Submission No 880

INQUIRY INTO COAL SEAM GAS

Name: Ms Louise Steer

Date received: 15/09/2011

SUBMISSION to NSW PARLIAMENT INQUIRY INTO COAL SEAM GAS MINING

We are writing to express our opposition to coal seam gas mining (CSG) because of the damage to the environment, in particular land use, water table and health risks from toxic chemicals.

Ban CSG in St Peters, NSW

We first became aware of CSG in November 2010 when it was reported that Apollo Energy, a subsidiary of Macquarie Group, held the licence to drill for CSG at Dial a Dump in St Peters. Apollo Energy has subsequently sold its interest to Dart Energy. As a result of protests by the local community, drilling has not commenced at St Peters and Dart Energy's exploration licence is due to expire in October 2011.

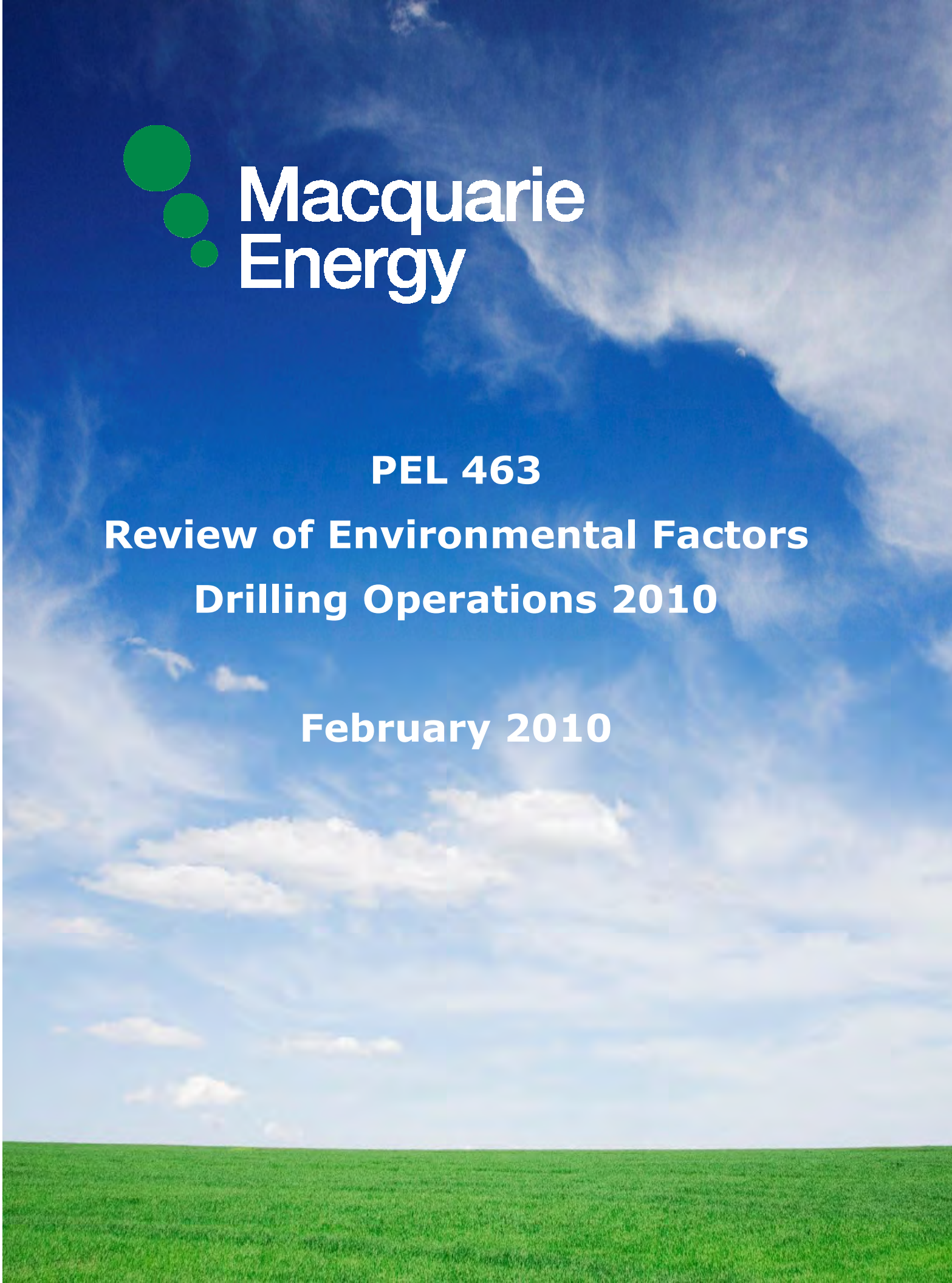
We submit that Dart Energy's licence should not be renewed as CSG is a totally inappropriate activity to carry out in the inner city of the most populated city in Australia, in a mixed residential and industrial area, above the already stressed Botany Aquifer, adjacent to the water pipes from the desalination plant at Kurnell and within a short distance of Sydney Airport, the busiest airport in Australia. We are unaware of any other city in the world which permits CSG in central, heavily built up urban areas. We live in Stanmore, only 3 kilometres from St Peters, and are thus at risk from any explosions, toxic chemical or gas emissions or other associated risks with CSG.

In the course of researching CSG in St Peters, we have become aware of the extent of CSG throughout NSW and are writing to express our opposition to CSG based on its unacceptably high level of risk to the environment and human health compared to the short term financial gains it may generate.

We expand on these reasons below.

CSG Risk Summary:

- not a green alternative, it's just another fossil fuel
- huge amount of good water wasted during fraccing



PEL 463

Review of Environmental Factors

Drilling Operations 2010

February 2010

Executive Summary

This Review of Environmental Factors (REF) has been prepared by CH2M HILL Australia Pty Ltd (CH2M HILL) on behalf of Macquarie Energy Pty Ltd (Macquarie Energy). Macquarie Energy is the holder of Petroleum Exploration Licence (PEL) 463. In early 2010, Macquarie Energy intends to undertake a stratigraphic drilling program to test the hydrocarbon potential of the Sydney Basin.

The purpose of this REF is to assess potential environmental impacts arising from the drilling works and comply with Macquarie Energy's obligations under Section 111 of the *Environmental Planning and Assessment Act* 1979 (EP&A Act) and Clause 228 of the Environmental Planning and Assessment Regulation 2000.

Statutory Planning

A review of legislation, regulatory environmental planning instruments, policy and guideline documents has been performed to identify Macquarie Energy's statutory obligations.

The EP&A Act and associated Regulations provide a framework for the assessment of the environmental impact of activities in NSW. Under SEPP (Mining, Petroleum Production and Extractive Industries) 2007, the proposed works are permissible without consent from Local Government Regulatory Authorities. As such, the proposed works have been assessed under Part 5 of the EP&A Act and the NSW Department of Industry and Investment (DII) is the determining authority for the activities covered by this REF.

The application of other legislative, planning and policy instruments have also been considered including the *Threatened Species Conservation Act* 1995 (NSW), *Fisheries Management Act* 1994 (NSW), *National Parks and Wildlife Act* 1974, (NSW), Protection *of the Environment Operations Act* 1997 (NSW) and the *Environmental Protection and Biodiversity Conservation Act* 1999 (Cth).

The proposed drill hole is *not* located in any of the following:

- An area reserved or dedicated under the *National Parks and Wildlife Act* 1974;
- Land reserved or dedicated within the meaning of the *Crown Lands Act 1989* for preservation of other environmental protection purposes;
- A World Heritage Area;
- Lands protected under SEPP 14 – Coastal Wetlands;
- Lands protected under SEPP 26 – Littoral Rainforests;
- Land identified as wilderness under the *Wilderness Act* 1987 or declared as wilderness under the *National Parks and Wildlife* Act 1974;

- Aquatic reserves dedicated under the *Fisheries Management Act* 1994;
- Wetland areas dedicated under the Ramsar Wetlands Convention;
- Land subject to a conservation agreement under the *National Parks and Wildlife Act* 1974;
- Western Lands Lease;
- Land identified as State Forest under the *Forestry Act* 1916; or
- Crown Land.

Consultation

Macquarie Energy has commenced consultation with the relevant property owners and will continue with this program until all rehabilitation works have been completed. Once the proposal is approved by DII, negotiation will occur with relevant property owners to reach an agreement regarding land access, compensation and rehabilitation.

Macquarie Energy will inform the local residential landowners of the proposed drilling works via a letter box drop. If requested by a resident Macquarie Energy will meet with the residential landowner on a one-on-one basis. Communication with the local residential landowners will continue as needed until all rehabilitation works have been completed.

Environmental Impact Assessment and Conclusions

This REF assessed the potential environmental impacts associated with the proposed drilling works against key environmental aspects. The assessment did not identify any significant, adverse environmental impacts as a result of the proposed drilling works, subject to implementation of the mitigation measures outlined in this REF.

Table of Contents

Appendices

Figures

Tables

1 Introduction

1.1 Background

Macquarie Energy Pty Ltd (Macquarie Energy) is the holder of Petroleum Exploration Licence (PEL) 463. The PEL was granted to Macquarie Energy under the *Petroleum (Onshore) Act* 1991 on 22 October 2008 and is valid for a period of 3 years. The PEL covers an area of 2,385km^2 of the Sydney Basin in New South Wales.

In early 2010 Macquarie Energy intends to undertake a stratigraphic drilling program to test the hydrocarbon potential of the PEL. The PEL 463 conditions of authority requires that prior to carrying out any drilling activities, a Review of Environmental Factors (REF) is required to be submitted to the NSW Department of Industry and Investment (DII) to enable a determination to be made under Part 5 of the *Environmental Planning and Assessment Act* 1979.

This REF has been prepared by CH2M HILL Australia Pty Ltd (CH2M HILL) on behalf of Macquarie Energy Pty Ltd (Macquarie Energy) for submission and determination by DII. The REF has been prepared using the DII Mineral Resources Division Guidelines for Review of Environmental Factors (ESB 18 March 2006), and in consultation with DII Environmental Sustainability Branch Officers.

1.2 Proponent Contact Information

The contact details for Macquarie Energy, the titleholder of PEL 463, are:

Address:	Suite 24.03, MLC Centre, 19-21 Martin Place NSW 2001
Postal Address:	GPO Box 1726, Sydney NSW 2001
Telephone:	(02) 9233 9200
Facsimile:	(02) 9233 9201
Email:	melissa@apollogas.net.au
Staff Contact:	Melissa Harrison

The REF was prepared by CH2M HILL on behalf of Macquarie Energy. CH2M HILL's contact details are as follows:

Address: Level 7, 9 Help Street, Chatswood NSW 2067

Postal Address: PO Box 5392

Telephone: (02) 9950 0200

Facsimile: (02) 9950 0600

Contact: Emma Hale

1.3 Declaration

The statements and opinions in this REF are attributable to Macquarie Energy and are given in good faith and in the belief that such statements are neither false nor misleading. In preparing this REF, Macquarie Energy has considered and relied upon information obtained from the public domain, supplemented by discussions between key Macquarie Energy staff, representatives from regulatory agencies and contractors.

Signed by Jason Needham, on behalf of Macquarie Energy.

17 February 2010

2 Project Description

2.1 Location

PEL 463 covers an area of approximately 2,385km^2 within the Sydney Basin in New South Wales. It extends from Gosford on the Central Coast north of Sydney to Coalcliff in the South (Figure 2-1).

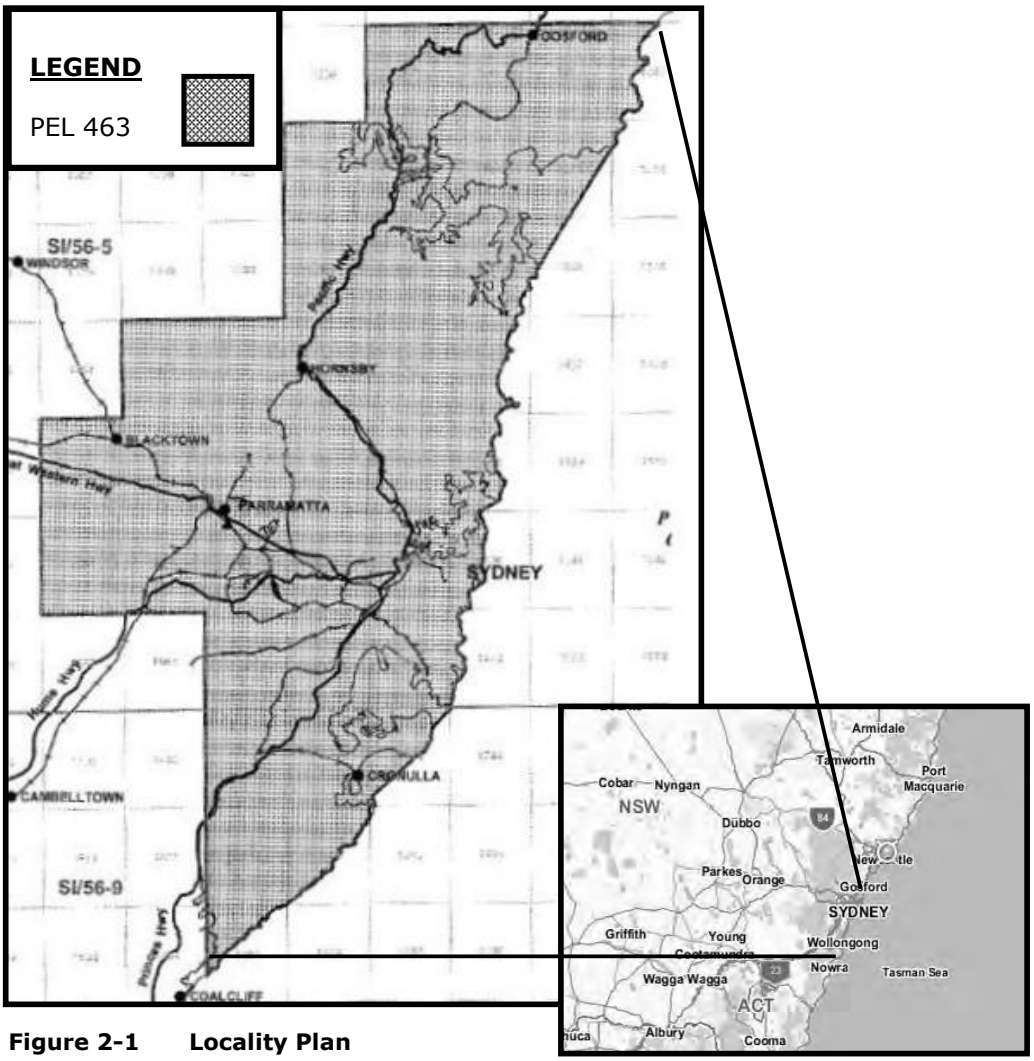


Figure 2-1 Locality Plan

One drill hole is proposed in the suburb of St Peters which is located approximately 5km southwest of the Sydney CBD. The subject site is bound by the Alexandra Canal to the south and Sydney Park to the north. The airport lies 1.5km south-west of the site. Whilst the drill hole itself will be located within the City of Sydney Local Government Area (LGA), the property also borders with the Marrickville Local Council Area.

The site is located at Lot 11 DP 1013168. Approximate coordinates of the drill hole are 33°54'59.20"S and 151°10'53.04"E. The drill hole is located on private property, owned by "Dial a Dump Industries". The property, known as "Alexandria Landfill" is located at 10-16 Albert Street, St Peters.

Figure 2-2 illustrates the location of the drill hole.

Figure 2-2 Proposed Drill Hole Location

2.2 Description of the Activity

Macquarie Energy proposes to drill a single drill hole to test the gas holding potential of the Illawarra Coal Measures in PEL 463.

The drill hole will have a specific well design that is compliant with the *Onshore Petroleum Exploration and Production Safety Requirements* (August 1992).

In general, an open hole of nominal 200mm diameter will be drilled through any alluvial and/or weathered material into competent rock and a 'Blow Out Preventer' casing cemented in place to control the escape of natural or noxious gases (as required by Condition 19 of PEL 463). The hole will be drilled using open hole rotary drilling to the depth at which core drilling can commence (core point). The hole will be cased to a depth of at least 10% of total depth,

dependant on the local stratigraphy. Continuous HQ diameter coring techniques will then commence for the purposes of recovering core and conducting open hole testing and geophysical logging.

Test work on some strata requires canisters of rock to be heated to subsurface temperatures. This requires heat baths to be powered 24 hours per day, resulting in the need for 24 hour power supply to the site.

The drilling contractor will excavate up to three small pits on site which are designed to catch the drill cuttings and recirculate the drilling fluid. These pits would be approximately 3.5m x 4m x 2.5m deep.

The three small pits proposed (if required) would all be excavated down slope from the drill hole collar. Spoil would be bunded down slope from both the pits and the drill hole collar to contain any escape of fluid.

Alternatively, depending on the site conditions and the preference of the drilling contractor, Macquarie Energy may instead elect to use three above-ground containment tanks to catch the drill cuttings and recirculate drilling fluids, each with dimensions of approximately 3.5m x 4m x 2.5m deep. In this case, no excavation for pits would be required, thereby eliminating the need for the associated soil storage, bunding and other management measures.

A water-based drilling fluid will be used, which may include calcium carbonate, potassium chloride and/or sodium chloride as weighting agents. As it is possible that some water-reactive clays may be encountered, potassium chloride may be added to the drilling fluid to control swelling clays and increase the stability of the formations intersected. There will also be a need to add polymers while drilling the drill hole to maintain the viscosity. Any water required for the drilling operations will be brought on site using tankers.

A selection of the potential production horizons may be tested for permeability by Drill Stem Test. A drill stem test is typically used once a borehole has penetrated a potentially productive zone. This test is used to determine the potential productivity of a particular formation (Encyclopaedia Britannica, 2010).

Works are anticipated to last for approximately 60 days.

2.2.1 Equipment and Infrastructure Requirements

The following equipment and associated temporary infrastructure are required for the proposed drilling operations:

- Mobile drilling rig, including support vehicles and equipment;
- Site office;
- Associated lined sumps and flare pit (to be constructed on site); and
- Water tankers.

2.2.2 Access, Site Compound and Temporary Lay Down Area

It is expected that the area to be disturbed at the drill hole site will be approximately 45-60m^2.

The drill hole site is located in a highly disturbed, cleared area in the south east portion of the "Alexandria Landfill" Dial a Dump premises, the ground in this area is currently gravel. As depicted in Figure 2-3 below, access to the drill site will be via the existing driveway of the Dial a Dump property, off Albert Street, St Peters.

Figure 2-3 Access to Drill Site off Albert Street, St Peters

The site will be secured and demarcated with temporary stock-proof fencing.

A final scouting survey will be undertaken prior to drilling taking place to confirm adequate lay down areas and site specific environmental control requirements.

2.2.3 Workforce, Works Duration and Drilling Hours

It is anticipated that up to 10 employees will be present at the drill site at any one time. The drilling operations are planned to commence in early 2010 and are expected to last a maximum of 60 days. This timeframe is dependent on the hours of operation and drilling conditions encountered.

The actual hours of operation are to be negotiated with the local residents, the Dial a Dump operator and approved by DII. Macquarie Energy is seeking approval to continue drilling operations over a 24 hour period. The drilling contractor will support any work period, having implemented necessary staff

resources and safety measures to accommodate these potential hours of operation. This timeframe is proposed because of the 24 hour heating requirements for testing canisters of rock (as outlined in Section 2.2 above).

2.3 Justification for Activities

The purpose of drilling the proposed drill hole is to assess the area for its potential to host natural gas resources. The procedures described in Section 2.2 above are required to define and identify commercially viable reserves of natural gas.

The proposed works are justified on the grounds that natural gas is in demand as an alternative fuel source that is more "greenhouse" friendly, with combustion of natural gas emitting approximately 45% less carbon dioxide than coal (Natural Gas, 2005).

Confirmation of a viable production resource in close proximity to demand centres (either energy production or natural gas consumption) presents a cost effective resource to meet these needs.

2.3.1 Tri-Generation Concept

Macquarie Energy is seeking to establish a partnership with the City of Sydney to utilise the coal-seam methane gas located beneath the City of Sydney to pilot a tri-generation facility to provide Sydney with an alternative indigenous source of secure, reliable, cleaner energy.

2.4 Abandonment

The drill hole will be fully plugged and abandoned and the area rehabilitated in line with legislative, landowner and licence requirements. A cement plug will be set to fill the drill hole from total depth to surface and the casing will be cut back. The area will then be rehabilitated in consultation with the landowners and DII (refer to Section 6). The drill hole site will then be inspected and monitored during the rehabilitation period to identify the need for any follow-up works.

The drill hole collar will be accurately surveyed and the drill hole logged using downhole tools. The position of the hole with respect to potentially mineable coal seams will be determined. All location data will be supplied to DII at completion of the activities.

2.5 Evaluation of Alternatives

2.5.1 Alternative Sites

The drill hole location is indicative and subject to further site selection and assessment. Provision has been made to relocate the drill hole within the

boundary of the Dial-a-Dump site to avoid sensitive environmental areas if the findings of this assessment determine any adverse impacts.

2.5.2 Alternative Drilling Methodology

There are currently no reasonable industry accepted alternatives to evaluate the hydrocarbon potential other than by undertaking the proposed drilling. There is little deep drilling in the area, and no drilling below 900m in PEL 463. Available geophysical techniques, including seismic, could be applied for exploration, but would not provide the ability to sample and analyse the stratigraphy and therefore would not progress the quantification of the gas generation potential of the area.

Drilling the proposed hole is essential in evaluating the potential to host natural gas resources in PEL 463.

3 Planning Context

The principal Act in NSW relating to the control and environmental assessment of development is the *Environmental Planning and Assessment Act* 1979 (EP&A Act). The three statutory approval pathways under the EP&A Act are:

- Part 3A of the EP&A Act which will apply where the development is determined to be a major project, either by the Minister for Planning, or by definition within an Environmental Planning Instrument (EPI), or where a Part 5 determination determines that a project will have significant impacts and an EIS would otherwise be required.

- Part 4 of the EP&A Act sets out the basic principles behind development assessment and it is most commonly applied when development consent is required under an EPI, typically a Local Environment Plan with approval sought from a local Council.

- Part 5 of the EP&A Act which will apply in the absence of a development consent requirement under an EPI and where an approval is required from a government agency to enable an activity to proceed.

The EP&A Act also establishes a legislative framework under Part 3 for the development of state, Regional and local EPIs which, through their hierarchy, determine the statutory process for environmental impact assessment and determination. EPIs comprise of:

- State Environmental Planning Policies (SEPPs); and

- Local Environment Plans (LEPs).

In addition to EPIs, State and Commonwealth environmental and planning legislation, such as Acts relating to the protection of heritage, conservation of flora and fauna and protection of the environment, must also be considered. The following sections provide a summary of the approvals process, EPIs, State and Commonwealth legislation that are related to the proposed works.

3.1 Approvals Process

The EPI that applies to this activity is SEPP (Mining, Petroleum Production and Extractive Industries) 2007 (SEPP Mining).

The aim of SEPP Mining is to provide for the proper management and development of mineral, petroleum and extractive material resources for the social and economic welfare of NSW. The SEPP also establishes appropriate planning controls to encourage ecologically sustainable development.

Subject to certain exemptions, Part 2 Clause 6 of SEPP Mining allows development for the purposes of petroleum exploration to be carried out

"without consent", including development for the purposes of "petroleum exploration". The definition of petroleum under SEPP Mining includes any naturally occurring hydrocarbon, whether in gaseous, liquid or solid state.

Therefore, this proposal is to be determined under Part 5 of the EP&A Act, because the proposal:

- May be carried out without development consent;
- Is not an exempt development; and
- Requires the approval of a determining authority.

A determining authority, for the purposes of this activity, is defined under Part 5 of the EP&A Act to include, but is not limited to, a public authority. In relation to PEL's, the DII is the determining authority for the activities covered by this REF.

In determining the proposal and degree of impact, Macquarie Energy has considered Section 111 of the EP&A Act and Clause 228 of the Environmental Planning and Assessment Regulation 2000.

3.2 Applicable Environmental Planning Instruments

3.2.1 State Environmental Planning Policies

SEPP (Mining, Petroleum Production and Extractive Industries) 2007

The aims of this Policy are, in recognition of the importance to NSW of mining, petroleum production and extractive industries:

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;*

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.*

As described above, Part 2 Clause 6 of the SEPP allows that certain development is "permissible" and may also be carried out without development consent, including development for the purposes of "petroleum exploration".

The activities described in this REF are considered by Macquarie Energy to be defined as "development permissible without consent", and therefore no local planning instruments or other local development controls contain any requirements that need further consideration under this assessment.

3.2.2 Local Environmental Plans

LEPs are developed by Councils to guide planning decisions for LGAs through land use zoning and development controls. LEPs determine development which is permissible (with or without consent) and that which is prohibited in a given Council area and its respective planning zones.

The LEP that applies to the area where the proposed works are to be carried out is the South Sydney LEP 1998. However, the application of SEPP Mining overrides the need to consider zoning controls, as activities covered by SEPP Mining are permissible without consent. For reference purposes the relevant LEP has been discussed below.

South Sydney Local Environment Plan 1998

The drill hole site is located within the South Sydney LGA and as such it falls under the provisions of the South Sydney LEP 1998. The objectives of this LEP include:

a) *to ensure a sustainable City of South Sydney through the efficient and equitable management and allocation of resources, and*
b) *to enhance the quality of life and well-being of the local community, and*
c) *to implement the goals and objectives contained in the Strategy for a Sustainable City of South Sydney published in June 1995 by the Council, and*
d) *to repeal all the existing local environmental planning instruments applying to the land to which this plan applies to the extent to which they apply to that land, and to replace those controls with a single local environmental plan, and*
e) *to rationalise the former land use restrictions by creating a small number of zones, and*
f) *to create an integrated planning framework of land use controls which allow detailed provisions to be made in development control plans.*

The drilling site is located within Zone 4 Industrial. The objectives of this zone are as follows:

a) *to facilitate and encourage suitable types of industrial development ranging from general industry to high technology industry, including warehousing, manufacturing and distribution centres, or other land uses which, due to their type, nature, scale, transport requirements or impacts, cannot reasonably be located in another zone, and*
b) *to allow for a range of ancillary, non-industrial land uses that provide direct services to industrial activities and their workforce, including associated research, administration, commercial and retail facilities, and*
c) *to ensure that development is carried out in a manner which does not detract from the amenity enjoyed by residents in neighbouring localities, the viability of commercial centres in the vicinity, or from the efficient operation of the local or regional road system, and*
d) *to provide for appropriate forms of industrial development which will contribute to the economic and employment growth of the area, and*

e) *to improve the environmental quality of the City of South Sydney by ensuring that industries conform to strict environmental and hazard reduction guidelines, and*
f) *to ensure that the scale, design and materials of construction, and the nature of development, contribute positively to the visual quality of major access routes*.

Whilst the application of SEPP Mining overrides the provisions of the South Sydney LEP 1998, this REF has taken into consideration the objectives of the LEP.

As the works will be located within existing highly modified and cleared areas and due to the temporary nature of the drilling program, it is considered that the works are consistent with the objectives of this plan.

3.2.3 State Legislation

Petroleum (Onshore) Act 1991

The *Petroleum (Onshore) Act* 1991 regulates the search for, and mining of, petroleum. Under the Act, petroleum means:

a) *any naturally occurring hydrocarbon, whether in a gaseous, liquid or solid state, or*

b) *any naturally occurring mixture of hydrocarbons, whether in a gaseous, liquid or solid state, or*

c) *any naturally occurring mixture of one or more hydrocarbons, whether in a gaseous, liquid or solid state, and one or more of the following, that is to say, hydrogen sulphide, nitrogen, helium, carbon dioxide and water, and includes any substance referred to in paragraph (a), (b) or (c) that has been returned to a natural reservoir, but does not include coal or oil shale or any substance prescribed to be a mineral for the purposes of the Mining Act 1992.*

Section 47 of *the Petroleum (Onshore) Act* 1991 states:

1) *If a person is authorised under this Act to carry out operations authorised under a petroleum title other than a production lease:*

   a) *nothing in, or done under, an environmental planning instrument operates so as to prevent the holder of the title carrying out any such operations on the land comprised in the title, and*

   b) *to the extent to which anything in, or done under, any such instrument would so operate, it is of no effect in relation to the holder.*

2) *A reference in this section to an environmental planning instrument does not include a reference to a State Environmental Planning Policy made on or after the commencement of this subsection.*

Macquarie Energy has been issued PEL 463 under the *Petroleum (Onshore) Act* 1991. As such, the conditions of the South Sydney LEP cannot prevent the proposed drilling operations.

Under Clause 72 of the Act, drilling operations can not occur within 200 metres of a dwelling house or 50 metres within a garden, orchard or vineyard without the owner's consent. The nearest residences are located over 200 metres from the proposed drill hole site, therefore consent from the landowners of adjacent houses is not required.

The drilling works will be carried out in accordance with the *Petroleum (Onshore) Act 1991*. All land used during exploration will be suitably restored to pre-works condition at the completion of operations. Furthermore, all activities carried out under the petroleum title will conform to the DII Schedule of *Onshore Petroleum Exploration and Production Safety Requirements* (August 1992).

Environmental Planning & Assessment Act 1979

The EP&A Act relates to the control and environmental assessment of development in NSW. As stated above, the proposed drilling works are assessed under the provisions of Part 5 of the Act, for which the determining authority is DII.

Under Section 5A of the EP&A Act, there is also an obligation to consider threatened species, populations or ecological communities or their habitats. Section 4.6 of this REF provides further detail.

Environmental Planning and Assessment Regulation 2000

Clause 228 of the Environmental Planning and Assessment Regulation 2000 lists factors to be taken into account when consideration is being given to the likely environmental impacts associated with a proposed development that is to be assessed under Part 5 of the EP&A Act. Clause 228(b(i)) states that the REF should be carried out in accordance with general guidelines in force under Clause 228. This REF has therefore been carried out in accordance with *Is an EIS Required – Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (DUAP, 1996).

Water Act 1912

The *Water Act* 1912 sets out provisions for the management of water rights, water and drainage, drainage promotion and artesian wells, in NSW. The proposed drill hole location is located within the footprint of the Botany Sands Aquifer which lies beneath the surface. This aquifer is highly vulnerable to contamination due to the permeability of the sands and the shallow water table

(Office of Water, 2009). Water from the aquifer seeps through the sands, silts and clay lying beneath the ground surface and flows towards Botany Bay. During drilling operations, Macquarie Energy may intercept this groundwater source, therefore a licence is required from the NSW Office of Water (formerly Department of Water and Energy) prior to drilling works commencing.

Due to the fact that approval to intercept an aquifer (under Chapter 3, Part 3 of the *Water Management Act* 2000) has not commenced, a licence will instead be required under Part 5 of the *Water Act* 1912 (*Pers. Comm.*, Department of Planning, 2009). This involves submitting an application per affected landholder with an accompanying letter of owner's consent for each property on which a drill hole will be located. Macquarie Energy will obtain the necessary licence prior to works commencing.

Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act* 1995 (TSC Act) sets out provisions for the planning and assessment of impacts on threatened species, populations and ecological communities. Development applications that require consent from Council or any other statutory authority are required to be assessed in accordance with Section 5A of the EP&A Act, as amended by the TSC Act and *Fisheries Management Act* 1994.

The TSC Act lists a number of factors to be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. Schedules 1 and 2 of the TSC Act lists species, populations or ecological communities of native flora and fauna considered to be threatened in New South Wales.

If a development may potentially affect any flora or fauna species, population or ecological community listed by the TSC Act, a Seven Part Test is required. The Seven Part Test, referred to in Section 94(2) of the TSC Act and Section 5A of the EP&A Act, determines whether the proposed works represent a significant impact. If a significant impact is determined, a Species Impact Statement and licence is required under the TSC Act.

The impact of the proposed works on threatened species, populations or ecological communities, or their habitats is described in Section 5.4.

Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act* 1997 (POEO Act) aims to protect the environment and reduce environmental degradation. The POEO Act examines issues such as air quality, pollution, waste, water quality and noise. The Act also prescribes 'activities' in which a licence must be obtained from the Department of Environment, Climate Change and Water (DECCW). These 'activities' include certain sized industrial, mining and agricultural developments. For petroleum works, this includes works which:

a) *produce, other than in the course of exploratory activities, crude petroleum or shale oil, or*

b) *produce more than 5 petajoules per year of natural gas or methane, or*

c) *refine crude petroleum, shale oil or natural gas, or*

d) *manufacture more than 100 tonnes per year of petroleum products (including aviation fuel, petrol, kerosene, mineral turpentine, fuel oils, lubricants, wax, bitumen, liquefied gas and the precursors to petrochemicals, such as acetylene, ethylene, toluene and xylene), or*

e) *store petroleum and natural gas products with an intended storage capacity in excess of:*

- 200 tonnes of liquefied gases, or
- 2,000 tonnes of any petroleum products, or

f) *dispose of oil waste or petroleum waste or process or recover more than 20 tonnes of oil waste or petroleum waste per year.*

Clause 5 and Schedule 1 of this Act pertain to works that are identified as 'scheduled activity'. The proposed drilling works are not identified as a 'scheduled activity' and therefore the proposal does not require an environmental protection licence to be issued by the DECCW or any further assessment under the POEO Act.

The *Protection of the Environment (Clean Air) Regulation* 2002 (POEO (Clean Air) Regs) contains provisions on the emission of air impurities from motor vehicles and the compulsory fitting and maintenance of anti-pollution requirements. All vehicles operating on site will comply with the POEO (Clean Air) Regs.

The *Protection of the Environment (Noise) Regulation* 2008 (POEO (Noise)) makes provisions for the use of power tools and equipment at residential premises between certain hours and determining noise levels of particular articles. All work on site will comply with the POEO (Noise) Regulations.

The *Protection of the Environment (Waste) Regulation* 2005 (POEO (Waste) Reg), as amended 28 April 2008, makes provision for, amongst other things, the tracking of waste between generators, transporters and receivers of waste and record keeping associated with such waste movements. Waste tracking and recording will be undertaken on site in accordance with the POEO (Waste) Reg requirements.

Contaminated Land Management Act 1997

The *Contaminated Land Management Act* 1997 (CLM Act) establishes a process for investigating and remediating land areas where contamination presents a

significant risk of harm to human health or the environment, and sets out criteria for determining whether such a risk exists.

Whilst the site is an operating non-putrescible landfill, the drilling works are not considered to have the potential to cause a significant risk of harm. However, if odours or changes to ground colour, indicating contaminated land, were to occur, then all works will cease and further investigations will be carried out.

Pesticides Act 1999

The *Pesticides Act* 1999 controls the use of pesticides in NSW. The Act aims to reduce the risks associated with the use of pesticides to human health, the environment, property, industry and trade. It also aims to promote collaborative and integrated policies for the use of pesticides.

The DECCW enforces the proper use of all pesticides in NSW, after the point of sale. This includes pesticide use in agriculture, on public lands and on domestic and commercial premises. Where necessary under the Act, any pesticide/herbicide application will require the following:

- Staff will be appropriately certificated/trained;
- Appropriate records will be kept where necessary;
- Property owners will be notified; and
- Contractors will be licensed.

Due to the highly disturbed nature of the site and lack of on site vegetation, it is not expected that the use of pesticides will be required. However, the *Pesticides Act 1999* will be applied if it is deemed necessary to remove any weeds from the site.

Native Vegetation Act 2003

The *Native Vegetation Act* 2003 has been developed to:

a) provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State, and

b) prevent broadscale clearing unless it improves or maintains environmental outcomes, and

c) protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation, and

d) improve the condition of existing native vegetation, particularly where it has high conservation value, and

e) *encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation, in accordance with the principles of ecologically sustainable development.*

In accordance with Clause 25(h) of the Act, approval is not required for "*any clearing that is, or is part of, an activity carried out in accordance with an approval of a determining authority within the meaning of Part 5 of the EPA Act if the determining authority has complied with that Part*". As the proposed works are subject to determination by DII under Part 5, development consent under the *Native Vegetation Act* 2003 is not required.

Fisheries Management Act 1994

The objectives of the *Fisheries Management Act* 1994 are:

a) *to conserve fish stocks and key fish habitats;*

b) *to conserve threatened species, populations and ecological communities of fish and marine vegetation;*

c) *to promote ecologically sustainable development, including the conservation of biological diversity, and, consistently with those objects;*

d) *to promote viable commercial fishing and aquaculture industries;*

e) *to promote quality recreational fishing opportunities;*

f) *to appropriately share fisheries resources between the users of those resources; and*

g) *to provide social and economic benefits for the wider community of New South Wales.*

The drilling site has been selected so as not to impact upon any critical habitat under this Act.

Waste Avoidance and Resource Recovery Act 2001

Waste disposal in NSW falls under the *Waste Avoidance and Resource Recovery Act* 2001. The relevant objectives of this Act to the proposed works are:

a) *to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ESD;*

b) *to ensure that resource management options are considered against a hierarchy of the following order:*

- avoidance of unnecessary resource consumption

- resource recovery (including reuse, reprocessing, recycling and energy recovery)
- disposal
- to provide for the continual reduction in waste generation
- to minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste
- to ensure that industry shares with the community the responsibility for reducing and dealing with waste
- to assist in the achievement of the objectives of the POEO Act.

To meet these objectives, the Act sets in place a hierarchy of waste management of avoidance, recovery and disposal in descending order. The drilling works will generate some waste which will be managed in accordance with the hierarchy set out in the Act. For further discussion on waste refer to Section 5.9.2

Heritage Act 1977

The *Heritage Act* 1977 aims to properly identify and conserve items of local and state historical significance. This can be in relation to a building, work, relic, moveable object or precinct and may be significant in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the place or item. Whilst there are items of heritage significance located nearby the proposed drill location, the proposed drilling works will not disturb these items (see Section 5.7). As such, no further restrictions under the *Heritage Act* 1977 apply to the proposed works.

National Parks and Wildlife Act 1974

Under the *National Parks and Wildlife Act* 1974, sites of archaeological and cultural Aboriginal significance are protected. It is an offence to damage or destroy them without prior permission from the Director General of the National Parks and Wildlife Service.

Due to the highly disturbed nature of the site it is not expected that any items of Aboriginal significance will be found on the site.

3.2.4 Commonwealth Legislation

Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environmental Protection & Biodiversity Act* 1999 (EPBC Act) identifies Matters of National Environmental Significance (NES) and contains

schedules of threatened species and Endangered Ecological Communities (EECs) to which it affords protection. The EPBC Act requires the Commonwealth/Federal Minister for the Environment to approve actions which may have an impact on matters of national environmental significance. Matters of NES include:

- World Heritage Areas;
- National heritage places;
- Wetlands of national importance;
- Commonwealth listed threatened species;
- Commonwealth listed migratory birds;
- Commonwealth marine area; and
- Commonwealth land.

Matters of NES may be referred to the Federal environment department (Department of Environment, Water, Heritage and Arts (DEWHA)) by a proponent for consideration if impacts are expected on threatened species or EECs. Impacts constituting a controlled action upon any matters of NES that have not been referred to DEWHA may be referred by a third party and may be subject to prosecution where the proposed action has not been previously assessed by the DEWHA.

The proposed drilling operation is not expected to have any significant impact to any matter of NES. Therefore, a referral under the provisions of the EPBC Act is not considered necessary for this proposal. Results of the NES search are presented in Appendix A.

3.3 Stakeholder Consultation

Key stakeholders relevant to the proposed exploration drilling program include:

- State regulatory agencies (DII, Office of Water);
- Local government (City of Sydney Council, Marrickville Council);
- Landholders and occupiers;
- Metropolitan Aboriginal Land Council;
- Local community, users of local facilities, business and special interest groups; and
- Utilities operators.

Macquarie Energy has commenced consultation with the relevant property owners and will continue with this program until all rehabilitation works have

been completed. Once the proposal is approved by DII, negotiation will occur with relevant property owners to reach an agreement regarding land access, compensation and rehabilitation.

Macquarie Energy will inform the local residential landowners of the proposed drilling works via a letter box drop. If requested by a resident Macquarie Energy will meet with the residential landowner on a one-on-one basis. Communication with the local residential landowners will continue as needed until all rehabilitation works have been completed.

The residential properties that have the potential to be impacted by the proposed drilling works are listed in Table 3-1.

Table 3-1 Summary of potentially affected residential properties

Address	Lot	Section	DP
13 Campbell Street	15	A	976191
15 Campbell Street	16	A	976191
17 Campbell Street	17	A	976191
17 Campbell Street	18	A	976191
19 Campbell Street	19	A	976191
19 Campbell Street	20	A	976191
19 Campbell Street	21	A	976191
21 Campbell Street	22	A	976191
21 Campbell Street	23	A	976191
21 Campbell Street	24	A	976191
23 Campbell Street	1	-	1072060
25 Campbell Street	1	-	219746
25 Campbell Street	2	-	219746
39 Campbell Street	39	-	1072165
41 Campbell Street	1	-	712298
43 Campbell Street	1	-	81461
-	50	C	976191
-	51	C	976191

A community consultation database has also been established and will be maintained to monitor and address any concerns or issues raised by the local community and/or key stakeholders.

4 Existing Environment

4.1 Regional Topography & Geology

St Peters is located within the Botany Basin, a sub region of the Sydney Basin, which has a relatively flat topography, situated at approximately 20m above sea level.

The area around St Peters is predominately characterised by Hawkesbury Sandstone and Wianamatta Shales, most notably the Ashfield Shale, formed during the Upper Triassic Age. The geology of the St Peters area has proved to be historically useful in providing resources for brick making, with several brickpits located in the area, including the St Peters brickpit on the corner of Canal Road and the Princes Highway. The area excavated for the brickpit now provides an important insight into the geological makeup and history of the Botany Basin, including evidence of the previous shoreline of Botany Bay, which rose during the end of the last glaciation. Additionally, the Ashfield Shale has provided a rich source of fossils from the Upper Triassic Age. Fossils of both invertebrate and vertebrate species have been identified in the surrounding area.

Blue/grey clay, yellow sand and shell horizons overlay the Ashfield Shale and are part of the group known collectively as the Botany Sands, deposited during the late Pleistocene/early Holocene period.

4.2 Land Use

The drill hole site is located in the south east portion of a cleared property owned by Dial a Dump. The area adjacent to the subject site is also being used by Dial a Dump and is known as "Alexandria Landfill". The landfill site is primarily used for solid and inert waste deposition, resource recovery and recycling purposes. The site only accepts non-putrescible waste.

Although the surrounding area is dominated by industrial land uses, there is also a mixture of other uses, including residential (greater than 200 metres) from the proposed drill hole, commercial and light industrial.

4.3 Climate

Climate data for the suburb of St Peters was taken from the weather station at Sydney Airport, Mascot, which is the closest station to the subject site. Average rainfall indicates that June is the wettest month with a mean rainfall of 120.9mm and September is the driest month, with a mean rainfall of 61.2mm. The annual average rainfall is 1085.20mm (BOM, 2009).

Temperature recordings for the area indicate that January is on average the warmest month with a mean temperature of 26.4 °C and July is the coolest month with an average temperature of 17°C. The mean annual temperature for the region is 22.2°C (BOM, accessed 13 October 2009).

4.4 Soils

The soils in the Botany Basin area were predominately formed by aeolian sand accumulation. The sands in the area are quartenary sands known as the Botany Sands. These are highly permeable sands which allow for high groundwater seepage (UNSW, accessed 19 October 2009).

The soils within the proposed drill site area have been highly disturbed as a result of the site's former activities as a landfill and brick pit.

A search of the Australian Soil Resource Information System (ASRIS) (15 October 2009), a CSIRO soil database, found that there is a low probability of Acid Sulphate Soils occurring in the area (Figure 4-1).

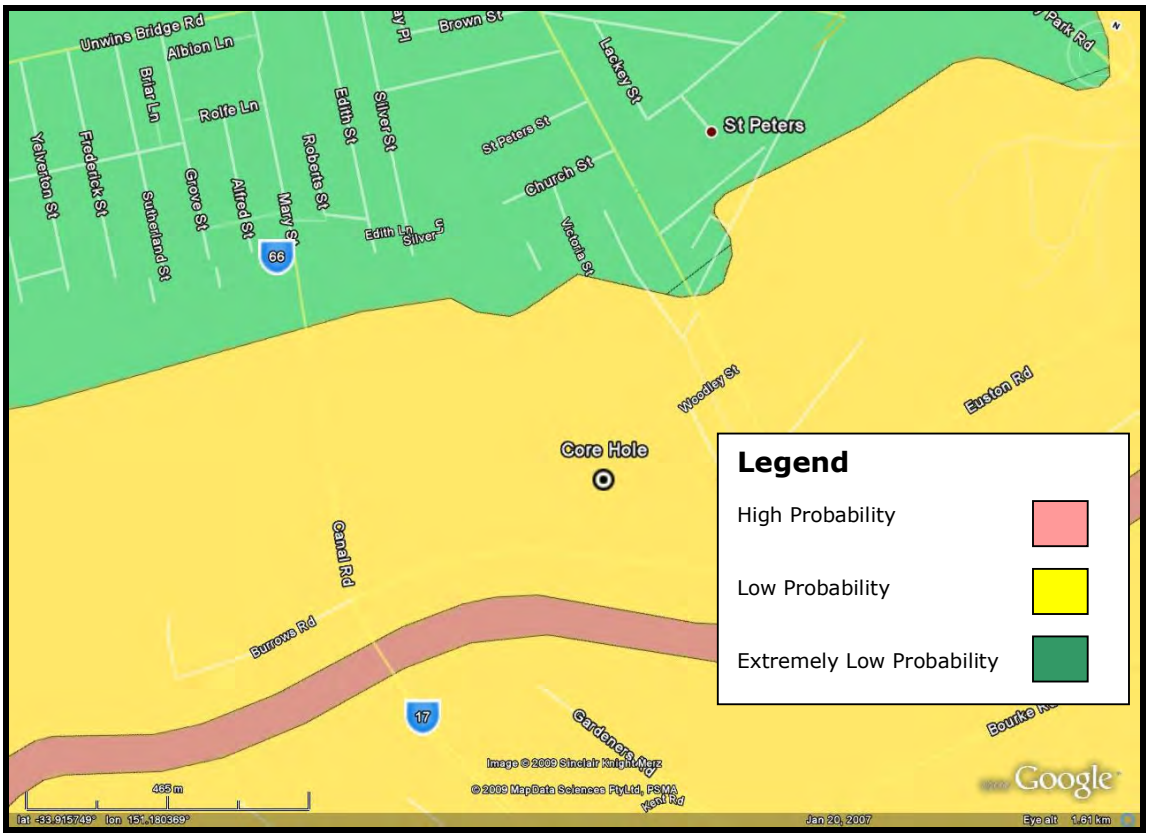


Figure 4-1 Acid Sulphate Soils

Acid sulphate soils (ASS) are soils which contain a significant concentration of pyrite. Pyrite is a common mineral composed of iron disulphide with a pale

brass-yellow colour used as an iron ore and in the production of sulphur dioxide for sulphuric acid. It oxidises when exposed to oxygen and in the presence of sufficient moisture results in the generation of sulphuric acid. If these soils become oxidised through disturbance or poor management, acidic conditions may develop. This can lead to damage to the environment (in relation to flora and fauna) and can also lead to the deterioration of steel and concrete associated with infrastructure (CSIRO, 2009).

4.5 Hydrology

4.5.1 Surface Water

Botany Bay lies 3.5km to the south west of the site, Sydney Harbour lies 7km to the north east and the Pacific Ocean lies 10km to the east of the site.

The drill site is located 200 metres north of the Alexandra Canal, a man made water body constructed in the late 19th Century. Built for the purpose of industrial transportation, Alexandra Canal stretches for 4.5 km from the Cooks River to the South, and to Huntley Street, Alexandria in the north. The Alexandra Canal created a connection between a land-locked industrial area and the Cooks River. The installation of the canal resulted in a need for land clearing impacting the soil profile of the immediate surrounds and altering the flow of runoff.

4.5.2 Groundwater

The Botany Sands Aquifer lies beneath the subject site. This aquifer is highly vulnerable to contamination due to the permeability of the sands and the shallow water table (Office of Water, 2009). Water from the aquifer seeps through the sands, silts and clay lying beneath the ground surface and flows towards Botany Bay.

Prior to extensive development in the area, the aquifer was replenished from rainfall, however, due to the highly developed nature of the area and the installation of stormwater drains (including the Alexandra Canal) and impervious land surfaces, the rate of aquifer replenishment has been significantly reduced.

4.6 Flora and Fauna

A search of the NSW National Parks and Wildlife Atlas online database (for flora and fauna) was undertaken on 17 February 2010 (Appendix A). This database contains records of sighted flora and fauna species and their status under the TSC Act and the NPWS Act.

From the review, a total of 38 threatened species of fauna are known to occur within ten kilometres of the Dial-a-Dump site. Eleven of these species are listed as endangered under the TSC Act.

A total of 37 threatened flora species have been recorded within ten kilometres of the dial-a-dump site, eighteen listed as endangered and one listed as critically endangered.

Due to the highly disturbed nature of the site and the lack of vegetation at the proposed location of the drill site, it is not anticipated that the proposed works will have any significant impact on any of these fauna or flora species.

4.6.1 Matters of Environmental Significance

A search of the EPBC Act Protected Matters Search Tool was within a 1km radius of the proposed drill hole location site on 17 February 2010 (Appendix A). The search tool identifies matters of conservation significance listed under the EPBC Act. The results of the search are summarised in Table 4-1 below and show that no World Heritage Properties, Commonwealth Marine Areas or threatened ecological communities occur within 1 kilometre of the proposed works location. Two National Heritage Places, thirteen threatened species, fourteen migratory species and one Wetland of International Significance, Towra Point Nature Reserve, are located within one kilometre of the proposed works location. The Towra Point Nature Reserve is located 10km to the south of the proposed drill hole site.

Table 4-1 Matters of Environmental Significance under the EPBC Act

Matter of Environmental Significance	Status
World Heritage Properties	0
National Heritage Place	2
Wetlands of International Significance (RAMSAR Sites)	1
Commonwealth Marine Areas	0
Threatened Ecological Communities	0
Threatened Species	13
Migratory Species	14

4.7 Noise and Vibration

The proposed drill hole location is within an industrial area with the closest residence located approximately 200m north-north east of the site. The site is within an industrial area and is adjacent to the Princes Highway.

As such, it is anticipated that the primary contributors to the ambient noise in the area are industry and traffic (motor vehicle and air traffic).

4.8 Air Quality

A National Pollutant Inventory search by postcode of St Peters (2044) summarised that there were 73 recorded air pollutants from 28 sources in the area (summary of data provided from diffuse data from 28 sources and no specific industrial sites) (DEWHA, 2010). Approximately 70% of pollution was from motor vehicles, domestic/commercial solvents/aerosols, aeroplanes, solid fuel burning and architectural surface coatings with the remaining 30% coming from various sources including lawn mowing, barbecues, railways, wind blown dust etc.

The existing air quality at the site is considered to be consistent with that of a highly urbanised industrial area. Local sources of airborne particulates are likely to include the adjacent landfill activities and other local industrial facilities including automobile mechanics, scrap metal yards and manufacturing warehouses. Vehicle exhaust emissions from traffic on the adjacent Princes Highway would also likely contribute to ambient air quality in the area.

4.9 Heritage

4.9.1 Indigenous Heritage

A search of the AHIMS was undertaken for the Lot and DP of the proposed drill hole location on 18 November 2009. The search concluded that no items or places of indigenous heritage significance occur within the Lot/DP of the drill hole (Appendix B).

4.9.2 Non-Indigenous Heritage

Searches were conducted of the Australian Heritage Council's Register of the National Estate, NSW Heritage Office's State Heritage Register and National Trust on 13 October 2009 to identify items of non-indigenous heritage significance that occur within the area (Appendix B). The results are summarised below.

Alexandra Canal

"Alexandra Canal is considered to be an important historical site for it depicts late nineteenth century coastal navigation. Formerly Shea's Creek, Alexandra Canal was constructed to create water transport as a means of further developing the industrial areas at Alexandria and Botany. Construction of the Canal began in 1887 and ceased in 1912."

St Peters Brick Pit Geological Site

St Peters Brickpit is located on the north west of the drill site, at the junction between the Princes Highway and Canal Road.

"The pit is significant as it provides evidence as to the extent that the Botany Bay shore line rose at the end of the last glaciation. Additionally, the Ashfield shale surrounding and excavated by the brick pit was a source of fossils from the Upper Triassic Age. The significance of the area is illustrated by the fact that it is commonly used as a teaching aid for tertiary students of geology as it provides a good representation of what is beneath the land's surface."

4.10 Chemicals Hazardous Materials and Contaminated Lands

The proposed works are located within a highly industrialised area of St Peters. It is expected that there would be a variety of chemicals, fuels and other hazardous materials that are stored and used throughout the region. There is a potential for the site to have some contaminated soils present.

4.11 Waste

The site of the proposed drill hole is currently utilised as a Dial-a-Dump facility and is adjacent to the 'Alexandria Landfill' which is primarily used for solid and inert waste landfilling, resource recovery and recycling purposes, with the site only accepting non-putrescible wastes.

4.12 Visual Amenity

The visual landscape in the region of the drill hole is dominated by industry with some light commercial and residential areas. The site of the proposed drill hole is currently utilised as a 'Dial-a-Dump'. The proposed site is surrounded by three large vegetated mounds (See Figure 4-2) that obstruct the view of the area from nearby residents.

Figure 4-2 Typical Vegetated Mound (on left) surrounding site

5 Environmental Impact and Mitigation Measures

5.1 Land Use

5.1.1 Impact Assessment

It is expected that the area to be disturbed at the drill hole site will be approximately 45-60m^2. As there will be limited ground disturbance as part of the proposed works, the impact to land use/amenity will be minor and of short duration.

The proposed project will not impact on surrounding land-uses and will involve no change to the current land-use.

5.1.2 Mitigation Measures

The following mitigation measures are proposed:

- Immediate notification to the Project Manager if any complaints are received to enable a fast response/resolution to the complainant.
- Location and 'pegging-out' of all services in the vicinity of the works and noting these locations in the works plan prior to drilling- "dial 1100 before you dig".
- All personnel will maintain a tidy appearance and exercise courtesy in any dealings with the public and/or Dial A Dump staff.

5.2 Soils

5.2.1 Impact Assessment

Any impact on soils is likely to be a result of the use of equipment at the drill site. Potential impacts include:

- Soil contamination as a result of oil, chemical, grease or fuel spillages or leaks associated with operation of machinery;
- Soil compaction in areas immediately surrounding the drill site. This may have implications for percolation of rainfall into the soil column and may slightly alter surface drainage characteristics; and
- Sediment runoff from disturbed areas adjacent to the site.

The potential exists for erosion during excavation of drill pits and sumps as well as 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 waterways. However, given the site currently operates as a landfill where excavations and stockpiling occur frequently, the additional spoil created by the drilling works is likely to be insignificant in comparison and managable with existing mounds and bunds at the site.

Acid Sulphate Soils

A search of the ASRIS CSIRO soil database found that there is a low probability of Acid Sulphate Soils occurring on the site (15 October, 2009) (Figure 4-1) and as such, minimal impacts are anticipated as a result of the acidification of soils.

5.2.2 Mitigation Measures

The following mitigation measures are proposed to reduce or minimise impacts:

- Testing for ASS will be undertaken prior to project commencement and disturbance of any soils. If ASS are found then an ASS Management Plan will be developed and implemented.
- Trucks and machinery will be checked for leaks on arrival to site and appropriate spill kits will be available at all times.
- All refuelling activities will be undertaken off site, as far as practicable.
- Sediment control devices will be installed parallel with the contours, immediately down slope of any areas where the existing ground surface will be disturbed. Additional control devices will be installed upslope of areas of disturbance where there is a probability of clean surface water flows flowing across the disturbed surfaces around the drill operations and exacerbating surface erosion or runoff quality.
- Wherever possible, excavated soil and sediment accumulated in erosion and sediment control structures will be reused for site restoration unless contaminated or otherwise inappropriate for reuse. The sediment will be visually checked for reuse ability prior to site restoration.
- Wheel washing and sweeping of public roads may be undertaken as necessary.
- Vehicle and machinery movement will be confined to existing roads, pathways and work areas.
- Vehicle access routes to and within the site(s) will be clearly defined.
- All sediment and erosion control measures will be in place prior to any earth works commencing.

- Sediment and erosion control measures will be routinely inspected and maintained to ensure they remain effective.
- Erosion and Sediment control measures will be consistent with those specified in the NSW Government's 'Blue Book' (4th Edition, 2004) on erosion and sediment control.
- Ground disturbance will be minimised.
- The site stabilisation and restoration measures adopted will be monitored for effectiveness, and modified as required (See Section 6).

5.3 Hydrology

5.3.1 Impact Assessment

Surface Water

As discussed previously, the drill hole site is located on the south east portion of the Alexandria Landfill (non-putrescible). In accordance with the landfill's licence to operate, this site is bunded and has a drainage system in place to prevent contaminated surface water runoff entering the Alexandra Canal, which is located 200m south of the proposed works. Water from the drilling works will be contained within the specifically constructed lined sumps. As the proposed drill hole is located within the landfill boundary and due to the localised nature and short term duration of the proposed drilling works, it is not expected that there will be any significant impact upon surface water, most notably stormwater, at the Dial-a-Dump site.

Groundwater

The proposed drill hole is located over the Botany Sands Aquifer, which in certain areas has been contaminated as a result of continued industrial use within the area. As drilling works are likely to intersect this aquifer there is potential to contaminate groundwater as a result of runoff from chemicals, fuel, oil and drilling fluids used onsite or associated with operating machinery onsite. Casing will be implemented to negate the potential for groundwater contamination (in accordance with DII regulations). It is not expected that there will be any impact to groundwater as a direct result of drilling activities. However, a licence from the NSW Office of Water may still be required (refer to Section 3.2.3).

5.3.2 Mitigation Measures

The following mitigation measures have been proposed to reduce or minimise impacts:

- A licence may be obtained from the NSW Office of Water (See Section 3.2.3).

- Should the drill hole intersect with an alluvial aquifer, it will be solid cased to minimise any potential effect on other users of the groundwater and the environment.
- Any contaminated waters will be contained in appropriately sized and lined sumps.
- Sediment fences will be installed to prevent soil loss and runoff into any nearby water course.
- All sumps will have an overflow capacity in case of heavy rain or flow from the bore hole.
- All water brought to the drill site will be removed off site at the completion of works and disposed at a licensed facility.
- A periodic "pumpout" of the sumps will occur as required to prevent any surcharge during wet weather events.
- Any water stored on site will be stored in appropriately lined bunds.
- All land disturbed during operations will be restored to the pre-operational state as soon as practicable.
- A Water Management Plan will be drafted and implemented to the satisfaction of the DII.
- All water contaminated by hydrocarbons or non-degradable additives other than potassium chloride (KCl), will be removed to a licenced disposal facility.
- Trucks and machinery will be checked for leaks and appropriate spill kits will be available on site at all times.
- All refuelling activities will be undertaken off site, as far as practicable.
- All chemicals and fuels will be stored in suitable bunded areas away from drainage lines. The capacity of the bunded area will be at least 120% of the largest chemical container stored within the bunded area.
- Temporary bunding will be installed around the work area to mitigate against potential chemical and drilling fluid spills and runoff.
- Where possible, stockpiles will be placed away from kerbs and drainage lines.

5.4 Flora and Fauna

5.4.1 Impact Assessment

The likelihood of disturbing actual or potential habitats associated with threatened species is low due to:

- The temporary nature of the works;
- The extent and historical duration of landfill activities that are currently occurring at the site; and
- The absence of remnant vegetation at the proposed drill hole location (refer to Figure 2-2 and Figure 5-1).

There is potential for weed invasion into and out of the proposed work site via vehicle/plant movement and disturbance. Weeds may compete with native species to such an extent that they can increasingly dominate and destroy the existing natural ecology. As the site is fully sealed and trucks will remain on surfaced roads driving to and from the site, the potential for the spreading of weeds is considered minimal. As the works will be conducted on a sealed area, there will be no need to undertake vegetation rehabilitation works as no vegetation is likely to be impacted as a result of the drill hole installation.

The results of the EPBC Act Protected Matters Search Tool listed one Wetland of International Significance, the Towra Point Nature Reserve, as occurring in the region. This is located approximately 10km to the south of the drill hole site. Given the localised and temporary nature of the works, and the location of the site, it is not anticipated that there will be any significant impact on this wetland.

Figure 5-1 Proposed drill hole location, left side of photo (in front of hill on gravel surface)

5.4.2 Mitigation Measures

The following mitigation measures have been proposed to reduce or minimise impacts:

- All vehicle movements in and out of the drill site will be restricted to existing cleared and defined surfaces to minimise disturbance to the surrounding vegetated mounds.
- Barriers will be erected around the open drill hole, surface pits and sumps to prevent fauna becoming trapped.
- Materials, plant, equipment and stockpiles will be placed in designated controlled areas.
- If any damage occurs to vegetation outside of the nominated work area, the Project Manager will be notified so that appropriate remediation strategies can be developed and implemented.

- All vegetation damaged by works will be appropriately remediated with native vegetation.
- Where possible, laydown areas and works will avoid planted areas.

5.5 Noise and Vibration

5.5.1 Impacts

Macquarie Energy seeks to conduct operations on a 24 hour basis. Potential noise and vibration sources associated with the proposed drilling activities include the drill rod handling, diesel powered equipment, and vehicles travelling to and from the site. Operation of this type of equipment during the night may disturb residents in the area of the drilling works.

It is noted that potential noise impacts will only occur for the duration of the works and that noise emitting sources already exist at the site due to landfilling activities, crushing and recycling activities and the nearby Princes Highway traffic.

The traffic generated by the proposed works is considered to be minimal and will not likely impact upon existing noise levels.

5.5.2 Mitigation Measures

The following mitigation measures have been proposed to reduce or minimise impacts:

- Consultation with any potentially affected receivers will occur in advance of any site activity to determine the least sensitive hours and undertake noise generating activities during these hours as far as is reasonably practicable.
- The noisiest activities will be conducted during least sensitive periods of the day as far as is reasonably practicable.
- A journal of activities will be kept, so any complaints received can be checked against the type of activity that was being carried out.
- Compression and exhaust braking will be kept to a minimum along access roads.
- Site inductions will include material that raises workers awareness of noise and vibration issues.
- Noise emitting machinery will be directed away from residential areas away from nearest residents where possible.

- Muffling measures on machinery will be implemented where possible, including rubber matting between drill rod stacks to minimise handling noise, efficient silencers and any other means approved by industry.
- Machinery will be switched off when not in use for periods of greater than 10 minutes.

5.6 Air Quality

5.6.1 Impact Assessment

Emissions from Equipment

Exhaust emissions from the drill rig, associated plant and vehicle movements to and from the drill site will intermittently occur during the exploration works. However, as the proposed works would be carried out for a maximum of approximately 60 days, air quality impacts are expected to be minor and temporary in nature and unlikely to alter the local and/or regional air quality, nor contribute significantly to greenhouse gas emissions.

Dust Generation

Given the site currently operates as a landfill and recycling facility and is covered with gravel (See Figure 5-2), the mobilisation of the drill rig, ancillary equipment and intermittent vehicle movements (trucks bringing in any soil or fill for regeneration works) around the drill site, have the potential to generate some dust.

Figure 5-2 Gravel Covered Site

Vehicle movements around the site may have the potential to generate some dust. Vehicle movements to and from the site are unlikely to contribute to dust issues as access will be via sealed roads.

There is potential for dust to be generated when drilling of the upper 60 to 100 metres of the drill hole. However, given the nature of the site's landfill activities, and the temporary nature of the drilling works, no significant impact is likely to occur.

Flaring of Gas

The drilling operation is expected to intersect gas bearing formations which could lead to flaring of gas. A number of safety precautions and contingencies have therefore been incorporated into the drilling program in order to minimise any risks associated with pressurised and volatile gases.

5.6.2 Mitigation Measures

The following mitigation measures have been proposed to reduce or minimise impacts:

- All vehicle exhaust systems will be properly maintained so that exhaust emissions comply with the Clean Air Regulations under the POEO Act.
- Stabilisation and any necessary landscaping will be carried out as soon as possible after disturbance.
- All work areas and stockpiles will be closely monitored for dust generation.
- A water cart will be utilised for dust suppression as needed.
- A safety imposed site speed limit of 7km/h will be imposed across the site which should further reduce the potential for vehicle related dust emissions.
- Trucks transporting any rehabilitation material will be covered when entering and leaving the site.
- Mud, sand and other debris will be removed from the wheels and bodies of vehicles and equipment prior to leaving the site and before entering public roads or sealed pavements.
- Work vehicles/machinery/lights will not be left running or idling when not in use.
- No matter of any kind will be burnt on site, except gas.
- A flare pit will be installed prior to commencing drilling operations, and will be appropriately located and sized. Gas blow lines will be installed by the drilling contractor as part of the blow-out prevention (BOP) equipment so that gas is directed into the flare pit where an ignition source can safely burn/flare any gas that is intersected by drilling.

5.7 Indigenous and Non-Indigenous Heritage

5.7.1 Impact Assessment

The Alexandra Canal is listed on the NSW Heritage Office's State Heritage Register and is located approximately 200m south of the drill hole site. Burrows Road and industrial facilities/buildings separate the drill hole site from the canal. Given the distance, and the small scale of the proposed drilling works, impact to this historic site is not anticipated.

The St Peters Brick Pit Geological site is listed as a registered item on the Register of the National Estate and is located 100m north-west of the drill hole

site. Given the distance, and the small scale of the proposed drilling works, impact to this historic site is not anticipated.

5.7.2 Mitigation Measures

The following mitigation measures have been proposed to reduce or minimise impacts:

- All workers will be briefed on the significance of the St Peters Brick Pit prior to commencement of any drilling works.
- Pursuant to Section 146 of the *Heritage Act* 1977, if any collection of historical objects likely to be more than 50 years old is identified during work, their presence will be notified to City of Sydney Council heritage officers and the State Heritage Council.
- If, in carrying out the drilling works, an item of potential historical significance is found, all work is to be ceased immediately and approval sought from the DECCW before continuing.

5.8 Chemicals, Hazardous Materials and Contaminated Lands

5.8.1 Impact Assessment

The operator has placed strict environmental controls on the proposed activities, including the recirculation of drilling fluids, their containment in lined sumps, utilisation of silt fencing and spill kits, monitoring of all activities and subsequent rehabilitation of the site. The potential pollutants on the site will be engine fuels and oils. Drilling additives acceptable for use are biodegradable or inert and the stabilisation/weight additives are widely used farm fertiliser.

The main additives used in the course of drilling will be potassium chloride (KCl), liquid polymer and Portland cement. Other additives will be avoided if possible. The use of hydrocarbon additives will not be permitted.

The KCl is used by the farming industry as a fertiliser in the course of pasture improvement. The liquid polymer used is widely utilised in the drilling industry and is degradable by both biological action and exposure to weather.

Contaminated Lands

Given the current use of the site as a landfill (Alexandria Landfill), it is anticipated that the site has some level of existing contamination. The landfill currently accepts non-putrescible waste such as mixed concrete and brick, road millings, timber, large trees, rubber, tyres etc. However, whilst these types of waste are generally non-hazardous, the potential exists for occupational health and safety issues when establishing the drill hole as the landfill has potentially

accepted other wastes (not non-putrescible wastes) over the life of its existence (such wastes possibly at depth).

Other than drilling samples taken for laboratory testing, no soil is to be removed from the site as part of the proposed works. All soil is proposed to be backfilled and then capped at the completion of drilling operations and as such, contamination resulting from the drilling works is considered to be negligible.

5.8.2 Mitigation Measures

The following mitigation measures have been proposed to reduce or minimise impacts:

- In the event of unexpected spills of pollutants, the procedures detailed in the Emergency Response Plan will be instigated and the determining authority duly notified.
- Bunding will be constructed on the down slope side of the site. This will intercept any potential pollution wash from the site. If deemed necessary, bunding on the upslope will reduce the volume of surface water flows entering the site.
- In the event of a fuel spill or similar event presenting potential environmental harm, spill kit materials will be used and additional emergency bunding will be constructed (at the point of the spill) with stockpiled spoil from the drill sumps.
- All chemicals on the site will be stored in sealed containers or on pallets, protected from weather and within a bunded area. When chemicals are being transported from storage areas, they will also be accompanied by appropriate spill kits.
- All chemical containers will be clearly labelled to identify their contents and their management requirements – including reference to any material safety data sheets (MSDS).
- MSDSs will be stored at an accessible fixed location for each chemical brought to site.
- Any hydrocarbons on site will be stored in sealed containers within the bunded area and any spill will be immediately treated with drysorb type materials. A spill control kit of suitable materials will be kept on site at all times.
- All drilling fluids will be contained within the primary fluid circulation system of the rig and drilling sumps and escape prevented by a secondary bund type containment system.
- If contaminated soils are encountered or suspected to have been encountered, works will cease and the Emergency Response Plan will be enacted.

- Any drilling spoil will be collected and stored within a bunded area adjacent to the drilling works. Once operations are complete at the drill location, the drilling spoil will either be buried or disposed off site at an appropriate waste emplacement facility.
- In the case where soils is to be removed from the site, it will be tested and classified prior to removal.
- To prevent the drill hole acting as a cross strata conduit for movement of water and soil in the substrata the drill hole will be capped with cement to return the drill location to its former state.

5.9 Waste Minimisation and Management

5.9.1 Impact Assessment

Both solid and liquid waste will be generated by the proposed works. Waste produced will include the following:

- Drilling spoil;
- Sewage from on site portable toilets;
- Excess water from the drill hole; and
- Incidental waste (paper, cardboard, plastic wrap).

The POEO Act makes it an offence to "*without lawful authority, wilfully or negligently dispose of waste in a manner which harms or is likely to harm the environment*". Accordingly, the requirement of the POEO Act will be adhered to during the drilling works.

Due to the minimal amount of waste produced and the composition, waste generated by the proposed works are unlikely to have a significant impact on the environment. Nevertheless, sound waste management practices are proposed as follows.

Drilling Fluids

All water produced during the exploration will be stored in lined drilling sumps. At this stage, the water quality and quantity are unknown and dependent on the drill hole position and substrata. During the drilling of the drill hole as a result of DII PEL condition (specified casing) no formation water is expected to be produced into the mud system.

All drilling fluids used will be water based and will be retained in lined sumps. The drilling sumps are fenced with temporary steel rail fencing panels to prevent native animals entering and to barrier these from personnel working on the site. It is anticipated that the municipal water supply will be used for all purposes on site. The salinity of the drilling fluid will be maintained at 4.5 to 5.0% Potassium

Chloride (KCl) and a pH of 7.0. Should this become excessively alkaline it will be neutralised. Acid conditions are not expected in drilling coal measure strata.

5.9.2 Mitigation Measures

The following mitigation measures have been proposed to reduce or minimise impacts:

- Wherever possible, excess soil will be reused onsite.
- All waste (excluding portable toilet waste and soil waste) generated will be stored in a suitable container, with a lid (to prevent pollutants from escaping and prevent access by vermin), and transported from the site when 80% full and/or at completion of works. Residential bins will not be used to dispose of any waste and all incidental waste generated at the site will be contained and disposed of appropriately offsite.
- Once operations are complete at the drill location, the drilling spoil will be dewatered, before being buried or disposed offsite at an appropriately licensed disposal facility.
- Asphalt/bitumen/concrete/liquid residues and absorbent materials (used to capture residues) will be disposed at an appropriately licensed waste facility.
- All waste generated as a result of the drilling works will be managed in accordance with DECCW *Waste Classification Guidelines.*
- The Waste Resource Management Hierarchy principles of the *Waste Avoidance and Resource Recovery Act* 2001 will be adhered to throughout works.
- Any spoil that is to remain onsite will be rehabilitated with vegetation to minimise any potential visual impacts and will be placed adjacent to the existing vegetated mounds at the site.
- In the event of any oil waste being generated onsite, this will be collected and transported to the nearest oil recycling facility.
- Transport of materials from site for re-use or disposal will be carried out using covered trucks where appropriate.
- Any woody weed vegetation will be separated, where practicable, and sent to an appropriate landfill for disposal.
- During the works, portable toilets will be provided onsite for the workers. Toilet waste will be removed by an appropriately licensed contractor.
- The drilling site will be left clean and free of weeds, debris and other rubbish at the end of works.

- Documents and records of the transport and fates of all materials removed from the site will be kept and submitted to the project manager as proof of correct disposal and for environmental auditing purposes.

5.10 Visual Amenity

5.10.1 Impact Assessment

The drill rig likely to be used for the drilling works has a 10m high mast. Given the surrounding mixed industrial and commercial land uses, the height of the surrounding vegetated mounds and buildings around the site, and the short duration of the drilling works (maximum 60 days), it is not expected that this will significantly affect the visual amenity of the area. Additionally, the excavation and drilling activities will be consistent with the existing land use as a waste storage and recycling facility and therefore the works are not expected to cause any significant impact to the visual amenity of the area.

Macquarie Energy seeks to operate on a 24 hour basis. The use of artificial lighting at the work site during the night may disturb residents in close proximity to the drilling area, in particular residents along Campbell Lane and Campbell Street as these are within 210m of the drill hole site. It is noted that this impact will only occur for the duration of the works (maximum 60 days) and that significant artificial lighting already exists in the area from other industrial and commercial activities.

5.10.2 Mitigation Measures

The following mitigation measures have been proposed to reduce or minimise impacts:

- Flood lights will be minimised at night to reduce light pollution. Necessary lighting will be focused on the worksite to avoid light spill into adjacent areas.
- All work equipment and materials will be contained within the designated boundaries of the work site.
- The spread of stockpiles, waste, and on site vehicle parking will be minimised.
- The work site will be restored as close to its original condition as soon as possible following completion of the proposed works.

5.11 Community Impact

5.11.1 Impact Assessment

The drill hole site will be accessed via one of two entrances to the Dial-A-Dump facility off Albert Street, Alexandria (Figure 2-3) and will include the arrival and departure of drilling contractors daily and the intermittent delivery of materials. The drilling contractor will have several heavy vehicles such as the drill rig and ancillary equipment. Most will remain at the drill site until the completion of drilling. Given the existing highly modified environment and the temporary nature of the works (traffic levels will return to normal conditions once the drilling is complete), traffic impacts are not considered to be significant.

Macquarie Energy will seek to enter into an Access and Compensation Agreement with the affected landowner. This agreement will cover access, compensation and rehabilitation of the land and will help to minimise any negative community impact.

As the activities will be undertaken on private property, access to community spaces, will remain unaffected by drilling operations.

Other than restriction of access to the immediate work site for safety purposes, there will be no significant curtailment to beneficial uses of the environment, either during or subsequent to the drilling.

5.11.2 Mitigation Measures

The following mitigation measures have been proposed to reduce or minimise impacts:

- Heavy vehicles and frequent traffic will use main roads where possible, bypassing roads close to residential areas. This will ensure minimal disturbance of the community by vehicle noise and exhaust emissions.
- Vehicles will be required to travel at low speed limits on private property to ensure traffic safety on access roads.
- Signage will be erected at the entrance to the drill site, illustrating the site safety requirements and the restricted nature of the site, along with a phone number for enquiries.

5.12 Bushfire Risk

5.12.1 Impact Assessment

Due to the urban nature of the area and that the site has been cleared of all vegetative matter, bushfire risk is not anticipated to be an issue.

5.12.2 Mitigation Measures

The following mitigation measures have been proposed:

- Fire fighting equipment is attached to all heavy plant, and spare extinguishers will be kept on site.
- In the unlikely event of a fire at the site, emergency procedures will be initiated as prescribed in the Emergency Management Plan of the drilling contractor.

5.13 Natural Resource Use

5.13.1 Impact Assessment

The only demand on natural resources will be a requirement for water for use in the drilling. It is estimated that a maximum of 200 kilolitres is required for the drilling. Water will be obtained from municipal water supplies and will be brought onto the site by tankers.

The project's modest electricity requirements will be obtained from an on site diesel generator.

5.13.2 Mitigation Measures

All site staff will use resources in a responsible manner.

5.14 Cumulative Environmental Effects

5.14.1 Impact Assessment

Due to the limited duration of the activities and the controls proposed by Macquarie Energy, no cumulative environmental impact is anticipated.

5.14.2 Mitigation Measures

No mitigation measures are proposed as a result of no anticipated cumulative impacts.

6 Rehabilitation Works

At the conclusion of the drilling works, complete environmental restoration of the site will be undertaken and no long-term environmental effects are envisaged. Specific rehabilitation steps that will be undertaken include:

- At such time as the borehole does not require further utilisation, it will be plugged with cement grout in accordance with requirements of the DII.
- As soon as practical, sumps will be de-watered and backfilled. Only firm drill cuttings, with near neutral pH, and hardened cement slurry residue will remain in sumps. Any cuttings remaining will be covered with at least one metre of imported soil or re-gravelled. Back filled sumps will be compacted and left mounded by 15% of their initial depth to provide for future settlement. Any surplus excavated material will be removed to an approved site.
- No rubbish will be buried within the proposed drill works area.
- All gravel pads will be removed from the drilling sites and the previous gravel layer will be re-instated
- The progress of rehabilitation will be monitored for six months after the completion of remediation works (or as needed). If at any time rehabilitation progress is deemed unsatisfactory, additional site rehabilitation works will be conducted.

7 Summary of Mitigation Measures

This section summarises the environmental management and mitigative measures proposed within this REF for each potential environmental impact.

Table 7-1 Summary of Mitigation Measures

Environmental Aspect	Mitigation Measures
Land Use	• Immediate notification to the Project Manager if any complaints are received to enable a fast response/resolution to the complainant. • Location and 'pegging-out' of all services in the vicinity of the works and noting these locations in the works plan prior to drilling- "dial 1100 before you dig". • All personnel will maintain a tidy appearance and exercise courtesy in any dealings with the public and/or Dial A Dump staff.
Soils	• Testing for ASS will be undertaken prior to project commencement and disturbance of any soils. If ASS are found then an ASS Management Plan will be developed and implemented. • Trucks and machinery will be checked for leaks on arrival to site and appropriate spill kits will be available at all times. • All refuelling activities will be undertaken off site, as far as practicable. • Sediment control devices will be installed parallel with the contours, immediately down slope of any areas where the existing ground surface will be disturbed. Additional control devices will be installed upslope of areas of disturbance where there is a probability of clean surface water flows flowing across the disturbed surfaces around the drill operations and exacerbating surface erosion or runoff quality. • Wherever possible, excavated soil and sediment accumulated in erosion and sediment control structures will be reused for site restoration unless contaminated or otherwise inappropriate for reuse. The sediment will be visually checked for reuse ability prior to site restoration. • Wheel washing will be used and sweeping of public roads will occur at completion of work each day and following rain events. • Vehicle and machinery movement will be confined to existing roads, pathways and work areas. • Vehicle access routes to and within the site(s) will be clearly defined. • All sediment and erosion control measures will be in place prior to any earth works commencing. • Sediment and erosion control measures will be routinely inspected and maintained to ensure they remain effective. • Erosion and Sediment control measures will be consistent with those specified in the NSW Government's 'Blue Book' (4th Edition, 2004) on erosion and sediment control.

Environmental Aspect	Mitigation Measures
	• Ground disturbance will be minimised. • The site stabilisation and restoration measures adopted will be monitored for effectiveness, and modified as required (See Section 6).
Hydrology	• A licence will be obtained from the NSW Office of Water (See Section 3.2.3). • Should the drill hole intersect with an alluvial aquifer, it will be solid cased to minimise any potential effect on other users of the groundwater and the environment. • Any contaminated waters will be contained in appropriately sized and lined sumps. • Sediment fences will be installed to prevent soil loss and runoff into any nearby water course. • All sumps will have an overflow capacity in case of heavy rain or flow from the bore hole. • All water brought to the drill site will be removed off site at the completion of works and disposed at a licensed facility. • A periodic "pumpout" of the sumps will occur as required to prevent any surcharge during wet weather events. • Any water stored on site will be stored in appropriately lined bunds. • All land disturbed during operations will be restored to the pre-operational state as soon as practicable. • A Water Management Plan will be drafted and implemented to the satisfaction of the DII. • All water contaminated by hydrocarbons or non-degradable additives other than potassium chloride (KCl), will be removed to a licenced disposal facility. • Trucks and machinery will be checked for leaks and appropriate spill kits will be available on site at all times. • All refuelling activities will be undertaken off site, as far as practicable. • All chemicals and fuels will be stored in suitable bunded areas away from drainage lines. The capacity of the bunded area will be at least 120% of the largest chemical container stored within the bunded area. • Temporary bunding will be installed around the work area to mitigate against potential chemical and drilling fluid spills and runoff. • Where possible, stockpiles will be placed away from kerbs and drainage lines.
Flora and Fauna	• All vehicle movements in and out of the drill site will be restricted to existing cleared and defined surfaces to minimise disturbance to the surrounding vegetated mounds. • Barriers will be erected around the open drill hole, surface pits and

Environmental Aspect	Mitigation Measures
	sumps to prevent fauna becoming trapped. • Materials, plant, equipment and stockpiles will be placed in designated controlled areas. • If any damage occurs to vegetation outside of the nominated work area, the Project Manager will be notified so that appropriate remediation strategies can be developed and implemented. • All vegetation damaged by works will be appropriately remediated with native vegetation. • Where possible, laydown areas and works will avoid planted areas.
Noise and Vibration	• Consultation with any potentially affected receivers will occur in advance of any site activity to determine the least sensitive hours and undertake noise generating activities during these hours as far as is reasonably practicable. • The noisiest activities will be conducted during least sensitive periods of the day as far as is reasonably practicable. • A journal of activities will be kept, so any complaints received can be checked against the type of activity that was being carried out. • Compression and exhaust braking will be kept to a minimum along access roads. • Site inductions will include material that raises workers awareness of noise and vibration issues. • Noise emitting machinery will be directed away from residential areas away from nearest residents where possible. • Muffling measures on machinery will be implemented where possible, including rubber matting between drill rod stacks to minimise handling noise, efficient silencers and any other means approved by industry. • Machinery will be switched off when not in use for periods of greater than 10 minutes.
Air Quality	• All vehicle exhaust systems will be properly maintained so that exhaust emissions comply with the Clean Air Regulations under the POEO Act. • Stabilisation and any necessary landscaping will be carried out as soon as possible after disturbance. • All work areas and stockpiles will be closely monitored for dust generation. • A water cart will be utilised for dust suppression as needed. • A safety imposed site speed limit of 7km/h will be imposed across the site which should further reduce the potential for vehicle related dust emissions. • Trucks transporting any rehabilitation material will be covered when entering and leaving the site. • Mud, sand and other debris will be removed from the wheels and bodies

Environmental Aspect	Mitigation Measures
	of vehicles and equipment prior to leaving the site and before entering public roads or sealed pavements. • Work vehicles/machinery/lights will not be left running or idling when not in use. • No matter of any kind will be burnt on site, except gas. • A flare pit will be installed prior to commencing drilling operations, and will be appropriately located and sized. Gas blow lines will be installed by the drilling contractor as part of the blow-out prevention (BOP) equipment so that gas is directed into the flare pit where an ignition source can safely burn/flare any gas that is intersected by drilling.
Heritage	• All workers will be briefed on the significance of the St Peters Brick Pit prior to commencement of any drilling works. • Pursuant to Section 146 of the Heritage Act 1977, if any collection of historical objects likely to be more than 50 years old is identified during work, their presence will be notified to City of Sydney Council heritage officers and the state Heritage Council. • Prior to drilling, an on site confirmatory survey will be held with a member or authorised representative of the Local Aboriginal Land Council to identify and confirm there are no sites of significance within close proximity to any of the drill sites. • If, in carrying out the drilling works, an item of potential historical significance is found, all work is to be ceased immediately and approval sought from the DECCW before continuing.
Chemicals, Hazardous Materials and Contaminated Lands	• In the event of unexpected spills of pollutants, the procedures detailed in the Emergency Response Plan will be instigated and the determining authority duly notified. • Bunding will be constructed on the down slope side of the site. This will intercept any potential pollution wash from the site. If deemed necessary, bunding on the upslope will reduce the volume of surface water flows entering the site. • In the event of a fuel spill or similar event presenting potential environmental harm, spill kit materials will be used and additional emergency bunding will be constructed (at the point of the spill) with stockpiled spoil from the drill sumps. • All chemicals on the site will be stored in sealed containers or on pallets, protected from weather and within a bunded area. When chemicals are being transported from storage areas, they will also be accompanied by appropriate spill kits. • All chemical containers will be clearly labelled to identify their contents and their management requirements – including reference to any material safety data sheets (MSDS). • MSDSs will be stored at an accessible fixed location for each chemical brought to site. • Any hydrocarbons on site will be stored in sealed containers within the bunded area and any spill will be immediately treated with drysorb type materials. A spill control kit of suitable materials will be kept on site at all times.

Environmental Aspect	Mitigation Measures
	• All drilling fluids will be contained within the primary fluid circulation system of the rig and drilling sumps and escape prevented by a secondary bund type containment system. • If contaminated soils are encountered or suspected to have been encountered, works will cease and the Emergency Response Plan will be enacted. • Any drilling spoil will be collected and stored within a bunded area adjacent to the drilling works. Once operations are complete at the drill location, the drilling spoil will either be buried or disposed off site at an appropriate waste emplacement facility. • In the case where soils is to be removed from the site, it will be tested and classified prior to removal. • To prevent the drill hole acting as a cross strata conduit for movement of water and soil in the substrata the drill hole will be capped with cement to return the drill location to its former state.
Waste Minimisation and Management	• Wherever possible, excess soil will be reused onsite. • All waste (excluding portable toilet waste and soil waste) generated will be stored in a suitable container, with a lid (to prevent pollutants from escaping and prevent access by vermin), and transported from the site when 80% full and/or at completion of works. Residential bins will not be used to dispose of any waste and all incidental waste generated at the site will be contained and disposed of appropriately offsite. • Once operations are complete at the drill location, the drilling spoil will be dewatered, before being buried or disposed offsite at an appropriately licensed disposal facility. • Asphalt/bitumen/concrete/liquid residues and absorbent materials (used to capture residues) will be disposed at an appropriately licensed waste facility. • All waste generated as a result of the drilling works will be managed in accordance with DECCW Waste Classification Guidelines. • The Waste Resource Management Hierarchy principles of the Waste Avoidance and Resource Recovery Act 2001 will be adhered to throughout works. • Any spoil that is to remain onsite will be rehabilitated with vegetation to minimise any potential visual impacts and will be placed adjacent to the existing vegetated mounds at the site. • In the event of any oil waste being generated onsite, this will be collected and transported to the nearest oil recycling facility. • Transport of materials from site for re-use or disposal will be carried out using covered trucks where appropriate. • Any woody weed vegetation will be separated, where practicable, and sent to an appropriate landfill for disposal. • During the works, portable toilets will be provided onsite for the workers. Toilet waste will be removed by an appropriately licensed contractor.

Environmental Aspect	Mitigation Measures
	• The drilling site will be left clean and free of weeds, debris and other rubbish at the end of works. • Documents and records of the transport and fates of all materials removed from the site will be kept and submitted to the project manager as proof of correct disposal and for environmental auditing purposes.
Visual Amenity	• Flood lights will be minimised at night to reduce light pollution. Necessary lighting will be focused on the worksite to avoid light spill into adjacent areas. • All work equipment and materials will be contained within the designated boundaries of the work site. • The spread of stockpiles, waste, and on site vehicle parking will be minimised. • The work site will be restored as close to its original condition as soon as possible following completion of the proposed works.
Community Impact	• Heavy vehicles and frequent traffic will use main roads where possible, bypassing roads close to residential areas. This will ensure minimal disturbance of the community by vehicle noise and exhaust emissions. • Vehicles will be required to travel at low speed limits on private property to ensure traffic safety on access roads. • Signage will be erected at the entrance to the drill site, illustrating the site safety requirements and the restricted nature of the site, along with a phone number for enquiries.
Bushfire Risk	• Fire fighting equipment is attached to all heavy plant, and spare extinguishers will be kept on site. • In the unlikely event of a fire at the site, emergency procedures will be initiated as prescribed in the Emergency Management Plan of the drilling contractor.
Natural Resource Use	• All site staff are to use resources responsibly

8 Summary of Impacts and Conclusions

The purpose of this REF is to assess potential environmental impacts arising from the drilling works to satisfy Macquarie Energy's duty under Section 111 of the EP&A Act and Clause 228 of the *Environmental Planning and Assessment Regulation* 2000.

This REF presents the knowledge of the environment and the potential impacts of the proposed drilling activities as they are known at this time. As a consequence of experience with previous exploration activities in the area and the willingness of both operator and contractors to minimise all environmental impacts, Macquarie Energy sees no major adverse impacts that might arise from the proposed activity.

8.1.1 Summary of Potential Impacts

There will be an impact on the immediate vicinity of the drill hole for the duration of the program (see Section 5). However, this will be both localised and temporary in nature.

Similar drill holes sunk elsewhere have been fully rehabilitated, and the precise location of many former drill holes is difficult (if not impossible) to detect. Such locations have not been permanently transformed in any environmentally adverse manner.

Except for the actual period of drilling, if all mitigation measures are implemented, it is expected that:

- Impact on the surrounding community will be minimal; and
- Impact to the surrounding environment will be localised and minor.

The following may occur during the installation of the drill hole, however, mitigation measures proposed in Section 5 will minimise/negate the impacts:

- Potential for aquifers to be intercepted mitigation measures such as casing, will be implemented to minimise impact (See Section 5.3.2); and
- Potential noise impacts for local residents (See Section 5.5).

8.1.2 Summary of Beneficial Effects

Drilling of the proposed drill hole is an essential step in contributing to the geological knowledge of PEL 463 and more importantly, evaluating the energy potential of the area. Discovery of hydrocarbon resources in this area has the potential to increase the State's reserves and revenue from gas and underpin future exploration or production in the region.

9 References

Bureau of Meteorology (BOM) (2009) *Climate Data Online, http://www.bom.gov.au/climate/averages*, accessed 13.10.09.

CSIRO (2009) *http://www.clw.csiro.au/acidsulfatesoils*, CSIRO accessed 27.07.2009.

Department of Environment, Climate Change and Water (DECCW) (2009) *http://maps.environment.nsw.gov.au/stateveg/default.htm*, NSW Government, accessed 30.07.09.

Department of Environment, Climate Change and Water (DECCW) (2009) *www.environment.gov.au*, NSW Government, accessed 30.07.09.

Department of Environment, Climate Change and Water (DECCW) (2008) *Waste Classification Guidelines*, NSW Government, April 2008.

Department of Environment, Climate Change and Water (DECCW) (2009) *http://www.environment.nsw.gov.au/warr/index.htm/data/cd_directory_syd.pdf*, NSW Government, accessed 30.07.09.

Department of Urban Affairs and Planning (DUAP) (1996) EIS Guidelines.

Encyclopedia Britannica (2010). *Petroleum production*. Encyclopædia Britannica Online: http://www.britannica.com/EBchecked/topic/1357080/petroleum-production Accessed 11.01.10

Landcom (2004) *Managing Urban Stormwater: Soils and Construction* (The Blue Book) NSW Government.

Natural Gas (2005) *Natural Gas and the Environment*, http://www.naturalgas.org/environment/naturalgas.asp accessed 11.01.10.

NSW Agriculture (2004) *Noxious and Environmental Weeds Control Handbook 2004–05,* NSW Government.

Office of Water (2009) *NSW Office of Water,* http://www.water.nsw.gov.au/, accessed 13.10.09

Appendix A

Threatened Species and EPBC Search Results

Australian Government
Department of the Environment, Water, Heritage and the Arts

Environmental Reporting Tool

You are here: Environment Home > ERIN > ERT

17 February 2010 19:48

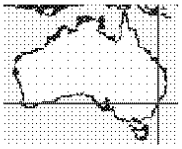
Database Report

This report includes places of national environmental significance that are registered in the Department of the Environment and Water Resources' databases, for the selected area. The information presented here has been provided by a range of groups across Australia, and the accuracy and resolution varies.

Search Type: Point

Buffer: 1 km

Coordinates: -33.91644,151.1814



Report Contents: Summary >> Details >> Caveat >> Acknowledgment

Biodiversity

Threatened Species:	13
Migratory Species:	14
Listed Marine Species:	13
Invasive Species:	17
Whales and Other Cetaceans:	None
Threatened Ecological Communities:	None

Heritage

World Heritage Properties:	None
Australian Heritage Sites:	2

Wetlands

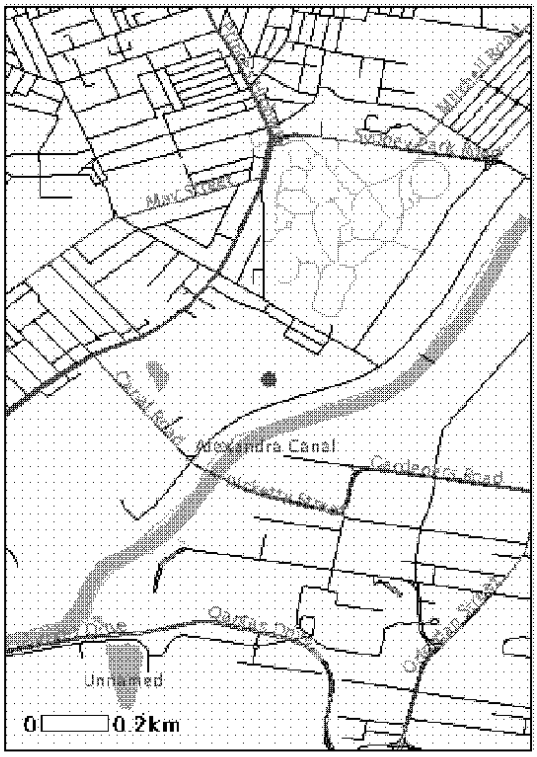
Ramsar sites: (Internationally important)	1
Nationally Important Wetlands:	None

National Pollutant Inventory

Reporting Facilities:	2
Airsheds:	1
Catchments:	1

Protected Areas

Reserves and Conservation Areas	None
Regional Forest Agreements:	None



Biodiversity

Threatened Species [Dataset Information]	Status	Comments
Birds		
Lathamus discolor Swift Parrot	Endangered	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Frogs		

Heleioporus australiacus Giant Burrowing Frog	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea Green and Golden Bell Frog	Vulnerable	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat may occur within area
Petrogale penicillata Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat may occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Hoplocephalus bungaroides Broad-headed Snake	Vulnerable	Species or species habitat likely to occur within area
Plants		
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Comments
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Neophema chrysogaster Orange-bellied Parrot	Migratory	Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Migratory Wetland Species		
Birds		
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area

Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Listed Marine Species [Dataset Information]	Status	Comments
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor Swift Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Listed - overfly marine area	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Neophema chrysogaster Orange-bellied Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area

Invasive Species [Dataset Information]	Status	Comments
Selected Invasive Species: Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.		
Mammals		
Capra hircus Goat	Feral	Species or species habitat may occur within area
Felis catus Cat, House Cat, Domestic Cat	Feral	Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit	Feral	Species or species habitat likely to occur within area
Sus scrofa Pig	Feral	Species or species habitat may occur within area
Vulpes vulpes Red Fox, Fox	Feral	Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed	WoNS	Species or species habitat may occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's	WoNS	Species or species habitat may occur within area

Smilax, Smilax Asparagus		
Chrysanthemoides monilifera Bitou Bush, Boneseed	WoNS	Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom	Invasive	Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage	WoNS	Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn	Invasive	Species or species habitat may occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ)	WoNS	Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine	Invasive	Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry	WoNS	Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtiji Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow	WoNS	Species or species habitat may occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed	WoNS	Species or species habitat may occur within area
Ulex europaeus Gorse, Furze	WoNS	Species or species habitat may occur within area

Heritage

Australian Heritage Sites [Dataset Information]
Note that not all Indigenous sites may be listed.

Historic

St Peters Anglican Church & Graveyard NSW

Natural

St Peters Brickpit Geological Site NSW

Wetlands

Wetlands of International Importance (Ramsar sites) [Dataset Information]

TOWRA POINT NATURE RESERVE	Within 10 km of Ramsar site

National Pollutant Inventory

Reporting Facility [Dataset Information]	Top Substance	Source
Substance emissions are ranked on a scale of 1-100: 1=lowest; 100=highest. Rankings are shown as: ◔=0-25; ◐=26-50; ◕=51-75; ●=76-100.		
Bitupave Limited (Boral Asphalt St Peters, St Peters NSW)	Carbon monoxide ◔ [Low]	Production of asphalt.
Pioneer Road Services Pty Ltd (Pioneer Road Services Alexandria, Alexandria NSW)	Polycyclic aromatic hydrocarbons (B[a]Peq) ◔ [Low]	Hot mix asphalt manufacturing.

Airshed [Dataset Information]	Substances	Sources
Greater Sydney Newcastle & Wollongong Regions (GMR), NSW	73	23

Catchment [Dataset Information]	Substances	Sources
Botany Bay, NSW	2	8

Caveat

The information presented here has been drawn from a range of sources, compiled for a variety of purposes. Details of the coverage of each dataset are included in the metadata [Dataset Information] links above.

Acknowledgment

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

- New South Wales National Parks and Wildlife Service
- Department of Sustainability and Environment, Victoria
- Department of Primary Industries, Water and Environment, Tasmania
- Department of Environment and Heritage, South Australia Planning SA
- Parks and Wildlife Commission of the Northern Territory
- Environmental Protection Agency, Queensland
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- Queensland Herbarium
- National Herbarium of NSW
- Royal Botanic Gardens and National Herbarium of Victoria
- Tasmanian Herbarium
- State Herbarium of South Australia
- Northern Territory Herbarium
- Western Australian Herbarium
- Australian National Herbarium, Atherton and Canberra
- University of New England
- Other groups and individuals

ANUCliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University was used extensively for the production of draft maps of species distribution. The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Search Results

Your selection: Fauna, threatened species, Selected Area - 151.01472,-33.91644,151.18140,-33.74972 returned a total of 1879 records of 38 species.

Report generated on 17/02/2010 - 20:07 (Data valid to 14/02/2010)

view map | search again | clear selection

Choose up to 3 species to map.

** Exotic (non-native) species*

Amphibia	Map	Scientific Name	Common Name	Legal Status	Count	Info
Hylidae						
	☐	Litoria aurea	Green and Golden Bell Frog	E1	773	
Myobatrachidae						
	☐	Pseudophryne australis	Red-crowned Toadlet	V	26	

Aves	Map	Scientific Name	Common Name	Legal Status	Count	Info
Accipitridae						
	☐	Hieraaetus morphnoides	Little Eagle	V	1	
	☐	Pandion haliaetus	Osprey	V	2	
Anatidae						
	☐	Nettapus coromandelianus	Cotton Pygmy-Goose	E1	4	
	☐	Stictonetta naevosa	Freckled Duck	V	1	
Ardeidae						
	☐	Botaurus poiciloptilus	Australasian Bittern	V	3	
	☐	Ixobrychus flavicollis	Black Bittern	V	2	
Burhinidae						
	☐	Burhinus grallarius	Bush Stone-curlew	E1	2	
Cacatuidae						
	☐	Callocephalon fimbriatum	Gang-gang Cockatoo	V	13	
	☐	Callocephalon fimbriatum	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	E2	13	
	☐	Calyptorhynchus lathami	Glossy Black-Cockatoo	V	1	
Charadriidae						
	☐	Charadrius leschenaultii	Greater Sand-plover	V	1	
Ciconiidae						
	☐	Ephippiorhynchus asiaticus	Black-necked Stork	E1	1	
Columbidae						
	☐	Ptilinopus superbus	Superb Fruit-Dove	V	7	
Haematopodidae						
	☐	Haematopus longirostris	Pied Oystercatcher	E1	1	
Laridae						
	☐	Sterna albifrons	Little Tern	E1	3	
Meliphagidae						
	☐	Xanthomyza phrygia	Regent Honeyeater	E1	8	
Neosittidae						
		Daphoenositta chrysoptera	Varied Sittella	V	1	

Psittacidae					
	Glossopsitta pusilla	Little Lorikeet	V	6	
	Lathamus discolor	Swift Parrot	E1	5	
	Neophema pulchella	Turquoise Parrot	V	1	
Scolopacidae					
	Calidris tenuirostris	Great Knot	V	1	
	Limicola falcinellus	Broad-billed Sandpiper	V	1	
	Limosa limosa	Black-tailed Godwit	V	7	
Strigidae					
	Ninox connivens	Barking Owl	V	4	
	Ninox strenua	Powerful Owl	V	53	
Tytonidae					
	Tyto capensis	Grass Owl	V	1	
	Tyto novaehollandiae	Masked Owl	V	1	

Mammalia	Map	Scientific Name	Common Name	Legal Status	Count	Info
Burramyidae						
		Cercartetus nanus	Eastern Pygmy-possum	V	1	
Dasyuridae						
		Dasyurus maculatus	Spotted-tailed Quoll	V	1	
		Dasyurus viverrinus	Eastern Quoll	E1	1	
Peramelidae						
		Perameles nasuta	Long-nosed Bandicoot population in inner western Sydney	E2	19	
Petauridae						
		Petaurus australis	Yellow-bellied Glider	V	1	
Pteropodidae						
		Pteropus poliocephalus	Grey-headed Flying-fox	V	898	
Vespertilionidae						
		Miniopterus australis	Little Bentwing-bat	V	1	
		Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	13	

Reptilia	Map	Scientific Name	Common Name	Legal Status	Count	Info
Varanidae						
		Varanus rosenbergi	Rosenberg's Goanna	V	1	

** Exotic (non-native) species*

Choose up to 3 species to map.

Search Results

Your selection: Flora, threatened species, Selected Area - 151.01472,-33.91644,151.18140,-33.74978 returned a total of 465 records of 37 species.

Report generated on 17/02/2010 - 20:13 (Data valid to 14/02/2010)

view map | search again | clear selection

Choose up to 3 species to map.

** Exotic (non-native) species*

Plants	Map	Scientific Name	Common Name	Legal Status	Count	Info
Campanulaceae						
	☐	Wahlenbergia multicaulis	Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	E2	41	
Convolvulaceae						
	☐	Wilsonia backhousei	Narrow-leafed Wilsonia	V	84	
Elaeocarpaceae						
	☐	Tetratheca glandulosa		V	9	
	☐	Tetratheca juncea	Black-eyed Susan	V	8	
Ericaceae						
	☐	Epacris purpurascens var. purpurascens		V	46	
Fabaceae (Faboideae)						
	☐	Dillwynia tenuifolia		V	1	
	☐	Pultenaea pedunculata	Matted Bush-pea	E1	1	
Fabaceae (Mimosoideae)						
	☐	Acacia bynoeana	Bynoe's Wattle	E1	3	
	☐	Acacia pubescens	Downy Wattle	V	105	
	☐	Acacia terminalis subsp. terminalis	Sunshine Wattle	E1	1	
Grammitidaceae						
	☐	Grammitis stenophylla	Narrow-leaf Finger Fern	E1	1	
Haloragaceae						
	☐	Haloragodendron lucasii		E1	4	
Hygrophoraceae						
	☐	Camarophyllopsis kearneyi		E1	1	
	☐	Hygrocybe anomala var. ianthinomarginata		V	1	
	☐	Hygrocybe aurantipes		V	1	
	☐	Hygrocybe austropratensis		E1	1	
	☐	Hygrocybe collucera		E1	1	
	☐	Hygrocybe griseoramosa		E1	1	
	☐	Hygrocybe lanecovensis		E1	1	
	☐	Hygrocybe reesiae		V	1	
	☐	Hygrocybe rubronivea		V	1	
Lamiaceae						

	Prostanthera marifolia	Seaforth Mintbush	E4A	3
Lobeliaceae				
	Hypsela sessiliflora		E1	1
Myrtaceae				
	Callistemon linearifolius	Netted Bottle Brush	V	6
	Darwinia biflora		V	51
	Eucalyptus camfieldii	Heart-leaved Stringybark	V	7
	Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	9
	Eucalyptus scoparia	Wallangarra White Gum	E1	1
	Leptospermum deanei		V	9
	Melaleuca deanei	Deane's Paperbark	V	19
	Syzygium paniculatum	Magenta Lilly Pilly	E1	7
Orchidaceae				
	Caladenia tessellata	Thick Lip Spider Orchid	E1	1
	Genoplesium baueri	Bauer's Midge Orchid	V	10
Poaceae				
	Deyeuxia appressa		E1	3
Proteaceae				
	Persoonia hirsuta	Hairy Geebung	E1	4
Rhamnaceae				
	Pomaderris prunifolia	P. prunifolia in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	E2	13
Thymelaeaceae				
	Pimelea curviflora var. curviflora		V	8

** Exotic (non-native) species*

Choose up to 3 species to map.

Appendix B

Heritage Listed Places

Aboriginal Heritage Information Unit
43 Bridge Street Hurstville NSW
PO Box 1967, Hurstville NSW 2220
Tel: (02) 95856345 Fax: (02) 95856094
ABN 30 841 387 271
www.environment.nsw.gov.au

Your reference : Lot 11 in DP 1013168
Our reference : AHIMS #28222

CH2M Hill Australia
PO Box 5392
Chatswood NSW 1515

Wednesday, 18 November 2009

Attention: Suzanne May

Dear Sir or Madam:

Re: AHIMS Search for the following area at Lot 11 in DP 1013168;Zone: 56;E: 331218 - 331947;N: 6245228 - 6245801

I am writing in response to your recent inquiry in respect to Aboriginal objects and Aboriginal places registered with the NSW Department of Environment, Climate Change and Water (DECCW) at the above location.

A search of the DECCW Aboriginal Heritage Information Management System (AHIMS) has shown that *0* Aboriginal objects and Aboriginal places are recorded in or near the above location. Please refer to the attached report for details.

The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not to be made available to the public.

The following qualifications apply to an AHIMS search:

- AHIMS only includes information on Aboriginal objects and Aboriginal places that have been provided to DECCW;
- Large areas of New South Wales have not been the subject of systematic survey or recording of Aboriginal history. These areas may contain Aboriginal objects and other heritage values which are not recorded on AHIMS;
- Recordings are provided from a variety of sources and may be variable in their accuracy. When an AHIMS search identifies Aboriginal objects in or near the area it is recommended that the exact location of the Aboriginal object be determined by re-location on the ground; and
- The criteria used to search AHIMS are derived from the information provided by the client and DECCW assumes that this information is accurate.

All Aboriginal places and Aboriginal objects are protected under the *National Parks and Wildlife Act 1974* (NPW Act) and it is an offence to destroy, damage or deface them without the prior consent of the DECCW Director-General. An Aboriginal object is considered to be known if:

- It is registered on AHIMS;
- It is known to the Aboriginal community; or
- It is located during an investigation of the area conducted for a development application.

If you considering undertaking a development activity in the area subject to the AHIMS search, DECCW would recommend that an Aboriginal Heritage Assessment be undertaken. You should consult with the relevant consent authority to determine the necessary assessment to accompany your development application.

Yours Sincerely

Gordon, David
Administrator
Aboriginal Heritage Information Unit
Information Systems and Assessment Section
Aboriginal Heritage Operation Branch
Culture and Heritage Division
Department and Environment, Climate Change and Water (DECCW)
Phone: 02 9585 6513
Fax: 02 9585 6094

List of Sites (Limited)

Lot 11 in DP 1013168

Grid Reference Type = AGD (Australian Geodetic Datum), Zone = 56, Easting From = 331218, Easting to = 331947, Northing From = 6245228, Northing to = 6245801, Requestor like 4238%, Service ID = 28222, Feature Search Type = AHIMS Features

Site ID	Access Restrictions		Further Info Contact Id	Report ID	Validity Status
	Gender	General Location			

No Site Recorded

- methane vented to the atmosphere during well construction
- huge amount of toxic water to be disposed of
- methane potentially leaking from surrounding ground areas
- toxic chemicals injected into underground
- poisoning of artesian water table
- risk of making bore water flammable with methane
- risk of cancer to nearby residents due to toxic groundwater & evaporation ponds
- large numbers of close-spaced wells, interconnected by gas pipelines, rendering farmland unusable

In NSW, the regulatory processes and environmental impact assessments which are applied to all other construction have not been properly applied to CSG exploration and mining, and the NSW government has ignored the documented problems caused by CSG mining in USA.

CSG extraction

Coal seam gas (CSG) is found in coal seams where the porous coal is impregnated with methane gas.
In conventional coal mining, this methane poses a danger of fires and explosions to the miners, and is usually vented away.

In CSG extraction, the methane gas is deliberately extracted for use in town gas supplies and power generation plants.
CSG extraction is usually applied when the coal seam is too deep underground to be economically mined for the coal itself.

Unlike natural gas deposits associated with oil wells, the gas does not occur in large resevoirs where it can simply be collected in large quantities from a single drill well.

CSG is found dispersed throughout the entire coal seam where it permeates microscopic cracks and fissures in the porous coal, (technically the methane is "adsorbed" to the coal). Due to the immense pressures underground, the methane is effectively in a liquid form, and is held in place by the pressure of existing groundwater in the coal seam aquifer.

To extract the CSG, a well is drilled to the coal seam, typically from 250m to 1000m deep.

Then the existing groundwater is pumped out, so as to release the pressure on the methane,
allowing it to return to gaseous form. This step alone involves pumping out vast quantities of existing groundwater,
which already contains a mixture of hydrocarbons from the coal seam, and must be somehow purified before disposal.

However because the CSG is dispersed widely throughout the coal seam, most of it would remain attached to the surface of the coal unless further action is taken. Typically CSG mining uses "hydraulic fracturing" to deliberately cause fracturing of the coal seam, so as to increase the surface area of the fissures in the coal, and to allow much higher yield of methane to be produced.

This hydraulic fracturing ("fraccing") involves pumping hundreds of thousands of litres of fresh water into the coal seam, at very high pressures, to deliberately cause underground cracking in the coal seam. Typically a mix of toxic chemicals are added to this water to improve the results of the fraccing & increase the methane extraction. All this additional water has to then be pumped out of the ground, as well as the pre-existing groundwater, but now the disposal problem has the added issue that the water now contains toxic chemicals.

Unlike natural gas & oil wells, a CSG well can only collect the low pressure methane gas from a short distance near the well.
This means that CSG production sites use large numbers of wells, about 500m apart, with all the wells connected
by pipelines to a processing plant which compresses the gas so it can be fed into the main gas supply.
In Sydney, the CSG project at Camden already has over 70 CSG wells, with another 70 planned.
In Queensland, the existing CSG projects in the Surat basin are planned to reach 40,000 CSG wells when fully operating.

CSG in Camden – the NSW Government assessment critiqued

The risks of CSG are evidenced by NSW Government's own documents as set out below. The NSW Government has known – and dismissed – the risks as far back as 2004 when assessing the Camden CSG project which is ongoing and in fact will be expanded to Narellan. Camden is on the outskirts of the Sydney metro area and was the initial area for CSG.

The cavalier attitude consistently shown by the NSW Government in assessing these risks is quite shocking as the NSW Government clearly puts profits before the health of voters and the environment they live in.

http://www.planning.nsw.gov.au/assessingdev/pdf/183-8-2004_final_assessment_report.pdf
www.planning.nsw.gov.au

In relation to **life of the Camden CSG project**, the NSW Dept of Planning states:

> "The EIS also reports that the total gas recovered from Stage I of the Project and from simulation work undertaken by the University of New South Wales, the resource within the entire Camden Gas Project area should generate economic flow rates for the next 21 years."

This is a clear admission that the Camden CSG mine will run out of gas literally in 2025, yet the damage done to the environment will be irreparable and permanent for many thousands of years.

In relation to **the method of extraction of CSG at Camden**, the 2004 report further states:

> "The EIS states that the potential gas resources within the Stage II Project may contain up to 106 PJ of energy within the Bulli Seam. In addition to this, the EIS states that these estimates do not consider methane located in other coal seams and sandstone reservoirs within the Project Area. For instance, Sydney Gas states that it has drilled into and fracced additional coal seams which further increases the potential recovery of methane."

This is a clear admission that CSG mining in NSW involves fraccing, despite the protestations of CSG companies such as Dart Energy, which claims it will not. Fraccing has proceeded in Camden without any public discussion prior to doing so.

> In relation to the **proposed buffer zone between CSG mines and other activities such as schools or farms**, the 2004 report further states:

"The Department has prepared a Guideline to provide direction to consent authorities considering future development applications in the vicinity of operating coal seam methane wells. This Guideline demonstrates that the appropriate separation distance for development from operating coal seam methane wells will range from 10 m – 25 m depending on the type of proposed use and age of the well), rather than 200 m which has been previously applied by local Councils. Therefore, the Department considers that the revised separation distances will provide appropriate separation of land uses (to minimise exposures to an unacceptable level of risk) whilst not compromising future development in the area. "

The Department Of Planning considers 200m is too big a buffer zone for a gas mine to be separated from schools or houses, even though this is a requirement in the Petroleum (Onshore) Act. There is no Act regulating CSG mining so the Department can do what it pleases, regardless of damage to the environment, the water table or the local population.

In relation to **noise**, the 2004 report states:

"The main noise source at the gas treatment plant will be from the compressors. The main noise sources during proposed activities at the gas wells will be machinery noise during site preparation, drilling and fraccing and site rehabilitation. Machinery noise will also occur during installation of the gas gathering system. The EIS concludes that noise impacts will be negligible and will comply with EPA Industrial Noise Policy criteria, based on distances and the transient nature of the noise."

The Department's assertion that noise is negligible is ludicrous. Overseas and interstate experience negates that assertion.

In relation to **air quality**, the 2004 report states:

"The Applicant has assessed the potential air quality impacts of the proposal, including predictive modelling, in the EIS. The EIS states that the predominant air emissions during the construction, operation and decommissioning phases of the project are nitrogen dioxide, total suspended particulates (TSP), PM10, odour, ethyl mercaptan and carbon monoxide."

This is simply incredible that the Department considers these are negligible problems. Toxic emissions are of concern to residents who live in the area. Winds that disperse such chemicals do not choose where to disperse them or who will inhale them.

In relation to **water quality,** the 2004 report states:

> "The Applicant states that the wells are being drilled to recover natural gas and not water and therefore there are no potential impacts on current groundwater users. The EIS states that the Hawkesbury Sandstone aquifers provide good quality groundwater resources however this unit is separated from the Illawarra Coal Measures by the Narrabeen Group, which is a low permeability strata and therefore Proposed Camden Gas Project Stage 2 – Coal Seam Methane Extraction NSW Department of Infrastructure, Planning and Natural Resources 65 January 2004 forms a hydraulic barrier. Further, the EIS notes that the presence of this barrier causes the coal seam methane extraction to yield such little water. Additionally, the coal measures have an inherently low horizontal permeability. Therefore, the Applicant considers that there is a negligible risk that the proposal could impact on the groundwater resources of the Hawkesbury Sandstone aquifers (as there is no pathway connecting the Illawarra Coal Measures). All gas wells will be cased and cemented in accordance with DMR requirements and therefore all aquifers within the geological section will remain isolated and cross-contamination of groundwater will not occur. "

It is ludicrous to claim that any kind of sandstone is impermeable, as the permeability of sedimentary rock is well established. Even the miners admit that they will be producing large volumes of waste water. This statement can only be considered as deliberate misinformation in view of what was known at the time. Since 2004, the damaging effects on the water table have been well documented world wide.

Further in relation to **water,** the 2004 report states:

> "The Applicant provided further information to clarify each water stream, its volume and proposed management of the water.

The Applicant noted that there will be three primary sources of water from the proposal as follows:
• Groundwater from the gas wells drilled into the coal seam;
• Condensed water from the extracted gas, collected in water traps within the gas gathering system; and
• Condensed water from the gas dehydration unit at the Treatment Plant."

And this is what CSG miners do with the water that mysteriously does not come from the underground aquifers but from some unknown source. Waste water also comes from the fraccing itself as this is what is used to force the rocks apart.

Finally, the Department is forced to admit that **waste water has no practical uses for dust suppression or irrigation.**

"The Applicant also provided information confirming that it no longer intends to use wastewater for dust suppression or irrigation as previously stated in the EIS. This issue was raised by NSW Agriculture, the Department (Natural Resources) and some community members. Rather than using the water from the gas wells for dust suppression, the Applicant has now committed to transfer this water to the Gas Treatment Plant evaporation dam where it will be mixed with Treatment Plant water and will either evaporate or be disposed off-site by Thiess Environmental Services. Water collected in water traps associated with the drilling and production of a gas well will also be handled in the same manner as described for water make from the gas wells. "

CSG is not a clean fuel

Proponents of CSG claim that since CSG is almost pure methane, (the same thing as our existing natural gas supplies), that it is a clean fuel, which burns with minimal pollution byproducts, and they promote it as a "green fuel". CSG extraction is commercially attractive to the gas companies because it is cheaper to drill a hole to extract gas from up to a kilometre underground, than it is to dig a coal mine to that depth.

However, this conveniently overlooks the fact that even if there were no environmental risks at all, CSG would still in fact be just another fossil fuel, like oil or coal.

Looking at the whole picture reveals significant errors – even misinformation - in the industry view. During the drilling and extraction process, a certain amount of methane is often released to the atmosphere accidentally, before the well head is sealed off. This adds to the greenhouse gases and contributes to global warming. The vast quantities of muddy dirty water containing toxic chemicals must be purified or disposed of somehow. Purification techniques e.g. reverse osmosis, are very expensive and consume large amounts of power themselves. Evaporation ponds risk polluting local rivers with toxic chemicals, as we have just seen across the entire Surat Basin in the 2011 Queensland flooding. The fraccing operation itself involves large numbers of pumping trucks and water tanker trucks and high noise levels for extended periods.

Fraccing in the USA - disasters

Experience in USA has shown that in many cases the well heads are not sealed properly and continue to leak flammable methane, and that there are numerous cases where due to mistakes in the fraccing process, methane gas now leaks from farmers fields, rendering them useless for stock or crop production. There are many documented cases in the USA where the CSG drilling and fraccing operations have breached natural rock barriers separating the artesian water aquifer (bore water) from the coal seam deeper down. This has led to bore water becoming saturated with methane leaking from the CSG operation, leading to several towns being able to set fire to their tap water. (See "Gaslands" film). The toxic chemicals injected during fraccing can leak into bore water, or be sprayed into the atmosphere with the evaporation ponds water, and have been linked with increased cancer rates in nearby towns.

CSG miners' misinformation debunked

In particular, the Q and A points below highlight the misinformation perpetrated by the CSG industry now in 2011.

Q) The gas companies say that the Gas Wells don't leak
A) The Gas wells do leak. QLD Government have tested many wells

http://www.dme.qld.gov.au/zone_files/petroleum_pdf/tara_leaking_well_investigation_report.pdf and found many of them leaking - however they only report leaking wells against a standard known as LEL. LEL is shorthand for the 'Lower Explosive Limit', or point at which methane becomes explosive.

Q) The industry (incl. gas companies and the govt) promote CSG as clean and green.
A) The Coal Seam industry publicly admits to two major environmental concerns, possible subsidence after water is extracted, and what to do with the toxic water once extracted.http://www.abc.net.au/catalyst/stories/2721216.htm. We believe that there may be a few more.

Q) "The industry (incl. gas companies and the govt) promote CSG as clean and green."
A) "A complete consideration of all emissions from using natural gas seems likely to make natural gas far less attractive than other fossil fuels in terms of the consequences for global warming."
http://cce.cornell.edu/EnergyClimateChange/NaturalGasDev/Documents/PDFs/GHG%20emissions%20from%20Marcellus%20Shale%20--%20April%201%202010%20draft.pdf

Q) Won't extracting Coal Seam Gas make energy generation cheaper for me, and provide Australians with cheap gas for years to come?
A) No! The Australian Industry Group expects to install infrastructure to export our gas overseas. Other countries get our gas, the international mining conglomerates get all the money - we get left with a permanently damaged environment. http://www.smh.com.au/business/energy-prices-set-to-climb-20110220-1b10e.html

US resources:

Report by the US group Food & Water Watch.

http://documents.foodandwaterwatch.org/frackingReport.pdf

The SEAB Shale Gas Production Subcommittee
Ninety-Day Report–August 11, 2011

http://www.shalegas.energy.gov/resources/081111_90_day_report.pdf

Here is an extensive and well referenced report which outlines the known problems with fracking and call for a moratorium in the USA

http://www.desmogblog.com/fracking-the-future/