Review of Environmental Factors

Brawboy Vertical Seismic Profile - PEL 456

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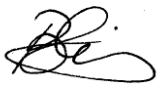
REF Prepared by:	Belinda Lewis RPS Level 12 92 Pitt Street Sydney NSW 2000 Position: Senior Planner Qualifications: Bach Env Sci (Hons) Signature:  Date: 30 September 2011 (Rev 1)
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Titleholder Declaration (Joint Titleholder)	As joint titleholder I declare that the information contained in this Review of Environmental Factors is neither false nor misleading. Name: Santos QNT Pty Ltd (as joint title holder declaration) Signature: Date:

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Executive Summary

Overview

RPS has prepared this Review of Environmental Factors (REF) on behalf of Santos QNT Pty Ltd (Santos) as Operator for and on behalf of the titleholders to assess the environmental impact of the proposed Vertical Seismic Profiling (VSP) and ancillary activities at a property located on Upper Dartbrook Road, Scone in the Gunnedah Basin. The purpose of the proposal is to investigate the potential coal seam gas resource within Petroleum Exploration Licence No. 456 (PEL 456).

The VSP involves driving a low impact vibrating unit, known as an EnviroVibe truck, across a 1.7km source line. The EnviroVibe truck lowers a 1m x 1m plate onto the ground surface and vibrates the ground at every 25 – 50m along the length of the line.

Utilising an existing suspended wellbore (Brawboy 2) a VSP tool will also be run into the wellbore from a wireline truck where it will receive signals from the surface in the form of vibrations. The vibrational energy received by the VSP will be interpreted and may assist with determining the depth of the coal in proximity of the wellbore as well as any changes in coal depth as one would walkaway from the wellbore.

As specialist Ecological Assessment has been undertaken by RPS to assist in the preparation of this REF.

Consideration has also been given to a broader range of environmental impacts, including heritage, air, surface water, soils, chemical and hazardous substances management, contaminated land, waste minimisation and management, natural resources, local community and neighbouring properties, visual impacts, land use and cumulative environmental effects.

Environmental Impacts

Ecology

Despite its highly disturbed condition, the VSP will be conducted within an area that is considered to be representative of White Box - Yellow Box - Blakely's Red Gum Woodland Endangered Ecological Community (EEC), listed under the *NSW Threatened Species Conservation Act 1995 (TSC) Act*. This community is not considered to be representative of the similar *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC) Act* listed Threatened Ecological Community (TEC). The ground cover of the site is dominated by weed species, with up to 65% weed cover.

No threatened fauna or flora species listed under the TSC Act and/or EPBC Act were recorded within the study area. Additionally, the likelihood of threatened flora and fauna species occurring in the study area is considered to be moderate to low.

A 7-part test of significance was undertaken for the White Box-Yellow Box-Blakely's Red Gum Woodland EEC. The 7-part test concluded that there is not likely to be a significant effect on this community arising from the proposed activities.

The ecological report concluded that the potential direct and indirect impacts that may be associated with the proposal are considered to be minimal.

Matters of National Significance

Pursuant to the EPBC Act, an assessment of potential impacts arising from the proposal on matters of national environmental significance (MNES) has been undertaken. The assessment has concluded that no significant impact is likely to relevant MNES.

Heritage

A due diligence survey of the proposed site was undertaken on 30 March 2011. This survey was conducted by Steven Coghill, Indigenous Affairs Officer for Santos and included the proposed VSP source line. No artefactual material was identified along the source line alignment as a result of the survey. The site comprises pastoral land that has been highly disturbed by clearing, grazing, cropping and general agricultural pursuits.

A search of the NSW Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS) was undertaken on 1 August 2011 and found that there were no items of cultural heritage located on the subject site or in the vicinity of the site**.**

There are no Commonwealth heritage items listed for Brawboy. A search of the Australian Heritage Places Inventory (AHPI) showed 28 items listed for the Upper Hunter Local Government Area (LGA), however none of these items are located within the vicinity of the project area.

A search of the State Heritage Inventory and Schedule 4 of the Scone Local Environmental Plan (LEP) (1986) show that there are over 150 heritage items within the Upper Hunter LGA, however only five of those sites are within the vicinity of project area. All of the items are listed as being of local significance. Of the five sites listed, three are homesteads, The Cuan (9km south), The Hawthornes (6km south east) and Thornthwaite (10km south east), whilst the remaining two items are natural heritage sites located within the Towarri National Park (6km to the north). None of the registered heritage items are within proximity of the site and therefore will not be affected by the proposed works.

Potential impacts associated with any unknown Aboriginal sites or objects or any items of European cultural heritage significance can be appropriately managed with the mitigation measures specified in the REF.

Groundwater

The proposal does not comprise any drilling as a suspended wellbore will be used. There are therefore unlikely to be any impacts to groundwater as a result of the proposal.

Depending on hole condition, there is the potential for chemicals (mainly potassium chloride) to be utilised to facilitate the efficient and safe conveyance of the VSP tool in line with best oilfield practice. There is therefore a potential for groundwater contamination due to spills of fuels and chemicals at the site. Mitigation measures have been proposed to ensure that these risks are appropriately managed.

Air

The air emissions associated with the proposal will be dust and greenhouse gases.

The dust generated by vehicle movements along the VSP source line are expected to be minimal. There will be no clearing of access tracks required as the EnviroVibe truck can operate off road along the existing ground cover. There will be minimal vehicle movements to and from site and minimal dust would be therefore be generated.

There will be minimal emissions when compared with the agricultural activities that take place throughout the region.

Noise

Noise will be generated by the movement of the vehicle along the VSP source line during the VSP activities, the VSP equipment itself (to be located on the vehicle) and vehicle movements to and from site over a duration of approximately 5 days. There will also be noise associated with the wireline truck. Activities will be confined to a 12 hour day between the hours of 6am and 6pm.

The nearest residence is approximately 1.2km from the site and is associated with the landholder's property. Other properties are located at 1.3km, 1.4km and 1.9km.

The noise associated with the EnviroVibe and wireline trucks will be comparable to other farm machinery and given the short term duration and proposed hours of operation, it is unlikely to cause significant noise disturbance to surrounding residents.

Mitigation of impacts will be through appropriate consultation and complaints handling.

Surface Water

There are watercourses in the vicinity of the site with the closest being Dart Brook just over 500m to the north. There are no earthworks or drilling associated with the proposed operations and therefore there is unlikely to be impacts in terms of erosion and sedimentation.

There is potential for chemicals and fuels to come into contact with watercourses and therefore standard mitigation measures have been identified to minimise this risk, including appropriate erosion and sediment control.

Soils

No new track will need to be constructed as part of the proposed operations. There will be no earthworks or drilling associated with the proposal. There will therefore be no stripping of topsoil and no soil is proposed to be removed from site.

Some gravelling of the partially rehabilitated Brawboy 2 well lease will be undertaken to facilitate the installation of the VSP tool down the well.

There is a very small potential risk for soil erosion to occur resulting in sediment transport to local waterways, however this is considered unlikely on the basis that there will be no additional ground disturbance as a result of the proposal. There is also a small potential risk of soil contamination occurring from the proposed activities. Mitigation measures, including appropriate erosion and sediment control and waste storage and handling, have been proposed to mitigate against this risk.

Chemical and Hazardous Substance Management

The activities will only use chemicals such as fuels, lubricants and potentially potassium chloride. While these substances are not considered highly hazardous, there is still the potential risk of fire and pollution to land, water and air if an accidental spillage was to occur.

The *Occupational Health and Safety Act 2000* (NSW), *Dangerous Goods (Road and Railway Transport) Act 2008* (NSW) and the *Protection of the Environment Operations Act 1997* (NSW) are the main Acts that regulate dangerous goods. These Acts would be adhered with through all operations for the proposal.

Any spills of chemicals used during activities will be managed applying best practice principles, be in accordance with all legislation and standards for the safe handling and storage of hazardous substances and dangerous goods and comply with all occupational health and safety requirements. Any contaminated soil will be removed from the site.

Contaminated Land

It is considered unlikely that previous operations on the property have resulted in contamination of the site. Proposed operations have the potential to result in some contamination due to chemical or fuel spills, however these are considered highly unlikely. Based upon the history of the locations and the minimal impact to site soils during operations, land contamination issues are considered to be minimal for the proposed activity.

It is considered that the potential impacts associated with contamination can be appropriately managed if the mitigation measures set out for surface water, soils and chemical and hazardous substances management are implemented.

Waste Minimisation and Management

General site operations waste will be produced as part of the proposed activities. This will be managed in an appropriate manner to avoid health risks and contamination of land and waterways.

A regular service of amenities will be conducted and waste is to be removed to a licensed facility.

Natural Resource Use

The key natural resources that would be affected by the proposed activities are agricultural land resources (see below) and fuels for the proposed operations and transportation of staff.

Fuels will be used for equipment and also for works and staff vehicles although this is not likely to be a significant quantity of fuel use.

Land Use

The subject site is part of an agricultural property. The works would take approximately 5 days and would be undertaken during the day only between the hours of 6am and 6pm. The proposal does not require the clearing of grazing land and therefore the land could be utilised for grazing purposes outside of these times. The existing 20m x 20m well lease at Brawboy 2 is sufficient in size and there will not need to be disturbance of additional land outside of this.

Under the approval for the drilling of Brawboy 2 the land will be rehabilitated within 3 years of the date of the approval (31 March 2010). There will be no other impacts on land use associated with the proposal.

With regard to access, all vehicles will access the site from Brawboy Road, 6 km north of Brawboy, within the Upper Hunter Shire Council Local Government Area. Access to the Brawboy 2 lease will be through the existing gate and access road. No upgrades to this road will be required.

The EnviroVibe truck will access the property through an existing gate and track in proximity to the Brawboy 2 lease. As the EnviroVibe truck has off-road capability it may deviate from the intended trajectory within a maximum of 20 degrees in order to avoid large objects or steep terrain. No vegetation removal is required and no access track will need to be constructed.

Local Community and Neighbouring Properties

The proposed activities that are the subject of this REF are temporary and will be undertaken during the day only and activities will be restricted from 6.00am to 6.00pm.The nearest residential dwelling is approximately 1.2km away and is part of the landholder's property. Other residences are located 1.3km, 1.4km and 1.9km from the site, however due to the low levels of noise and temporary nature of the proposed works, impacts are considered to be negligible.

Appropriate consultation with the landowner and broader community will be undertaken to ensure community members are kept informed of proposed operations.

Visual Assessment

No significant impacts on the visual amenity of the area are expected from the proposal.

Cumulative Environmental Impacts

There are not expected to be any cumulative impacts associated with the proposal. It is not anticipated that there will be any other exploratory activities occurring within the vicinity of the site. In addition, those wells closest to the site are all either plugged and abandoned to suspended.

Conclusion

This REF has been prepared in accordance with Clause 228 of the *Environmental Planning and Assessment Regulation 2000* and provides consideration of the environmental impact of the proposed works as required by Section 111 of the *Environmental Planning and Assessment Act 1979*. The proposal comprises temporary, small scale works of a short term duration. The REF has identified that the proposed VSP and associated activities is not likely to significantly affect the environment or threatened species, populations or ecological communities or their habitats.

1.0 Introduction

1.1 Background

RPS has prepared this Review of Environmental Factors (REF) on behalf of Santos QNT Pty Ltd (Santos) as Operator for and on behalf of the titleholders to assess the environmental impact of the proposed Vertical Seismic Profiling (VSP) and ancillary activities at a property located on Upper Dartbrook Road, Scone, in the Gunnedah Basin. The purpose of the proposal is to investigate the potential coal seam gas resource within Petroleum Exploration Licence No. 456 (PEL 456).

Drilling of an existing suspended well, referred to as “Brawboy 2”, was finalised on 22 June 2010. This was the subject of a Supplementary REF submitted following the plugging and abandonment of the Brawboy 1 in 2009 well due to downhole technical difficulties. The approval for the drilling of Brawboy 2 (dated 31 March 2010) requires that the well be completed and fully abandoned within 3 years of the date of the approval, unless a development application is lodged for the conversion of the well to a production well.

In accordance with the Petroleum Exploration Licence Conditions issued for PEL 456 under Part 3 of the *Petroleum (Onshore) Act 1991*, petroleum exploration holes are classified as a Category 3 activity. A Category 3 activity requires notification of the activity to an Environmental Officer of the Department of Primary Industries (DPI) – Mineral Resources (of the Department of Trade and Investment, Regional Infrastructure and Services) and in most circumstances, a specific determination of the proposal under Part 5 of the *Environmental Planning and Assessment Act 1979*.

This REF has been prepared in accordance with Clause 228 of the *Environmental Planning and Assessment Regulation 2000* and provides consideration of the environmental impact of the proposed works as required by Section 111 of the *Environmental Planning and Assessment Act 1979*.

1.2 Technical Investigation

A specialist Ecological Assessment has been prepared by RPS to assist in the preparation of this REF.

1.3 Structure of REF

This REF comprises the following:

- Section 1 introduces the proposal and provides an overview of the REF.
- Section 2 provides an overview of the site, locality and key site features.
- Section 3 provides a detailed description of the activities to be undertaken as part of the proposal.
- Section 4 discusses the relevant planning legislation associated with the proposal.
- Section 5 considers the likely environmental impacts of the proposal and recommends mitigation measures to ensure these impacts are appropriately managed.
- Section 6 concludes the REF.

2.0 Site Description and Context

2.1 Location & description

The site is located within Petroleum Exploration Licence (PEL) 456. PEL 456 is located within the Gunnedah region and covers a number of local government areas (LGAs), including the Upper Hunter Shire LGA where the proposed activities are located (refer Figure 2-1). The proposed VSP source line itself is shown in Figure 2-2. The region has been used extensively for agricultural activities since the 1830s. Agricultural activities include mixed farming of sheep, cattle and grain crops with a gradually larger reliance on cattle. There are also overlapping coal and mineral tenures within PEL 456, however no coal mines are located in the immediate vicinity of the site (Figure 2-3).

The subject site is located on an agricultural property on Upper Dartbrook Road, Scone, approximately 16km to the north west of the township. Scone is located approximately 25km north of Muswellbrook and 8km south of Parkville within the Upper Hunter Shire. The subject site is surrounded by agricultural land and Dart Brook is around 0.5km away. Upper Dartbrook Road dissects the north western portion of the site creating a narrow section of land between the road and the brook that is separated from the remainder of the site. The property is currently used for grazing and has been historically selectively cleared.

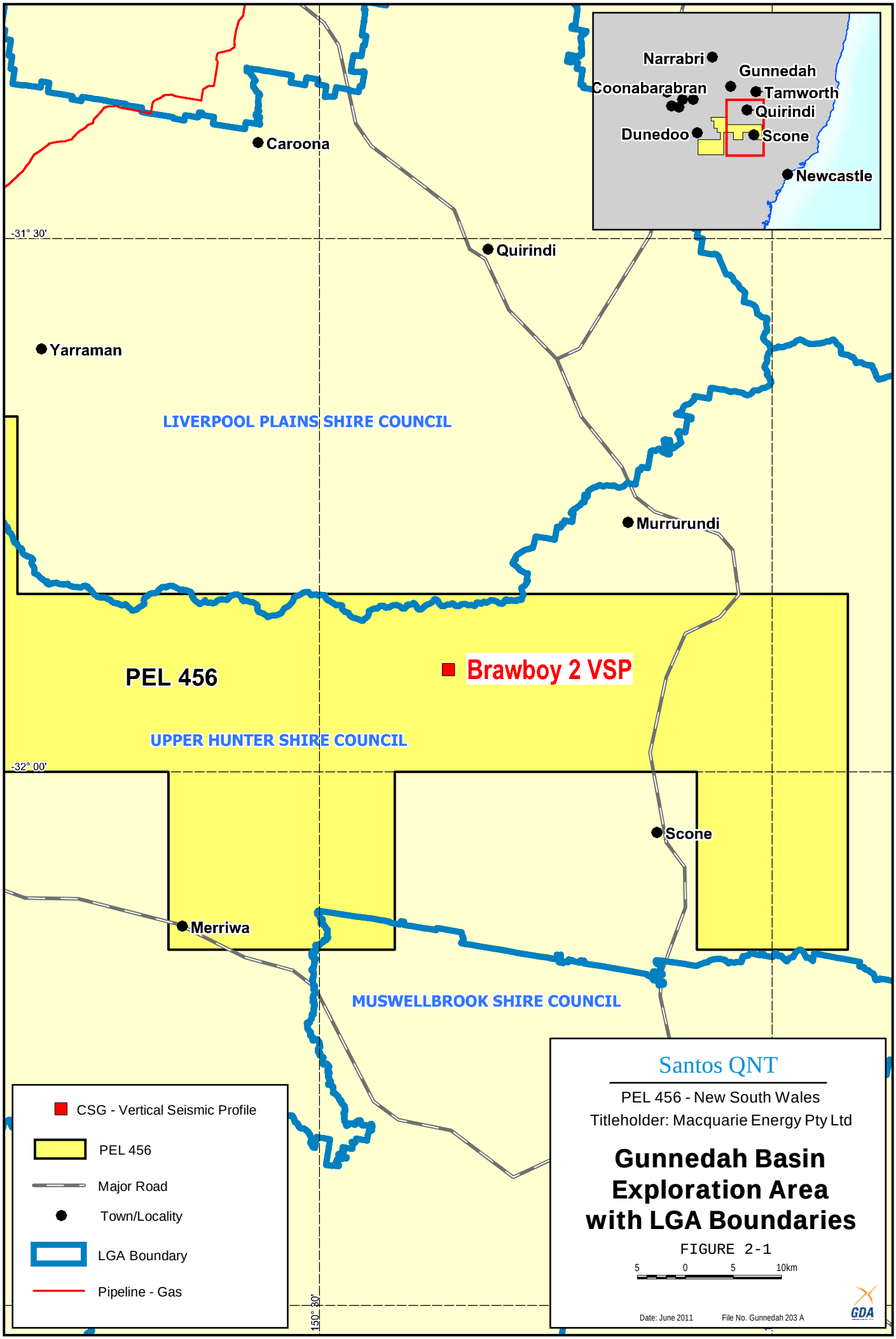
The proposal is to be undertaken on Lot 89 in DP750914 and Lot 6 in DP237954, which comprise a combined area of 1014ha.The Brawboy 2 well site is located within Lot 89. The VSP source line extends into Lot 6. Brawboy 1 is located approximately 1.5km north west of Brawboy 2 and on the same property. Brawboy 1 was plugged and abandoned in 2009.

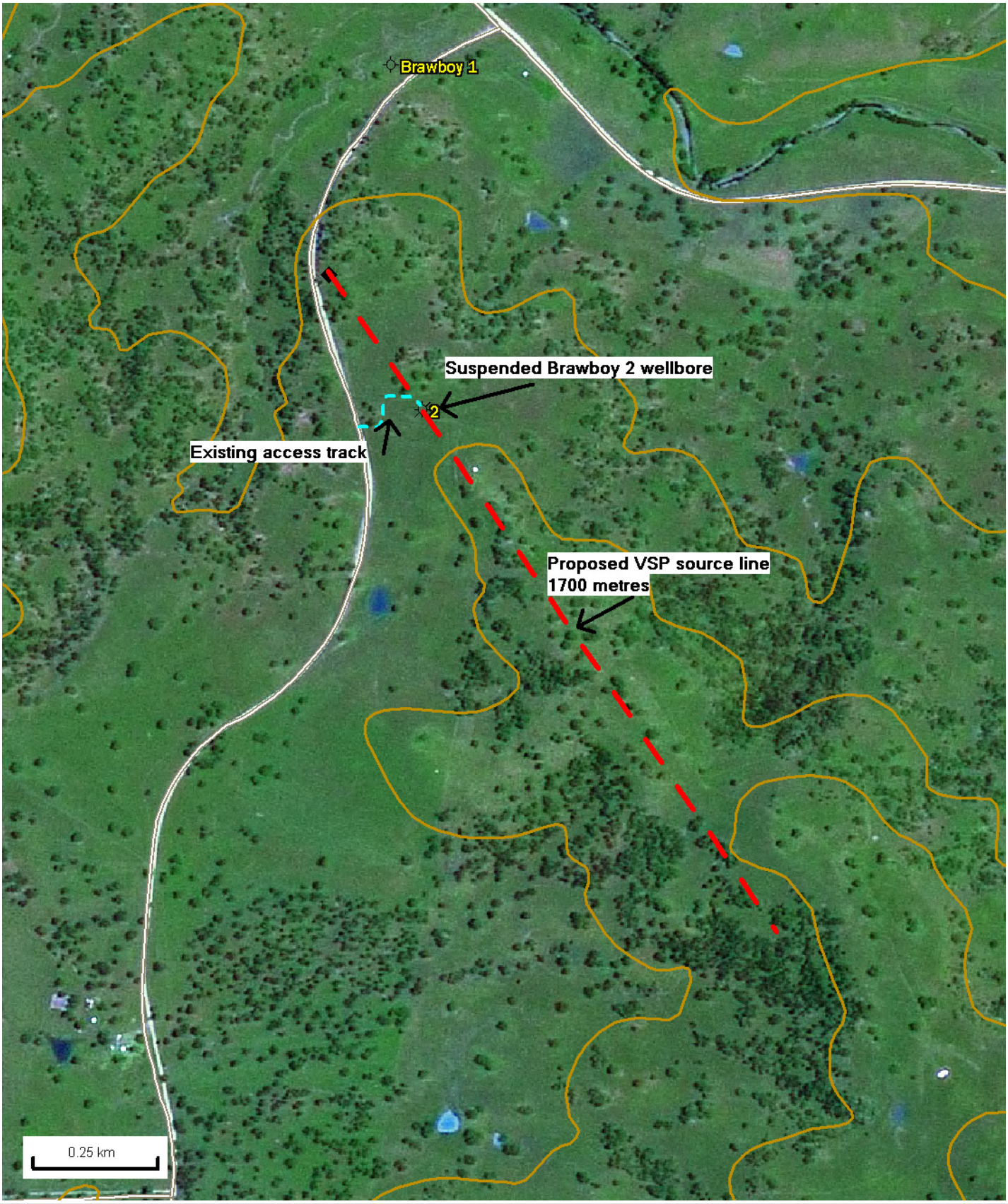
The track, referred to as “the source line”, that will be driven by an EnviroVibe truck to carry out the VSP, is approximately 1.7 km in length. The source line is in a straight line oriented in a north west to south east direction. Brawboy 2 is located approximately 350 m from the north western extent of the source line. The Ecological Assessment (Appendix A) describes the source line as being comprised of Grassy Woodland with a scattered canopy dominated by Rough-barked Apple and ground cover that is dominated by weed species. No shrub layer is present at the location of the source line. The Ecological Assessment found the source line to be in poor condition.

The coordinates of the Brawboy 2 well and VSP source line are outlined in the following table.

Table 2-1 Coordinates for Brawboy 2 Well Lease & Proposed Source Line

Name	Longitude	Latitude
Brawboy 2	150° 38” 33.077’	-31° 54” 15.605’
VSP Source Line (start)	150° 38” 26.41’	-31° 54” 05.78’
VSP Source Line (end)	150° 38” 58.83’	-31 °54” 53.45’


Narrabri
Gunnedah
Coonabarabran
Tamworth
Quirindi
Dunedoo
Scone
Newcastle
Caroona
-31° 30'
Quirindi
Yarraman
LIVERPOOL PLAINS SHIRE COUNCIL
Murrurundi
PEL 456
Brawboy 2 VSP
UPPER HUNTER SHIRE COUNCIL
-32° 00'
Scone
Merriwa
MUSWELLBROOK SHIRE COUNCIL
150° 30'
CSG - Vertical Seismic Profile
PEL 456
Major Road
Town/Locality
LGA Boundary
Pipeline - Gas
Santos QNT
PEL 456 - New South Wales
Titleholder: Macquarie Energy Pty Ltd
Gunnedah Basin Exploration Area with LGA Boundaries
FIGURE 2-1
5 0 5 10km
Date: June 2011
File No. Gunnedah 203 A
GDA



Santos

Gunnedah Basin - PEL 456

Proposed Vertical Seismic Profile source line

FIGURE 2-2

The content on this map is provided for information purposes only. No undertakings, guarantees or warranties as to the accuracy, completeness, currency or suitability of the data for any purpose are provided. The user of these data should not rely on the data presented herein for any reason and should check for confirmation from the originating data owner or other body prior to the commencement of any works program.

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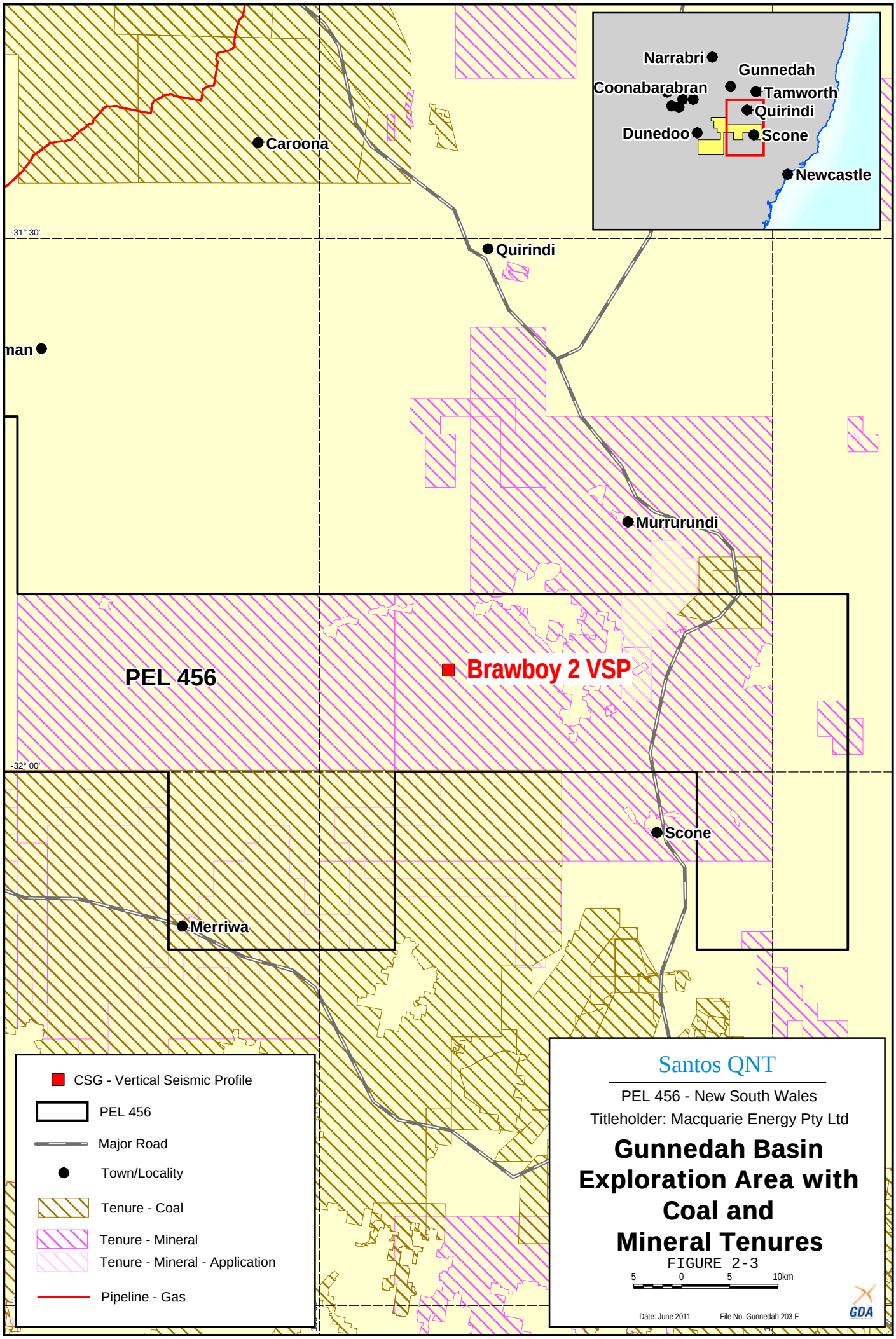

Narrabri
Gunnedah
Coonabarabran
Tamworth
Quirindi
Dunedoo
Scone
Newcastle
Caroona
-31° 30'
Quirindi
man
Murrurundi
PEL 456
Brawboy 2 VSP
-32° 00'
Scone
Merriwa
CSG - Vertical Seismic Profile
PEL 456
Major Road
Town/Locality
Tenure - Coal
Tenure - Mineral
Tenure - Mineral - Application
Pipeline - Gas
Santos QNT
PEL 456 - New South Wales
Titleholder: Macquarie Energy Pty Ltd
Gunnedah Basin Exploration Area with Coal and Mineral Tenures
FIGURE 2-3
5 0 5 10km
Date: June 2011
File No. Gunnedah 203 F
GDA

The following photographs illustrate subject site.

Plate 2-1 View north from northern extent of VSP source line

Plate 2-2 View south from northern extent of VSP source line

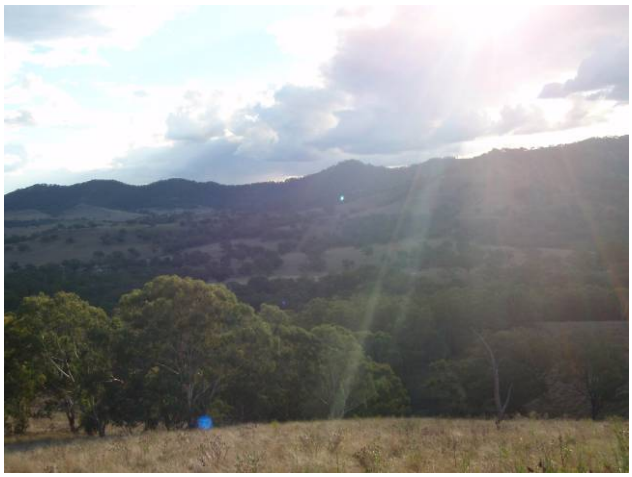


Plate 2-3 View west from southern extent of VSP source line

Plate 2-4 View north west for southern extent of VSP source line

Plate 2-5 View north from southern extent of VSP source line

Plate 2-6 View south from Brawboy 2 well lease

2.2 Topography

The landform is comprised of rolling hills ranging between 340m AHD at the north eastern corner of Lot 6 and 600m AHD at the south eastern corner of Lot 6. Brawboy 2 and the source line is situated on a slope which is approximately 490m AHD at the south eastern end of the line to 410m at the north western end of the line. Contours in the vicinity are shown in Figure 2-4.

2.3 Flora and Fauna

An Ecological Assessment was undertaken over the subject site by RPS (Appendix A). It found that the site and surrounds is representative of an Agophora and Eucalypt Grassy Woodland. The scattered canopy is dominated by Rough-barked Apple, with Yellow Box frequently occurring. Blakely's Red Gum also occur occasionally. No shrub layer is present across the survey line.

The ground cover is dominated by weed species, with up to 65% weed cover. Dominant weed species include Saffron Thistle, Tall Fleabane, Shepherds Purse, Common Sida, Balloon Cotton Bush, and Scotch Thistle. No declared weeds under the Noxious Weeds Act 1993 were observed on site.

Native species occurring on the site include Pitted Blue Grass, Common Bottlewashers, Stout Bamboo Grass, Slender Rats Tail Grass, Threeawn Speargrass, Australian Bluebells and Tufted Bluebells.

Five threatened flora species listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC) Act* were identified as potentially occurring in the site locale (10km buffer) and seven threatened species listed under the *NSW Threatened Species Conservation Act 1995 (TSC) Act* were identified as potentially occurring in the study area. However, based on broad habitat type and species distribution, only the endangered Tiger Orchid was considered to be possibly located in the study area as suitable habitat occurs on the site.

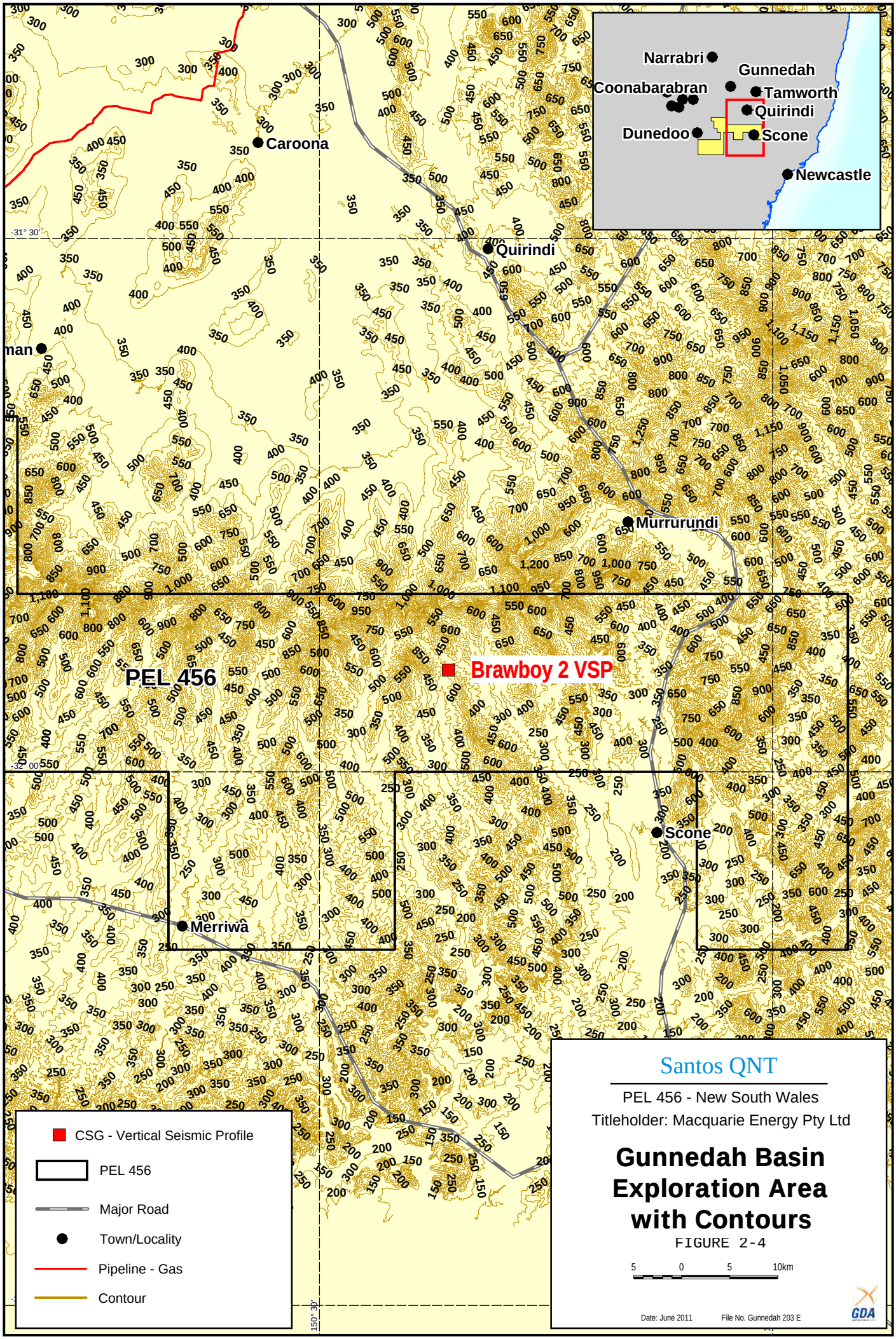
Three threatened ecological communities listed under the EPBC Act were identified as potentially occurring within the site:

- Natural Grasslands on Basalt and Fine-textured alluvial plains of northern New South Wales and southern Queensland;
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland; and
- Weeping Myall Woodlands.

During physical surveys, no threatened fauna or flora species listed under the TSC Act and/or EPBC Act were recorded on site.

In terms of habitat values, the site and adjacent areas are comprised of understory vegetation that is dominated by exotic species, with scattered mature eucalypts occurring. Several eucalypts have hollows ranging in size that provide breeding habitat for a number of native birds, mammals and reptiles.

The groundcover is structurally simple, but provides limited habitat for generalist species, including foraging opportunities for native mammals, reptiles and bird.


Narrabri
Gunnedah
Coonabarabran
Tamworth
Quirindi
Dunedoo
Scone
Newcastle
Caroona
Quirindi
Murrurundi
PEL 456
Brawboy 2 VSP
Scone
Merriwa
-31° 30'
-32° 00'
150° 30'
CSG - Vertical Seismic Profile
PEL 456
Major Road
Town/Locality
Pipeline - Gas
Contour
Santos QNT
PEL 456 - New South Wales
Titleholder: Macquarie Energy Pty Ltd
Gunnedah Basin Exploration Area with Contours
FIGURE 2-4
5 0 5 10km
Date: June 2011
File No. Gunnedah 203 E
GDA

2.4 Water Resources

2.4.1 Surface Water

The permit PEL 456 overlies both the Hunter/Central Rivers and Central West catchment management areas. The subject site is located within the Hunter-Central Rivers catchment management area and more specifically, the Hunter River catchment.

The Hunter-Central Rivers region covers 37,000km^2 on the east coast of NSW, extending from Taree in the north to Gosford and the coastal waterways of the Central Coast in the south, and from Newcastle in the east to the Merriwa Plateau and Great Dividing Range in the west.

The Upper Hunter LGA is dissected by a number of rivers and streams running from west to east. The VSP site falls within this area. The surface water originates predominantly in the Liverpool and Mount Royal ranges and flow through the escarpments along well defined drainage lines.

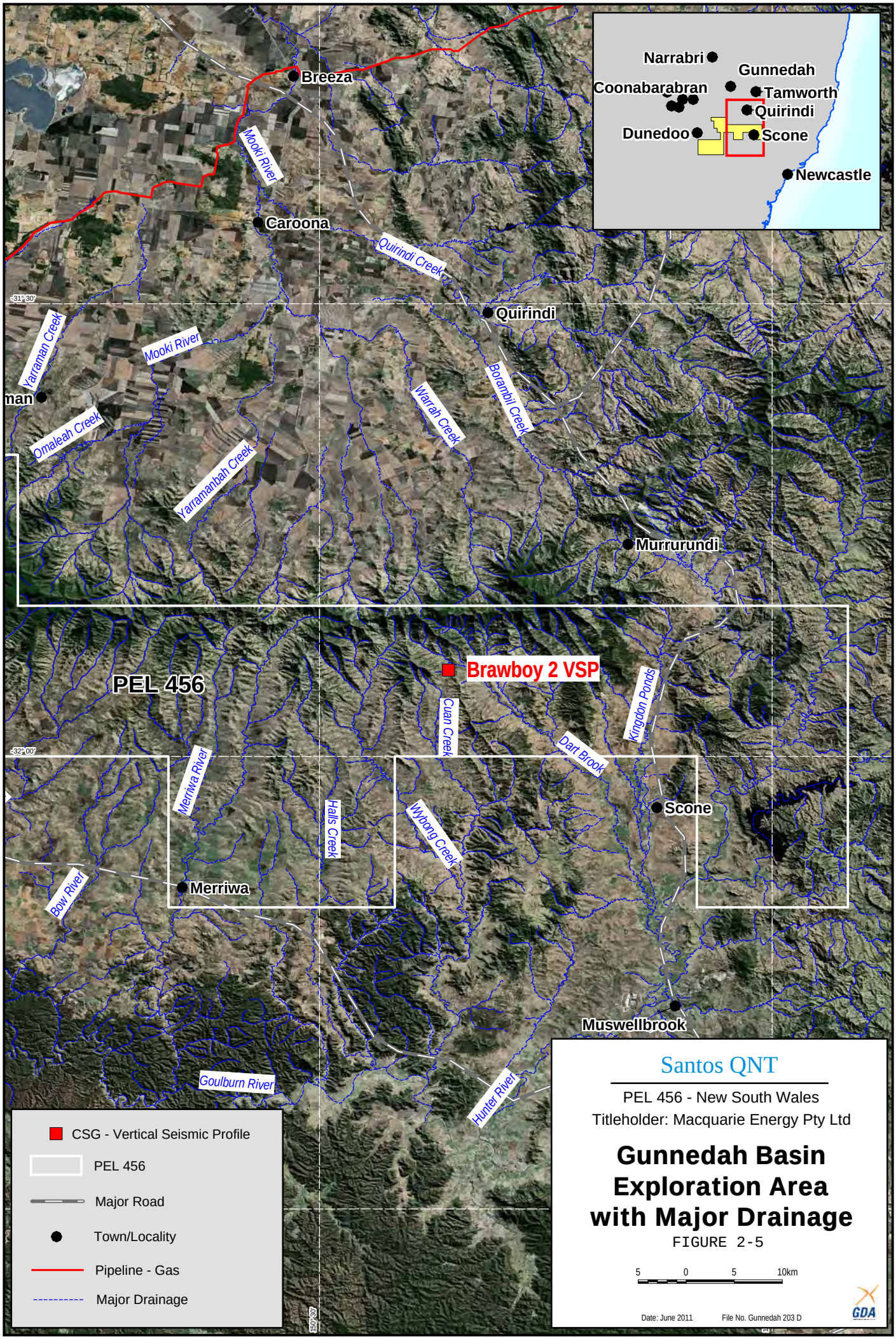
The principal river systems are:

- The Pages River;
- The Isis River;
- The Hunter River; and
- The Goulburn River.

However there are a number of other major stream systems that are important water sources, including:

- Dart Brook;
- Middle Brook;
- Wybong Creek;
- Merriwa River;
- Krui River;
- Moonan Brook; and
- Stewarts Brook.

The subject site is located approximately within proximity to the south of Dart Brook and approximately 5km north of Cuan Creek as shown on Figure 2-5.


Narrabri
Gunnedah
Coonabarabran
Tamworth
Quirindi
Dunedoo
Scone
Newcastle
Breeza
Mooki River
Caroona
Quirindi Creek
Quirindi
Yarraman Creek
Mooki River
Omaleah Creek
Yarramanbah Creek
Warrah Creek
Borambil Creek
Murrurundi
PEL 456
Brawboy 2 VSP
Cuan Creek
Kingdon Ponds
Dart Brook
Merriwa River
Halls Creek
Wybong Creek
Scone
Bow River
Merriwa
Muswellbrook
Goulburn River
Hunter River
CSG - Vertical Seismic Profile
PEL 456
Major Road
Town/Locality
Pipeline - Gas
Major Drainage
Santos QNT
PEL 456 - New South Wales
Titleholder: Macquarie Energy Pty Ltd
Gunnedah Basin Exploration Area with Major Drainage
FIGURE 2-5
5 0 5 10km
Date: June 2011
File No. Gunnedah 203 D
GDA

2.4.2 Groundwater

Groundwater in the Hunter-Central Rivers region is used for town water supply, irrigation, commercial use, stock watering and domestic water. There are three main types of groundwater systems in the region (HCMA, 2011):

- Local aquifers in alluvium and sand beds: This type of groundwater is found in the low lying river valleys and coastal dune areas. Because little salt dissolves from the sediments, this groundwater is generally fresh. These types of sediments have the ability to store large amounts of water that can be extracted quickly. There are a number of Groundwater Dependent Ecosystems (GDE) associated with this type of groundwater including terrestrial vegetation, wetlands and coastal sand dune systems.
- Porous rock aquifers: The deeper porous rock aquifers are found underneath most of the catchment and can yield large volumes of groundwater. In general, however, more salt tends to dissolve from this type of rock, making these waters saltier.
- Fractured rock aquifers: Rock fractures are found underneath most of the catchment and can yield large volumes of groundwater. They also act as an important conduit for flow between different aquifers providing recharge to deeper aquifers.

It is expected that groundwater at the site and surrounding areas will consist of both alluvial and hard rock aquifers. Water from alluvium and sand beds is the most important source of groundwater in the region because it has good water quality and is easy to extract. Groundwater from deeper porous and fractured rock is generally saltier and tends not to be used as much for irrigation or town water supply. It has limited use for stock watering.

There are ecosystems that rely on groundwater, all or part of the time, for existence. These include:

- land based vegetation communities and animals that rely on them;
- the base flow in rivers and their riparian vegetation;
- aquatic ecosystems that occupy caves or aquifers;
- wetlands, groundwater fed lakes and their fringing vegetation;
- native animals that directly use groundwater rather than rely on it for habitat; and
- coastal, estuarine and near shore marine plants and animals.

The extraction of water from groundwater sources and sharing between different users are now being managed by the Department of Natural Resources through Water Sharing Plans.

2.5 Heritage

2.5.1 Aboriginal heritage

A due diligence survey of the proposed site was undertaken on 30 March 2011. This survey was conducted by Steven Coghill, Indigenous Affairs Officer for Santos and included the proposed VSP source line. No artefactual material was identified along the source line alignment as a result of the survey. The site comprises pastoral land that has been highly disturbed by clearing, grazing, cropping and general agricultural pursuits.

A search of the NSW Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS) was undertaken on 1 August 2011 and found that there were no items of cultural heritage located on the subject site or in the vicinity of the site (refer **Appendix B**).

2.5.2 Other heritage

There are no Commonwealth heritage items listed for Brawboy. A search of the Australian Heritage Places Inventory (AHPI) showed 28 items listed for the Upper Hunter LGA, however none of these items are located within the vicinity of the project area.

A search of the State Heritage Inventory and Schedule 4 of the Scone Local Environmental Plan (LEP) (1986) show that there are over 150 heritage items within the Upper Hunter LGA, however only five of those sites are within the vicinity of project area. All of the items are listed as being of local significance. Of the five sites listed, three are homesteads, The Cuan (9km south), The Hawthornes (6km south east) and Thornthwaite (10km south east), whilst the remaining two items are natural heritage sites located within the Towarri National Park (6km to the north). None of the registered heritage items are within proximity of the site and therefore will not be affected by the proposed works.

2.6 Environmentally Sensitive Areas

The subject site is not identified as occurring within an Environmentally Sensitive Area (refer Table 2-2) however there are National Parks and Nature Reserves located in the vicinity of the subject site, from approximately 6km away (Figure 2-6). These include:

- Towarri National Park: approximately 7km east of the site
- Wingen Maid Nature Reserve Spring Ridge State Forest: approximately 12km east of the site

Table 2-2 Environmentally Sensitive Areas

Is the proposal located within any of the following:	Yes/No
An area reserved or dedicated under the *National Parks and Wildlife Act 1974*?	No
Is the proposal located within land reserved or dedicated within the meaning of the *Crown Lands Act 1989* for preservation of other environmental protection purposes?	No
A World Heritage Area?	No
Environmental Protection Zones in environmental planning instruments?	No
Lands protected under SEPP 14 – Coastal Wetlands?	No
Lands protected under SEPP 26 – Littoral Rainforests?	No
Land identified as wilderness under the *Wilderness Act 1987* or declared as wilderness under the *National Parks and Wildlife Act 1974*?	No
Aquatic reserves dedicated under the *Fisheries Management Act 1994*?	No
Wetland areas dedicated under the Ramsar Wetlands Convention?	No
Land subject to a conservation agreement under the *National Parks and Wildlife Act 1974*?	No
Land identified as *State Forest under the Forestry Act 1916*?	No
Western Lands Lease	No
Freehold or Crown Land. If Crown Land, what type?	Freehold

Therefore the scheme is not located within an Environmentally Sensitive Area.

2.7 Climate

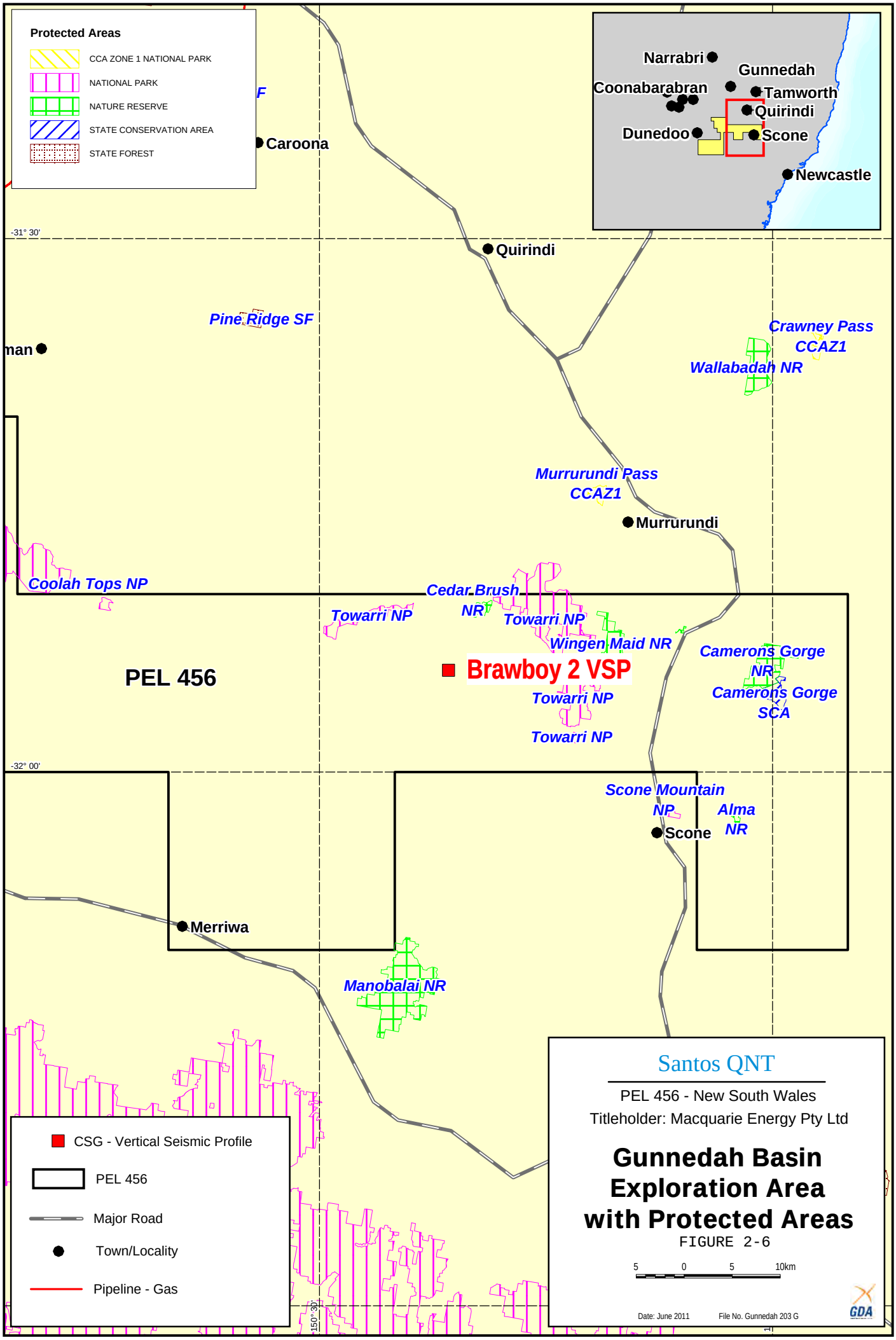
The subject site is situated within the south-eastern section of the Brigalow Belt South bioregion, which is located with the eastern subhumid region of NSW. The Upper Hunter LGA has a temperate climate with a summer dominant rainfall, and annual rainfall of generally 600-800 mm per annum. Climatic conditions vary across the LGA with generally drier conditions with increasing distance from the coast, and lower elevation areas (UHSC, 2006).

The Bureau of Meteorology (BoM) weather station considered to be most representative of the subject locality is Bunnan, which only provides rainfall data. Scone Airport is the closest station with temperature statistics. The local climate is temperate with a slight dominance of summer rainfall. The average daily maximum temperature is around 24.2°C, while the average daily minimum temperature is around 10°C (BoM, 2011). Long-term mean annual rainfall for the locality is 633.5 mm.

As shown in Table 2-3, based on mean temperature records the warmest month is January and the coolest months are July and August. January receives the greatest rainfall and August the least.

Table 2-3 Climate Statistics from Bunnan (rainfall) & Scone Airport (temp) BoM Weather Stations

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Max Temp (°C)	31.3	30.4	27.8	24.4	20.3	17.0	16.4	18.6	21.8	24.7	27.4	29.7
Mean Min Temp (°C)	16.8	16.6	13.9	9.8	6.8	4.6	3.5	3.5	6.8	9.5	13.0	15.3
Mean Rainfall (mm)	79.4	70.5	54.9	41.6	39.3	44.1	39.4	37.1	39.6	52.5	61.2	72.9


Protected Areas
CCA ZONE 1 NATIONAL PARK
NATIONAL PARK
NATURE RESERVE
STATE CONSERVATION AREA
STATE FOREST
Narrabri
Gunnedah
Coonabarabran
Tamworth
Quirindi
Dunedoo
Scone
Newcastle
Caroona
-31° 30'
Quirindi
Pine Ridge SF
Crawney Pass CCAZ1
Wallabadah NR
Murrurundi Pass CCAZ1
Murrurundi
Coolah Tops NP
Cedar Brush NR
Towarri NP
Towarri NP
Wingen Maid NR
Camerons Gorge NR
Camerons Gorge SCA
PEL 456
Brawboy 2 VSP
Towarri NP
Towarri NP
-32° 00'
Scone Mountain NP
Alma NR
Scone
Merriwa
Manobalai NR
CSG - Vertical Seismic Profile
PEL 456
Major Road
Town/Locality
Pipeline - Gas
Santos QNT
PEL 456 - New South Wales
Titleholder: Macquarie Energy Pty Ltd
Gunnedah Basin Exploration Area with Protected Areas
FIGURE 2-6
5 0 5 10km
Date: June 2011
File No. Gunnedah 203 G
GDA

2.8 Soils

The soils across the region vary depending on the local sediment source. In the Upper Hunter Shire the soils are described as follows (UHSC, 2006):

- Black earths occur on the Tertiary basalt in the west of the Shire and on basic alluvium and colluvium between the Pages River and Kingdon Ponds;
- The Merriwa plateau is characterised by rich dark Vertisols with a uniform profile of well structured clay soil which is generally black, dark red or dark brown in colour. They are reasonably fertile soils and generally do not have trace element deficiencies. The high clay content in black earths results in considerable swelling and shrinking on wetting and drying. Volume changes are typically between 20 and 40 per cent. This does not restrict agricultural development of the soil, but can cause problems such as foundation cracking and underground pipe displacement. Black earths show considerable erodibility under poorly managed pasture or arable conditions even on gentle to moderate slopes;
- In general, alluvial soils are fertile and intensively used for grazing dairy cattle or cropping under irrigation. Erosion potential is low due to the low gradients on which the soil develops;
- The Euchrozem group of soils occur in the central area of the Shire on the slopes to the west and east of the New England Highway as far north as Wingen and to the east of Gundy. Euchrozems are gradational red and red brown clay soils grading from a clay loam or light clay to medium textured clay at depth without any sharp changes in texture. They are moderately fertile. The erodibility of such soils is highly variable, reflecting the complexities of the underlying geology. Under pasture the soils are considered stable but they may be subject to severe erosion when cultivated, if adequate soil conservation measures are not employed;
- Solodic soils are associated with the hilly and rugged land developed on the Devonian and Carboniferous rocks in the eastern half of the Shire and on the belt of Permian, Triassic and Jurassic rocks to the west of Kingdon Ponds. Red solodic soils occur in well drained locations, yellow solodic soils are confined to areas where the water table is high. Solodic soils comprise of loamy A horizon overlying a clay B horizon with a sharp change between horizons. These soils are of low fertility, with deficiencies in nitrogen and phosphorus, and are highly susceptible to erosion when disturbed; and
- A Krasnozem Prairies Soil Complex occurs in the high rainfall areas of the Shire, including the upper slopes of the Mount Royal Range and along the ridge of the Moobi Range to the southwest of Scone. The Krasnozem soils are similar to the Euchrozem soils, with a more friable subsoil horizon. They are generally fertile and of low erodibility.

2.9 Geology

PEL 456 is located in the southern portion of the Gunnedah Basin where Jurassic and Cretaceous Surat Basin sediments unconformably overlie Permo Triassic Gunnedah Basin sediments as shown on Figure 2-7. The Gunnedah Basin, covers an area of more than 15,000 sq km and is defined in structural terms as being bounded to the east by the Hunter Mooki Thrust Fault System and the New England Fold Belt, and to the west by the Lachlan Fold Belt onto which the Gunnedah Basin sediments gradually onlap.

Metavolcanics, meta-sediments and minor ignimbritic volcanics of the Lachlan Fold Belt form much of the basement under the western part of western part of the Gunnedah Basin and the Rocky Glen Ridge. Widespread Late Carboniferous and Early Permian mafic lavas were succeeded by paralic-lacustrine environments with sediments of the Leard and Goonbri Formations deposited. This was followed by low energy fluvial conditions in which the coal measures of the Maules Creek Formation were deposited.

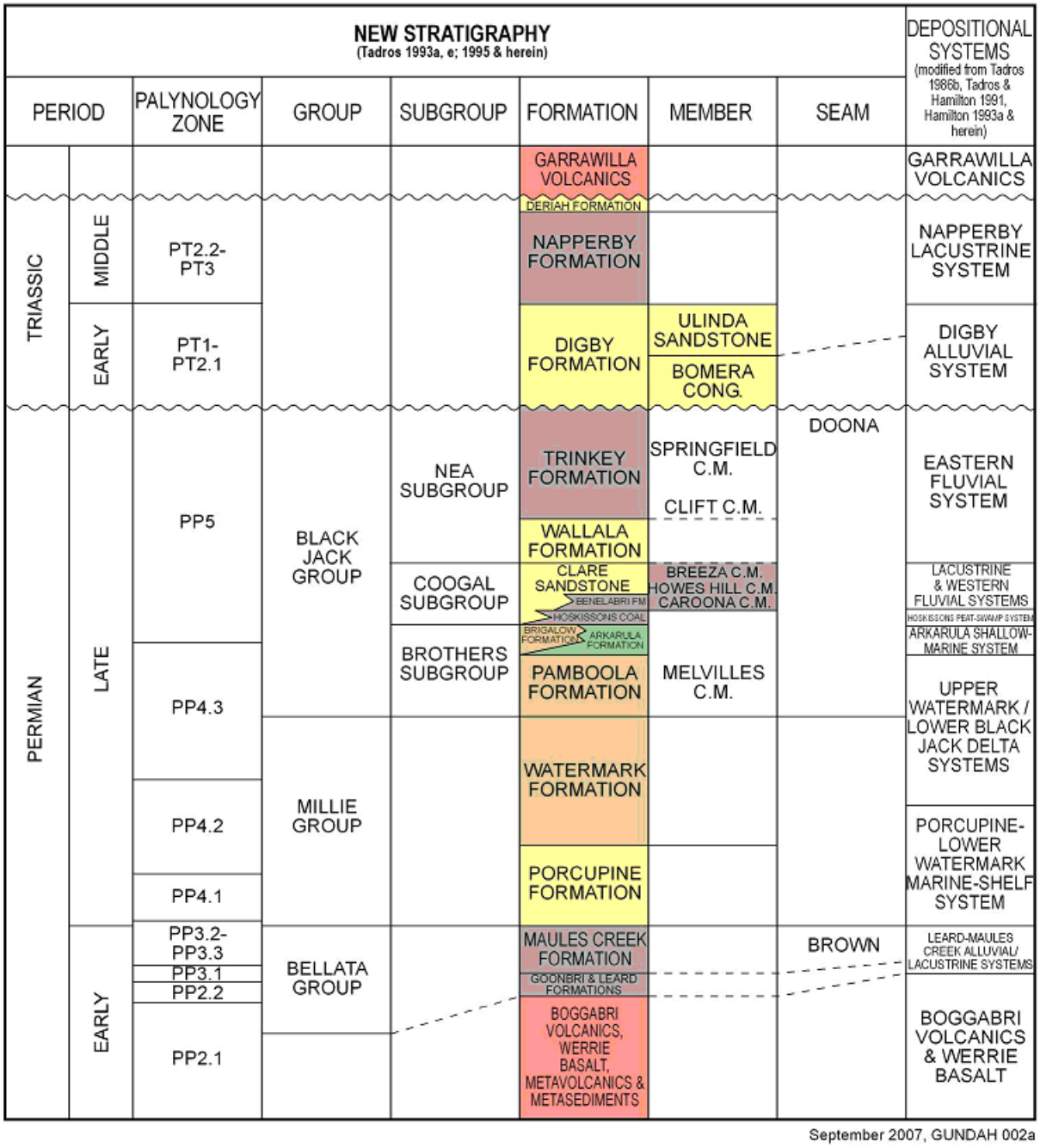


Figure 2-7 Stratigraphy of the Gunnedah Basin

An Early Permian transgression then inundated the area and deposited shallow marine para-conglomerate, sandstone and siltstone of the Porcupine and lower Watermark Formations and culminating in the deposition of the upper Watermark Formation marine claystone.

The Black Jack Formation was deposited in a major delta system with a dominantly northeast sediment source from the New England region. A minor westerly provenance associated with the emergence of the Lachlan Fold Belt is also apparent. The New England provenance of the lower Black Jack Formation resulted in generally quartz lithic and arkosic sandstones with limited reservoir potential. The sandstones were deposited in a lower delta plain/marginal marine environment.

Deposition of the lower Black Jack Formation sediments was followed by an episode when marine conditions affected the Gunnedah Basin, with the deposition of sandstones of poor to fair reservoir quality. Deposition of the western derived quartzose sandstones was followed by very widespread coal swamp conditions depositing the thick Hoskissons Coal seam that is readily correlated across the Basin. The thickness of the Hoskissons Coal ranges from less than 1m in the west to more than 12m in the north and to 18m in the south-east.

Late Permian volcanic activity and tectonism to the east resulted in renewed deposition of more lithic sediments with an easterly provenance and consequently the upper Black Jack Formation has only limited potential for reservoir development. A period of tectonism, uplift and erosion of variable intensity throughout the Basin followed Late Permian deposition. The end of the Permian is marked by a major regional unconformity.

The Digby Formation is marked by a basal conglomerate that has been derived from the New England Fold Belt. This unit thickens towards the east and onlaps onto the older sediments and basement to the west. Reservoir quality is generally poor due to a tight sandstone matrix. Thick near-shore marine shales of the overlying Napperby Formation are considered a potential seal to any hydrocarbons reservoir in the Digby Formation.

A major period of uplift and erosion during the Late Triassic ended Gunnedah Basin deposition. Deposition of the Surat Basin sequence commenced during the Early Jurassic, preceded by lava flows, pyroclastics with intercalated claystones of the Garrawilla Volcanics (Nandewar Range). During the Tertiary period of tectonism, the Liverpool Ranges were formed by massive extrusions of basalts representing the last major depositional episode in PEL 456.

3.0 Project Description

3.1 Introduction

Santos proposes to undertake a Vertical Seismic Profile (VSP) to assess the subsurface coal seam properties of PEL 456.

The VSP involves driving a low impact vibrating unit, known as an EnviroVibe truck, across a 1.7km source line (refer Figure 2-2). The EnviroVibe Truck is approximately the size of a large four wheel drive vehicle, with larger wheels. The EnviroVibe truck lowers a 1m x 1m plate onto the ground surface and vibrates the ground at every 25 – 50m along the length of the line. The plate will flatten any grasses encountered and leave a light impression in the ground.

Utilising an existing suspended wellbore (Brawboy 2) a VSP tool will be run into the wellbore from a wireline truck where it will receive signals from the surface in the form of vibrations. The vibrational energy received by the VSP will be interpreted and may assist with determining the depth of the coal in proximity of the wellbore as well as any changes in coal depth as one would walkaway from the wellbore.

The source line trajectory has been oriented in a way which may assist in steering a lateral wellbore within the target coal seam. The source line will intersect the standing wellbore as well as extend to better define the position of the coal seams at distance from the wellbore.

In summary, the process involves:

- accessing existing well lease area Brawboy 2;
- running the VSP tool into the well using a wireline;
- mobilising the EnviroVibe truck unit to traverse the track multiple times;
- receive and process the source energy at various depths within the wellbore;
- suspending the wellbore; and
- removal of EnviroVibe truck and wireline unit.

3.2 Site Preparation & Equipment

No significant site preparation is required for the VSP operation to occur. The wellbore utilised to run the VSP tool, Brawboy 2, is a suspended wellbore on a previously constructed lease which has had a partial rehabilitation. The size of the partially rehabilitated lease has the ability to receive a wireline or equivalent unit for the purposes of running the VSP tool.

The EnviroVibe truck is capable of traversing steep terrain and has the ability to steer around large objects such as trees so therefore no clearing will be required for the source line.

3.3 Access

All vehicles will access the site from Brawboy Road, 6 km north of Brawboy, within the Upper Hunter Shire Council Local Government Area. Access to the Brawboy 2 lease will be through the existing gate and access road. No upgrades to this road will be required.

The EnviroVibe truck will access the property through an existing gate and track in proximity to the Brawboy 2 lease. As the EnviroVibe truck has off-road capability it may deviate from the intended trajectory within a

maximum of 20 degrees in order to avoid large objects or steep terrain. No vegetation removal is required and no access track will need to be constructed.

3.4 Proposed Activities

The Brawboy 2 wellbore is presently suspended and partially rehabilitated to an area approximately 20m x 20m. Prior to commencing the VSP operation, access to the wellbore will need to be re-instated and the 20m x 20m well lease will be gravelled. The reinstatement operations will include assessing the annular and tubing pressure on surface prior to removal of the blind flange which currently caps the wellhead. A pressure control device, a lubricator or equivalent, may be rigged up depending on the pressure encountered. The suspension plug will then be retrieved and the VSP tool will be run into the wellbore.

The EnviroVibe truck will initiate the source energy through low frequency vibrations at the start of the proposed track. It will then travel along the intended trajectory vibrating the ground every 25-50 metres. As the energy source traverses the track the VSP tool will be moved up the wellbore to gain higher resolution data and as such may require multiple passes along the same surface track. The proposed source line traverses some steep terrain and as there is an approximate 30 degree operation limitation of the EnviroVibe truck certain areas along the source track will not yield any data. Once the subsurface data has been acquired the EnviroVibe truck will leave along the same track as it entered the property. The VSP tool will be retrieved and the wireline unit or equivalent conveyance unit will exit the Brawboy 2 lease. The Brawboy 2 wellbore will be suspended pending further activities.

Note that as the EnviroVibe truck has off-road ability there will be no track construction via the laying down of any material, it is planned to simply drive the truck overland and operate the vibrating plate as and when required along the route.

3.5 Duration

VSP activities are temporary and will not have any long-term impact on the visual amenity of the area. The lease and property access will occur over a 5 day interval including rig-in, data acquisition and rig-out. This timeframe may be longer if any delays are encountered (e.g. inclement weather).

3.6 Staff & Hours of Operation

The number of employees present on the site at any one time is expected to be up to 15.

The hours of operation during the VSP data acquisition will be on a 12-hour a day basis, with crews from approximately 6am to 6pm each day. Personnel movements to site outside of these hours will be minimised but may be necessary due to emergency situations or specific activities (e.g. service companies entering and leaving site).

As this operation is of a short duration it is not proposed to provide a workers camp on the site, but workers will be accommodated in nearby accommodation with travel to and from site as required.

3.7 Chemicals

Depending on hole condition, there is the potential for chemicals (namely Potassium Chloride – KCl) to be utilised to facilitate the efficient and safe conveyance of the VSP tool in line with best oilfield practice. These chemicals are typical of those generally used in oilfield activities and may include wellbore stability additives such as, to stabilize swelling clays. The Materials Safety Data Sheet (MSDS) information for all of these chemicals can be found on the Santos web site: http://www.santos.com/exploration-acreage/gunnedah-

basin-gas/fact-sheets-msds.aspx. The fluids are water based (not synthetic or oil based) and recycled for reuse as much as possible during the process.

3.8 Justification & Alternatives

Conducting a VSP in the Brawboy 2 wellbore location is a necessary step in the ongoing exploration and evaluation of the hydrocarbon potential in PEL 456, which to date has undergone limited petroleum exploration. The data acquired may assist in defining the nature and characteristics of coal seams at depth and has the potential to increase the state's reserves and revenue from gas.

There is limited exploration activity in this area of the Gunnedah Basin. Santos has undertaken coal seam gas exploration through drilling five coreholes and one chiphole in PEL 456. The resulting assessment of the area includes a prospective result in the Brawboy area. Future investigations will be required to further define the coal seam gas asset and as such the location of the Brawboy VSP is in an ideal location for defining the structural setting of the coal which has the potential for future use in the steering of a lateral wellbore in the area. The proposed program consists of running a VSP tool, emitting surface vibrations, receiving and recording source line information and processing the subsurface data. These operations are required to define and identify commercially valuable reserves of coal seam gas.

In conjunction with favourable coal seam gas potential the site has been selected to avoid and/or minimise potential ecological impacts. The well lease site has already been constructed and partially rehabilitated and as the operation of the EnviroVibe truck occurs along a single alignment, the impacts will be isolated to an area where no threatened fauna or flora species have been identified. Potential direct or indirect impacts associated with the VSP operation are considered to be minimal.

3.9 Stakeholder Consultation

In early April 2011, Santos commenced community information sessions for its proposed coal seam gas exploration program for 2011 in the Gunnedah Basin. Santos is committed to providing ongoing information on activities with key stakeholders prior to work starting and for the duration of their presence in the region.

Key stakeholder groups include:

- Landholders;
- Business;
- Town communities;
- All levels of government;
- Utilities operators;
- Local Aboriginal Land Councils; and
- Special interest and activist groups.

Consultation aims to:

- Increase understanding of any coal seam gas activities that are to be undertaken by Santos in the area;
- Explain how the differences between petroleum exploration legislation and mining legislation in NSW affect the activities that are to be undertaken; and
- Discuss and inform on issues that generate community interest and concern in the area.

Santos recognises that many stakeholders have an interest in more than one PEL (for example Local, State and Federal government and their elected representatives and industry representative associations such as

				shrubs.		
Warkworth Sands Woodland of the Sydney Basin Bioregion; and		EEC	-	This EEC is found on aeolian sand deposits south east of Singleton in the Hunter Valley. This ecological community is currently known to occur in the local government area of Singleton but may occur elsewhere in the Bioregion. Warkworth Sands Woodland is generally of woodland to low woodland structure with trees of *Angophora floribunda* and *Banksia integrifolia*, and shrubs and ground species including *Acacia filicifolia*, *Pteridium esculentum, Imperata cylindrica, Brachyloma daphnoides* and *Melaleuca thymifolia.*	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Amphibians						
Litoria booroolongensis	Booroolong Frog	E	E	Found along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Birds						
Anthochaera phrygia	Regent Honeyeater	E	E, M	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland and open riparian forests of River Sheoak.	Possible. Suitable habitat occurs in woodland habitat adjacent to the VSP.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.

Anseranas semipalmata	Magpie Goose	V	M	Floodplains and wet grasslands.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Apus pacificus	Fork-tailed Swift	-	M	Aerial over open country, from semi-desserts to coasts, islands and sometimes over forests and cities.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Ardea alba	Great Egret	-	M	Prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Ardea ibis	Cattle Egret	-	M	Found in grasslands, woodlands, wetlands, pastures and croplands, especially where drainage is poor.	Possible. Suitable habitat occurs within the study area.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Burhinus grallarius	Bush-stone Curlew	V	-	Open forests and woodlands with a sparse grassy groundlayer and fallen timber.	Possible. Suitable habitat occurs in woodland habitat adjacent to the VSP.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Calyptorhynchus lathami	Glossy-Black Cockatoo	V	-	She-oaks, in forests, woodlands, timbered watercourses, in eucalypt and native cypress, brigalow scrub.	Unlikely due to lack of suitable feeding trees.	Unlikely to be affected due to the lack of suitable feeding trees in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Climacteris picumnus	Brown Treecreeper	V	-	Found in Eucalypt woodlands and dry open forest of the inland slopes and	Possible. Suitable habitat	Although suitable habitat occurs adjacent to the VSP, it is unlikely

				plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked Eucalypts, usually with a grassy understorey.	occurs in adjacent woodland areas.	that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Daphoenositta chrysoptera	Varied Sittella	V	-	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Erythrotriorchis radiatus	Red Goshawk	E	-	Coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Gallinago hardwickii	Latham's Snipe	-	M	Soft wet ground or shallow water with tussocks with other green or dead growth, wet parts of paddocks, seepage below dams, irrigated areas, scrub or open woodland from sea level to alpine bogs over 2000m, samphire on salt marshes, mangrove fringes	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Glossopsitta pusilla	Little Lorikeet	V	-	Forages primarily in the canopy of open Eucalypt forest and woodland. Riparian habitats are particularly used, due to higher soil fertility. Also found in isolated flowering trees in open country, e.g. paddocks and roadside remnants.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M	Habitat characterised by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest (including rainforest) and even urban areas.	Possible overfly species.	This species is considered a possible flyover. It is unlikely to be impacted by the proposed activity, given the minimal level of impact the proposed VSP activities.
Hieraaetus morphnoides	Little Eagle	V	-	The Little Eagle occupies habitats rich in prey within open eucalypt forest,	Possible. Suitable habitat	Although suitable habitat occurs adjacent to the VSP, it is unlikely

				woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used.	occurs in adjacent woodland areas.	that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Hirundapus caudacutus	White-throated Needletail	-	M	Almost exclusively aerial most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy.	Possible overfly species.	This species is considered a possible flyover. It is unlikely to be impacted by the proposed activity, due to the low level of impact of the proposed activities.
Lathamus discolour	Swift Parrot	E	E	Migrates to south-east Australia between March and October. Occurs in areas where Eucalypts are flowering profusely or where there are abundant lerp infestations.	Possible. Suitable habitat occurs in adjacent woodland areas. .	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-	Occupies mostly upper levels of drier open forests or woodlands dominated by Box or ironbark Eucalypts. Also inhabits open forests of smooth-barked Gums, stringy barks, ironbarks and tea-trees.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Merops ornatus	Rainbow Bee-eater	-	M	Occurs mainly in open forests and woodlands, shrub lands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation.	Possible overfly species.	This species is considered a possible flyover. It is unlikely to be impacted by the proposed activity, due to the low level of impact of the proposed activities.
Myiagra cyanoleuca	Satin Flycatcher	-	M	Found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Possible overfly species.	This species is considered a possible flyover. It is unlikely to be impacted by the proposed activity, due to the low level of impact of the proposed activities.
Ninox strenua	Powerful Owl	V	-	Open forests and woodlands, as well as along sheltered gullies in wet forests with dense understoreys, especially along watercourses.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not

						required.
Petroica boodang	Scarlet Robin	V	-	Dry eucalypt forests and woodlands.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Polytelis swainsonii	Superb Parrot	-	V	Found in Box-Gum, Box-Cypress-pine and Boree woodlands and River Red Gum forest. Nests in small colonies in the hollows of large trees, mainly in tall riparian River Red Gum forest or woodland.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V	-	Inhabits open Box-Gum woodlands on the slopes, Box-Cypress pine and open Box woodlands on alluvial plains.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Pyrrholaemus saggitatus	Speckled Warbler	V	-	Lives in a wide range of Eucalypt dominated communities that have a grassy understorey and often on rocky ridges or in gullies.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Rostratula australis	Australian Painted Snipe	-	V	Inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Stagonopleura guttata	Diamond Firetail	V	-	Found in grassy eucalypt woodlands, including Box-Gum woodlands and Snow Gum woodlands. Often found in riparian areas and sometimes in lightly wooded farmland.	Possible. Suitable habitat occurs in adjacent woodland	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not

					areas.	required.
Tyto novaehollandiae	Masked Owl	V	-	Roosts and breeds in moist Eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Lives in dry Eucalypt forests and woodlands.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Mammals						
Bettongia penicillata penicillata	Brush-tailed Bettong (South-East Mainland)	EX	-	The Brush-tailed Bettong (south-east mainland) was associated with grassland, heath and sclerophyll woodland. Other accounts record the subspecies from open eucalypt forest with low woody scrub, tussock grass and occasional bare patches.	Extinct.	N/A.
Chalinolobus dwyeri	Large-eared Pied Bat	-	V	Roosts in caves, crevices in cliffs, old mine workings and disused Fairy Martin (*Hirundo ariel*) nests, frequenting dry open forest and woodland close to these features.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs adjacent to the VSP, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Conilurus albipes	White-footed Tree Rat	EX	-	The White-footed Rabbit-rat was known to inhabit open forest woodlands and grassy ecosystems in Victoria. Habitat information is not known for other states in which the species occurred. Gould observed the species sleeping in the hollow limbs of prostrate trees, or in hollow branches of large Eucalypts near the ground.	Extinct.	N/A.
Dasyurus maculatus maculatus	Spotted-tail Quoll	V	E	Recorded in a wide range of habitat types including dry and moist sclerophyll forests and woodlands, rainforest, coastal heathland, and riparian forest. Found in shelters and dens in small caves, fallen logs with large hollows and tree hollows.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Dasyurus geoffroii	Western Quoll	E	V	Most kinds of wooded habitat including eucalypt forest, dry woodland and mallee	Unlikely due to lack of suitable	Unlikely to be affected due to the lack of suitable habitat in the study

				shrubland.	habitat.	area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Generally roosts in eucalypt hollows. Prefers moist habitats.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Lagorchestes leporides	Eastern Hare-wallaby	EX		The Eastern Hare-wallaby was common in open plains country around the Murray River and in the grasslands and woodlands of western Victoria and southeastern South Australia.	Extinct.	N/A.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Myotis macropus	Southern Myotis	V	-	Generally roost in caves close to water, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Nyctophilus timoriensis	Greater Long-eared Bat	-	V	Commonly roosts in crevices, hollows and under loose bark in Box / Ironbark / Cypress Pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Onychogalea fraenata	Bridled Nailtail Wallaby	E	-	Preferred habitat is a narrow band of transitional vegetation that separates dense Acacia scrub from open grassy Eucalypt woodland.	Unlikely. Outside of known distribution.	Unlikely to be affected due to the study area being outside of the species 'known distribution' and the minimal level of impact resulting from the proposed activities. An

						AoS for this species is therefore not required.
Perameles bougainville fasciata	Western Barred Bandicoot	PE	EX	Inhabited a variety of landscapes and vegetation types, including Saltbush covered Nullarbor Plain, woodlands on sand ridges, Bluebush plains, Desert Acacia, shrublands and heath.	Extinct.	N/A.
Petaurus australis	Yellow-bellied Glider	V	-	Tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Petaurus norfolcensis	Squirrel Glider	V	-	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	Possible. Suitable habitat occurs in adjacent woodland areas.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Phascolarctos cinereus	Koala	V	-	Inhabits Eucalypt woodlands and forests, spending most of their time in trees. Feeds on the foliage of more than 70 Eucalypt and 30 non-Eucalypt species.	Possible. Suitable habitat trees occur in the study area, however no traces of Koala were identified.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Pseudomys australis	Plains Rat	E	V	Primarily found in stone-covered plains and mod slopes with boulders, small stones and gilgais. Associated vegetation is predominantly chenopod as well as ephemeral plants.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.

Pseudomys gouldii	Gould's Mouse	E	-	It is a poorly known species. Animals are reported to have preferred sandhills and plains, and to make burrows under bushes in loose soil.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Pseudomys novaehollandiae	New Holland Mouse	-	V	Rediscovered in Sydney and has since been found to be widespread in coastal NSW and Victoria and to also occur in Tasmania's northeast. The New Holland mouse prefers recently burnt heath, in which seed producing plants such as wattles and peas are in greatest abundance	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	A range of habitats including subtropical and temperate rainforests, dry and wet sclerophyll forests, Banksia woodland, heaths and Melaleuca swamps.	Possible. Suitable habitat trees occur in the study area.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Rattus villosissimus	Long-haired Rat	V	-	Sustained in mesic, densely vegetated sites. During plagues can be found in virtually all inland habitats. Following extended periods of above average rainfall or flood this species can breed rapidly. Resulting populations disperse widely, then die away abruptly as food is depleted and water evaporates. Predators rely on these rat plagues for their own rapid reproduction.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Roosts in tree hollows and buildings. If there are no trees, they are known to occupy mammal burrows.	Possible. Suitable habitat trees occur in the study area.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Vespadelus troughtoni	Eastern Cave Bat	V	-	Cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs.	Unlikely due to lack of suitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of

						impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.

Sources: EPBC Act Protected Matters Search Tool (Department of Sustainability, Environment, Water, Population, and Community, 2011), Atlas of Wildlife, Map Sheet 8935 – Curlewis (NSW Office of Environment and Heritage, 2011)

Key: CE: Critically Endangered, E: Endangered, V: Vulnerable, EEC: Endangered Ecological Community; PE/EX: Presumed Extinct, M: Migratory

Bold: Known to occur

5.2 Impact Assessment under the TSC Act

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts proposed activities on 'threatened species, populations or ecological communities (or their habitats)' listed under the TSC Act. The Assessment of Significance (7-part test) is used to determine whether activities are 'likely' to cause 'a significant impact' on threatened biota and thus whether a Species Impact Statement (SIS) is required.

On this basis, a 7-part test of significance is required for the White Box-Yellow Box-Blakely's Red Gum Woodland EEC. The application of the 7-part test (**Appendix C**) concluded that there is not likely to be a significant effect on this community arising from the proposed activities.

5.3 Impact Assessment under the EPBC Act

An EPBC Act Protected Matters Search was undertaken using the on-line database to generate a list of those MNES on potentially occurring within the study area and surrounds. This data, combined with other local knowledge and records, was utilised to assess whether the proposed activities will have, or are likely to have a significant impact on MNES.

World Heritage Areas:

The proposed activities are not in a World Heritage area, and are not in close proximity to any such area.

Wetlands protected by international treaty (the Ramsar convention):

The EPBC Protected Matters Search tool identifies that the study area is upstream from a Ramsar site, Hunter Valley estuary wetlands. Given that the study area is located over 100km to the north west of the Ramsar site, it is highly unlikely that the Ramsar site will be impacted by the proposed activity.

Nationally listed threatened species, migratory species and ecological communities:

Although White Box-Yellow Box-Blakely's Red Gum grassy woodland is considered to be an EEC under the TSC Act, it does not meet the criteria to be a TEC under the EPBC Act. No listed threatened species or migratory species were recorded within the study area, or are likely to occur.

5.4 Key Threatening Processes Relevant to Proposed Activities

A threatening process is defined under the TSC Act as 'a process that threatens, or that may threaten, the survival or evolutionary development of a species, population or ecological community'. Threatening processes that adversely affect threatened species, populations or ecological communities, or possibly cause others that are not currently threatened; to become threatened are listed as key threatening processes (KTPs) under the TSC, FM and EPBC Acts. KTPs relevant to the proposed activities are discussed in **Table 5.2**.

Table 5.2: Key Threatening Processes Relevant to the Proposed Activities

Key Threatening Process	Relevance to Proposed Activities
Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands	The study area is identified as being located upstream from a Ramsar site, Hunter estuary wetlands. This wetland will not be affected by the VSP, given that the site is located over 100km upstream.
Invasion of native plant communities by exotic perennial grasses	The study area has been previously disturbed by the introduction of exotic grasses. There exists the potential for the invasion and spread of additional weed species if machinery and vehicles contain weed seeds.
Clearing of native vegetation	There will be no native vegetation cleared as a result of the proposed activities, however the plate on the Envirovibe truck will flatten any grasses encountered and leave a light impression in the ground.
Loss of hollow-bearing trees	No hollow bearing trees will be removed as part of this activity.
Removal of dead trees and dead wood	No dead 'stag' trees will be removed from the study area.
Infection of native plants by *Phytophthora cinnamomi*	There exists the potential for the importation of this pathogen on unclean vehicles and plant machinery. It is recommended that all vehicles be cleaned of foreign soil from other sites to ensure that this pathogen is not introduced.

5.5 Koala SEPP 44

Scone LGA is listed in the *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44), Schedule 1 as an LGA where this policy applies. Schedule 2 of SEPP 44 lists 10 tree species that are considered indicators of 'Potential Koala Habitat'. The presence of any of the species listed on a site proposed for development triggers the requirement for an assessment for 'Potential Koala Habitat'. SEPP 44 defines potential Koala Habitat as:

"*areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component*".

While one species of listed Koala food tree is present in the study area (White Box), it does not constitute 15% of the total number of trees in the upper canopy of lower strata. The study area is therefore not considered potential Koala habitat under SEPP 44.

5.6 Discussion of Impacts

The potential impacts associated with the proposed activities are short-term and temporary. The physical ground disturbance will include the flattening of grasses and a light impression on the ground from the lowered 1m x 1m plate on the Envirovibe truck. Vegetation within the study area will not be cleared as a result of the VSP.

While the proposed VSP is located adjacent to areas that provide habitat for a range of common generalist species, the impacts to these habitats associated with the proposed activity are expected to be negligible.

Site access will be via existing farm tracks and no clearing of native vegetation is required.

5.6.1 Potential Impacts

There are minimal potential impacts associated with the VSP exercise, as it primarily involves driving a vehicle along the proposed line. No vegetation is required to be cleared to conduct the survey; however some grasses will be impacted by the lowered 1m x 1m plate.

The proposed activity is considered to have minimal impacts on fauna habitat, as no vegetation is required to be cleared. The VSP has the potential to temporarily impact upon resident fauna population due to noise and vibrations.

Conducting the VSP may potentially result in weed invasion, and transportation of weeds off site if not managed properly.

5.6.2 Overview of Identifying Potential Impacts

The assessment of potential ecological impacts revealed the following:

- Potential short-term impacts upon grasses; and
- Introduction and spread of weed species.

Each of the above listed potential impacts is discussed in greater detail within the following relevant sections.

Potential Short-term Impacts Upon Grasses

Temporary short-term impacts will be associated with the VSP, as the 1m by 1m plate, and vehicle access will result in temporary impacts to ground covers. No vegetation will require clearing to undertake the VSP.

Introduction and spread of weed species

The proposed activities have the potential to create favourable conditions for additional introduced weed species within the study area, given they may result in a temporary increase in vehicle movements. This may lead to the spread of existing weeds and/or the introduction of new species.

Vehicles will be washed down and cleaned of any foreign soil and seed prior to being transported on site, where they have previously been in known weed infestation, to prevent the potential spread of introduced weeds and pathogens.

6.0 Impact Mitigation and Management

6.1 Introduction

In order to minimise potential ecological impacts resulting from the proposed activity, the location and design of the VSP and associated infrastructure, and identification of appropriate mitigation measures has been undertaken in accordance with the 'avoid – minimise – mitigate' hierarchy:

- Avoiding the impact altogether by relocating the proposed activity, or parts of an activity;
- Minimising impacts by restricting the magnitude of the proposed activity and its implementation; and
- Mitigating the impact of the activity by appropriately managing the proposed activity, and rehabilitating, or restoring the affected environment.

6.1.1 Avoid

While the study area is considered to be White Box - Yellow Box - Blakely's Red Gum Woodland EEC, the site selected is in poor condition, and is currently grazed. The site has been selected to avoid disturbances to higher quality fragments of the EEC in surrounding areas.

6.1.2 Minimise

An EnviroVibe truck will be used to conduct the VSP, which is able to maneuver around any canopy vegetation within the VSP line, reducing the need for unnecessary clearing activities.

Weed management procedures will be implemented to prevent the spread of weeds both on and off site, including vehicle washdown as required. Where vehicles and machinery are moving between the site and weed free areas, wash down procedures must be implemented.

6.1.3 Mitigate

Monitoring of the VSP will occur to ensure that areas of grass have naturally regenerated following the temporary disturbance. Where grasses have not regenerated, they will be reseeded with native species that currently occur within the study area, representative of a White Box - Yellow Box - Blakely's Red Gum Woodland EEC.

Weed monitoring will occur prior to and after conducting the VSP, to ensure weeds have not been introduced to the study area. Weed removal will be carried out as necessary.

6.1.4 Offset

Due to the proposed activities being short-term and the level of impacts being temporary and minimal in extent, as well as the recommended mitigation measures to rehabilitate the study area, offsets are not required.

7.0 Conclusion

Santos is proposing to conduct a VSP located within PEL 456. The VSP will be conducted within an agricultural property which is has been disturbed due to intensive grazing, and historical land management practices.

Despite the highly disturbed condition of much of the study area, the VSP will be conducted within an area that is considered to be representative of White Box - Yellow Box - Blakely's Red Gum Woodland EEC, listed under the TSC Act. This community is not considered to be representative of the similar EPBC Act listed TEC.

The proposed VSP line has been selected in accordance with the 'avoid – minimise – mitigate – offset' hierarchy to minimise impacts on White Box - Yellow Box - Blakely's Red Gum Woodland. The VSP line has been selected as is void of canopy vegetation, and consists of disturbed ground covers only.

No threatened fauna or flora species listed under the TSC Act and/or EPBC Act were recorded within the study area. Additionally, the likelihood of threatened flora and fauna species occurring in the study area is considered to be moderate to low.

The potential direct and indirect impacts that may be associated with the proposal are considered to be minimal, given that no vegetation clearing is required as part of the VSP profile. No significant impact on the White Box - Yellow Box - Blakely's Red Gum Woodland will occur as a result of the proposed activity.

8.0 References

Department of Sustainability, Environment, Water, Population and Community (2011). *EPBC Act Protected Matters Search Tool* (online). Accessed 6/4/2011.

Office of Environment and Heritage (2011*). Atlas of NSW Wildlife, Curlewis Map Sheet*.

Office of Environment and Heritage (2011). *Threatened Species, Populations, and Ecological Communities of NSW. Liverpool Plains Catchment Management Area Sub-region Threatened Species List* (online). Accessed 5/4/2011.

Appendix A to the Ecological Assessment

EPBC Protected Matters Report

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

Protected Matters Search Tool

EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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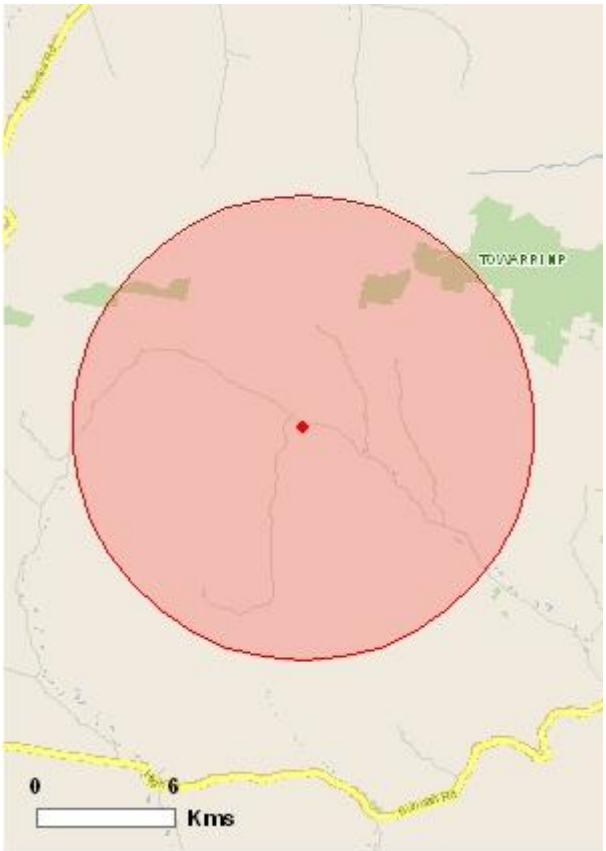

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Summary

Details

- Matters of NES
- Other matters protected by the EPBC Act
- Extra Information

Caveat

Acknowledgements

Coordinates
Buffer: 10Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance (Ramsar Wetlands):	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communitites:	3
Threatened Species:	14
Migratory Species:	12

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	10

Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	1
State and Territory Reserves:	2
Regional Forest Agreements:	1
Invasive Species:	18
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Wetlands of International Significance (RAMSAR Sites) [Resource Information]

Name	Proximity
Hunter estuary wetlands	Upstream from Ramsar site

Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area

Threatened Species [Resource Information]

Name	Status	Type of Presence
BIRDS		
Anthochaera phrygia		
Regent Honeyeater [82338]	Endangered	Species or species habitat may occur within area
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area
FISH		
Maccullochella peelii peelii		

Murray Cod, Cod, Goodoo [68443]	Vulnerable	Species or species habitat may occur within area
FROGS		
Litoria booroolongensis		
Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area
MAMMALS		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Nyctophilus timoriensis (South-eastern form)		
Greater Long-eared Bat, South-eastern Long-eared Bat [66888]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse [96]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area
PLANTS		
Digitaria porrecta		
Finger Panic Grass [12768]	Endangered	Species or species habitat likely to occur within area
Prasophyllum sp. Wybong (C.Phelps ORG 5269)		
a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Tylophora linearis		
[55231]	Endangered	Species or species habitat may occur within area

Migratory Species

[Resource Information]

Name	Status	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area

Myiagra cyanoleuca	
Satin Flycatcher [612]	Breeding likely to occur within area
Xanthomyza phrygia	
Regent Honeyeater [430]	Species or species habitat may occur within area
Migratory Wetlands Species	
Ardea alba	
Great Egret, White Egret [59541]	Species or species habitat may occur within area
Ardea ibis	
Cattle Egret [59542]	Species or species habitat may occur within area
Gallinago hardwickii	
Latham's Snipe, Japanese Snipe [863]	Species or species habitat may occur within area
Rostratula benghalensis s. lat.	
Painted Snipe [889]	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land - Australian Telecommunications Commission

Listed Marine Species [Resource Information]

Name	Status	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat may occur within area
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Breeding likely to occur within area
Rostratula benghalensis s. lat.		
Painted Snipe [889]		Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	Status
Natural	
Cedar Brush Nature Reserve NSW	Registered

State and Territory Reserves [Resource Information]

Cedar Brush, NSW
Towarri, NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

North East NSW RFA, New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Frogs		
Bufo marinus Cane Toad [1772]		Species or species habitat likely to occur within area
Mammals		
Capra hircus Goat [2]		Species or species habitat may occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat may occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara		

Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]	Species or species habitat likely to occur within area
Lycium ferocissimum	
African Boxthorn, Boxthorn [19235]	Species or species habitat may occur within area
Nassella trichotoma	
Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]	Species or species habitat may occur within area
Pinus radiata	
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]	Species or species habitat may occur within area
Rubus fruticosus aggregate	
Blackberry, European Blackberry [68406]	Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtiji	
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]	Species or species habitat may occur within area
Salvinia molesta	
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]	Species or species habitat may occur within area
Ulex europaeus	
Gorse, Furze [7693]	Species or species habitat may occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are

collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:
- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:
- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:
- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

150.64806 -31.90111

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium

-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix B to the Ecological Assessment

Site Flora Species List

Family Name	Scientific Name	Common Name
ASCLEPIADACEAE	*Gomphocarpus fruticosus* *	Narrow-leaf Cotton Bush
ASTERACEAE	*Bidens pilosa* *	Cobblers Pegs
ASTERACEAE	*Carthamus lanatus* *	Saffron Thistle
ASTERACEAE	*Chrysocephalum apiculatum*	Yellow Buttons
ASTERACEAE	*Conyza sumatrensis* *	Tall Fleabane
ASTERACEAE	*Onopordum acanthium* *	Scotch Thistle
ASTERACEAE	*Senecio madagascariensis* *	Fireweed
ASTERACEAE	*Vittadinia muelleri*	Narrow-leaf New Holland Daisy
ASTERACEAE	*Xanthium spinosum* *	Bathurst Burr
BRASSICACEAE	*Capsella bursa-pastoris* *	Shepherds Purse
CACTACEAE	*Opuntia stricta* *	Prickly Pear
CAMPANULACEAE	*Wahlenbergia communis*	Tufted Bluebell
CAMPANULACEAE	*Wahlenbergia gracillis*	Sprawling Blue Bell
CUPRESSACEAE	*Callitris glaucophylla*	White Cypress Pine
CYPERACEAE	*Cyperus* sp.	-
JUNCACEAE	*Juncus* sp.	-
LAMIACEAE	*Mentha pulegium* *	Pennyroyal
LAMIACEAE	*Salvia reflexa* *	Mintweed
MALVACEAE	*Sida rhombifolia* *	Common Sida
MYRTACEAE	*Angophora woodsiana*	Rough-barked apple
MYRTACEAE	*Eucalyptus albens*	White Box
MYRTACEAE	*Eucalyptus blakelyi*	Blakeleys Red Gum
MYRTACEAE	*Eucalyptus melliodora*	Yellow Box
MYRTACEAE	*Eucalyptus populnea*	Poplar Box, Bimble Box
PAPAVERACEAE	*Argemone ochroleuca* *	Mexican Poppy
POACEAE	*Agrostis capillaries* *	Bent Grass
POACEAE	*Aristida personata*	Purple Wire Grass
POACEAE	*Aristida vagans*	Three-awn Speargrass
POACEAE	*Austrodanthonia fulva*	Wallaby Grass
POACEAE	*Austrostipa aristiglumis*	Plains Grass
POACEAE	*Austrostipa verticillata*	Slender Bamboo Grass
POACEAE	*Bothriochloa decipiens*	Pitted Blue Grass
POACEAE	*Enneapogon avenaceus*	Common Bottlewashers
POACEAE	*Paspalum dilatatum* *	Paspalum
POACEAE	*Sporobolus creber*	Slender Rats Tail Grass
STERCULIACEAE	*Brachychiton populnea*	Kurrajong
VERBENACEAE	*Verbena officinalis* *	Common Verbena

* denotes introduced species

Appendix C to the Ecological Assessment

7-Part Test

7-Part Test

Approach

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of proposed activities on 'threatened species, populations or ecological communities or their habitats' (threatened biota) listed under the TSC Act. The so-called '7-part test' is used to determine whether proposed activities are 'likely' to impose 'a significant effect' on threatened biota and thus whether a Species Impact Statement (SIS) is required to be produced.

The significance of the impacts on White Box-Yellow Box-Blakely's Red Gum Woodland has been assessed in the sections below.

White Box Yellow Box Blakely's Red Gum Woodland

White Box Yellow Box Blakely's Red Gum Woodland is found on relatively fertile soils on the tablelands and western slopes of NSW and generally occurs between the 400 and 800 mm isohyets extending from the western slopes, at an altitude of c. 170m to c. 1200 m, on the northern tablelands. The community occurs within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes Bioregions.

7-Part Test Criteria

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> ***(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

The proposed action is unlikely to have an adverse effect on the extent of the ecological community, given that no vegetation clearing is proposed. Similarly, given the minimal impact of the proposed activity, it is unlikely that the action will substantially and adversely modify the composition of the

ecological community. To ensure any potential impacts to the composition of the ecological community are minimised, weed management procedures will be implemented.

d) In relation to the habitat of a threatened species, population or ecological community:

> ***(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and***
>
> ***(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and***
>
> ***(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.***

The proposed activity will not result in the removal of any of the Box Gum Woodland. No vegetation clearing is required as part of the VSP survey. It is unlikely that the proposed action will result in the removal or modification, fragmentation or isolation of the community.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat is registered for this EEC.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The DECCW (2010) has prepared a (draft) national recovery plan for this EEC. The primary objective of the recovery plan is to minimise the risk of extinction of this EEC through:

- Achieving no net loss in extent and condition of the ecological community throughout its geographic distribution;
- Increasing protection of sites in good condition;
- Increasing landscape functionality of the ecological community through management and restoration of degraded sites;
- Increasing transitional areas around remnants and linkages between remnants; and
- Bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland.

No EEC will be removed as part of this action, ensuring that the primary objective of the recovery plan is met.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

There are currently 35 key threatening processes (KTP's) listed under the TSC Act. The most relevant ones to this proposed activities and White Box Yellow Box Blakely's Red Gum Woodland are the invasion

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Appendices

Appendix A: EPBC Act Protected Matters Report
Appendix B: Site Flora Species List
Appendix C: 7-Part Test

Terms & Abbreviations

Abbreviation	Meaning
AoS	Assessment of Significance
BoM	Bureau of Meteorology
CEEC	Critically Endangered Ecological Community
CMA	Catchment Management Authority
DECCW	NSW Department of Environment, Climate Change and Water
DEWHA	Department of Water, Heritage and the Arts
EA	Ecological Assessment
EEC	Endangered Ecological Community
EMP	Environmental Management Plan
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FM Act	NSW Fisheries Management Act1994
ha	hectare
KTP	Key Threatening Process
LGA	Local Government Area
Locality	Lands within 10km of the study area
MNES	Matters of National Environmental Significance
NES	National Environmental Significance
NPWS	NSW National Parks and Wildlife Service
NSWG	NSW Government
NV Act	Native Vegetation Act 2003
NW Act	Noxious Weeds Act 1993
REF	Review of Environmental Factors
RPS	RPS Australia East Pty Ltd
SEPP 44	State Environmental Planning Policy 44 “Koala Habitat Protection”
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
Sp	Singular Species
Spp	Multiple Species
Ssp. or subsp.	Subspecies
Activity Site	Area directly associated with the proposed activities
Study Area	Area indirectly associated with the proposed activities
TEC	Threatened Ecological Community
TSC Act	NSW Threatened Species Conservation Act 1995

1.0 Introduction

1.1 Background

RPS has been engaged by Santos QNT Pty Ltd (Santos) to undertake an ecological pre-clearance survey of a proposed vertical survey profile (VSP) located within PEL 456.

This ecological assessment accompanies the review of environmental factors (REF) prepared in accordance with the *Environmental Planning and Assessment Act 1979* (NSW) in relation to the proposed activities.

1.2 Site Particulars

The VSP line is located on a property approximately 6km north of Brawboy, within the Upper Hunter Shire Council Local Government Area (LGA). The property is currently used for grazing, and has been historically selectively cleared. The landform is comprised of rolling hills.

The property is bound to the north and east by Upper Dartbrook Road, and to the west by Brawboy Road. The property is surrounded by grazing lands with scattered trees, and is located approximately 7km to the south of Towarri National Park.

1.3 Description of the Proposed Activities

Santos proposes to conduct a VSP across the study area (**Figure 1.1**), from 150° 38" 26.41'; -31° 54" 05.78' to 150° 38" 58.83'; -31 °54" 53.45', spanning a distance of 1.7km. The VSP involves driving a low impact vibrating unit, known as an EnviroVibe truck across the survey line. The Envirovibe Truck is approximately the size of a large four wheel drive vehicle, with larger wheels. The Envirovibe truck lowers a 1m x 1m plate onto the ground surface and vibrates the ground at every 25 – 50m along the length of the line. The plate will flatten any grasses encountered and leave a light impression in the ground. The truck is able to deviate from the intended line with a maximum of 20 degrees, and is able to maneuver around large obstacles such as trees or shrubs. As such, no clearing is required as part of the VSP. The truck will not vibrate along any steep hills greater than 35 degrees. The truck will travel multiple times along the source line but will follow the same track each time and vibrate in the same locations on each pass.

The wellbore is presently suspended and prior to commencing the VSP operation, access to the wellbore will need to be re-instated. This operation will include assessing the annular and tubing pressure on surface prior to removal of the blind flange which currently caps the wellhead. A pressure control device, a lubricator or equivalent, may be rigged up depending on the pressure encountered. The suspension plug will then be retrieved and the VSP tool will then be run into the wellbore.

As the energy source traverses the track, the VSP tool will be moved up the wellbore to gain higher resolution data, and as such may require multiple passes along the same surface track. Once the subsurface data has been acquired, the EnviroVibe truck will leave along the same track as it entered the property. The VSP tool will be retrieved and the wireline unit or equivalent conveyance unit will exit the lease. The wellbore will then be suspended pending further activities.

1.4 Scope of the Study

The objective of this assessment was to undertake an ecological assessment of a proposed vertical survey profile (VSP) located within PEL 456 to identify ecological impacts of the proposed activities, and recommend appropriate mitigation measures. The specific scope of the assessment was to:

- Conduct a background review of relevant environmental databases, maps and policies;
- Verify the vegetation communities and ecosystems occurring in the study area;
- Identify threatened species habitat values of the study area;
- Identify significant weed species;
- Identify constraints associated with the ecological features of the site in a legislative and planning context;
- Identify potential ecological impacts associated with the VSP; and
- Recommend appropriate mitigation measures to minimise potential ecological impacts.

A desktop assessment of the proposed VSP and surrounds was conducted prior to completing a pre-clearance assessment on 30 March, 2011. This assessment details the findings of the background review and pre-clearance survey. Additionally, Commonwealth, state and local legislation relevant to the proposal have been addressed in this assessment.

1.5 Licensing and Certification

Research was conducted under the NSW National Parks and Wildlife Service Scientific Investigation Licence S10300 (Valid 30 November 2011).

0 130 260 390
Meters

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Project Manager	BD
Compiled by	TL
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR107872.mxd
Sheet Number	1 of 1

Client
Santos QNT Pty Ltd

Title
Visual Survey Profile
Brawboy

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:15,000	02/08/2011	PR107872-1	1

2.0 Legislative Context

The following legislation is likely to be applicable to the site (from an environmental perspective) and may require further detailed consideration during the approval process.

2.1 Commonwealth Legislation

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) provides that a person proposing to take an action that the person thinks may be a "controlled action" must refer the proposal to the Minister for Sustainability, Environment, Water, Population and Communities (Minister). A "controlled action" is an action that:

- Will have or is likely to have a significant impact on:
  - World heritage areas;
  - National heritage places;
  - Ramsar wetlands of international importance;
  - Commonwealth listed threatened species and communities;
  - Commonwealth listed migratory species;
  - Commonwealth marine areas;
  - The environment on Commonwealth land; and
  - Great Barrier Reef Marine Park;
- Is undertaken by the Commonwealth and will have or is likely to have a significant impact on the environment;
- Is undertaken by any person on Commonwealth land and will have or is likely to have a significant impact on the environment; or
- Is a nuclear action.

These are referred to as "matters of national environmental significance" (MNES). The EPBC Act sets out the process for identifying and listing the MNES including listed threatened species and listed migratory species.

If the Minister decides that the proposed action is a controlled action, then the approval of the Minister is required under the EPBC Act.

A person proposing to take an action that the person thinks is not a controlled action may refer the proposal to the Minister for the Minister's decision whether or not the action is a controlled action. The proposed activities are not expected to have, or be likely to have, a significant impact on MNES including, in particular, listed threatened species or listed migratory species under the EPBC Act. The activity is not

considered a controlled activity. On this basis, a referral to the Minister under the EPBC Act is not proposed.

2.2 NSW State Legislation

2.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) regulates development carried out in New South Wales. The carrying out of development is regulated under either Part 3A, Part 4 or Part 5 of the EP&A Act.

Development is required to be assessed under Part 5 of the EP&A Act if the relevant environmental planning instruments provide that the development does not require consent or is not exempt development and the development is either carried out by a determining authority or requires the approval of a determining authority.

The proposed activities fall within the local government area (LGA) of Upper Hunter Shire. The site is zoned as partly 1(e) General Agricultural and 1(i) Intensive Agricultural under the Scone Local Environmental Plan. The proposed activities are permissible with development consent under the Scone LEP. However, *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (NSW) (Mining SEPP) applies to the activities. The Mining SEPP aims "to provide for the proper management and development of mineral, petroleum and extractive material resources for the social and economic welfare of [New South Wales]". Clause 6 of the Mining SEPP provides that development for the purposes of petroleum exploration may be carried out without development consent. Clause 6 applies despite the provisions of the LEP. This has the effect that the proposed activities are required to be assessed under Part 5 of the EP&A Act.

A determining authority, for the purposes of this activity, is defined in Part 5 to include a public authority whose approval is required before an activity may be carried out. The Assistant Director, Environment of the Department of Primary Industries and the New South Wales Office of Water will be determining authorities for the purposes of Part 5 of the EP&A Act because their approval is required for the proposed development under the legislation administered by these determining authorities.

<u>Determining Authorities</u>

Under Part 5 of the EP&A Act, a determining authority is required to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

Additionally, clause 228 of the *Environmental Planning and Assessment Regulation 2000* (NSW) sets out the factors that must be taken into account concerning the impact of an activity on the environment.

The determining authorities are required to consider whether the proposed activity is likely to significantly affect the environment or threatened species, populations or ecological communities, or their habitats to determine whether an EIS or SIS is required. In deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities or their habitats, section 5A of the EP&A Act requires the following factors to be taken into account (the "seven part" test of significance):

(1) *In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction;*

(2) *In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction;*

(3) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

   (i) *Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*

   (ii) *Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

(4) *In relation to the habitat of a threatened species, population or ecological community:*

   (i) *The extent to which habitat is likely to be removed or modified as a result of the action proposed, and*

   (ii) *Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed activities, and*

   (iii) *The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

(5) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly);*

(6) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan; and*

(7) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

This ecological assessment has been prepared to assist the determining authorities in meeting their obligations under the EP&A Act. In particular, the "seven part" test has been applied to the proposed VSP in **Appendix C**.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

The subject site is within the Upper Hunter LGA, which comprises portions of the former LGA of Scone. Scone is listed in the *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44), Schedule 1 as LGAs where this policy applies. SEPP 44 aims "to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline".

Schedule 1 of SEPP 44, which lists the LGAs to which SEPP 44 applies, includes the Upper Hunter LGA. SEPP 44 applies to local councils determining development applications under Part 4 of the EP&A Act. Although SEPP 44 does not apply in relation to the assessment of development under Part 5 of the EP&A Act, it has been considered in the preparation of this REF.

SEPP 44 requires that before granting development consent under Part 4 of the EP&A Act for development on land over 1 hectare in area, a consent authority must form a view as to whether the land is "potential"' or "core" Koala habitat. Potential Koala habitat is defined as:

> *areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.*

Core Koala habitat is defined as:

> *an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.*

Where core Koala habitat is found to occur, SEPP 44 requires that a site-specific Koala plan of management be prepared.

2.2.2 Threatened Species Conservation Act 1995

The objects of the *Threatened Species Conservation 1995* (NSW) (TSC Act) include:

- To conserve biological diversity and promote ecologically sustainable development;
- Prevent the extinction and promote the recovery of threatened species, populations and ecological communities;
- To protect the critical habitat of those threatened species, populations and ecological communities that are endangered; and
- To ensure that the impact of any action affecting threatened species, populations and ecological preventing the extinction and promoting the recovery of threatened species, populations and ecological communities is properly assessed.

The TSC Act provides the procedure for the listing of threatened species, populations and ecological communities and key threatening processes in New South Wales and the preparation and implementation of recovery plans and threat abatement plans.

The TSC Act also provides the mechanism for applying for and obtaining licences to take actions which will or is likely to result in harm to any animal that is a threatened species, population or ecological community, the picking of any plant which is part of a threatened species, population or ecological community, damage to critical habitat or damage to habitat of a threatened species, population or ecological community where such actions require a license to be obtained.

2.2.3 National Parks and Wildlife Act

Part 8A of the *National Parks and Wildlife Act 1974* (NPW Act) regulates the undertaking of activities which may impact on threatened species, populations and ecological communities listed under the TSC Act and their habitats. The NPW Act provides that a person must not harm any animal that is a threatened species, population or ecological community, pick any plant which is part of a threatened species, population or ecological community, damage any critical habitat or damage any habitat of a

threatened species, population or ecological community without a licence being obtained under the NPW Act or TSC Act or unless another exception applies.

The NPW Act provides that these requirements do not apply if the action was essential for the carrying out of an activity in accordance with an approval of a determining authority under Part 5 of the EP&A Act where the determining authority has complied with Part 5.

2.2.4 Key Threatening Processes

A key threatening process is defined under the TSC Act as 'a process that threatens, or that may threaten, the survival or evolutionary development of a species, population or ecological community. Threatening processes that adversely affect threatened species, populations or ecological communities, or possibly cause others that are not currently threatened; to become threatened may be eligible for listing as a key threatening process (KTP).

2.2.5 Noxious Weeds Act

The *Noxious Weeds Act 1993* relates to the management of declared weed species. This act allows for classification of weed species according to severity or 'invasiveness' and dictates the control requirements of weed species occurring on a site according to its classification.

2.2.6 Native Vegetation Act 2003

The *Native Vegetation Act 2003* regulates the clearing of native vegetation on all land in NSW, except for excluded land in Schedule 1 of the Act. The Act outlines what landowners can and cannot do in clearing native vegetation.

2.3 Local Legislation

The site is located within the Upper Hunter Shire Council. The *Scone Shire Council Local Environmental Plan 1992* applies to the site.

3.0 Methodology

3.1 Desktop Assessment

A desktop assessment was undertaken to identify potential development constraints as well as significant ecosystems and species that may potentially occur within the VSP line. The following databases and maps were reviewed:

- EPBC Protected Matters Search Tool (Department of Sustainability, Environment, Water, Population and Community (DSEWPaC), 2011) (**Appendix A**);
- Review of threatened fauna and flora records contained in the Department of Environment, Climate Change and Water (DECCW) Atlas of NSW Wildlife (Murrurrundi Map Sheet and Hunter Catchment Area sub-region);
- National Vegetation Information Systems mapping; and
- Aerial photography.

3.2 Field Assessment

A pre-clearance assessment was carried out on the 30 March 2011 to:

- Verify the results of the desktop assessment;
- Ground-truth vegetation communities;
- Undertake a fauna habitat assessment and incidental fauna observations;
- Identify potential habitat for potentially occurring significant species as listed under the EPBC and *Threatened Species Conservation Act 1995* (TSC);
- Search for weed species; and
- Identify required mitigation measures to minimise ecological impacts associated with the VSP.

Surveys of the proposed VSP line and adjacent areas consisted of a threatened species search, a vegetation survey and a flora and fauna habitat assessment. The threatened species search targeted those threatened species listed within the EPBC Protected Matters search and those species listed within the NSW Wildlife Atlas database. The flora survey consisted of a random meander and general threatened flora searches. This method generated a flora species list for and a description of the dominant flora species for the site.

3.3 Survey Limitations

It should be noted that the detectability of plants and the ability to accurately identify plants to species level may vary greatly with the time of year, prevailing climatic conditions and the presence of reproductive material (e.g. flowers, fruit, and seed capsules). Consequently, the survey conducted for the study area should not be regarded as conclusive evidence that certain protected plants do not occur within the study area; however every effort has been made to detect these species in habitats that were considered suitable.

In response to the abovementioned limitations the precautionary approach has been adopted; as such ‘assumed presence’ of known and expected threatened species, populations and ecological communities has been made where relevant to ensure a holistic assessment.

4.0 Results

4.1 Literature Review and Database Search Results

4.1.1 Environmental Protection and Biodiversity Conservation

A search using the EPBC Act protected matters search tool revealed ten threatened fauna species, comprising three birds, one frog, one fish, and five mammals (including three bats), and four threatened flora species listed under the EPBC Act that are predicted to occur within the locality of the study area.

In addition, 12 migratory bird species were revealed as predicted to occur within the locality of the study area.

The EPBC Act Protected Matters Search Tool identified three threatened ecological communities (TEC) potentially occurring within the site:

- Natural Grasslands on Basalt and Fine-textured alluvial plains of northern New South Wales and southern Queensland;
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland; and
- Weeping Myall Woodlands.

The site is upstream from one Ramsar site, Hunter estuary wetlands, as identified by the EPBC Act Protected Matters Search Tool, however the site is located over 100km to the north west of the wetlands. The results of the database search are shown in **Appendix A**.

No World Heritage properties, National Heritage properties or Commonwealth marine environments occur in the study area or would be affected by the activity.

A full list of threatened and migratory species obtained from the protected matters search tool is available in **Table 5.1** for flora, fauna and migratory species, as well as TECs. The table describes the conservation status, habitat requirements, likelihood of occurrence and potential for impact of each listing. A review of the specific habitat requirements of these species, and the habitat present within the study area and its surrounds allowed a number of these species and/or TECs to be eliminated as having nil, or low likelihood of occurrence in the study area.

4.1.2 Threatened Species Conservation Act

The results of the DECCW wildlife atlas database search revealed seven threatened flora species and 38 threatened fauna species, previously recorded within the Murrurundi map sheet area.

In addition there are 18 Threatened Ecological Communities listed within the NSW TSC Act (1995) that are known or predicted to occur in the Hunter Catchment Management Area Sub-region. These include:

- Central Hunter Grey Box - Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions;

- Central Hunter Ironbark - Spotted Gum - Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions;
- Coastal Saltmarsh in the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;
- Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;
- Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions;
- Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion;
- Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions;
- Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion;
- Kurri Sand Swamp Woodland in the Sydney Basin Bioregion;
- Littoral Rainforest in the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;
- Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion;
- Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions;
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;
- Swamp Oak Floodplain Forest of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;
- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;
- Sydney Freshwater Wetlands in the Sydney Basin Bioregion;
- Warkworth Sands Woodland of the Sydney Basin Bioregion; and
- White Box Yellow Box Blakely's Red Gum Woodland.

A full list of threatened and migratory species obtained from the DECCW wildlife atlas database search is available in **Table 5.1** for flora, fauna and migratory species, as well as EECs. The table describes the conservation status, habitat requirements, likelihood of occurrence and potential for impact of each listing. A review of the specific habitat requirements of these species, and the habitat present within the study area and its surrounds allowed a number of these species and/or EECs to be eliminated as having nil, or low likelihood of occurrence in the study area.

4.2 Flora Survey Results

4.2.1 Existing Condition

Vegetation within the VSP line and surrounds is representative of an *Angophora* and *Eucalypt* Grassy Woodland. The scattered canopy is dominated by Rough-barked Apple (*Angophora woodsiana*), with Yellow Box (*Eucalyptus melliodora*) frequently occurring. Blakely's Red Gum (*E. blakelyi*) also occur occasionally. No shrub layer is present across the survey line. Refer to **Plates 1 & 2**.

The ground cover is dominated by weed species, with up to 65% weed cover. Dominant weed species include Saffron Thistle (*Carthamus lanatus*), Tall Fleabane (*Conyza sumatrensis*), Shepherds Purse (*Capsella bursa-pastoris*), Common Sida (*Sida rhombifolia*), Balloon Cotton Bush (*Gomphocarpus physocarpus*), and Scotch Thistle (*Onopordum acanthium*).

Native species occurring on site include Pitted Blue Grass (*Bothriochloa decipiens*), Common Bottlewashers (*Enneapogon avenaceus*), Stout Bamboo Grass (*Austrostipa verticillata*), Slender Rats Tail Grass (*Sporobolus creber*), Threeawn Speargrass (*Aristida vagans*), Australian Bluebells (*Wahlenbergia gracillis*), and Tufted Bluebells (*Wahlenbergia communis*). A detailed species list is included in **Appendix 2**. **Plates 1 & 2** provide photos of the site condition.

Plate 1 – Site Vegetation

Plate 2 - Site Vegetation

4.2.2 Weeds

No declared weeds under the *Noxious Weeds Act 1993* were observed on site; however environmental weeds dominate the understorey.

4.2.3 Significant Flora Species

Using the EPBC Act Protected Matters Search Tool (**Appendix A**), five threatened flora species listed under the EPBC Act were identified as potentially occurring in the study area locale (10km buffer). Seven threatened species listed under the TSC Act were identified as potentially occurring in the study area, based on the Murrurrundi Atlas of NSW Wildlife. The likelihood of occurrence of these flora species was assessed based on broad habitat type and species distribution and is outlined in **Table 5.1**. No threatened flora species were identified within the study area. However, one species Tiger Orchid is considered to possibly occur in the study area, as suitable habitat exists. The remainder of threatened flora species returned through the database search are considered to be unlikely within the VSP.

4.2.4 Threatened Ecological Communities Assessment

An assessment of the VSP against the EPBC Act Policy Statement for Box-Gum Grassy Woodland and Derived Grassland, and Identification guidelines have been provided for the White Box - Yellow Box - Blakely's Red Gum Woodland EEC listed under the TSC Act (NPWS 2002) was conducted, given the presence of key indicator species within the proposed VSP line.

The vegetation occurring across the VSP is considered to be an EEC under the TSC Act, as outlined below. It is not considered to be a TEC under the EPBC Act.

EPBC Assessment

An assessment of the study area against the EPBC Act Policy Statement for Box-Gum Grassy Woodland and Derived Grassland, outlined in **Table 4.1.** The study area is considered to be a White Box - Yellow Box - Blakely's Red Gum Woodland EEC listed under the TSC Act; however it does not meet the criteria under the EPBC Guidelines, as it does not include 12 native understorey species. Additionally, the study area does not comprise an average of 20 or more mature tree per hectare.

Table 4.1 Assessment of the Study Area Against EPBC Act Policy Statement

Criteria	Comments
Does the subject site contain or previously have contained White Box, Yellow Box or Blakely's Red Gum?	Yellow Box and Blakely's Red Gum occur across the study area.
Does the subject site have a predominately native understorey?	A predominantly native understorey is one where at least 50% of the perennial vegetation is comprised of native species. While weed species dominate the study area, at least 50% of the perennial vegetation is comprised of native species such as *Sporobolus creber,* Common Bottlewashers, Pitted Bluegrass, Purple Wiregrass and Threeawn Speargras.
Is the patch 0.1 ha or greater in size?	Yes, the patch is greater than 0.1ha in size.
Are there 12 or more native understorey species present (excluding grasses)? There must be at least one important species.	No. A flora species list is included in **Appendix B** that indicates that there are less than 12 native understorey species (excluding grasses) recorded in the study area.
Is the patch 2ha in size or greater?	Yes, the patch is greater than 2ha in size.
Does the patch have an average of 20 or more mature trees per hectare, or is there natural regeneration of the dominant overstorey eucalypts?	The study area does not have an average of 20 or more mature trees per hectare. No evidence of natural regeneration of the dominant overstorey eucalypts was observed in the study area.

TSC Act Assessment

Under the TSC Act, White Box - Yellow Box - Blakely's Red Gum Woodland EEC can exist in a number of states. Intact stands that contain diverse upper and mid-storeys and ground layers are rare. Modified states include the following:

- Areas where the main tree species are present ranging from an open woodland formation to a forest structure, and the ground layer is predominantly composed of exotic species; and
- Subject sites where the trees have been removed and only the grassy groundlayer and some herbs remain.

Identification guidelines have been provided for this community (NPWS 2002). The vegetation in the study area has been assessed against these guidelines in **Table 4.2**.

Table 4.2 TSC Act Box Gum Woodland Listing Criteria

Box Gum Woodland	NPWS Comment	Response
1. The subject site is in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands or NSW South Western Slopes Bioregions. Proceed to 2.		1. The study area is located within the Nandewar Bioregion.
1*. The site is outside of the above bioregions.	The study area is not Box-Gum Woodland.	N/A
2. There are no native species in the understorey, and the subject site is unlikely to respond to assisted natural regeneration	The study area is not Box Gum Woodland	N/A
2* The subject site is otherwise. Proceed to 3.		The understorey, whilst dominated by weed species, includes some native grass, herb and forb species.
3. The subject site has trees. Proceed to 4.		N/A
3* The subject site is treeless, but is likely to have supported White Box, Yellow Box or Blakely's Red Gum prior to clearing.		The study area supports Yellow Box and Blakely's Red Gum.
4. White Box, Yellow Box or Blakely's Red Gum, or a combination of these species, are or were present. Proceed to 5.		N/A
4* White Box, Yellow Box or Blakely's Red Gum have never been present.	The study area is not Box Gum Woodland	N/A
5. The subject site is predominantly grassy.	The study area is Box Gum Woodland	The study area comprises a weedy understorey, however limited native grasses are present.
5* The understorey of the subject site is dominated by shrubs excluding pioneer species.	The study area is not Box Gum Woodland	N/A

As identified above, the study area is considered to be the TSC Act listed White Box - Yellow Box - Blakely's Red Gum Woodland, as it comprises native ground covers in conjunction with White Box and Blaekely's Red Gum.

No other Endangered Ecological Communities listed under the TSC Act were observed within the study area.

4.3 Habitat Assessment

4.3.1 Fauna Habitats of the Study Area

The study area is comprised of understory vegetation that is dominated by exotic species, with scattered mature eucalypts occurring. Several eucalypts have hollows ranging in size that provide breeding habitat for a number of native birds, mammals and reptiles.

The groundcover is structurally simple, but provides limited habitat for generalist species, including foraging opportunities for native mammals, reptiles and birds.

4.3.2 Fauna Observations

Several bird species were recorded opportunistically adjacent to the study area, including Dusky Woodswallow (*Artamus cyanopterus*), Crimson Rosella (*Platycercus elegans*), Red-rumped Parrot (*Psephotus haematonotus)*, and Restless Flycatcher (*Myiagra inquieta*). None of the above bird species are listed as threatened and/or migratory under the TSC Act and/or EPBC Act.

Eucalypt trees were surveyed for the presence of Koalas and scats, however no evidence of Koala usage was observed.

4.3.3 Significant Species

Nineteen threatened fauna species listed under the EPBC Act were identified as potentially occurring in the study area locale (10km buffer) using the EPBC Protected Matters Search Tool (**Appendix A**). Thirty-eight threatened species listed under the TSC Act were identified as potentially occurring in the study area, based on the Murrurrundi Atlas of NSW Wildlife. The likelihood of occurrence of these species was assessed, based on broad habitat type and species distribution, outlined in **Table 5.1**.

The assessment identified that the study area and adjacent woodland habitat provides suitable habitat for several threatened species, such as Brown Treecreeper (*Climacteris picumnus*), Powerful Owl (*Ninox strenua*), and Yellow-bellied Sheath-tail Bat (*Saccolaimus flaviventris*). While suitable habitat occurs for these species in the study area, the VSP is considered to have minimal impact upon fauna habitat, as no clearing of vegetation will be required.

An additional ten migratory species were identified as potentially occurring in the study area locale using the EPBC Protected Matters Search Tool. The likelihood of occurrence of these species was assessed, based on broad habitat type and species distribution, also outlined in **Table 5.1**. The assessment identified that the study area provides possible habitat for three species, including Rainbow Bee-eater (*Merops ornatus).* While suitable habitat occurs for these species in the study area for three species, the VSP is considered to have minimal impact upon fauna habitat, as no clearing of vegetation will be required.

5.0 Environmental Impact Assessment

5.1 Threatened Flora, Fauna and Ecological Communities

Those threatened flora and fauna species (listed under the *TSC Act* and the *EPBC Act*) that have been gazetted / recorded from within the locality have been considered in this ecological assessment. EEC's and Endangered Populations known from the broader area have also been addressed. Each species / community / population is considered for its potential to occur within the study area and the likely level of impact as a result of the proposed activities. This ecological assessment deals with each species / community / population separately and identifies the ecological parameters of significance associated with the proposed activities.

Those species / communities that have been identified as potentially being impacted have been assessed in **Appendix C.**

'Species' or **'EEC / Population'** – Lists each threatened species / EEC / population known from the vicinity of the site. The status of each threatened species under the *TSC Act* and *EPBC Act* is also provided.

'Habitat' – Provides a brief account of the species / community / population and the preferred habitat attributes required for the existence / survival of each species / community / population.

'Likelihood of Occurrence'– Assesses the likelihood of each species / community / population to occur within the site in terms of the aforementioned habitat description and taking into account local habitat preferences, results of recent field investigations, data gained from various sources and previously gained knowledge via fieldwork undertaken within other ecological assessments in the locality.

'Potential for Impact' – Through consideration of the likely level / significance of impacts to each species / community / population that would result from the proposed activities, taking into account both short and long-term impacts, a decision has been made whether further assessment is required. This assessment is largely based on the chance of occurrence of each species / community with due recognition to other parameters such as home range, habitat use, connectivity etc. It also considers the scope of the proposed activities.

Table 5.1 Likelihood of Threatened Species, Populations and Ecological Communities Occurring in the Study Area

Species	Common Name	TSC Act Status	EPBC Act Status	Habitat	Likelihood of Occurrence	Potential for Impact
Asterolasia sp. "Dungowan Creek"	Dungowan Starbush	E	-	Dungowan Starbush grows in rocky alluvial soil along a creek bank dominated by River Oak *Casuarina cunninghamiana*. Recent populations have been found growing near (100-150m) major drainage lines.	Unlikely due to unsuitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Cymbidium canaliculatum	Tiger Orchid	E	-	Dry sclerophyll forests and woodlands of tablelands and western slopes, growing in hollows of trees.	Possible. Suitable habitat occurs in the study area.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.
Digitaria porrecta	Finger Panic Grass	-	E	Occurs in grasslands and in undulating woodlands and open forests with an underlying basaltic geology.	Unlikely due to highly disturbed nature of the study area.	Considered unlikely to be adversely affected by the proposed activities due to the highly disturbed nature of the study area and the low level of impact, therefore an AoS for this species is not required.
Diuris pedunculata	Small Snake Orchid	E	-	Moist grassy areas in sclerophyll forest.	Unlikely due to unsuitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	-	Grassy or sclerophyll woodland in association with many other eucalypts.	Possible. Suitable habitat occurs in the study area.	Although suitable habitat occurs in the study area, it is unlikely that this species will be affected due to the minimal level of impact of the proposed VSP activities. An AoS for this species is therefore not required.

Eucalyptus oresbia	Small-fruited Mountain Gum	V	-	Steep slopes in wet forest at higher altitudes.	Unlikely due to unsuitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Pomaderris queenslandica	Scant Pomaderris	E	-	Moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.	Unlikely due to unsuitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Prasophyllum sp. Wybong	A Leek-orchid	-	CE	Generally found in shrubby and grassy habitats in dry to wet soil. It is known to occur in open Eucalypt woodland and grassland.	Suitable habitat occurs in the study area, however given the highly disturbed nature of the study area, it is considered unlikely.	Considered unlikely to be affected by the proposed activities due to the highly disturbed nature of the study area and the low level of impact resulting from the proposed VSP activities. Therefore, an AoS for this species is not required.
Stemmacantha australis	Austral Cornflower	E	V	Eucalypt open forest with grassy understory with *Chloris gayana, Cirsium vulgare, Eucalyptus tereticornis* and *Angophora floribunda* on black clay soil.	Unlikely due to unsuitable soil type.	Considered unlikely to be affected due to the unsuitable soil type in the study area and the minimal level of impact resulting from the proposed VSP activities. Therefore, an AoS for this species is not required.
Thesium australe	Austral Toadflax	-	V	Occurs in grasslands or grassy woodlands and is often found in damp sites in association with Kangaroo Grass.	Unlikely due to unsuitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.
Tylophora linearis	-	-	E	Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry Eucalypt and/or Callitris woodlands.	Unlikely due to unsuitable habitat.	Unlikely to be affected due to the lack of suitable habitat in the study area and the minimal level of impact resulting from the proposed VSP activities. An AoS for this species is therefore not required.

TSC Act and/or EPBC Act – Threatened Ecological Communities						
EPBC Act - White Box-Yellow Box-Blakely's Red Gum grassy woodland and derived native grassland **TSC Act - White Box Yellow Box Blakely's Red Gum Woodland**		**EEC**	**CE**	**White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as Box-Gum Woodland) is an open woodland community (sometimes occurring as a forest formation) , in which the most obvious species are one or more of the following: White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*). Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses and a very high diversity of herbs.** **Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW.**	**TSC Act – Known to occur within the VSP.** **The community is not considered to be a TEC under the EPBC Act.**	**The community is not considered to be the EPBC listed community, however it is considered to be the TSC Act community (Section 2.3.4).** **The potential impact upon this community is considered to be minimal, as the proposed activities will result in disturbances to ground covers only due to increased vehicle movements. However, a 7-part test of significance (TSC Act) has been applied to this ecological community and included in Appendix C.**
EPBC Act – Natural Grasslands on Basalt and Fine-textured Alluvial Plains of Northern New South Wales and Southern Queensland		-	CE	Natural Grasslands on Basalt and Fine-textured Alluvial Plains of Northern New South Wales and Southern Queensland commonly occur in the Darling Downs of southern Queensland and the Liverpool Plains and Moree Plains of northern NSW. Species composition can change yearly and seasonally in response to rainfall, temperature, fire, grazing pressure and management. This community is typically dominated by tussock grasses in the genera *Austrodanthonia, Austrostipa, Bothriochloa, Chloris, Enteropogon*, or *Themeda*, with	While species from the listed generas occur within the VSP, this community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.

			occurrences of other herbaceous plants such as native daisies, orchids, lilies and other wildflowers. The shrub cover is typically a very minor component of the grassland. A tree canopy is typically absent. The ecological community generally occurs on flat to low slopes, of no more than 5 percent (or less than 1 degree) inclination. The community is mainly associated with fine textured, often cracking clay soils derived from either basalt or alluvium.		
EPBC Act - Weeping Myall Woodlands.	-	E	The Weeping Myall Woodlands range from open woodlands to woodlands, generally 4 – 12m high. The overstorey is dominated by Weeping Myall (*Acacia pendula*). The understorey often includes an open layer of shrubs over a ground layer which includes a diversity of grasses and forbs. There are more than 80 species of plants that could be part of the community. The ecological community generally occurs on flat areas, shallow depressions or gilgais on raised alluvial plains. Occurs on black, brown, red-brown or grey clay or clay loam soils.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Central Hunter Grey Box - Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions;	EEC	-	Typically forms a woodland dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *Brachychiton populneus* subsp. *populneus* (Kurrajong) and *Eucalyptus moluccana* (Grey Box). Central Hunter Grey Box - Ironbark Woodland occurs in areas of relatively low rainfall and high temperatures. It is associated mostly with Permian	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.

			lithology, and is situated on gently undulating hills, slopes and valleys, or occasionally on rocky knolls. Central Hunter Grey Box - Ironbark Woodland occurs in the Central Hunter Valley between about Singleton and Muswellbrook.		
Central Hunter Ironbark - Spotted Gum - Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions;	EEC	-	Typically forms an open forest or woodland dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *Corymbia maculata* (Spotted Gum) and *Eucalyptus moluccana* (Grey Box). This community occupies undulating country including low rises and slopes, occurring on all aspects. It may also occur on alluvial and colluvial soils in valleys. It mostly occurs on clayey soils found on Permian sediments and occurs in the central Hunter Valley mainly between Maitland and Muswellbrook. It occurs in the Muswellbrook, Singleton, Cessnock, Maitland and Dungog LGAs.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Coastal Saltmarsh in the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;	EEC	-	Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Characteristic plants include *Baumea juncea, Juncus krausii, Sarcocornia quinqueflora, Sporobolus virginicus, Triglochin striata, Isolepis nodosa, Samolus repens,Selliera radicans, Suaeda australis* and *Zoysia macrantha*. Occasionally mangroves are scattered through the saltmarsh. Tall reeds may also occur, as well as salt pans.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.

Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;	EEC	-	Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. They are dominated by herbaceous plants and have very few woody species. The communities that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants. The communities with standing water that is deeper or more permanent, amphibious and emergent plants become less abundant, while floating and submerged aquatic herbs become more abundant.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions;	EEC	-	Hunter Lowland Redgum Forest is an open forest where the most common canopy tree species are *Eucalyptus tereticornis* (Forest Red Gum) and *E. punctata* (Grey Gum). This community occurs between Muswellbrook, Beresfield, Mulbring and Cessnock in the Lower Hunter in the Sydney Basin and North Coast bioregions. It occurs on gentle slopes of depressions and drainage flats on Permian sediments on the Hunter Valley floor.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion;	VEC	-	This community is a woodland, or occasionally an open forest, with a sparse to moderately dense tree layer with occasional small trees and a moderately dense to dense shrub layer.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site

			The tree canopy is typically dominated by *Eucalyptus dawsonii* (Slaty Gum) and/or *Eucalyptus moluccana* (Grey Box). *Acacia salicina* (Cooba) and *Allocasuarina luehmannii* (Bulloak) may form a small tree layer or be part of the upper-most canopy. It mainly occurs on the southern side of the Hunter Valley from near Bulga to the Bylong/Goulburn River National Park area. It occurs on colluvial soils on exposed footslopes associated with the interface between Triassic Narrabeen sandstones and Permian sediments.		assessment. An AoS for this community is not required.
Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions;	EEC	-	Hunter Valley Vine Thicket typically forms a low forest, usually less than 10 m tall, with a closed canopy dominated by small trees. The canopy may include *Elaeodendron australe* (Red Olive Plum), *Geijera parviflora* (Wilga), *Notelaea microcarpa* var.*microcarpa* (Native Olive), *Alectryon oleifolius* subsp. *elongatus* (Western Rosewood), *Melia azedarach* (White Cedar) and *Brachychiton populneus* subsp. *populneus* (Kurrajong). Emergent eucalypts are common and include *Eucalyptus albens* (White Box), *E. dawsonii* (Slaty Box) and *E. crebra* (Narrow-leaved Ironbark). Hunter Valley Vine Thicket mainly occurs on rocky slopes on Carboniferous sediments and volcanics, occasionally with limestone. It has a highly restricted geographic distribution in the central Hunter Valley. The community occurs mostly as patches of less than 10 ha, with a few larger patches exceeding 100 ha. Hunter Valley Vine Thicket has been recorded	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.

			in the Muswellbrook, Singleton, and Upper Hunter LGAs.		
Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion;	EEC	-	Typically has a dense to open tree canopy up to about 15 m tall, depending on disturbance and regrowth history. The most common tree is *Acacia pendula* (Weeping Myall), which may occur with *Eucalyptus crebra* (Narrow-leaved Ironbark), *A. salicina* (Cooba) and/or trees within the *A. homalophylla - A. melvillei* complex. This community is associated with heavy clay soils on depositional landforms in the south-western part of the Hunter River valley floor. It is currently known from parts of the Muswellbrook and Singleton LGA, but may occur in the Upper Hunter LGA, although its presence has not yet been confirmed there.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Kurri Sand Swamp Woodland in the Sydney Basin Bioregion;	EEC	-	Kurri Sand Swamp Woodland is a low woodland or heathland, generally with a low open canopy rarely exceeding 15 m in height and a shrubby understorey. The overstorey is usually dominated by *Eucalyptus parramattensis* subsp. *decadens* (Parra matta Red Gum) and *Angophora bakeri* (Narrow-leaved Apple). Known to occur in the Kurri Kurri–Cessnock area of the Cessnock LGA in the lower Hunter Valley. Occurs on soils developed on poorly-drained Tertiary sand deposits that blanket Permian sediments.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Littoral Rainforest in the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;	EEC	-	Littoral Rainforest is generally a closed forest, the structure and composition of which is strongly influenced by its	This ecological community was not identified in	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known

			proximity to the ocean. The plant species of this community are predominantly rainforest species. Several species have compound leaves, and vines may be a major component of the canopy. This community occurs only on the coast and is found at locations in the NSW North Coast Bioregion, Sydney Basin Bioregion and South East Corner Bioregion. Littoral Rainforest is very rare and occurs in many small stands on sand dunes and on soil derived from underlying rocks.	the study area.	to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion;	EEC	-	This community is dominated by Spotted Gum *Corymbia maculata* and Broad-leaved Ironbark *Eucalyptus fibrosa*, while Grey Gum *E. punctata* and Grey Ironbark *E. crebra* occur occasionally. A number of other eucalypt species occur at low frequency, but may be locally common in the community. This community is restricted to a range of approximately 65 km by 35 km centred on the Cessnock - Beresfield area in the Central and Lower Hunter Valley. It occurs principally on Permian geology in the central to lower Hunter Valley and is strongly associated with, though not restricted to, the yellow podsolic and solodic soils.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions;	VEC	-	Lower Hunter Valley Dry Rainforest typically has a canopy of 15-25m high with 40-80% cover. The most common canopy trees include *Elaeocarpus obovatus* (Hard Quandong), *Baloghia inophylla* (Brush Bloodwood), *Streblus brunonianus* (Whalebone Tree), *Mallotus philippensis* (Red	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.

			Kamala), *Capparis arborea* (Brush Caper Berry), *Olea paniculata* (Native Olive) and *Dendrocnide excelsa* (Giant Stinging Tree). It mainly occurs on the Barrington footslopes along the northern rim of the Hunter Valley Floor, where it occupies gullies and steep hillslopes with south facing aspects. Often occurs on steep rocky or scree slopes, especially granite.		
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;	EEC	-	This EEC is found on the river flats of the coastal floodplains. It has a tall open tree layer of eucalypts, which may exceed 40 m in height. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Swamp Oak Floodplain Forest of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;	EEC	-	This EEC is associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Swamp Oak Floodplain Forest generally occurs below 20m (rarely above 10 m) elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.

			community may vary fro open forests to low woodlands, scrubs.		
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast; Sydney Basin and South East Corner Bioregions;	EEC	-	This ECC is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Swamp Sclerophyll Forest on Coastal Floodplains generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community is typically open forest, although partial clearing may have reduced the canopy to scattered trees. In some areas the tree stratum is low and dense, so that the community takes on the structure of scrub. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent.	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.
Sydney Freshwater Wetlands in the Sydney Basin Bioregion;	EEC	-	This EEC is characterised by the assemblage of species including *Banksia robur, Baumea articulata, Callistemon citrinus, Casuarina glauca, Gahnia clarkei, Melaleuca linariifolia, Melaleuca nodosa* and many more wetland species. Characteristic vegetation is sedges and aquatics particularly *Eleocharis sphacelata, Baumea juncea, Baumea rubiginosa, Baumea articulata, Gahnia sieberiana, Ludwigia peploides subsp. montevidensis* and *Persicaria* species. There may be considerable areas of open water particularly where drainage conditions have been altered. There may be patches of emergent trees such as Melaleuca quinquenervia and	This ecological community was not identified in the study area.	Unlikely to be affected by the proposed VSP activities, as this ecological community is not known to occur in the study area, nor was it observed during the site assessment. An AoS for this community is not required.

NSW Farmers' Association, Chambers of Commerce and Local Aboriginal Land Councils) and for that reason Santos makes available information about their activities across the entire exploration area using the following consultation methods:

(1) Community information sessions are being held in the Bunnan area in the lead up to work commencing. The information sessions given by Santos include using subject specialists (geologists, drilling engineers, hydrologists and hydro-geologists, government relations and stakeholder management). To date, Santos has held two community information sessions in Bunnan and has monthly information sessions planned in the future.

(2) A 1800 number for the whole of the Gunnedah Basin is attended during business hours, all calls returned within 48 business hours. Santos have had contact from community members in the Bunnan area seeking information on certain aspects of the activities. Written advice has been provided to those community members who have sought information.

(3) A public email address – emails returned within 48 business hours.

(4) Briefing of key Local, State and Federal government staff and elected representatives.

4.0 Regulatory Context

There is a range of legislation applicable to the proposed activities which is addressed below.

4.1 Petroleum (Onshore) Act

The *Petroleum (Onshore) Act 1991* (NSW) (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 an exploration licence has the right to prospect for petroleum on the land comprised in the licence. The proposed activities will be undertaken within the area of PEL 456 granted under the Petroleum Act. PEL 456 indicates categories of works that are permissible as follows:

Category 1

- Geological mapping
- Rock sampling (by hand held equipment)
- All reconnaissance drilling other than petroleum exploration holes
- Geophysical surveys other than seismic
- Airborne surveys

Category 2

- Access tracks or line clearing involving formed construction or significant native vegetation disturbance

Category 3

- Petroleum exploration holes
- Seismic surveys

The proposed activities fall under Category 3. Under Condition 1 of PEL 456, Category 3 activities require notification to the Department of Primary Industries, submission of a Review of Environmental Factors (REF) under Part 5 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) and approval of the Assistant Director, Environment of the Department of Primary Industries. This REF is being submitted in accordance with Condition 1 of PEL 456.

4.2 Environmental Planning & Assessment Act

4.2.1 Overview

The *Environmental Planning and Assessment Act 1979* (NSW) (EP& A Act) regulates development carried out in New South Wales. The carrying out of development is regulated under either Part 3A (this is being repealed and replaced), Part 4 or Part 5 of the EP&A Act.

Development is required to be assessed under Part 5 of the EP&A Act if the relevant environmental planning instruments provide that the development does not require consent or is not exempt development and the development is either carried out by a determining authority or requires the approval of a determining authority.

The proposed activities fall within the local government area (LGA) of Upper Hunter Shire. The site is zoned as partly 1(e) General Agricultural and 1(i) Intensive Agricultural under the Scone Local Environmental Plan. The proposed activities are permissible with development consent under the Scone LEP. However, *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (NSW) (Mining SEPP) applies to the activities. The Mining SEPP aims "to provide for the proper management and development of mineral, petroleum and extractive material resources for the social and economic welfare of [New South Wales]". Clause 6 of the Mining SEPP provides that development for the purposes of petroleum exploration may be carried out without development consent. Clause 6 applies despite the provisions of the LEP. This has the effect that the proposed activities are required to be assessed under Part 5 of the EP&A Act.

A determining authority, for the purposes of this activity, is defined in Part 5 to include a public authority whose approval is required before an activity may be carried out. The Assistant Director, Environment of the Department of Primary Industries and the New South Wales Office of Water will be determining authorities for the purposes of Part 5 of the EP&A Act because their approval is required for the proposed development under the legislation administered by these determining authorities.

4.2.2 Determining Authorities and the REF

Under Part 5 of the EP&A Act, a determining authority is required to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

Additionally, clause 228 of the *Environmental Planning and Assessment Regulation 2000* (NSW) sets out the factors that must be taken into account concerning the impact of an activity on the environment.

The determining authorities are required to consider whether the proposed activity is likely to significantly affect the environment or threatened species, populations or ecological communities, or their habitats to determine whether an Environmental Impact Statement (EIS) or Species Impact Statement (SIS) is required. In deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities or their habitats, section 5A of the EP&A Act requires the following factors to be taken into account (the "seven part" test of significance)

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

This REF has been prepared to assist the determining authorities in meeting their obligations under the EP&A Act. The Ecological Assessment in **Appendix A** reports that the proposed activities are not likely to significantly affect the environment or threatened species, populations or ecological communities or their habitats.

4.2.3 Scone Local Environmental Plan

The site is zoned partly 1(e) General Agricultural and 1(i) Intensive Agricultural under the Scone LEP. As stated above, the effect of the Mining SEPP is to require the proposed development to be assessed under Part 5 of the EP&A Act. However, consideration has been given to the nature and objectives of the 1(e) General Agricultural zone and 1(i) Intensive Agricultural. The objectives of zone 1(e) are:

- *To preserve the essential broadacre agricultural landscape of the local government area of Scone, by encouraging continued extensive agricultural land use and by discouraging land uses that may detract from that character;*
- *To protect and conserve large agricultural holdings and to encourage continuing and sustainable agricultural land use;*
- *To provide a for a range of compatible land uses which maintain the rural environment, character and landscape of the locality;*
- *To encourage only development which is ecologically sustainable and carried out in a manner that will not have any adverse impacts on the environmental qualities of the locality, particularly any adverse cumulative impact;*
- *To permit non-agricultural land uses such as rural industries, tourist facilities and the like which are in keeping with the proceeding zone objectives and which will not adversely affect agricultural productivity.*

The objectives of zone 1(i) Intensive Agricultural are:

- *To conserve prime crop and pasture land which is suitable for intensive agricultural pursuits;*
- *To encourage the development of intensive commercial agricultural enterprises which meet sustainable natural resource management principles and will not have any adverse impact on the environmental qualities of the locality, particularly any adverse cumulative impact;*
- *To protect intensive agricultural enterprises from operational constraints caused by land use conflicts, especially those arising from a pressure to maintain a level of amenity more appropriate to a residential or hobby farming area;*
- *To prevent the inappropriate use of land with a high potential for agricultural productivity (including to prevent its use for rural residential and hobby farm purposes);*
- *To ensure that holdings used for the purpose of intensive infrastructure are of a suitable size for that use;*
- *To protect land within the zone from inefficiencies posed by excessive and non productive improvements, fragmentation of holdings and conflict between land uses;*
- *To permit supporting, small scale and compatible value adding industries to intensive agriculture where they are ancillary to agriculture; and*
- *To prevent adverse impact on the environmental qualities of the locality, particularly any adverse cumulative impact.*

Whilst an area of agricultural land would be used, this is for a temporary period and there will not be the need for any access track construction. Any site infrastructure, such as amenities etc, would be confined to the existing well lease and would not require further disturbance of agricultural land. Under the approval for the Brawboy 2 wellbore, the land would be rehabilitated by 31 March 2013, unless a development application was applied for to convert the well to a production well.

4.2.4 State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims "to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline".

Schedule 1 of SEPP 44, which lists the LGAs to which SEPP 44 applies, includes the former Scone LGA. SEPP 44 applies to local councils determining development applications under Part 4 of the EP&A Act. Although SEPP 44 does not apply in relation to the assessment of development under Part 5 of the EP&A Act, it has been considered in the preparation of this REF.

SEPP 44 requires that before granting development consent under Part 4 of the EP&A Act for development on land over 1 hectare in area, a consent authority must form a view as to whether the land is "potential"' or "core" koala habitat. Potential koala habitat is defined as:

> *areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.*

Core koala habitat is defined as:

> *an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.*

Where core koala habitat is found to occur, SEPP 44 requires that a site-specific koala plan of management be prepared.

The Ecological Assessment in **Appendix A** reports that whilst one species of listed Koala food tree is present on site (White Box), it does not constitute 15% of the total number of trees in the upper canopy of lower strata. The site is therefore not considered potential Koala habitat under SEPP 44.

4.3 Environmental Protection and Biodiversity Conservation Act

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) provides that a person proposing to take an action that the person thinks may be a "controlled action" must refer the proposal to the Minister for Sustainability, Environment, Water, Population and Communities (Minister). A "controlled action" is an action that:

- will have or is likely to have a significant impact on
  - World heritage areas
  - National heritage places
  - Ramsar wetlands of international importance
  - Commonwealth listed threatened species and communities
  - Commonwealth listed migratory species
  - Commonwealth marine areas
  - The environment on Commonwealth land
  - Great Barrier Reef Marine Park;
- Is undertaken by the Commonwealth and will have or is likely to have a significant impact on the environment;
- Is undertaken by any person on Commonwealth land and will have or is likely to have a significant impact on the environment; or
- Is a nuclear action.

These are referred to as "matters of national environmental significance" (MNES). The EPBC Act sets out the process for identifying and listing the MNES including listed threatened species and listed migratory species.

If the Minister decides that the proposed action is a controlled action, then the approval of the Minister is required under the EPBC Act.

A person proposing to take an action that the person thinks is not a controlled action may refer the proposal to the Minister for the Minister's decision whether or not the action is a controlled action. The proposed activities are not expected to have, or be likely to have, a significant impact on MNES including, in particular, listed threatened species or listed migratory species under the EPBC Act. The activity is not considered a controlled activity. On this basis, a referral to the Minister under the EPBC Act is not proposed.

4.4 Threatened Species Conservation Act

The objects of the *Threatened Species Conservation 1995* (NSW) (TSC Act) include:

- To conserve biological diversity and promote ecologically sustainable development;
- Prevent the extinction and promote the recovery of threatened species, populations and ecological communities;
- To protect the critical habitat of those threatened species, populations and ecological communities that are endangered; and

- To ensure that the impact of any action affecting threatened species, populations and ecological preventing the extinction and promoting the recovery of threatened species, populations and ecological communities is properly assessed.

The TSC Act provides the procedure for the listing of threatened species, populations and ecological communities and key threatening processes in New South Wales and the preparation and implementation of recovery plans and threat abatement plans.

The TSC Act also provides the mechanism for applying for and obtaining licences to take actions which will or are likely to result in harm to any animal that is a threatened species, population or ecological community, the picking of any plant which is part of a threatened species, population or ecological community, damage to critical habitat or damage to habitat of a threatened species, population or ecological community where such actions require a licence to be obtained.

Threatened species, populations or ecological communities are not likely to be impacted by the proposal.

4.5 National Parks and Wildlife Act

Threatened Species

Part 8A of the *National Parks and Wildlife Act 1974* (NPW Act) regulates the undertaking of activities which may impact on threatened species, populations and ecological communities listed under the TSC Act and their habitats. The NPW Act provides that a person must not harm any animal that is a threatened species, population or ecological community, pick any plant which is part of a threatened species, population or ecological community, damage any critical habitat or damage any habitat of a threatened species, population or ecological community without a licence being obtained under the NPW Act or TSC Act or unless another exception applies.

The NPW Act provides that these requirements do not apply if the action was essential for the carrying out of an activity in accordance with an approval of a determining authority under Part 5 of the EP&A Act where the determining authority has complied with Part 5.

Aboriginal Cultural Heritage

The NPW Act conserves places, objects and features of significance to Aboriginal people.

It is an offence under the NPW Act to:

- harm or desecrate an object that the person knows is an Aboriginal object except in accordance with an Aboriginal heritage impact permit;
- harm or desecrate Aboriginal objects and Aboriginal places except in accordance with an Aboriginal heritage impact permit or where the person can show they exercised due diligence to reasonably determine that no Aboriginal object would be harmed.

Clause 80B of the *National Parks & Wildlife Regulations 2009* provides defences to the strict liability offence of harming an Aboriginal object or place contained in s86(2) of NPW Act. Clause 80B (1) relevantly states (*inter alia*):

"It is a defence to a prosecution for an offence under s 86(2) of the Act, if the defendant establishes that the act or omission concerned:

(i) Was work of the following kind on land that has been disturbed:

(i) Seismic surveying,"

Clause 80B (4) states further:

"For the purposes of this clause, land is disturbed if it has been the subject of human activity that has changed the land's surface, being changes that remain clear and observable. Note: Examples of activities that may have disturbed land include the following:

(d) clearing of vegetation;

(g) Substantial grazing involving the construction of rural infrastructure."

As the subject land is grazing land that has undergone substantial clearance for the purposes of grazing, the project meets the criteria set out for defence in Clause 80B (1)(i).

Nonetheless, Santos has elected to exceed its statutory obligations regarding the potential harm of Aboriginal cultural heritage and conducted a due diligence survey of the proposed project area on 30 March 2011. This survey was conducted by Steven Coghill, Indigenous Affairs Officer for Santos and included the proposed VSP source line. The survey confirmed that the land was of a disturbed nature in keeping with the suggested examples in Clause 80B (4). No artefactual material was identified along the source line alignment as a result of the survey. An AHIMS search did not identify any items in the vicinity of the site (refer **Appendix B**).

There will be no earthworks associated with the proposal. The EnviroVibe truck will traverse the ground without the requirement for an access track to be constructed. While the existing partially rehabilitated well lease associated with Brawboy 2 will be re-gravelled, there will be no disturbance outside the existing 20m x 20m area. This reduces the risk of impacting upon areas of possible Aboriginal cultural heritage.

4.6 Native Vegetation Act

The *Native Vegetation Act 2003* (NV Act) sets a framework for:

- Encouragement of revegetation and rehabilitation of land with appropriate native vegetation;
- Providing incentives for landholders to undertake management of native vegetation on their properties; and
- An end to broad scale clearing, unless it improves or maintains the environment.

The NV Act provides three categories of native vegetation including regrowth, protected regrowth and remnant vegetation with clear definitions.

The NV Act provides greater flexibility and incentives for landholders to manage native vegetation sustainably. The Act gives effect to the Government's commitment to ending broad scale clearing unless it improves or maintains environmental outcomes.

Under section 25(g), the NV Act does not apply to any clearing that is part of an activity carried out by a determining authority within the meaning of Part 5 of the EP&A Act where the determining authority has complied with Part 5. Under section 25(m), the NV Act does not apply to any clearing authorised under the *Petroleum (Onshore) Act 1991 (NSW).*

4.7 Heritage Act

The main objective of the *Heritage Act 1977* (NSW) (Heritage Act) is to encourage the conservation of the heritage of New South Wales. It prevents impacts on "relics", which are defined as:

> *any deposit, artefact, object or material evidence that:*
>
> *(a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and*
>
> *(b) is of State or local heritage significance.*

Under the Heritage Act, it is an offence to "disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit". The proposed activities have been located to reduce the risk of impacting upon relics. No relics were identified during the site inspection of the sites for the proposed activities.

4.8 Protection of the Environment Operations Act

The primary objective of the *Protection of the Environment Operations Act 1997* (NSW) (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 entities intending on carrying out an activity declared to be a "scheduled activity" under Schedule 1 to hold an environmental protection licence (EPL) and comply with the conditions set out in the EPL.

The proposed activities are not a scheduled activity and an EPL is not required.

4.9 Water Legislation

Water Act 1912 (NSW)

The *Water Act 1912* (Water Act) was the principal legislation for regulating access to surface water and groundwater in NSW from 1912 to 2000. The Water Act is being phased out and replaced with the Water Management Act 2000 (NSW) (Water Management Act). However, the Water Act still applies to some activities in parts of NSW.

Under Part 5 of the Water Act, bore licences are required to be obtained from the NSW Office of Water for the drilling of wells. As the proposed works are utilising an existing well, a bore licence is not required.

Water Management Act 2000 (NSW)

The Water Management Act applies in respect of groundwater resources which are regulated by water sharing plans (WSPs). A WSP is a statutory water management instrument prepared under the Water Management Act. Given the proposal will not involve the drilling of a well, this is not applicable in this instance.

In any case, it should be note that water licences, water use approvals and water supply work approvals under the Water Management Act will not be required because the *Water Management (General) Regulation 2004* (NSW) provides an exemption from the requirement to obtain these licences and approvals for prospecting for petroleum under the Petroleum (Onshore) Act 1991 in relation to water required for that purpose.

5.0 Environmental Impacts and Mitigation

5.1 Introduction

This section of the REF addresses the potential environmental impacts associated with the proposal and any mitigation measures required to ensure that they are appropriately managed. A specialist Ecological Assessment has been undertaken by RPS (**Appendix A**).

5.2 Ecology

5.2.1 Flora & Fauna

Impacts

Despite its highly disturbed condition, the VSP will be conducted within an area that is considered to be representative of White Box - Yellow Box - Blakely's Red Gum Woodland EEC, listed under the TSC Act. This community is not considered to be representative of the similar EPBC Act listed TEC. The ground cover of the site is dominated by weed species, with up to 65% weed cover.

No threatened fauna or flora species listed under the TSC Act and/or EPBC Act were recorded within the study area. Additionally, the likelihood of threatened flora and fauna species occurring in the study area is considered to be moderate to low.

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts proposed activities on 'threatened species, populations or ecological communities (or their habitats)' listed under the TSC Act. The Assessment of Significance (7-part test) is used to determine whether activities are 'likely' to cause 'a significant impact' on threatened biota and thus whether a Species Impact Statement (SIS) is required.

On this basis, a 7-part test of significance is required for the White Box-Yellow Box-Blakely's Red Gum Woodland EEC. The application of the 7-part test (Appendix C of the Ecological Assessment in **Appendix A**) concluded that there is not likely to be a significant effect on this community arising from the proposed activities.

The potential impacts associated with the proposed activities are short-term and temporary. Site access will be via existing farm tracks and no clearing of native vegetation is required. The physical ground disturbance will include the flattening of groundcovers and a light impression on the ground from the lowered 1m x 1m plate on the EnviroVibe truck. Vegetation within the study area will not be cleared as a result of the VSP.

While the proposed VSP is located adjacent to areas that provide habitat for a range of common generalist species, the impacts to these habitats associated with the proposed activity are expected to be negligible The VSP has the potential to temporarily impact upon resident fauna population due to noise and vibrations.

The proposed activities have the potential to create favourable conditions for additional introduced weed species within the study area, given they may result in a temporary increase in vehicle movements. This may lead to the spread of existing weeds and/or the introduction of new species.

5.2.2 Matters of National Environmental Significance

An EPBC Act Protected Matters Search was undertaken using the on-line database to generate a list of those matters of national environmental significance (MNES) on potentially occurring within the study area

and surrounds. This data, combined with other local knowledge and records, was utilised to assess whether the proposed activities will have, or are likely to have a significant impact on MNES.

Table 5-1 Matters of National Environmental Significance

Matter of National Environmental Significance	Overview
World Heritage Areas	The site is not a World Heritage area, and is not in close proximity to any such area.
Wetlands protected by international treaty (the RAMSAR convention)	The study area is some distance upstream from a Ramsar site, Hunter Valley estuary wetlands. However, as no vegetation will be cleared due to the proposed activities, it is highly unlikely that the Ramsar site will be impacted by the proposed activity.
Nationally listed threatened species, migratory species and ecological communities	Although White Box-Yellow Box-Blakely's Red Gum grassy woodland is considered to be an EEC under the TSC Act, it does not meet the criteria to be a TEC under the EPBC Act. No listed threatened species or migratory species were recorded within the study area, or are likely to occur.
All nuclear actions	No type of nuclear activity is proposed for the site.
Commonwealth marine areas	The proposed activity on the site will not have a significantly adverse effect on any Commonwealth marine area.

5.2.3 Key Threatening Processes

A threatening process is defined under the TSC Act as 'a process that threatens, or that may threaten, the survival or evolutionary development of a species, population or ecological community'. Threatening processes that adversely affect threatened species, populations or ecological communities, or possibly cause others that are not currently threatened, to become threatened are listed as key threatening processes (KTPs) under the TSC, *Fisheries Management Act 1994* and EPBC Acts. KTPs relevant to the proposed activities are discussed in Table 5.2.

Table 5-2 Key Threatening Processes

Key Threatening Process	Relevance to Proposed Activities
Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands	The study area is located upstream from a Ramsar site, Hunter estuary wetlands. This wetland will not be affected by the VSP.
Invasion of native plant communities by exotic perennial grasses	The study area has been previously disturbed by the introduction of exotic grasses. There exists the potential for the invasion and spread of additional weed species if machinery and vehicles contain weed seeds.
Clearing of native vegetation	There will be no native vegetation cleared as a result of the proposed activities, however the plate on the EnviroVibe truck will flatten any grasses encountered and leave a light impression in the ground.
Loss of hollow-bearing trees	No hollow bearing trees will be removed as part of this activity.
Removal of dead trees and dead wood	No dead 'stag' trees will be removed from the study area.
Infection of native plants by *Phytophthora cinnamomi*	There exists the potential for the importation of this pathogen on unclean vehicles and plant machinery. It is recommended that all vehicles be cleaned of foreign soil from other sites to ensure that this pathogen is not introduced.

Mitigation Measures

Section 6 of the Ecological Assessment (**Appendix A**) outlines a mitigation strategy for the proposal.

Mitigation comprises the following:

- Operations are to be managed through the specific operational management plan prepared by the

operator.

- Weed management procedures will be implemented to prevent the spread of weeds both on and off site, including vehicle washdown as required.
- Where vehicles and machinery are moving between the site and weed free areas, wash down procedures must be implemented. Vehicles will be washed down and cleaned of any foreign soil and seed prior to being transported on site, where they have previously been in known weed infestation, to prevent the potential spread of introduced weeds and pathogens.
- Monitoring of the VSP will occur to ensure that areas of grass have naturally regenerated following the temporary disturbance. Where grasses have not regenerated, they will be reseeded with native species that currently occur within the study area, representative of a White Box - Yellow Box - Blakely's Red Gum Woodland EEC.
- Weed monitoring will occur prior to and after conducting the VSP, to ensure no weeds have not been introduced to the study area. Weed removal will be carried out as necessary.

5.3 Heritage

5.3.1 Aboriginal Heritage

Impacts

A due diligence survey of the proposed site was undertaken on 30 March 2011. This survey was conducted by Steven Coghill, Indigenous Affairs Officer for Santos and included the proposed VSP source line. No artefactual material was identified along the source line alignment as a result of the survey. The site comprises pastoral land that has been highly disturbed by clearing, grazing, cropping and general agricultural pursuits.

A search of the NSW OEH Aboriginal Heritage Information Management System (AHIMS) was undertaken on 1 August 2011 and found that there were no items of cultural heritage located on the subject site or in the vicinity of the site (refer **Appendix B**).

It is considered that the potential impacts associated with Aboriginal heritage can be appropriately managed. The following mitigation measures will be implemented.

Mitigation Measures

To limit any potential impact on any unknown Aboriginal sites or objects the following measures will be implemented:

- Minimise impact to areas outside the area of operation through appropriate on site induction of all employees and contractors attending site.
- Vehicle access is to remain within existing tracks where possible in order to minimise potential impacts on surrounding vegetation and reduce erosion.
- In the event that any vegetation clearing is required to allow large machinery access to a given area, soil disturbance will be kept to a minimum. Subject to ecological constraints, vegetation will be cut with a chain saw rather than bulldozed, and trees and bushes will be cut at their base just above ground level where possible.
- If works fall outside of the areas inspected for the purposes of the cultural heritage assessment or access routes are altered Santos are advised to have those areas investigated by a qualified archaeologist.
- If an Aboriginal object or site is identified at any point during the proposed works, all works in the vicinity will cease immediately. That area will be temporarily fenced with high visibility tape or barrier fencing in

order to prevent further impact and a suitably qualified archaeologist contacted. Works in that location will not proceed until the site has been registered with the OEH and an appropriate course of action determined by the archaeologist. In most instances this would involve applying for an Aboriginal Heritage Impact Permit (AHIP) from OEH in consultation with the Aboriginal Community.

- In the event that skeletal remains are uncovered, work will cease immediately in that area and the area fenced. Santos will then contact the NSW Police and follow the advised procedure. If the skeletal remains are determined to be Aboriginal, Santos will then contact the OEH and relevant Aboriginal Community Stakeholders in order to determine an action plan for the management of the skeletal remains prior to works commencing.

5.3.2 Other Cultural Heritage

Impacts

There are no Commonwealth heritage items listed for Brawboy. A search of the Australian Heritage Places Inventory (AHPI) showed 28 items listed for the Upper Hunter LGA, however none of these items are located within the vicinity of the project area.

A search of the State Heritage Inventory and Schedule 4 of the Scone LEP (1986) show that there are over 150 heritage items within the Upper Hunter LGA, however only five of those sites are within the vicinity of project area. All of the items are listed as being of local significance. Of the five sites listed, three are homesteads, The Cuan (9km south), The Hawthornes (6km south east) and Thornthwaite (10km south east), whilst the remaining two items are natural heritage sites located within the Towarri National Park (6km to the north). None of the registered heritage items are within proximity of the site and therefore will not be affected by the proposed works.

It is considered that the potential impacts associated with other cultural heritage can be appropriately managed if the mitigation measures presented below are implemented.

Mitigation Measures

It is considered highly unlikely that any items of European cultural heritage significance will be impacted by the proposed works. Nonetheless, heritage items are protected by legislation in NSW. If an object is found during the activities works that is considered to be of any heritage significance, all works should cease, and a qualified archaeologist should be contacted.

5.4 Ground water

Impacts

The proposal does not comprise any drilling as a suspended wellbore will be used. There are therefore unlikely to be any impacts to groundwater as a result of the proposal.

Depending on hole condition, there is the potential for chemicals (mainly potassium chloride) to be utilised to facilitate the efficient and safe conveyance of the VSP tool in line with best oilfield practice. There is therefore a potential for groundwater contamination due to spills of fuels and chemicals at the site and mitigation measures to minimise this risk are set out below.

Mitigation Measures

Activities will be undertaken in accordance with good industry practice.

The management measures to control the handling and storage of chemical and hazardous substances and for spill prevention and response are identified in Section 5.9 Hazardous and Chemical Substances Management.

Measures to minimise and manage waste are identified in Section 5.11 Waste Minimisation and Management.

5.5 Air

Impacts

The existing air quality of the locality is typical of a rural area with the majority of air emissions and pollutants arising from existing agricultural activities such as stock grazing, land clearing and soil preparation, sowing and harvesting of crops, vehicle and heavy machinery movements, bushfires and burn-offs.

The potential for the activity to introduce additional air emissions would arise from the following sources:

- vehicle movements during the proposed VSP activities; and
- vehicle movements to and from the sites.

The air emissions associated with the proposal will be dust and greenhouse gases.

The dust generated by vehicle movements along the VSP source line is expected to be minimal. There will be no clearing of access tracks required as the EnviroVibe truck can operate off road along the existing ground cover. There will be minimal vehicle movements to and from site and minimal dust would be therefore be generated. In the context of the surrounding agricultural activities this will not be a significant issue.

Any damage to access roads would be repaired as soon as possible after occurrence to minimise any impact on the landholder or the public. No impact on roadside vegetation is anticipated.

Santos will notify the Upper Hunter Shire Council of the proposed start time of activities prior to commencement and will liaise with the appropriate Council representatives should any repairs to Council roads be necessary.

As the proposed activities are associated with exploration and not production, potential contributions to greenhouse gases, for the duration of the activities, would be confined to the operation of diesel fuelled vehicular traffic.

Collectively these represent minimal emissions when compared with the agricultural activities that take place throughout the region. It is considered that the potential impacts associated with air emissions can be appropriately managed if the mitigation measures presented below are implemented.

Mitigation Measures

To minimise impacts on air quality the following actions will be undertaken:

- Access tracks are to be maintained with gravel throughout the duration of the project.
- Land disturbance areas are to be minimised.

5.6 Noise

Impacts

Noise will be generated by the movement of the vehicle along the VSP source line during the VSP activities, the VSP equipment itself (to be located on the vehicle) and vehicle movements to and from site over a duration of approximately 5 days. There will also be noise associated with the wireline truck. Activities will be confined to a 12 hour day between the hours of 6am and 6pm.

The nearest residence is approximately 1.2km from the site and is associated with the landholder's property (Figure 5-1).

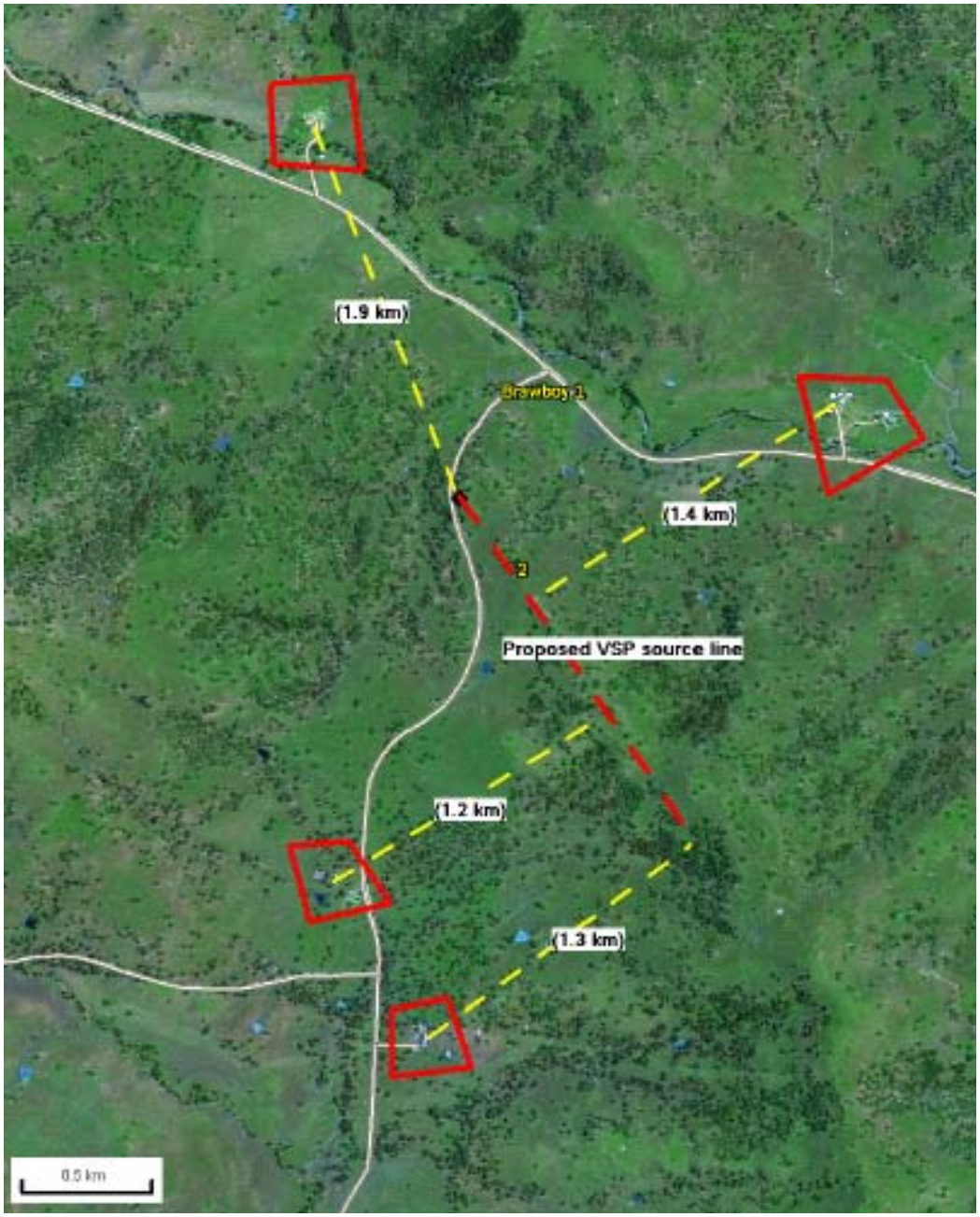

Figure 5-1 Closest residential properties

The noise associated with the EnviroVibe and wireline trucks will be comparable to other farm machinery and given the short term duration and proposed hours of operation, it is unlikely to cause significant noise disturbance to surrounding residents.

Subject to the implementation of the measures above and additional noise mitigation measures below the potential noise impact to the nearest residential receiver will be minimised.

Mitigation Measures

To minimise the potential impacts on noise the following actions will be implemented:

- Santos will ensure that any community issues of concern will be met with a prompt response.
- Landholder notification will be given prior to commencement of operations.

5.7 Surface water

Impacts

There are watercourses in the vicinity of the site with the closest being Dart Brook just over 500m to the north. There are no earthworks or drilling associated with the proposed operations and therefore impacts in terms of erosion and sedimentation are unlikely.

There is potential for chemicals and fuels to come into contact with watercourses and therefore mitigation measures to minimise this risk are identified below. It is considered that the potential impacts associated with surface water can be appropriately managed if the mitigation measures presented below are implemented.

Mitigation Measures

General measures to protect surface waters include:

- Where practical and necessary, sediment fences and traps will be installed on the Brawboy 2 well lease to prevent soil loss or sedimentation.
- Fuel and lubricants will be stored on site only when necessary and maintained off site whenever possible.
- All areas storing or handling fuel, fuel using equipment, and chemicals will be bunded in accordance with Australian Standard 1940 – 1993: The Storage and Handling of Flammable and Combustible Liquids.
- The maintenance and cleaning of vehicles and other equipment or plant will be carried out in areas from where the resultant contaminants cannot be released into any waters.
- Wastewater from amenities will be removed from site managed by a contractor licensed to carry and handle water.
- Where applicable maintenance of roads, drains, bund walls, contour and diversion banks to occur. All drainage structures will be maintained for the life of the development.
- Disturbed land will be rehabilitated to pre-operational quality or better, to minimise sediment erosion.

5.8 Soil

Impacts

No new track will need to be constructed as part of the proposed operations given that the EnviroVibe truck has off road capabilities and there is an existing track which can be used to access the Brawboy 2 well lease

from the main road. Some gravelling of partially rehabilitated existing 20m x 20m Brawboy 2 well lease will be undertaken to facilitate installing the VSP tool down the well.

There will be no earthworks or drilling associated with the proposal. There will therefore be no stripping of topsoil and no soil is proposed to be removed from site.

There is a very small potential risk for soil erosion to occur resulting in sediment transport to local waterways, however this is considered unlikely on the basis that there will be no additional ground disturbance as a result of the proposal.

There is also a small potential risk of soil contamination occurring from the proposed activities. The activities may require the use of potassium chloride and other hazardous substances (fuel).

It is considered that the potential impacts associated with soils can be appropriately managed if the mitigation measures presented below are implemented.

Mitigation Measures

The erosion and sediment control measures are proposed as follows:

- Existing ground cover will be maintained where possible.
- Entry/exit points to the work area and any high traffic areas will be stabilised.
- Where practical and necessary, sediment fences and traps will be installed on the Brawboy 2 well lease to prevent soil loss or sedimentation.
- Any disturbed area will be rehabilitated upon completion of required activities in accordance with the requirements of the approval for drilling of Brawboy 2.

The following mitigation measures will be implemented to reduce the risk of soil contamination:

- Spill kit for clean of up spills of diesel, lubricants, oil etc will be provided.
- Any spills or leaks will be immediately cleaned up.
- There will be a daily pre-start inspection of plant and equipment to identify any maintenance requirements.
- All potential contaminants will be stored, handled, used and disposed of in accordance with the MSDS.
- All wastes will be removed from the site as required.
- There will be minimal on-site storage of fuel.
- Any soil that becomes contaminated through contact with fuels or lubricants will be removed from the site and disposed of at an appropriate licensed disposal facility.

5.9 Chemical and Hazardous Substances Management

Impacts

The activities will only use chemicals such as fuels, lubricants and potentially potassium chloride. While these substances are not considered highly hazardous, there is still the potential risk of fire and pollution to land, water and air if an accidental spillage was to occur.

The *Occupational Health and Safety Act 2000* (NSW), *Dangerous Goods (Road and Railway Transport) Act 2008* (NSW) and the *Protection of the Environment Operations Act 1997* (NSW) are the main Acts that regulate dangerous goods. These Acts would be adhered with through all operations for the proposal.

It is considered that the potential impacts associated with chemical and hazardous substances can be appropriately managed if the mitigation measures presented below are implemented.

Mitigation Measures

Any spills of chemicals used during activities will be managed applying best practice principles, be in accordance with all legislation and standards for the safe handling and storage of hazardous substances and dangerous goods and comply with all occupational health and safety requirements. Any contaminated soil will be removed from the site.

5.10 Contaminated land

Impacts

Recent site inspections have also revealed that there is no reason to suspect that the proposed site has ever been used for purposes which would have resulted in any contamination of the site.

The proposed activities will pose minimal impact on the soils. No earthworks are proposed and no soil is proposed to be removed from the site. Based upon the history of the locations and the minimal impact to site soils during operations, land contamination issues are considered to be minimal for the proposed activity.

It is considered that the potential impacts associated with contamination can be appropriately managed if the mitigation measures presented below are implemented.

Mitigation Measures

Those mitigation measures identified in Sections 5.8, 5.9 and 5.11 will ensure that any contamination risk is appropriately management.

5.11 Waste Minimisation and Management

Impacts

General site operations waste will be produced as part of the proposed activities. These will be managed in an appropriate manner to avoid health risks and contamination of land and waterways.

A regular service of amenities will be conducted and waste is to be removed to a licensed facility.

It is considered that the potential impacts associated with waste can be appropriately managed if the mitigation measures presented below are implemented.

Mitigation Measures

- A general waste management strategy based upon the principles of reduce, reuse and recycling will be implemented.
- All staff and contractors will be made aware of waste management procedures during induction.
- Appropriate waste containers will be provided on the site.
- Any waste generated is to be disposed of in an appropriate manner in accordance with relevant standards and guidelines.
- Spills of waste material shall be dealt with in a prompt and thorough manner, and reported to the appropriate authority if necessary.
- General refuse will be collected and transported to an approved recycling or disposal site.

- Onsite waste disposal will be prohibited.
- Hazardous waste will be managed in accordance with existing guidelines and standards.

5.12 Natural Resource Use

Impacts

The key natural resources that would be affected by the proposed activities are agricultural land resources and fuels for the proposed operations and transportation of staff.

The subject site is part of an agricultural property. The works would take approximately 5 days and would be undertaken between 6.00am and 6.00pm only. The proposal does not require the clearing of grazing land and therefore the land could be utilised for grazing purposes outside of these times. The existing 20m x 20m well lease at Brawboy 2 is sufficient in size and there will not need to be disturbance of additional land outside of this.

There would therefore be a temporary loss of the use of the agricultural land in agreement with the landholder and, in the context of the total agricultural land holding and the wider agricultural uses of the region, is of minimal significance.

Fuels will be used for equipment and also for works and staff vehicles although this is not likely to be a significant quantity of fuel use.

It is considered that the potential impacts associated with natural resource use can be appropriately managed if the mitigation measures presented below are implemented.

Mitigation Measures

The loss of the use of the agricultural land is temporary and no grazing land will be cleared as a result of the proposal.

The use of fuel is not considered to be significant however the fuel will be used as efficiently as possible through appropriate work behaviour (e.g. switching off equipment when not in use).

5.13 Local Community & Neighbouring Properties

Impacts

As described previously, Santos has a commitment to open and transparent consultation with the communities within which it works. Over 30 community information sessions have been held since Santos begun its Gunnedah Basin coal seam gas exploration in 2008. Monthly information sessions have been planned for the future with this community. Therefore, the community is kept informed about the activities, stakeholders have the opportunity to speak directly with those undertaking the works and Santos is able to identify matters of concern to stakeholders.

The proposed activities that are the subject of this REF are temporary and will be undertaken between 6.00am to 6.00pm only. The nearest residential dwelling is approximately 1.2km away and is part of the landholder's property. Other residences are located 1.3km, 1.4km and 1.9km from the site, however due to the low levels of noise and temporary nature of the proposed works, impacts are considered to be negligible. Activities will also be restricted to 6.00am to 6.00pm only.

The closest communities to the site are Brawboy, approximately 5km to the south west of the site and the township of Bunnan which is approximately 15km to the south west of the site.

The effect associated with the temporary loss of the agricultural use of the land is described in Section 5.12.

There is not anticipated to be a significant visual impact because the activities are temporary and the proposed machinery is comparable to other farm machinery used in the area.

It is considered that the potential impacts associated with the local community and neighbouring properties can be appropriately managed if the mitigation measures presented below are implemented.

Mitigation Measures

In order to minimise impacts on landholders the following measures will be implemented:

- Undertake ongoing landholder and stakeholder consultation.
- Respond promptly to any community concerns or complaints.
- Inform the community promptly of any changes to timing or scheduling which will have an adverse impact on them.

5.14 Visual Impact

Impacts

There will be no visual impacts associated with the proposed activities, which involves the traversing of a vehicle across the VSP source line for a short period of only 5 days. Infrastructure will also be installed in an existing well, however this will not result in significant visual impacts.

Mitigation Measures

No specific measures are proposed, as any impacts would be negligible and short term.

5.15 Land use

Impacts

As described in Section 2.1 the site is within a property used for grazing. Section 5.12 above addresses the temporary unavailability of agricultural land during the 5 days of operations. Under the approval for the drilling of Brawboy 2 the land will be rehabilitated within 3 years of the date of the approval (31 March 2010). There will be no other impacts on land use associated with the proposal.

It is considered that the potential impacts associated with land use can be appropriately managed if the mitigation measures presented below are implemented.

Mitigation Measures

No specific measures are proposed, as any impacts would be negligible and short term.

5.16 Cumulative Environmental Impacts

There are no known exploration activities currently occurring within the vicinity of the site. There are therefore unlikely to be cumulative impacts associated with the proposal, in particular noise, traffic, visual impact and land use.

A number of wells exist in the vicinity of the site. The closest are outlined below and are all either plugged and abandoned to suspended.

- Brawboy 1, approximately 0.5km to the north of the site – plugged and abandoned
- Brawboy 2 to be used for the VSP activities – suspended
- Cuan, approximately 7km to the south of the site – plugged and abandoned
- Rouchel Rouchel 2, approximately 16km to the south east of the site – abandoned

5.17 Summary of Mitigation Measures

The following table provides an overview of the mitigation measures recommended in Section 5. It is considered that all potential impacts identified in this section can be appropriately managed if these mitigation measures are implemented.

Table 5-3 Summary of Mitigation Measures

Potential Impact	Proposed Mitigation Measure
Ecology	▪ Operations are to be managed through the specific operational management plan prepared by the operator. ▪ Weed management procedures will be implemented to prevent the spread of weeds both on and off site, including vehicle washdown as required. ▪ Where vehicles and machinery are moving between the site and weed free areas, wash down procedures must be implemented. Vehicles will be washed down and cleaned of any foreign soil and seed prior to being transported on site, where they have previously been in known weed infestation, to prevent the potential spread of introduced weeds and pathogens. ▪ Monitoring of the VSP will occur to ensure that areas of grass have naturally regenerated following the temporary disturbance. Where grasses have not regenerated, they will be reseeded with native species that currently occur within the study area, representative of a White Box - Yellow Box - Blakely's Red Gum Woodland EEC. ▪ Weed monitoring will occur prior to and after conducting the VSP, to ensure no weeds have not been introduced to the study area. Weed removal will be carried out as necessary.
Aboriginal Heritage	▪ Minimise impact to areas outside the area of operation through appropriate on site induction of all employees and contractors attending site. ▪ Vehicle access is to remain within existing tracks where possible in order to minimise potential impacts on surrounding vegetation and reduce erosion. ▪ In the event that any vegetation clearing is required to allow large machinery access to a given area, soil disturbance will be kept to a minimum. Subject to ecological constraints, vegetation will be cut with a chain saw rather than bulldozed, and trees and bushes will be cut at their base just above ground level where possible. ▪ If works fall outside of the areas inspected for the purposes of the cultural heritage assessment or access routes are altered Santos are advised to have those areas investigated by a qualified archaeologist. ▪ If an Aboriginal object or site is identified at any point during the proposed works, all works in the vicinity will cease immediately. That area will be temporarily fenced with high visibility tape or barrier fencing in order to prevent further impact and a suitably qualified archaeologist contacted. Works in that location will not proceed until the site has been registered with the OEH and an appropriate course of action determined by the archaeologist. In most instances this would involve applying for an Aboriginal Heritage Impact Permit (AHIP) from OEH in consultation with the Aboriginal Community. ▪ In the event that skeletal remains are uncovered, work will cease immediately in that area and the area fenced. Santos will then contact the NSW Police and follow the advised procedure. If the skeletal remains are determined to be Aboriginal, Santos will then contact the OEH and relevant Aboriginal Community Stakeholders in order to determine an action plan for the management of the skeletal remains prior to works commencing.
Other Heritage	▪ It is considered highly unlikely that any items of European cultural heritage significance will be impacted by the proposed works. Nonetheless, heritage items are protected by legislation in NSW. If an object is found during the activities works that is considered to be of any heritage significance, all works should cease, and a qualified archaeologist should be contacted.

Potential Impact	Proposed Mitigation Measure
Groundwater	▪ Activities will be undertaken in accordance with good industry practice. ▪ The management measures to control the handling and storage of chemical and hazardous substances and for spill prevention and response are identified in Section 5.9 Hazardous and Chemical Substances Management. ▪ Measures to minimise and manage waste are identified in Section 5.11 Waste Minimisation and Management.
Air	▪ Access tracks are to be maintained with gravel throughout the duration of the project. ▪ Land disturbance areas are to be minimised.
Noise	▪ Santos will ensure that any community issues of concern will be met with a prompt response. ▪ Landholder notification will be given prior to commencement of operations.
Surface Water	▪ Where practical and necessary, sediment fences and traps will be installed on the Brawboy 2 well lease to prevent soil loss or sedimentation. ▪ Fuel and lubricants will be stored on site only when necessary and maintained off site whenever possible. ▪ All areas storing or handling fuel, fuel using equipment, and chemicals will be bunded in accordance with Australian Standard 1940 – 1993: The Storage and Handling of Flammable and Combustible Liquids. ▪ The maintenance and cleaning of vehicles and other equipment or plant will be carried out in areas from where the resultant contaminants cannot be released into any waters. ▪ Wastewater from amenities will be removed from site managed by a contractor licensed to carry and handle water. ▪ Where applicable maintenance of roads, drains, bund walls, contour and diversion banks to occur. All drainage structures will be maintained for the life of the development. ▪ Disturbed land will be rehabilitated to pre-operational quality or better, to minimise sediment erosion.
Soils	▪ Existing ground cover will be maintained where possible. ▪ Entry/exit points to the work area and any high traffic areas will be stabilised. ▪ Where practical and necessary, sediment fences and traps will be installed on the Brawboy 2 well lease to prevent soil loss or sedimentation. ▪ Any disturbed area will be rehabilitated upon completion of required activities in accordance with the requirements of the approval for drilling of Brawboy 2. ▪ Spill kit for clean of up spills of diesel, lubricants, oil etc will be provided. ▪ Any spills or leaks will be immediately cleaned up. ▪ There will be a daily pre-start inspection of plant and equipment to identify any maintenance requirements. ▪ All potential contaminants will be stored, handled, used and disposed of in accordance with the MSDS. ▪ All wastes will be removed from the site as required. ▪ There will be minimal on-site storage of fuel. ▪ Any soil that becomes contaminated through contact with fuels or lubricants will be removed from the site and disposed of at an appropriate licensed disposal facility.
Chemical and Hazardous Substances	▪ Any spills of chemicals used during activities will be managed applying best practice principles, be in accordance with all legislation and standards for the safe handling and storage of hazardous substances and dangerous goods and comply with all occupational health and safety requirements. Any contaminated soil will be removed from the site.
Waste	▪ A general waste management strategy based upon the principles of reduce, reuse and recycling will be implemented. ▪ All staff and contractors will be made aware of waste management procedures during induction. ▪ Appropriate waste containers will be provided on the site. ▪ Any waste generated is to be disposed of in an appropriate manner in accordance with

Potential Impact	Proposed Mitigation Measure
	relevant standards and guidelines. ▪ Spills of waste material shall be dealt with in a prompt and thorough manner, and reported to the appropriate authority if necessary. ▪ General refuse will be collected and transported to an approved recycling or disposal site. ▪ Onsite waste disposal will be prohibited. ▪ Hazardous waste will be managed in accordance with existing guidelines and standards.
Natural Resource Use	▪ The loss of the use of the agricultural land is temporary and no grazing land will be cleared as a result of the proposal. ▪ The use of fuel is not considered to be significant however the fuel will be used as efficiently as possible through appropriate work behaviour (e.g. switching off equipment when not in use).
Community	▪ Undertake ongoing landholder and stakeholder consultation. ▪ Respond promptly to any community concerns or complaints. ▪ Inform the community promptly of any changes to timing or scheduling which will have an adverse impact on them.
Visual	▪ No specific measures are proposed, as any impacts would be negligible and short term.
Land Use	▪ No specific measures are proposed, as any impacts would be negligible and short term.

5.18 Clause 228 Guidelines

Clause 228 of the EP&A Regulation states that for the purpose of Part 5 of the EP&A Act the following factors are to be taken into account concerning the impact of an activity on the environment. These factors are considered in Table 5-4.

Table 5-4 Clause 228 Guidelines

Factor	Impact
Any environmental impact on the community	Negligible impact.
Any transformation of a locality	Negligible impact.
Any environmental impact on the ecosystems of the locality.	Minor negative. Some temporary disruption to the ecosystem will occur during site operations, however these are minor acceptable impacts and can be appropriately managed.
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality	Negligible impact.
Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations	Negligible impact.

Factor	Impact
Any impact on the habitat of protected fauna (within the meaning of the National Parks and Wildlife Act 1974)	Minor, short term negative. There will be some minor, short term impacts on fauna habitat however these have been assessed and are considered acceptable.
Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air	Negligible impact.
Any long-term effects on the environment	Nil.
Any degradation of the quality of the environment	Negligible impact.
Any risk to the safety of the environment	Minor short term negative. The proposal may result in short term potential risks to the safety of the environment due to incidents and spills.
Any reduction in the range of beneficial uses of the environment	Nil. The footprint of activities for the proposal would not result in any reduction in the range of beneficial use of the environment.
Any pollution of the environment	Negligible impact. The proposal may result in short term potential risk of pollution of the environment due to incidents and spills.
Any environmental problems associated with the disposal of waste	Negligible impact.
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	Negligible impact.

6.0 Conclusions

RPS has prepared this REF on behalf of Santos QNT Pty Ltd to assess the environmental impact of the proposed VSP activities at Brawboy 2, an existing wellbore in the Gunnedah Basin. The purpose of the VSP is to investigate the potential coal seam gas resource within PEL 456.

Specialist assessments have been prepared for the proposal to assist in guiding the location of facilities assessing the potential impacts of the operations. An assessment was undertaken for ecology and a site inspection was undertaken for cultural heritage.

Consideration has also been given to a broader range of environmental impacts, including air, surface water, soils, chemical and hazardous substances management, contaminated land, waste minimisation and management, natural resources, local community and neighbouring properties, visual impacts, land use and cumulative environmental effects.

This REF has been prepared in accordance with Clause 228 of the *Environmental Planning and Assessment Regulation 2000* and provides consideration of the environmental impact of the proposed works as required by Section 111 of the *Environmental Planning and Assessment Act 1979*. The proposal comprises temporary, small scale activities of a short term duration. The REF has identified that the proposed VSP activities are not likely to significantly affect the environment or threatened species, populations or ecological communities or their habitats.

7.0 References

Bureau of Meteorology (BoM) (2011), *Climate Statistics for Scone Airport*, accessed on 9 May 2011 at: http://www.bom.gov.au/climate/averages/tables/cw_061363.shtml

Hunter-Central Rivers Catchment Management Authority (HCMA) (2011), Hunter-Central Rivers Catchment Management Area. Website accessed on 9 May 2011: http://www.hcr.cma.nsw.gov.au/

Upper Hunter Shire Council (UHSC) 2008-2009, *State of the Environmental Report*, 2009.

Upper Hunter Shire Council (UHSC) (2011). Website accessed 9 May 2011.

Appendix A

Ecological Assessment

prepared by RPS

Brawboy Vertical Survey Profile

Ecological Assessment

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In preparing this report we have made certain assumptions. We have assumed that all information and documents provided to us by the Client or as a result of a specific request or enquiry were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

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Document Status

Version	Purpose of Document	Orig	Review	Review Date	QA Review	RPS Release Approval	Issue Date
A	Draft for Review	HR	BD	20/4/2011	BD	BD	3/5/2011
B	Draft for Client Review	HR, KB	BD		BD	BD	
C	Final Report	KB	BD	18/9/2011	BD	BD	19/9/2011
0	Final report for Submission	KB / HR	BL	20/9/2011	BD	BD	20/9/2011
1	Final report for Submission	HR	Santos	28/9/2011	BD	BD	30/9/2011

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of native plant communities by exotic perennial grasses. Given that weed management procedures will be implemented in a site EM Plan, it is unlikely that the proposed action will result in a significant increase in the operation of this KTP to the Box Gum woodland.

Conclusion

Based on the consideration of the above factors, the proposed activities are not likely to significantly affect the listed threatened ecological community White Box-Yellow Box-Blakely's Red Gum Woodland or its habitats.

Appendix B

AHIMS Search Results

AHIMS Web Services (AWS)
Search Result

Your Ref Number :

Client Service ID : 47829

Santos - Spatial Information & Drafting - Brisbane

Date: 01 August 2011

Queensland 0

Attention: Tahlita Ahwang

Email: tahlita.ahwang@santos.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 6, DP:DP237954 with a Buffer of 50 meters. conducted by Tahlita Ahwang on 01 August 2011

A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

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