



CLIENTS | PEOPLE | PERFORMANCE

Sydney Gas Operations Pty Ltd

Hunter Corehole Drilling
Program (five sites)

Review of Environmental
Factors for PEL 267

April 2008

Contents

1.	Introduction	1
1.1	Locality & Land Ownership	2
1.2	Description of the proposed activity	6
1.3	Evaluation of alternatives	8
2.	Planning context	9
2.1	Licences and approvals required	9
2.2	Planning issues	14
2.3	Stakeholder consultation	17
3.	Existing environment	19
3.1	Landforms, Soils and Geology	19
3.2	Climate	20
4.	Environmental impacts and management	21
4.1	Air	21
4.2	Water	22
4.3	Soils	24
4.4	Noise and vibration	26
4.5	Flora and fauna	29
4.6	Chemical and hazardous substance management	47
4.7	Contaminated Land	48
4.8	Waste minimisation and management	48
4.9	Natural resource use	49
4.10	Impact on the community	49
4.11	Visual assessment	49
4.12	Heritage	50
4.13	Landuse	53
4.14	Cumulative environmental impacts	53
4.15	Summary of mitigation measures	54
5.	Rehabilitation works	64

6.	Summary of Impacts & Conclusions	67
6.1	Biophysical Effects	67
6.2	Social / Community Effects	67
6.3	Economic Effects	67

Table Index

Table 2.1	Assessment of HREP's Specific Planning Issues	16
Table 2.2	Policies for the control of development on rural land	16
Table 4.1	Distance to nearest receiver	26
Table 4.2	Modelled daytime receiver sound pressure levels	27
Table 4.3	Summary of mitigation measures	55
Table 5.1	Rehabilitation Measures	64

Appendices

- A Detailed Site Maps
- B Technical Specifications for the drilling rig
- C Air Quality Assessment
- D Hydrogeological Assessment
- E Soil & Water Management Plans
- F Noise Impact Assessment
- G Ecological Assessment
- H Heritage Assessment
- I Community Information newsletter
- J (Confidential – Site ownership details & Contaminated lands statements)

1. Introduction

The Hunter Joint Venture is a partnership that comprises 50:50 undivided interests between Sydney Gas Operations Pty Ltd (Sydney Gas) and AGL Gas Production Pty Ltd (AGL). Sydney Gas is the operator of the Hunter Joint Venture, which aims to extract coal seam methane gas located within the Hunter Valley.

After developing these potential NSW gas reserves, local industry would gain access to competitively priced gas and thus greater security of supply in the event of any future disruption to interstate supply.

The Hunter Gas Joint Venture has the potential to become a substantial local supply for the NSW gas market. The Joint Venture has been supplying gas into the Sydney market since 2001, through a contract with AGL Wholesale Gas Limited. The Joint Venture is currently producing more than 4.5 petajoules of gas each year, representing nearly 3% of the total NSW gas market.

Sydney Gas's planned Hunter corehole drilling program will assist its coal seam methane (CSM) evaluation ahead of Sydney Gas's future appraisal and possible further development of this potential energy resource. In order to further progress its CSM evaluation process, Sydney Gas is proposing to drill up to six (6) coreholes within the limits of its current Petroleum Exploration Licence No. 267 (PEL 267). Of these six (6) coreholes proposed to be drilled within PEL 267, one (1) of these, Hunter Corehole 5 near Mount Thorley has already been the subject of a formal environmental assessment process and has recently gained project approval from the Department of Primary Industries – Mineral Resources (DPI).

The five (5) proposed corehole sites that are being assessed within this Review of Environmental Factors (REF) document are as follows (refer to **Figure 1** and to more detailed maps of each site presented in **Appendix A**):

1. Rothanal 01 (RN01);
2. Roughit 01 (RI01);
3. Wollombi 01 (WB01);
4. Paynes Crossing 01 (PC01); and
5. Maison Dieu 01 (MD01).

The Department of Primary Industries – Mineral Resources (DPI) has a statutory responsibility under Section 111 of the *Environmental Planning and Assessment (EP&A) Act 1979* to assess the environmental impacts of any activities carried out within titles issued under the *Petroleum (Onshore) Act 1991*. Prior to any corehole drilling work being undertaken by Sydney Gas at any of the above sites, an appropriate level of environmental assessment must therefore be undertaken and provided to the DPI, for consideration as part of Sydney Gas's application for approval to drill at each site.

This REF document considers and assesses the potential environmental impacts associated with Sydney Gas's corehole drilling proposal for the above-mentioned five (5) sites.

1.1 Locality & Land Ownership

The proposed five (5) corehole sites are all located within PEL 267, at the various locations shown below in **Figure 1** (also refer **Appendix A**).

All the proposed sites are wholly located within the Singleton local government area (LGA). Other locality details for the individual sites are as follows:

Rothanal 01 (RN01)

The Rothanal 01 site would be located on part of Lot 5, DP 823737, near the township of Belford. The proposed corehole drilling site is proposed to be adjacent to an unformed road on the southern side of the Main Northern Railway and the New England Highway, about 1.2 kilometres south of the Highway.

Roughit 01 (RI01)

The Roughit 01 site would be located on part of Lot 2, DP 245730, adjacent to an unsealed road about one kilometre north of Glendon Road and also about 1.2 kilometres north of the Hunter River.

Wollombi 01 (WB01)

The Wollombi 01 site would be located on part of Lot 3, DP 7639, about 1.2 kilometres south of the village of Wollombi. The site is proposed to be located within revegetated cleared grazing land. An existing access route to the site crosses a small bridge over Wollombi Brook.

Paynes Crossing 01 (PC01)

The Paynes Crossing 01 site would be located on part of Lot 14, DP 664533, at Paynes Crossing, on Stockyard Creek, approximately 500 metres from its confluence with Wollombi Brook.

It should be noted that a wetland is located adjacent to an initially assessed, potential corehole location at this site. Following GHD's inspection of the site (refer Section 4.5) the proposed corehole site was relocated by approximately 10 to 15 metres to the southwest from the initial location, in order to avoid potential impacts on this wetland area.

Maison Dieu 01 (MD01)

The Maison Dieu 01 site would be located on part of Lot 3, DP 252505, adjacent to an existing road, approximately 140 metres from the Hunter River.

1.1.1 Access to the sites

The routes proposed for access to each site are shown on the detailed maps of each site presented in **Appendix A** (it should be noted that the Maison Dieu 01 site is

proposed to be located almost immediately adjacent to an existing roadway and therefore the very short section of access track required is not able to be appropriately presented on the relevant site map presented in **Appendix A**).

All proposed sites have been chosen due to:

- » Minimal clearing requirements;
- » Minimal earthwork requirements; and
- » Ease of access for the proposed drilling and subsequent rehabilitation activities.

1.1.2 Access and Compensation Agreements

Individual *Access and Compensation Agreements* pursuant to the *Petroleum (Onshore) Act 1991* have been signed by each site's registered landowner and by Sydney Gas. These Agreements acknowledge and document each landowner's consent for the activities proposed on their land.

Individual ownership of all five (5) proposed sites are as per the registered details contained within the Confidential Appendix to this REF (**Appendix J**). These ownership details have not been listed here, due to the requirements of the *Privacy and Personal Information Protection Act 1998*.

1.1.3 Surrounding Land Uses

Rothanal 01 (RN01)

The proposed Rothanal 01 site is to be located within a semi-cleared paddock on a gradual slope. The site is situated about two hundred metres from the nearest ephemeral tributary to Jump-up Creek.

Native woodland lies to the immediate southwest of the site and scattered trees border the southeast of this site. A heavily vegetated creekline occurs within 50 metres to the north of the proposed site. Another wooded creekline is traversed by the proposed access track to the south of the site.

Other surrounding land uses include agriculture, vineyards and mining activities.

Roughit 01 (RI01)

The proposed Roughit 01 site is to be located about 400 hundred metres from the nearest creek line, this being a tributary to First Creek. The site lies within a relatively flat open grazing paddock predominantly containing native and exotic pasture grasses and occasional scattered trees.

A farm dam is located approximately 160 metres to the southeast of the site, with an intermittent creek and another dam occurring approximately 400 metres to the north of the site.

A residential dwelling is located at the start of the access track to the south of the site. Other surrounding land uses include agriculture and grazing.

Wollombi 01 (WB01)

The proposed Wollombi 01 site is located on a gentle slope within a semi-cleared grazing paddock. This site is bordered to the immediate west, south and further east by wooded mountainside. Small isolated pockets of trees also occur close to the proposed site. A creek runs to the northwest of the proposed corehole site. This creekline is crossed by the proposed access track to the site, via an existing bridge.

Other surrounding land uses include agriculture and grazing.

Paynes Crossing 01 (PC01)

The proposed Paynes Crossing 01 site is located within a cleared valley, surrounded on its eastern and southwestern sides by wooded mountainsides and to the immediate west by Stockyard Creek. One small farm dam is located approximately 60 metres to the north of the site and approximately 20 metres from the route of the proposed access track.

The site is relatively flat and slopes slowly down towards the creek on the western side of the site. A small wetland or “soak” is located to the east of the site.

Pokolbin State Forest is located approximately 450 metres to the north of the site.

A residential dwelling is located approximately 400 metres to the south of the proposed corehole site. Other surrounding land uses include agriculture and grazing.

Maison Dieu 01 (MD01)

The proposed Maison Dieu 01 site is located within predominantly cleared, relatively flat open grazing land next to an existing access track.

The Hunter River runs approximately 140 metres to the west of the site, with another creek and large dam located approximately 200 metres to the east and southeast of the proposal site.

Other surrounding land uses include agriculture and grazing.

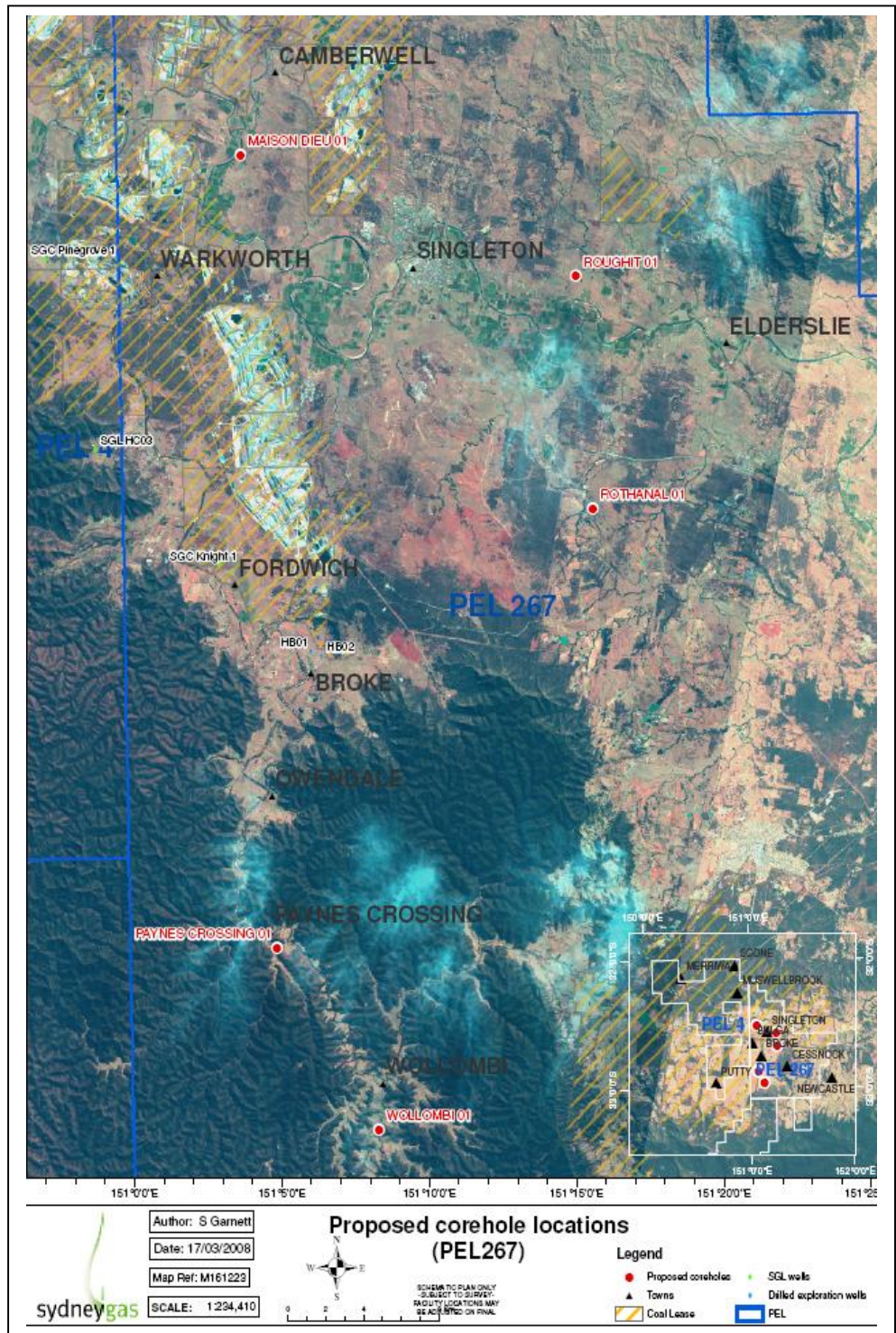


Figure 1 Location of 5 sites proposed in PEL 267

1.2 Description of the proposed activity

Sydney Gas's corehole drilling program proposes to utilise a drilling method called "coring". This method is designed to assess the potential methane gas storage associated with the Upper and Lower Permian Coal Measures in the Hunter Valley in NSW. This method also reduces the risk of development of any poorly performing wells and thus seeks to focus future gas extraction development only within more economically viable locations.

Sydney Gas proposes to drill one (1) exploration corehole at each of the five (5) nominated sites. The proposed drilling activity at each site would require the establishment of a 30 x 60 metre, enclosed clearance area, including the minor excavation of three small pits (two of which would be approximately 3.5m x 4m x 2.5 metres deep and one would be 4m x 4m x 2.5 metres deep) at each site, in order to catch the drill's "cuttings" and to recirculate the drilling fluid required for the drilling operations. These pits would be excavated down slope from the drill hole collar. Spoil would be banded down slope from both the pits and the drill hole collar to contain any escape of fluid. Excavated topsoil would be stockpiled separately from any other subsurface material, fenced off separately on the site and covered.

Alternatively, depending on the individual site conditions encountered at any one (or all) of the proposed sites, Sydney Gas may elect to catch the drill's cuttings and recirculate drilling fluids via the use of three above-ground containment tanks, each with dimensions of 3 m x 4 m x 2.4 metres deep. These tanks would be constructed and placed on the site in lieu of the excavation of the above-mentioned pits, thereby eliminating the need for the associated topsoil excavation, storage, banding and other management measures.

Each drilling site would be occupied by up to 7 people (comprising up to 4 drilling crew, 1 or 2 geologists and 1 drilling supervisor) for up to 65 days, depending on final drilling depth and prevailing weather conditions. Expected hours of drilling operation would be 7.00am to 6.00pm, Monday to Friday and 8.00am to 1.00pm Saturday, with no work being done on either Sundays or Public Holidays without consent being first obtained from the landholder and surrounding neighbours, if any.

It is proposed that the main equipment proposed for drilling operations would be a stand alone *UDR 1200* drilling rig. The technical specifications for this rig are presented in **Appendix A** to this REF document. If for any reason a different rig type were to be utilised, a revised rig specification would be submitted to the DPI before any drilling work is conducted.

A mobile crane may also be utilised for up to 1 or 2 separate days to install surface and intermediate casing, if required at any individual site.

Following initial site establishment operations, drilling operations would be sequenced as follows:

- » The maximum well depth is proposed to be up to 1400 metres below the ground surface. In addition, up to 700 metres may be drilled quickly, using percussive drilling methods;

- » Rock chips would be collected at the surface;
- » Slower corehole sample extraction drilling would then commence, at a pre-determined depth;
- » Drill cores would be collected in 6 metre intervals;
- » “Non coal” core would be logged by a geologist and stored in core boxes;
- » Coal core would be photographed and immediately placed into sealed canisters for subsequent gas testing;
- » The above drilling and testing would then continue until the total depth is reached;
- » The borehole would then be subject to geophysical logging and other potential “down hole” testing;
- » After all testing had been carried out the hole would be filled to the surface with cement in accordance with DPI requirements;
- » The casing would be removed (where practical) and a steel plate installed near the top of the hole, approximately 2 metres below the surface; and
- » The remaining hole and pits would then be backfilled and site rehabilitation works commenced.

Proposed creek crossing at Rothanal 01

In order to facilitate initial access and final egress for the drill rig to / from the proposed Rothanal 01 site, an appropriate method to cross a dry, ephemeral creek bed that feeds into Jump Up Creek, about 450 metres to the west of the proposed corehole drilling site, needs to be provided.

It is proposed that a Temporary Vehicle Quick Bridging method would be used at this crossing. The Quick Bridging structure would be designed by professional engineers to meet the appropriate Roads and Traffic Authority’s (RTA) “T44” specifications.

It is proposed that this temporary bridge structure would only be located on the creek bed site during the actual time that the drilling rig would require to cross this creek (i.e. initially for less than one (1) working day and again for the rig’s return journey at the conclusion of drilling activities). All other, smaller vehicles that would require more regular or routine site access would be able to traverse this route without the need for this temporary bridging facility to be in place.

Proposed creek crossing at Wollombi 01

In order to facilitate access for the drill rig to the proposed Wollombi 01 site it would be required to appropriately reinforce the existing wooden bridge structure via the use of an appropriate “transferable bridge” structure. This would be transported to the site on a trailer and lowered into position such that it would effectively cover and reinforce the deck of the existing wooden bridge. The placement of this structure would enable the existing wooden bridge to be traversed by the drilling rig and other vehicles without transferring any significant loads onto the bridge’s underlying deck structure.

It is proposed that this “transferable bridge” structure would be in place during the whole period proposed for on site activities at the Wollombi 01 site.

1.3 Evaluation of alternatives

Due to the highly specialised nature of the proposed works, corehole sampling is the only feasible method available to obtain reliable gas content and gas composition data relevant to the local coal resource. The further evaluation of alternatives to the proposed drilling method is therefore not considered to be appropriate.

The desired general vicinity of each proposed corehole was located through mapping of the available technical data of the coal resource and identifying the optimal locations to potentially explore for gas. Other locally available sites have been considered, however these sites are not preferred due to the potential high levels of site disturbance required, and/or restricted site access.

2. Planning context

The *Environmental Planning & Assessment Act 1979* (EP&A Act) contains the core legislation relating to planning and development activities in NSW. Part 5 of the EP&A Act covers activities that do not require development consent to be obtained. For the purposes of the Act, Sydney Gas is the “proponent” of the proposed activities and the Department of Primary Industries – Mineral Resources (DPI) is the “determining authority”, under the definitions relevant to Part 5 of the Act.

Under Part 5 of the Act, a public authority such as the DPI is required to consider the environmental impact of activities over which it has control or influence. Section 111 of the EP&A Act also specifically requires that a public authority must consider all matters proposed to affect, or likely to affect the environment as a result of any activities under its control.

The DPI has a statutory responsibility under Section 111 to assess the environmental impacts of activities carried out within any titles issued under the *Petroleum (Onshore) Act 1991*. Therefore, prior to any coring work being undertaken by Sydney Gas, an appropriate level of environmental assessment must be undertaken and provided to the DPI for their consideration and determination (i.e., the determining authority’s approval) as part of Sydney Gas’s application to the DPI for approval to commence drilling.

This REF was prepared to satisfy Sydney Gas’s and the DPI’s requirements under Part 5 of the EP&A Act and to form the basis of the DPI’s decision as to whether an Environmental Impact Statement (EIS) and/or Species Impact Statement (SIS) may also be required to be prepared, in accordance with either the *EP&A Act* or the *National Parks and Wildlife (NPW) Act, 1974*.

2.1 Licences and approvals required

Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* provides the statutory framework under which the proposal will be assessed. Consent to a development application is not required as the proposed works fall under the definitions within *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (refer Section 2.2.1). Therefore this proposal will be assessed under the provisions of Part 5 of the EP&A Act.

The Department of Primary Industries – Mineral Resources (DPI) is the nominated determining authority for the proposal, under the meaning contained within section 110A of the Act. The EP&A Act requires that any public authority must consider the environmental impacts of its activities, or the activities that may come under its control. Under Section 111 of the EP&A Act, before the DPI issues any approval to Sydney Gas, all matters affecting, or likely to affect the environment as a result of these proposed activities must be appropriately considered, including, but not limited to, all of the following:

- » Any conservation agreement under the *National Parks and Wildlife Act 1974*;
- » Any plan of management;
- » The *Threatened Species Conservation Act 1995*;
- » Any wilderness area proclaimed under the *Wilderness Act 1987*;
- » Any critical habitat;
- » Threatened species, populations and ecological communities, or their habitats; and
- » Protected fauna or native plants.

In addition to the above, Clause 228 of the *Environmental Planning and Assessment Regulation 2000* details further "factors to be taken into account concerning the impact of an activity on the environment". All the relevant factors for consideration are addressed in this REF.

Petroleum (Onshore) Act 1991

The DPI (as the nominated determining authority) is required under NSW's *Petroleum (Onshore) Act 1991* to consider the environmental impacts of any of the activities that may come under its control. Section 74 of the *Petroleum (Onshore) Act* specifies that the need to protect natural resources shall be taken into account before granting of any petroleum titles under the Act. All the proposed sites are located within PEL 267 issued by the Department of Primary Industries (Mineral Resources).

Section 74 of the *Petroleum (Onshore) Act (Environment to be considered before grant of petroleum titles)* specifically requires the following:

(1) *In deciding whether or not to grant a petroleum title, the Minister is to take into account the need to conserve and protect:*

(a) *the flora, fauna, fish, fisheries and scenic attractions, and*

(b) *the features of Aboriginal, architectural, archaeological, historical or geological interest,*

in or on the land over which the petroleum title is sought.

(2) *The Minister may cause such studies (including environmental impact studies) to be carried out as the Minister considers necessary to enable a decision whether or not to grant a petroleum title to be made.*

A deposit of methane gas is considered to be a "petroleum deposit", for the purposes of the Act, because of the following:

- » Section 3 of the Act defines "petroleum" as "any naturally occurring hydrocarbon, whether in a gaseous, liquid or solid state"; and
- » Section 3 also defines a "petroleum deposit" as "any naturally occurring accumulation of petroleum on or below the surface of the earth".

This REF therefore addresses and documents all the matters required for consideration by the Minister (i.e., by the DPI) in deciding whether or not to grant an approval to Sydney Gas under the *Petroleum (Onshore) Act 1991* for Sydney Gas's proposed corehole drilling activity at each of the proposed sites.

Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* provides a national framework for protecting specified “Matters of National Environmental Significance” (NES Matters). Under the EPBC Act, Commonwealth approval is required to carry out a “controlled action”, this being any project or development that would have, or that would be likely to have, a significant impact on any NES matter. In such cases, the details of the proposal must be referred to the Commonwealth Minister for Environment and Heritage and appropriate approvals sought.

No habitat would be removed as a result of the proposal. This proposal is unlikely to have significant impacts on any Threatened Species, Endangered Ecological Communities or any other NES Matters. Therefore, no further provisions of the EPBC Act need apply to this proposal.

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations (POEO) Act 1997* establishes New South Wales’s environmental regulatory framework and determines whether an environment protection licence may be required.

The objectives of the Act are contained in section 3, with the relevant objectives to this proposal being to:

- » *protect, restore and enhance the quality of the environment in NSW, particularly with regard to ecologically sustainable development;*
- » *provide increased opportunities for community involvement;*
- » *ensure community access to information about pollution; and*
- » *reduce risk to human health and degradation of the environment.*

Activities that require a licence to be issued under the POEO Act include those with the greatest potential to harm the environment, such as heavy industry, electricity generation, sewage treatment and other potentially offensive infrastructure such as waste treatment and/or storage facilities.

The proposal for Sydney Gas’s corehole drilling activities is not identified as a “scheduled activity” under Clause 5 or Schedule 1 of the POEO Act. Therefore, the proposal would not require an environment protection licence to be issued by the Department of Environment and Climate Change (DECC).

The proposed activity is therefore not subject to any requirements for further assessment under the POEO Act.

Threatened Species Conservation Act 1995

The *Threatened Species Conservation (TSC) Act 1995* lists threatened species, populations and endangered ecological communities (EEC) within New South Wales. If a threatened species, population or EEC, or its habitat is likely to be present in any area that may be affected by a development proposal, then an “Assessment of Significance”, undertaken in accordance with Section 5A of the EP&A Act, must be

conducted in order to determine whether the proposal would have a “significant” impact on that species, population or community. If such an assessment concludes that there would be a significant impact, then a Species Impact Statement (SIS) must be prepared. The proposal would then be subject to approval by the Director-General of the DECC.

No habitat would be removed as a result of the proposal, nor is the proposal likely to represent any potentially significant impacts on any Threatened Species or Endangered Ecological Communities (refer Section 4.5). Therefore, no further provisions of the TSC Act apply to this proposal.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife (NPW) Act 1974* provides for the Director-General of the DECC to be responsible for the care, control and management of all National Parks, historic sites, nature reserves, Aboriginal areas and State Game Reserves.

The Act sets out the responsibilities of the DECC in relation to the protection of Aboriginal heritage under section 90 of the Act. The DECC should also be formally consulted prior to undertaking any works to determine the existence of any items of Aboriginal heritage on the sites and in their vicinity.

Consent from the DECC must be received prior to disturbance of any sites where any items of Aboriginal heritage are known to occur. Development activities and any associated works must cease and the DECC must be notified if any potential Aboriginal heritage items are uncovered during the development activities or works. Should an Aboriginal site be discovered, a licence pursuant to Section 90 of the Act is required to destroy or to otherwise disturb the site.

No indigenous heritage sites were found to exist at any of the proposed sites during detailed site investigations undertaken in March 2008 by Insite Heritage Pty Ltd (Insite), in consultation with appropriate representatives of the each relevant local Aboriginal community.

An indigenous heritage site was found to exist near to one of the proposed sites (Maison Dieu 01) during Insite’s field investigations, approximately 50m to the north west of the proposed corehole site, however this is outside of the study area for the proposed corehole activity (refer Section 4.12). A discussion of the findings at this site and of all of Insite’s other recent heritage investigations is presented in Section 4.12. A full copy of Insite’s Archaeological Assessment report is presented in **Appendix H**.

Heritage Act 1977

The *Heritage Act 1977* identifies and protects heritage items. The Act is administered by the NSW Heritage Council. Under the Act, it is an offence to disturb an item of heritage significance without the consent of the Heritage Council. Under section 60 of the Act, any work that would impact on an item listed on the State Heritage Register or Interim Heritage Orders requires approval from the Heritage Council. Approval under section 139 of the Act may also be required if it is proposed to disturb a relic.

Under the Act, a heritage “item” may include a “place, building, work, relic, moveable object or precinct”. “Environmental heritage” is defined as places, buildings, works, relics, moveable objects and precincts of State or local heritage significance.

A heritage “relic” means any deposit, object or material evidence:

- a. *which relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and*
- b. *which is 50 or more years old.*

As discussed in Section 4.12 and in the Archaeological Assessment report presented in **Appendix H**, the proposal would not impact on any items of heritage significance. There are no items in the study area that are listed on the State Heritage Register or that are the subject to an Interim Heritage Order.

Rivers and Foreshores Improvement Act 1948

The *Rivers and Foreshores Improvement Act 1948* (RFI Act) applies to the proposal. The RFI Act requires consultation with the Department of Water and Energy (DWE) with respect to any proposal to conduct “controlled activities”, defined as “the carrying out of any other activity that affects the quantity or flow of water in a water source”, amongst other things.

None of the proposed corehole drilling sites would be situated within 40 metres of any creeks or other waterways. A small wetland is located just to the east of the initially proposed Paynes Crossing 01 site (refer Section 4.5), however it has been proposed to locate the actual drilling site about 15 to 20 metres further away than was initially planned, in order to avoid potential impacts on this wetland area. The finally proposed drilling site would therefore be located about 70 metres away from this wetland.

At the proposed Rothanal 01 site an appropriate creek crossing would be required to cross the dry, ephemeral creek bed that feeds into Jump Up Creek, about 450 metres to the west of the proposed corehole drilling site in order to facilitate initial access and final egress for the drill rig to / from the corehole site. It is therefore proposed to use a Temporary Vehicle Quick Bridging method to facilitate this crossing (refer Sections 1.2 and 4.5). It is proposed that this temporary bridge structure would only be located on the creek bed site during the actual time that the drilling rig would need to cross this creek (i.e. for less than one (1) working day to provide initial access for the drill rig and again for the rig’s return journey at the conclusion of drilling activities). All other, smaller vehicles that would require more regular or routine site access would be able to traverse this route without the need for the temporary bridging facility to be in place.

At the proposed Wollombi 01 site it would be required to appropriately reinforce an existing wooden bridge structure in order to facilitate access for the drill rig. It is proposed that a “transferable bridge” structure would be transported to the site on a trailer and lowered into position, effectively covering and reinforcing the deck of the existing wooden bridge. It is proposed that this “transferable bridge” structure would be in place during the whole period proposed for on site activities at the Wollombi 01 site (refer Sections 1.2 and 4.5).

No significant earthworks would be required to facilitate the placement or subsequent removal of either of these temporary bridging or bridge reinforcement structures. Neither the placement nor subsequent removal of either structure would be conducted during any significant rainfall events.

Sydney Gas has consulted with relevant local officers of the DWE regarding the possible need for a permit for such works to be issued under the RFI Act. Due to the temporary nature of the bridging works proposed, Sydney Gas has been initially advised that they may not need to obtain such a permit, however it should be noted that if it is later confirmed by DWE that a permit is required, this will be appropriately applied for by Sydney Gas.

Apart from the above, the proposal is not considered to constitute a controlled activity at any of the proposed corehole drilling sites.

2.2 Planning issues

2.2.1 State Environmental Planning Policies

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 came into force on 16 February 2007. The aims of this SEPP are:

- (a) *to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and*
- (b) *to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and*
- (c) *to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.*

Clause 6 of the SEPP allows that certain development is “permissible” and may also be carried out without the need to obtain development consent, including development for the purposes of “petroleum exploration”.

Sydney Gas’s current proposal is clearly included within this definition and is therefore considered to be “permissible without consent” under Clause 6. It is therefore considered by Sydney Gas that no local planning instruments or other local development controls contain any formal requirements that would need to be further considered as part of this assessment of their proposed corehole drilling activities.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy no. 44– Koala Habitat Protection (SEPP 44) aims to encourage the conservation and appropriate management of areas of natural vegetation that provide potential habitat for koalas, in order to ensure a permanent

free-living population over their present range and to reverse the current trend of decline in extant Koala populations. Singleton is an LGA to which SEPP 44 applies.

The Ecological Assessment conducted in March 2008 (refer **Appendix G**) confirmed that potential foraging habitat for the Koala is present within the study areas of both the Payne's Crossing 01 and Wollombi 01 sites. *Eucalyptus tereticornis* (Forest Red Gum) is listed under SEPP 44 as a "primary Koala feed tree" and is present near both sites. It should be noted that for an area to be considered potential Core Koala Habitat (under the provisions of SEPP 44), appropriate tree species must represent at least 15% of the total number of trees within the upper and lower strata of the tree component at that location. This is considered to be the case within the River Flat Eucalypt Forest that occurs adjacent to both the Payne's Crossing 01 and Wollombi 01 access tracks, however no relevant trees would be cleared or otherwise significantly impacted as a result of this proposal. That is, no core Koala habitat is proposed to be cleared on either of these sites as a result of this proposal. Some limited lopping of Forest Red Gum trees located along the Payne's Crossing 01 access track would be required in order to reduce further detrimental impacts on the surrounding vegetation by the movement of large machinery along the access route to this site. Appropriate mitigation measures would therefore be implemented (refer Section 4.5.8) to ensure that no significant impacts to any Koalas or Koala feed trees occur as a result of this proposal.

State Environmental Planning Policy No. 55 – Remediation of Land

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) and the *Managing Land Contamination: Planning Guidelines* were each developed to complement the aims of the *Contaminated Land Management Act, 1997*. The general aim of the Act is to establish a process for investigating and, where appropriate, remediating contaminated land.

All land uses within the relevant surrounding areas of each site are primarily rural in nature. Sydney Gas has consulted with each landowner and it has been confirmed that, to the best of the knowledge available, no potentially contaminated activities have ever been conducted on any of the subject land. There is no other evidence that any of the subject land has ever been used for the purposes of market gardens, orchards or any other potentially contaminating agricultural or horticultural activities.

Letters of confirmation of the above have been obtained from each relevant landowner. Copies of these letters are presented in **Appendix J**.

A Stage 1 Environmental Site Assessment, or any other form of more intensive land contamination investigation is therefore not warranted in this case, for any of the proposed sites.

No other State Environmental Planning Policies contain any specific requirements that are relevant to the corehole drilling activity proposed at any of the proposed sites.

2.2.2 Regional Environmental Plans

Hunter Regional Environmental Plan 1989

The *Hunter Regional Environmental Plan 1989* (HREP 1989) applies across the Hunter Valley region and therefore to all the proposed corehole drilling sites. HREP 1989 aims to promote the balanced development of the region, improving its urban and rural environments and to allow development to occur in a manner that optimises the use of land and other resources. **Table 2.1** sets out the only two specific planning issues and policies contained in Part 6 of HREP 1989 that would relate to Sydney Gas's proposed corehole drilling activities and provides comments with respect to each of these issues.

Table 2.1 Assessment of HREP's Specific Planning Issues

Specific Planning Issue / Policy	Comment
Part 6 (1) aims to ensure the extraction of materials in the region occurs in such a way that adverse environmental impacts and populations likely to be affected are minimised.	The proposal has been designed in such a way so that it is unlikely that the corehole drilling activities would represent any adverse environmental impacts.
Part 6 (2) aims to provide for the safe and effective disposal of industrial and other wastes.	Gathered core samples would be removed from the site for evaluation purposes. All other wastes produced on site would be re-used, recycled or otherwise disposed of in a sustainable manner.

Table 2.2 sets out the HREP's various policies for the control of development on rural land and provides comments with respect to each of these issues.

Table 2.2 Policies for the control of development on rural land

Specific Planning Issue / Policy	Comment
<i>Before granting consent to a development application for development (other than commercial farming) on land identified as prime crop or pasture land councils should take account of the views of officers of the Department of Agriculture and Fisheries on the effect of the development on the productive potential of the land and on the productive use and potential of adjoining lands.</i>	The proposal has been designed in such a way that it is considered unlikely that the development will have any impact on the productive potential of the subject (or surrounding) land or on the productive use and potential of adjoining land parcels, in the long term.

Specific Planning Issue / Policy	Comment
<i>Before granting consent to an application for open-cut coal or other mining or resource extraction on land identified on the map as prime crop or pasture land consent authorities should consider:</i>	
<i>(a) the degree to which the mining or resource extraction area can be restored for further agricultural use,</i>	It is anticipated that disturbances caused by drilling activities would be insignificant, due to the proposal's temporary nature and localised impacts.
<i>(b) the contents of the policy statement "Rehabilitation of Land Affected by Mining" issued by the Soil Conservation Service,</i>	The policy statement is not applicable as the activity is not a mining activity. Nonetheless, however, post-drilling rehabilitation works would return the site to a state as good as when operations began.
<i>(c) the likely effects on agricultural land and surface and groundwater resources in the vicinity, and</i>	It is unlikely that coring would impact on groundwater or surface water resources in the area due to the proposed nature of the activities.
<i>(d) the cost of sterilisation of the coal resource, mineral resource or extractive material if mining or extraction does not proceed.</i>	Not relevant to this proposal.

There are no other Regional Environmental Plans or other relevant planning instruments that are considered to apply to this proposal.

2.3 Stakeholder consultation

Sydney Gas defines a "stakeholder" as being any person interested in its activities and regards its community consultation approach as being:

- » Consistent with best practice, i.e., an "inclusive" rather than "exclusive" approach;
- » Supportive of open and transparent reporting;
- » Committed to being a good corporate citizen and sustainability;
- » Steadfast, aimed at building a long term communication infrastructure;
- » Part of establishing a broad networking process, for example, Sydney Gas has recently joined both the Hunter and Singleton Chambers of Commerce;
- » Assisted Sydney Gas to capture issues and risks early in the process and thus focusing on its reputation; and
- » Ensuring participation by most groups (an example of this was the focus group analysis undertaken in March 2007. The aim was to capture issues accurately and in a timely manner).

The Community Consultation process adopted by Sydney Gas for this proposal has used, but has not been limited to the following general approach:

1. Sydney Gas has conducted two "Open Days" (public information sessions) at Singleton Library on 24th and 25th November 2006. 66 interested parties attended these Open Days. The Open Days were advertised in the local media and specific invitations were delivered to residents of both Broke and Bulga, including the offices of the local Members of Parliament Mr Kerry Hickey and Mr George Souris;
2. No significant objections were recorded during the Open Days. Thirteen requests were made by participants for Sydney Gas to provide additional information;
3. An information pack consisting of information relevant to the area was made available at the Open Days and has also been mailed to several parties who expressed interest;
4. Sydney Gas's Project Manager held a briefing session with officers of Singleton Council on 15 May 2007, with respect to these proposed activities;
5. Sydney Gas delivered two Information Sheets by mail to residents of the Broke / Bulga area, one in July 2006, another in November 2006 and three further Information Sheets in July, October and December 2007. These Information Sheets are regarded as a good medium to provide answers to potential community concerns, to answer any queries and to respond to the wider community via an equitable consultation process. A copy of the most recent of these Community Information Sheets is presented in **Appendix I**;
6. At least 30 questions or requests for further information have been made to date, allowing Sydney Gas to respond further by preparing appropriate "Fact Sheets for public distribution";
7. Sydney Gas has held further consultation sessions with at least seven local associations and other groups of interested parties, including Singleton Shire Council, the Broke Bulga Landcare Group, the Broke Bush Fire Brigade and Wollombi Catchment Water Users' Association;
8. Sydney Gas's Managing Director (MD) has responded to all letters received from interested parties, whether potentially affected landowners or the general public, for example, the Hunter Bulga Gas Action Group;
9. Sydney Gas's MD has visited the Hunter region and will continue to be available for further consultation with local residents;
10. Sydney Gas's Executive Chairman met with the Hunter/Bulga Gas Action Group on 5 July 2007;
11. A presentation was given to the Hunter Business Chamber and other stakeholders on 6 July 2007; and
12. A presentation was given to the Muswellbrook Chamber of Commerce on 7 November 2007 by Sydney Gas's Project Manager.

3. Existing environment

3.1 Landforms, Soils and Geology

The following general information on landforms, soils and geology is based on review of the *Singleton 1:250 000 Soil Landscape Sheet. Soil Landscape Series Sheet SI 56-1* (Soil Conservation Service of NSW, 1991).

Rothanal 01 (RN01)

The proposed Rothanal 01 corehole drilling site is located within the Rothbury Soil Landscape. Topography and landform comprise of undulating to rolling hills with relief ranging from 60 to 80 metres and slopes ranging from 6 to 12%.

The underlying geology of the Rothbury Soil Landscape is characterised by Permian sandstone, shale, mudstone, siltstone, tuff and coal seams.

Soils are characterised by Red Podzolic Soils on the upper slopes, Yellow Podzolic Soils on the mid slopes and Yellow Solodic Soils and brown Soloths on the lower slopes. Prairie Soils also occur within drainage lines.

Roughit 01 (RI01)

The proposed Roughit 01 corehole drilling site is located within in the Sedgefield Soil Landscape. Landform and topography consists of undulating low hills, with local relief of 40 to 60 metres and slope gradients up to 6%.

The underlying geology of the Sedgefield Soil Landscape comprises Permian mudstone, sandstone, conglomerate, siltstone, shale and coal seams.

Soils are characterised by Yellow Soloths on upper to mid slopes, yellow Solodic Soils on lower slopes and in drainage lines, with black Soloths occurring in areas of seepage.

Wollombi 01 (WB01)

The proposed Wollombi 01 corehole site is located within the Wollombi Soil Landscape. Slope gradients within this landscape are up to 3%, with local relief up to 20 metres.

The Wollombi Soil Landscape comprises Layered Alluvial Soils on alluvial flats and undulating rises associated with the Wollombi Brook and its tributaries.

Paynes Crossing 01 (PC01)

The proposed Paynes Crossing 01 corehole site is also located within the Wollombi Soil Landscape (refer above). Slope gradients within this landscape are up to 3%, with local relief up to 20 metres.

This soil landscape comprises Layered Alluvial Soils on alluvial flats and undulating rises associated with the Wollombi Brook and its tributaries.

Maison Dieu 01 (MD01)

The proposed Maison Dieu 01 corehole site is located within the Roxburgh Soil Landscape. Local landforms are dominated by undulating low hills and hills with local relief ranging from 60 to 120 metres and slope gradients up to 8 to 10%.

Underlying geology in this locality consists of Permian sandstone, shale, mudstone conglomerate and coal.

Soils comprise Yellow Podzolic Soils on the upper to mid slopes, red Solodic Soils on rounded hills, Lithosols on crests and Brown Podzolic Soils on slopes with conglomerate outcrops. Yellow Soloths also occur in some gullies.

3.2 Climate

The Commonwealth Bureau of Meteorology website (2008) provides the following climatic information taken from Cessnock Airport (the closest weather station to the sites):

- » Mean rainfall peaks in summer range from 95.3 mm in February to 30.6 mm in July;
- » Mean daily maximum temperatures range from 29.9°C to 17.4 °C in summer and winter respectively; and
- » Mean daily minimum temperatures range from 16.7 °C to 3.7 °C in summer and winter respectively.

Winter rainfall levels within this general vicinity can be somewhat variable but would generally average about 30 millimetres per month. Summer rainfalls are more stable at approximately 55 to 60 millimetres per month, giving a mean annual rainfall of 740 millimetres. During the summer months, the increased rainfall rate and reduced ground cover can result in a relatively higher risk of soil erosion effects. Rainfall is known to impact upon soils through runoff and rain splash, resulting in further erosional degradation and the associated movement of soils.

Generally, the climate of the Upper Hunter is relatively mild, however on more than about thirty or forty days per year the maximum daytime temperature may normally be expected to reach above 30°C. The highest recorded temperatures generally occur during February or mid to late January and will also sometimes approach, or even exceed 40°C on up to two or three days during each summer season. During the winter months the overnight minimum temperature would also be expected to drop near, or below freezing point. The lowest night-time temperatures across the region generally occur during July each year.

The average relative humidity of the Hunter area can be described as medium to high, with the mean 9am and 3pm relative humidity readings being 77% and 48% respectively, but with some marked variation between seasons.

The summer season generally experiences the highest average rainfall levels and winter the lowest, although most of NSW (and a large part of south-eastern Australia) has been experiencing the worst ever recorded drought conditions during most of the last decade.

4. Environmental impacts and management

The following provides an overview of relevant aspects of the existing environment at the propose corehole drilling sites, a discussion of the impacts that may potentially occur as a result of the proposed drilling activity at these sites and a recommended set of mitigation measures to either avoid or to minimise the consequences of those impacts.

4.1 Air

Parsons Brinckerhoff (PB) has conducted a preliminary air quality investigation of Sydney Gas's proposed Hunter coal seam methane exploration activities. A copy of PB's *Preliminary Air Quality Investigation* for Sydney Gas's Hunter Exploration Activity (December 2006) is presented in **Appendix C**. PB's investigations were aimed at identifying and characterising the existing ambient air environment and identifying any potential impacts to air quality within the proposed Hunter Exploration Area that may specifically relate to the corehole drilling activities. These investigations involved the following:

- » A review of regional meteorological and ambient air quality issues for the exploration area;
- » Identification of existing key air emission sources in the exploration area (i.e. those not associated with the proposed works);
- » Identification of air quality emissions associated with possible future flaring and venting operations; and
- » Identification of appropriate management issues and mitigation measures.

PB found that the existing air quality within the area is typical of a rural environment and that no major pollutant generating activities are located within the immediate area. Local minor sources of air emissions include a combination of general residential activities, as well as both local and arterial roads.

PB also found that air emissions during the proposed corehole drilling activities would be negligible, consisting of minor quantities of particulate matter as well as some emissions of various by-products from the combustion of engine fuels, from various machinery required for the drilling process.

With respect to potential for dust generation, it should be noted that the "construction" phase of any project (in this case, the entire proposed drilling phase at each site) has the potential to generate higher than normal dust levels, however, given the limited requirement for exposure of earth and storage of other dust producing materials for Sydney Gas's proposed drilling activities at these sites, it is unlikely that potential dust producing materials would represent a significant impact to any surrounding or other local land users.

4.1.1 Mitigation measures

Potential air quality impacts from this proposal would be most appropriately managed through the implementation of the following safeguards:

- » Engines would not be left running when not specifically required for drilling purposes;
- » Individual vehicular trips to and from the site would be kept to a minimum;
- » Tailgates on all vehicles transporting materials to and from the site would be securely fixed prior to loading and immediately after loading;
- » Water carts would be available to minimise and prevent dust emissions from vehicles using access roads;
- » No burning of any combustible materials would occur; and
- » Revegetation of disturbed surfaces would take place as soon as possible.

4.2 Water

Intense summer rainfall events are a factor that should be considered during the drilling program. Heavy local and regional rainfall should also be expected to occur, from time to time, regardless of the actual time of year of drilling at each site. The occurrence of any localised heavy rainfall can amplify on-site and access problems, as any water that does not readily absorb into the ground surface would drain across the surface of the ground as “sheetwash”, potentially transporting sediment loads into adjoining drainage lines and thence towards local creeks and waterways.

Rothanal 01 (RN01)

The proposed Rothanal 01 site is situated about two hundred metres from the nearest ephemeral tributary to Jump-up Creek.

A heavily vegetated creekline also occurs within 50 metres to the north of the proposed site. Another wooded creekline is traversed by the proposed access track to the south of the site.

Roughit 01 (RI01)

The proposed Roughit 01 site would be located about 400 hundred metres from the nearest creek line, this being a tributary to First Creek.

A farm dam is located approximately 160 metres to the southeast of the site, with an intermittent creek and another dam occurring approximately 400 metres to the north of the site.

Wollombi 01 (WB01)

A creek runs to the northwest of the proposed Wollombi 01 corehole drilling site. This creekline is crossed by the proposed access track to the site, via an existing bridge.

Paynes Crossing 01 (PC01)

A small farm dam is located approximately 60 metres to the north of proposed Paynes Crossing 01 site and approximately 20 metres from the route of the proposed access track.

A small wetland or “soak” is located just to the east of the originally proposed site, however it is now proposed to relocate the actual drilling site about 15 to 20 metres further away (refer Section 4.5) in order to avoid any direct impacts on this wetland area. The proposed drilling site would therefore be located about 70 metres away from this wetland.

Maison Dieu 01 (MD01)

The Hunter River runs approximately 140 metres to the west of proposed Maison Dieu 01 site. A creek and a large farm dam are located approximately 200 metres to the east and southeast of the proposal site, respectively.

4.2.1 Impact Assessment

Within each drilling site compound only minimal site disturbance would be required. Some temporary soil stockpiles would be required to be established to accommodate soils and rock material that would be removed as a result of the drilling activity.

The potential impacts of the proposal on surface water quality at each site can be summarised as follows:

- » Erosion and sediment loss from the access tracks and the corehole drilling site;
- » Erosion and sediment loss from soil stockpiles; and
- » Any potential spillage of hydrocarbons, either from vehicles or from the drilling equipment.

Parsons Brinckerhoff (PB) have conducted a preliminary hydrogeological investigation of the region (PB 2006). The results of PB’s investigations are presented in **Appendix D**. The objective of these investigations (as relevant to these proposed corehole drilling activities) was to identify the aquifer systems in the local area and to characterise the water quality and hydrogeological properties and to make suitable recommendations with respect to the findings made.

With respect to groundwater issues, it was found that the drilling of coreholes would not cause disturbances to the water tables encountered and that there would be no effects on water quality through the use of standard drilling techniques. Groundwater cross-contamination of aquifers would be avoided, as all coreholes would be cased-off and at their conclusion, cemented to surface in accordance with DPI requirements. There would be no groundwater management issues associated with corehole drilling activities and therefore no need for any specific mitigation measures with respect to groundwater issues.

No other potential impacts to local groundwater reserves are expected as a result of Sydney Gas’s corehole drilling program.

4.2.2 Mitigation measures

All on-site stockpiles would be no more than two (2) metres high and would be established in an appropriate manner that would limit potential impacts from erosion. Sediment fencing would be established on the downhill side of each drilling site to ensure that no sediment leaves the site or is otherwise able to enter receiving waters.

All works on site, including all site disturbance required within each drilling compound, would be managed in accordance with Sydney Gas's Soil and Water Management Plans for each site (refer **Appendix E**). Each Plan considers the relevant site constraints and sets out an appropriate methodology to ensure that all potential water quality impacts from this proposal are effectively minimised and/or mitigated. Any works conducted within the vicinity of any creek or waterway would also be conducted in accordance with the relevant recommendations contained in Sections 4.3.3 and 4.5.8.

The drilling and reinstatement of all coreholes would be in accordance with DPI requirements.

Following the completion of works at each site, all areas of disturbance would be reinstated, all sediment fences removed and the area(s) reseeded and stabilised with native grasses, with the concurrence of the landowner.

Revegetation of all disturbed surfaces would take place as soon as possible.

As mentioned above, there would be no need for any specific mitigation measures with respect to groundwater issues.

4.3 Soils

The following soils information is based on the *Singleton 1:250 000 Soil Landscape Sheet. Soil Landscape Series Sheet SI 56-1* (refer Section 3.1).

Rothanal 01 (RN01)

Soils at the Rothanal 01 corehole drilling site are characterised by Red Podzolic Soils on the upper slopes, Yellow Podzolic soils on mid slopes and Yellow Solodic Soils and brown Soloths on lower slopes. Prairie Soils also occur within drainage lines.

Roughit 01 (RI01)

Soils at the Roughit 01 site are characterised by Yellow Soloths on upper to mid slopes, yellow Solodic Soils on lower slopes and in drainage lines, with black Soloths occurring in areas of seepage.

Wollombi 01 (WB01)

Soils at the Wollombi 01 site comprise Layered Alluvial Soils on alluvial flats and undulating rises associated with the Wollombi Brook and its tributaries.

Paynes Crossing 01 (PC01)

Soils at the Paynes Crossing 01 site comprise Layered Alluvial Soils on alluvial flats and undulating rises associated with the Wollombi Brook and its tributaries.

Maison Dieu 01 (MD01)

Soils at the Maison Dieu 01 comprise Yellow Podzolic Soils on the upper to mid slopes, red Solodic Soils on rounded hills, Lithosols on crests and Brown Podzolic Soils on slopes with conglomerate outcrops. Yellow Soloths also occur in some gullies.

4.3.1 Potential Acid Sulfate Soils

Potential Acid Sulfate Soils (PASS) generally only occur at very low elevations, commonly well below 10 metres (AHD). The whole of the Hunter Valley is well above 10 metres elevation and so all the sites of the proposed works are considered to have a low probability of PASS. It is therefore considered that there would be a very low risk of Potential or Actual Acid Sulfate Soils being encountered during any of the activities required for this drilling proposal.

4.3.2 Impact assessment

Apart from the corehole drilling activities, on site activities would involve minor excavation works to construct three small pits at each site, required to catch the drill's cuttings and to recirculate drilling fluid. Two of these pits would be approximately 3.5m x 4m x 2.5 metres deep and one would be 4m x 4m x 2.5 metres deep.

Alternatively, depending on the individual site conditions encountered at any one (or all) of the proposed sites, Sydney Gas may elect to catch the drill's cuttings and recirculate drilling fluids by instead using three above-ground containment tanks, each with dimensions of 3 m x 4 m x 2.4 metres deep. In this case, no excavation for any pits would be required as the tanks would be constructed and placed on the site, thereby eliminating the need for the associated topsoil excavation, storage, bunding and other management measures.

In either case, the potential exists for erosion during such excavation and other minor site set-up activities. Temporary stockpiles would have the potential to erode due to wind or water exposure. The occurrence of any heavy rainfall can also amplify on-site erosion problems with water draining off work areas and then transporting sediment loads into adjacent drainage lines and thence to local creeks and waterways.

Appropriate erosion and sediment controls taking into account these erosion risks would therefore need to be implemented, as outlined in Section 4.3.3 below.

4.3.3 Mitigation measures

The three small pits proposed to be established at each site (if required) would all be excavated down slope from the drill hole collar. Spoil would be banded down slope from both the pits and the drill hole collar to contain any escape of fluid. Excavated topsoil would be stockpiled separately from any other subsurface material, fenced off separately on the site and covered.

The construction and operation of these pits (if required) and all other works on site, including all other site disturbance required within each drilling compound would be managed in accordance with Sydney Gas's Soil and Water Management Plans for each site (refer **Appendix E**).

All the following mitigation measures would also be implemented at each proposed corehole drilling site:

- » All sediment and erosion control measures would be in place prior to any earth works commencing;
- » Sediment and erosion control measures would be routinely inspected and maintained to ensure they remain effective;
- » Ground disturbance would be minimised;
- » Works would not be undertaken during periods of high rainfall; and
- » Revegetation of disturbed surfaces would take place as soon as possible after disturbance.

4.4 Noise and vibration

Table 4.1 presents the approximate distances from each of the currently proposed corehole locations to their nearest sensitive receiver location (in this case, the nearest residential building).

Table 4.1 Distance to nearest receiver

Proposed site	Estimated distance to nearest receiver
Rothanal 01	No receivers within 400 metres.
Roughit 01	<ul style="list-style-type: none"> » No receivers within 400 metres » An unoccupied shed is within 300 m.
Wollombi 01	No receivers within 400 metres.
Paynes Crossing 01	<ul style="list-style-type: none"> » One residence is approx. 400 m away. » A farm shed is 265 m to the east.
Maison Dieu 01	No receivers within 400 metres.

No specific noise assessment studies have been conducted for this proposal, however the results of a relevant, previous desktop acoustic assessment for a similar corehole drilling proposal (GHD 2006) were considered (refer **Appendix F**). GHD's 2006 noise assessment report identifies the predicted noise impacts for the nearest receiver locations for Sydney Gas's corehole drilling activities at their proposed "Hunter Corehole 3" site, near Bulga, also within the Upper Hunter Valley area of NSW. These receiver locations were between 225 to 243 metres away from the Bulga corehole drilling site and were all predicted to be within the required noise goal.

Similar to the previous work done at the Bulga location, the topography immediately around all the proposed sites consists predominantly of flat or gently undulating, open pastureland. Therefore, the previous work conducted for the Bulga site can be used as

a benchmark to consider potential noise impacts at the proposed corehole sites. The results of the previous noise assessment work are therefore discussed further below.

4.4.1 Results of Bulga (Hunter Corehole 3) Noise Assessment

A conservative background noise level of 35dB(A) was assumed to apply to all receivers within the vicinity of the Bulga corehole site, as would be typical of such a rural environment and would also be relevant to the “daytime only” drilling operations.

The period of drilling operations at the Bulga site was also expected to be less than 26 weeks (i.e. only up to 65 days, as for the currently proposed sites) therefore a construction noise criterion was proposed with the project specific noise goal set as 45dB(A) (L_{A10}). Noise propagation modelling was undertaken to predict the noise exposure at the nearest residence to the Bulga site that would be expected to be generated by the proposed corehole drilling activities. Modelling results suggested that the DECC’s noise criteria would be complied with at all the affected noise receivers (i.e. residences) during the daytime operational period, as shown in **Table 4.2**.

Table 4.2 Modelled daytime receiver sound pressure levels [dB(A)] for the Bulga Corehole 3 location

Receiver	Distance (m)	Predicted Level dB(A)
R1	225	43
R2	230	43
R3	227	43
R4	243	42

The results of Bulga corehole noise assessment show that compliance to the set criteria could be expected at all the modelled receivers during the operational daytime periods. All predicted site sound levels were predicted to be below the set noise criteria up to a distance of 225 metres from the proposed noise source (i.e. proposed drilling activities).

It should also be noted that subsequent noise monitoring work conducted during the drilling activities at the Bulga location (i.e. at the Corehole 3 site) the recorded noise levels at the nearest sensitive potential receiver never exceeded 45 dBA at the nearest receiver locations (i.e. at 225 and 243 metres away from the drilling site) during daylight hours, even whilst a generator was also in operation (also refer Section 4.4.3).

4.4.2 Impact Assessment of proposed sites

No potentially sensitive noise receivers are located within up to 400 metres of any of the five (5) proposed sites (refer **Table 4.1**), the closest residence being located approximately 400 metres away from the Paynes Crossing 01 site.

The results of the previous studies for the Corehole 3 site at Bulga can therefore be considered to be an adequate (and fairly conservative) indication of the maximum level of noise impact that may be expected to occur at 225 metres away from any of the five (5) proposed sites. The mitigation measures recommended for the Corehole 3 site have also been adopted for the currently proposed sites (refer Section 4.4.4).

4.4.3 Proposed use of generator

Sydney Gas proposes to use a small 20kVA generator at each site to supply the electrical power required for on-site gas testing. This on-site gas testing is required as part of the overall activities proposed to be conducted at each site. The generator would be operated only during normal daylight working hours and also only when the “target coring zone” is actually being drilled.

Given the results of operational noise monitoring from the Bulga corehole location (refer Section 4.4.2), it is considered that the potential for noise impacts from the operation of a generator, at sensitive noise receivers at a distance of 400 metres from the proposed drilling sites would not be significant.

4.4.4 Mitigation measures

Best practice noise management measures would be implemented in all aspects of the drilling operation, in order to control potential operational noise. The following management and mitigation measures are recommended to ameliorate any potential noise impacts during the proposed drilling operation:

During routine drilling activities

- » Noisiest activities would be scheduled during the least sensitive periods of the day, i.e. from 9:00am to 12 noon and from 2:00pm to 5:00pm;
- » The quietest work methods, plant and equipment would be selected, wherever available;
- » A specific person would be designated, on-site, to note the time of various activities, to enable the accurate identification of which specific activities were occurring at the time of any complaints (if any arise); and
- » As part of job-site induction prior to arrival on-site, awareness of noise related issues at noise sensitive sites would be provided for relevant drilling and other staff.

During operation of the Crane (if required)

- » Where feasible, all engine exhaust and noise emitting components would be faced away from the nearest residences;
- » Operations would be conducted so as to minimise noise wherever practical; and
- » Arrival and set-up activities, on-site, would be only within designated work hours.

General Equipment Measures

- » A small, 20kVA generator would be used to supply electrical power required for on-site gas testing but would only be operated during designated operating hours (i.e. during normal, daylight working hours) and also only when the “target coring zone” is being drilled;
- » All combustion engine plant, such as generators and compressors would be checked to ensure they produce minimal noise with particular attention to residential grade exhaust silencers;
- » Equipment would be used which is well serviced, with no air-leaks on equipment;
- » Vehicles would be kept properly serviced and fitted with appropriate mufflers;
- » The use of exhaust brakes would be eliminated, where practical;
- » Where practical, all vehicular movements to and from the drilling site would be made only during normal working hours;
- » Where practical, machines would be switched off when not being used, rather than left idling for prolonged periods;
- » Machines found to produce excessive noise compared to industry best practice would be stood down until repairs or modifications can be made. Subcontractors should be able to provide well maintained service history of plant items or machinery;
- » Movements of equipment and mobile plant only within designated work hours; and
- » Where possible, without interference to any requirements for safe and efficient operation, equipment should be oriented away from residential receivers.

Site Access and Staging Areas

- » Site access points and access tracks would be situated as far as possible away from residential receivers; and
- » With regard to potential traffic noise, by keeping plant related vehicles serviced, fitted with mufflers and eliminating exhaust brake usage, noise due to trucking activity associated with the site operations can be significantly mitigated.

Due to the actual, scale and duration of the drilling works proposed, additional compliance monitoring is not considered necessary at this time. Should any significant noise-related complaints be received by Sydney Gas, noise monitoring would be undertaken at the affected site.

4.5 Flora and fauna

GHD undertook an on-site flora and fauna assessment of the proposed corehole sites on 13 and 14 March 2008. The site surveys included both the cleared areas on each property where it is proposed that each corehole would be drilled, as well as the proposed access route from the nearest public road to the drilling location. A full copy of GHD’s Ecological Assessment report is presented in **Appendix G**. The report’s findings are summarised below.

A number of reference sources were also initially investigated in order to gain an appropriate understanding of the potential flora, fauna and vegetation communities that may be present within a 10km radius of each site, including:

- » National Parks and *Wildlife Service's Wildlife Atlas Database* for threatened species and endangered ecological communities listed under the TSC Act and which have been recorded within a 10 km radius from the study area (dated 10 May 2007); and
- » Department of Environment and Heritage's *Protected Matters Search Tool for Matters of NES* listed under the EPBC Act within a 10 km radius from the site.

4.5.1 Flora

The vegetation at each site was verified through targeted field observations for threatened flora species. All flora species present within a 30 m x 60 m quadrat at each site were recorded and appropriate notes taken with respect to the dominant flora species, soil types and condition, levels of weed invasion and any other signs of disturbance. All species identified at each site are listed within GHD's Ecological Assessment report presented in **Appendix G**.

Rothanal 01 (RN01)

The proposed corehole site is located within an area that has been predominantly cleared of remnant canopy vegetation. The site is dominated by the following mixture of native and exotic grasses and herbs:

- » *Aristida vagans* (Three-awn Speargrass);
- » *Cheilanthes sieberi* (Red-leg Grass);
- » *Cymbopogon refractus* (Barbed-wire Grass); and
- » *Setaria gracilis* (Slender Pigeon Grass).

Scattered immature regrowth of *Casuarina glauca* (Swamp Oak) and *Eucalyptus tereticornis* (Forest Red Gum) also occurs around the site. The area immediately surrounding the proposed corehole site contains a mixture of cleared pasture, scattered native regrowth Swamp Oak and Forest Red Gum and nearby is some other regenerating native woodland.

A significant stand of vegetation occurs immediately adjacent to the proposed site as well as along two creeklines that run to the north and south of the site. Vegetation contained within this stand is considered to constitute Hunter Lowland Red Gum Forest (HLRF). This community is listed as an EEC under the TSC Act.

Directly to the north of the proposed corehole site is an area of regenerating Swamp Oak Floodplain Forest (SOFF), occurring along a dry ephemeral creek that feeds into Jump Up Creek, about 450 metres to the west of the proposed corehole site. SOFF is also listed as an EEC under the TSC Act. Another stand of this community (SOFF) also occurs along another creekline to the south of the site.

The route of the proposed access track runs through a mixture of native grasses, herbs and regrowth Forest Red Gum. The route would cross the dry ephemeral creek,

through an existing cleared section of SOFF. The route would then continue to the location of the proposed corehole drilling site along an existing farm maintenance track.

A temporary bridging facility (refer Section 1.2) has been proposed to enable both initial access and final egress for the corehole drilling rig to cross this dry creek bed. The temporary bridge structure is proposed to be located on the creek bed site only during the actual time that the drilling rig would require to cross this creek, that is, initially for less than one (1) working day prior to commencement of drilling activities at this site and then for a further one (1) working day at the conclusion, to facilitate the rig's return journey. All other, smaller vehicles that would require more regular or routine site access would be able to traverse this route without the need for the temporary bridging facility to be in place.

No significant earthworks would be required to facilitate the placement or subsequent removal of this temporary bridge structure. Neither the placement nor subsequent removal of this bridge structure would be conducted during any significant rainfall events.

Roughit 01 (RI01)

The proposed corehole site, as well as the route proposed for the access track is predominantly cleared of remnant canopy vegetation. The area contains the following mixture of native and exotic pasture species:

- » *Chloris truncata* (Windmill Grass);
- » *Sporobolus creber* (Western Rat's Tail Grass);
- » Couch (*Cynodon dactylon*);
- » Paspalum (*Paspalum dilatatum*); and
- » Slender Pigeon Grass.

Scattered mature *Eucalyptus crebra* (Narrow-leaved Ironbark) and Swamp Oak occurs approximately 150 metres northwest of the proposed site and also adjacent to the proposed access track.

Wollombi 01 (WB01)

The proposed corehole site is dominated by a mixture of native and exotic grasses and herbs including the following:

- » Couch;
- » Paspalum;
- » *Pennisetum clandestinum* (Kikuyu);
- » *Centella asiatica*; and
- » *Cyperus brevifolius* (Mullumbimby Couch).

Occasional Forest Red Gum seedlings are also present. The site is also surrounded by pasture grasses and scattered trees including small stands of Forest Red Gum and *Eucalyptus eugenoides* (Thin-leaved Stringy-bark).

The adjacent vegetation on the wooded mountain slope to the south and southwest of the site are dominated by the following trees:

- » Narrow-leaved Ironbark; and
- » Thin-leaved Stringy-bark.

The vegetation mapping reviewed for this study also identifies the vegetation that occurs to the north of the site as Sheltered Blue Gum Forest. The vegetation that occurs to the south of the site is Hunter Range Grey Gum Forest.

The route of the proposed access track traverses predominantly cleared open grazing paddocks dominated by native and exotic pasture grasses, however it is also proposed to cross a vegetated creekline via an existing wooden bridge structure approximately 130 metres northwest of the proposed corehole site. It is proposed that the deck of this wooden bridge would be appropriately reinforced via the use of a “transferable bridge” structure that would be transported to the site on a trailer and lowered into position (refer Sections 1.2).

The vegetation along this creekline included the following species:

- » Forest Red Gum;
- » *Tristaniopsis laurina* (Kanooka);
- » *Lomandra longifolia* (Mat Rush);
- » *Rubus parviflora* (Native Raspberry);
- » *Poa labillardieri* (Tussock Grass); and
- » *Pratia purpurascens* (White Root).

The above vegetation is considered to constitute a community known as River-Flat Eucalypt Forest on Coastal Floodplains. This community is listed as an EEC under the TSC Act. The vegetation along the creek showed a good structural diversity with little evidence of weed invasion, although it was also observed to have been heavily cleared down to the riparian zone.

Paynes Crossing 01 (PC01)

As noted in Section 1.1, a wetland area is located adjacent to the initially assessed corehole location at this site. Following GHD’s inspection of this it was considered prudent to re-locate the finally proposed corehole location by approximately 10 to 15 metres to the southwest from the initially assessed location, in order to avoid potential impacts on this wetland area.

The proposed corehole location lies within an area predominantly cleared of remnant canopy vegetation, however scattered regrowth of *Acacia parvipinnula* (Silver-stemmed Wattle) occurs across the site. The following mixture of native and exotic grasses, herbs and shrubs dominated the site:

- » Paspalum;
- » Western Rat’s Tail Grass;
- » A species belonging to the *Conyza* genus (Flea Bane);

- » Native Raspberry; and
- » Silver-stemmed Wattle.

A significant stand of vegetation also occurs to the north and east of the proposed corehole site and adjacent to the existing access track.

A low-lying wetland or “soak” that is dominated by *Carex appressa* (Tall Sedge) exists at the northeast corner and along the northern boundary of the proposed corehole site, comprising the vegetation community known as Freshwater Wetlands on Coastal Flood-plains. This community is listed as an EEC under the TSC Act.

A small stand of *Rubus fruticosus* (Blackberry) is present at the northwest end of this wetland area, however no other weeds are present within the wetland. Recent dredging of nearby soils may have increased the outflow (drainage) from this wetland, however this area still contains a high moisture content and did not seem to be adversely impacted by any such previous minor earth works.

The existing access track to the site runs through existing stands of native vegetation for approximately 500 metres, including the following species:

- » Forest Red Gum;
- » *Backhousia myrtifolia* (Grey Myrtle);
- » Mat Rush; and
- » Thin-leaved Stringybark.

This vegetation is considered to be River-Flat Eucalypt Forest on Coastal Floodplains. This community is listed as an EEC under the TSC Act. It is considered to be in good condition with little to no weed invasion evident at this location, however there is the potential for this vegetation to be impacted as a result of the movement of large machinery along this section of the access track, due to the overgrown nature of the vegetation at this location.

Stockyard Creek flows to the west of the site and along the edge of the existing access track. The vegetation along this section of creek is predominantly devoid of canopy cover and largely comprised the following:

- » *Melaleuca lineariifolia* (Snow-in-Summer);
- » *Melaleuca stypheloides* (Prickly-leaved Paperbark); and
- » Silver-stemmed Wattle.

The riparian zone along Stockyard Creek (near the site) shows evidence of past damage due to domestic cattle, including “pugging” (i.e. the breaking of a soil surface by animal hooves during wet weather; also known as “bogging”) and other damage to the creek bank, including grazing of the in-stream sedges at this location.

A small farm dam is located approximately 65 metres to the north of the proposed corehole drilling site and approximately 20 metres from the existing access track. This dam contains in-stream vegetation and is considered to be in a generally good condition.

Maison Dieu 01 (MD01)

The proposed corehole site is located on top of a ridge within predominantly cleared, relatively flat open grazing land. The following native grasses dominate the location of the proposed corehole site:

- » Western Rat's-tail Grass;
- » Windmill Grass;
- » *Bothriochloa macra* (Red-leg Grass);
- » *Microlaena stipoides* (Weeping Meadow Grass); and
- » *Chloris ventricosa* (Plump Windmill Grass).

Exotic grasses and weeds that are also present include the following:

- » Fleabane;
- » Paspalum; and
- » Slender Pigeon Grass.

Scattered Narrow-leaved Ironbarks occur within the paddocks adjacent to the site. Small bushes of *Olea europea* (African Olive) and *Lycium feroissimum* (African Boxthorn) are also present.

The Hunter River runs approximately 140 metres to the west of the site. The riparian zone of this River contains a highly modified canopy of Swamp Oak with a dense understorey of exotic weeds including the following:

- » *Ricinus communis* (Castor Oil Plant);
- » African Olive;
- » *Bidens Pilosa* (Cobbler's Pegs); and
- » A species belonging to the *Cardiospermum* genus (Balloon Vine).

Native groundcovers within the riparian zone at this location include:

- » *Cymbopogon refractus* (Barbed-wire Grass);
- » *Lomandra multiflora*; and
- » *Commelina cyanea* (Native Wandering Jew).

The native vegetation component of this community is considered to constitute Swamp Oak Floodplain Forest, however it is degraded and contains a high weed content. This community is listed as an EEC under the TSC Act but would not be impacted as a result of this proposal.

Another tree-lined creekline and a large farm dam are both located approximately 200 metres to the south-east of the proposed corehole drilling site, however these areas are not considered to be potentially impacted as a result of the proposal.

An existing gravelled road occurs to the immediate west of the proposed corehole site. This road leads almost directly to the proposed corehole site and therefore only a small

length (approximately 20 metres) of native and exotic pasture grasses would need to be impacted in order to facilitate access to the corehole drilling site.

4.5.2 Fauna

GHD's assessment of each study area aimed to determine the likelihood of threatened species and/or their habitats to occur within that location and to quantify any potential impacts from the proposal, where relevant. As the physical area proposed for disturbance at each corehole site is relatively small, it was considered that extensive fauna surveying was not necessary. Instead the following methods were used to assess the likelihood of threatened fauna species occurring at each site:

- » Habitat Assessment (assessment of the nature and condition of habitats, specific resources and features of relevance for native fauna, as well as noting appropriate records of any opportunistic sightings);
- » Hollow Bearing Trees (searches for hollow-bearing trees were undertaken throughout each study area); and
- » Presence of scratch marks on trees and/or any other observable signs of fauna activity.

All species identified as potentially occurring at each site are listed within GHD's Ecological Assessment report presented in **Appendix G**. Appropriate comments are also included regarding the ecologist's assessment of the actual likelihood of each species occurring at each site.

Rothanal 01 (RN01)

A high number of macropod scats (i.e. the droppings of kangaroos and/or wallabies, etc) were recorded within the proposed Rothanal 01 site as well as within the broader study area surrounding this site.

Numerous bird species were also observed within the study area, including all the following:

- » *Cracticus nigrogularis* (Pied Butcherbird);
- » *Cracticus torquatus* (Grey Butcherbird);
- » *Corvus coronoides* (Australian Raven); and
- » *Podargus strigoides* (Tawny Frogmouth).

Due to its small size, the actual site of the proposed drilling compound area is considered to offer only limited foraging habitat for macropods and for woodland birds. No significant tree hollows were observed within the subject site, however scattered remnant canopy trees throughout the broader study area offer potential habitat for many woodland fauna species, especially birds and other arboreal (tree dwelling) fauna.

Nearby creeklines offer only limited habitat for amphibians, due to their ephemeral nature, however the dense vegetation and large hollow-bearing trees bordering these

creeklines would offer significant habitat for small ground-dwelling mammals, birds (possibly including owls), arboreal mammals and microchipertan bats.

Roughit 01 (RI01)

The proposed Roughit 01 site is currently grazed by domestic cattle (generally belonging to the *Bos* genus). Due to this and to its generally highly modified nature, the site is considered to offer limited habitat for native fauna species, including both macropods and woodland birds.

The native and introduced ground covers at this site provide potential foraging habitat for various macropods and reptiles. All the following common native bird species were observed utilising the study area:

- » *Gymnorhina tibicen* (Magpie);
- » Australian Raven;
- » *Platycercus eximius* (Eastern Rosella); and
- » *Eolophus roseicapillus* (Galah).

Nearby scattered trees (Narrow-leaved Ironbarks) also contain small hollows and “spouts” (i.e. broken branches that leave very small or “potential” hollows that are often used for refuge by very small bats and other fauna). Hollows and spouts potentially offer roosting and/or nesting sites for microchipertan bats and various birds, including some parrot species.

Wollombi 01 (WB01)

The proposed Wollombi 01 site is currently grazed by domestic cattle. Due to this and to its generally highly modified nature, the site is considered to offer limited habitat for native fauna species, including both macropods and woodland birds.

Numerous bird species were recorded (i.e. were heard calling) around the site, including the following:

- » *Strepera graculina* (Pied Currawong); and
- » *Pardalotus punctatus* (Spotted Pardalote).

Litoria fallax (Eastern Dwarf Tree-frogs) were also heard calling from within the pasture grasses just to the southeast of the site.

Pasture grasslands at the proposed corehole site are also well represented in the area immediately surrounding this site. No significant tree hollows were recorded within the site, however nearby wooded vegetation is considered to provide excellent habitat, including numerous rocky outcrops, hollow-bearing trees and various fallen timber. A wombat burrow was observed approximately 50 metres southeast of the site.

The creek to the north-west of the proposed corehole site contains large canopy trees, a “stag” (i.e. a large dead tree containing numerous potential habitat opportunities) and dense shrubby vegetation potentially providing habitat for various amphibians, reptiles, small birds and/or microchipertan bats, as well as some marginal, potential foraging habitat for arboreal mammals and some owl species.

Paynes Crossing 01 (PC01)

The proposed Paynes Crossing 01 site is considered to offer limited foraging habitat for macropods and woodland birds due to its small size and general lack of habitat features.

Nearby wooded vegetation would provide excellent habitat for native fauna, including numerous rocky outcrops, hollow-bearing trees, fallen timber and various Forest Red Gums, a favoured “feed tree” for the Koala (refer Section 2.2.1 for further comments regarding requirements under SEPP 44 with respect to Koala feed trees).

Numerous fauna species were heard calling across the study area during the field survey, including the following birds:

- » *Menura novaehollandiae* (Lyrebird);
- » Spotted pardalote; and
- » *Climacteris affinis* (White-throated Treecreeper).

No tree hollows were recorded within the proposal site, however scattered, remnant canopy trees are present throughout the broader study and would offer suitable habitat for many woodland fauna species, in particular birds and other arboreal fauna. A large native lizard of the species *Varanus varius* (Lace Monitor) was observed within the study area.

Stockyard Creek is considered to provide only limited habitat for amphibians due to the modified nature of its riparian vegetation and its currently low water level.

Nevertheless, some frog species were heard calling from the creekline including the following:

- » *Litoria fallax* (Eastern Dwarf Tree-frog); and
- » *Crinia signifera* (Common Froglet)

The ephemeral nature of this creek is considered to limit the availability of habitat for many other aquatic species.

The nearby farm dam provides potential habitat for water birds and frog species and has good quality in-stream vegetation, including sedges and floating lilies. Nearby canopy species would also provide possible roosting sites for various waterbirds that may use the dam.

Maison Dieu 01 (MD01)

The proposed Maison Dieu 01 site is grazed by domestic cattle and is considered to offer limited foraging habitat for macropods and woodland birds due to its small size and highly modified nature.

Scattered hollow-bearing trees are present within the immediate area surrounding the site that would offer potentially suitable habitat for various woodland fauna species, especially birds and other arboreal fauna. These trees would not to be impacted as a result of this proposal, however.

Other potentially available habitat features are generally not present around this site. Nearby water bodies include the Hunter River, a large farm dam and a nearby

creekline that contains limited in-stream vegetation. These water bodies would nevertheless provide potential habitat for water birds and frog species that occur within the area, including various migratory birds, fish species, water dragons and turtles.

4.5.3 Threatened Species & Endangered Ecological Communities

Rothanal 01 (RN01)

No threatened species were recorded during the recent assessment of the Rothanal 01 site, although threatened species previously recorded within close proximity to the site include the following:

- » Easter Bent-wing Bat;
- » *Eucalyptus glaucina*;
- » Grey-crowned Babbler;
- » Spotted-tail Quoll; and
- » Large-footed Myotis.

The proposed corehole site is considered to offer limited habitat for threatened fauna as it is of such small size and is currently cleared of canopy species.

As the proposal would not require clearing of any significant vegetation it is considered that threatened species that may occur in the area would be unlikely to be significantly impacted as a result of this proposal.

Vegetation occurring immediately adjacent to the proposed corehole site may constitute Hunter Lowland Red Gum Forest (HLRF), listed as EEC under the TSC Act. Various grasses and regrowth Forest Red Gum occurs within the vicinity of the proposed corehole site, however no significant vegetation constituting this EEC would be cleared as a result of this proposal.

Vegetation occurring along the two creeklines to the north and south of the site constitutes Swamp Oak Floodplain Forest (SOFF), listed as an EEC under the TSC Act. The access track traverses one section of already cleared creekline through SOFF to the south of the site. A temporary bridging facility (refer Section 1.2) has been proposed to enable both initial access and final egress for the corehole drilling rig to cross this dry creek bed.

It is considered, however, that as no vegetation is to be cleared to accommodate the proposed corehole site or its access track then no EECs are likely to be significantly impacted as a result of this proposal.

Roughit 01 (RI01)

No threatened species were recorded during the recent assessment of the Roughit 01 site, although threatened species previously recorded within close proximity to the site include the following:

- » Brush-tailed Phascogale;
- » Grey-crowned Babbler;

- » Black-necked Stork;
- » Speckled Warbler; and
- » Greater Broad-nosed Bat.

The limited site area required for the proposed drilling site is unlikely to offer any significant habitat for threatened fauna given its small size and limited habitat opportunities. Nearby scattered trees would provide potential habitat components (e.g. refuge, foraging and breeding opportunities), however these nearby trees would not be impacted as part of this proposal.

A small stand of Swamp Oak Floodplain Forest occurs to the northwest of the site (listed as an EEC under the TSC Act).

As no vegetation is to be cleared to accommodate the proposed corehole site or its access track then no EECs are likely to be significantly impacted as a result of this proposal.

Wollombi 01 (WB01)

No threatened species were recorded during the recent assessment of the Wollombi 01 site, although threatened species previously recorded within close proximity to the site include the following:

- » Regent Honeyeater;
- » Giant Barred Frog;
- » Greater Broad-nosed Bat; and
- » Koala.

The limited site area required for the proposed drilling site is unlikely to offer any significant habitat for threatened fauna given its small size and absence of canopy species.

The proposal would not require clearing of any significant vegetation including any canopy or shrub species. It is therefore considered that any threatened species that occur in the area are unlikely to be significantly impacted as a result of this proposal.

Vegetation occurring along the creekline to the northwest of the site constitutes River-Flat Eucalypt Forest on Coastal Floodplains, listed as EEC under the TSC Act. The proposed access route would use an existing wooden bridge to cross this creek. It is proposed that the deck of this wooden bridge would be appropriately reinforced via the use of a “transferable bridge” structure that would be transported to the site on a trailer and lowered into position (refer Sections 1.2).

No significant native vegetation clearance is required to accommodate the placement of this bridge structure or otherwise for access of any required vehicles. It is therefore considered that that no EEC’s are likely to be significantly impacted as a result of this proposal.

Paynes Crossing 01 (PC01)

No threatened species were recorded during the recent assessment of the Paynes Crossing 01 site, although threatened species previously recorded within close proximity to the site include the following:

- » Speckled Warbler;
- » Koala; and
- » Glossy Black Cockatoo.

Other species previously recorded nearby include the following:

- » Yellow-bellied Glider;
- » Masked Owl;
- » Grey-crowned Babbler; and
- » Gang-gang Cockatoo.

The limited site area required for the proposed drilling site is unlikely to offer any significant habitat for threatened fauna given its small size and absence of canopy species.

Remnant woodland occurs along the route of the access track and within the adjacent forest areas that would offer potential habitat for a number of threatened fauna species, however only the vegetation within the 30 x 60 metre corehole drilling area and along the access track would be directly impacted as a result of the proposal. Minimal lopping of low-lying tree limbs to accommodate the movement of vehicles along the access track (only if required) may have localised impacts on the surrounding vegetation, however is unlikely that these impacts would represent any significant impacts on any threatened species that may utilise this area.

Vegetation occurring along the existing access track and creekline constitute River-Flat Eucalypt Forest on Coastal Floodplains, listed as EEC under the TSC Act. Adjacent areas of swampland may also constitute Freshwater Wetlands on Coastal Floodplains, also listed as an EEC. Therefore the location originally proposed for the corehole site has been re-located by approximately 10 to 15 metres to the southwest from its previously proposed location in order to avoid impacts on this wetland area.

As access to the site would be limited to the existing tracks, no native vegetation would be required to be cleared to accommodate the movement of vehicles or machinery along the track or within the wetland area adjacent to the proposed corehole. It is therefore considered that no EECs are likely to be significantly impacted as a result of this proposal.

Maison Dieu 01 (MD01)

No threatened species were recorded during the recent assessment of the Paynes Crossing 01 site, although threatened species previously recorded within any proximity to the site include the following:

- » Grey-crowned Babbler; and

- » Grey-headed Flying-fox.

It should be noted that the nearest previously recorded threatened species to this site is about two (2) kilometres away.

The limited site area required for the proposed drilling site is unlikely to offer any significant habitat for threatened fauna given its small size and absence of canopy species. Adjacent scattered hollow-bearing trees, vegetation communities and waterways would not be directly impacted as a result of this proposal.

Access to the site would be gained via an existing road. No native vegetation would be required to be cleared to accommodate the movement of vehicles or machinery to the proposed corehole site. It is therefore considered that no threatened species are likely to be significantly impacted as a result of this proposal.

Swamp Oak Floodplain Forest (SOFF) is listed as an EEC and is present along the Hunter River, 140 metres to the west of the proposed corehole site, however this EEC would not be directly impacted as a result of this proposal. It is therefore considered that no EECs are likely to be significantly impacted as a result of this proposal.

4.5.4 Impact Assessment

The proposal has been assessed with respect to its potential to result in the following impacts on individual species, listed EECs and/or the general biodiversity of each study area:

- » **Vegetation clearance** (potentially reducing the amount of foraging habitat for fauna species at the site): The proposal would result in the clearance of a 30 metre x 60 metre area of pastureland at each proposed corehole site, as well as some limited clearing of some ground-layer vegetation and minor lopping of low-lying branches in order to accommodate vehicle travel along parts of some of the proposed access routes. No significant clearing of any woodland in the vicinity of any of the access routes is proposed and no further significant native vegetation would need to be removed or impacted as a result of the proposal. It has been determined that there are no significant impacts proposed on any nearby threatened flora or EECs as a result of this proposal (refer Section 4.5.6).

At the Paynes Crossing 01 site appropriate mitigation measures (refer Section 4.5.8) would be implemented that would control the potential impacts on surrounding vegetation and any other threatened species. As the originally proposed location for the Paynes Crossing 01 site also abuts a small wetland area (identified as Freshwater Wetland on Coastal Floodplains) it was recommended that the proposed access track to this site should be moved to avoid crossing this section of wetland and that the proposed corehole site should also be moved approximately 10 to 15 metres to the southwest of its previously proposed location. The modified proposed Paynes Crossing 01 corehole drilling location takes full account of this recommendation.

At the Rothanal 01 site the existing track traverses across a creekline that is already cleared of vegetation. No further vegetation clearance would be required to

accommodate the access track however care (refer Section 4.5.8) would also be taken to avoid all significant disturbances to these areas.

- » **Run-off and sedimentation** (including impacts on any adjacent vegetation and/or nearby waterbodies from runoff and sedimentation): The proposed corehole drilling activity would result in some potential for run-off and sedimentation impacts to occur. Considering the location of some sites above either existing creeklines, farm dams, wetlands or other water bodies, as well as to some adjacent, significant stands of vegetation, appropriate control of any run-off and/or sedimentation would need to be implemented, especially with respect to creeklines and all riparian vegetation along sections of the proposed access routes (refer Section 4.5.8);
 - » **Edge Effects:** The proposed drilling sites are already highly modified environments and are also generally surrounded by highly modified agricultural land. An increase in weed species may occur along the edges of adjacent creeklines and nearby woodlands due to the movement of both vehicular and human traffic along the proposed access routes and across the sites during drilling operations. Appropriate care would therefore need to be taken to avoid significant disturbance to these areas as a result of the proposal (refer Section 4.5.8);
 - » **Weed Invasion:** *Lycium ferroissimum* (African Boxthorn), *Rosa rubignosa* (Sweet Briar), *Rubus fruticosus* (Blackberry) and *Oxalis corniculata* (Oxalis) are listed as noxious weeds for the Upper Hunter County Council (including the LGAs of Singleton, Muswellbrook and Upper Hunter) under the NSW *Noxious Weeds Act 1993*. Birds will disperse propagules of these weed species however they will also germinate directly from the fruit produced or from underground lignotubers and runners. The following field survey observations should be noted:
 - No noxious weeds were observed within the immediate area of the Rothanal 01 site or along its proposed access track; however
 - African Boxthorn and Oxalis were observed within the Roughit 01 study area;
 - Sweet Briar, Blackberry and Oxalis were observed within the Paynes Crossing 01 study area;
 - Blackberry and Oxalis were observed within the Wollombi 01 study area; and
 - African Boxthorn was observed within the Maison Dieu 01 study area;
- It should be noted that the occurrence of these weeds within these study areas is not considered to be significant. It should also be noted that these weeds can be relatively easily removed or avoided during the proposed corehole drilling activities. As such, the potential impacts associated with weed invasion are unlikely to increase as a result of the proposal;
- » **Alteration to Light, Noise and Dust Levels:** The proposed corehole drilling activities would result in marginal increases in noise levels at each site during daylight hours for a period of up to 65 days. Works would not be carried out at night and therefore significant increases to ambient light levels are unlikely.

Dust levels may increase during the drilling period, potentially disrupting pollination cycles, the ability of native plants to regenerate and may also smother some flora species.

Increased noise levels can disturb sensitive fauna species, potentially disrupting breeding cycles and/or the foraging or roosting behaviour of some native fauna species. The season chosen for the proposal at each site could affect the dormancy period of some common native species of frogs and bats, for example, and could also affect the migration and dispersal ability of some other, common native fauna, however it is considered that these impacts would only be temporary.

It is therefore also considered that it would be unlikely that any threatened species or EECs would be significantly impacted as a result of either altered light, noise or dust levels resulting from the proposal; and

- » **Hydrological Changes:** The establishment of access roads and the establishment of each corehole site would have a limited potential to interrupt the existing hydrological regime relevant to each location, potentially resulting in plant death and/or alterations to species composition with an individual vegetation community.

At the Rothanal 01 site the route proposed for site access through the creekline south of the proposed corehole site lies within the area of an EEC (Swamp Oak Floodplain Forest). This represents a potential for impact to occur on the existing hydrological regimes within the area of this creekline. Existing hydrological regimes within the study area could be maintained via the installation of a temporary “bridging facility” (refer Section 4.5.8) that could be installed where the existing access route crosses this creekline, in order to avoid these impacts on the creekline and vegetation.

At the Paynes Crossing 01 site, the route originally proposed for site access would have passed along the top of the nearby riparian zone and within close proximity to an EEC (Freshwater Wetland). If the proposal were to be implemented at this previously proposed location, this would represent potential impacts to the existing hydrological regimes within these areas. Existing hydrological regimes within the study area would be maintained, however, via the subsequent relocation (refer Section 1.2) of the proposed corehole site and access track. Also, in order to further avoid impacts occurring on this nearby wetland area and any associated ephemeral streams and other creeklines, no untreated waste waters would be allowed to exit the site.

At the Wollombi 01 site the existing vegetation and hydrological regimes would be maintained along the area of the adjacent creekline (where the access route crosses this creek) via the use of an existing bridge. It is proposed that the deck of this existing bridge would be appropriately reinforced via the temporary placement of an appropriate “transferable bridge” structure that would be transported to the site on a trailer and lowered into position (refer Section 1.2). The placement of this transferable structure would reinforce the deck of the existing wooden bridge but would not otherwise impact on the existing vegetation or hydrological regimes at this site.

No other waterways or significant vegetation would be directly impacted at either the Roughit 01 or Maison Dieu 01 sites as a result of this proposal. Therefore no waterways at any site would be significantly impacted as a result of this proposal.

4.5.5 Key Threatening Processes

Phytophthora cinnamomi is a soil borne fungus that causes “dieback” (root rot disease) amongst Australian native plants and may be introduced into an area via a number of sources, for example, soils from contaminated sources that may be carried on the wheels of vehicles or on other machinery or work equipment.

The proposed increase in human and vehicle traffic to each site might increase the chances of introducing this fungus onto these sites. Appropriate and strict methods to ensure effective control of the *Phytophthora cinnamomi* fungus would therefore need to be implemented during the proposal to minimise the chance of infestation of this fungus to any of the proposed sites (refer Section 4.5.8).

4.5.6 Assessment of Significance (Section 5A of the EP&A Act)

In accordance with the requirements of Section 5A of the EP&A Act, an Assessment of Significance must be conducted if any works are proposed on land that is “critical habitat” or if any impacts are proposed on any threatened species, populations or EECs, or their habitats, which are listed under the TSC Act. An Assessment of Significance considers and quantifies the potential impacts of a proposal based on specific criteria set out in Section 5A of the EP&A Act.

If an Assessment of Significance concludes that a significant impact is likely then a Species Impact Statement (SIS) must be prepared and its findings appropriately considered.

An Assessment of Significance has been carried out for all the following Ecological Communities, with respect to potential impacts associated with this proposal (also refer to GHD’s Ecological Assessment report presented in **Appendix G**):

- » Swamp Oak Flood Plain Forest and Hunter Lowland Red Gum Forest (with respect to the Rothanal 01 site);
- » River-flat Eucalypt Forest on Coastal Floodplains (with respect to the Wollombi 01 site); and
- » Freshwater Wetlands on Coastal Floodplains & River-flat Eucalypt Forest on Coastal Floodplains (with respect to the Payne’s Crossing 01 site).

The Assessments concluded that, as minimal vegetation disturbance is required to carry out the proposed activity and as any indirect impacts on these EECs would be able to be controlled through appropriate mitigation measures (refer Section 4.5.8) the proposed activity is unlikely to have a significant impact on the EECs present either at the Rothanal 01, Payne’s Crossing 01 or Wollombi 01 sites. Therefore an SIS would not need to be prepared with respect to the impacts proposed on any of these EECs. No further requirements of either the TSC or EP&A Acts are considered to be relevant to this proposal.

4.5.7 Assessment under the Commonwealth EPBC Act

In accordance with the requirements of the EPBC Act, an assessment of significance must be conducted if any works are proposed on land that is “critical habitat”, on Commonwealth land or if any other “Matters of National Environmental Significance” (NES Matters) need to be considered, including if any impacts are proposed on any threatened species, populations or EECs, or their habitats, which are listed under the EPBC Act. If such an assessment concludes that a significant impact is likely then a formal referral must be made to the Commonwealth Minister for Environment and Heritage.

No critical habitat, Commonwealth land, threatened species, populations or ecological communities listed under the *EPBC Act* are likely to be impacted as a result of the proposal. It is therefore not necessary to make a referral to the Commonwealth Minister for the Environment. No further requirements of the EPBC Act are considered to be relevant to this proposal.

4.5.8 Mitigation measures

All the following site specific management and mitigation measures are recommended to minimise potential impacts on surrounding flora and fauna, or their habitat:

Rothanal 01 (RN01)

- » The final location of the Rothanal 01 site should be located away from nearby vegetation to avoid the need for clearing of any trees or other potential impacts on the surrounding woodland communities (Swamp Oak Floodplain Forest and Hunter Lowland Red Gum Forest EECs) occurring; and
- » A temporary bridging facility (refer Section 1.2) would enable both initial access and final egress for the corehole drilling rig to cross the ephemeral creek bed that feeds into Jump Up Creek, about 450 metres to the west of the proposed corehole drilling site. The temporary bridge structure would only be located on the creek bed site during the actual time that the drilling rig would need to cross this creek, that is, for less than one (1) working day to facilitate initial site access and for a further one (1) working day at the conclusion of drilling activities, to facilitate the rig’s return.

Paynes Crossing 01 (PC01)

- » The minor lopping of low-hanging branches within vegetation lining the existing access track (River-flat Eucalyptus Forest EEC) should be conducted prior to the movement of any large vehicles along the existing access track on this site. Any such minor lopping or pruning works would need to be kept to an absolute minimum.

It should also be noted that the location of the Paynes Crossing 01 site has been re-located from its previously proposed location by approximately 10 to 15 metres, to the southwest of the initial location, in order to avoid the potential for direct impacts on the adjacent Freshwater Wetland EEC.

Rothanal 01, Wollombi 01 and Paynes Crossing 01 sites

- » Appropriate care should be taken to minimise disturbance in, and near, the creek lines, nearby waterways and any wetland areas occurring on the Rothanal 01, Wollombi 01 and Paynes Crossing 01 sites and their surrounding woodland areas by ensuring appropriate final site location of the actual corehole to avoid direct impacts on these areas;
- » Appropriate on-site control methods should be implemented to ensure that all vehicles always travel only along designated, gravelled access tracks;
- » Temporary bridges and bridge reinforcement structures should be installed wherever necessary;
- » Placement and subsequent removal of any bridge structures would not be conducted during any significant rainfall events; and
- » All activity and traffic should be kept well away from forested areas at all times.

All sites

All the following general management and mitigation measures are recommended to minimise potential impacts on surrounding flora and fauna:

- » All vegetation clearance should be kept to a minimum. Existing cleared areas for drilling site locations and access tracks should be utilised wherever possible and vegetation clearance to improve access roads should be avoided;
- » All issues of run-off, erosion and sedimentation should be mitigated by appropriate management measures such as sediment fencing and the gravelling of any exposed soil, particularly in areas where run-off may impact on nearby waterways or on surrounding native vegetation;
- » Adequate run-off, erosion and sedimentation controls shall be in place prior to any construction/upgrading activities for all access roads and prior to any drilling activities commencing, especially in all areas where run-off may impact on nearby waterways or surrounding vegetation;
- » All gravels and/or other materials that are to be used at any of the sites or their access tracks should be sourced locally to avoid potential contamination of surrounding soils and other impacts on surrounding vegetation;
- » All potential run-off or sedimentation issues shall be resolved prior to the final abandonment of any site;
- » Appropriate on-site control methods should be implemented to ensure that the pre-existing hydrological conditions at each site are maintained both during and after drilling operations;
- » Appropriate on-site control methods should be implemented to ensure that no contamination to the surrounding soil or waterways at any sites occurs as a result of the proposed activities;

- » A qualified ecologist or wildlife carer should be present during any tree lopping activities to ensure that any such trees are not occupied by Koalas or other native animals;
- » All tree lopping activities should only be conducted outside the recognised Koala breeding season;
- » Appropriate measures should be implemented to protect remnant woodland and vegetation surrounding each drilling site and their access roads from further weed invasion by the implementation of an appropriate weed control program;
- » Measures should be implemented to protect remnant woodland and vegetation surrounding the drilling sites and access tracks from further weed invasion by the implementation of an appropriate weed control program;
- » A follow up weed control program may be necessary to control the encroachment of weed species into surrounding areas;
- » Appropriate measures should be implemented to protect adjacent areas of remnant and regenerating woodland occurring on each site and existing access track from the *Phytophthora cinnamomi* fungus by ensuring appropriate wash downs of all vehicles and other wheeled or tracked machinery working near areas of adjacent native vegetation;
- » All unnecessary accessing of surrounding native vegetation areas should be avoided;
- » All vegetation removed from any site should be disposed off-site, in consultation with Singleton Council;
- » Appropriate measures should be implemented to ensure that dust is controlled throughout the construction period, including appropriate management of the potential for dusts to be created via the use of all access roads;
- » All corehole drilling activities and/or the use of heavy machinery should be undertaken only during daylight hours in order to avoid impacting on local fauna species that may occur within the area(s); and
- » Appropriate care should be taken when moving along all access tracks during dawn or dusk periods to avoid potential collisions with native wildlife that may inhabit the surrounding area.

4.6 Chemical and hazardous substance management

There would be limited use of hazardous substances and dangerous goods on the proposed corehole drilling sites, generally limited to only such goods as lubrication oils and motor fuels. The presence of these substances would result in a potential risk of fire or of pollution to land, water and/or air, if uncontained spillage were to occur.

4.6.1 Mitigation measures

The relevant drilling contractor at each site must comply with all legislation and standards for the safe handling and storage of hazardous substances and dangerous

goods and meet all relevant occupational health and safety requirements. Each contractor would be required to develop and implement an appropriate Occupational Health and Safety Plan. Any fuels or oils stored on-site would need to be contained within appropriately banded areas.

4.7 Contaminated Land

On the basis of Sydney Gas's investigations of past land use (i.e. primarily agricultural), the proposed areas to be drilled are not expected to have been previously contaminated. Sydney Gas has consulted with each landowner and it has been confirmed that, to the best of the knowledge available, no potentially contaminated activities have ever been conducted on any of the subject land. Letters of confirmation obtained from each relevant landowner are presented in **Appendix J**.

Recent site visits have also confirmed that there is no reason to reasonably suspect that any of the subject sites have ever been used for purposes other than as advised by the landowner. There is no other evidence that any of the subject land has ever been used for the purposes of market gardens, orchards or any other potentially contaminating agricultural or horticultural activities.

Drilling works are likely to have minimal impact on the site's soils. It is not proposed that any soil would be removed from site during the drilling operations (other than in a very controlled sense, for laboratory analysis purposes, only). On completion of drilling activities, all other excavated material would be backfilled, on site.

Based on the type of activities that Sydney Gas plans to conduct for its corehole drilling program (i.e., minimal disturbance to the site and no soil being transported off site), Sydney Gas does not reasonably suspect that land contamination issues would be significant at any of these proposed sites.

4.7.1 Mitigation measures

General waste would be appropriately contained on site, and then separated for either recycling or disposal at an appropriate landfill site.

The drilling spoil would be collected and stored within each drill pit. Once the drilling is completed at each site, the drill pit would be dewatered and desiccated. Drilling spoil would then be buried and covered with excavated soils and rehabilitated. All drilling spoil would be buried under two metres of cover at completion, below the root zone of any crops or proposed revegetation species.

4.8 Waste minimisation and management

Waste generated by the proposed drilling activities would include drilling spoil and some general site litter.

4.8.1 Mitigation measures

Vegetation and any topsoils that may need to be cleared from any of the subject sites would be left on-site for use in site reinstatement, thereby minimising the potential for spread of any contained weed seeds to other sites.

General waste would be appropriately contained on site, and then separated for either recycling or disposal at an appropriate landfill site.

4.9 Natural resource use

The use of natural resources (in any significant sense, at least) is expected to be limited to the use of motor fuels, for transportation of staff and equipment on and off the site, and for operation of the drilling rig and associated equipment at each site.

4.9.1 Mitigation measures

The Drilling Contractor and all Sydney Gas and other associated staff would endeavour to conserve fuel usage at all possible times, to not run engines when not specifically required for drilling purposes, for example, and to keep individual vehicular trips to and from the site to a minimum.

4.10 Impact on the community

Each drilling site would be occupied by up to 7 people (comprising up to 4 drilling crew, 1 or 2 geologists and 1 drilling supervisor) for up to 65 days, depending on final drilling depth and prevailing weather conditions. The normal day-to-day operations / activities of the affected landholder or other members of the community would not be expected to be disrupted in any significant manner.

Expected hours of drilling operation would be restricted to 7:00am to 6:00pm, Mondays to Fridays and 8:00am to 1:00pm on Saturdays. No work would be undertaken on Sundays or Public Holidays.

All other potentially significant impacts to the local and broader communities have been considered above.

4.10.1 Mitigation measures

Appropriate mitigation measures have already been proposed for all potentially significant impacts reasonably anticipated to either the local or broader communities. In addition, Sydney Gas would continue its general practice of providing 7 days prior written notification to all residents immediately surrounding the site. This notification would include details of Sydney Gas's 24 hour contact telephone number that may be accessed for any community complaints. Any community complaints received would be promptly and appropriately addressed and also documented.

4.11 Visual assessment

No significant impacts to the local visual environment at any of the subject sites are reasonably anticipated as the proposed activities are only temporary in nature and no

visible, permanent infrastructure would be installed. None of the subject sites are located on a visually prominent ridgeline and nor would any of the activities proposed otherwise detract from the “particular scenic value” of any of these sites (except in only a very limited and temporary manner).

4.11.1 Mitigation measures

No specific measures to mitigate against impacts to the local scenic environment are recommended.

4.12 Heritage

Insite Heritage Pty Ltd (Insite) conducted an Archaeological Assessment of all the proposed corehole drilling sites in March 2008, in consultation with all relevant members of the local Aboriginal community. Insite’s Archaeological Assessment report is presented in **Appendix H**.

Insite’s field inspections were conducted on 14 and 17 March 2008 and were guided by Sydney Gas’s Land Manager. Insite’s archaeologist was accompanied by a representative of the Wanaruah Local Aboriginal Land Council (LALC) for the inspections conducted on 14 March of the Rothanal (RN01), Roughit (RI01), Paynes Crossing (PC01) and Maison Dieu 01 (MD01) sites. Insite’s archaeologist was accompanied by a representative of the Mindaribba LALC for the inspection conducted on 17 March of the Wollombi (WB01) site.

The field surveys aimed to identify and assess the impact of the proposal on any archaeological relics within the testing envelopes. An “on-foot” survey was conducted over the extent of the testing envelope at each site, as outlined by Sydney Gas’s representative.

The Archaeological Assessment also included the following tasks:

- » A review of relevant statutory registers and inventories for indigenous cultural heritage including the NSW NPWS *Aboriginal Heritage Information Management System* (AHIMS) for known archaeological sites, the *State Heritage Register*, the *Register of the National Estate*, the *Singleton LEP* and the *Register of the National Trust*;
- » A review of local environmental information (topographic, geological, soil, geomorphological and vegetation descriptions) to determine the likelihood of archaeological sites and specific site types, prior and existing land uses and site disturbance that may effect site integrity;
- » A review of previous cultural heritage investigations to determine the extent of archaeological investigations in the area and any archaeological patterns;
- » The development of a predictive archaeological statement based on the data searches and literature review;
- » Consultation with the Aboriginal community, in accordance with DECC’s *Interim Community Consultation Requirements for Applicants* (2005);

- » A review of cultural knowledge and cultural sites provided by the Aboriginal community;
- » Identification of impacts in relation to known and recorded archaeological sites and predicted archaeological potential of the study area, and
- » The development of appropriate mitigation and conservation measures.

The results of Insite's investigations are discussed below. The full details and results of the investigations conducted by Insite are contained within the Archaeological Assessment report presented in **Appendix H**.

4.12.1 Aboriginal heritage

Rothanal 01 (RN01)

Insite's AHIMS database search did not identify any previously recorded sites within a five kilometre radius of the proposed Rothanal 01 site. No relics were identified during the field inspection within the location proposed for the corehole drilling activities.

In consultation with Wanaruah LALC it has been determined that there are no archaeological constraints preventing Sydney Gas's corehole drilling proposal from proceeding at the Rothanal 01 site.

Roughit 01 (RI01)

Insite's AHIMS database search did not identify any relevant (i.e. nearby) previously recorded sites. No relics were identified during the field inspection within the location proposed for the Roughit 01 corehole drilling site.

In consultation with Wanaruah LALC it has been determined that there are no archaeological constraints preventing Sydney Gas's corehole drilling proposal from proceeding at the Roughit 01 site.

Wollombi 01 (WB01)

Insite's AHIMS database search identified four (4) previously recorded sites within a five kilometre radius of the proposed Wollombi 01 corehole drilling site, these comprising three (3) rock shelters with art as well as a fourth rock shelter containing both art and an archaeological deposit. Full details are presented in the Archaeological Assessment report in **Appendix H**.

No relics were identified during the field inspection within the location proposed for the Wollombi 01 corehole drilling site, however, and therefore, in consultation with Mindaribba LALC it has been determined that there are no archaeological constraints preventing Sydney Gas's corehole drilling proposal from proceeding at the Wollombi 01 site.

Paynes Crossing 01 (PC01)

Insite's AHIMS database search identified four (4) previously recorded sites within 1 kilometre of the proposed corehole location, all of which are recorded as "shelter with art", however no relics were identified during the field inspection within the location proposed for the Paynes Crossing 01 corehole drilling site.

In consultation with Wanaruah LALC it has been determined that there are no archaeological constraints preventing Sydney Gas's corehole drilling proposal from proceeding at the Paynes Crossing 01 site.

Maison Dieu 01 (MD01)

Insite's AHIMS database search identified two (2) previously recorded sites within the five kilometre radius around the proposed Maison Dieu 01 corehole drilling site, both comprising relatively old recordings from the 1970's and in 1981. One is the location of a small collection of artefacts that were taken to the Australian Museum, however it is considered that it is reasonably probable that only some samples of all the artefacts actually present at that site were actually removed at that time and therefore the site still "technically" exists. Full details are presented in the Archaeological Assessment report in **Appendix H**. These two sites are located 500 metres and 1 kilometre south of the proposed Maison Dieu 01 site.

The field inspection also identified one indigenous archaeological site located nearby, approximately 50m to the north west of the proposed corehole site, however this is outside of the study area for the proposed corehole activity. That site comprises three flakes and one angular fragment of red and yellow mudstone, however it should be noted that the area of this archaeological site is not proposed to be impacted in any way by the proposed corehole drilling activities. Wanaruah LALC nevertheless expressed a desire to monitor the initial earthworks at the corehole drilling site, however this should be confined to the location of the actual excavation area for the drill water cutting pits.

No other relics were identified by during the field inspection within the location proposed for the Maison Dieu 01 corehole drilling site. Therefore, in consultation with Wanaruah LALC it has been determined that there are no archaeological constraints preventing Sydney Gas's corehole drilling proposal from proceeding at the Maison Dieu 01 site.

4.12.2 Other cultural heritage

Insite's Archaeological Assessment report (refer **Appendix H**) also concluded that, as the study areas at each site are relatively small and are all located within the context of large open paddocks then therefore the greatest potential for identification of other (i.e. non-indigenous or European) cultural heritage artifacts or features would relate to past agricultural activities.

No significant evidence of any such historical activity or other potential non-indigenous heritage items was identified within the areas of either the proposed access routes or within the proposed corehole drilling sites during the field assessments conducted on 14 and 17 March 2008.

4.12.3 Mitigation measures

Given the relatively small footprint of impact at these sites and the results of the Archaeological Assessment, it is considered that the proposed corehole drilling activities would have no significant impact on any archaeological relics or other items

of cultural heritage. The Wanaruah LALC has nevertheless requested that they be invited to monitor the initial earthworks at the Maison Dieu 01 site. It is recommended that this should be conducted as early as possible in the initial development stages at this site and confined to the actual location of the area to be excavated for the drill water cuttings pits.

The following general recommendations for heritage management have also been made:

- » All persons responsible for the management of any works on site would ensure that all staff, contractors and others involved in construction or maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. For example, Section 90(1) of the *National Parks and Wildlife Act, 1974* states that it is an offence to knowingly destroy, deface or damage, or cause or permit the destruction or defacement of or damage to, an object or Aboriginal place without first obtaining the consent of the DECC; and
- » If an object is found, all works would cease and the DECC, the NSW Heritage Office and/or a qualified archaeologist would be contacted and any recommended procedures followed. No further work should then commence until after any subsequent recommendations or requirements of the DECC have been appropriately implemented.

The DECC should also be formally consulted prior to undertaking any works.

4.13 Landuse

No significant impacts to the local landuse potential at any of the sites are anticipated. The areas surrounding each site are used for intermittent grazing purposes, only. The site would be occupied and used for only a limited timeframe for Sydney Gas's corehole drilling proposal and would be fully rehabilitated afterwards.

4.13.1 Mitigation measures

No specific measures to mitigate against impacts to local landuse potential are recommended.

4.14 Cumulative environmental impacts

Sydney Gas ultimately proposes to drill coreholes at several locations within the Hunter Valley area, in order to assess the methane producing potential of the coal measures at these locations.

Drilling operations proposed at these separate locations will be conducted at sites that are effectively quite remote from each other. Most of the potential for significant impacts (to flora, fauna, etc) would be limited to the area of the actual drilling operations, i.e., an area of 30 x 60 metre, only. All other significant impacts that may be experienced at locations "remote" from each site would only extend a few hundred metres. Therefore, no cumulative impacts from Sydney Gas's corehole drilling program are reasonably anticipated.

Due to the temporary nature of the proposed coring activities and the location of the proposed sites, in relation to any other existing infrastructure, it is not anticipated that any cumulative impacts would result from drilling of the proposed corehole.

4.14.1 Mitigation measures

No specific measures are recommended to mitigate against cumulative impacts, however various other mitigation measures proposed in this REF would, in the long term, ensure that all significant environmental impacts of this proposal are appropriately addressed and/or mitigated against.

4.15 Summary of mitigation measures

The various environmental safeguards outlined in this document would reduce any potentially adverse impact arising from the proposed works on the surrounding environment and are summarised in **Table 4.3**.

All planning, construction and operation activities would be conducted in accordance with Sydney Gas's *Health, Safety and Environment Policy*. The Policy outlines Sydney Gas's commitment to sound management of environmental aspects and OH&S performance for the project. Sydney Gas is committed to responsible management and believes that:

- » potential adverse environmental effects can be effectively managed; and
- » potential Occupational Health and Safety (OH&S) incidents are preventable to all practical extent.

Environmental management measures to mitigate and manage the potential environmental impacts of the proposed corehole drilling program would be detailed in Sydney Gas's Environment, Health and Safety Management Plan (EHSMP) for Drilling activities. These safeguards are also summarised in Table 4.3 below.

Prior to commencing operations on site, the drilling contractors together with Sydney Gas staff would review the EHSMP and supporting documentation to familiarise themselves with the manner in which corehole drilling would be best managed and controlled.

The EHSMP would be provided for the benefit of the operating staff, contractors and regulators and would represent an amalgamation of all of the environmental safeguards contained in this assessment, together with existing operating conditions, as appropriate. The EHSMP will:

- » Identify the environmental effects of site operations;
- » Confirm the environmental controls to be implemented;
- » Specify any conditions of consent;
- » Indicate how the conditions are to be met; and
- » Specify a monitoring program.

Table 4.3 Summary of mitigation measures

Potential Impacts	Proposed Safeguard
<p>Air Quality</p>	<ul style="list-style-type: none"> » Engines would not be left running when not specifically required for drilling purposes; » Individual vehicular trips to and from the sites would be kept to a minimum; » Tailgates on all vehicles transporting materials to and from the sites would be securely fixed prior to loading and immediately after loading; » Water carts would be available to minimise and prevent dust emissions from vehicles using access roads; » No burning of any combustible materials would occur; and » Revegetation of disturbed surfaces would take place as soon as possible.
<p>Water Quality</p>	<ul style="list-style-type: none"> » All works on site would be managed in accordance with Sydney Gas's Soil and Water Management Plans for each site (refer Appendix E); » Any works conducted within the vicinity of any creek or waterway would also be conducted in accordance with the recommendations relevant to that site set out under both Soils and Flora and Fauna, below (also refer Sections 4.3.3 and 4.5.8); » The drilling and reinstatement of all coreholes would be in accordance with DPI requirements; » All on-site stockpiles would be no more than two (2) metres high and would be established in an appropriate manner that would limit potential impacts from erosion; » Sediment fencing would be established on the downhill side of each drilling site in a manner that ensure that no sediment leaves the site or is otherwise able to enter receiving waters; » Following the completion of works at each site, all areas of disturbance would be reinstated, all sediment fences removed and the area(s) reseeded and stabilised with native grasses, with the concurrence of the landowner; and » Revegetation of all disturbed surfaces would take place as soon as possible

Potential Impacts	Proposed Safeguard
Soils	<ul style="list-style-type: none"> » Any small pits that may be required at each site would be excavated down slope from the drill hole collar; » Spoil would be banded down slope from both the pits and the drill hole collar and shall contain all potential escapes of fluids; » Excavated topsoil would be stockpiled separately from any other subsurface material, fenced off separately on the site and covered; » All sediment and erosion control measures would be in place prior to any earth works commencing; » Sediment and erosion control measures would be routinely inspected and maintained to ensure they remain effective; » Ground disturbance would be minimised; » Works would not be undertaken during periods of high rainfall; » Revegetation of disturbed surfaces would take place as soon as possible after disturbance; and » The excavation and operation of three small pits (if required) and all site disturbance and other works on site would be managed in accordance with Sydney Gas's Soil and Water Management Plans for each site (refer Appendix E).
Noise and vibration	<p>Best practice noise management measures (generally as described below) would be implemented in all aspects of the drilling operation, in order to control potential operational noise. All of the following management and mitigation measures are therefore recommended to ameliorate the likely noise impacts during the proposed drilling operation:</p> <p><i>During Routine drilling activities</i></p> <ul style="list-style-type: none"> » Schedule noisiest activities during the least sensitive periods of the day; » Selection of the quietest methods, plant and equipment where available; » Designation of a specific person, on-site, to note the time of various activities to enable the accurate identification of which specific activities were occurring at the time of any complaints (if any arise); and » As part of job-site induction prior to arrival on-site, awareness of noise related issues at noise sensitive sites would be provided for relevant drilling and other staff.

Potential Impacts	Proposed Safeguard
<p>Noise and vibration (cont.)</p>	<p><i>During operation of the Crane (if required)</i></p> <ul style="list-style-type: none"> » Where feasible, face all engine exhaust and noise emitting components away from the nearest residences; » Conduct operations so as to minimise noise where practical; and » Arrival and set-up on-site would be only within designated work hours. <p><i>General Equipment Measures</i></p> <ul style="list-style-type: none"> » A small, 20kVA generator would only be used to supply electrical power required for on-site gas testing, would only be operated during designated operating hours and would only be operated when the “target coring zone” is being drilled; » All combustion engine plant, such as generators and compressors would be checked to ensure they produce minimal noise with particular attention to residential grade exhaust silencers; » Equipment would be used which is well serviced, with no air-leaks on equipment; » Vehicles would be kept properly serviced and fitted with appropriate mufflers; » The use of exhaust brakes would be eliminated, where practical; » Where practical, all vehicular movements to and from the drilling site would be made only during normal working hours; » Where practical, machines would be switched off when not being used, rather than left idling for prolonged periods; » Machines found to produce excessive noise compared to industry best practice would be stood down until repairs or modifications can be made. Subcontractors should be able to provide well maintained service history of plant items or machinery;

Potential Impacts	Proposed Safeguard
Noise and vibration (cont.)	<ul style="list-style-type: none"> » Movements of equipment and mobile plant only within designated work hours; and » Where possible, without interference to any requirements for safe and efficient operation, equipment should be oriented away from residential receivers. <p><i>Site Access and Staging Areas</i></p> <ul style="list-style-type: none"> » Site access points and roads would be situated as far as possible away from residential receivers; » With regard to potential traffic noise, by keeping plant related vehicles serviced, fitted with mufflers and eliminating exhaust brake usage, noise due to trucking activity associated with the site operations could be significantly mitigated; and » Noise monitoring would be undertaken at the affected site if any significant noise-related complaints are received by Sydney Gas.

Potential Impacts	Proposed Safeguard
<p>Flora and Fauna</p>	<p>The following site-specific management and mitigation measures would be implemented:</p> <p><i>Rothanal 01 (RN01)</i></p> <ul style="list-style-type: none"> » The final location of the Rothanal 01 site should be located away from surrounding woodland communities (Swamp Oak Floodplain Forest and Hunter Lowland Red Gum Forest EECs); » A temporary bridge would be put in place at the required creek crossing along the existing access track to the proposed corehole site; and » The temporary bridge structure would only be in place for one (1) working day prior to commencement of drilling activities at this site and for a further one (1) working day at the conclusion of drilling activities. <p><i>Paynes Crossing 01 (PC01)</i></p> <ul style="list-style-type: none"> » The minor lopping of low-hanging branches within the vegetation lining the existing access track should be conducted prior to the movement of any large vehicles along the existing access track on this site; and » Any minor lopping or pruning works required would be kept to an absolute minimum. <p><i>Rothanal 01, Wollombi 01 and Paynes Crossing 01 sites</i></p> <ul style="list-style-type: none"> » Appropriate care should be taken to minimise disturbance in, and near, the creek lines, nearby waterways and any wetland areas occurring on the Wollombi 01, Paynes Crossing 01, and Rothanal 01 sites and their surrounding woodland areas; » Appropriate on-site control methods should be implemented to ensure that all vehicles always travel only along designated, gravelled access tracks; » Temporary bridges and bridge reinforcement structures should be installed wherever necessary; » Placement and subsequent removal of any bridge structures would not be conducted during any significant rainfall events; and » All activity and traffic should be kept well away from forested areas at all times.

Potential Impacts	Proposed Safeguard
Flora and Fauna (cont)	<p>The following general management and mitigation measures would be implemented:</p> <ul style="list-style-type: none"> » All vegetation clearance would be kept to a minimum. Existing cleared areas for drilling site locations and access tracks would be utilised wherever possible and vegetation clearance to improve access roads would be avoided; » All issues of run-off, erosion and sedimentation would be mitigated by appropriate management measures such as sediment fencing and the gravelling of any exposed soil, particularly in areas where run-off may impact on nearby waterways or on surrounding native vegetation; » Adequate run-off, erosion and sedimentation controls would be in place prior to any construction/upgrading activities for all access roads and prior to any drilling activities commencing, especially in all areas where run-off may impact on nearby waterways or surrounding vegetation; » All gravels and/or other materials that are to be used at any of the sites or their access tracks would be sourced locally; » All potential run-off or sedimentation issues would be resolved prior to the final abandonment of any site; » Appropriate on-site control methods would be implemented that ensure that the pre-existing hydrological conditions at each site are maintained; » Appropriate on-site control methods would be implemented that ensure that no contamination occurs to surrounding soils or waterways; » A qualified ecologist or wildlife carer would be present during any tree lopping activities; » All tree lopping activities would only be conducted outside the recognised Koala breeding season; » An appropriate weed control program would be implemented to protect remnant woodland and vegetation surrounding the drilling sites and access tracks from further weed invasion by the implementation of an appropriate weed control program; » A follow up weed control program may be necessary to control the encroachment of weed species into surrounding areas;

Potential Impacts	Proposed Safeguard
Flora and Fauna (cont)	<ul style="list-style-type: none"> » Appropriate measures would be implemented to protect adjacent areas of remnant and regenerating woodland occurring on each site and existing access tracks from the <i>Phytophthora cinnamomi</i> fungus, including appropriate wash downs of all vehicles and other wheeled or tracked machinery; » All unnecessary accessing of surrounding native vegetation areas would be avoided; » All vegetation removed from any site would be disposed off-site, in consultation with Singleton Council; » Appropriate measures would be implemented to ensure that dust is controlled throughout the construction period, including appropriate management of the potential for dusts to be created via the use of all access roads; » All corehole drilling activities and/or the use of heavy machinery would be undertaken only during daylight hours; and » Appropriate care would be taken when moving along all access tracks during dawn or dusk periods.
Chemical and hazardous substance management	<ul style="list-style-type: none"> » The Drilling Contractor must comply with all legislation and standards for the safe handling of hazardous substances and dangerous goods and meet all relevant occupational health and safety requirements; » The Contractor shall be required to develop and implement an appropriate Occupational Health and Safety Plan; and » Any fuels or oils stored on-site would need to be contained within an appropriately bunded area.
Contaminated Land	<ul style="list-style-type: none"> » Should any evidence of contaminated soil / land be evidenced during the course of drilling, all drilling operations would cease immediately and appropriate action shall occur, including appropriate notification to the DECC; and » All drilling spoil would be collected and stored within the drill pit. Once the drilling is completed, the drill pit would be dewatered and desiccated. Any remaining drilling spoil would then be buried under two metres of cover, covered with excavated soils and rehabilitated.
Waste Management and Minimisation	<ul style="list-style-type: none"> » Vegetation and any topsoils needing to be cleared from the site shall be left on-site for use in site reinstatement; and » General waste shall be appropriately contained on site and then separated for either recycling or disposal at an appropriate landfill site.
Natural resource use	<ul style="list-style-type: none"> » The Drilling Contractor, all Sydney Gas and other associated staff shall endeavour to conserve fuel usage at all possible times, to not run engines when not specifically required for drilling purposes and to keep individual vehicular trips to and from the site to a minimum.

Potential Impacts	Proposed Safeguard
Impact on the community	<ul style="list-style-type: none"> » Prior to accessing the site and commencing works, Sydney Gas will provide 7 days written notification to all residents immediately surrounding the site; » Notification notices would also provide Sydney Gas's 24 hour contact telephone number that may be accessed for any community complaints; and » Any community complaints received would be promptly and appropriately addressed and also documented.
Visual assessment	No specific measures to mitigate against impacts to the local visual environment are recommended.
Heritage issues	<p>The Wanaruah LALC should be invited to monitor the initial earthworks at the Maison Dieu 01 site, as early as possible in the initial development stages at this site and confined to the actual location of the area to be excavated for the drill water cuttings pits.</p> <p>The following general recommendations for heritage management have also been made:</p> <ul style="list-style-type: none"> » All persons responsible for the management of any works on site would ensure that all staff, contractors and others involved in construction or maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. For example, Section 90(1) of the <i>National Parks and Wildlife Act, 1974</i> states that it is an offence to knowingly destroy, deface or damage, or cause or permit the destruction or defacement of or damage to, an object or Aboriginal place without first obtaining the consent of the DECC; and » If an object is found, all works would cease and the DECC, the NSW Heritage Office and/or a qualified archaeologist would be contacted and any recommended procedures followed. No further work should then commence until after any subsequent recommendations or requirements of the DECC have been appropriately implemented. <p>The DECC should also be formally consulted prior to undertaking any works.</p>
Landuse	No specific measures are recommended to mitigate against impacts to local landuse potential.

Potential Impacts	Proposed Safeguard
Cumulative environmental impacts	No specific measures are recommended to mitigate against cumulative impacts.

5. Rehabilitation works

Each of the five (5) proposed sites have been specifically chosen due to the minimal requirements for disturbance to the land at each location.

Nevertheless, appropriately conducted rehabilitation works would be conducted to endeavour to return each site to a state as good as when the proposed activities began, or better, wherever practicable.

On completion of drilling and logging at each site, all drill holes would be backfilled with cement. The installation of a pressure monitor may also be desired by Sydney Gas at this point, to be cemented into the hole for longer term data collection purposes, however the approval of the land owner for this installation and all other rehabilitation works would be sought and obtained before finalising these activities.

The management objectives of clean-up and rehabilitation are to:

- » Minimise potential for soil erosion and sedimentation;
- » Minimise impact of the well site on existing drainage patterns;
- » Minimise weed establishment;
- » Restore fauna habitats;
- » Minimise the visual impact of the borehole site; and
- » Minimise adverse impacts of the borehole site on other existing land use.

The various re-vegetation and general site clean-up activities that would be carried out as Sydney Gas's final rehabilitation activities at each site (as already outlined in various parts of this document) are further detailed in **Table 5.1**. Responsibilities for implementation for each action are also assigned within **Table 5.1**.

Table 5.1 Rehabilitation Measures

Aspect	Management Strategies	Responsibility
Planning	<ul style="list-style-type: none"> » For each property a rehabilitation plan shall be developed to include requirements for reseeding and fertiliser as approved by the landholder; and » The workforce induction program shall inform site personnel of the required clean up and rehabilitation procedures. 	Project Manager
Access	<ul style="list-style-type: none"> » Private roads and tracks used during construction shall be returned to their pre-construction state, or to a condition agreed by the landholder. 	Project manager & Drilling contractor
Land Use & property Infrastructure	<ul style="list-style-type: none"> » Any damage to pastoral infrastructure shall be reported immediately to Sydney Gas management; » Any infrastructure (including fences) 	Project Manager & Drilling contractor

Aspect	Management Strategies	Responsibility
	<p>disturbed during construction shall be restored to the landholder's satisfaction; and</p> <ul style="list-style-type: none"> » Any pastoral property tracks damaged by the proposal shall be reinstated to a condition equal to or better than their pre-existing condition; » All disturbed areas shall be appropriately rehabilitated upon completion of the drilling activities. Where appropriate, **Furney's Native Grass mix" shall be used to re-seed disturbed areas of pasture grasses; » Completion of rehabilitation activities shall be deemed to have been reached when all temporary infrastructure has been removed from the site and when successful reseedling of all disturbed areas has also occurred; and » Successful reseedling shall be deemed to have been reached when successful germination of rehabilitation species has been reached. The Project Manager shall continue to assume responsibility for rehabilitation works / reseedling activities for a period of not less than six weeks, or as soon as successful reseedling has occurred, if deemed appropriate by the project manager. 	
Soils	<ul style="list-style-type: none"> » Erosion and sediment control devices shall be installed. Topsoil shall not be used for the installation of contour berms; » Stockpiled topsoil and seed stock shall be respread across the work areas from which it was removed; and » Surface roughness shall be encouraged when respreading topsoil to assist water retention and seed trapping. » Revegetation of disturbed surfaces (as specified above); » Completion of rehabilitation activities (as specified above); and » Successful reseedling (as specified above). 	Project Manager & Drilling Contractor
Air Quality	<ul style="list-style-type: none"> » Revegetation of disturbed surfaces (as specified above). 	Project Manager & Drilling contractor
Water Quality (Groundwater / Surface Water)	<ul style="list-style-type: none"> » All areas of disturbance would be made good; » All sediment fences would be removed; » Revegetation / reseedling of all areas of 	Project Manager & Drilling contractor

Aspect	Management Strategies	Responsibility
	<p>disturbance should take place as soon as possible, in consultation with the land owner;</p> <ul style="list-style-type: none"> » Completion of rehabilitation activities (as specified above); and » Successful reseeded (as specified above). 	
General site clean-up	<ul style="list-style-type: none"> » All waste materials and equipment shall be removed from the construction area once backfilling and tie-ins are completed; » All flagging and bunting installed for environmental or safety reasons shall be removed; and » Small amounts of rocks and stones generated by the construction process shall be distributed evenly over the work area or removed to a location offsite in consultation with the landholder. 	Project Manager, Drilling contractor & all other employees

*“Furney’s Native Grass mix” is a mix of native grasses endemic to the Singleton LGA

6. Summary of Impacts & Conclusions

6.1 Biophysical Effects

The REF indicates that the proposal would have no significant adverse impacts on either the biological or physical environment, especially when considered in light of the various mitigation and management measures proposed above and summarised in Table 4.3.

6.2 Social / Community Effects

Little or no community inconvenience is expected to be experienced before, during or following on from Sydney Gas's corehole drilling proposal. Appropriate mitigation measures would nevertheless be implemented during the proposed activities in order to minimise or avoid any potentially significant impacts. Drilling operations would be over a short duration only (i.e. up to 65 days) and therefore all impacts would be temporary and short-term only.

6.3 Economic Effects

The proposal would have an overall positive economic outcome for the local and broader communities by increasing both the demand on locally produced goods and services for local suppliers to Sydney Gas as a business, and also potentially accessing an environmentally cleaner and viable energy resource for the future of NSW.

Appendix A
Detailed Site Maps

Appendix B

Technical Specifications for the drilling rig

Appendix C
Air Quality Assessment

Appendix D
Hydrogeological Assessment

Appendix E
Soil & Water Management Plans

Appendix F
Noise Impact Assessment

Appendix G
Ecological Assessment

Appendix H
Heritage Assessment

Appendix I
Community Information newsletter

Appendix J
(Confidential – Site ownership details &
Contaminated lands statements)

GHD Pty Ltd ABN 39 008 488 373

10 Bond Street Sydney NSW 2000

-

T: 2 9239 7100 F: 2 9239 7199 E: sydmail@ghd.com.au

© **GHD Pty Ltd 2008**

This document is and shall remain the property of GHD Pty Ltd. The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
Prel. Draft	C. Carloss					31/03/08
A	C Carloss	D Chubb	<i>D Chubb</i>	D Chubb	<i>D Chubb</i>	02/04/08
B	C Carloss	D Chubb	<i>D Chubb</i>	D Chubb	<i>D Chubb</i>	03/04/08