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MINERAL RESOURCES OF THE MENANGLE PARK DEVELOPMENT SITE – REVIEW

Prepared for:

Landcom and

Campbelltown City Council

Job Reference: 201185

Date:25/1/2010

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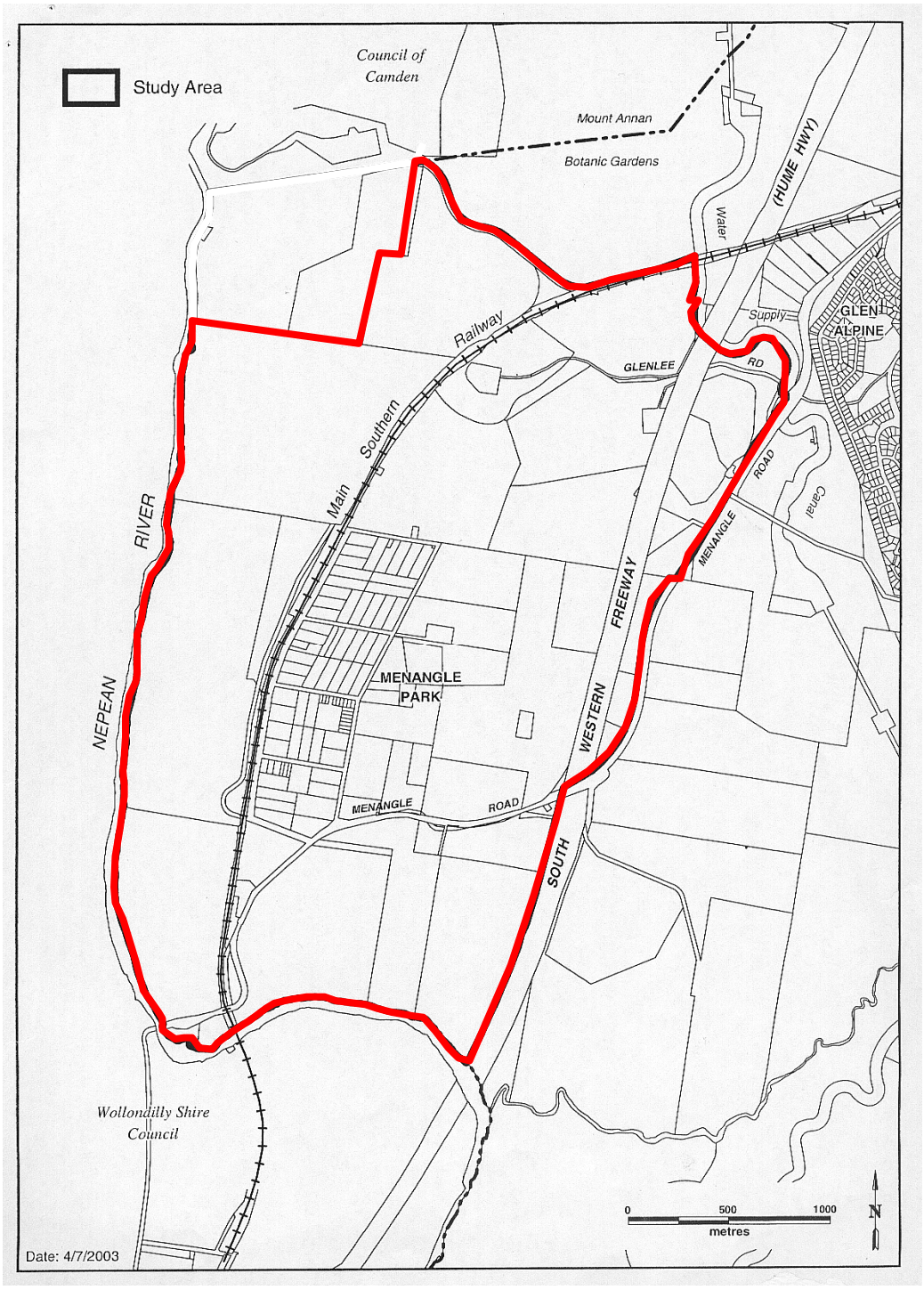

Figure 1.1

Menangle Park Development Site

Project Location

Landcom and Campbelltown City Council

HARVEST SCIENTIFIC SERVICES

MINERAL RESOURCES OF THE MENANGLE PARK DEVELOPMENT SITE - REVIEW

1.0 INTRODUCTION

This report is an update of an assessment completed by this Firm (Harvest Scientific Services, 2004) for APP Corporation Pty Ltd acting on behalf of Landcom and Campbelltown City Council in 2004. The purpose of the assessment was to review and report upon the status of "mineral resources" located within the Menangle Park Development Site (MPDS) (see Figure 1) and to assess the extent of these resources, determine likely environmental impacts in the event of extraction or development and provide an outline of environmental controls which would minimise the impact of such extraction on the residential development potential of the site. "Minerals" in the context of this assessment refers to:

- Sand and soil deposits;
- Coal deposits; and
- Coal Bed Methane (CBM).

For the benefit of this update, a review of Geothermal "minerals" has also be undertaken. The scope of the assessment was to include:

- A review of relevant resource studies completed to date:
- Consultation with relevant agencies to obtain up to date resource data and plans for development;
- Production of a plan delineating extractable mineral resources;
- Providing an overview of environmental impacts to any urban development arising from resource extraction activities;
- Produce a phasing plan indicating staging and/or timing of extraction activities and its relationship with future urban release areas;
- Participate in the planning process;
- Prepare a mineral resource management strategy; and
- Prepare a technical report reviewing the above issues.

This report now seeks to update the original 2004 assessment. Readers are advised that this report should be read in conjunction with the 2004 report as certain sections of the original report have been deleted or shortened in the interests of providing a more concise update. It should be noted that this report draws significantly on new or updated information detailed in an Environmental Impact Statement submitted to Campbelltown City Council regarding the extraction and processing of sand and soil deposits of the Western Deposit (Harvest Scientific Services, 2009).

2 SAND AND SOIL RESOURCES

2.1 Overview

The MPDS contains sand and soil deposits which have varying potential for development. In the northern part of the MPDS, two separate sand and soil deposits (referred to as the Western Deposit and the Eastern Deposit respectively) are yet to be developed. To the south, natural continuations of the Western Deposit within the MPDS have now been mined out. However, to the south of the MPDS a portion of this resource is still being quarried and processed by Menangle Sand and Soil Pty Ltd (MSS).

In addition, the freehold owners of the land that encompasses the Eastern Deposit have indicated that development of these sand and soil deposits is unlikely to occur as the land is part of the Menangle park Urban Development Area (URA) and as such unable for extractive activities.

2.2 Geological Background

Sand and soil resources within the MPDS are associated with Tertiary and Quaternary age alluvial deposits and the location of these deposits is illustrated on Figure 2.1. The Tertiary deposits are high level alluviums, whereas the Quaternary deposits are more recently deposited quartz and lithic fluvial sand, silts and clays (NSW Department of Mineral Resources, 1985).

The Quaternary deposits are all located adjacent to the Nepean River and exclusively to the West of the Sydney-Melbourne Railway. For the purpose of this report, these deposits will be referred to as the Western Deposit. The bulk of the Tertiary deposits are located east of the Railway and will be referred to as the Eastern Deposit.

2.3 Delineation of the Western and Eastern Sand and Soil Deposits

2.3.1 Work completed By NSW Department of Mineral Resources

These sand and soil deposits were referred to in a number of State Government publications and are summarised below:

This area now almost extracted – subject to rehabilitation

Significant sand deposits in this area but excluded from current consent.

Approved extraction area (Menangle Sand and Soil Pty Ltd).

WESTERN DEPOSIT

EASTERN DEPOSIT

Sand too thin to extract in this area

100 year flood line

100 year flood line

Nepean River

Nepean River

HUME HIGHWAY

F5

F5

MELBOURNE TO SYDNEY RAILWAY LINE

LEGEND

Aerial extent of sand and soil deposits

Extracted sand and soil for the period ending 1/5/2004

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Outline of Sand and Soil Resources

Figure 2.1

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- An investigation was conducted in 1976 by the Department of Mineral Resources (Van Heeswyck A 1979). This investigation involved the completion of 36 auger holes within a valley area bounded by the Melbourne-Sydney Railway to the West, Menangle Road to the South and what is now the Hume Highway (Freeway) to the East (now referred to as the Eastern Deposit). The deposit is bounded by ridges to the north and south, with the elevation of the deposit increasing from 70 metres above sea level to approximately 105 metres at its south eastern extremity. The deposit was reported to consist of sand and loam and suitable for use in the construction industry as a concrete sand and mortar sand. Other parts of the deposit were also considered to be suitable for fill (ie formwork for residential footings and slabs, trenching fill for concrete pipes, etc). The deposits, which occur over a distance of 2 kilometres vary in depth between 0 and 9 metres, with the thickest part occupying a north-south trending valley fill in the centre of the deposit. Resources were then estimated to be in the order of 2.7 million tonnes, including land that was not owned by the Macarthur Development Board (MDB) at the time;

- A follow-up investigation of the above by the Department of Mineral Resources was conducted in 1981 (Ray, HN. 1981). This investigation modified the boundaries of the deposit, particularly in the area owned by the Macarthur Development Board. The maximum extractable sand and soil resource was defined at the time by:

  - A minimum extractable depth of 1 metre;
  - The finished level after extraction not being any lower than 1 metre above the 1 in 100 year maximum flood level; and
  - The site should be free draining and extraction batters should have a maximum slope of 1 in 10.

- Total maximum indicated reserves in the above area were revised at 2.7 million cubic metres (4.1 million tonnes assuming a conversion ratio of 1:1.5). Other options based on limited access due to existing residential areas, and other physical constraints limited the potential size of the resource to approximately 2.7 million tonnes.

Both of the above reports were referred to briefly in a Department of Mineral Resources publication, which assessed these deposits in the context of the wider Sydney Basin (Shirwin L and Holmes GG, 1986).

2.3.2 Work Completed by Other Parties

Clutha Limited

Clutha Limited investigated sand and soil resources of the Western Deposit (Longworth & McKenzie Pty Ltd, 1987). This entailed the excavation and investigation of 46 test pits. Maximum depths achieved were in the vicinity of 6 metres. A number of samples were submitted for laboratory analysis which indicated that the deposits were not strictly suited for use as mortars based on Australian Standards. However, blending with coarser sands may result in a more suitable product. The deposit was described as being composed of silt (topsoil) underlain by sand to silty sands which in turn were underlain by residual clay and shale.

Total resources identified by this work equate to 3.09 million cubic metres and includes interpreted depths in locations where the test pitting was unable to test the full soil profile.

Lalich & Assoicates

A review of the above resources was recently conducted by an independent consultant (Lalich and Associates, 1999)

This report focused on land use issues relating to the proposed extraction, and included a revised resource estimate for the deposit. This was considered warranted due to the poor correlation of DMR published reserves for the nearby (and similar) Springs Farm resources and actual sand recovered.

With respect to the Eastern Deposit, the revised estimate of total sand resources was reduced to 2.1 million tonnes, whereas the Western Deposit was estimated to contain 3.6 million tonnes.

Harvest Scientific Services

A review of both the Eastern and Western Deposits has been completed (Harvest Scientific Services, 2002, 2004 and 2009). Findings are summarized in the following sections:

Western Deposit-Scale of Deposit

Estimates of the size of the Western Deposit have been based on the above historical as well as recently acquired data. Initial estimates date back to 1987 and have been supplemented with further investigations, the most recent being carried out in 2009.

These estimates are based predominantly on test pitting, by hydraulic excavators and/or backhoe. Approximately 50 test pits have been conducted across the site to date.

The latest test pitting was carried out in December 2008 with the purpose of demonstrating the range of product types and the depth of the sand and soil in various locations across the site.

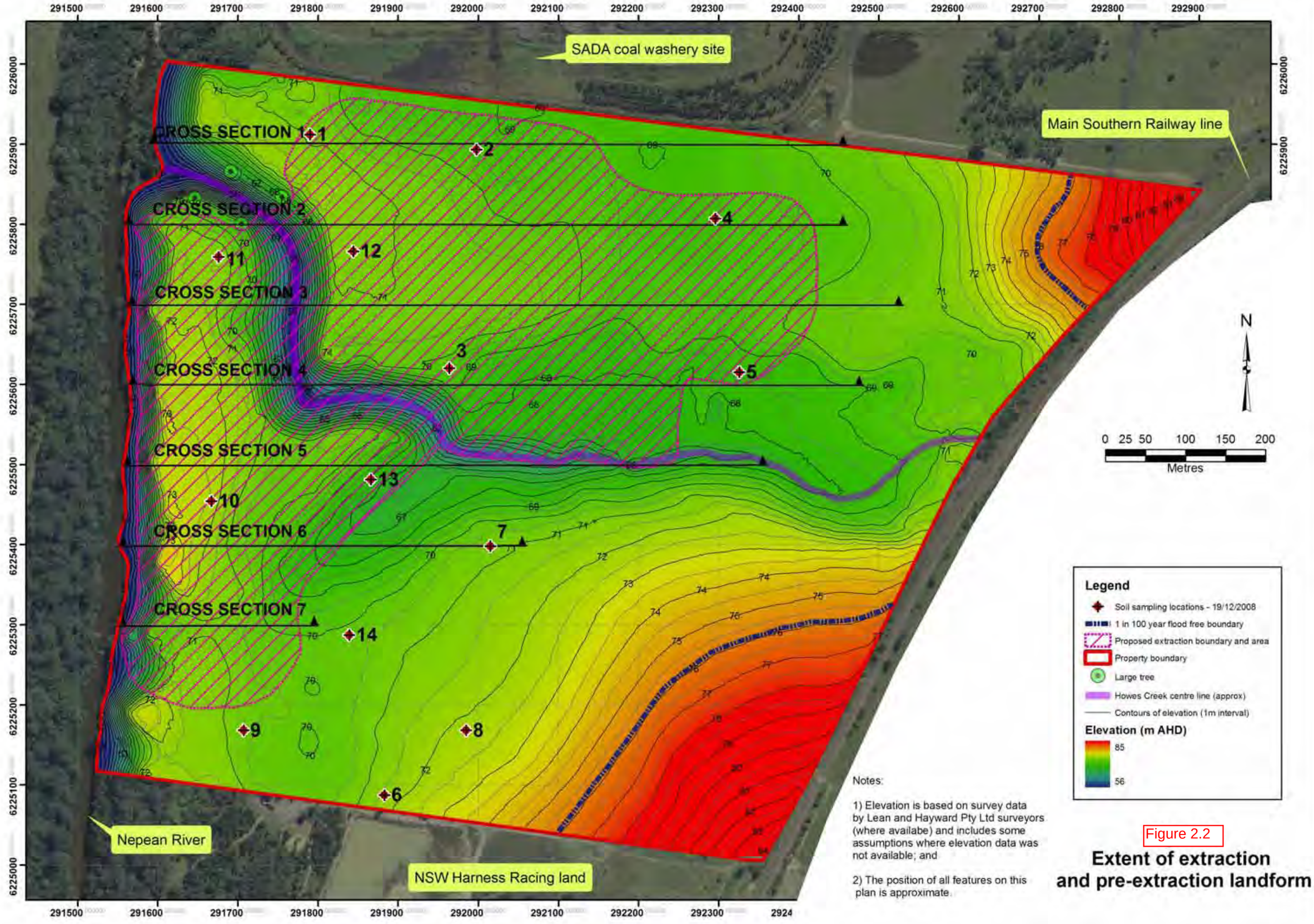
Because of potential environmental and planning constraints, the exact tonnage figure is difficult to determine. However, a working estimate of 2.4 million tonnes is considered reasonable and has been adopted for planning purposes. The adopted size of the deposit suggests that development of the deposit is economically justifiable.

Based on a distillation of the above information, an extractive area has been delineated which is illustrated in Figure 2.2. The main points to note about the Deposit include:

- It varies in thickness between 1 and 17m;
- It is thickest near the Nepean River and consequently this is the location were most of the extraction effort is likely to be focussed;
- It is primarily of a landscape quality soil with subordinate sand; and
- Quality, colour and density are variable across the site. This means that 2 extraction locations would need to be open at any one time in order to obtain materials to support the optimum mix of products suitable for the market.

Quality of Deposit

The quality of the Deposit is governed to a significant degree on the amount of clay and impurities found within the resource. In general terms, the clay and silt content is high throughout the Deposit and as such, it has limited application in the landscaping and construction industry without some form of improvement.



Notes:

1) Elevation is based on survey data by Lean and Hayward Pty Ltd surveyors (where availabe) and includes some assumptions where elevation data was not available; and

2) The position of all features on this plan is approximate.

Figure 2.2

Extent of extraction and pre-extraction landform

By blending portions of the Deposit with other organic and non-organic materials, the overall quality is enhanced to a point where a very marketable product can be produced.
Alternatively, should the Deposit be washed of its “fines”, sand type products can be generated which can result in a very valuable product suitable for the construction industry.

Economic parameters

There are a number of commercial and environmental factors which will determine the economic viability of developing the deposit. These include:

- Volume of the material available for extraction (after applying environmental and physical constraints);
- Quality of the material and the potential for enhancement by blending internally or with other imported materials;
- Capital and operating costs (these tend to be well known and understood by the extractive industry in general);
- Government (Local and State) and landowner levies; and
- Long-term demand for product.

Current knowledge about the Deposit together with an understanding of the current economic climate has generated sufficient interest amongst a number of commercial operators to suggest that an extraction project on this site is economically viable.

Eastern Deposit:

- The Eastern Deposit contains approximately 4.2 million tonnes in total and confirms the original DMR estimates;
- The thickest part of the deposit (sand depths in excess of 6 metres) is located within a north-west trending depression located towards the north-eastern margin of the deposit – this tend then turns towards the south-west; and
- The deposit is not likely to be mined as it falls within the Menangle Park Urban Development Area (URA).

Deposits previously identified as the Trotting Club and Campbelltown City resource and located within the MPDS are now exhausted and operations have been terminated. Rehabilitation activities are still being conducted to a certain extent but these too are being wound down. As a result, the Western Deposit is the last viable source of sand and soil within the MPDS.

2.4 Potential Extraction of the Western Deposit

2.4.1 Introduction

Since the initial review was completed (Harvest Scientific Services, 2004), a Development Application with an accompanying Environmental Impact Statement (EIS) has been lodged with Campbelltown City Council for the extraction and processing of sand and soil resources found within the Western Deposit. This application has been lodged on behalf of the property owner, Landcom (Harvest Scientific Services, 2009). A summary of the project together with a description of potential environmental impacts is outlined in the following sections and has been taken directly from the EIS.

The project is considered to be a Designated Development and is a permissible use within the existing land zoning, subject to consent. Campbelltown City Council is the consent authority.

2.4.2 Objectives

Landcom's objectives for the project are to:

- Access a valuable resource prior to it being potentially sterilized by other development activity;
- Continue the supply of sand and soil to the Macarthur region;
- Undertake extraction activities in an environmentally sensitive manner;
- Minimise the impact of the project on the local community;
- Stabilise and rehabilitate the Nepean River embankment;
- Rehabilitate Howes Creek; and
- Re-establish riparian corridors along the Nepean River and Howe's Creek.

2.4.3 Project description

The project is focused on a sand and soil deposit of approximately 2.9 million tonnes of which it is proposed to access around 2.4 million tonnes. It is anticipated that production of sand and soil will be up to 200,000 tonnes per annum, with a project life of 10-12 years.

Extraction and processing will entail a five step process whereby sand and soil is:

- 'Won' by excavator and/or front end loader;
- Processed by dry and/or wet methods;
- Blended, where necessary to produce a premium product with imported materials;
- Stockpiled ready for sale; and
- Sold by weight and transported off-site.

The project will initially entail the establishment of extraction infrastructure, which will include internal access roads, sediment basins, two water storage basins (terminal ponds) and the establishment of an Administrative and Blending Area (ABA). The ABA will include a weighbridge, portable office, ablution facilities, a power-screen and two (2) metre high earth mounds around it's perimeter to aid in noise attenuation and visual screening. Vegetative plantings will be established on the earth bund.

After the initial infrastructure phase is complete, extraction is to take place in two extraction pits within the project area. Two extraction pits are necessary as the properties of the deposit are substantially different on either side of Howes Creek and access to both deposit types is required to deliver appropriately blended products to the market.

To obtain a premium product and ensure that a wide range of products are available for the local market, blending of different sand and soil types will be required. Each pit is to have an active extraction and stockpiling area not exceeding one hectare. Processing will entail options for both dry and wet screening. In the latter case, tailings will be generated which will be dried and emplaced on-site as part of the rehabilitation of the site. Finally, all extracted areas are to be progressively rehabilitated as extraction moves across the site.

2.4.4 Statutory Planning

This project is subject to the development and assessment processes and requirements of Part 4 of the EP&A Act. Director General Requirements (DGRs) were issued on 19 October 2007, which included requirements issued by the Department of Environment and Climate Change (DECC) (now known as DECCW), the Department of Water and Energy (DWE), the Department of Primary Industries (DPI), the Roads and Traffic Authority (RTA) and Campbelltown City Council. Supplementary recommendations were also issued by DWE and DPI in 2009 as part of the consultation process with these regulatory authorities.

Licences and approvals that may be required for the sand and soil extraction and processing facility include:

- An Environmental Protection Licence (EPL) under the provisions of the Protection of the Environment Operations Act 1997 (POEO Act). The EPL is administered by the Department of Environment, Climate Change and Water (DECCW);
- A Controlled Activity Approval (CAA) under the Water Management Act 2000 (WMA Act) to drain groundwater. The CAA is administered by the Department of Water and Energy (DWE);
- A Controlled Activity Approval (CAA) under the Water Management Act 2000 (WMA Act) for works within 40m of the top of bank of waterfront land. The CAA would apply to works associated with Howes Creek and the bank of the Nepean River. The CAA is administered by the Department of Water and Energy (DWE);
- A Water Access Licence (WAL) may be required for the use and or re-use of surface waters collected onsite in storage dams (terminal ponds). It is noted that as these dams are to be installed for environmental purposes (i.e. sediment management) a WAL may not be required. This is subject to assessment by the Department of Water and Energy (DWE);
- A Water Access Licence (WAL) may be required for the use of groundwater onsite for dust suppression and process water;
- A variation to the existing permit (administered under Section 12 of the Water Act 1912) to extract waters from the Nepean River for the purpose of irrigation to include for the purpose of process waters and dust suppression;

- A licence under Section 123c of the Threatened Species Act 1995 for works within an Endangered Ecological Community (EEC). 123C licenses are administered by the Department of Environment, Climate Change and Water (DECCW);
- A permit under Part 7a of the Fisheries Management Act 1994 for works within a 'Key Fish Habitat'. Part 7a permits are administered by the Department of Primary Industries (DPI) (fisheries);
- An Aboriginal Heritage Impact Permit (AHIP) issued under Part 6 of the National Parks and Wildlife Act 1974 (NPW 1974) for an activity that is likely to impact on Aboriginal objects or places. AHIPs are administered by the Department of Environment, Climate Change and Water (DECCW);
- The Department of Primary Industries (DPI) Mine Safety Operations Branch will set compliance requirements under the Mine Inspections Act 1901.

2.4.5 Consultation

Consultation was undertaken with a number of stakeholders including residents in and around the township of Menangle Park and landholders located adjacent to the project site. Two public information nights were conducted with the view to providing the community with background information on the project, ascertaining community concerns relating to the project and advising attendees of the outcomes of a number of specialist studies.

The main concern expressed by some community members was the potential for airborne particles from the proposed operation to cause health impacts and the potential to exacerbate existing illnesses including bronchitis and asthma as a number of residents already suffered these conditions.

It was alleged by a number of residents that the township of Menangle Park contained a cancer cluster and it was claimed that cancer was caused by airborne dust from previous sand and soil extraction operations around the Menangle Park township. Potential causes of cancer were stated to include silicosis from fine airborne particles and potentially carcinogenic compounds that may be present as a result of possible soil contamination in previously extracted areas.

Other concerns raised by members of the local community included noise, traffic and the possible future expansion of the sand and soil extraction proposal to include land to the east of the Main Southern Railway.

2.4.6 Environmental Impact Assessment

In response to the DGRs, advice from the other regulatory authorities and community concerns, a number of specialist studies and assessments were undertaken to assess the impact of the proposed operations. A list of the specialist studies and the investigating organisations (in brackets) is presented below:

- Geomorphology (GHD)
- Soils, salinity, contamination and acid sulphate soil risk (Douglas Partners)
- Erosion and sediment controls (Harvest Scientific Services)
- Flooding (GHD)
- Groundwater (Harvest Scientific Services)
- Air quality (Parsons Brinckerhoff)
- Bushfire risk (Ecological Australia)
- Ecological impact assessment and vegetation management (GHD)
- Indigenous heritage (Jo McDonald Cultural Heritage)
- European heritage (Rappoport)
- Visual (Musecape)
- Noise (Parsons Brinckerhoff)
- Traffic and transport (Traffic & Transport Planning Associates)
- Silicosis assessment (Parsons Brinckerhoff)
- Environmental management (Harvest Scientific Services)

2.4.7 Geomorphology

A geomorphological assessment was undertaken to provide an understanding of the fluvial geomorphology of the watercourses on the site and to develop recommendations for the mitigation of any impacts.

The significant geomorphic features of the Nepean River and Howes Creek were described and the potential impact on these features was assessed. The description of these features and the assessment of impact were based upon a field inspection, laboratory analysis of soils, assessment of historic aerial photography and hydraulic modelling.

Bank instability and erosion that was attributed to post-European landscape disturbance was noted on the bank of the Nepean River and a number of existing head-cuts in Howes Creek were also noted.

Furthermore, Howes Creek was described as being divided into three zones, an upstream Discontinuous zone, a central Transitional zone and a downstream Entrenched zone. The morphology of each of these zones was described.

It was found that as a result of the proposed works the channel-floodplain connectivity would be improved, bank stability on the Nepean River would be improved and the project provides an opportunity to ameliorate head-cut progression and existing stability issues in Howes Creek.

A number of recommendations were made to mitigate, avoid and manage any potential impacts and improve the environmental outcomes for the project, which included incorporation of measures to stabilise head-cuts on Howes Creek. No adverse impact on geomorphic functioning and stability of the waterways is therefore anticipated.

2.4.8 Soils, salinity, contamination and acid sulphate soil risk

A salinity, preliminary contamination and acid sulphate soils risk assessment was undertaken for the project site.

There were no reported overt signs of salinity present at the site such as scalding, salt pans or an over abundance of salt tolerant species. A number of soil samples collected from the site were subjected to salinity testing. The results of this laboratory analysis indicated that soils are non-saline to slightly saline (0.2 – 3.7 dS/m) and pH was generally in a non-aggressive to mildly aggressive range (5.3 – 6.6). It was considered that there is generally a low potential for salinity impacts.

The contamination assessment identified several areas of environmental concern (AECs). These included the former Chinese market garden homes/shed, coal wash filling used in the gravel roads and in Howes Creek, the aeroclub, various items of anthropogenic debris along the tree line in the north western section of the site, an excavated area and retention basin in the north west corner of the site and a drainage pipe connecting the site and the coal washery to the north. A detailed description of these areas is provided in Table 5 of Appendix 4. It was recommended that these AECs be further assessed based on an appropriate contamination assessment prior to extraction.

No further action or investigation into the presence of acid sulphate soils is considered to be warranted unless signs of concern are noted during the soil extraction process.

2.4.9 Surface waters - Erosion and sediment controls

The operational measures that are to be adopted to protect the local and regional drainage regime from potential water quality impacts are outlined in an Erosion and Sediment Control Plan (ESCP) that has been prepared for the proposed works.

The principle design aspect of the ESCP is the prevention of 'clean' water in surface water sheet flows entering the active disturbance area and to control the discharge of surface water sheet flows from disturbed areas.

This will be achieved through the use of perimeter bunding (earth mounds), as well as the containment of 'dirty' water in sediment control structures within the active areas of the project to eliminate any uncontrolled runoff.

Potential water quality impacts were modelled by 'MUSIC' modelling software and it was demonstrated that implementation of the proposed ESCP will result in a 'Neutral or Beneficial Effect' (NorBE) on water quality in the Nepean River.

2.4.10 Flooding

With the exception of the north-east and south-eastern corners of the project site, the entire site is below the 1 in 100 flood contour.

To assess the potential flooding impacts of the proposal on the Nepean River and Howes Creek, the proposed post-extraction rehabilitated landform was modelled by the TUFLOW flood modelling software and Howes Creek by HECRAS flood modelling software. Simulations were undertaken for the 5-year, 20-year, and 100-year ARI events.

It was concluded that post-extraction and rehabilitation impacts are considered minor and provide an overall benefit by marginally lowering flood levels and providing more floodplain storage. Impacts can be effectively managed by a number of strategies.

Construction and operational phase impacts can be addressed by providing a flood evacuation plan for the site operations that includes monitoring to assess flood risk during operation, location of all plant and site equipment outside the 100-year ARI flood affected area if possible, placing stockpiles outside flood effected areas and undertaking all works in accordance with a site Erosion and Sediment Control Plan.

It was thus considered that the impact of flooding on the proposed operations can be effectively managed and that the resultant land form derived from the completion of the extraction will not have a detrimental impact on the local flooding regime.

2.4.11 Groundwater

Based on regional and site studies, the main site hydro-geological conditions were identified as follows:

- Shallow near-surface perched groundwater (<6m below ground level);
- Deeper sediment hosted groundwater (<20m below ground level);
- Shale hosted groundwater (20 – 80m below ground level); and
- Hawkesbury Sandstone hosted groundwater (<80 below ground level).

Some areas of shallow near-surface perched groundwater will be drained as part of the proposal. The other main potential impacts relate to possible contamination of shallow near-surface perched groundwater and deeper sediment hosted groundwater with seepage waters from the Administration and Blending Area (ABA).

Potential seepage from the ABA is to be managed by the maintenance of the 500mm thick clay base layer within the ABA area and ongoing monitoring for groundwater contamination. Other groundwater management recommendations include the provision of a 1m thick buffer to deeper sediment hosted groundwater during extraction operations and a 3m thick buffer post-extraction.

Provided the recommendations for groundwater management and monitoring outlined in this EIS are implemented no significant impacts on groundwater are anticipated.

2.4.12 Air quality

The potential impacts of the proposed operation on the local air quality were assessed in accordance with the guidelines presented in "Approved Methods and Guidelines for the Modelling of Air Pollutants in New South Wales and Technical Framework for the Assessment and Management of Odour from Stationary Sources in NSW".

Data for particulate matter less than or equal to 10 micrometres in aerodynamic diameter (PM_{10}) for 2006 was obtained from the Department of Environment and Climate Change and Water (DECCW) air quality monitoring station at Macarthur. Total suspended particulates less than or equal to 30 micrometres in aerodynamic diameter (TSP) and particles less than or equal to 2.5 micrometres in aerodynamic diameter ($PM_{2.5}$) were extrapolated from the available PM_{10} data. There were four exceedances of the PM_{10} DECC goal of 50 micrograms per cubic metre ($\mu g/m^3$) at the Macarthur air quality station in 2006. Dust deposition data was referenced from deposition monitoring undertaken on and adjacent to the site during 2002.

The report describes the potential for off-site air quality impacts from the proposed activities based on predictive air quality modelling. One year (2006) of continuous TAPM configured meteorological data for the project site and the CALPUFF dispersion model were used to predict impact levels for a number of selected pollutants (dust and odour).

Model predictions were reported for total suspended particulates (TSP), deposition, and particulate matter (PM_{10} and $PM_{2.5}$ fractions) and odour. Incremental and cumulative impact levels for both concentration and deposition profiles were determined at the nearest potentially affected sensitive receptors.

Annual TSP concentration levels were predicted to be within the 90 $\mu g/m^3$ cumulative goal and annual TSP deposition levels (monthly averages) were predicted as complying with the 4 g/m^2/month (30 days) goal.

Reported annual PM_{10} and $PM_{2.5}$ concentration levels are within their respective air quality goals of 30 $\mu g/m^3$ and 8 $\mu g/m^3$ at all sensitive receptors considered.

The 1st highest cumulative 24 hour PM_{10} level exceeded the 50 $\mu g/m^3$ goal at all locations modelled due to high background dust levels exceeding the 24hour goal for 4 days in the 2006 data set for Macarthur. All other cumulative impacts were below the adopted goal.

Incremental 24-hour $PM_{2.5}$ concentrations were below the 25 $\mu g/m^3$ 'advisory' goal at all receptors modelled. Cumulative impacts exceeded the 25 $\mu g/m^3$ on one day at all receptors for the 2006 data set. This exceedance was due to an elevated 24 hour average background PM_{10} level on 24 September 2006 from which the background $PM_{2.5}$ data was derived. Second highest cumulative impacts were below the 24 hour 'advisory' level.

In summary, it was demonstrated that if the recommended strategies for management of dust impacts are implemented then the relevant air quality goals could be achieved at all sensitive receptors.

2.4.13 Bushfire risk

A bushfire protection assessment for the proposed sand and soil extraction works was undertaken. It was concluded that the nature of the development and the large separation distance from bushfire prone vegetation provides an adequate bushfire protection and operational environment. The recommendations for the development include:

- A 10m asset protection zone around all assets to be contained within the subject land and managed in accordance with the specifications of appendix 5 of 'Planning for Bushfire Protection, 2006';

- Ember-proofing of the main site office as a precaution to provide safe refuge during fire;
- A dedicated static water supply and fire hose reels to be maintained for fire fighting purposes;
- Maintain at least two (2) access options in the proposed development to aid emergency access/egress where required;
- Provide access around all buildings and make exits available away from the bushfire hazard to the south; and
- Implementation of actions to minimise ignition sources.

2.4.14 Ecological impact assessment

A detailed assessment of the project site's flora, fauna and aquatic environment was undertaken. This entailed literature reviews and field surveys.

It was found that the natural environment at the site has been extensively modified by historic clearing and ongoing agricultural activities. Vegetation communities include intact patches of native forest and partially disturbed and regrowth woodland, derived native grass and sedgeland and entirely exotic vegetation. The most extensive and highest quality native vegetation remnants occur along the Nepean River as a relatively narrow linear band along the western edge of the site. The site contains the Ecologically Endangered Communities (EECs) River Flat Eucalypt Forest and Swamp Oak Floodplain Forest listed under the TSC Act. There is a local population of one threatened plant, Pomaderris Brunnea, in the study area as well as habitat for this species within the site.

A moderate abundance and diversity of native animals were observed during field surveys, including a number of regionally significant fauna species such as Common Wombat and Swamp Wallaby and two threatened fauna species: Grey-headed flying Fox and Eastern Freetail-bat both listed as Vulnerable under the NSW TSC Act. The site contains valuable habitat resources for native fauna including habitat trees, feed trees, wetlands and a regionally significant wildlife corridor along the eastern bank of the Nepean River.

The development will have impact on native biota and their habitats including direct removal of native vegetation within the proposed extraction area. Specific mitigation measures have been incorporated into the development design to minimise impacts on biota within the site and on the natural environment surrounding the site.

The mitigation of adverse effects arising from the development has been presented according to the hierarchy of avoidance, mitigation and offsetting of impacts. The majority of the development area falls within land which is extensively modified by historical disturbance and ongoing agricultural activities. The development would result in some short to medium impacts upon some elements of the natural environment. These impacts are not expected to impose a significant negative effect on any local populations of native biota, including threatened species, EECs and their habitats, which occur on the study site or in adjoining habitats based on the following considerations:

- The development is unlikely to injure or kill a significant proportion of any local populations, or otherwise interfere with the life cycle of any threatened biota such that a local population would be placed at risk of extinction;
- The development is unlikely to remove critical breeding, roosting or sheltering habitat for any threatened biota;
- A maximum of 3.26 ha of native woodland and forest would be cleared. Other habitat within the proposed extraction area is extensively degraded by grazing, weed invasion and earthworks;
- There is a total of approximately 770 ha of equivalent habitat in Riparian Forest and Alluvial Woodland in the locality and a total of approximately 4430 ha of native vegetation mapped as ‘core’ or ‘support to core’ habitat. In this context the areas of habitat to be removed and modified are likely to have little importance to the long-term survival of threatened native biota in the locality; and
- The post-extraction rehabilitation of the site would increase the overall extent and local quality of habitat for native biota.

2.4.15 Vegetation management

A Vegetation Management Plan (VMP) was prepared for the project site. The VMP provides guidance on the plant species, planting techniques, revegetation methods and maintenance requirements for the site. Implementation of the VMP will:

- Revegetate large areas of native vegetation associated with the riparian zones of both the Nepean River and Howes Creek;
- Improve the condition of areas of existing native vegetation, through bush regeneration;
- Improve vegetation cover and connectivity throughout the site and surrounds;

- Remove heavy weed infestations throughout Howes Creek and the eastern 'bank' of the Nepean River; and
- Improve water quality leaving the development site and entering the Nepean Catchment.

The VMP generally satisfies all applicable provisions required by the DGR's, DECCW and CCC without impacting on any of the other issues to be considered as part of the proposed development.

2.4.16 Indigenous heritage

A test excavation and archaeological assessment was performed to assess the likely impact of the proposed extraction activities on indigenous heritage.

A strategic management model for the Menangle Park Release Area indicates that areas of Zone 1 (High archaeological potential) should be considered as a conservation outcome. Part of the current study area was initially assessed as being Zone 1 – but low surface visibility (and poor exposure of potential deposits) meant that this could not be properly assessed without sub-surface excavation. A s87 AHIP (AHIMS #3137) was granted to undertake further work and a preliminary test excavation program was carried out in June 2009.

A total of 183 cultural lithics were recovered during the investigation. An area of interest was identified on sandy deposits on the south side of and within 200m of Howes Creek. This area was assessed as having good archaeological potential. The artefacts retrieved indicate apparent change over time in artefact types, raw materials and artefact size. Such changes may result from change in raw material procurement, flaking technology and tool production. Archaeological potential is diminished by the effects of repeated cultivation of the upper 20-30cm of the deposit, which has disturbed the most recent components of the assemblage. The remainder of the study area was assessed as having moderate and low archaeological potential.

A range of impacts associated with this extraction proposal have been identified. If the proposed soil extraction activities proceed, the proponent should seek an Aboriginal Heritage Impact Permit (AHIP) from the Director-General of DECCW NSW. This AHIP should be granted, conditional upon salvage of the area zoned as having good archaeological potential.

An area in the north-west of the subject land adjacent to the Nepean River has been identified as having cultural values. This area will not be impacted by the proposed soil extraction and should be managed as a conservation outcome.

Northern Access Option 1 is preferred over Northern Access Option 2 to prevent inadvertent damage to a previously identified site known as Glenlee 10. It is also noted that, through consultation, both the Cubbitch Barta and Tharawal local Aboriginal groups have expressed a preference for a conservation outcome as part of this project.

2.4.17 European heritage

A Heritage Impact Statement was prepared to assess European Heritage Impacts of the proposed development. Specifically, the assessment was based upon two built heritage items - one of which no longer exists. The two items are identified as Brien's Farm and House site and a cluster of remnant structures associated with Chinese Market Gardener's accommodation. The remains of both items were documented and archived.

It was concluded that the proposed sand and soil extraction works would not generate a negative impact on European Heritage.

2.4.18 Visual assessment

An assessment of the visual impacts of the operation on the surrounding community was undertaken.

With regard to short term impacts (i.e. during the extraction and rehabilitation periods of 10-12 years), it was concluded that perceptions by passers-by of the change in the local landscape due to the execution of the proposal will vary depending on their attitudes to extractive resource development. They may be aware that extraction operations are occurring on a site where none exist at the present time but for many people, particularly local residents, their perceptions with regard to visual impacts are likely to be moderated by the knowledge that there have been similar operations nearby (including on adjacent land to the south) for many years.

Negative impacts on visual and landscape amenity are likely to be greatest for the residents of the historic house 'Glenlee'. Whilst negative impacts for train travellers and visitors to Mount Annan Botanic Gardens are likely to be of short duration and attenuated by speed of travel and increased viewing distance respectively. Impacts on residents within the Menangle Park township are localised and will also be attenuated by an increased viewing distance and the proposed mitigation measures.

Long term (post extraction and rehabilitation) impacts are considered to be negligible as the extraction proposal proposes to return the main visual elements of the existing landscape by rehabilitation of riparian corridors associated with Howes Creek and the Nepean River with local providence vegetation and retaining open pasture/paddocks at locations that are currently open paddocks.

2.4.19 Noise and vibration assessment

A baseline noise survey was undertaken in the local environment. Attended (daytime) noise monitoring was carried out at the nearest potentially affected residential receivers to the project site. Measured attended and unattended noise levels were applied to the NSW Industrial Noise Policy (NSW EPA INP 2000) in determining project noise criteria at the nearest potentially affected receivers. Residential receiver daytime noise criteria of 39 dB(A) $L_{Aeq,15min}$ was adopted. Road traffic noise impacts were assessed with reference to the Environmental Criteria for Road Traffic Noise document. A day time $L_{Aeq,\ 1hr}$ base criteria of 60 dB(A) was established.

Modelling indicated that provided the recommended noise management and mitigation measures are implemented compliance with the adopted 39 dB(A) $L_{Aeq,\ 15min}$ operational noise goal is expected to be achieved at all nearest sensitive receiver locations throughout the project. Road traffic noise impacts were anticipated to be less than the adopted criteria.

2.4.20 Traffic and transport

The proposed development was assessed in the context of local and regional traffic constraints. Potential site access from the north via Springs Road or from the south via Menangle Road was considered. The assessment concluded that the volume of traffic generated by the proposed development is small in comparison to existing levels on Springs Road or Menangle Road. In the case of the Menangle Road access, it was recommended that the speed limit be reduced from 80km/h to 60km/h adjacent to the site access. In addition, site access is to be upgraded. Overall, no significant impacts were predicted.

2.4.21 Silicosis assessment

The potential for the generation of health threatening dust was specifically raised by the community as a major health and environmental concern. In response, a specific investigation was conducted focused on the potential generation of respirable crystalline silica which can cause silicosis, lung cancer and other lung damaging conditions.

A review of the proposed operations was undertaken as well as past and existing operations that are typically dust generators located within close proximity to Menangle village. In addition, a review of the causes of these lung conditions as well as the types of operations likely to cause emissions of respirable crystalline silica was assessed.

Whilst it was concluded that the proposed operations had the potential to generate dust, some of which may be in the form of respirable crystalline silica, the type and duration of the proposed operations were not considered to be likely to cause harmful long term effects. It was considered that the implementation of a dust management plan incorporating specific measurement of dust control and onsite monitoring are sufficient to manage the potential risks of silicosis.

2.4.22 Infrastructure, socio economic and planning assessments

The project site and its immediate surrounds were assessed according to potential demands on existing infrastructure and land ownership considerations together with its socio-economic setting. No significant issues were encountered in this regard. The project was assessed in the context of compliance with all applicable statutory plans, controls and acts. These covered relevant local government, Sate and Federal Government regulatory areas. It was considered that subject to granting of relevant operational licences the proposal will comply with the requirements of the applicable statutory plans, controls and acts.

2.4.23 Environmental management

On an operational level, an environmental risk and safety assessment was conducted on the various activities that are inherent to the proposed project. Furthermore, all aspects of the project are to be managed under the auspices of an Environmental Management Plan (EMP). This EMP and its periodic compliance auditing will form the basis for the projects compliance to all conditions of consent and provide all of the regulatory authorities with a reporting regime which will measure on a regular basis, the performance of the project against a number of environmental and community goals, standards and criteria. Furthermore, an Environmental Management Representative (EMR) is to be nominated for the duration of the project and a complaints phone number is to be provided and displayed at the entrance to the site. An EMR is to be available 24 hours a day for contact by telephone to address any complaints from residents that may arise from the facility.

2.4.24 Conclusion of Environmental Impact Assessment

It was concluded that the proposed extraction operation should be allowed to proceed because it will supply products that are beneficial to the community at large without having an adverse impact on the environment. Subject to the environmental controls discussed in this EIS, it has also been demonstrated that the proposal, will over time, enhance the biodiversity in and around the project area. At the same time, the proposal will support a viable business providing revenue and employment to the local community. At the time of writing, the DA was yet to be determined. A number of submissions have been received by Campbelltown City Council and these are being reviewed with the objective of providing appropriate responses to each of the issues raised.

3.0 COAL RESOURCES

3.1 Overview

High quality coal measures underlie the entire MPDS and indeed most of the Wollongong – Port Hacking 1:100,000 Geological Sheet (Shirwin, L and Holmes GG, 1986). This section describes the nature and extent of the deposits and considers the latest available information regarding their future development.

3.2 Technical Aspects

3.2.1 Geology

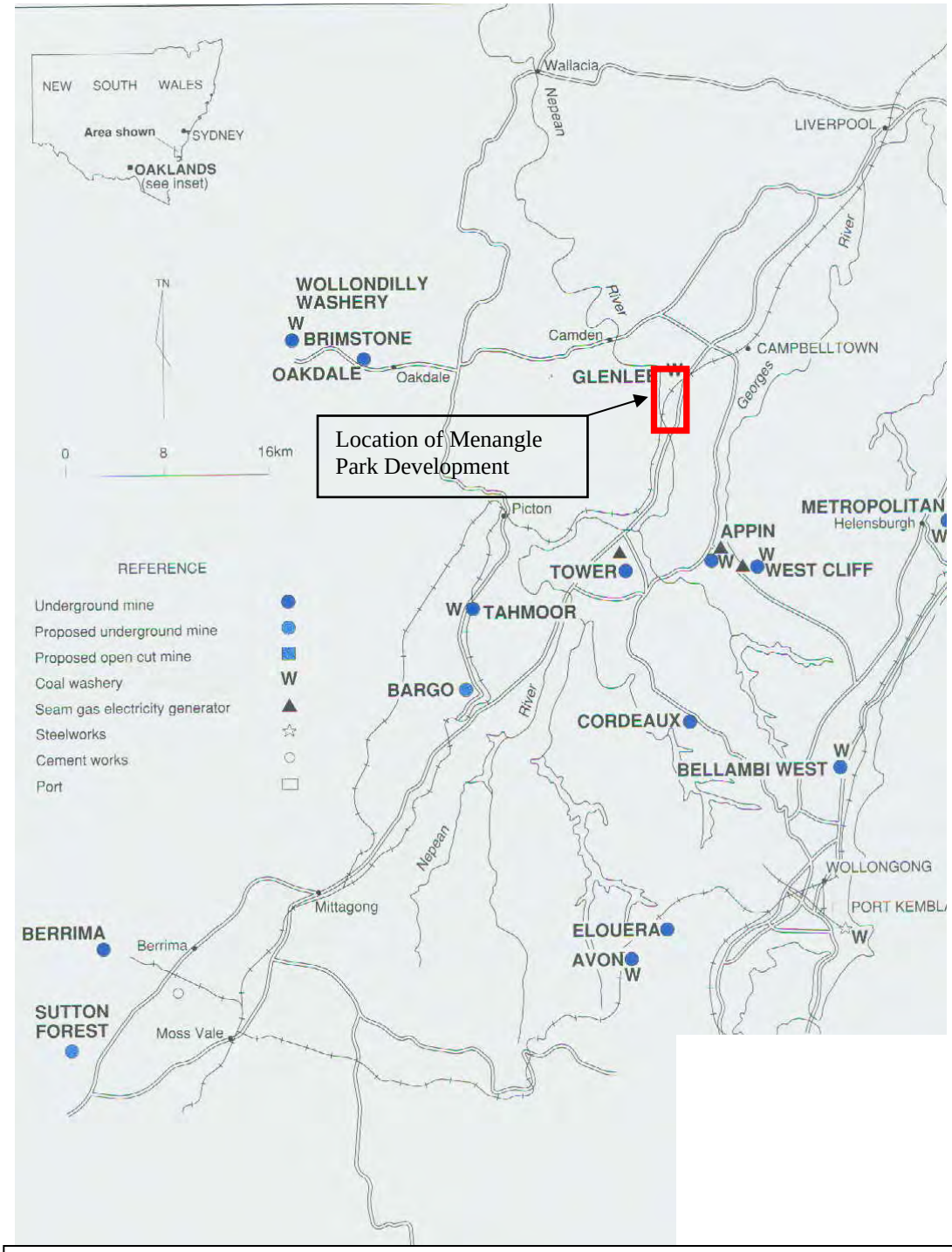
Several coal seams are located within the MPDS and include the Bulli, Balgownie, Wongawilli and Tongarra Seams. The MPDS is located in the northern portion of what is generally known as the Southern Coalfields (Figure 3.1). The location of the MPDS within the Southern Coalfields is further illustrated in Figure 3.2.

- The Bulli Seam is of economic thickness throughout most of the area and ranges in thickness from about 2.4 metres in the south to nearly 4.0 metres to the north west (Figure 3.3). Depth to the seam varies between 550 metres to 750 metres respectively (Armstrong, M. 2004).
- The Balgownie Seam is generally less than 1.0 metre thick within the MPDS area and as such, is uneconomic to mine.
- The Wongawilli Seam varies in thickness between 6 and 15 metres but typically includes numerous shale and clay bands. The Seam is mined extensively in the Wollongong region.
- The Tongarra seam occurs over a wide area but is of an economic thickness in only limited areas.

Only the Bulli Seam is likely to be mined within the MPDS.

3.2.2 Mining Technique

The underground mining technique likely to be used underneath the MPDS is known as Longwall Mining. The following descriptions and illustrations (Figures 3.4 and 3.5) have been reproduced from the Dendrobium Coal Project (Olsen Environmental Consulting, 2001).



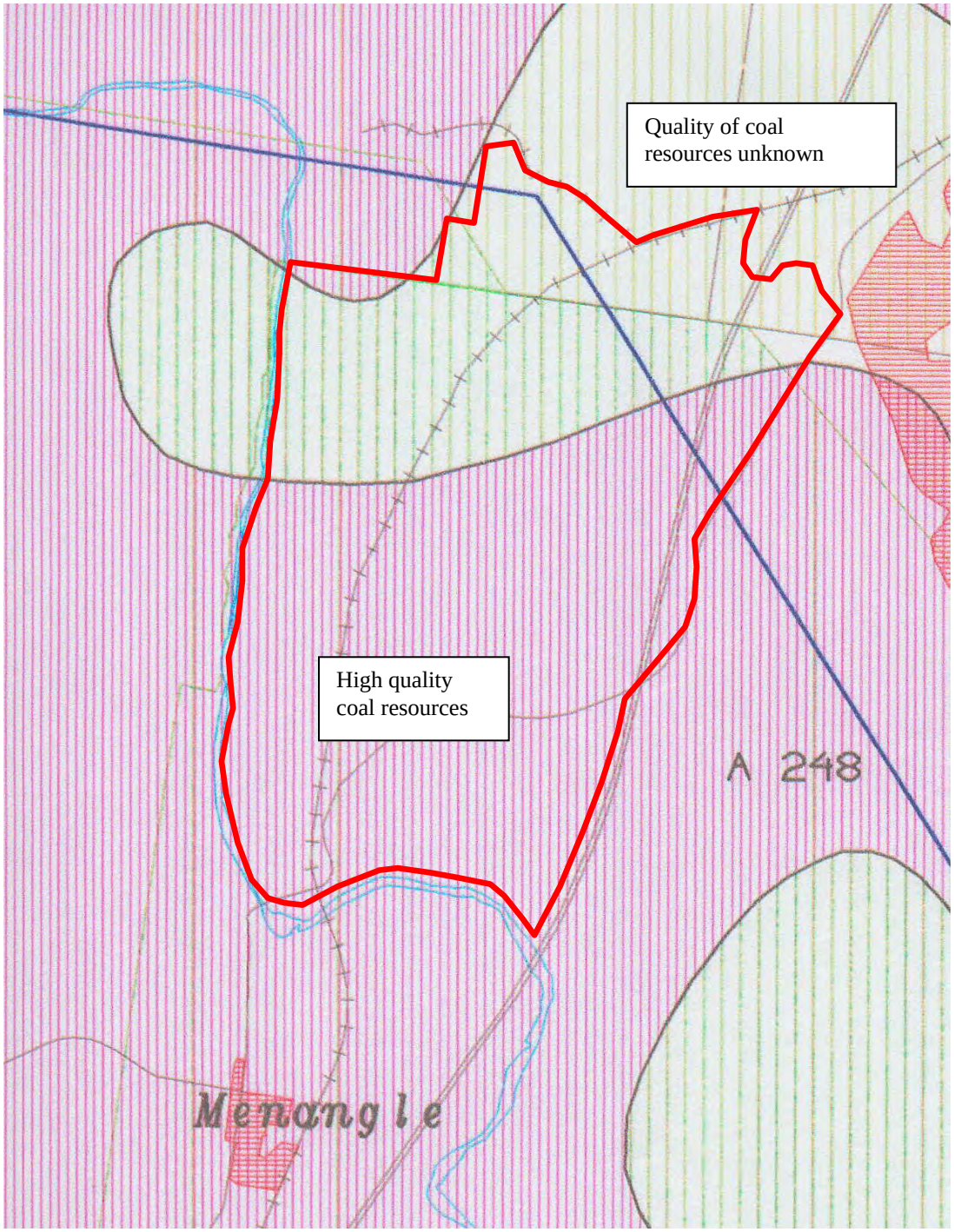
From: Department of Mineral Resources, 2003. Coal Industry Profile.

Figure 3.1

Menangle Park Development Site

Development Site in Relation to Southern Coalfields

Landcom and Campbelltown City Council



From: Department of Mineral Resources, 2003. Southern Coalfield Land Use Study.

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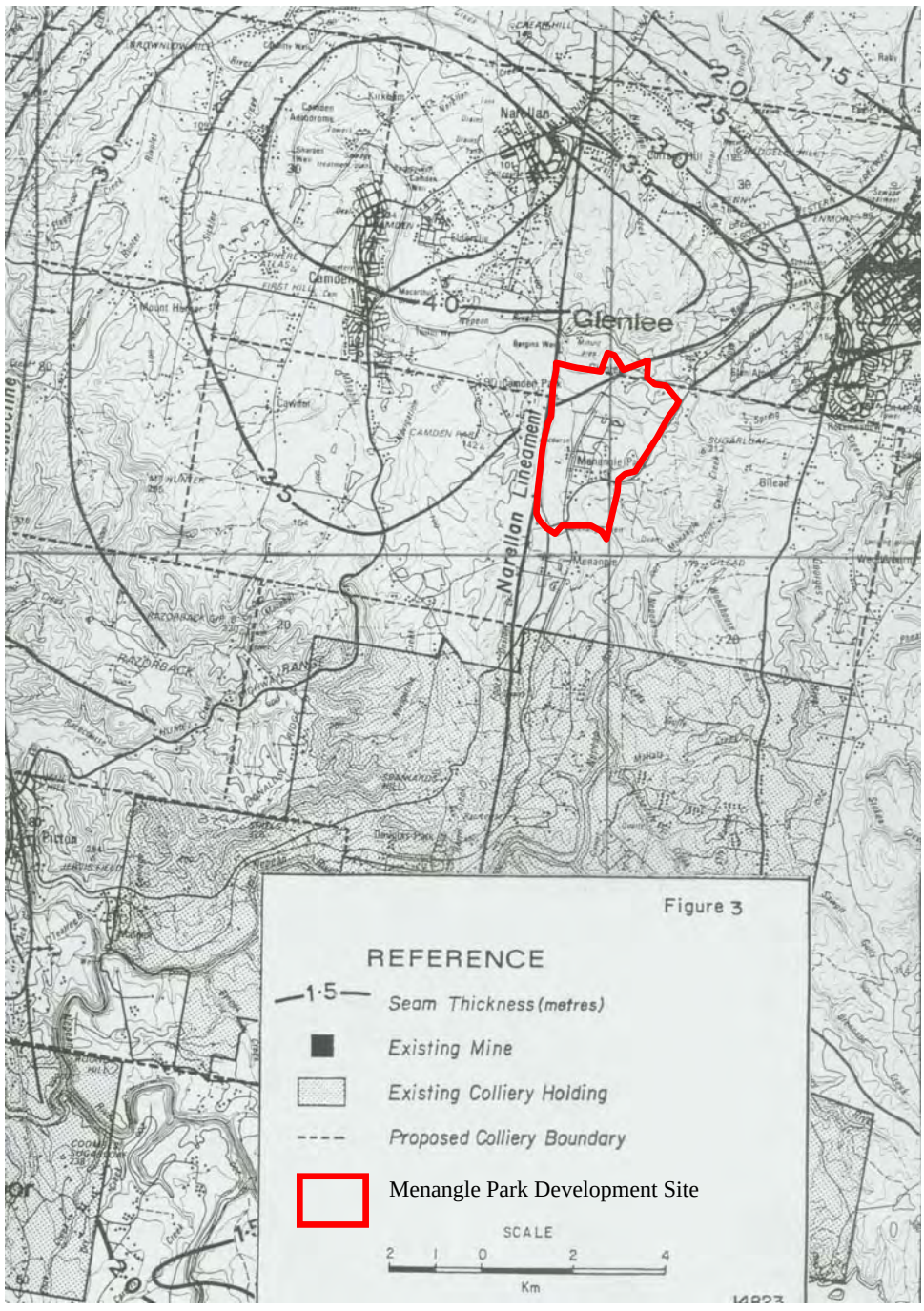
HARVEST SCIENTIFIC SERVICES

Figure 3.2

Menangle Park Development Site

Development Site in Relation to Coal Resources

Landcom and Campbelltown City Council



From: Coal Resource Development Committee, Undated.

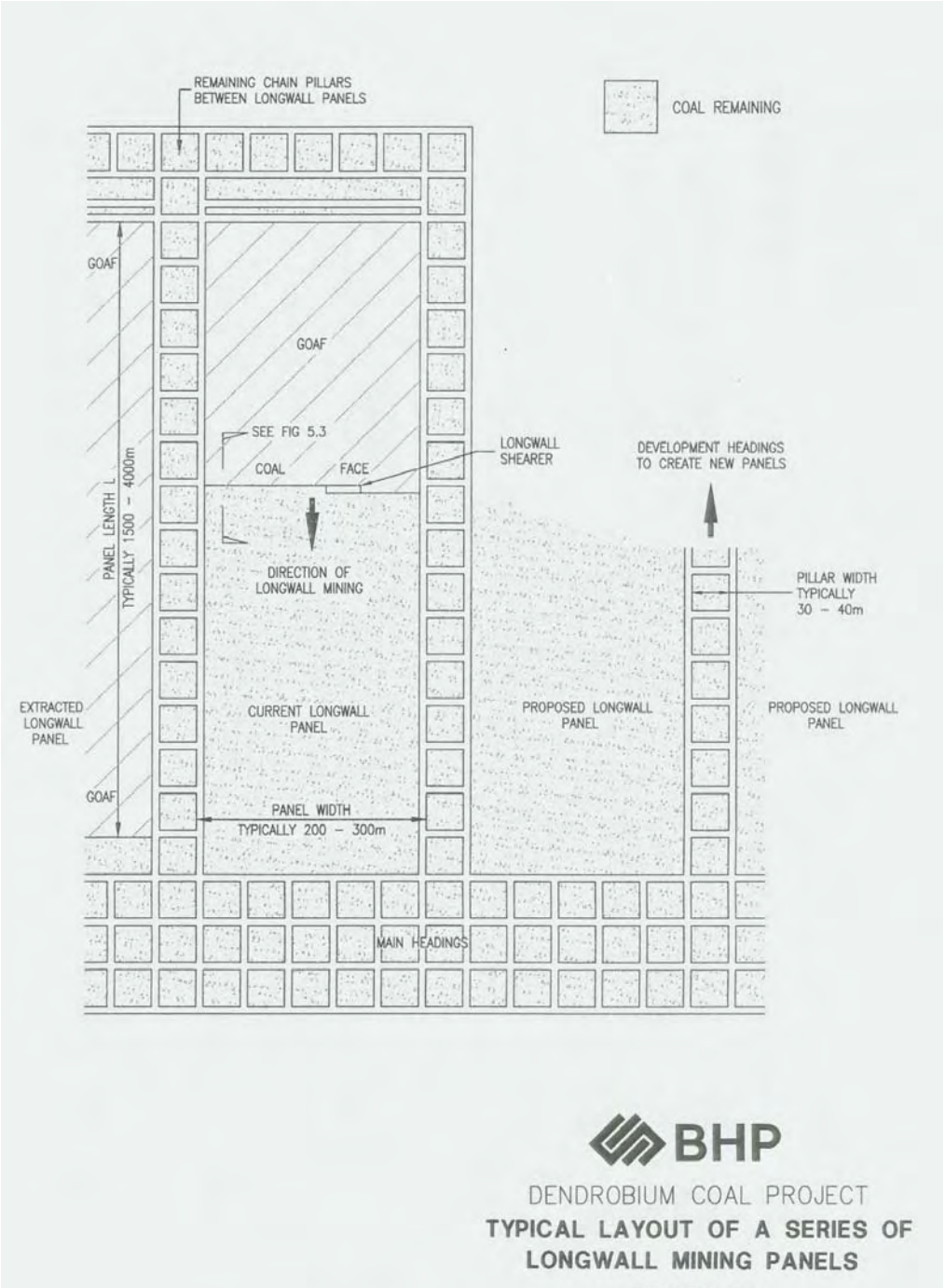
Figure 3.3

Menangle Park Development Site

COAL CONTOURS
Bulli Seam

Landcom and Campbelltown City Council

HARVEST SCIENTIFIC SERVICES



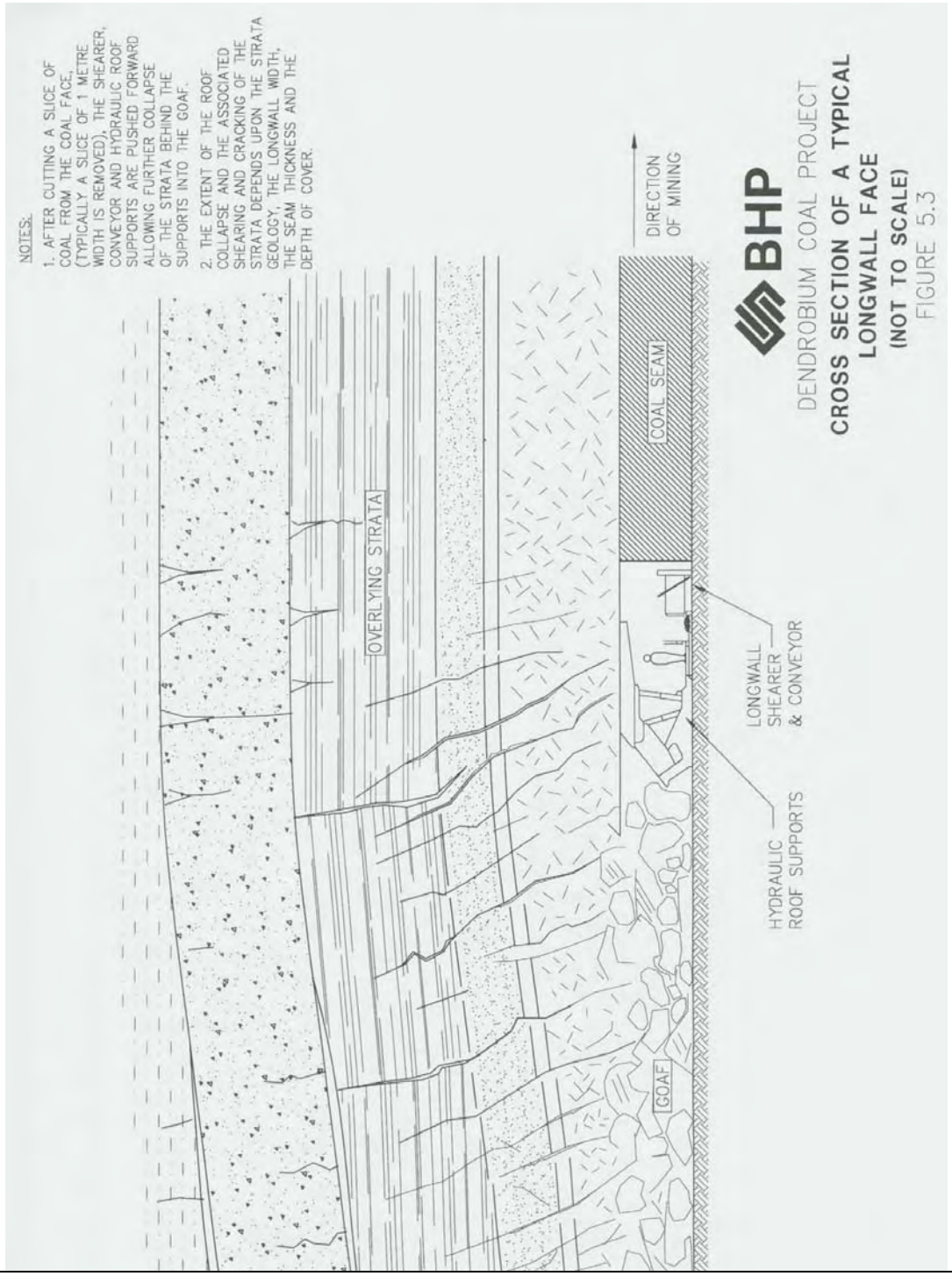
From: Olsen Environmental Consulting, 2001. Dendrobium Coal Project – BHP Billiton.

Figure 3.4

Menangle Park Development Site

Typical Layout of a Series of Longwall Mining Panels

Landcom and Campbelltown City Council



From: Olsen Environmental Consulting, 2001. Dendrobium Coal Project – BHP Billiton.

Figure 3.5

Menangle Park Development Site

Cross Section of Typical Longwall Face

Landcom and Campbelltown City Council

The initial stage of longwall mining involves the development of roadways around the blocks of coal which have been identified as being suitable for extraction. Extraction involves the complete removal of the coal blocks between the developed roadways. Longwall shearing machinery travels back and forth across the coal face in each block.

This machine cuts the coal from the coal face on each pass and a face conveyor, running along the full length of the coalface, carries this away to discharge onto a belt conveyor. The belt conveyor carries the coal out of the mine.

The section in front of the coal face is held up by a series of hydraulic roof supports which temporarily hold up the roof strata and enable enough space for the shearer and face conveyor to operate. After each slice of coal is removed, the face conveyor, hydraulic rood supports and the shearer are moved forward. The roof over blocks of coal that have been mined are allowed to collapse. This feature of the mining technique is translated to the surface as mine subsidence.

Traditional mining techniques include Room and Bord and continuous miner and pillar extraction. However, these have proved uneconomic and are now rarely used.

3.2.3 Economic Aspects

The Southern Coalfield produced 13.41 million tonnes of raw coal in 2006-2007(Mineral Resources, 2008). Approximately one third of the saleable product services the needs of the domestic steel market and the remaining two thirds are sold as export coking and thermal coal (Mineral Resources, 2003). The Coal Industry Profile indicates that the Southern Coalfield is renown for its premium quality hard coking coals, most of which are associated with the Bulli seam. Furthermore, the Southern Coalfield is the only source of hard coking coal in NSW.

“The coalfield’s remaining unallocated resources of prime coking coal are developed in the Bulli and Balgownie seams underlying the Camden-Campbelltown-Picton region.”

It has long been recognised that the northward trending extraction of theses resources is in stark juxtaposition to the southerly expansion of urban areas. In addition, the mineability of the resources will also be affected by flood-prone lands surrounding the Nepean River.

Although it is believed that there are sufficient resources within the existing mining leases and exploration areas to service the domestic steel industry well into the current century, the depletion of reserves within those collieries servicing the export market may result in a number of closures over the next 20 years. Hence, the unallocated resources in the northern sector (including the MPDS) may be required to maintain the coal mining industry’s share of the hard coking coal export market. Assuming an average Bulli seam thickness of 3.0 metres, it is estimated that the MPDS contains approximately 38 Million tonnes of coal.

However, the northern part of the MPDS is affected by a number of geological cross-structures which probably renders this part of the resource unavailable.

3.2.4 Tenure

The whole of the MPDS is covered by BHP Billiton's (BHP) Authorisation A248 (Figure 3.3). This gives BHP sole right to mine coal from the area. In addition, BHP has also indicated that the MPDS lies within its 30 year resource base, indicating a high priority to its eventual extraction (Mineral Resources, 2008) – see Figure 3.6.

3.3 Potential Impacts of Underground Coal Mining

3.3.1 Introduction

The primary impact that underground coal mining has relates to subsidence of the overlying rock strata after mining of the coal seam has been completed. Other impacts relate to the provision of surface infrastructure requirements. For the benefits of this report, it has however been assumed that access to the coal resources within the MPDS will not require the establishment of any surface infrastructure (although this cannot be ruled out).

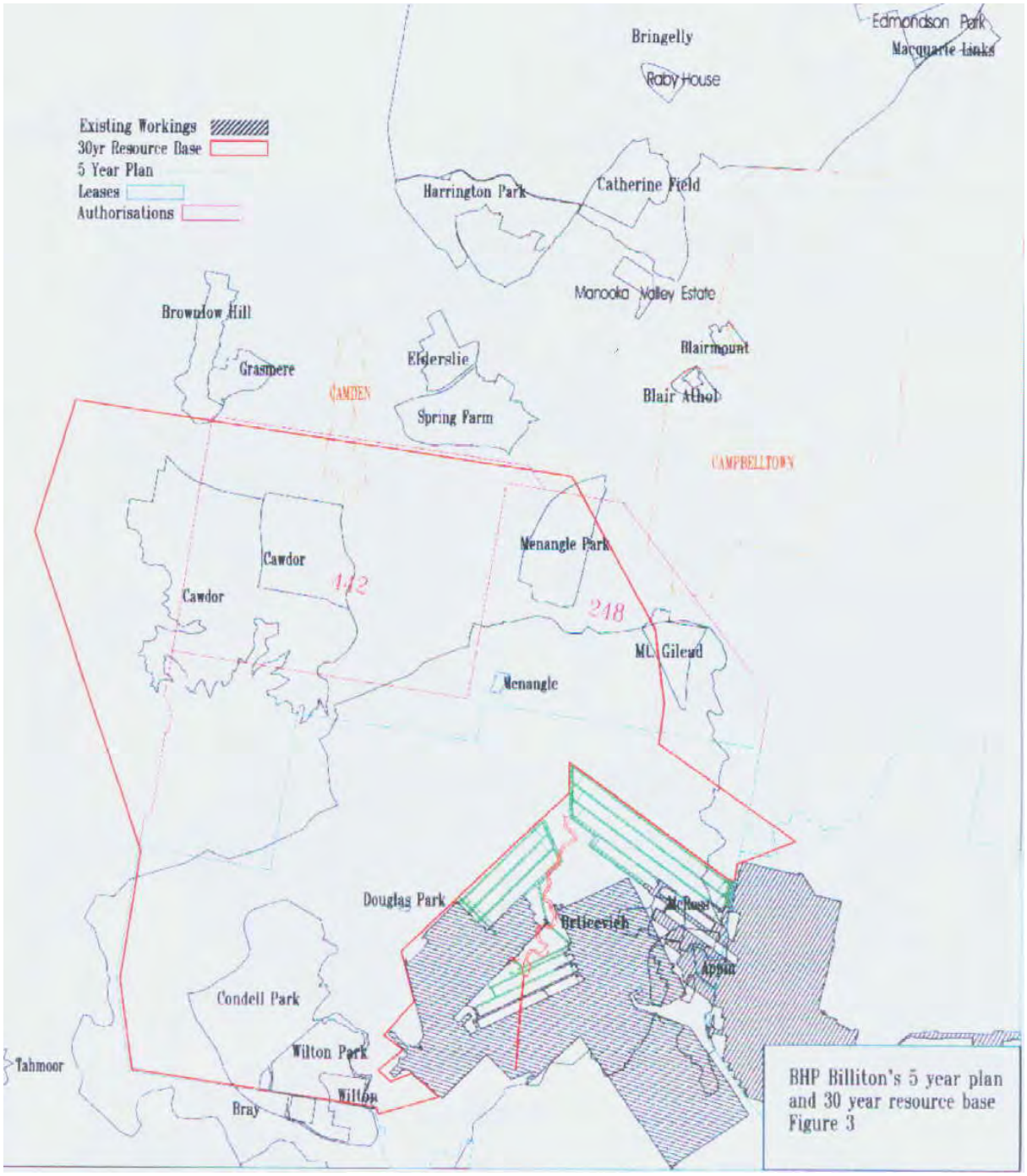
3.3.2 Mine Subsidence Impacts

3.3.2.1 Overview

Mine subsidence is a major issue where underground coal mining is conducted by the longwall mining method. This is the case for the Bulli seam in the vicinity of the MPDS. The magnitude of subsidence at the surface depends on a range of parameters including the thickness of the coal seam being mined and the width of the mining panel. In addition, the nature of the existing landform can also enhance or reduce the magnitude of these impacts.

Potential subsidence impacts of the Tahmoor North Project (Kembla Coal and Coke Pty Limited, 1993) and the Dendrobium Coal Project (Olsen Environmental Consulting, 2001) have been reviewed in this report as a guide to potential impacts which may manifest within the MPDS.

The Tahmoor North Project is focused on the Bulli Seam and is located only 15 kilometres away to the south west of the MPDS. The Seam varies in thickness between 1.6 and 2.25 metres and at Tahmoor is located approximately 460 metres below the surface.



From: Department of Mineral Resources, 2003. Southern Coalfields Land Use Study.

Figure 3.6

Menangle Park Development Site

BHP Billiton's 30 Year Resource Plan

Landcom and Campbelltown City Council

The Dedrobium Project on the other hand is located approximately 30 kilometres away to the immediate south of the MPDS. Whilst the natural surface above this coal project differs markedly to that at MPDS and the seam being worked is the Wongawilli seam, the same forces are at work. Furthermore, the thickness of the seam to be mined is between 2.8 to 3.5 metres above the seam floor which is comparable with the Bulli seam located within the MPDS. Depth to the Wongawilli Seam in this area varies between 350 and 400 metres below the surface.

3.3.2.2 Nature of Subsidence

The nature of subsidence is illustrated in Figures 3.7 and 3.8 which have been reprinted from the Tahmoor North Project (Kembla Coal and Coke Pty Limited, 1993). These figures illustrate the main forces at work when subsidence occurs. Hence, not only is there a downward movement of the land surface, but there is also lateral movements (both compressive and tensional) and tilting impacts to contend with as a result of the subsidence.

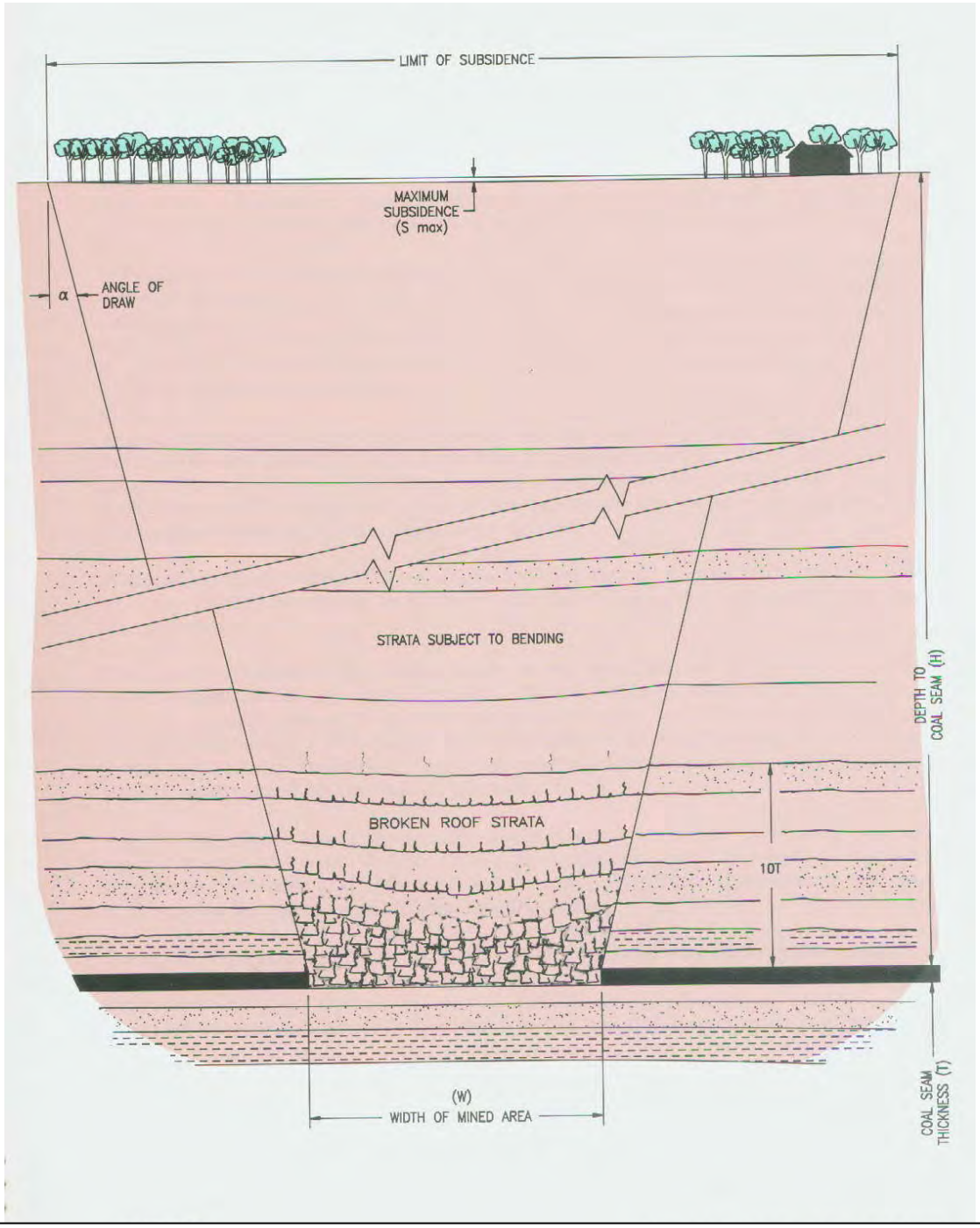
The timing of subsidence based on previous data indicates that 90% of the subsidence above a panel will occur immediately and up to 10% of the movement will take place over several months. As there always a number of adjoining panels to be extracted, the main settlement period for each panel can last 12 months. Thereafter, minor ground movements can continue for several years until stability is achieved.

In relation to the Tahmoor North Project, it was predicted that subsidence would vary between 0.10 to 0.75 metres, whereas for the Dendrobium Project, maximum subsidence may exceed 2.0 metres. Lateral movements and tilting would vary from place to place which ultimately depend on a number of local geological variables.

The following section outlines specific impacts on a variety of infrastructure items as well as natural features.

3.3.3 Potential Infrastructure Impacts

- Subsidence impacts can manifest themselves in residential or commercial buildings in the form of cracked brickwork or gyprock as well as tilted slabs. In a recent report, the Mines Subsidence Board reported that a number of claims had been attended to in Appin as a result of longwall mining (Mines Subsidence Board, 2003). The Board had completed repairs as well as purchased two dwellings – indicating significant damage had resulted;

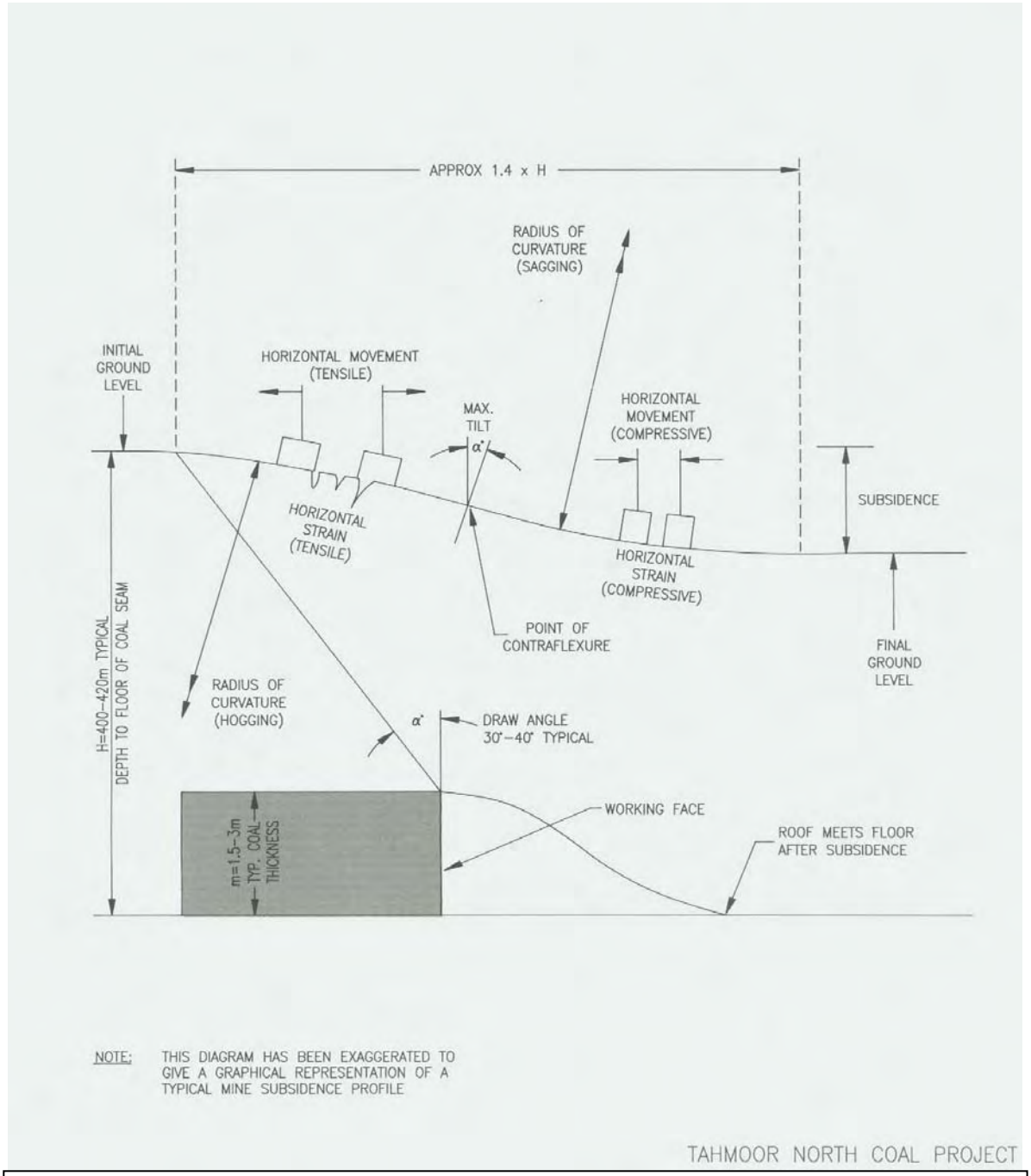


From: Kembla Coal and Coke Pty Ltd, 1993. Tahmoor North Project.

Figure 3.7

Menangle Park Development Site

General Subsidence Diagram



From: Kembla Coal and Coke Pty Ltd, 1993. Tahmoor North Project.

Figure 3.8

Menangle Park Development Site

Development of a Typical Subsidence Profile

Landcom and Campbelltown City Council

- Water Supply Lines and stormwater pipes are prone to compressive as well as tensile strains, in addition to subsidence;
- Subsidence can result in the tilting of transmission line towers. The larger the structure, the greater the potential tilt. In addition, ground clearances would also be affected;
- Natural Gas Pipelines could be affected by lateral stresses, depending upon the direction of longwall mining. It is noted that the Duke Energy Natural Gas Pipeline crosses the north-eastern portion of the MPDS. In addition, Sydney Gas plans to install a gas gathering system within the MPDS. Both pipeline systems may thus be prone to damage as a result of mining;
- Sealed roads and the Main Southern Railway are potentially at risk and may require repair as mining passes through the area;
- Kerb and guttering can buckle or crack depending on the relative position of the longwall mining and the orientation of these structures; and
- Telecommunication Services may be affected in extreme examples of subsidence or tensile stress.

3.3.4 Impacts on Natural Features

- Surface cracking may arise as a result of subsidence. In steeply incised country this may result in near surface erosion channels being formed and in extreme cases, the collapse of cliff faces;
- Gas emissions at surface may arise as a result of deep seated cracking caused by mining. Although most mine gases are removed by the mine ventilation system, gas can escape through voids in the rock mass and diffuse towards the surface through any continuous cracks or fissures. This has already been documented within the Cataract Gorge, near Appin.
- There is some potential for bushfires to occur should gas escape via subsurface cracking. This is unlikely in the MPDS given the paucity of continuous vegetation of any magnitude; and
- The position of designated flood lines will change.

3.4 Planning for Subsidence

The MPDS is located within the Campbelltown South Mine Subsidence District as are the suburbs of Elderslie, Spring Farm and Glen Alpine. Proposals for urban development located within Mines Subsidence Districts require reference to the Mines Subsidence Board, usually via the relevant local government. The approval process is described in Board publications (Mines Subsidence Board, undated)

The Mines Subsidence Board has reviewed data on the MPDS provided to them by the Department of Mineral Resources (Mines Subsidence Board, 2004) and indicated that:

"The Principal Subsidence Engineer has predicted up to 1.55 metres of vertical subsidence, subject to final mine design. Mine subsidence will impact on any structures built on the site and the Mines Subsidence Board is concerned with the proposed development. As the area is a Mines Subsidence District, the Board's approval is required for subdivision and surface development."

Camden Council was advised by the Mines Subsidence Board (Mines Subsidence Board, 2000) that developments in the Elderslie and Spring Farm release areas would be required to conform to the following building guidelines:

- For residential improvements entailing single or two storey timber or steel framed improvements clad with weatherboards or other similar materials and erected on reinforced concrete footings and slabs are to comply with AS 2870.1;
- For residential improvements entailing single or two storey brick veneer improvements on reinforced concrete footings and/or slabs are to comply with AS 2870.1;
- For industrial improvements entailing single storey, steel framed improvements clad with steel or other similar materials, with single storey masonry amenities and office blocks and masonry construction in Fire Walls are to comply to engineers design; and
- Other types (both residential and industrial) will be considered on their individual merits.
- Infrastructure such as water and sewerage services, communication and power and bridges need to be designed to Mines Subsidence requirements.

It was noted that the predicted subsidence in the Elderslie and Spring Farm release areas was 1.3 and 1.6 metres respectively (these figures are comparable to the predicted subsidence for the MPDS as indicated above). Furthermore, developments in these areas would be affected in a change to the 1 in 100 year flood line.

Underground coal mining is currently advancing through the township of Tahmoor. The longwall is orientated with a north-easterly aspect, with the cutting sweep moving from south-east to northwest and back again. A number of recent residential and commercial developments have been affected by the mining including the recently completed Tahmoor Shopping Centre, located on the corner of Thirlmere Way and the Hume Highway.

It is understood that a number of properties have so far been adversely affected by subsidence. A copy of a recent Residents Weekly Update from the The Tahmoor Chamber of Commerce is attached as Appendix 1.

3.5 Subsidence Mitigation and Remedial Measures

It is inevitable that some damage will occur to any built structure on the land surface as a longwall mining project passes below. In many cases, the damage is imperceptible, but in other cases can be extreme. This is also applicable to the zone of influence, which is greater than the actual area mined and is generally 1.4 times the depth to the seam being mined (see Figure 3.8). In the case of the MPDS, the zone of influence would extend roughly 450 metre beyond the MPDS boundary, assuming an average depth of 650 metres.

The highest level of protection is to leave the coal in the ground. In the case of the Tahmoor North Project, such a strategy was agreed to in several instances – the Queen Victoria memorial Hospital near Thirlmere and the Redbank rail tunnel at Picton. For less sensitive areas, pillars can be left which will reduce the maximum subsidence impacts. Where the full extent of mining is to take place, a number of preventative measures can be used in the design and construction stage of any building, viz:

Footings – buildings utilising slab construction should be discouraged in favour of pier and beam

Trenching – excavation of trenches alongside of a structure to reduce horizontal forces being transmitted from the ground into foundations;

Slotting – large panels of masonary or brickwork should be broken up into smaller panels or expansion joints to accommodate ground movement;

Adjustable supports – can be installed beneath sensitive items of plant and equipment.

In the case of services (pipelines, telecommunication lines, etc), the following measures can be implemented as part of the original design, viz:

Flexible joints – where service pipes are joined to buildings, water tanks or pools to avoid fractures due to relative displacement;

Expansion joints and loops - can be installed to give greater flexibility in service mains. Valves can be provided to facilitate the isolation of lengths of pipe for repair; and

Removal of overburden - can be undertaken above and alongside buried pipelines to reduce the transfer of ground strains into the pipes.

Advice from the Mines Subsidence Board (Mines Subsidence Board, 2010) indicates that no new prescriptive guidelines have been issued. Rather, the Mines Subsidence Board relies on Australian Standard 2870 (Residential Slabs and Footings) as the default design guidelines for all standard residential dwellings up to two storeys. For other types of development, it is up to the proponent to supply the appropriate design to the Mines Subsidence Board for comment and approval.

The 2004 report recommended that a Subsidence Management Strategy should be implemented which would entail the involvement of the landowners, Campbelltown City Council, the Mines Subsidence Board, BHP Billiton and AGL. This would be made up of two parts. In the first instance, a thorough analysis should be conducted as to the nature of the longwall mining that is to take place under the MPDS. Obviously this needs to be carried out with the full cooperation of BHP. It should be noted that there appears to be a large amount of data available regarding mine subsidence impacts and as a result, modelling of impacts within the MPDS could be carried out to a high level of sophistication. Such modelling would generate a series of directives with respect to the construction and development of the entire site.

The second part of the Strategy would be instigated as mining approaches and would entail the following:

- Identify and agree upon areas that can be quarantined from mining or which utilise non-longwall mining techniques;
- Survey and recording of all built structures and services;
- Identification of protective measures;
- Determination and implementation of monitoring measures;
- Establishment of the timing and programming of the monitoring and preventative works;
- Identification of resources required to carry out the works;

- Identification of contingency measures which can be made available;
- Establishment of such security measures as may be required for the protection of the public;
- Definition of the remedial measures required on completion; and
- Assessing funding requirements.

The above strategy however, is predicated on the availability of geological data from within and without the MPDS boundaries. This would entail the completion of a number of drill holes, geotechnical testwork, seismic surveys, etc.

Raw data could then be modelled and predictive outcomes detailed. Given that the cost of such investigations could be extremely prohibitive and that BHP Billiton has no plans for exploration of the area in the near future, the generation of such data could be years away. However, as detailed in the following section, AGL (who has taken over Sydney Gas Operations Pty Ltd) have already completed a number of bore holes within the MPDS as part of their 2nd Stage Development. Data from this drilling (should it be available) might prove to be very valuable for subsidence studies.

3.6 Summation

Coal mining if allowed to take place underneath the MPDS, will result in damage to infrastructure and residential improvements. The extent of such damage and the effect of pre-mining measures to control this damage is unpredictable at the time of writing.

In 2004, it was understood that BHP Billiton and the Mines Subsidence Board considered that development of the MPDS should be curtailed as much as possible. In particular, the Mines Subsidence Board was fearful of a significant liability that could arise from the concentrated form of the desired development (ie + or – 4000 lots). It is unlikely that this view has changed significantly, a view somewhat borne out by the results of coal mining in the Tahmoor area. Previous correspondence (NSW Department of Planning, 2006) suggested that a position had been reached whereupon the mining of coal beneath Menangle Park would "be restricted to enable urban development to occur at a scale and form necessary to make the development viable."

The parameters for any underground mining in the vicinity of the Menangle Park Urban Release Area, given potential implications for subsidence, need to be confirmed in order that the Department's objective can be satisfied.

4.0 COAL BED METHANE

4.1 Nature of Coal Bed Methane

Coal Bed Methane ("CBM") is the natural gas formed during the coalifaction process whereby peat and other organic matter is turned into coal by compaction and heat associated with the depth of burial. Methane is adsorbed on the surfaces of micropores within the coal, and also as free gas within fractures in a coal seam. It is generally regarded as an unconventional source of natural gas, the 'traditional' source being derived from sandstone reservoirs.

The composition of Coal Bed Methane is, as the name suggests, predominantly methane (>95%) with minor amounts of carbon dioxide and other gases (such as ethane) including water vapour.

4.2 Outline of Resources within Menangle Park Development Area

It has been estimated, that the Sydney Basin may contain up to 130,000 PJ of energy in coal seam methane (Weber and Bocking, 1993). A small fraction of this resource is located within the AGL-Sydney Gas Limited joint venture area (Project Stage II), which completely encompasses the MPDS. The resource within Stage II is described as follows (Sydney Gas Company, 2003):

Thickness of Bulli Seam	3.05 metres (average)
Relative density	1.46 g/cc
Total tonnes of Bulli Seam Coal	2.5×10^8
Coal gas content	13 cubic metres /tonne of coal (average)
Methane content (Bulli Seam only)	2.8×10^9 cubic metres
Energy	106 PJ

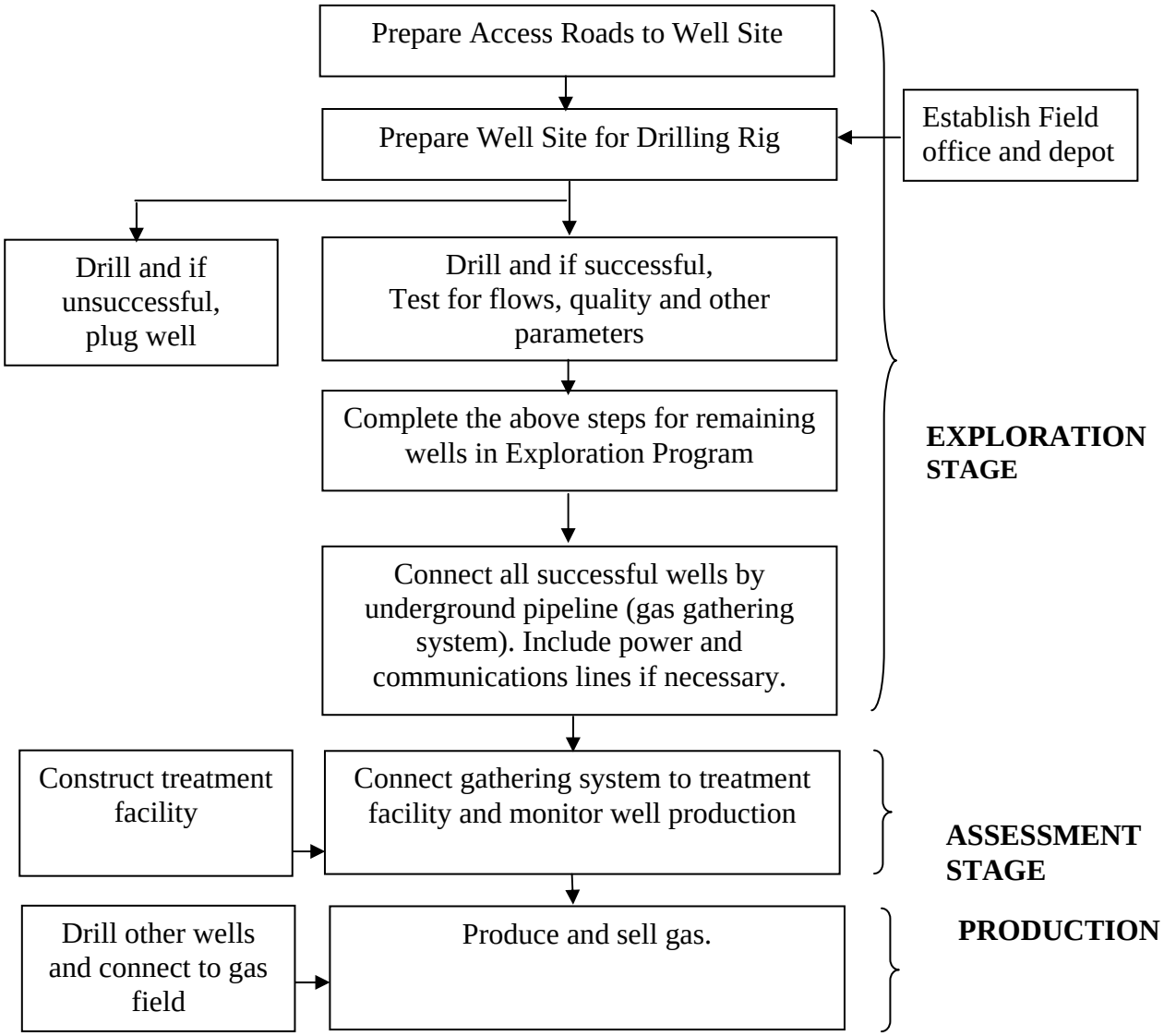
This resource represented approximately 76% of NSW's annual energy needs at time.

The area covered by the AGL Gas Project Stage II is approximately 55 square kilometres, whereas the Menangle Park Development site is approximately 6.5 square kilometres in area. It should also be noted that the above resource covers the Bulli Seam only – no allowance for resources contained in a number of other (underlying) coal seams has been made. The aerial extent of the MPDS is relatively small in area and in general terms represents only a small part of the overall resource that is perceived to be accessible at this point of time.

On a technical basis, geological factors (one of the main constraints to extractable CBM) vary from place to place and implies that gas recovery rates will also vary. However, it is understood that the resource within these areas should generate economic flow rates for at least 21 years. That is to say, cumulatively, the wells completed within this area will produce commercially viable amounts of gas, even though it is too early to predict which wells will be successful and which ones will fail.

4.3 Development of CBM Resources

The extraction of CBM involves a number of procedures. These include the construction or drilling of wells, the connection of producing wells by a reticulated "gas gathering system" and the treatment of the gas prior to its distribution to industrial and residential consumers. A summary of this procedure is illustrated below.



4.4. Key Elements of CBM Extraction

4.4.1 Well Construction and Completion.

This entails drilling exploratory boreholes to target either one or more coal seams located within the Illawarra Coal Measures. Drilling is usually carried out by percussion drilling but in some cases, coring is first undertaken to enable detailed geological and other testwork to be carried out. Following the drilling, the targeted coal seam (or seams) are hydraulically fractured which then allows gas to flow back to the well head and by defacto, results in "gas production".

4.4.2 Construction of Gas Pipelines including Gathering Systems and Steel Trunkline.

This covers the linkage of wells by underground pipes to transport water and gas to other parts of the field and/or off-site. It includes connection of wells to power and water lines and the testing of individual wells to evaluate gas flow rates, permeabilities and pressures. Pipelines located within a gasfield which convey gas to a Treatment Plant are generally all plastic (Polyethylene or 'PE'), whereas a steel pipeline transmits gas off-site to a reticulation system.

4.4.3 Treatment Plant.

A Treatment Plant has the function of stripping excess moisture from the incoming gas and boosting the outlet gas pressure to meet existing gas pipeline specifications for reticulation to consumers. The location of the proposed Treatment Plant for the AGL's Stage II development (Leafs Gully) is approximately 1 kilometre east of the MPDS boundary adjacent to Cleary Brothers sandstone quarry. Approval for the Treatment Plant was granted by the NSW Government in 2009.

4.4.4 Positioning of Well Sites

Having identified the most favourable area from a geological and geophysical perspective, well sites are selected on the basis of several other limiting criteria including:

- Well spacing of approximately 500 -750 metres;
- Located at least 200m from the nearest residence;
- Current usage by landholders;
- Landform and topography – flat lying is best;

- Ease of access to site; and
- Available infrastructure – e.g. Powerlines, roads, etc.

4.5 Well Drilling Operations

Set Up

A typical well site is composed of a number of elements. These include the following:

- A level well site area is prepared;
- A sump to capture drill cuttings and water is constructed ;
- Adequate space is required to enable the positioning of all of the infrastructure used in the drilling process and may measure 50m x 60m;

Drilling Operations

The drilling procedure for each well is as follows:

- Drill to final depth;
- Case well;
- "Stimulate" well; and
- Establish well head infrastructure.

Drilling is carried out by specialised truck-mounted drilling gear together with ancillary equipment, such as air compressors. Access to each well site (including any specific property related requirements) is generally negotiated with the property owner.

Coal Seam Fracturing Procedures

The target coal seam is hydraulically "stimulated" by the high pressure injection of water and sand. Pressure is applied until the coal yields and breaks (or fractures). As water is removed from the coal, the reservoir pressure decreases and methane devolves. The sand filled channels or fractures allows the methane from the coal seams to flow to the well bore. This process is commonly referred to as 'fraccing' in the oil and gas industry.

Duration of Drilling Activities

In the short term, the above activities can be completed generally within 30-35 working days. However, for various logistical reasons, completion of all activities around any one well site is more then likely to take 4-8 weeks. Following rehabilitation, testing and monitoring of each well is then undertaken over the life of the well.

4.6 Construction of a Gas Gathering System

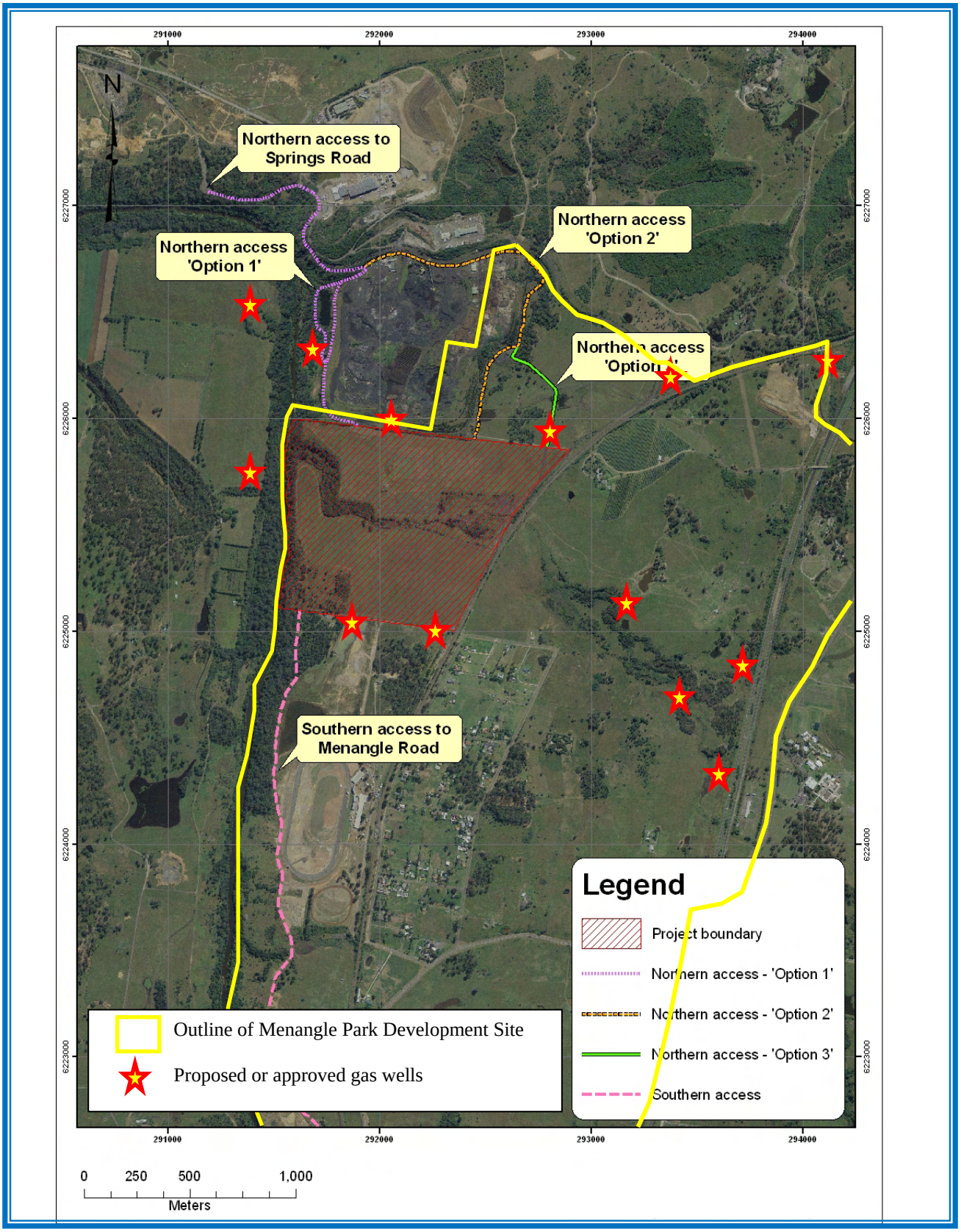
A 'gas gathering system' is defined as a network of pipelines that collect gas from a number of wells within a catchment area. The purpose of the gathering system is to enable sufficient quantities of gas to be collected to meet commercial delivery requirements. The gathering system further enables the gas to be transported to a central point where it can be suitably treated before being introduced into an existing gas distribution network.

Gas from each well site is transported along a polyethylene (PE) pipe, buried between 0.75 and 1.0 metres underground. This pipeline network is located along property boundaries, fence lines and existing roads. The gas thus gathered flows to a dehydration and compression facility (the Treatment Plant) where excess water is removed, chemical odour added and the gas compressed to facilitate distribution to an existing network by steel pipeline. In the case of the AGL development, an independent Quantitative Risk Assessment incorporating Hazard and Operability Studies was conducted (Sydney Gas, 2003). This study concluded that risks associated with the project were manageable provided appropriate controls and procedures were implemented and maintained.

4.7 Potential Impacts

AGL over the last 2 years has received approval to complete a number of gas wells around Menangle Park, a number of which are located within the MPDS. The location of these wells are illustrated in Figure 4.1.

In obtaining approval for the development of these wells, AGL has assessed the likely impacts of these operations as well as indicating a range of environmental controls to be implemented as part of an Environmental Management System. The assessment included a review of impacts for a number of environmental parameters including:



From: Environmental Impact Statement
Proposed Sand and Soil Extraction and Processing Facility
(Harvest Scientific Services, 2009)

Figure 4.1

MENANGLE PARK DEVELOPMENT SITE

WORKING AND APPROVED GAS WELLS

Landcom and Campbelltown City Council

Geotechnical:	Surface impacts – subsidence, vibration
	Sterilisation of Coal Seams
Ecology:	Ground disturbance and introduction of weed species
Water Resources:	Surface drainage
	Flooding
	Water quality
	Water usage
Air Quality:	Construction air emissions
	Operational air emissions
	Odour
Noise and Vibration:	Earth moving plant, drilling
Aboriginal Heritage:	Disturbance to physical artefacts
European Heritage:	Disturbance to physical artefacts
Visual Amenity:	Temporary and Permanent presence of infrastructure
Infrastructure:	Service lines, transport routes and pipelines
Traffic:	Construction and operational phases
Waste Management:	Construction and operational phases

As a result, the NSW Department of Planning has issued an approval under the Section 75J of the Environmental Planning and Assessment Act 1979. A copy of this approval is attached as Appendix 2.

It should be noted that locations guidelines for residential and other developments within the vicinity of gas wells have been developed (Department of Infrastructure, Planning and Natural Resources, 2004). In these guidelines, residential and other developments are able to be constructed within 5 to 20 metres of the well, the distance varying according to the status of the well and the sensitivity of the proposed developments. Hospitals, schools and aged-care facilities are considered to be “sensitive” developments and would therefore require a greater separation.

5.0 GEOTHERMAL POTENTIAL

The eastern side of the MPDS is currently covered by Exploration Licence 6212, held by Longreach Oil Limited (LOL) in joint venture with Hot Rock Energy - see Figure 5.1. The licence, which has been granted for “Geothermal substances” (or Group 8 “Minerals”) expires on March 3, 2010. However, a public release by Longreach (Longreach Oil Limited, 2009) indicates that renewal for part of the licence has been approved by NSW DII.

Longreach has indicated that the area under the licence is attractive for the definition of geothermal “hot spots” in the basement rocks beneath the sedimentary cover. Proximity to the Sydney and Wollongong markets is a strategic factor to the economic viability of any successful exploration. The joint venture partners “intend to conduct gravity in-fill surveys over potential intra-basement structures and gravity-temperature modeling to determine the prospective drilling locations”. Whether the joint venture partners wish to drill within the MPDS is currently unkown.

Group 8 Minerals

MINVIEW

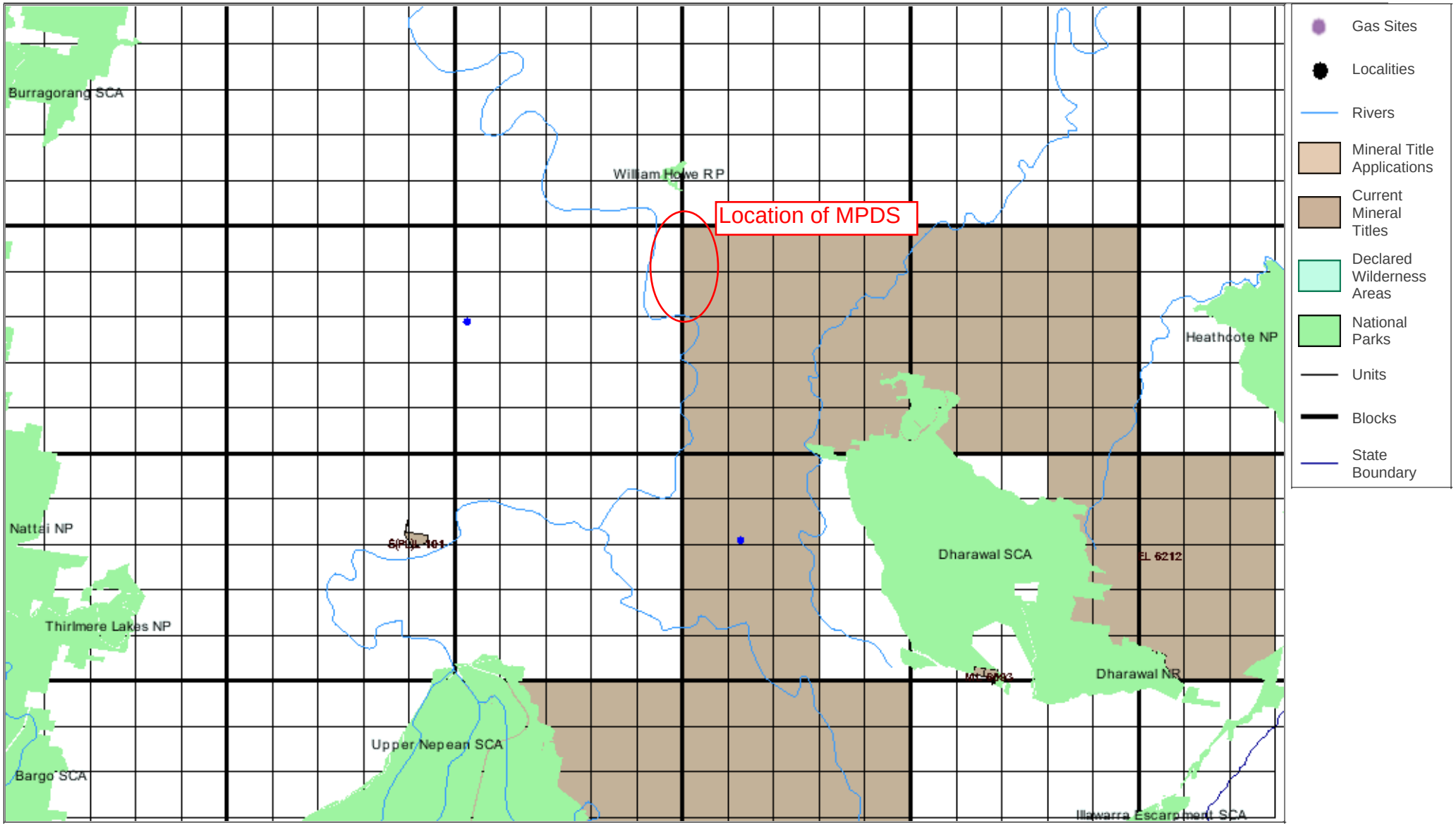


Figure 5.1

6.0 PROPOSED SCHEDULING OF MINERAL EXTRACTION ACTIVITIES

In the previous report, a schedule of extraction activities had been formulated. This schedule is reproduced below but amended to reflect an extended time-table to accommodate the sand extraction schedule proposed for the Menangle West sand extraction and processing project.

Activity	Year 1 Approval	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Years 10-12
Sand and Soil Extraction	←	←	←	←	←	←	←	←	→
Gas Well and Pipeline Construction	←	→	Proposed work in MPDS approved subject to appeal and Landowner consent.						
Subsidence studies	←	→							
Delineation of Coal Mining areas		←	→						
Coal Mining	BHP Billiton have sole rights to mine subject to grant of mining lease								? →

In the 5.5 years since the presentation of this schedule, only activities associated with the development of gas wells has been more or less completed. Sand and soil activities, now associated only with the Western Deposit are now awaiting the results of a DA submitted to Campbelltown City Council. It is anticipated that a determination will be made during Q3/Q4 of the 2010 financial year.

With respect to coal resources it is understood that no clear plan has yet been formulated in regards to the mining of coal underlying the MPDS. As indicated previously, BHP Billiton view these coal resources as falling within their 30 year resource development plan.

Mart Rampe B.Sc (Applied Geology)
Principal Consultant
25/1/2010

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APPENDIX 1

Weekly Subsidence Update

9th November - 15th November 2009

Xstrata Coal - Tahmoor Colliery

www.xstratacoal.com.au

NEWS FROM DOWNUNDER!

Reported Subsidence Impacts

This week there were **0** new impacts reported.

MSB Property Repair Progress

The MSB can only finalise repairs to property when the property will no longer be affected by subsidence. This can be up to 3 years after the impact to the property. To date the MSB has finalised repairs at **93** premises and repairs are underway at another **25.**

Council News – Mine Subsidence Restorations November 2009.

Restoration works planned for Remembrance Driveway between Bradbury and Progress Streets and at Thirlmere Way between Remembrance Driveway and York Street, Tahmoor are still scheduled to commence in the first quarter of 2010. Both approaches to the bridge over Myrtle Creek in Castlereagh Street Tahmoor have now been repaired, removing the uneven surface which had formed due to subsidence. There are some remaining areas around Tahmoor which have ongoing temporary repairs. The permanent repairs to these areas will be carried out once subsidence has ceased.

Weekly Longwall Position Snapshot

Red line shows longwall current position .

Blue line shows the end point.

IMPORTANT CONTACT NUMBERS

Mine Subsidence Board (MSB)
4677 1967
1800 248 083 (After hours free call)

Tahmoor Colliery Enquiries/Complaints Line
1800 154 415 (free call)

Free Counselling Service for Residents Affected by Subsidence

Subsidence Impacts

In Tahmoor/Thirlmere 1289 premises are located in areas where subsidence has occurred.
78.0% (1006) have had no reported impacts

14.0% (180) have had superficial or easily repaired impacts

8.0% (103) have had impacts that may require more significant repair by the MSB.

'Women like silent men. They think they're listening'. (Marcel Archard)

Weekly Longwall Progress

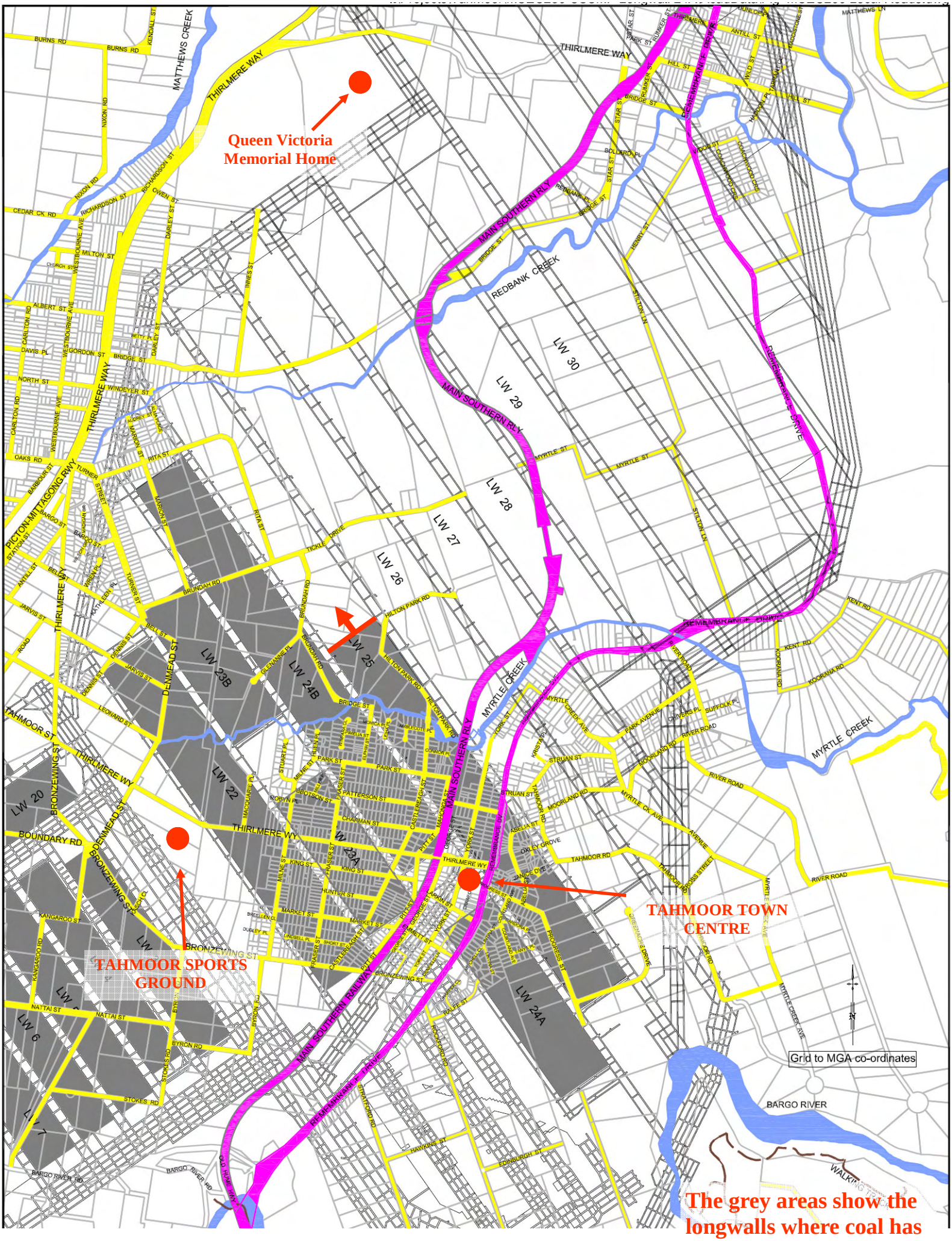
By Sunday 15th November 2009, Longwall 25 had progressed 2082.5m from its starting point. The weekly subsidence map is attached at the end of this update.

Tahmoor Colliery has a new Community Coordinator

I would like to introduce myself. My name is Belinda Clayton and I am the new Community Coordinator at Tahmoor Colliery. I will strive to continue and improve the work that the previous Community Coordinator, Dave Clarkson, and the team at Tahmoor Colliery have been doing over the years in regards to managing subsidence and supporting the local community needs.

Dave would like to thank you all for all the assistance that you have given him during his time working at Tahmoor Colliery. As a community he has found you extremely friendly and helpful. He would like to wish you all a merry Christmas and great new year.

DOWNLOAD this newsletter from the **TAHMOOR CHAMBER OF COMMERCE SITE**—
http:www.tahmoorchamberofcommerce.com.au
To add or remove your name from our emailing list send an email to **tahmoorenquiries@xstratacoal.com.au**
or call **1800 154 415**


Queen Victoria Memorial Home
TAHMOOR SPORTS GROUND
TAHMOOR TOWN CENTRE
Grid to MGA co-ordinates
The grey areas show the longwalls where coal has been extracted.
THIRLMERE WAY
MAIN SOUTHERN RLY
REDBANK CREEK
MYRTLE CREEK
MATTHEWS CREEK
BARGO RIVER
LW 20
LW 22
LW 23A
LW 23B
LW 24A
LW 24B
LW 25
LW 26
LW 27
LW 28
LW 29
LW 30
BOUNDARY RD
TAHMOOR RD
RIVER ROAD
DENMEAD ST
BRONZEWING ST

APPENDIX 2

Project Approval

Section 75J of the *Environmental Planning & Assessment Act 1979*

I, the Minister for Planning, under Section 75J of the *Environmental Planning and Assessment Act 1979*, approve the project referred to in Schedule 1, subject to the conditions set out in Schedules 2 to 5.

The reason for these conditions is to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the on-going environmental management of the project.

Frank Sartor MP
Minister for Planning

Sydney 4th Sept 2008 File No. S02/02299

SCHEDULE 1

Project Application:	06_0291
Proponent:	AGL Gas Production (Camden) Pty Ltd
Approval Authority:	Minister for Planning
Land:	See Appendix 1
Project:	Spring Farm Project Area and Menangle Park Project Area, as shown in Appendix 2

TABLE OF CONTENTS

DEFINITIONS

AEMR	Annual Environmental Management Report
CCC	Community Consultative Committee
Day	Day is defined as the period from 7.00am to 6.00pm on Monday to Saturday, and 8.00am to 6.00pm on Sundays and public holidays
DECC	Department of Environment and Climate Change
Department	Department of Planning
Director-General	Director-General of the Department of Planning, or delegate
DPI	Department of Primary Industries
EA	Environmental Assessment
EMP	Environmental Management Plan
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
Evening	Evening is defined as the period from 6.00pm to 10.00pm
Fracture Stimulation	The process by which coal seams are hydraulically fractured (fracced) by pumping a mixture of sand and water under high pressure into the seam until the coal fractures, in order to establish porous pathways to allow gas to flow back to the well from a larger drainage area
Land	Land means the whole of a lot, or contiguous lots owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this approval
Night	Night is defined as the period from 10.00pm to 7.00am on Monday to Saturday, and 10.00pm to 8.00am on Sundays and Public Holidays
Proponent	AGL Gas Production (Camden) Pty Ltd
QRA	Quantitative Risk Assessment in Appendix D of Volume 2 of the EA
RTA	Roads and Traffic Authority
Site	Land to which the Project Approval applies (see Appendix 1)
SIS well	Surface to In-seam well
Well	A hole made by drilling in connection with exploration for petroleum or operations for the recovery of petroleum
Well surface location	An area that may incorporate up to 6 co-located wells at one well site or compound

SCHEDULE 2
ADMINISTRATIVE

Obligation to Minimise Harm to the Environment

1. The Proponent shall implement all practicable measures to prevent or minimise any harm to the environment that may result from the construction or operation of the project.

Terms of Approval

2. The Proponent shall carry out the project generally in accordance with the:
   (a) Project Application 06_0291;
   (b) EA titled "*Environmental Assessment – Expansion of Stage 2 of the Camden Gas Project Stage 2 Concept Area Spring Farm Project Area Menangle Park Project Area*", Volume 1 and 2 prepared by ENSR Australia Pty Ltd, and dated September 2007;
   (c) Submissions Report prepared by ENSR Australia Pty Ltd, and dated December 2007;
   (d) Statement of Commitments; and
   (e) conditions of this approval.

3. If there is any inconsistency between the above documents, the latter document shall prevail over the former to the extent of the inconsistency. However, the conditions of this consent shall prevail over all other documents to the extent of any inconsistency.

4. The Proponent shall comply with any reasonable requirement/s of the Director-General arising from the Department's assessment of:
   (a) any reports, plans, programs or correspondence that are submitted in accordance with this approval; and
   (b) the implementation of any actions or measures contained in these reports, plans, programs or correspondence.

Limits on Approval

5. This approval shall lapse 21 years after the date of this approval or on the expiry date of Petroleum Production Lease No. 4 or Petroleum Production Lease No. 5, whichever is the sooner.

6. Nothing in this approval permits the drilling and operation of more than 4 well surface locations in Spring Farm and more than 12 well surface locations in Menangle Park.

7. This approval permits the drilling of well surface locations SF04A, SF10, SF17 and SF20 in Spring Farm. The Proponent shall not drill well surface location SF04.

8. This approval permits the drilling of well surface locations MP02. MP03, MP04, MP05, MP06, MP11, MP19, MP21, MP22, MP23, MP24 and MP33 in Menangle Park.

9. The Proponent shall not drill more than 6 co-located wells within each well surface location.

10. The Proponent shall surrender the approval for any well surface location where work has not been commenced within 5 years of the date of this approval.

11. The Proponent shall not construct well surface locations MP04, MP19 and MP21 without the written approval of the Director-General. In seeking the Director-General's approval, the Proponent shall:
   (a) in relation to MP04, submit evidence that the Proponent has consulted with Transgrid and/or Integral Energy on the design and location of MP04 and considered the safety issues of the location of gas well(s) adjacent to the Macarthur Substation and its earthing system;
   (b) in relation to MP19 and MP21, submit evidence that the Proponent has consulted with Landcom and Campbelltown City Council on the design and location of MP19 and MP21 in relation to the proposed Spring Farm arterial road and the relevant Menangle Park draft urban layout; and
   (c) provide a detailed site layout plan(s) of the well surface location (condition 1 of Schedule 3);

   to the satisfaction of the Director-General.

Note: If the proposed well surface location is outside the environmental envelope of the well surface location that was assessed in the EA, then the Proponent will require a separate approval for the proposed well surface location under the EP&A Act.

12. The Proponent shall not produce gas from any well until a Production Lease under the *Petroleum (Onshore) Act 1991* has been obtained for the full length of the well.

Notification of Council

13. Within 3 months of the commissioning of the wells, the Proponent shall provide Camden Council and Campbelltown City Council with:
    (a) the Geographical Positioning System (GPS) co-ordinates and digital survey data for the well surface locations and gas gathering system, in a format suitable to the councils; and
    (b) the wellhead configuration of each well.

    The Proponent shall provide a copy of this information to the landowner on request.

Protection of Public Infrastructure

14. The Proponent shall:
    (a) repair, or pay all reasonable costs associated with repairing public infrastructure that is damaged by the project; and
    (b) relocate, or pay all reasonable costs associated with relocating public infrastructure that needs to be relocated as a result of the project.

    Where agreement is not reached with the owner on the cost of repairs, the Director-General shall determine the amount considered reasonable.

Operation of Plant and Equipment

15. The Proponent shall ensure that all plant and equipment used at the site is:
    (a) maintained in a proper and efficient condition; and
    (b) operated in a proper and efficient condition.

SCHEDULE 3
ENVIRONMENTAL PERFORMANCE

IDENTIFICATION OF WELL SURFACE LOCATION

1. Prior to construction commencing at an individual well surface location, the Proponent shall submit a Site Layout Plan of the well surface location to the satisfaction of the Director-General. The Site Layout Plan must be prepared in consultation with the landowner and include details of:
   (a) the site construction layout and construction footprint;
   (b) the wellheads and production compound layout:
   (c) the route of the gas gathering lines and access roads; and
   (d) initial rehabilitation works following construction

NOISE

Construction and Maintenance Hours

2. Except for the drilling (including well casing and grouting) of wells, the Proponent shall comply with the construction and maintenance hours in Table 1:

Table 1: Construction and Maintenance Hours for the Project

Activity	Day	Time
Construction	Monday – Friday	7:00am to 6:00pm
	Saturday	8:00am to 1:00pm
	Sunday and Public Holidays	Nil
Planned maintenance activities (includes well workover)	Monday – Friday	7:00am to 6:00pm
	Saturday	8:00am to 1:00pm
	Sunday and Public Holidays	Nil (unless inaudible at any residential receiver)

Notes:

- *Inaudible means that the construction activity cannot be heard by the human ear at the nearest affected residential receivers.*
- *This condition does not apply to the delivery of material if that delivery is required by the police or other authorities for safety reasons; and/or the operation or personnel or equipment is endangered. In such circumstances, prior notification is to be provided to affected residents where possible.*

Construction Noise Goals

3. The Proponent shall use its best endeavours to undertake construction activities to comply with the construction noise goals specified in Table 2.

Table 2: Construction Noise Goals dB(A) $L_{Aeq(15\ min)}$

Location (nearest residential dwelling)		Day	Evening	Night	Saturday 1pm-6pm Sunday 7am-6pm
MP02, MP03, MP04		49	47	41	47
MP05, MP06		40	40	40	40
MP11, MP24, MP33		42	42	40	42
MP19	R3	40	40	40	40
	R25	49	47	41	47
MP21, MP22, MP23		49	47	41	47
SF04A		43	42	37	42
SF10, SF17, SF20		43	41	36	43

Note: See notes to condition 5

Construction Noise Management Plan

4. The Proponent shall prepare and implement a Construction Noise Management Plan for construction of the project to the satisfaction of the Director-General. The plan shall be submitted to the Director-General prior to construction commencing and shall include:
   (a) a detailed description of the measures that would be implemented to achieve the construction noise goals in condition 3;
   (b) a community notification protocol for the proposed construction activities (including any redrilling or re-fraccing of wells);
   (c) a description of the measures that would be implemented where the construction noise goals in condition 3 are unlikely to be achieved or are not being achieved; and
   (d) details of who would be responsible for monitoring, reviewing and implementing the plan.

Operational Noise Criteria

5. The Proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria in Table 3.

Table 3: Noise Impact Assessment Criteria dB(A)L_{Aeq}

Location (nearest residential dwelling)	Day	Evening	Night
	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$	$L_{Aeq(15\ minute)}$
SF10	43	42	37
SF04A, SF17, SF20	43	41	36
MP05. MP06, MP11	40	40	40
MP19, MP21, MP24, MP33	42	42	40
MP02, MP03, MP04, MP22, MP23	49	45	40

Notes:

- *Noise from the site is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the identified noise limits, except where otherwise specified below.*
- *Where it can be demonstrated that direct measurement of noise from the project is impractical, alternative means of determining compliance may be acceptable (see Chapter 11 of the NSW Industrial Noise Policy).*
- *The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.*
- *The identified noise emission limits apply under meteorological conditions of wind speed up to 3m/s at 10 metres above ground level, and temperature inversion conditions.*
- *As the area develops the background noise may change. At that time it may be appropriate to review the intrusive noise criteria for the proposal.*

Continuous Improvement

6. The Proponent shall, to the satisfaction of the Director-General:
   (a) implement all reasonable and feasible best practice noise mitigation measures;
   (b) investigate ways to reduce the noise generated by the project; and
   (c) report on these investigations and the implementation and effectiveness of these measures in the AEMR.

Noise Monitoring Program

7. The Proponent shall prepare and implement a Noise Monitoring Program for the construction and operation of the project to the satisfaction of the Director-General. The Program shall be submitted to the Director-General prior to construction commencing and shall include a noise monitoring protocol for evaluating compliance with the construction noise goals and the operational noise impact assessment criteria in this approval.

AIR QUALITY

8. The Proponent shall implement all practicable measures to minimise dust emissions generated by the construction and operation of the project to the satisfaction of the Director-General.

WATER

Soil and Water Management

9. The Proponent shall prepare and implement a Soil and Water Management Plan for the project to the satisfaction of the Director-General. The plan shall be submitted to the Director-General prior to construction commencing and shall:
   (a) be consistent with the requirements in *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, 2004* (Landcom);
   (b) identify construction and operational activities that could cause soil erosion and generate sediment;
   (c) describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters;
   (d) describe the location, function, and capacity of erosion and sediment control structures for both construction and operation;
   (e) describe what measures would be implemented to maintain the structures over time; and
   (f) describe the procedures that would be followed for planned and unplanned water discharges from the site.

Gas Gathering System

10. The Proponent shall, to the satisfaction of the Director-General, ensure that:
   (a) pipelines are designed, constructed and operated in accordance with the *Australian Standard for the Installation and Maintenance of Plastic Pipe Systems for Gas AS 3723-1989* (or its latest version);
   (b) the route of gas gathering and water transport systems and access roads follow previously or currently disturbed areas wherever possible;
   (c) trenches are not left open overnight, unless adequately covered;
   (d) open trenching works within 20 metres of watercourses are only undertaken during dry weather conditions;
   (e) construction activities do not impede lateral water flows;
   (f) no crown or camber remains along any gas gathering system line, following rehabilitation; and
   (g) signs are erected at intervals along all gas gathering system lines indicating the presence of a buried gas pipeline.

11. Should the future urban development of the Spring Farm and Menangle Park urban release areas identify the need to relocate any gas gathering lines the subject of this approval, that infrastructure shall be relocated by, and at the cost of the Proponent to the satisfaction of the Director-General, following consultation with the relevant council and/or landowner. The requirement to relocate at the cost of the Proponent shall be limited to one occasion.

FLOOD MANAGEMENT

12. The Proponent shall prepare and implement a Flood Management Plan for well surface locations within the 1 in 100 year flood level, to the satisfaction of the Director-General. The plan shall be submitted to the Director-General prior to commissioning of the wells and shall include measures to minimise and mitigate flooding impacts associated with the project.

WASTE MANAGEMENT

13. The Proponent shall ensure that any waste or wastewater (including drill pits and drill/formation waters) is assessed and classified in accordance with the DECC's *Environmental Guidelines: "Assessment Classification and Management of Liquid and Non-Liquid Wastes"*, and disposed of at a licensed waste disposal facility or as otherwise agreed with the DECC.

HAZARDS AND RISK

Safety and Risk Management

14. The Proponent shall prepare and implement an Emergency Plan for the project to the satisfaction of the Director-General. The plan shall be submitted to the Director-General prior to commissioning of the project and shall be prepared in accordance with the Department's *Hazardous Industry Planning Advisory Paper No. 1 - Industry Emergency Planning Guidelines.*

15. The Proponent shall prepare and implement a Safety Management System (SMS) for the project, to the satisfaction of the Director-General. The SMS shall be submitted to the Director-General prior to commissioning of the project and shall be prepared in accordance with the Department's *Hazardous Industry Planning Advisory Paper No. 9 - Safety Management*. The SMS shall;:
    (a) cover all operations on the wells and gas gathering system;
    (b) clearly specify all safety related procedures, responsibilities and policies, along with details of mechanisms for ensuring adherence to procedures;
    (c) include a summary of records to demonstrate that management of change procedures were followed for the connection of new gas lines to the existing network and for the integration of new wells into the automatic control system; and
    (d) confirm that the design and operation of all wells comply with the Department's *Locational Guidelines - Development in the Vicinity of Operating Coal Seam Methane Wells* (May 2004) or the Quantitative Risk Assessment carried out by Planager Pty Ltd (dated 19 September 2007) and that all safety related systems required by the guidelines or QRA have been included.

Compliance Report

16. Within 3 months of commissioning of the project, the Proponent shall prepare a compliance report to the satisfaction of the Director-General. The report shall be prepared by a suitably qualified, experienced, and independent expert whose appointment has been endorsed by the Director-General and shall include:
    (a) dates of commencement of construction and commissioning;
    (b) actions taken (or proposed to be taken) to implement conditions 14 and 15; and
    (c) a signed statement that:
        - the Emergency Plan required under condition 14 is effectively in place and that at least one emergency exercise has been conducted;
        - the SMS required under condition 15 has been fully implemented and that records required by the system are being kept;
        - the Emergency Plan and SMS have been prepared in accordance with the relevant *Hazardous Industry Planning Advisory Paper*;
        - all recommendations of the QRA, Emergency Plan and SMS have been implemented and are being maintained; and
        - all safety management systems and their associated risk controls have been implemented and are being maintained.

LANDSCAPE AND REHABILITATION

17. The Proponent shall progressively rehabilitate the site to the satisfaction of the Director-General, in a manner that is generally consistent with the landform of the surrounding land.

18. The Proponent shall prepare and implement a Landscape and Rehabilitation Management Plan for each well surface location, to the satisfaction of the Director-General. This Plan must:
    (a) be prepared in consultation with the landowner by suitably qualified experts;
    (b) be submitted to the Director-General for approval prior to commissioning;
    (c) describe in detail the short, medium and long term measures that would be implemented to:
        - rehabilitate the site;
        - implement planting of native vegetation;
        - manage the remnant vegetation and habitat on the site; and
        - landscape the site to mitigate visual impacts of the project;

(d) include a description of what measures would be implemented to rehabilitate the site; and
(e) provide details of who is responsible for monitoring, reviewing and implementing the plan.

19. The Proponent shall consult with the landowner in the selection of fencing and other materials to be used for landscaping, to the satisfaction of the Director-General.

ABORIGINAL HERITAGE

20. The Proponent shall prepare and implement an Aboriginal Heritage Management Plan for each well surface location, in consultation with the DECC and relevant Aboriginal communities, and to the satisfaction of the Director-General. The plan shall be submitted to the Director-General prior to construction commencing at each well surface location (or as otherwise agreed by the Director-General) and shall include:
(a) a description of the measures that would be implemented for the mapping, and salvage or relocation of archaeological relics;
(b) a description of the measures that would be implemented if any new Aboriginal objects are discovered during the project; and
(c) a protocol for the ongoing consultation and involvement of the Aboriginal communities in the conservation and management of Aboriginal cultural heritage on the site.

HERITAGE

21. The Proponent shall ensure that the location of wells or other infrastructure avoid or minimise any impacts on the heritage significance of any State Heritage Register listed items in the project area.

TRAFFIC AND TRANSPORT

22. The Proponent shall prepare and implement a Construction Traffic Management Plan for the project, in consultation with the RTA, Camden Council and Campbelltown City Council, and to the satisfaction of the Director-General. The plan shall be submitted to the Director-General prior to construction commencing (or as otherwise agreed by the Director-General) and shall include:
(a) a description of the measures that would be implemented to:
- maintain access;
- minimise the potential noise and safety impacts associated with the construction of the gas gathering lines and construction traffic; and
- keep the community informed of any traffic disruptions that would be caused by the project;

(b) traffic control plans where appropriate.

23. Should the installation of the gas gathering line require an underbore of the South Western (F5) Freeway, the underbore works shall be undertaken to the satisfaction of the RTA and:
(a) have a minimum depth of 1.2 metres below the lowest point of the road formation, 300mm below the invert of the table drains and 900mm below the natural surface elsewhere in the road reserve;
(b) excavation of thrust pits must be conducted outside the F5 reserve; and
(c) require no access for construction or maintenance from the F5.

ONGOING OPERATIONS

Community Notification

24. The Proponent shall give written notification of planned maintenance activities (including well workover) to landowners, potentially affected residences and identified noise sensitive receivers at least 14 days prior to work commencing. The notification is to include:
(a) information explaining the maintenance procedures to be undertaken;
(b) an estimate of the length of works at each site;
(c) contact details for a representative of the Proponent; and
(d) information regarding a 24-hour telephone contact number.

Redrilling and Re-fraccing

25. The Proponent shall obtain the approval of the Director-General prior to undertaking work involving the redrilling and/or re-fraccing of wells approved under this approval.

Note: For the purposes of this approval the redrilling and/or re-fraccing of a well does not constitute wellhead (workover) maintenance.

Reporting

26. The Proponent may satisfy conditions 4, 7, 9, 12, 14, 15, 18, 20 and 22 in Schedule 3 of this approval by demonstrating to the satisfaction of the Director-General that existing equivalent documentation has been appropriately updated to reflect the expansion of Stage 2 of the Camden Gas Project.

SCHEDULE 4
ENVIRONMENTAL MANAGEMENT AND MONITORING

ENVIRONMENTAL MANAGEMENT PLAN

1. The Proponent shall prepare and implement an Environmental Management Plan (EMP) for the construction and operation of the project to the satisfaction of the Director-General. The EMP shall be submitted to the Director-General prior to construction of the project and shall:
   (a) incorporate the various environmental management plans, monitoring programs and other requirements set out in Schedule 3 of this approval;
   (b) identify statutory and other obligations that the Proponent is required to fulfil during the construction and operation of the project;
   (c) describe the environmental policies and principles to be applied to the project;
   (d) describe in general how the environmental performance of the project would be monitored and managed;
   (e) describe the procedures that would be implemented to:
      - keep the local community and relevant agencies informed about the environmental performance of the project;
      - receive, handle, respond to, and record complaints;
      - resolve disputes that may arise during the course of the project;
      - respond to any non-compliance;
      - manage cumulative impacts; and
      - respond to emergencies (including bushfires); and
   (f) describe the role, responsibility, authority, and accountability of all the key personnel involved in the environmental management of the project.

INCIDENT REPORTING

2. Within 7 days of detecting an exceedance of the goals/limits/performance criteria in this approval or an incident causing (or threatening to cause) material harm to the environment; the Proponent shall report the exceedance/incident to the Department (and any relevant agency). The report shall:
   (a) describe the date, time, and nature of the exceedance/incident;
   (b) identify the cause (or likely cause) of the exceedance/incident;
   (c) describe what action has been taken to date; and
   (d) describe the proposed measures to address the exceedance/incident.

ANNUAL REPORTING

3. Within 12 months of the date of this approval, and annually thereafter during the life of the project, the Proponent shall prepare an Annual Environmental Management Report (AEMR) for the project to the satisfaction of the Director-General. The AEMR shall:
   (a) identify the standards, performance measures and statutory requirements that apply to the project;
   (b) assess the environmental performance of the project to determine whether it is complying with these standards, performance measures, and statutory requirements;
   (c) identify any non-compliance during the year with the conditions of this approval or any standard, performance measure or statutory requirement that applies to the project;
   (d) describe, if any non-compliance is identified, the actions and measures carried out or being carried out to ensure compliance, clearly indicating who would carry out these actions and measures, when they would be carried out, and how the effectiveness of these measures would be monitored over time;
   (e) include a copy of complaints for the year and a description of actions taken or being taken to address registered complaints;
   (f) include a discussion of issues or recommendations raised by the CCC and a description of actions taken or being taken to address these issues or recommendations; and
   (g) include a detailed summary of results of all monitoring required by this approval and a discussion of any significant results, trends or exceptions in these results,

4. The Proponent shall submit a copy of the AEMR to the DPI, DECC, Camden Council and Campbelltown City Council.

INDEPENDENT ENVIRONMENTAL AUDIT

5. Within 2 years of the date of this approval, and every 3 years thereafter, unless the Director-General directs otherwise, the Proponent shall commission and pay the full costs of an Independent Environmental Audit. The Independent Environmental Audit shall:
   (a) be conducted by a suitably qualified, experienced, and independent person(s) whose appointment has been approved by the Director-General;
   (b) be consistent with *ISO 19011:2002 - Guidelines for Quality and/or Environmental Management Systems Auditing*, or updated versions of these guidelines/manuals;
   (c) assess the environmental performance of the project, and its effects on the surrounding environment;
   (d) include a hazard audit of the project in accordance with the Department's *Hazardous Industry Planning Advisory Paper No. 5, "Hazard Audit Guidelines"*;
   (e) assess whether the project is complying with the relevant standards, performance measures and statutory requirements;
   (f) review the adequacy of the EMP; and
   (g) recommend measures or actions to improve the environmental performance of the project, and/or its environmental management and monitoring systems.

6. Within 3 months of completion of each Independent Environmental Audit, the Proponent shall submit a copy of the audit report to the Director-General, DPI and DECC, with a response to any of the recommendations contained in the audit report.

7. Following each Independent Environmental Audit, the Proponent shall review and if necessary revise the EMP (and any documents contained in the plan), to the satisfaction of the Director-General. The revised EMP shall be submitted to the Director-General within 6 months of completing the audit.

COMMUNITY CONSULTATIVE COMMITTEE

8. The Proponent shall ensure that the construction and operation of the project is subject to the consideration of the Camden Gas Project's CCC, as established under Schedule 5 condition 17 of development consent DA No. 282-6-2003-I, dated 16 June 2004.

ACCESS TO INFORMATION

9. Within 1 month of the approval of any plan/strategy/program required under this approval (or any subsequent revision of these plans/strategies/programs), or the completion of the audits or AEMR required under this approval, the Proponent shall:
   (a) provide a copy of the relevant document(s) to the relevant agencies and the CCC; and
   (b) ensure that a copy of the relevant document(s) is made publicly available on its website.

10. During the project, the Proponent shall:
   (a) make a summary of all environmental monitoring results required under this approval publicly available on the website; and
   (b) update these results on a regular basis (at least every 6 months), or as required.

Reporting

11. The Proponent may satisfy conditions 1, 3 and 5 in Schedule 4 of this approval by demonstrating to the satisfaction of the Director-General that existing equivalent documentation has been appropriately updated to reflect the expansion of Stage 2 of the Camden Gas Project

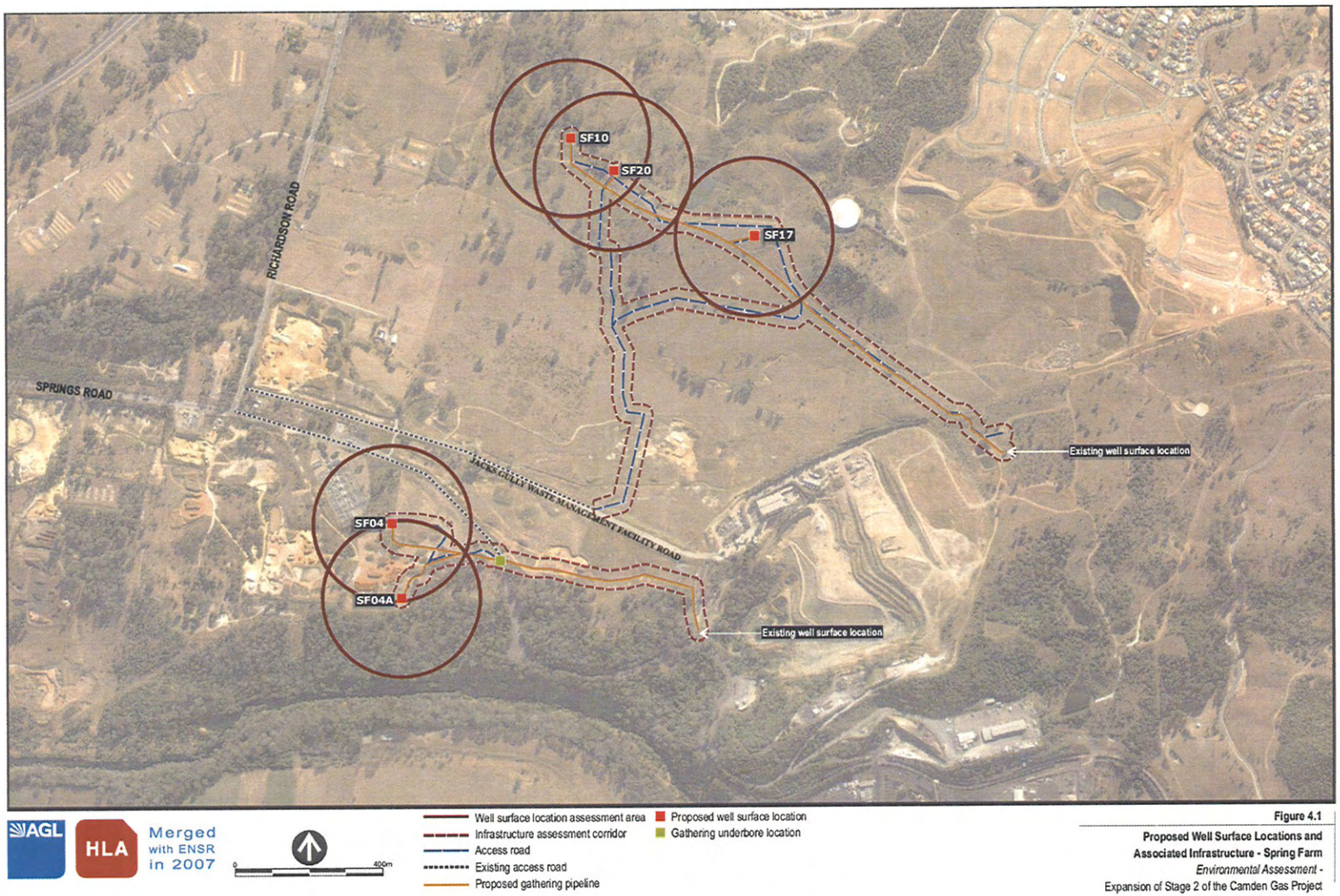
APPENDIX 1
SCHEDULE OF LAND

Owner	Lot/DP Number	Well Surface Location and supporting infrastructure details
Spring Farm		
Landcom	13/ DP1081753	SF17, SF04A, access through lot along WSN right of carriageway to Lot 2 in DP1076817, access roads, gas gathering and water lines
	2/ DP 816858	Access via WSN right of carriageway off Richardson Road to Lot 2 in DP1076817
Camden Council	1/ DP 1007608	SF10, SF20, access, gathering and water lines
	4/ DP 1007608	Access route and gas gathering lines
WSN Environmental Solutions	11/ DP1081753	Connection of access route and gas gathering lines from SF10, SF17 and SF20 to existing system near GL02/12
	2/ DP 1076817	Connection of access route and gas gathering lines from SF04A to existing system near GL06
	14/ DP1081753	Access via existing road for connection of proposed SF04A with existing system at GL06
SADA Services Pty Limited	2/ DP 863680	Access via existing road to Lot 54 in DP 864754 for SF04A and for connection into the existing system near GL06
TJ & RF Fordham Pty Limited	54/ DP 864754	Access via existing road for SF04A works and for connection of gathering into the existing system near GL06, including gathering line underbore of the road
Menangle Park		
Landcom	7/ DP 253700	MP02, MP03, access, gathering lines and potential underbore options for gathering
	2/ DP 790254	MP06, access, gathering lines and option for potential underbore of the rail line near underpass to connect MP04 to gathering from MP05
	X/ DP 378264	MP06, access road and gas gathering line to interconnect to existing gas gathering trunk line
	D/ DP 19853	Access road and gas gathering line to interconnect to the existing gas gathering trunk line
	2/ DP 737485	MP11, MP19, access road and gas gathering line options
	8/ DP 249530	MP19, MP22, access road and gathering line options which may include a gathering underbore
	1/ DP 598067	MP21, MP23, access road and gathering lines
	11/ DP 584016	MP21, MP22, MP23, gathering lines and access route which may include a gathering underbore
	2/ DP 554242	Access route option off cnr Taber St & Cummins Rd
	3/ DP 628052	Gathering line and access route from MP04 to rail line underbore
	5/ DP 249530	Access route option off Glenlee Road (East)
	41/ DP 259152	Access route for MP02 and MP03 off Gilchrist Drive
University of Western Sydney	6/ DP 253700	Access route for MP02 and MP03 off Gilchrist Drive
Minister Administering the EP&A Act	8/ DP 253700	Access and gathering for MP03 as well as a potential underbore of the rail line for potential gathering options
	1085/ DP792746	Potential gathering line option (Menangle/ Glenlee Roads) to link MP02 and MP04 which may include an underbore of Upper Canal at junction of Menangle and Glenlee Roads from either Lot 1085 in DP 792746 or Lot 2 in DP 842735 to Glenlee Road
	181/ DP791988	Potential gathering line option (Menangle/ Glenlee Roads) to link MP02 and MP04 which includes a

		potential underbore from Lot 9 in DP 253700
	2/ DP 842735	Potential gathering option (Menangle/ Glenlee Roads) which may involve an underbore of Upper Canal at junction of Menangle and Glenlee Roads from either Lot 1085 in DP 792746 or Lot 2 in DP 842735 to Glenlee Road (East)
TransGrid	31/ DP 1100981	MP04, access, gathering lines and potential underbore
Sydney Catchment Authority	26/ DP 249530	Access road off Glenlee Road (East)
	27/ DP 249530	Continuation of access road from Glenlee Road (East)
	1/ DP 616271	Potential access option to MP04 along Upper Canal and potential gathering line option to link MP03 and MP04 which would require underbore of the F5 and possible underbore or crossing of Upper Canal from either to Lot 3 or 5 in DP 249529 to Lot 31 in DP 1100981
	2/ DP 616271	Potential gathering option (Menangle/ Glenlee Roads) which requires underbore of Upper Canal and potentially Menangle Road at the junction of Menangle and Glenlee Roads from either Lot 1085 in DP 792746 or Lot 2 in DP 842735
	2/ DP 1086648	Potential gathering option (Menangle/ Glenlee Roads) which requires underbore of Upper Canal at junction of Menangle and Glenlee Roads
Australian Rail Track Corporation (ARTC)	1/ DP 790254	MP05, access, gathering lines and gathering line underbore of the south rail spur line to Lot 2 in DP 790254
	9/ DP 253700	Access and gathering for MP02 and a potential underbore location for the potential gathering line option (Menangle/ Glenlee Roads) to connect MP02/03 across from Lot 181 in DP 791988 with MP04
	1/ DP 234108	Access for MP02 and MP03
	10/ DP 253700	Access for MP02 and MP03
	Govt. Gazette 5/11/1858 Folio 1823	- Main Southern rail line easement for gathering line option to link MP02 and MP03 with MP04
	Book 70 No. 447 Book 80 No. 475	- Main Southern Rail line underpass for access south of the Glenlee rail spur and north of Glenlee House from Glenlee Road (East) and gathering which may include a potential underbore from Lot 3 DP628052 to Lot 2 DP790254
	Book 71 No. 92 Book 68 No. 798	- Access through Main Southern Rail line underpass at the Howes Creek crossing
SADA Services Pty Limited	1101/ DP 883495	Access for MP05 and MP06
	38/ DP 1098588	Access for MP05 and MP06
	1/ DP 405624	Access for MP05 and MP06
J Tripodi	1102/ DP 883495	Access for MP05 and MP06
Campbelltown City Council	2/ DP 236059	MP24, access, gathering lines and underbore of Menangle Road
	3/ DP 236059	Gathering line from MP24 to link into existing system and access option off Menangle Rd to MP33
	1/ DP 249393	MP33, gas gathering lines and access route options
	7/ DP 787284	Access to Menangle Road and potential gas gathering lines
	124/ DP1097090	Access to Menangle Road
	125/ DP1097138	Access to Menangle Road
	33/ DP1101983	Access to Menangle Road
	19/ DP 260090	Access to Menangle Road
	22/ DP 260090	Access to Menangle Road

	23/ DP 260090	Access to Menangle Road
	1/ DP 708770	Access to Menangle Road
	1/ DP 707225	Access to Menangle Road
L & E Trevisan	4/ DP 205663	Potential gathering line option (Freeway) to link MP03 and MP04
A & M Begaj	1/ DP 249529	Potential gathering line option (Freeway) to link MP03 and MP04
P & B Durovic	2/ DP 249529	Potential gathering line option (Freeway) to link MP03 and MP04
M Harris	3/ DP 249529	Potential gathering line option (Freeway) to link MP03 and MP04, including potential underbore location
Roads & Traffic Authority (RTA)	Menangle Road (Crown Road) reserve between the rail overpass and the Nepean River Bridge	Gathering line underbore of Menangle Road just west of the rail line, then gathering line in verge of road under the rail overpass for connection to existing gathering system
	4/ DP 249529 5/ DP249529 6/ DP249529 7/ DP249529	Potential gathering line option (Freeway) to link MP03 and MP04 which may require underbore of the F5 from Lot 3 in DP 249529 to Lot 31 in DP 1100981
	4/ DP 210548	Potential gathering line option (Menangle/ Glenlee Roads) to link MP02 and MP04
	17/ DP249530 19/ DP249530 20/ DP249530 21/ DP249530 22/ DP249530	Potential gathering line option (Menangle/ Glenlee Roads) to link MP02 and MP04 which may involve an underbore or strap on to the Mark Evans Bridge. (F5 freeway at the Mark Evans Bridge)
Torrens Re-Development and Research Pty Limited	3003/802845	Potential gathering line option (Menangle/ Glenlee Roads) to link MP02 and MP04 which may include underbore

APPENDIX 2
PROJECT AREA



Spring Farm Project Area (Figure 4.1 of the EA)

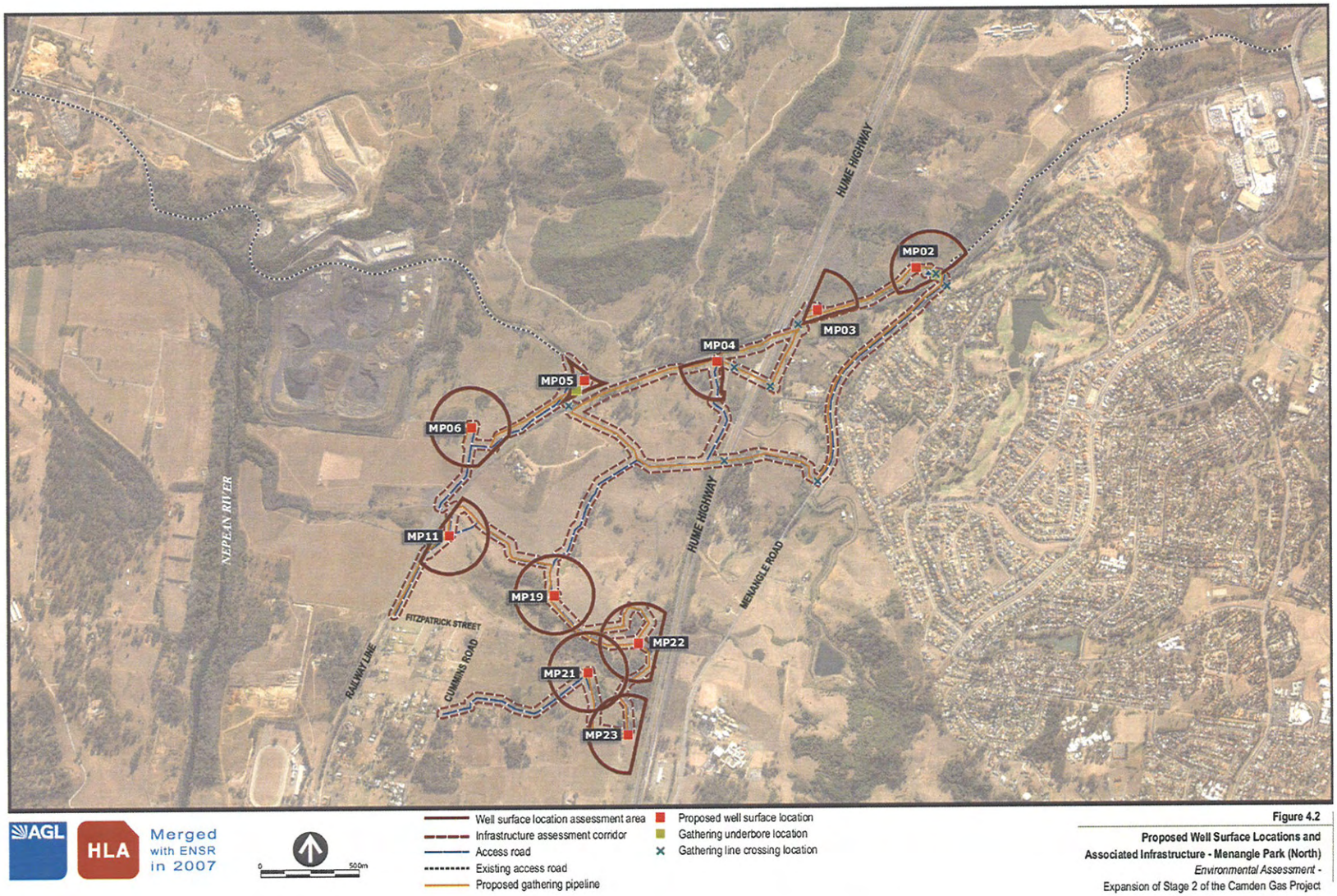


Figure 4.2
Proposed Well Surface Locations and Associated Infrastructure - Menangle Park (North)
Environmental Assessment - Expansion of Stage 2 of the Camden Gas Project

Menangle Park Project Area (North) (Figure 4.2 of the EA)

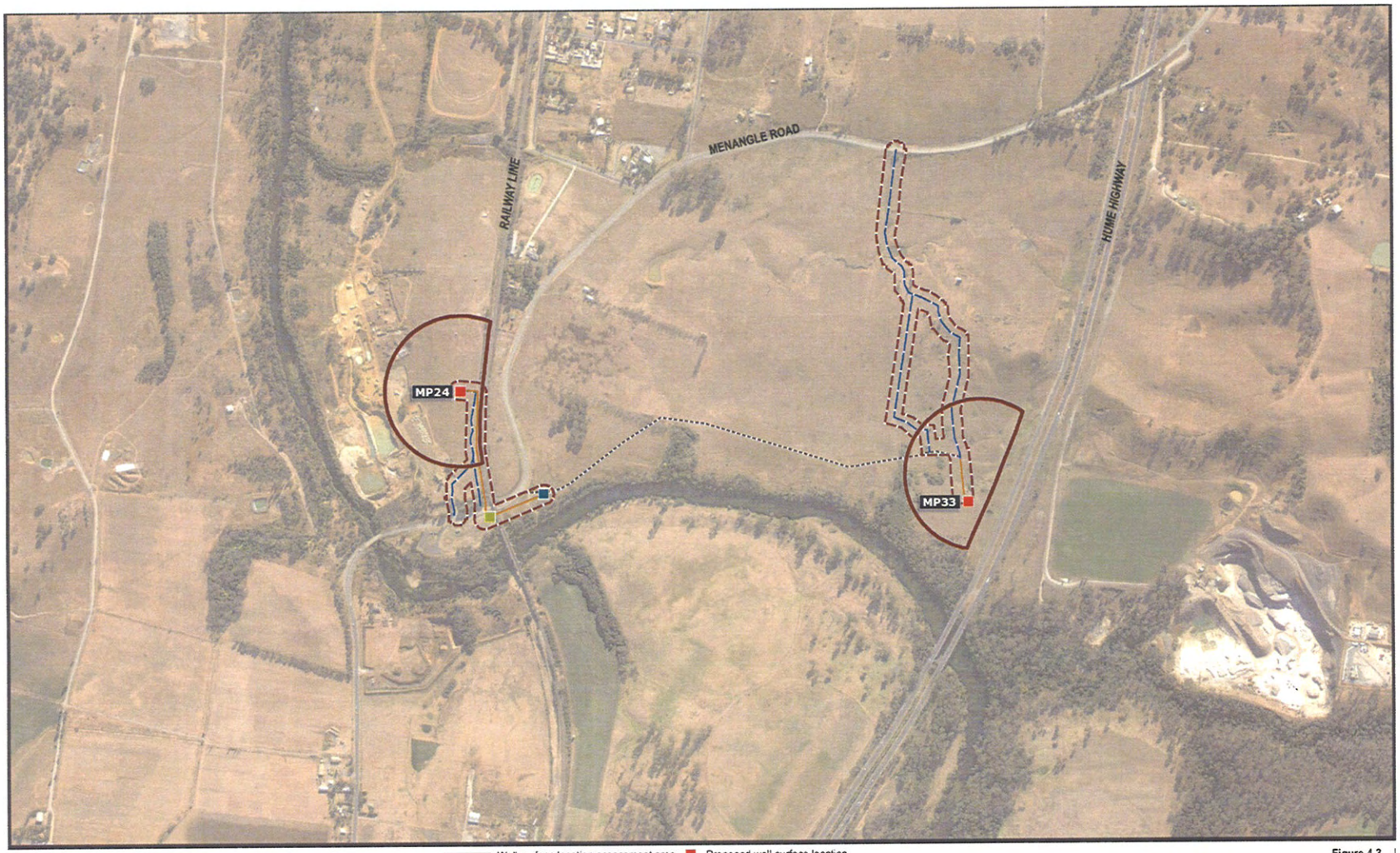


Figure 4.3

Proposed Well Surface Locations and Associated Infrastructure - Menangle Park (South)

Environmental Assessment - Expansion of Stage 2 of the Camden Gas Project

Menangle Park Project Area (South) (Figure 4.3 of the EA)

APPENDIX 3
STATEMENT OF COMMITMENTS

Issue	Commitment
General	1. The Proponent shall implement all practicable measures to prevent or minimise harm to the environment that may result from the construction or operation of the Project. 2. The Proponent shall provide Camden Council and Campbelltown City Council with the Geographical Positioning System (GPS) co-ordinates and digital survey data for gas well surface locations and gas gathering systems within its Local Government Area, in a format suitable to Council, within three months of the commissioning of the gas wells. 3. The Proponent shall provide Camden Council and Campbelltown City Council with the wellhead configurations of each gas well within three months of the gas well being commissioned. 4. The Proponent shall comply with the following in the construction of the gas gathering system pipeline: (a) the route of gas gathering and water transport systems and access roads follow previously or currently disturbed areas wherever possible; (b) signs stating the presence of a buried gas pipeline shall be erected periodically along the length of the trench once the pipeline has been laid; (c) trenches are to be restored and reseeded with local grass seeds or a seed blend agreed to by the landowner on completion of the work; (d) the Proponent shall construct the gas gathering system so as not to impede lateral water flows; (e) the Proponent shall ensure that no crown or camber remains along the gas gathering systems, following construction; (f) the pipeline shall be designed, constructed and operated in accordance with the Australian Standard for the installation and maintenance of Plastic Pipe Systems for Gas AS 3723-1989 (or its latest version); and (g) trenches are not left open overnight, unless adequately covered. 5. The Proponent shall provide a site layout to the Director General prior to construction of a well surface location. The site layout would include information identifying: • Initial rehabilitation of surplus construction footprint following completion of the construction phase; and • Rehabilitation and Landscape Concept Plan of well surface locations for the post-commissioning phase as well as following final closure of the wells.
Air Quality	6. The Proponent shall implement all practicable measures to minimise dust emissions generated by the construction and operation of the project to the satisfaction of the Director-General.
Ecology	7. The Proponent shall take all practicable measures to minimise potential flora and fauna impacts of the proposed Project. 8. The Proponent shall prepare and implement a Landscape Management Plan detailing landscaping to be undertaken at well surface locations, including a maintenance program for these landscaping works. Landscaping shall be undertaken using appropriate native species. 9. The Proponent shall take all practicable measures to limit the potential spread of noxious weeds at the sites.

Issue	Commitment
Noise	10. The proponent shall conduct construction activities, except for drilling of wells for the Project only between the following hours: 7.00 am to 6.00 pm Monday to Friday; and 8.00 am to 1.00 pm Saturdays. 11. The Proponent shall implement all practicable measures to undertake the development in a way that minimises the noise generated. 12. The Proponent will utilise a combination of design measures at well construction sites as required (refer to Section 8.5.5 for identified mitigation measures at each site) to ensure that noise impacts during the construction period are minimised. 13. The Proponent will implement the following measures during the construction period to further manage potential noise impacts: (a) Preparation of a Construction Noise Management Plan (CNMP) to consider the following issues: (b) Identification of noise goals; (c) Identification of residential receivers; (d) Length of construction; (e) Hours of construction; (f) Best practice, construction equipment and noise mitigation; (g) Noise monitoring; (h) Community notification; and (i) Complaints handling. 14. The Proponent shall undertake a program of noise monitoring once wells are operational in order to validate design of operating well surface locations. A combination of the mitigation measures and design options would be applied on a site by site basis, as determined by the results of noise monitoring, to ensure that operational noise is maintained at an acceptable level.
Soil and Water	15. The Proponent shall prepare and implement a Flood Management Plan for wells located within the 1 in 100 year flood level to the satisfaction of the Director-General. The plan shall be submitted to the Director-General prior to commissioning of those wells, and shall include measures to minimise and mitigate flooding impacts associated with the project. 16. The Proponent shall prepare and implement a Soil and Water Management Plan for the project to the satisfaction of the Director-General. The plan shall be submitted to the Director-General prior to construction commencing.
Heritage	17. The Proponent shall prepare and implement an Cultural Heritage Management Plan, in consultation with the DECC and relevant Aboriginal communities, and to the satisfaction of the Director-General for well surface locations, gathering lines and access roads associated with this Project which are likely to impact on the archaeological relics. The plan shall be submitted to the Director General prior to construction commencing of those works, and shall include: • A description of the measures that would be implemented for the salvage, relocation or mapping of the archaeological relics as identified in the Aboriginal Heritage Assessment included as Appendix H to this EA.

Safety and Risk Management	18. The Proponent shall prepare/update and implement an Emergency Response Plan and Safety Management System for the Project. The plan/ system shall be submitted to the Director-General, prior to the commissioning of the Project. 19. Within three months of commissioning of the Project, the Proponent shall prepare to the satisfaction of the Director-General a compliance report detailing compliance with Commitment 17, including: (a) dates of study/ plan/ system completion/ submission and commencement of construction and commissioning; and (b) actions taken or proposed, to implement recommendations made in the studies/ plans/ systems. The report shall verify that: (a) The Emergency Plan required by Commitment 17 is effectively in place and that at least one emergency exercise has been conducted; and (b) The Safety Management System required by Commitment 17 has been fully implemented and that records required by the system are being kept. The report shall include a signed statement by the Proponent's representative responsible for the operation of the Project that for each study/ plan/ system: (a) The required study/ plan/ system has been undertaken or prepared to the relevant Hazardous Industry Planning Advisory Panel; (b) All recommendations of each study/ plan/ system have been implemented; and (c) All safety management systems and their associated risk controls have been implemented and are being maintained.

Environmental Management and Performance	20. Prior to construction, the proponent shall consult with Integral Energy and TransGrid with regard to the siting and construction of well surface location MP04 to the satisfaction of the Director General. 21. The Proponent shall prepare/update and implement an Environment, Health and Safety Management Plan (EHSMP) to provide environmental management practices and procedures to be followed during the operation of the Project. The EHSMP shall include, but not necessarily be limited to: (a) identification of statutory and other obligations that the Proponent is required to fulfil in relation to operation of the Project; (b) a description of the roles and responsibilities for all key personnel involved in environmental management of the Project; (c) the environmental policies and principles to be applied to the operation of the Project; and (d) describe in general terms how the environmental performance of the Project would be monitored and managed. 22. The Proponent shall commission and pay the full costs of an Independent Environmental Audit of the construction of the gas gathering system, construction of the access roads and drilling and fracture stimulation of gas wells within the CGP. (a) be conducted by a suitably qualified, experienced, and independent person(s) whose appointment has been approved by the Director-General; and (b) be consistent with ISO 19011:2002 – Guidelines for Quality and/or Environmental Management Systems Auditing, or updated versions of these guidelines/manuals. The audit shall: (i) assess the environmental performance of the construction of the Project, and its effects on the surrounding environment; (ii) assess whether the development is complying with the relevant standards, performance measures, and statutory requirements; (iii) consider the Proponent's EHSMPs; and (iv) recommend measures or actions to improve the environmental performance of the construction of the Project, and/or its environmental management and monitoring systems (if required). 23. Within three months of completion of the audit, the Proponent must submit a copy of the audit report to the Director-General, the NSW Heritage Office and DPI. The Director-General may require the Proponent to address certain matters identified in the report and any comments received from the NSW Heritage Office and DPI. Any action required to be undertaken shall be completed within such period as the Director-General may agree.