Once each well has reached the planned depth, geophysical wire-line logs would be run over the entire length of the hole to identify major stratigraphic units, intersected coal seam depth and seam thickness. In the vertical well (Dewhurst 30) a combination of steel and fibreglass casing would be run in the hole and pressure-cemented to ensure total isolation of the well from the surrounding coal seams and potential aquifers. The three lateral wells drilled from Dewhurst 31 would use steel casing and intercept the fibreglass casing in Dewhurst 30 over the target coal sequences.

The wells would be completed using a smaller workover rig. This would involve installing the pumps and hydraulic drive head (wellhead) with additional support and monitoring equipment.

3.4.3 Surface equipment and tie-in to gathering system

A wellhead separator and metering skids with associated power generation equipment (gas and diesel), motor control centre, pump and telemetry units would be installed at each pilot well. The wellhead separator at each pilot would be connected to the proposed gas and water gathering system.

The proposed gas and water gathering system would comprise separate buried, low pressure flowlines for gas and water linking the Dewhurst 30 and 31 pilot wells to the Dewhurst 26-29 gathering system. The proposed gathering system would be located within the cleared 10 metre service corridors and constructed using either ploughing or traditional trenching. The benefits of ploughing is that it reduces the width of the

corridor and top soil disturbance, as the soil plough machine pushes the spoil removed by the plough back into the trench as the machine feeds the new pipe into the hole removing the need for backfill.

3.5 Construction staff and hours

Approximately 40 employees and contractors may be present onsite each day for works at each of the Pilots. Drilling and construction activities may occur 24 hours per day, seven days per week to maximise efficiencies and use of a remote work force.

3.6 Construction schedule

Drilling activities for Dewhurst 16H-18H are planned to commence around early 2014 and the drilling of Dewhurst 30 and 31 is planned to commence around mid-2014, subject to approval. Construction, including site preparation, drilling and installation of ancillary infrastructure for each pilot set, is expected to take approximately four to six months.

3.7 Operation

3.7.1 Pilot testing

Operation of the Dewhurst 13-18H Pilot and Dewhurst 26-31 Pilot is expected to commence in late 2014. Pilot testing would occur for up to three years.

During the pilot testing period, pressures, water volumes, water levels, compositions and gas rates would be monitored and transmitted via a Remote Telemetry Unit (RTU) to Santos offices to enable operations personnel to gain required information. The pilots would be able to be controlled and monitored remotely.

Security measures would also be installed, for example, the pilot wells would have automated shutdown systems triggered in the event that abnormal operating conditions occur.

3.7.2 Gas and water management

At the surface, each pilot well would be connected to a small separator, operating at low pressure to separate any CSG from the produced water. Both the gas and water would be transferred from the separator at each well via the gathering system to facilities at Dewhurst 14 and Dewhurst 28 lease areas.

3.7.2.1 Gas

Recovered coal seam methane gas would flow up the well annulus separate to the water with the gas stream entering the wellhead separator to remove any entrained water. A portion of the produced gas would be diverted to the local fuel gas skid for conditioning, prior to being used within the site generators, with the balance flowing to the low pressure gas gathering network to the flare at Dewhurst 14 (for the Dewhurst 13-18H Pilot) or Dewhurst 28 (for the Dewhurst 26-31 Pilot). During periods of high fire danger gas may be vented to the atmosphere (ie released and not flared) to minimise the risk of ignition sources within the forest or nearby vegetation.

3.7.2.2 Water

Water from the wells would be pumped to the surface. For the vertical well (Dewhurst 30) a progressive cavity pump (PCP) would be installed just above the coal seams and transfer water to the surface through the well tubing. For the directional wells (Dewhurst 16H, 17H 18H and Dewhurst 31), an electrical submersible pump (ESP) would be located at the depth of the target coal seams.

The produced water flowing from the wellhead separators would be mixed with the produced water from the PCP/ESP tubing flow lines. The combined water stream would enter the gathering system and be pumped to the storage facilities at Dewhurst 14 and Dewhurst 28, then transferred to the Bibblewindi Water Transfer Facility and on to the Leewood Produced Water Facility.

3.7.3 Partial rehabilitation

Once the drilling activities are complete, it is proposed that any surplus lease area at Dewhurst 30, 31 and Dewhurst 16-18H would be rehabilitated to an area of approximately 20 x 20 metres around each wellhead to allow for ongoing workover operations and eventual abandonment operations. Appropriate mitigation measures and environmental safeguards implemented to minimise potential impacts would be undertaken.

The gathering system corridors for both pilots would be rehabilitated once construction works are completed. All rehabilitation works would be undertaken with regard for vegetation, subsoil and topsoil management, weed control, erosion and sedimentation management and re-vegetation.

3.7.4 Maintenance activities

Workover operations using a smaller rig would be required on the pilot wells from time to time for corrosion monitoring, mechanical repairs or other interventions as required. Maintenance of the gas and water gathering systems would be undertaken periodically.

3.8 Post operation

On completion of operations, pilot wells and ancillary infrastructure would be decommissioned and well leases rehabilitated or suspended. If exploration and appraisal activities confirm the CSG resource as commercially viable, approval may be sought for production. A production project may include the use of the pilot wells, flow lines, supporting facilities and ancillary infrastructure but would be subject to further environmental assessment and government approvals. In the event that Santos decides to seek approval for a production project, the wells would be suspended until determination of the role, if any, the wells would play in a commercial gas production project. If Santos does not pursue a commercial gas production project, or a well or supporting infrastructure is not a part of a commercial gas production project for which approval is sought, then the pilot wells and infrastructure would be decommissioned and rehabilitated.

Decommissioning the wells would include:

- sealing the wells from bottom to top by plugging with cement in approximately 200 metre increments
- pressure testing the cement plug across the surface casing to ensure the wells are sealed
- removing the wellhead at a depth of greater than 1.5 metres below surface and burying.

Buried surface infrastructure would be flushed, capped at each end and left in-situ in accordance with legislative requirements. The lease areas would be fully rehabilitated within approximately six months of well abandonment, where practicable, and where external factors such as the weather permit.

If the decision is made to proceed to commercial production, additional environmental assessment would be carried out to assess converting the pilot wells and the applicable government approvals would be sought.

4.0 Planning and permissibility

4.1 Commonwealth legislation

4.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) provides for the protection of certain Matters of National Environmental Significance (MNES) listed under the Act, which include:

- World Heritage Areas
- National Heritage Places
- Ramsar wetlands of international importance
- Commonwealth listed threatened species and ecological communities
- listed migratory species
- Commonwealth marine areas
- Great Barrier Reef Marine Park
- nuclear actions.

In March 2013, the Commonwealth Government announced that it would seek an amendment to the EPBC Act to include water resources as a MNES, in relation to CSG and large coal mining developments. The amendments were enacted in June 2013.

Under the EPBC Act, Commonwealth approval is required from the Minister of Sustainability, Environment, Water, Population and Communities (Minister) for any action that will have or is likely to have a significant impact on a MNES, or on the environment of Commonwealth land or on the environment if the action is proposed to be taken by a Commonwealth agency (known as a 'controlled action').

A person proposing to take a controlled action must refer the proposed activity to the Minister for determination. A person proposing to take an action that the person thinks is not a controlled action may refer the proposed activity to the Minister for the Minister's decision whether or not the action is a controlled action.

An EPBC referral for Santos' Energy NSW CSG exploration and appraisal program over the next two to three years within PEL 238 and PAL 2 has been prepared and is planned to be submitted to the Minister in June 2013. The proposed activity (expansion and operation of Dewhurst 13-18H and Dewhurst 26-31 Pilots) has been included in the referral.

In addition, an EPBC Act Protected Matters Search Report was generated for a 10-kilometre radius surrounding the Dewhurst 13-18H and Dewhurst 26-31 sites in January and April 2013, respectively. The results of the search are outlined in Table 4-1. An assessment of the proposed activity against MNES would be undertaken during preparation of the EIS.

Table 4-1 Matters of National Environmental Significance

MNES	Overview
World Heritage Properties	No World Heritage Properties are located within 10 km of both sites.
National Heritage Places	No National Heritage Places are located within 10 km of the site of both sites.
Wetlands of international importance (RAMSAR wetlands)	No wetlands of international importance are located within 10 km of both sites.
Nationally listed threatened species and ecological communities:	Four Threatened Ecological Communities, listed under the EPBC Act were identified as having the potential to occur within 10km of the Dewhurst 13-18H Dewhurst 26-31 Pilot, including: Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions, listed as endangered Grey Box Grassy Woodlands and Derived Native Grasslands of South-eastern Australia, listed as endangered Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland, listed as critically endangered Weeping Myall Woodlands, listed as endangered. Fourteen threatened species listed under the EPBC Act were identified as having the potential to occur within 10 km of the Dewhurst 13-18H site. Twenty threatened species listed under the EPBC Act were identified as having the potential to occur within 10 km of the Dewhurst 26-31 Pilot.
Migratory species	Twelve terrestrial migratory bird species listed under the PEBBC Act were identified as having the potential to occur within 10m of the Dewhurst 13-18H site. Six terrestrial migratory bird species listed under the EPBC Act were identified as having the potential to occur within 10 km of the site.
Commonwealth marine areas	No Commonwealth marine areas are located within 10 km of both sites.
Great Barrier Reef Marine Park	Both sites are located in excess of 1200 km from the Great Barrier Reef Marine Park and will not have any impact.
All nuclear actions	The proposed activity does not involve a nuclear activity.

4.1.2 Native Title Act 1993

The objectives of the *Native Title Act 1993* (Native Title Act) are to:

- recognise native title rights and sets down basic principles in relation to native title in Australia
- provide for the validation of past acts which may be invalid because of the existence of native title
- provide for a future act regime in which native title rights are protected and conditions imposed on acts affecting native title land and waters
- provide a process by which native title rights can be established and compensation determined
- provide processes for negotiations and determinations about whether future acts, including grants and activities carried out under those grants, can be done over native title land and waters
- provide for a range of other matters, including the establishment of a National Aboriginal and Torres Strait Islander Land Fund.

A search of the National Native Title Tribunal (NNTT) registers on 9 October 2012 identified the Registered Native Title Claim of the Gomeroi Nation (NSD2308/2011). Their claim extends over an area of 111,340 square kilometres and includes the Narrabri LGA.

Santos is currently undertaking preliminary engagement activities with the Gomeroi People to explore shared interests as a basis for consideration of future arrangements.

As PEL 238 was granted prior to the commencement of the *Native Title Act 1993* (Cth), there is no further need to comply with the *Native Title Act* for the conduct of the proposed activity. Should Santos wish to apply for a production lease in the area of PEL 238, Santos understands that the Native Title Act requires

completing the right to negotiate process under Subdivision P of Division 3 of Part 2 of the Act, or concluding an Indigenous Land Use Agreement.

4.2 NSW legislation and policy

4.2.1 Petroleum (Onshore) Act 1991

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

- (a) *any naturally occurring hydrocarbon, whether in a gaseous, liquid or solid state, or*
- (b) *any naturally occurring mixture of hydrocarbons, whether in a gaseous, liquid or solid state, or*
- (c) *any naturally occurring mixture of one or more hydrocarbons, whether in a gaseous, liquid or solid state, and one or more of the following, that is to say, hydrogen sulphide, nitrogen, helium, carbon dioxide and water,*

and includes any substance referred to in paragraph (a), (b) or (c) that has been returned to a natural reservoir, but does not include coal or oil shale or any substance prescribed to be a mineral for the purposes of the Mining Act 1992.

The holder of a petroleum exploration licence has the right to prospect for, and to assess any, petroleum on the land within the lease area. The proposed activity is situated within PEL 238 granted under the Petroleum Act. Under PEL 238, there are three categories of prospecting operations that may be undertaken. The category considered relevant for the proposed activity is Category 3, which is detailed below.

Category 3

- construction and use of petroleum wells
- prospecting operations and water management infrastructure required to be carried out in accordance with an approved Produced Water Management Plan
- fracture stimulation
- installation of gas gathering and pipeline infrastructure
- any prospecting operation resulting in a cumulative surface disturbance exceeding a total of five hectares within the exploration licence area
- any other prospecting operations not listed in Category 1 prospecting operations or Category 2 prospecting operations.

The proposed activity falls under Category 3 prospecting operations. Under Condition 2 of PEL 238 the licence holder must obtain approval from the Resources Minister prior to carrying out any Category 3 prospecting operations on the exploration licence area.

As explained in Section 0, the proposed activity is classified as State Significant Development (SSD) and therefore will require development consent under Part 4, Division 4.1, of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

4.2.2 Environmental Planning and Assessment Act 1979

4.2.2.1 Overview

The EP&A Act establishes the statutory framework for planning and environmental assessment in NSW. Implementation of the EP&A Act is the responsibility of the Minister for Planning and Infrastructure, statutory authorities and local councils. The applicable approval process (i.e. Part 4 or Part 5 of the EP&A Act) is generally determined by reference to the relevant environmental planning instruments and other controls. These include Local Environmental Plans (LEPs) and State Environmental Planning Policies (SEPPs).

Under clause 7(2) of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) development consent is required for the purposes of drilling or operating petroleum exploration wells except in certain circumstances including where there is a set of five or fewer wells that is more than three kilometres from any other petroleum well in the same petroleum title.

Section 89C(2) of the EP&A Act provides that a SEPP may declare any development or any class or description of development, to be State Significant Development (SSD) and therefore would be assessable under Part 4 Division 4.1 of the EP&A Act with the Minister for Planning and Infrastructure as the consent authority.

Clause 6 of Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) identifies the following 'Petroleum (oil and gas)' development as SSD:

'development for the purpose of drilling and operating petroleum exploration wells, not including... a set of five or fewer wells that is more than three kilometres from any other petroleum well (other than an abandoned petroleum well) in the same petroleum title'.

The proposed development (expansion of the Dewhurst 13-18H Pilot and Dewhurst 26-31 Pilot) would involve the drilling and operation of more than five petroleum wells, other than abandoned wells, within a three kilometre radius within PEL 238, and is therefore SSD. Approval for the proposed development is being sought under Part 4, Division 4.1 of the EP&A Act.

Section 78A(8A) of the EP&A Act requires an environmental impact statement (EIS) assessing the proposed activity to be submitted. Before preparing an EIS, Clause 3(1) of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) requires a written application to be made to the Director-General for the environmental assessment requirements with respect to the proposed EIS. This document has been prepared for the purpose of obtaining the Director-General's Requirements (DGRs).

The development assessment process under Division 4.1 of Part 4 of the EP&A Act is shown in Figure 4-1.

4.2.2.2 Section 79C requirements

Section 79C of the EP&A Act applies to the determination of SSD, subject to the provisions of Division 4.1, and requires the consent authority to take into consideration the matters identified in Table 4-2. The EIS would address these matters for consideration.

Table 4-2 Matters for consideration under Section 79C of EP&A Act

Matters for consideration	Response
(a) <i>the provisions of:</i>	
(i) <i>any environmental planning instrument</i>	The primary environmental planning instruments of relevance to the proposed activity are discussed in Section 0. The EIS would consider all relevant matters within applicable environmental planning instruments.
(ii) <i>any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority</i>	Draft amendments to the Mining SEPP were exhibited during November and December of 2012. These amendments seek to establish the Gateway process for State significant mining and petroleum projects located on Strategic Agricultural Land (SAL) under the <i>Strategic Regional Land Use Policy</i> (DoP&I, 2012). While the proposed activity is not located on SAL, under the draft amendments to the Mining SEPP, Santos may need to apply for a site verification certificate prior to submitting the development application for the proposed activity.
(iii) <i>any development control plan</i>	In accordance with Section 11 of the SRD SEPP, development control plans do not apply to SSD.
(iiia) <i>any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F</i>	Any planning agreements or draft planning agreements would be addressed in the EIS.
(iv) <i>the regulations</i>	There are no relevant matters prescribed by the regulations.
(v) <i>any coastal zone management plan (within the meaning of the Coastal Protection Act 1979), that apply to the land to which the development application relates</i>	There are no coastal zone management plans relevant to the site.
(b) <i>the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality</i>	Section 5 provides preliminary consideration of the potential impacts of the proposed activity. The EIS would provide further detailed assessment of the potential impacts of the proposed activity.
(c) <i>the suitability of the site for the development</i>	Justification for selecting the proposed site is provided in Section 6. Further assessment of the site's suitability for the proposed activity will be provided in the EIS.
(d) <i>any submissions made in accordance with this Act or the regulations</i>	Any submissions received during the statutory exhibition period would be considered by the Department of Planning and Infrastructure prior to determination of the application.
(e) <i>the public interest.</i>	The public interest would be served through the application of all relevant planning controls and objectives.

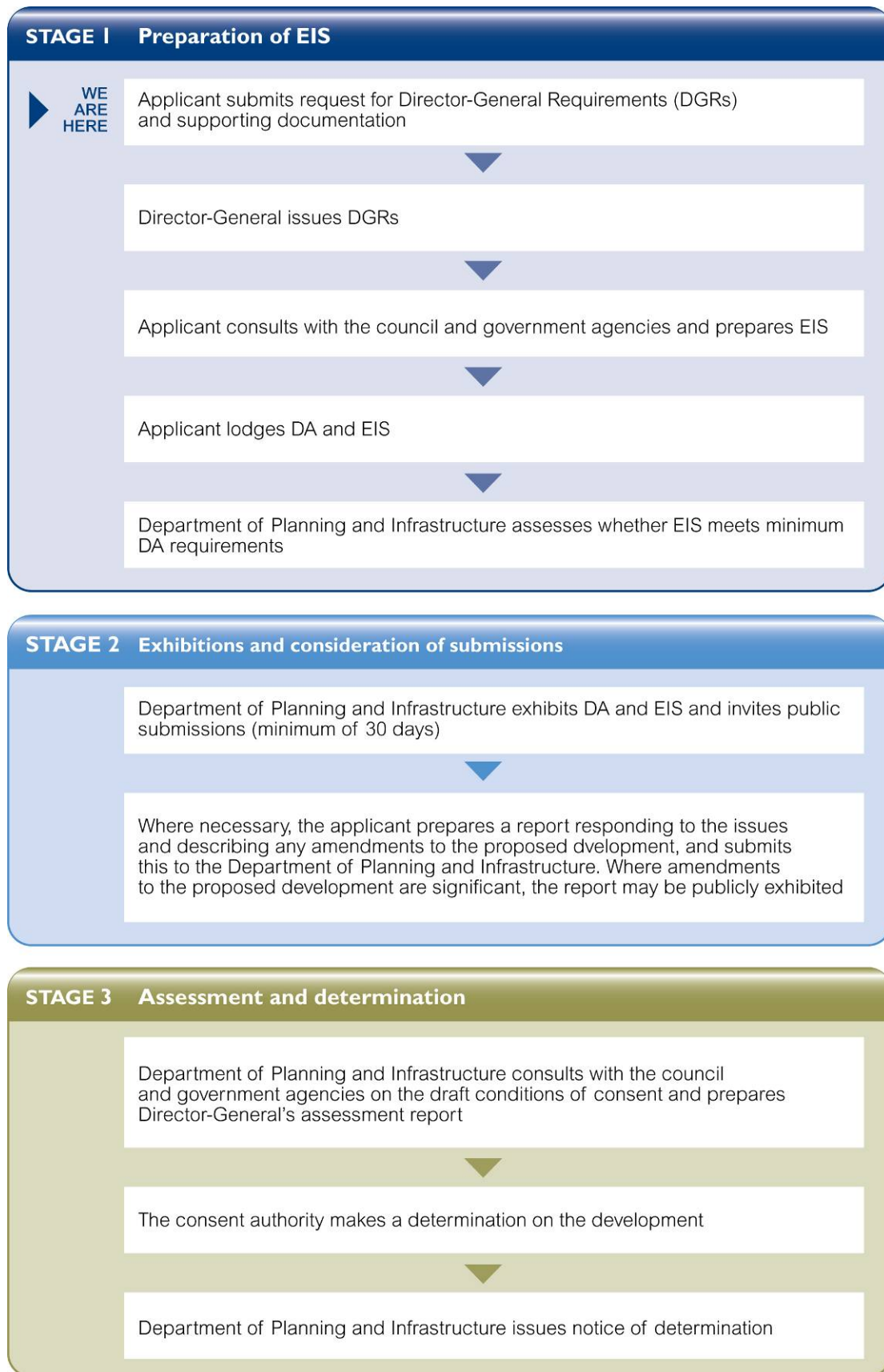


Figure 4-1 The development assessment process

4.2.3 Strategic Regional Land Use Policy

The *Strategic Regional Land Use Policy* (DoP&I 2012) identifies and protects more than two million hectares of strategic agricultural land (SAL), protects valuable water resources, and provides greater certainty for companies wanting to invest in mining and CSG projects in regional NSW.

The proposed activity is not located on biophysical strategic agricultural land (BSAL) or a Critical Industry Cluster (CIC) mapped under the *Strategic Regional Land Use Plan New England North West Region*. The closest mapped BSAL is approximately 9.5 kilometres from the Dewhurst 13-18H Pilot and 13 kilometres from the Dewhurst 26-31 Pilot. However, under draft amendments to the Mining SEPP, a Site Verification Certificate may be required for submission with the development application to verify that the site is not SAL.

On 19 February 2013 the NSW Government announced that a two kilometre exclusion zone would be imposed around residential zoned land to prevent new CSG exploration, assessment and production activities. The nearest receiver to the Dewhurst 13-18H is 1.8 kilometres, but the proposed activity is not situated within two kilometres of a residential zone. The Dewhurst 26-31 Pilot is located within the Pilliga East State Forest and not within two-kilometres of a residential zone. The nearest residential receivers to Dewhurst 30 and 31 are located at least 11 kilometres away.

4.2.4 Narrabri Local Environmental Plan 2012

The Dewhurst 13-18H Pilot is located within the Narrabri LGA and is located on land zoned as RU1 (Primary Production) under the *Narrabri Local Environmental Plan 2012* (Narrabri LEP). As discussed in section 4.2.2.1, the proposed activity is SSD and requires development consent under Part 4, Division 4.1 of the EP&A Act, despite the provisions of the Narrabri LEP.

The Dewhurst 26-31 Pilot is located within land zoned RU3 Forestry under the Narrabri LEP. Under the Narrabri LEP, uses authorised under the *Forestry Act 2012* or for the purposes of roads are permitted without consent within the RU3 Forestry zone. As discussed in Section 4.2.1 and Section 0, the proposed activity is permissible with consent under the provisions of the Mining SEPP and SRD SEPP, which overrides the provisions of the Narrabri LEP.

4.2.5 Forestry Act 2012

Under Section 60 of the *Forestry Act 2012*, the land manager of a forestry area may issue a forest permit authorising the holder of the permit to use the forestry area for such purposes (including recreational, sporting or commercial activities) as are specified in the permit. Santos holds a Permit to Occupy issued by Forests NSW under the *Forestry Act 1916* (which was replaced by the *Forestry Act 2012*) for the area of the Pilliga East State Forest within the boundaries of PEL 238. The Permit to Occupy allows activities authorised under the Petroleum Act or a petroleum title within this area and is for a period of 30 years, commencing from 2011.

4.2.6 Water Management Act 2000

4.2.6.1 [Water sharing plans](#)

The *Water Management Act 2000* (WM Act) provides for a system of assessment and licensing and approvals relating to the equitable take of water from water sources, in addition to works and activities occurring within or affecting these water sources. Water Sharing Plans (WSPs), prepared under the provisions of the WM Act set out Water Sharing Rules and Management Rules for aquifer interference activities within each water source that operate under these water management principles.

The following WSPs apply to water sources beneath or in the vicinity of the site:

- NSW Great Artesian Basin (GAB) Groundwater Sources WSP
- NSW Murray-Darling Basin (MDB) Porous Rock Groundwater WSP
- NSW MDB Fractured Rock Groundwater WSP
- Namoi Unregulated and Alluvial Water Sources WSP.

The proposed activity will need to comply with the rules developed for the affected water sources within the relevant WSPs outlined above.

4.2.6.2 [Aquifer interference policy](#)

The *NSW Aquifer Interference Policy* (AIP) (NOW, 2012) was released in September 2012 to clarify the requirements for obtaining water licences and approvals for aquifer interference activities. The AIP specifies that the volume of water taken from a water source(s) as a result of an activity is required to be predicted prior to project approval and that approval will not be granted unless the Minister is satisfied that adequate arrangements are in force to ensure that no more than minimal harm will be done to an aquifer or its dependent ecosystems.

4.2.6.3 [Water access licences](#)

Under Part 2 of Chapter 3 of the WM Act, it is an offence to take water from a source regulated by the WM Act unless in accordance with a water access licence (WAL). A WAL is also required for the taking of groundwater, whether for consumption or incidentally, unless an exemption applies. Exemptions from requiring WALs are listed under Part 1 of Schedule 5 of the *Water Management (General) Regulation 2011*. Any new mining and petroleum exploration activities that take more than three mega litres per year from groundwater sources need to hold a WAL. The volume of water to be extracted for both pilot well sets would be more than three mega litres and a Water Access Licence would need to be obtained.

4.2.6.4 [Aquifer interference approvals](#)

Under Section 91F of the WM Act, it is an offence to carry out an aquifer interference activity without an aquifer interference approval. However, section 91F of the WM Act does not currently apply. Section 88A provides that Part 3 of Chapter 3 (including section 91F) applies to each part of the State or each water source and each type or kind of approval that relates to that part of the State or that water source that is declared by proclamation. At the time of writing, no proclamation has been made declaring that Part 3 of Chapter 3 of the Act applies in relation to aquifer interference approvals and an aquifer interference approval would not be required for the proposed activity.

4.2.7 Protection of the Environment Operations Act 1997

One of the primary objectives of the *Protection of the Environment Operations Act 1997* (POEO Act) is to 'protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development'. The POEO Act requires environmental protection licences (EPLs) be obtained for the carrying out of 'scheduled activities'.

On 19 February 2013 the NSW Government announced that all CSG exploration, assessment and production titles and activities would be required to hold an EPL. A draft *Protection of the Environment Operations (Coal Seam Gas Activities) Regulation 2013* has been released for public consultation. If enacted, the regulation may require Santos to apply for an EPL for the proposed activity.

4.3 Other NSW legislation

Other NSW legislation that would be addressed in the EIS includes, but is not limited to:

- *Brigalow and Nandewar Community Conservation Area Act 2005*
- *Contaminated Land Management Act 1997*
- *Crown Lands Act 1989*
- *Dangerous Goods (Road and Rail Transport) Act 2008*
- *Fisheries Management Act 1994*
- *Forestry Act 2012*
- *Heritage Act 1977*
- *National Parks and Wildlife Act 1974*
- *Native Title (New South Wales) Act 1994*
- *Noxious Weeds Act 1993*
- *Roads Act 1993*
- *Threatened Species Conservation Act 1995*
- *Waste Avoidance and Resource Recovery Act 2001*
- *Work Health and Safety Act 2011.*

Section 89J of the EP&A Act removes the need to obtain certain approvals and authorisations under various acts of legislation (including some of those listed above) for SSD for which development consent has been granted. The EIS would identify the additional approvals and authorisations required for the proposed activity.

5.0 Preliminary environmental assessment

5.1 Environmental risk analysis

A preliminary environmental risk assessment of the proposed activity was undertaken to identify and prioritise issues requiring further assessment in the EIS. Potential environmental issues associated with the proposed activity were identified based on desktop investigations, preliminary ecological and archaeological field investigations, knowledge of the statutory planning and regulatory requirements, and consideration of the nature and scale of the proposed activity. Environmental risks were identified for each aspect during various stages of the proposed activity and each risk was given an inherent risk ranking based on the likelihood and potential consequences of the risk without any mitigation measures being applied.

Potential issues with a risk rating of three or greater were identified as key environmental issues for the proposed activity, and would require further detailed environmental assessment and/or specific mitigation strategies to be developed. Issues with a risk rating equal to, or less than two, were considered to be non-key environmental issues for the proposed activity and could likely be managed through the implementation of standard mitigation measures.

The risk analysis identified potential impacts on biodiversity, hazard and risk (including bushfire risk) and community relations as being key issues for the proposed activity. For more information on community relations refer to Section 7.0. Groundwater, noise and air quality and emissions were not determined to be key environmental issues based on the preliminary environmental risk assessment, due to the low likelihood of an impact on sensitive receivers (both the environment and community). However, given the community perceptions relating to CSG activities, these issues have been considered as key issues for the purposes of this report.

5.2 Key environmental issues

5.2.1 Groundwater

5.2.1.1 Existing environment

Groundwater in the Namoi catchment supports the irrigation industry and also provides the water supply for many towns and intensive industries. The 'Upper Namoi' and 'Lower Namoi Alluvium' form the principal aquifers of the Namoi River Catchment and are heavily used for irrigation (Schlumberger Water Services, 2012). However, according to the relevant water sharing plans for the region, the proposed activity site does not sit within any of these aquifers. The main groundwater sources underlying the site include:

- Southern Recharge groundwater source, under the Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources.
- Gunnedah-Oxley Basin Murray Darling Basin (MDB) buried groundwater source, under the Water Sharing Plan for the NSW MDB Porous Rock Groundwater Sources.
- Lachlan Fold Belt MDB buried groundwater source, under the Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources.

The nearest registered bores are located approximately two kilometres from Dewhurst 13-18H Pilot (six bores) and approximately ten kilometres from Dewhurst 26-31 Pilot (four bores) (NSW Natural Resource Atlas search, April 2013). These bores primarily target the Pilliga Sandstone layer at a depth of approximately 150 metres. Nearby bores have been considered in the preliminary groundwater investigations.

5.2.1.2 Consideration of potential issues

Impacts to groundwater have greatest potential to occur during operation of the wells but may also occur during drilling. Drilling of Dewhurst 30 and 31 has the potential to introduce preferential flow pathways between aquifers if not carried out in accordance with regulatory requirements and best practice. The wells will be drilled and constructed in accordance with the methodology presented in the *NSW Code of Practice for Coal Seam Gas Well Integrity* (DTIRIS 2012) and the significance of this potential impact is considered to be low. The successful implementation of the methodology will most likely remove the potential impact completely. There is less risks associated with re-entering Dewhurst 16-18H as these wells are already cased and pressure tested.

During operation of the pilots, CSG would be extracted from the coal seams of the Maules Creek Formation (at depth of approximately 1000 metres). This formation is part of the porous rock groundwater source of the Gunnedah Basin (NSW Murray Darling Basin Porous Rock groundwater source WSP), and is a 'Less Productive' groundwater source in the context of the AIP. In order to release CSG from the coal seams, the coal seams need to be depressurised by extracting water from the formation.

Potential impacts associated with this extraction relate to the drawdown/depressurisation of overlying groundwater sources and subsequent reduction in the quantity of water held within the overlying rock strata.

A cumulative groundwater impact assessment of the program was previously prepared by CH2MHill to support the referral of the program under the EPBC Act (CH2MHill, 2013). The findings of that assessment show that depressurisation of the target coal seam as a result of pilot activities indicate a negligible decline in water levels (less than 0.5 metres) within the Namoi Alluvium and the Pilliga Sandstone groundwater sources. This impact is generally not manifested for a considerable amount of time (>500 years), by which time the calculated fluxes generating these impacts and the extents of drawdown are diminished to magnitudes, undetectable within the natural range of annual fluctuations.

The cumulative groundwater modelling undertaken to date also indicates that the late Triassic to early Jurassic strata, including the Triassic Napperby and Deriah Formations and the Jurassic Garrawilla Volcanics, may experience very localised maximum drawdown in the range of 1.4 to 3.8 metres occurring after at least 400 years from inception of CSG water extraction. Water quality and accessibility within these formations is considered poor, and there are no known beneficial use abstractions within the program area. Modelling of the CSG produced water extraction from the target coal seams is required to depressurise the coal seams. Inevitably this results in higher hydraulic head reduction in the corresponding and overlying model layers surrounding the targeted coal seams.

Impacts to groundwater associated with operation of the Dewhurst 13-18H and Dewhurst 26-31 Pilots, and other pilots which are part of the program, would be discussed in more detail in the EIS.

Santos has prepared and will implement its Groundwater Monitoring and Modelling Plan for the program, which includes a combination of shallow and deep aquifer monitoring bores.

5.2.1.3 Strategy to address potential issues

The proposed drilling and well construction and completion methods would significantly reduce the risk of impacts to groundwater sources during drilling. A groundwater impact assessment, including detailed groundwater modelling would be undertaken during preparation of the EIS. As part of this assessment:

- the volume of water to be extracted from the target coal seams by the proposed wells would be estimated as well as water extracted by the existing surrounding pilot wells
- the potential water level drawdown in the target coal seam and overlying strata would be calculated

- the potential flux of water induced between various formations would be calculated
- resultant impacts to existing groundwater users and GDEs in the area would be assessed.

5.2.2 Biodiversity

5.2.2.1 Background

Preliminary ecological investigations of the proposed activity sites were carried out by RPS for both the Dewhurst 13-18H Pilot and Dewhurst 26-31 Pilot, and included:

- searches of the EPBC Act Protected Matters Search Tool and the OEH Atlas of NSW Wildlife database for threatened biodiversity records within 10 kilometres of the site
- a review of National Vegetation Information Systems mapping for the Namoi Catchment
- a review of available aerial photography
- an ecological survey of the proposed lease areas for Dewhurst 30 and 31 and surrounds on 14 November 2012 to confirm vegetation communities and assess fauna habitat
- detailed fauna surveys targeting areas of higher value habitat between 12 and 16 November 2012 for Dewhurst 30 and 31
- an ecological survey of the Dewhurst 13-18H Pilot on 24 January 2013.

The results of the investigation are summarised below.

5.2.2.2 Existing environment

Flora

Vegetation community

One vegetation community, the Narrow-leaved Ironbark Shrubby Woodland, was identified at both sites during ecological field surveys. This community does not constitute a Threatened Ecological Community (TEC) listed under the EPBC Act or the TSC Act. This community is commensurate with the Ironbark Shrubby Woodland of the Pilliga Area, Brigalow Belt South as mapped by the Namoi Catchment Management Authority (NCMA, 2013).

At Dewhurst 30 and 31, the canopy height ranges from 13 to 18 metres and is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*) with Brown Bloodwood (*Corymbia trachyphloia*) also occasionally occurring.

Canopy cover is approximately 45 per cent at the site of Dewhurst 31, and 20 per cent at Dewhurst 30. The sub-canopy is moderately sparse (approximately 15 per cent), ranging in height from 8 metres to 11 metres. The sub-canopy is dominated by Bulloak (*Allocasuarina luehmannii*) and Narrow-leaved Ironbark, with occasional Black Cypress (*Callitris endlicheri*) and White Cypress (*Callitris glaucophylla*).

The shrub layer ranges in height from one to three metres, and is sparse with an average cover of approximately 15 per cent. A denser secondary shrub layer occurs with an average cover of approximately 50 per cent. Height ranges from 0.5 metres to 1.75 metres. The shrub layer varies across the site, with many areas that are void of a shrub layer, particularly adjacent to the existing road. Ground-cover is sparse, with grasses, herbs and forbs comprising approximately 30 per cent of ground cover.

This Narrow-leaved Ironbark Shrubby Woodland community at Dewhurst 30 and 31 was observed to be generally in good condition, and is considered to be remnant vegetation. Disturbances are associated with the existing roads, and historical logging. Dewhurst 30 also comprises a disused access track through the site.

At Dewhurst 13-18H, the canopy (comprising 20 per cent coverage) is dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*) with Pilliga Grey Box (*Eucalyptus pilligaensis*) occasionally occurring. A secondary

canopy layer occurs (with 20 to 35 per cent coverage), and is dominated by White Cypress Pine (*Callitris glaucophylla*). The understorey is comprised of two shrub layers. The primary shrub layer (comprising up to 45 per cent coverage) includes Pilliga Wattle (*Acacia pilligaensis*), Carol's Wattle (*Acacia caroleae*), Dean's Wattle (*Acacia deanei*) and Sticky Hop-bush (*Dodonaea viscosa*). The secondary shrub layer (30 per cent coverage) comprises Urn Heath (*Melichrus urceolatus*), Dean's Wattle and Prickly Beard-heath (*Leucopogon juniperous*). Ground cover is moderate, with native perennial grass (approximately 25 to 30 per cent coverage), herbs and forbs. Patches of bare ground occupy approximately 30 per cent of this community, while leaf litter constitutes approximately 25 per cent of the ground cover.

Threatened flora species

No threatened species were identified during the ecological field surveys at either pilot site. However, both sites provide suitable habitat to support *Bertya opposens*, *Rulingia procumbens*, *Tylophora linearis* and *Pterostylis cobarensis* species, which are listed under both the TSC Act and EPBC Act; *Philotheca ericifolia* listed under the EPBC Act; and *Polygala linariafolia* listed under the TSC Act.

Weeds

No environmental weeds were identified on either pilot site during ecological field surveys.

Fauna

Fauna Surveys

No species listed under the EPBC or TSC Act were observed during the field surveys at the Dewhurst 13-18H Pilot however marginal habitat was observed that could provide limited foraging and breeding opportunities for some threatened species.

No species listed under the EPBC Act were recorded in the area of consideration during the field surveys for Dewhurst 26-31. Fauna surveys have been conducted in close proximity to Dewhurst 30 and 31, as part of the ecological assessment for Dewhurst 26-29 and the Dewhurst Southern Flow Line projects. These surveys revealed the presence of 45 bird species, 19 mammal species (including 12 microbat species), three amphibians, and 12 reptile species within habitat consistent with, and adjoining the site. The surveys identified the following TSC Act listed threatened fauna species, which are considered likely to occur within the proposed activity site:

- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)
- Speckled Warbler (*Chthonicola sagittata*)
- Little Pied Bat (*Chalinolobus picatus*)
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*).

In addition, the Bristle-faced Free-tailed bat (*Mormopterus eleryi*), listed as Endangered under the TSC Act may also occur but could not be reliably identified from Anabat recordings.

Habitat values and connectivity

The habitat surrounding the Dewhurst 13-18H Pilot provides a range of resources for native fauna species, however clearing and infrastructure associated within the existing well lease areas and access tracks has resulted in edge effects. Habitat values are considered to be limited within the area surrounding the existing lease areas, access tracks and public road as a result of such disturbances. The Dewhurst 13-18H Pilot site may still provide foraging resources for a range of species.

The Dewhurst 30 and 31 sites comprise woodland habitat characterised by a moderately sparse canopy and a varying shrub layer. Several trees with small to medium sized hollows occur across the site. These hollows could provide breeding habitat for numerous native birds, mammals and reptiles, including several threatened species such as the Eastern Pygmy Possum (*Cercartetus nanus*), Corben's Long-eared Bat (*Nyctophilus corbeni*) and Barking Owl (*Ninox connivens*). Other features include a hollow termite mound, numerous fallen logs and old stockpiles.

The Eucalypt canopy is also likely to provide foraging resources for nectar-reliant bird species, such as honeyeaters, parrots and wattlebirds. The moderate to sparse understory would provide foraging, sheltering and breeding opportunities for a variety of native birds and small mammals.

The area of consideration for Dewhurst 30 and 31 occurs within the Pilliga East State Forest, which forms part of the largest contiguous patch of remnant vegetation in NSW, much of which forms state forests and conservation area. The Pilliga Scrub supports a diverse array of habitats, and includes numerous ephemeral waterways. The contiguous nature of the remnant vegetation provides easy movement and dispersal opportunities throughout the Pilliga Forest. Outside of the forested area, barriers to movement include the Newell Highway, and large tracts of agricultural land.

At a local scale, the area of consideration for Dewhurst 30 and 31 is somewhat fragmented by access tracks, with some disturbances associated with forestry and existing CSG activities. While these are not considered to be serious barriers for movement of most fauna species, smaller mammals may be impacted by local fragmentation.

Migratory species

Six migratory terrestrial species listed under the EPBC Act have the potential to occur at both pilot sites, based on the presence of suitable habitat and known species distribution. Of these, one has been recorded, namely the White-threaded Needle-tail (*Hirundapus caudacutus*).

Groundwater Dependant Ecosystems for Dewhurst 13-18H and Dewhurst 26-31

Two high priority groundwater dependent ecosystems (GDEs), Hardys Spring and Eather Spring, are located in the vicinity of the proposed activity. These are hydrogeologically associated with the Pilliga Sandstone aquifer.

5.2.2.3 Consideration of potential issues

The proposed activity would result in the removal of only a small area of vegetation. The proposed activity at the Dewhurst 13-18H Pilot would require the removal of about 0.3 hectares of vegetation to allow for the new gas and water gathering system. No other vegetation removal would be required, as the lease areas have already been established. The proposed activity at Dewhurst 30 and 31 would require clearing of approximately two hectares of vegetation for the two lease areas at Dewhurst 30 and 31 and some additional clearing for access tracks, and the potential for removal of some hollow bearing trees.

Clearing native vegetation and loss of hollow bearing trees are key threatening processes listed under the TSC Act and EPBC Act. EcoLogical Australia has prepared considered cumulative vegetation clearing effects across all activities as part of Santos' Energy NSW CSG Exploration and Appraisal Program, as well as historical clearing from CSG activities. Given the relatively small amount of clearing as a proportion of available habitat, the current land uses and extent of rehabilitation, exploration impacts are generally not expected to significantly fragment or reduce the availability of habitat in a way which will adversely affect species within PEL 238 or PAL 2 (EcoLogical, 2013a & 2013b).

It was noted that wherever possible, the exploration works have utilised existing tracks for access, for conducting surveys and for the installation of flowline infrastructure. Some of the exploration has taken place in areas that have previously been cleared and are used for activities such as farming and grazing. Impacts are largely linear in nature within the context of a well vegetated landscape predominately managed for forestry.

The impact on threatened bird species recorded is considered unlikely to be major, given the minimal clearing proposed, and the highly mobile nature of these species. While threatened bat species are also highly mobile, they may potentially minimise the hollow-bearing trees within the sites. Of note, many hollow-bearing trees occur along the eastern boundary of Dewhurst 30. The final location of the lease area would be positioned to minimise the removal of these trees, where feasible.

Construction and drilling activities have the potential to introduce weeds to the site or spread existing weeds throughout the site and surrounding area. Soil, seed or vegetation attached to plant, machinery, vehicles or personnel may transfer weeds to or from the site. Vegetation removal and earthworks may create favourable conditions for weeds and encourage weed growth. To address these potential threats, Santos has prepared a weed management strategy and a comprehensive rehabilitation strategy will be prepared which will address issues of restoration, weed invasion and feral animal invasion over the life of the program.

During construction, noise generated by vehicles, machinery and drilling may deter native fauna from the site or surrounding areas, which may affect the migration and dispersal ability of native fauna. The breeding cycle, roosting, sheltering and foraging behaviour of some fauna species may be impacted by noise, lighting and vehicle traffic. Such impacts would likely only affect individuals for the duration of construction and drilling activities. Dust generated during construction has the potential to disrupt the pollination cycle and the ability of some native plants to re-generate.

During operation, noise would be emitted from the generator and pumps although noise levels are expected to be much lower than during drilling activities and are not anticipated to result in major impacts to native fauna.

Groundwater would be extracted from coal seams within the Maules Creek Formation. The results of numerical groundwater modelling indicate the proposed activity is not expected to impact on the Pilliga Sandstone aquifer on which the Hardy's Spring and Eather Spring GDE's are reliant (Halcrow, 2013a and Halcrow, 2013b).

5.2.2.4 Strategy to address potential issues

The modified gathering system at Dewhurst 13-18H has been designed along existing access tracks, where possible to reduce the need for vegetation removal. The Dewhurst 30 and 31 pilot wells have also been sited adjacent to existing roads and access tracks to minimise vegetation clearing and have also avoided areas of higher quality habitat within the Pilliga such as riparian corridors and heath communities.

The area of disturbance would be minimised as much as practicable during construction. In addition the following would be proposed:

- fauna spotter/catcher would be present during vegetation clearing to identify and relocate any native fauna at risk of injury or displacement in the work area
- any hollow bearing trees that require removal would be relocated to the edge of the lease area.
- weed management measures would be implemented throughout construction and operation
- noise and dust management measures implemented to reduce the potential impacts to biodiversity.

Potential impacts to biodiversity from the proposed activity would be further assessed in the EIS and specific mitigation strategies identified. This would include:

- assessments of significance for each EPBC Act listed species that may potentially be impacted by the proposed activity in accordance with the EPBC Act and *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines Matters of National Environmental Significance* (DEWHA, 2009)
- assessments of significance (7-part tests) for all TSC Act listed species that may potentially be impacted by the proposed activity in accordance with *Threatened Species Assessment Guidelines: The assessment of significance* (DECC, 2007).

Additional fauna surveys are not recommended given that a summer survey has already been conducted adjacent to the sites. The methodology for this survey would be detailed in the EIS. Numerous surveys have also been conducted within similar habitat types within the Pilliga for other Santos activities, the results of which would be considered as part of the EIS for the proposed activity.

5.2.3 Bushfire

5.2.3.1 Existing environment

Fire plays a major role in the ecology of the Pilliga scrub, with many plant species depending on fire to regenerate. In unfavourable conditions fire can be extremely intense, destroy entire ecosystems, spread very quickly and threaten nearby properties. The critical wildfire season generally occurs during November and December (NPWS, 2006 & OEH, 2012).

The magnitude of historical Pilliga bushfires correlates with the El Nino Southern Oscillation phenomena, with El Nino (dry) years having the most severe fires (NPWS, 2006). During El Nino periods, the critical wildfire season can extend from September to January (NPWS, 2006 & OEH, 2012). In 1997 a major fire burned almost half the Pilliga scrub, while an extremely dry winter and spring in 2006 saw a number of large fires develop (NPWS, 2006). Areas of the Pilliga Nature Reserve to the south of the site were again threatened by fire in January 2013.

5.2.3.2 Consideration of potential issues

Construction activities would increase the risk of fire through the use of hot works and the operation of machinery in a hot and fuel-laden environment in close proximity to vegetation. However, the lease areas would be cleared of vegetation to reduce the risk of ignition occurring.

During operation, gas would be transferred to Dewhurst 14 (for the Dewhurst 13-18H Pilot) and Dewhurst 28 (for the Dewhurst 26-31 Pilot) where a flare is located and has been designed to limit the risk of ignition. There may be an increased risk of fire in the event of a blow out at the wellhead. However, such a risk is considered to be minimal, as both wells would have blow out preventers (BOPs) installed.

5.2.3.3 Strategy to address potential issues

The risk of bushfire would be assessed in more detail as part of the EIS and measures to reduce the risk, such as use of blue chip metal around the wellhead, would be explored.

5.2.4 Air quality and greenhouse gas emissions

5.2.4.1 Existing environment

The nearest sensitive receivers are approximately 1.8 kilometres from the Dewhurst 13-18H Pilot and 11 kilometres from the Dewhurst 26-31 Pilot. Air quality in the region is influenced by mining activities,

grazing, land clearing and soil preparation, sowing and harvesting of crops, vehicle and heavy machinery movements, bushfires, burn-offs and use of combustion heaters.

5.2.4.2 Consideration of potential issues

Potential air emissions from the proposed activity would include:

- dust generated during establishment of the well lease, including excavation and well drilling
- exhaust emissions from vehicle movements to and from the site
- exhaust emissions from plant and machinery operations onsite,
- venting of methane (CH₄) and carbon dioxide (CO₂) during drilling.

Dust levels generated by the proposed activity would vary depending on weather conditions.

The main air pollutants associated with vehicle, plant and machinery exhaust emissions include fine particulates (PM_{2.5}), carbon monoxide, oxides of nitrogen, carbon dioxide and hydrocarbons. These pollutants generally dissipate with distance from the source and are therefore unlikely to affect nearest sensitive receptors given the distance to these receptors.

Scope 1 air emissions (direct GHG) from the proposed activity would include:

- exhausts from plant and machinery
- small quantities of CH₄ and CO₂ release during drilling, venting and flaring
- fugitive emissions of CH₄ and CO₂ from the wellhead or joins in the gathering system during operation
- clearing of vegetation (when vegetation is cleared the stored carbon is typically lost to the atmosphere as CO₂ along with small amounts of carbon monoxide (CO) and CH₄).

Scope 2 (indirect GHG) emissions would not occur as there would be no purchases of electricity from the grid.

Scope 3 (other indirect) emissions would be associated with the transport of material and equipment to the site during construction.

5.2.4.3 Strategy to address potential issues

The EIS would investigate and identify appropriate measures to reduce dust and other air emissions from the proposed activity. These would include such measures as minimising the area of disturbance, imposing site speed limits and turning off plant and vehicles when not in use.

Direct greenhouse gas emissions associated with the proposed activity would be identified and the quantities estimated as CO₂ equivalent. Estimated greenhouse gas emissions would be compared to NSW and national greenhouse gas emissions.

5.2.5 **Noise and vibration**

5.2.5.1 Existing environment

The existing noise environment immediately around the sites is expected to be typical of a rural area with background noise levels influenced by birds, insects wind through trees. The nearest sensitive noise receivers are 1.8 kilometres from the Dewhurst 13-18H Pilot and 11 kilometres from the Dewhurst 26-31 Pilot. A dwelling is located within 500 metres of Dewhurst 13-18H although this is part of an area that is under lease to Santos Ltd, through Eastern Star Operations Pty Ltd for a three year period to December 2015 and is currently vacant.

Baseline noise monitoring has been conducted at the site by Noise Measurement Services as part of an initial noise assessment for Dewhurst 13-18H. The assessment concluded that, in the absence of insects and winds the background noise levels recorded are below 30 dBA. Background noise monitoring has not been undertaken at receiver sites for Dewhurst 26-31 given the distance to the nearest sensitive receivers.

5.2.5.2 Consideration of potential issues

Noise and vibration would be generated during site preparation, drilling and cementing activities. The greatest noise and vibration impacts have the potential to occur during the drilling activities, which may occur 24 hours a day, seven days per week. Noise generated by the proposed activity during construction may be audible at the nearest sensitive receiver for the Dewhurst 13-18H Pilot, however noise impacts at sensitive receivers are not expected for the Dewhurst 26-31 works given the distance between the pilot and location of sensitive receivers.

Noise and vibration during operation of the pilot wells is not expected to be an issue for sensitive receivers.

5.2.5.3 Strategy to address potential issues

The EIS would assess potential noise and vibration impacts of the proposed development in accordance with the *Interim Construction Noise Guideline* (DECCW, 2009). The assessment would:

- identify all potentially affected sensitive receivers
- predict noise and vibration impacts at these receivers
- identify mitigation and management measures to reduce noise and vibration impacts.

5.3 **Other environmental issues**

5.3.1 **Geology, soils and land stability**

5.3.1.1 Existing environment

PEL 238 is located in the central portion of the Gunnedah Basin where Jurassic and Cretaceous Surat Basin sediments unconformably overlie Permo Triassic Gunnedah Basin sediments. The stratigraphy of the Gunnedah Basin is illustrated in Figure 5-1.

The soil landscape underlying the Dewhurst 13-18H Pilot and surrounds is designated as 'Coghill Alluvial Plains' according to the *NSW (Mitchell) Landscapes* (DECC, 2002). The *Draft Inherent Soil Fertility mapping of the New England – North West region* (OEH, 2012) describes the soil fertility of Dewhurst 30 and 31 as 'moderately low' to 'low'.

The soil landscape underlying the Dewhurst 26-31 Pilot and surrounds is designated as 'Cubbo Uplands' according to the *NSW (Mitchell) Landscapes* (DECC, 2002). The *Draft Inherent Soil Fertility mapping of the New England – North West region* (OEH, 2012) describes the soil fertility of Dewhurst 30 and 31 as 'moderately low'.

5.3.1.2 Consideration of potential issues

Minor earthworks may be required to prepare lease areas for the new wells at Dewhurst 30 and 31 and for the connections to the gas and water gathering systems for both pilots. Such works have the potential to cause soil erosion, loss of topsoil and sedimentation of waterways. However, on completion of drilling activities, the lease areas/gathering systems would be partially rehabilitated to the minimum area necessary for ongoing operation.

The proposed activity could result in soil contamination as a result of spilled or leaked chemicals (such as drilling fluid additives), fuel or oil. Spills or leaks could occur during handling, use, storage or transit of chemicals, fuels and oils. Spills or leaks may also occur during refuelling or maintenance of plant or equipment. There is minimal risk of soil contamination occurring due to the use of drilling fluid as this would be water-based and would contain non-toxic additives.

5.3.1.3 Strategy to address potential issues

The EIS would investigate and identify appropriate measures to address soil erosion and sedimentation issues and reduce the risk of contamination due to accidental spills or leaks or other site activities.

Gunnedah and Surat Basins Stratigraphy

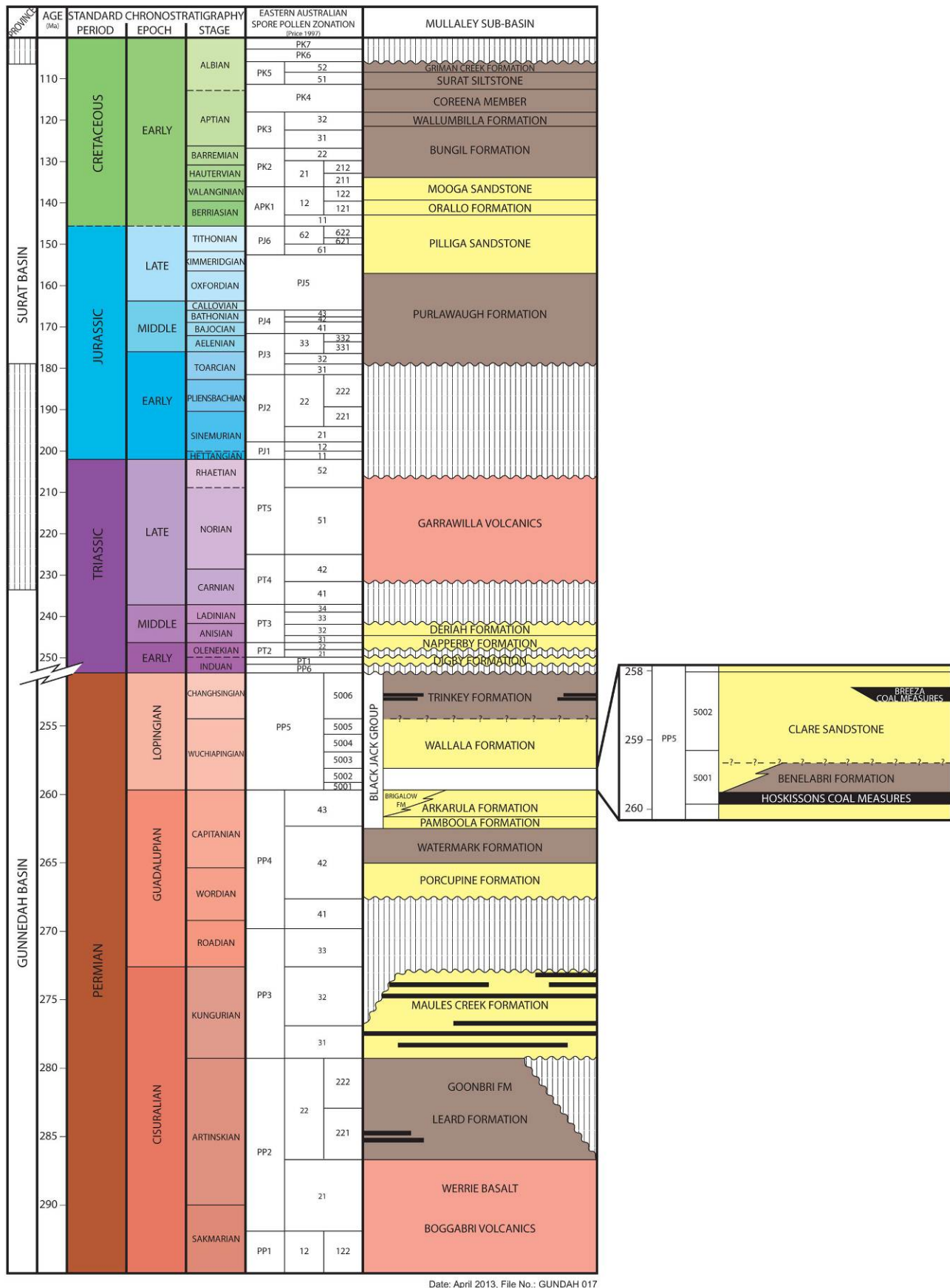


Figure 5-1 Gunnedah-Surat Basin stratigraphy

5.3.2 Surface water

5.3.2.1 Existing environment

The proposed activity is located within the Namoi River catchment that covers an area of approximately 42,000 square kilometres stretching from Woolbrook in the east to Walgett in the west. Its main tributaries are the Manilla and Peel rivers that join the Namoi upstream of the Boggabri, and the Coxs, Pian, Narrabri, Baradine and Bohena creeks that join below Boggabri (NCMA, 2012).

The Dewhurst 13-18H Pilot is located within the Eulah Creek sub-catchment of the Namoi River catchment. The sub-catchment covers an area of approximately 1,581 square kilometres and extends north and south of the Namoi River. The main tributaries within the sub-catchment include an unnamed tributary of Tuppiari Creek that flows into Tuppiari Creek and Jacks Creek. The drainage line flows east to west across the site, crossing the existing gathering system between the Dewhurst 16H and 17H lease areas and again between the Dewhurst 14 and 15 lease areas. Figure 5-2 shows the drainage for Dewhurst 13-18H and the drainage mapping also indicates that the creek intercepts Dewhurst 14 on a diagonal, although this drainage line was not observed during onsite inspections.

The Dewhurst 26-31 Pilot is located within the Bohena Creek sub-catchment of the Namoi River catchment. The Bohena Creek sub-catchment stretches for a distance of approximately 50 kilometres and covers an area of approximately 830 square kilometres. The main tributaries within the sub-catchment include Bohena, Cowallah and Bibblewindi Creeks (NCMA, 2012). This sub-catchment forms the Bohena Creek Water Source under the Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources.

Figure 5-3 shows drainage for Dewhurst 26-31. An unnamed drainage line is mapped across the southern section of the proposed lease area for Dewhurst 30 (refer Plate 5-1). The closest watercourse is Mt Pleasant Creek that extends between Dewhurst 30 and 31. This creek is approximately 200 metres south-west of Dewhurst 30 and 700 metres north-east of Dewhurst 31.

Both the Dewhurst 13-18H Pilot and Dewhurst 26-31 Pilot are not located within flood prone land.



Plate 5-1 Unnamed drainage line at Dewhurst 30

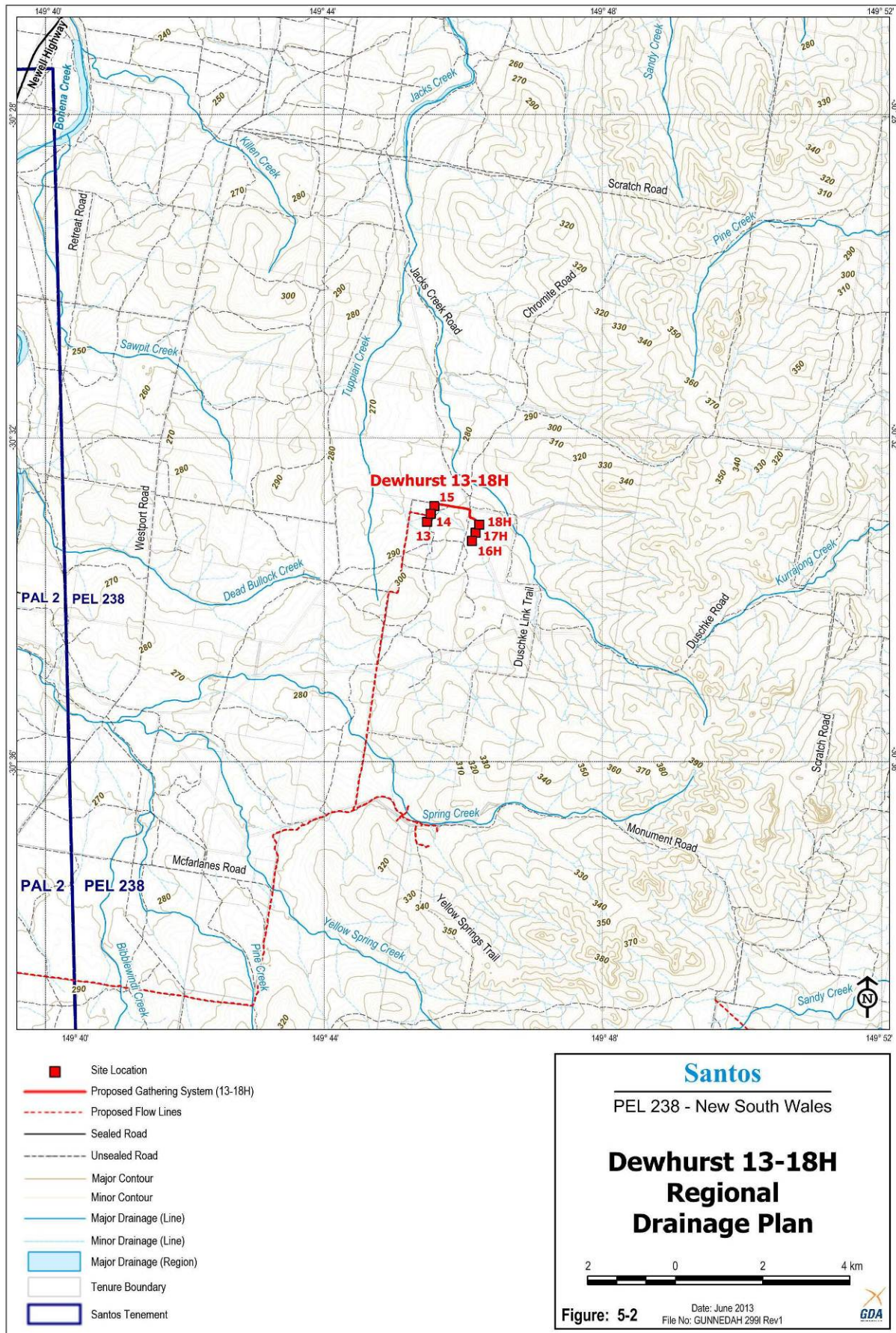


Figure 5-2 Drainage for Dewhurst 13-18H

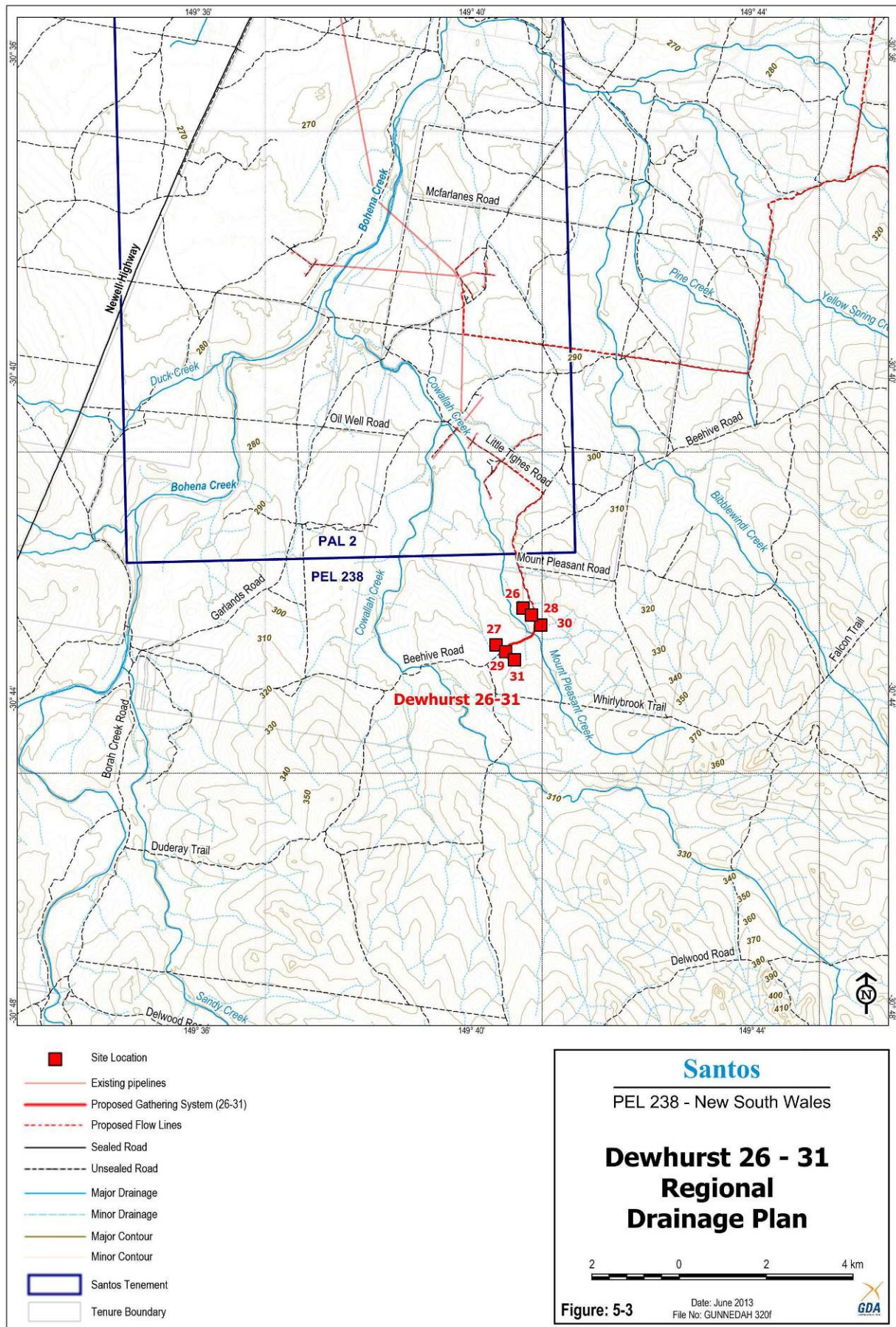


Figure 5-3 Drainage for Dewhurst 26-31

5.3.2.2 Consideration of potential issues

As discussed in Section 5.3.1.2, earthworks and stockpiling activities would increase the erosion potential of the sites and may result in increased sediment loads in surface runoff, which could increase turbidity and suspended sediment loads within local drainage lines.

There is potential for drilling fluid to be spilled due to overflow of surface tanks as a result of heavy rain or tank failure, during the drilling process or during transit to and from the sites. This could result in pollution of waterways with sediment and other contaminants. There is potential for other pollutants such as chemicals, fuels, oils or litter to enter drainage lines or waterways and degrade local water quality during construction or operation.

The proposed activity would not affect the flow regime of the area, or be impacted by floods, as the pilots are not located within flood prone land.

5.3.2.3 Strategy to address potential issues

Potential impacts to surface waters, and in particular to the unnamed drainage line within the vicinity of Dewhurst 30, would be assessed in the EIS. The EIS would investigate and identify appropriate measures to reduce erosion and sedimentation issues and other impacts to surface waters. Such measures would include installing best practice erosion and sediment control measures prior to site disturbance, limiting the area of disturbance and maintaining spill kits onsite.

Surface tanks are proposed to collect excess drilling fluid and would be appropriately designed to minimise risk of overflows or spills (i.e. extra capacity). Alarms would also be installed to advise of tank failure. Santos has plans to develop a fluids recycling and treatment facility as its existing operations centre, located at 300 Yarrie Lake Road, Narrabri which would assist in the management of drilling fluids. The Narrabri Shire Council approved a Development Application (DA) for the expansion of the operations in March 2012. A second DA to include a fluids treatment facility and a cement bulk facility was submitted to Narrabri Shire Council on 8 April 2013.

5.3.3 **Traffic and transport**

5.3.3.1 Existing environment

Access to the Dewhurst 13-18H Pilot is via an unnamed road to the north of Lot 32 DP 757104 which is a Crown Land road reserve held under enclosure permit (EP 46419) by the landowner of Lot 32 DP 757104. It is an unsealed vehicle track, along which the gathering system will run in parallel. It connects to Killara Road and then Rockdale Road heading south. These roads link in to X-Line Road which connects to the east with the Newell Highway, approximately 20 kilometres from the site. X-Line Road provides an east west connection through the Pilliga Forest, and is predominantly used by Santos and Forestry NSW staff and some local landowners.

Access to the Dewhurst 26-31 Pilot is via Beehive Road that runs in a north-south direction through this section of the Pilliga East State Forest. Beehive Road is an unsealed vehicle track that connects to Garlands Road and the Newell Highway (approximately 12 kilometres west of the site). Dewhurst 30 is about 100 metres east of Beehive Road. Dewhurst 31 is about 300 metres south east of Beehive Road.

5.3.3.2 Consideration of potential issues

The proposed activity is expected to result in increases in traffic along the aforementioned roads throughout the construction and operation of the proposed activity. It is anticipated that the existing road network could

accommodate the proposed levels of traffic; however degradation of the road surface may accelerate, particularly during wet weather.

5.3.3.3 [Strategy to address potential issues](#)

The EIS would identify construction traffic volumes and potential routes associated with the proposed activity and potential for degradation of road surfaces. The EIS would investigate and identify traffic control measures to be employed during construction to minimise traffic disruptions or road safety access/issues.

5.3.4 **Natural resources**

5.3.4.1 [Consideration of potential issues](#)

The Dewhurst 13-18H Pilot has been previously used for low intensity stock grazing activities; however no commercial farming activity currently takes place on this property, with some grazing of domestic stock still occurring. The surrounding land use generally comprises State forest.

The Dewhurst 26-31 Pilot is located within the Pilliga East State Forest. Some vegetation clearing would be required. More information on the biodiversity impacts associated with clearing is included in Section 5.2.2.2. The site is not located within a conservation area or within an existing mining title.

The proposed activity is not located on biophysical strategic agricultural land (BSAL) or a Critical Industry Cluster (CIC) mapped under the *Strategic Regional Land Use Plan New England North West Region*. The closest BSAL are approximately 9.5 kilometres from the Dewhurst 13-18H Pilot and 13 kilometres from the Dewhurst 26-31 Pilot (DoP&I, 2012).

Natural resources required for the proposed activity during construction include diesel and petroleum fuels for operation of plant and machinery and water for drilling and general site activities. Quantities of fuel and water are not expected to be major. Drilling activities would require water that would be sourced from the Narrabri town water supply, licenced bores or trucked onsite.

During operation, the pilot wells would extract significant volumes of groundwater.

5.3.4.2 [Strategy to address potential issues](#)

An Agricultural Impact Statement would be prepared as part of the EIS to consider impacts to agriculture. Potential impacts to groundwater users would be assessed as part of the detailed groundwater impact assessment, as detailed in Section 5.2.1.3. The appropriate water licenses would be obtained prior to taking any water for drilling or other purposes.

5.3.5 **Aboriginal cultural heritage**

5.3.5.1 [Existing environment](#)

A search of the Aboriginal Heritage Information Management System (AHIMS) register and an archaeological inspection of the proposed Dewhurst 13-18H Pilot (31 January 2013) and Dewhurst 30 and 31 well leases (14 November 2012), and surrounding area was undertaken by RPS for due diligence purposes.

Both areas show some signs of disturbance due to previous vegetation clearance, nearby track grading (at Beehive Road, west of Dewhurst 30 and 31) and general vehicle access. No Aboriginal objects, sites, places of significance or culturally modified trees were identified within the lease areas or immediate surrounds during the visual inspection at both pilot locations.

Aboriginal objects are often associated with particular landscape features as a result of Aboriginal people's use of those features for resource procurement, habitation and cultural activities (DECCW, 2010). Such landscape features include rock shelters, sand dunes, waterways, waterholes and wetlands. Although a minor ephemeral drainage line was identified within the Dewhurst 30 lease area during the archaeological inspection, no evidence of Aboriginal objects or sites were identified in association with this landscape feature.

No other landscape features that indicate the likely presence of Aboriginal objects were identified in or near to the lease areas. In addition to this, no Aboriginal objects or places recorded on the AHIMS were identified within 10 kilometres of the pilot sites.

Based on the environmental and cultural heritage context of the lease areas, as outlined above, the potential for any previously unidentified Aboriginal objects or sites to be located within the pilot sites or immediate surrounds is considered to be nil to low.

5.3.5.2 Consideration of potential issues

Risks to Aboriginal cultural heritage result from earthworks and other activities, which disturb the landscape. No earthworks are proposed for the re-drilling of the wells at Dewhurst 13-18H, and only minor earthworks would be required for the new gas and water gathering system. Some drilling and earthworks would be required at Dewhurst 30 and 31.

However the proposed wells and ancillary infrastructure would be located entirely within the proposed lease areas and access tracks, which, as outlined above, have already been subject to an archaeological inspection and desktop assessment for both pilot sites and no objects or places were identified. As such, the proposed activity would not impact on any previously identified Aboriginal cultural heritage objects or places and there is very low potential for any previously unidentified Aboriginal sites or objects to be impacted.

5.3.5.3 Strategy to address potential issues

While potential impacts to Aboriginal cultural heritage are considered highly unlikely, Santos would undertake further Aboriginal cultural assessment as part of the EIS phase in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010). The EIS would prescribe mitigation measures in the event that a potential site or item is uncovered during construction/drilling activities to ensure compliance with Part 6 of the *National Parks and Wildlife Act 1974*.

5.3.6 Non-Indigenous cultural heritage impacts

5.3.6.1 Existing environment

Database searches indicated that there are no items of international, national or state significance listed on the World Heritage List, National Heritage List (including Register of the National Estate) or Commonwealth Heritage List that occur within the Narrabri LGA. No items listed on the NSW State Heritage Register (or of State significance) occur within the site. Several European heritage items of local significance are listed under the *Narrabri Local Environmental Plan 2012*. However, these are not located in the vicinity of the proposed activity.

In addition no heritage sites, relics or places of non-Indigenous cultural heritage value, or vegetation with natural heritage values were recorded on the site during the archaeological survey undertaken by RPS on 31 January 2013 (for Dewhurst 13-18H) and 14 November 2012 (for Dewhurst 30 and 31).

5.3.6.2 Consideration of potential issues

The proposed activity is unlikely to impact on any listed or identified non-Indigenous cultural or natural heritage. There is limited potential for previously unidentified non-Indigenous cultural heritage items or relics to be impacted during the works.

5.3.6.3 Strategy to address potential issues

Based on the archaeological survey and desktop review, the potential for non-Indigenous cultural heritage to exist in the lease areas is extremely unlikely, as such no further detailed assessment is recommended for the EIS phase. However the EIS would prescribe mitigation measures in the event that a potential site or item is uncovered during construction/drilling activities.

5.3.7 **Management of waste and by-products**

5.3.7.1 Consideration of potential issues

The proposed activity would generate the following waste streams during construction:

- drilling fluid and cuttings
- chemical, fuel and oil containers
- general site waste such as packaging materials and scrap metal
- domestic wastes (such as food scraps and rubbish) and sewage
- cement slurry.

The potential impacts associated with the generation, management and disposal of these wastes include:

- leaching of chemicals or other pollutants into groundwater, soils or surface water
- pollution or contamination of land or water due to illegal dumping of waste, lack of suitable containment of waste or improper management of produced water
- littering of the sites, surrounding properties or surface waters due to lack of suitable containment of waste
- odours caused by improper storage or treatment of putrescible waste.

Produced water would be temporarily stored at the water storage tank at Dewhurst 14 before it is transferred via flowlines to the proposed Leewood Produced Water Facility.

5.3.7.2 Strategy to address potential issues

Waste would be managed in accordance with the resource management hierarchy principles of the *Waste Avoidance and Resources Recovery Act 2001*. The EIS would identify and quantify wastes and provide a waste management strategy for the proposed activity following these principles. Where possible materials will be reused or recycled. For example, the drilling fluid (once separated from the cuttings) would be reused onsite for other drilling projects in the area. The EIS would provide a detailed management strategy for drilling fluids and consider in detail any impacts associated with gas and water by-products.

6.0 Justification

6.1 Need and benefits

The proposed activity is necessary for the ongoing exploration, appraisal and evaluation of the CSG hydrocarbon potential in PEL 238 and PAL 2. The proposed activity is part of Santos' wider exploration and appraisal program. The program will assist in gaining further knowledge of coal fines, gas composition and flow rates, the deliverability of the reservoir, and investigating well design, drilling and completion technologies. This information is essential to determine whether a commercial gas production project is viable and would be used in development planning for a potential commercial gas production project within the areas of PEL 238 and PAL 2.

Discovery of the CSG resources in the area has the potential to increase NSW's gas reserves and revenue from gas, and underpin future exploration and production in the region. Not undertaking the proposed activity would limit the evaluation of the potential CSG resource.

The proposed activity is consistent with the SRLUP, which recognises the regions potential for CSG production and identifies the sites and surrounding land as having high CSG resources. The SRLUP states that development of the gas industry in the region would bring capital investment and economic benefits, and has the potential to play a significant role in the delivery of a secure supply of domestic gas for NSW and alleviate the States' reliance on imported gas.

6.2 Site selection

6.2.1 Dewhurst 13-18H

There is limited previous targeted drilling in this area of the Gunnedah Basin for the Namoi and Rutley seams. Establishing wells to target these seams is essential to gain knowledge of the gas content, composition and detailed stratigraphic data, which can then inform potential production potential.

It is proposed to target the Namoi and Rutley seams through establishing additional horizontal wells within three existing wells at Dewhurst 16H, 17H and 18H. The benefit of such an approach is that it minimises existing infrastructure and access tracks, and removes the need for additional land and vegetation clearing. Alternative options would require the establishment of new lease areas, wells and surface infrastructure.

The existing gas and water gathering system does not currently meet Santos standards and needs to be replaced. It is proposed to upgrade the gathering system and to include links from the Dewhurst 16H, 17H and 18H wells to a central gas and water facility to be installed at Dewhurst 14 (this includes new water storage tank and flare). The proposed new gathering system would be installed adjacent to the existing access tracks to minimise vegetation impacts.

6.2.2 Dewhurst 26-31

The proposed Dewhurst 30 and 31 pilot wells would complement and expand on the operations of the planned Dewhurst 26-29 pilot wells and are located in a geologically favourable area.

Efforts have been made to locate the Dewhurst 30 and 31 pilot wells outside of areas of 'very high' or 'high' ecological sensitivity and to use existing access from Beehive Road to minimise vegetation clearing. The Dewhurst 30 and 31 pilot wells would utilise the gas and water gathering system (with extensions to the Dewhurst 30 and 31 well sites) proposed for Dewhurst 26-29 minimising the need for additional new infrastructure.

7.0 Consultation

The Dewhurst 13-18H Pilot is located partly on freehold land (Lot 32 DP 757104) and partly within the Crown Land road reserve held under an enclosure permit (EP 46419) by the landowner of Lot 32 DP 757104. Santos has engaged extensively with the landowner and a land access and compensation agreement is in place. Key issues raised by the relevant landowner relevant included property access and security, the implementation of a bore monitoring program and rehabilitation works.

A road closure application has been lodged by the landowner with the Crown Lands Division within the DTIRIS with a decision yet to be made, as of the date of this document. If the road is closed and purchased by the landowner, the land access and compensation agreement would need to be revised accordingly. However, if the road is closed and but not purchased, the land will vest in the Crown.

The Dewhurst 26-31 Pilot is located on land managed by the Forestry Corporation of New South Wales (Forestry NSW). Santos holds a Permit to Occupy from Forestry NSW and the State of NSW. The Permit to Occupy outlines a range of environmental mitigation strategies that Santos must comply with.

Santos and Forestry NSW are in regular contact, including regular meetings between Santos' Narrabri Operations Manager and a representative of Forestry NSW. A schedule of upcoming activities is provided to Forestry NSW, which is updated on a monthly basis.

In addition, the following stakeholders will also be consulted during preparation of the EIS and throughout all stages of the proposed activity:

- Landowner and adjoining landowners
- Commonwealth Department of Sustainability, Environment, Water, Population and Communicates
- Department of Trade, Investment, Regional Infrastructure and Services (DTIRIS) including the Offices of Coal Seam Gas contained and the Division of Resources and Energy
- Department of Primary Industries including the NSW Office of Water, Forestry Corporation of NSW, NSW Agriculture, NSW Fisheries and Catchment and Lands (Crown Lands Division)
- Environment Protection Authority
- NSW Health
- Office of Environment and Heritage (including the Heritage Branch)
- Namoi Catchment Management Authority
- Roads and Maritime Services
- Narrabri Shire Council
- NSW Rural Fire Service
- Narrabri Local Aboriginal Land Council
- The Gomeroi People
- Community Consultation Committee – Narrabri Shire (Narrabri CCC)
- General community.

Division 6 of Part 6 of the *Environmental Planning and Assessment Regulation 2000* also prescribes minimum requirements for public participation for SSD including publication of the notice of the development application within a local newspaper and a minimum 30 day exhibition period. These activities would be undertaken by the Department of Planning and Infrastructure once the EIS is submitted and accepted by the Department.

8.0 Capital investment value

The estimated capital investment value of the proposed activity is approximately \$11.3 million for the expansion activities at the Dewhurst 13-18H Pilot and \$6.49 million for the Dewhurst 30 and 31 wells (as part of the expansion of the Dewhurst 26-31 Pilot).

9.0 Conclusion and next steps

The proposed activity (expansion works to the Dewhurst 13-18H and Dewhurst 26-31 Pilots) can be classified as SSD as per the provisions of the SRD SEPP and therefore requires assessment and development consent by the Minister for Planning and Infrastructure under Part 4, Division 4.1 of the EP&A Act. To this end, an EIS assessing the proposed activity would be prepared to support the development application.

This report supports Santos' formal request for Director-General's Requirements (DGRs) to prepare an EIS for the proposed activity. This report has provided a preliminary environmental assessment of the proposed activity and identified key issues for the proposed activity, which are considered to be biodiversity, groundwater, bushfire risk, noise impacts, air quality and emissions and community relations.

The EIS to be prepared for the proposed activity will assess the DGRs and all issues identified in the preliminary environmental assessment. A range of stakeholders will also be consulted during preparation of the EIS. Once submitted to the Department of Planning and Infrastructure, the EIS will be placed on public exhibition for a minimum period of 30 days, during which time the Department will invite the public and government agencies to make submissions.

10.0 References

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11.0 Terms and abbreviations

Term/abbreviation	Meaning
Abandonment	Decommissioning the well. A process that involves shutting down the well and rehabilitating the site.
AHIMS	Aboriginal Heritage Information Management System
AIP	Aquifer Interference Policy
Annulus	The space between the wellbore and surrounding pipe.
Blow out preventer	One of several valves installed in a wellhead to prevent the escape of pressure either in the annular space between the casing and the drill pipe or in the open hole during drilling, completion and workover operations.
BOP	Blow out preventer
BSAL	Biophysical Strategic Agricultural Land (as defined in the <i>Strategic Regional Land Use Plan</i>)
CCC	Community Consultation Committee
Cementing	The application of a liquid slurry of cement and water to various points inside and outside the casing.
CH ₄	Methane
CIC	Critical Industry Cluster (as defined in the <i>Strategic Regional Land Use Plan</i>)
CO ₂	Carbon Dioxide
Coring	Process of cutting a vertical, cylindrical sample of the formations.
CSG	Coal Seam Gas
DGRs	Director-General's Requirements
Drill fluid	Circulating fluid that can lift cuttings from the wellbore to the surface and to cool down the drill bit.
DTIRIS	Department of Trade, Investment, Regional Infrastructure and Services
EIS	Environmental Impact Statement
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPL	Environment Protection Licence
ESA	Ecological Sensitivity Analysis (study carried by EcoLogical Australia)
ESP	Electrical Submersible Pump
GAB	Great Artesian Basin
LCM	Lost circulation material
LEP	Local Environmental Plan
LGA	Local government area
MD	Measured depth
MDB	Murray Darling Basin
Mining SEPP	<i>State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007</i>
MNES	Matter of National Environmental Significance
MSDS	Materials Safety Data Sheets
NNTT	National Native Title Tribunal
NOW	NSW Office of Water
OEH	Office of Environment and Heritage

Term/abbreviation	Meaning
PAL	Petroleum Assessment Lease
PCP	Progressive Capacity Pump
PEL	Petroleum Exploration Licence
Plug	Any object or device that blocks a hole or passageway.
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
REF	Review of Environmental Factors
RTU	Remote Telemetry Unit
SAL	Strategic Agricultural Land (as defined in the <i>Strategic Regional Land Use Plan</i>)
SCA	State Conservation Area
SEPP	State Environmental Planning Policy
SRD SEPP	<i>State Environmental Planning Policy (State and Regional Development) 2011</i>
SRLUP	<i>Strategic Regional Land Use Plan</i>
SSD	State Significant Development as prescribed by the <i>State Environmental Planning Policy (State and Regional Development) 2011</i>
TEC	Threatened Ecological Community
TSC Act	<i>Threatened Species Conservation Act 1995</i>
Surface casing	A drilled and cemented pipe used to provide blow-out protection, to seal off water/hydrocarbon sands and prevent the loss of circulation. Also used to seal off water sands, weak formations and/or lost circulation zones. In some cases surface and intermediate casing requirements are provided by the same string.
WAL	Water Access Licence
Wall cake	Low permeability 'skin' around the wall of the hole.
Wellhead	The system of spools, valves and associated adapters that provide pressure control for production.
WMA	<i>Water Management Act 2000</i>
WSP	Water Sharing Plan