

Project Description – Summary of Key Outcomes

AGL proposes to build a nominally 300 MW gas-fired peaking power plant comprising two gas turbines each nominally 150 MW operating in open cycle mode. The power plant would be fuelled by natural gas from two major existing pipelines running through the Development Site. The electricity generated by the power plant would be fed into the high voltage transmission network also running through the Development Site. Additional allowance has been made in the footprint for an additional two units to be installed. The installation of additional units, however would be based on project need and the performance of the two operational turbines. This Environmental Assessment is seeking approval for two turbines only. The installation of additional turbines, would fall under a separate application process and does not form part of this assessment process.

Each gas turbine unit comprises the turbine itself, a generator and a high voltage transformer with air coolers, compressors and filters on the inlet. A gas receiving and conditioning station would be required for each of the two pipeline connections to ensure flow and pressure control, isolation and filtration.

Some small amounts of chemicals and oil would be required on-site for use in the Leaf's Gully Power Project and storage will comply with statutory requirements. Water would be stored on-site in three tanks for process, domestic and fire fighting uses. Rainwater would be captured and used on-site in lieu of mains water for non-potable purposes. Process water would be recycled to the extent possible before being discharged into an evaporation pond. Sewage generated on the Site would be directed to a proprietary system on-site or a pump out system with off-site disposal to an appropriate facility.

All surface water captured on the developed area would be collected in a sedimentation pond and treated to remove oil and floating material. Oil and grit traps would prevent potential spills of oil escaping into the stormwater system.

The power plant may be operated remotely with staff working during day shifts and on call at other times. During operation, about five staff would be employed. Construction would occur over 18 to 24 months. The successful contractor would prepare detailed construction programs and plans.

Subject to consent conditions determined by the Minister for Planning, AGL would create a Conservation Area to permanently conserve vegetation communities in the area between the Nepean River and the Upper Canal as well existing vegetation and fauna habitat around the facility footprint comprising approximately 170 ha of vegetation within the Development Site. The Voluntary Conservation Agreement or biobanking agreement or some other enduring mechanism becomes permanent upon implementation of the agreement and transfers with title to the land so that any future landowners have to abide by the agreement.

Chapter 4

Project Description

4.1 Overview

4.1.1 General

AGL proposes to build a gas-fired power plant (known as the Leaf's Gully Power Project) at Gilead, near Appin NSW. The power plant would use two open cycle gas turbines and have a nominal power generating capacity of approximately 300-360 MW (depending on turbine manufacturer). Allowance has been made within the footprint for an additional two units to be approved and installed at a later date and subject to another approvals process.

The electricity generated fed into the 330 kilovolt (kV) transmission network via a new switchyard on the Development Site. The power plant would use natural gas supplied by existing pipelines: either the Alinta Gas Networks Main Trunk Pipeline (AlintaGN) or the Eastern Gas Pipeline (EGP), both of which run through the Development Site.

Each of the proposed gas turbine generators would be rated at approximately 150 MW each run in open cycle mode. The power plant would be constructed and operated on an area less than 20 ha of the 280 ha property known as Leaf's Gully Farm. A metering and control facility would be required at the connection with each of the gas pipelines whilst a gas conditioning facility is required at the power plant end. The new pipelines connecting the power plant to the existing pipelines would be located underground.

4.1.2 Development Area

The Development Area includes the titles listed in **Table 4-1**.

Table 4-1 Titles for Development Area

Lot identifier	Owner	Comment	Proposed Use	Reference in this document
Lot 101 in DP 716209	Mitchell	Leafs Gully Farm	Part infrastructure (gas and transmission connection) Part conservation area	Development Site
Lot 102 in DP 716209	Mitchell	Leafs Gully Farm	Part footprint of proposed facility and access roads within Development Site Part conservation area	
Lot 104 in DP 716209	Veech & Veech			
Lot 105 in DP 716209	Mitchell & Warren			
Lot 103 in DP716209	Mitchell	Leafs Gully Farm	Part conservation area	

Project Description

Chapter 4

Lot identifier	Owner	Comment	Proposed Use	Reference in this document
Part of Lot 1 in DP 70208 burdened by the Right of Carriageway 10m wide and an Easement for Services Access 10m wide identified in Deposited Plan 633800	Sheraton Homes Pty Ltd	Easement over adjacent lot for right of carriageway	Access road for site	Access road
Road reserve – part Main Road 177	Campbelltown City Council	Appin Road	Upgrade of intersection of Appin Road and access road	Intersection Upgrade

The Development Site is located in Gilead, approximately 55 km south west of the Sydney CBD and 10 km south of the Campbelltown CBD. Urban development extending south from Campbelltown reaches the suburbs of Rosemeadow and St Helens Park approximately 5 km north east of the Development Site (refer to **Figure 1-1**).

The Development Site is 4.5 km north west of the township of Appin. Developments immediately surrounding the Development Site are predominantly rural enterprises on medium size holdings and smaller rural home sites of between 2 and 10 ha. Inghams Appin Broiler Complex adjoins the southern boundary of the Development Site and the Nepean River forms the western boundary of the Development Site (refer to **Figure 4-1**).

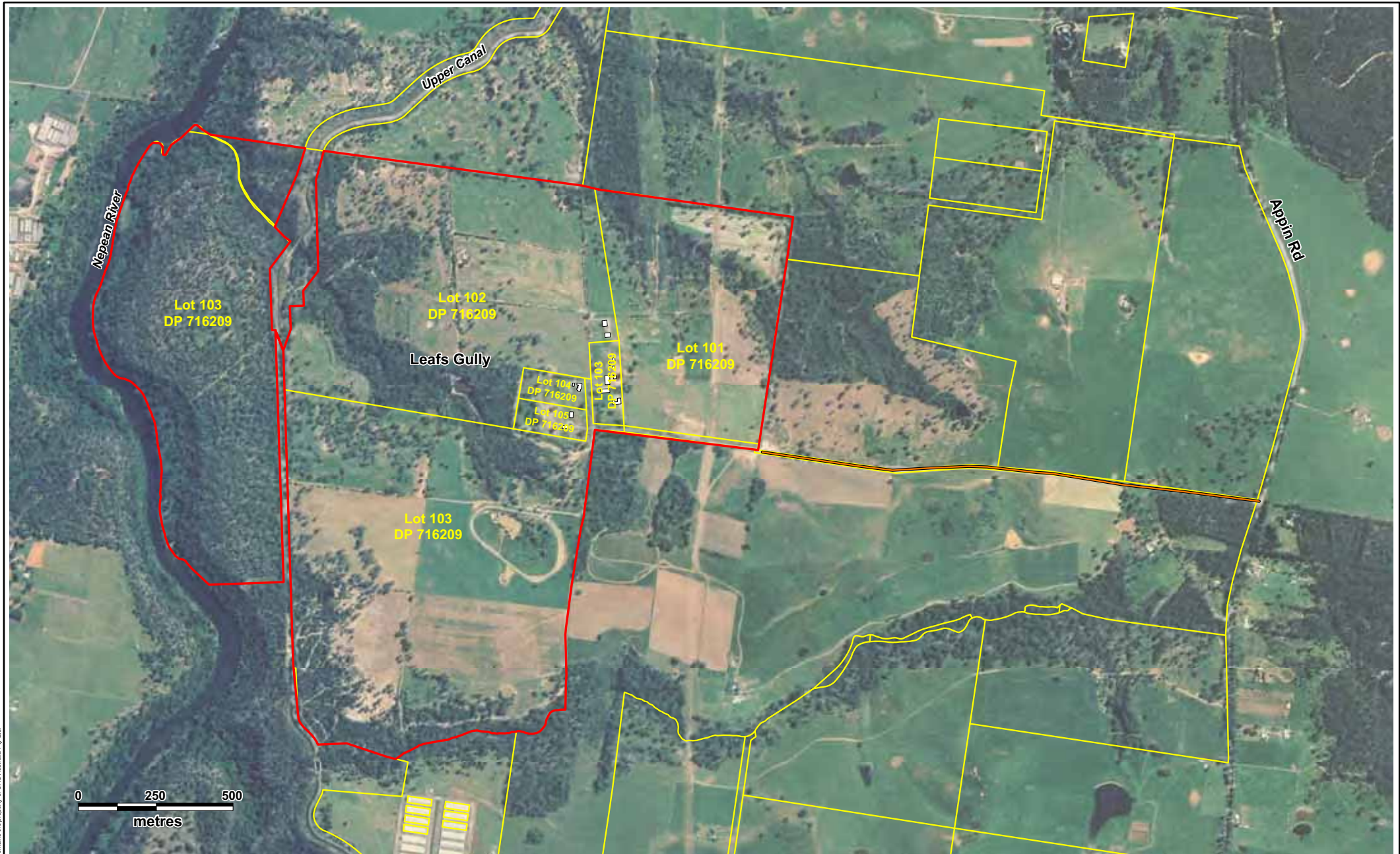
It is noted that as the proposed development falls within the definition of critical infrastructure under the EP&A Act, land owners consent is not required for lodgement of the development application. Refer to **Section 5.2.2** for further detail.

The Development Site currently operates as a trotting horse breeding and training enterprise. The majority of the Development Site is cleared and used for horse grazing and horse yards. Main improvements include four residences used by the owner, the owner's family and an employee, farm buildings and a purpose built trotting track (refer to **Figure 4-1**).

The access road is located in a Right of Carriageway 10m wide and an Easement for Services Access 10m wide created on 11 August 1983 by the registration of an instrument under section 88B of the *Conveyancing Act 1919* and Deposited Plan (DP) 633800 benefits Leaf's Gully Farm (Right of Way). The current title description of the land burdened by the Right of Way is Lot 1 in DP 70208.

Existing access to the Development Site is by way of a sealed road that does not fully occupy the land compromised in the Right of Way. The access road will be upgraded and re-aligned on that part of Lot 1 DP 70208 burdened by the easements benefiting the Development Site.

On Appin Road, the intersection with the access road will require upgrading. AGL is seeking Project Approval for the intersection works as part of the Leaf's Gully Power Project.



Legend

- Property Boundary
- Access Road

Datum: GDA94 Projection: MGA Zone 56

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title PROPOSED DEVELOPMENT SITE
	Drawn: AJW Approved: FINAL Date: 22.06.06 Job No: 43177401 File No: 43177401-020.wor	Figure: 4-1

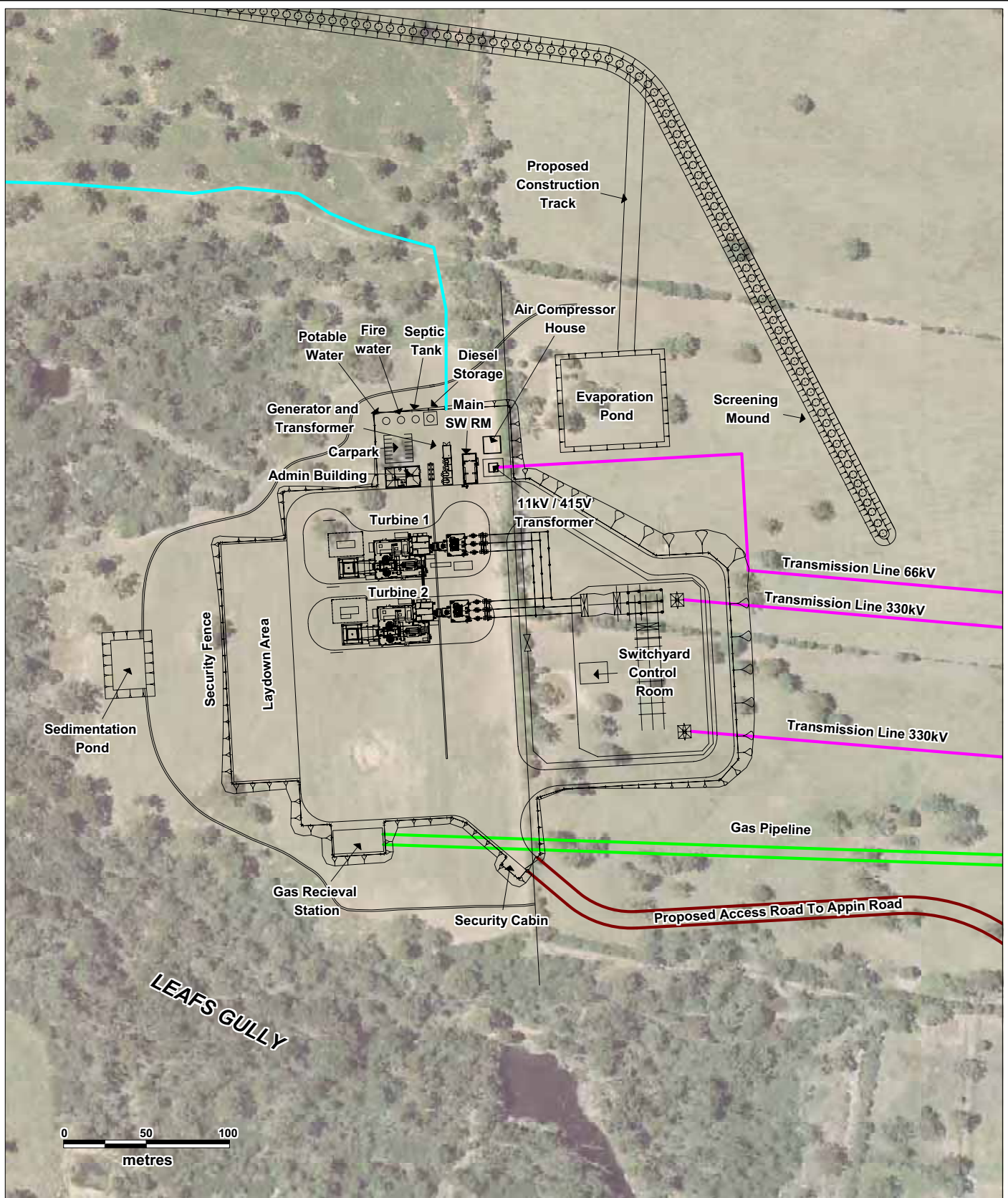
4.1.3 Proposed layout and key components

Less than 20 ha of the 280 ha of the Development Site is required for the Leafs Gully Power Project. The Leafs Gully Power Project comprises the following key components:

- power plant comprising two gas turbines, generators and ancillary plant;
- high voltage switchyard comprising high voltage transformers and switchgear;
- transmission line connection to the 330 kilovolt network;
- control room, administration, amenities, car parking and workshop facility;
- connecting gas pipelines, gas receiving station and gas conditioning station;
- fire protection tank;
- process water tank;
- domestic/rainwater tank(s);
- domestic wastewater treatment and disposal system;
- sedimentation pond and associated earth bund and diversion drain;
- evaporation pond to accommodate waste water discharges from the evaporative air inlet cooler;
- air compressor plant;
- switchroom;
- emergency generator and transformers;
- landscaping and tree planting to provide visual screening of the facility;
- internal roads;
- access road for the plant from Appin Road;
- security and general fencing and gatehouse; and
- upgrade works on Appin Road at the intersection with the access road.

The preliminary indicative layouts of the key components of the Leafs Gully Power Project are presented in **Figure 4-2**.

Where possible, existing dwellings and structures may be modified for use as administration and amenities facilities during the construction and operating stages. At this stage AGL does not propose to demolish any of the existing buildings or horse tracks on the Development Site with the exception of the employee's residence located within the proposed transmission line connection easement.



0 50 100
metres



- Electricity Transmission Lines
- Gas Pipeline
- Proposed Access Road
- Plant Layout
- Proposed Water Pipeline

Source: KBR, 2006

Map compiled using MapInfo StreetPro Data. © 2004 MapInfo Australia Pty Ltd, URS Australia and PSMA Australia Ltd. URS Australia, MapInfo Australia or PSMA Australia do not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that these companies shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title SITE CONCEPT PLAN
	Drawn: AJW Approved: FINAL Date: 15-05-06 Job No: 43177401 File No: 43177401-006.wor	Figure: 4-2

4.2 Staging and Process Description

Leafs Gully Power Project comprises two gas turbines together generating 300-360 MW (depending on the manufacturer).

The vendors for the gas turbine units would be determined through a tendering process. The potential units would be assessed on the basis of proven levels of efficiency, reliability and operability. It is envisaged that the gas turbines would be proprietary units, provided by manufacturers. Precise outputs would only be known once the tendering process is completed. An approximate output of 300 MW has been provided for the purposes of this Environmental Assessment. **Figure 4-3** illustrates the plant process.

4.2.1 Gas Turbines

Each gas turbine generator unit consists of three main items being the gas turbine, generator and high voltage transformer (refer to **Figure 4-2**). In each gas turbine generator, air is drawn in through filters to remove particulate matter and is compressed. The compressed air flows into the combustion chambers where natural gas is injected and burnt, increasing the temperature to approximately 1100 – 1200 °C.

The combustion products from the combustion chambers enter the turbine area and expand to atmospheric pressure, reducing in temperature to around 550 °C. As the gas expands, it drives each turbine, which in turn drives the compressor and an electrical generator. From the turbine, the heated exhaust gases pass through a silencer unit and are discharged through a stack. The combustors feature Dry Low NO_x technology to produce very low NO_x emissions.

The height of the exhaust stacks would be in the range of 30 to 35 m. Ancillary plant and buildings would be up to 20 m in height. **Figures 4-4 to 4-8** provide a general arrangement of the plant layout. **Figures 4-9 to 4-10** overlay the layout within the proposed footprint on the Development Site. The above figures demonstrate layouts for the various turbines that are on the market, with the outcomes of a tendering process determining a preferred manufacturer, as discussed above.

Fuel

The fuel for the turbines would be natural gas supplied by either the AlintaGN or the EGP, both of which run through the Development Site. Connections would be made to both pipelines. The new pipelines connecting the proposed power plant to the existing pipelines would be located underground.

When the gas turbines are operating, natural gas would be used at a maximum rate of approximately 32 tonnes per hour per gas turbine.

The AlintaGN and EGP would deliver gas at a maximum pressure of 12 MPa to the gas receiving station where it would be reduced to 3.4 MPa or lower prior to injection into the gas turbine.

Chapter 4

Project Description

Gas Receiving Station

The gas receiving station would be located at the connection with each of the gas pipelines. The receiving station regulates the gas entering the power station. The inlet facility would contain the following equipment:

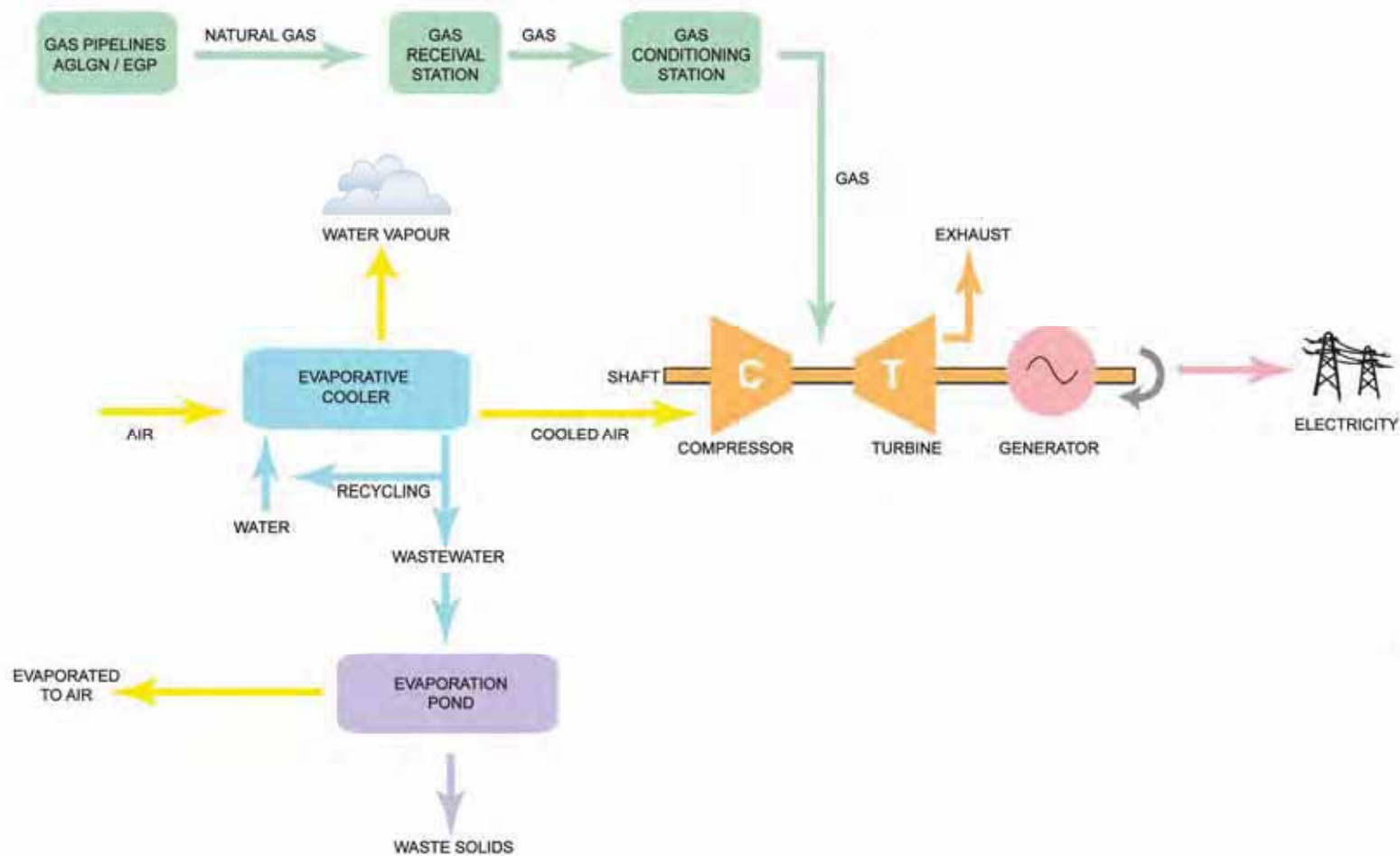
- gas filtration, custody transfer, flow control and metering;
- process control and communications equipment; and
- pipeline connection to the gas conditioning station.

This station would be fenced.

Safety features at the gas receiving station include automatic shutdown due to low pressure. There would also be manual shut down (i.e. isolating manually) at the pipeline off take. Methods to prevent pipeline leaks would include:

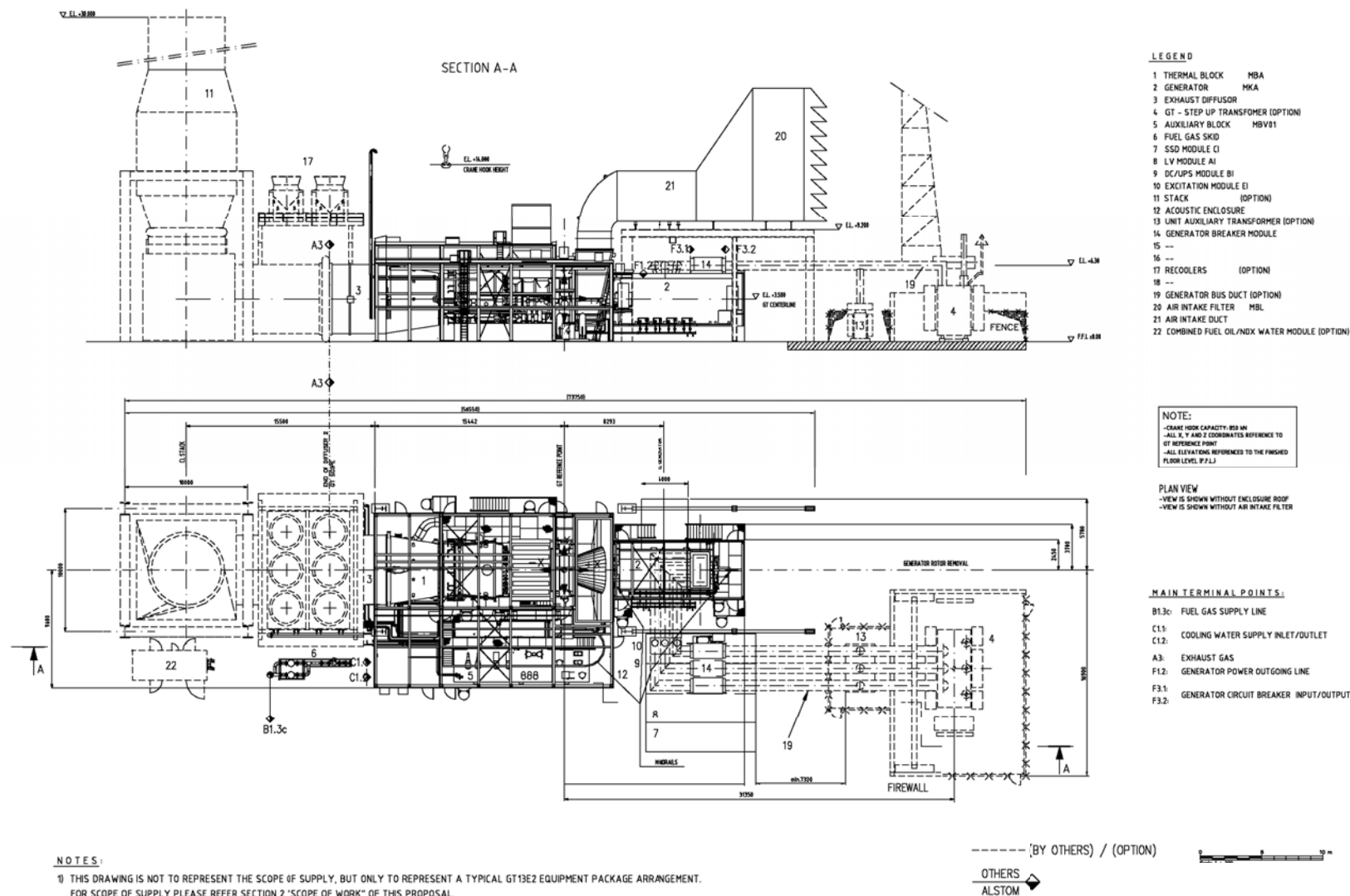
- coating on external surfaces;
- regular patrolling of pipeline;
- cathodic protection for external corrosion; and
- installing gas detectors at both the gas receiving and conditioning station.

These methods would be detailed in a plan for pipeline protection.



Client AGL POWER GENERATION (NSW)	Project AGL LEAF'S GULLY POWER PROJECT EA		Title PROCESS DIAGRAM
	Drawn: AJW	Approved: FINAL	Date: 08.08.06
	Job No: 43177401	File No: 43177401-035.wor	

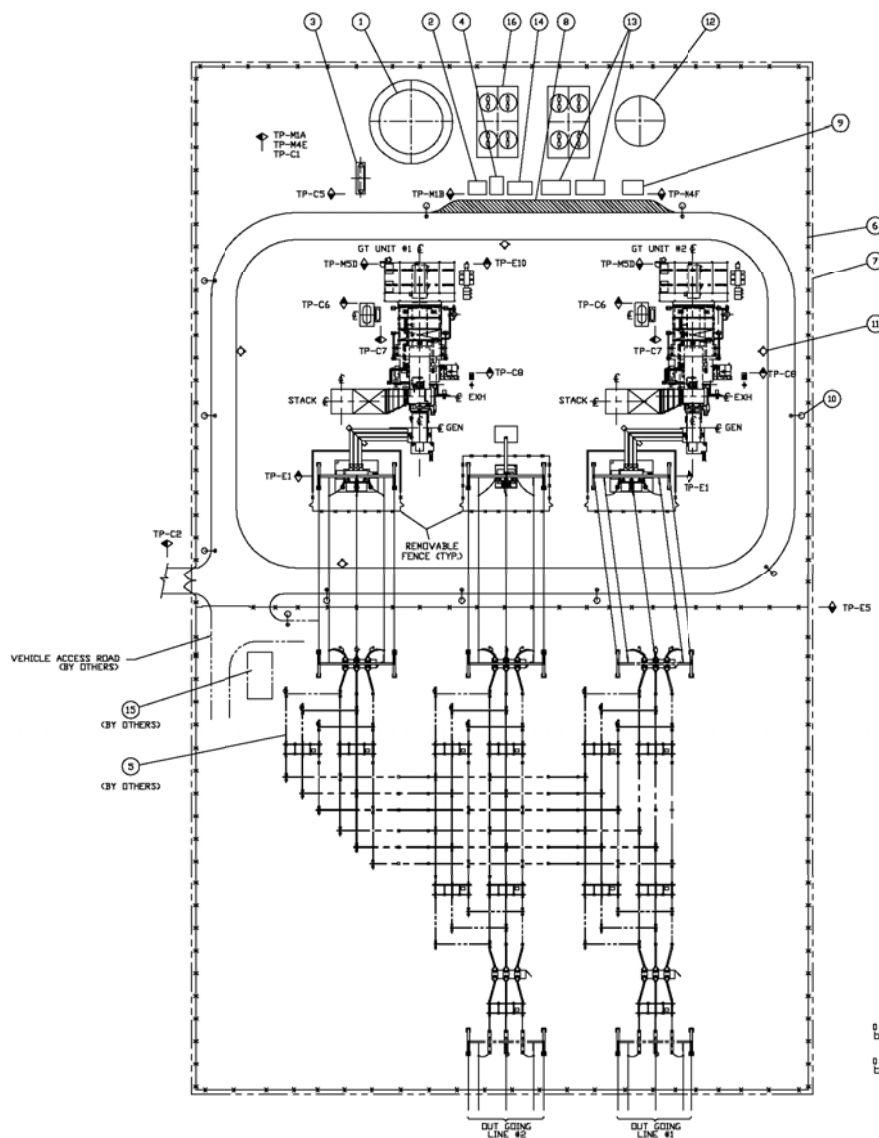
Figure: 4-3



PRELIMINARY

NOT FOR CONSTRUCTION

Client	Project	Title			
AGL POWER GENERATION (NSW)	AGL LEAFS GULLY POWER PROJECT EA	GENERAL ARRANGEMENT FOR PLANT LAYOUT - ALSTOM			
	Figure: 4-4				
			Drawn: AJW	Approved: FINAL	Date: 07.07.06
			Job No: 43177401	File No: 43177401-037.wor	



- LEGEND**
- 1 FUEL OIL STORAGE TANK & DIKE
 - 2 FUEL OIL UNLOADING SKID
 - 3 OIL / WATER SEPARATOR
 - 4 FUEL FORWARDING SKIDS
 - 5 220KV SWITCHYARD (BY OTHERS)
 - 6 PROPERTY FENCE
 - 7 SITE BOUNDARY
 - 8 STORAGE TANK UNLOADING CONCRETE APRON
 - 9 DEMINERALIZED WATER UNLOADING STATION
 - 10 PERIMETER LIGHTING (AS REQUIRED)
 - 11 FIRE HYDRANT
 - 12 DEMINERALIZED WATER STORAGE TANK
 - 13 WATER INJECTION SKIDS
 - 14 WATER WASH SKID
 - 15 SWITCHYARD CONTROL HOUSE
 - 16 COOLING WATER MODULES

TERMINAL POINT (TP) INDEX

- OWNER GE
- TP-C1 - STORM DRAINAGE
TP-C2 - PLANT SERVICE ROADS
TP-C3 - OILY DRAINS
TP-C6 - GAS TURBINE WATER WASH DRAIN TANK
TP-C7 - GAS TURBINE DRAIN TANK
TP-C8 - FUEL GAS SCRUBBER DRAIN TANK
- TP-E1 - TRANSFORMER DEAD END TOWER
TP-E2 - OUTGOING POWER
TP-E3 - GROUNDING
TP-E10 - 400V AUXILIARY BACK-UP POWER
- TP-M1A - FUEL GAS
TP-M1B - DISTILLATE OIL UNLOADING STATION
TP-M1E - FIRE WATER
TP-M1F - DEMINERALIZED WATER FILL CONNECTION

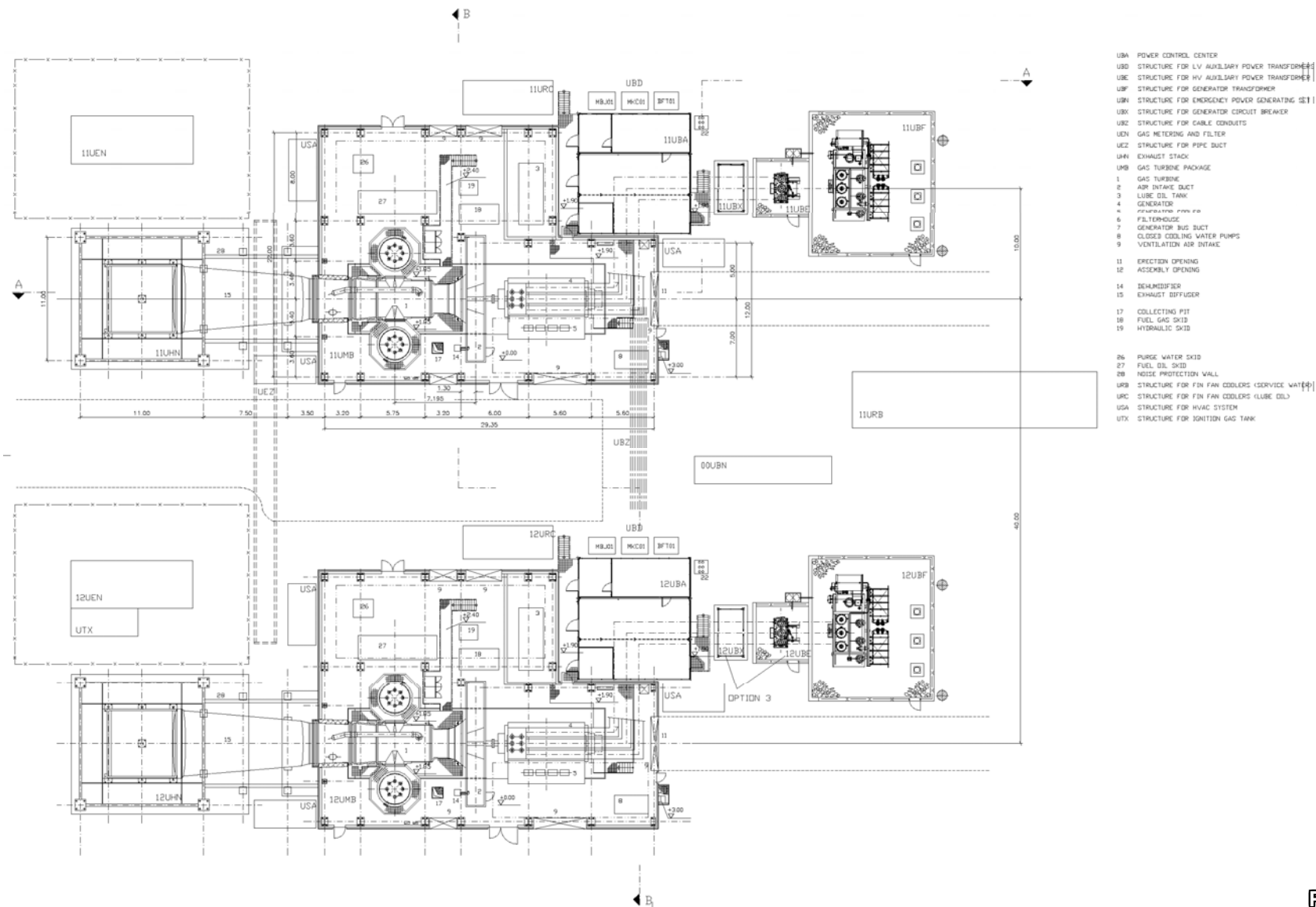
NOTES

1. FOR GAS TURBINE EQUIPMENT IDENTIFICATION SEE STATION ARRANGEMENT DRAWING 510B4011F MOD6.
2. FOR COMPLETE TERMINAL POINT LISTING SEE "TERMINAL POINTS" SECTION OF THE PROPOSAL.

PRELIMINARY

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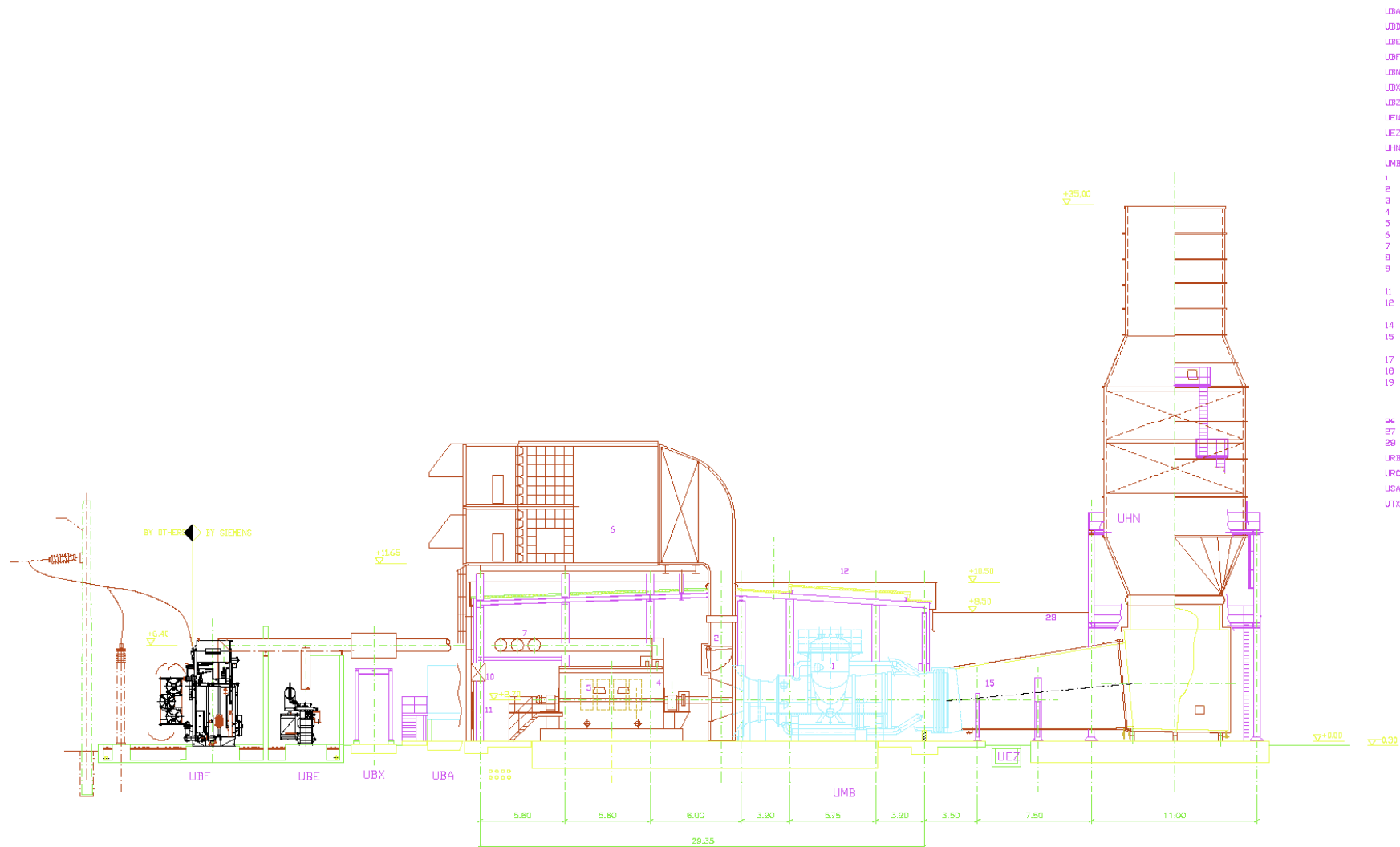
Client	Project	Title
AGL POWER GENERATION (NSW)	AGL LEAFS GULLY POWER PROJECT EA	GENERAL ARRANGEMENT FOR PLANT LAYOUT - GENERAL ELECTRIC
	Drawn: AJW	Approved: FINAL
	Date: 07.07.06	
	Job No: 43177401	File No: 43177401-037.wor
		Figure: 4-5



PRELIMINARY

NOT FOR CONSTRUCTION

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title GENERAL ARRANGEMENT FOR PLANT LAYOUT - SIEMENS AG
	Drawn: AJW Approved: FINAL Date: 07.07.06 Job No: 43177401 File No: 43177401-037.wor	Figure: 4-6



- UBA POWER CONTROL CENTER
- UBD STRUCTURE FOR LV AUXILIARY POWER TRANSFORMERS
- UBE STRUCTURE FOR HV AUXILIARY POWER TRANSFORMER
- UBF STRUCTURE FOR GENERATOR TRANSFORMER
- UBN STRUCTURE FOR EMERGENCY POWER GENERATING SET
- UBX STRUCTURE FOR GENERATOR CIRCUIT BREAKER
- UBZ STRUCTURE FOR CABLE CONDUITS
- UEN GAS METERING AND FILTER
- UEZ STRUCTURE FOR PIPE DUCT
- UHN EXHAUST STACK
- UMB GAS TURBINE PACKAGE
- 1 GAS TURBINE
- 2 AIR INTAKE DUCT
- 3 LUBE OIL TANK
- 4 GENERATOR
- 5 GENERATOR COOLER
- 6 FILTERHOUSE
- 7 GENERATOR BUS DUCT
- 8 CLOSED COOLING WATER PUMPS
- 9 VENTILATION AIR INTAKE
- 11 ERECTION OPENING
- 12 ASSEMBLY OPENING
- 14 DEHUMIDIFIER
- 15 EXHAUST DIFFUSER
- 17 COLLECTING PIT
- 18 FUEL GAS SKID
- 19 HYDRAULIC SKID
- 24 PURGE WATER SKID
- 27 FUEL OIL SKID
- 28 NOISE PROTECTION WALL
- URB STRUCTURE FOR FIN FAN COOLERS (SERVICE WATER)
- URC STRUCTURE FOR FIN FAN COOLERS (LUBE OIL)
- USA STRUCTURE FOR HVAC SYSTEM
- UTX STRUCTURE FOR IGNITION GAS TANK

PRELIMINARY

NOT FOR CONSTRUCTION

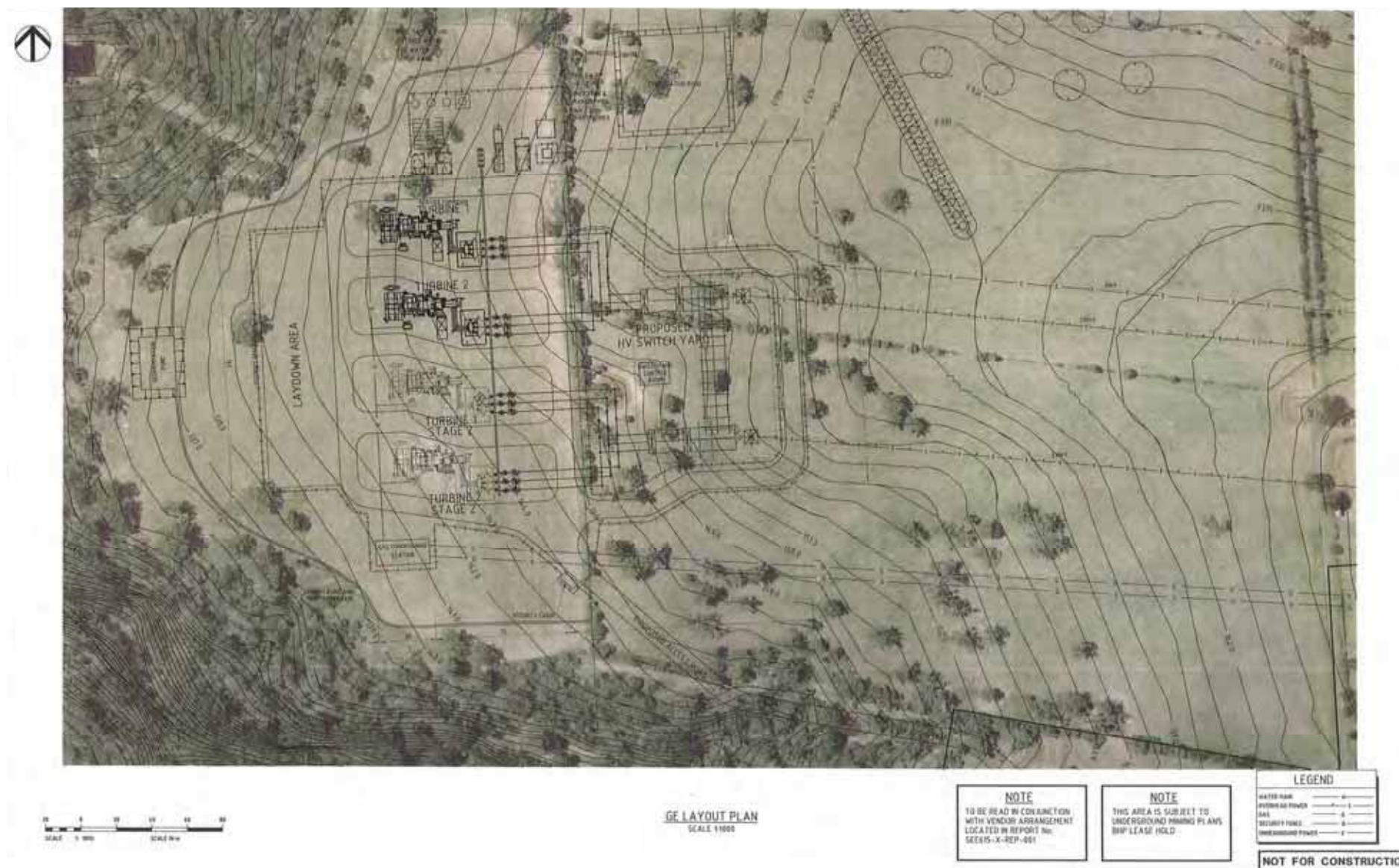
Client	Project	Title
AGL POWER GENERATION (NSW)	AGL LEAFS GULLY POWER PROJECT EA	GENERAL ARRANGEMENT FOR PLANT LAYOUT SECTION - SIEMENS AG
	Figure: 4-7	
	Drawn: AJW	Approved: FINAL
	Date: 07.07.06	
	Job No: 43177401	File No: 43177401-037.wor



NOTE: Although four turbines are shown on this figure, it is noted that this Environmental Assessment is seeking approval for only two turbines.

PRELIMINARY

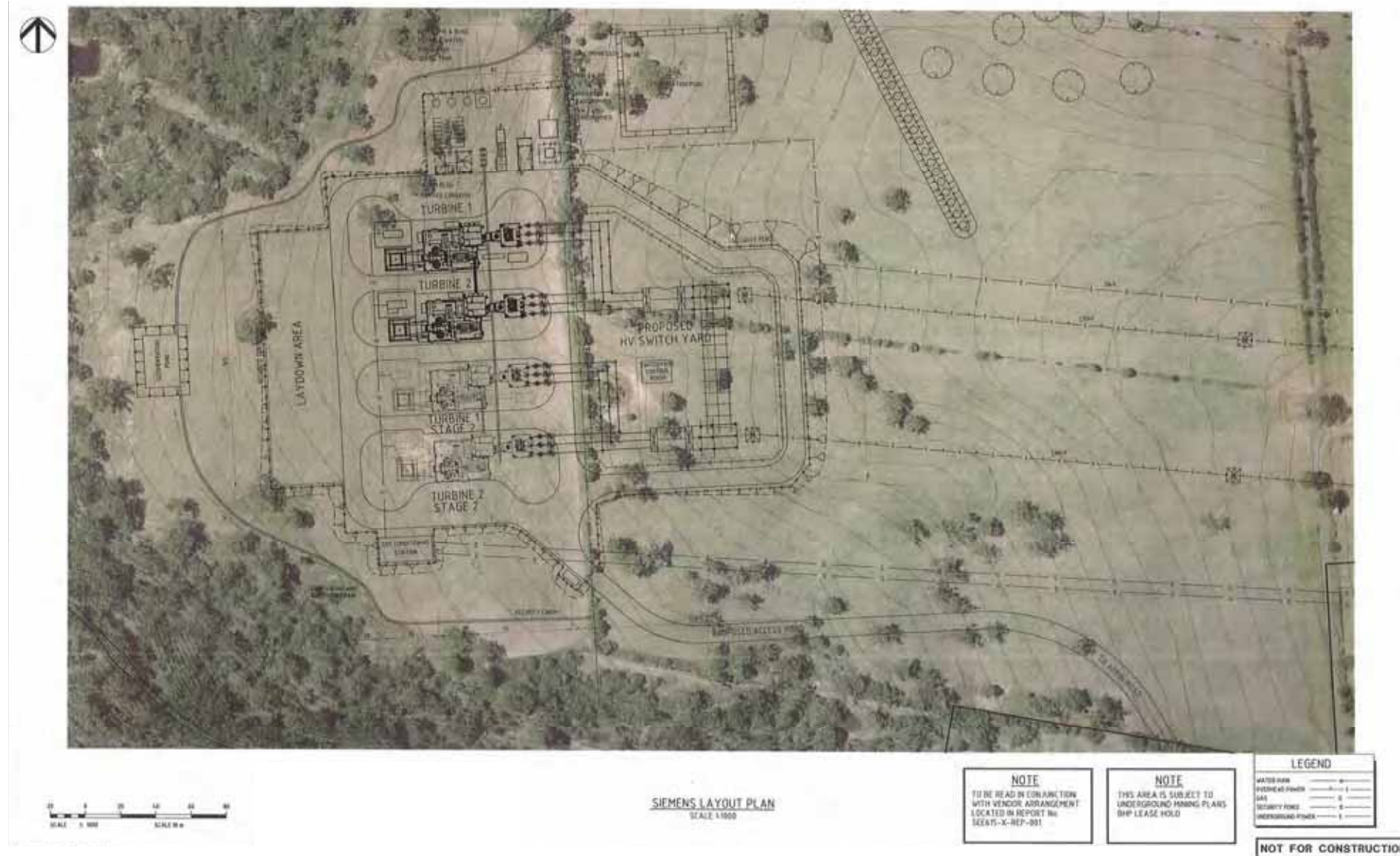
Client	Project			Title
AGL POWER GENERATION (NSW)	AGL LEAFS GULLY POWER PROJECT EA			CONCEPTUAL ARRANGEMENT - ALSTOM EQUIPMENT
	Drawn: AJW	Approved: FINAL	Date: 07.07.06	Figure: 4-8
	Job No: 43177401	File No: 43177401-038.wor		



NOTE: Although four turbines are shown on this figure, it is noted that this Environmental Assessment is seeking approval for only two turbines.

PRELIMINARY

Client	Project			Title
AGL POWER GENERATION (NSW)	AGL LEAFS GULLY POWER PROJECT EA			CONCEPTUAL ARRANGEMENT - GE EQUIPMENT
URS	Drawn: AJW		Approved: FINAL	Date: 07.07.06
	Job No: 43177401		File No: 43177401-038.wor	
	Figure: 4-9			



Client	Project			Title
AGL POWER GENERATION (NSW)	AGL LEAFS GULLY POWER PROJECT EA			CONCEPTUAL ARRANGEMENT - SIEMENS EQUIPMENT
	Drawn: AJW	Approved: FINAL	Date: 07.07.06	Figure: 4-10
	Job No: 43177401		File No: 43177401-038.wor	

Gas Conditioning Station

The gas conditioning station is the connection of the supply of gas into the power station. The final location however would be determined during detailed design. The following equipment would be located in the pipeline delivery facility:

- header pipeline connecting the conditioning station to each of the gas turbines;
- actuated isolation valve installed at the inlet facility;
- gas filtration, heating and pressure regulation equipment;
- over pressure protection and emergency venting systems; and
- process control and communications equipment.

The header pipeline connects the pressure regulation station to the inlet gas manifold at the gas turbines. The length and diameter of the header pipe would be determined in the detailed design phase and would be designed to comply with the requirements of Australian Standard *AS4041 Pressure Piping*.

Safety features would be installed to provide overpressure protection. The delivery facility would incorporate equipment to vent gas from the connecting pipeline if required for maintenance or in an emergency situation. In the event of a plant trip signal and the sudden reduction in gas demand, pressure protection mechanisms would need to be in place to protect pipe work from overpressure between the pressure regulation and station and the gas turbine facility. These mechanisms would be determined in the detailed design phase but would include a pressure relief valve and / or control valves and slam-shut valves.

4.2.2 Electrical Generators

Attached to each gas turbine is an electrical generator that generates electricity when rotated by the turbine. The generators are large items of plant, assembled off-site and delivered in one piece.

Emergency Generator

An emergency generator would be available as back up to ensure an uninterrupted power supply for plant start up. This emergency generator would use diesel. A diesel tank of 1,000 L would supply this generator. The diesel tank would be managed in accordance with the requirements of the *Occupational Health and Safety Act 2000* and the *Occupational Health and Safety Regulation 2001*. Diesel is a class C1 combustible liquid and not listed in the Australian Dangerous Goods Code. The diesel tank would be installed in accordance with relevant WorkCover requirements and Australian Standard *AS1940:2004 Storage and Handling of Flammable and Combustible Liquids*.

Chapter 4

Project Description

Although diesel is not classified as a hazardous material it is combustible. The diesel tank, associated pipelines and fittings would be constructed in accordance with relevant Australian Standards and regular inspection and/or testing shall be conducted by a licensed contractor.

4.2.3 Cooling System

E Class turbines

To facilitate the combustion conditions, air is cooled then compressed prior to entry into the combustion chamber of the gas turbine. This requires an evaporative cooling unit.

Evaporative inlet air coolers are similar to domestic evaporative air conditioners. Water flows over baffles and air is drawn into the gas turbine inlet through the baffles. The air is cooled by evaporation as it passes over the water film on the baffles. This reduces the density of the air, allowing the gas turbine to operate at a higher output. After passing down the baffles, the remaining water is collected in a sump and then recycled by a pump to the top of the inlet baffles. Water is continually added to replace the evaporated water.

As water evaporates, there is an increase in the concentration of dissolved salts. To control this and prevent scaling of the system (build-up of salts), some water is continually bled off or “blown down” from the sump. The blow down rate is adjusted to keep the concentration of dissolved salts below the level that scaling can occur. The blow down water is collected in a pond and left to evaporate.

The water requirements for evaporative cooling are presented in **Table 4-2**. These figures demonstrate the maximum quantities of water required, which would coincide with maximum operating capacity during hot summer weather with low humidity. Actual water consumption would vary based on weather conditions. It is also noted that the gas turbines can run without water, however, this affects efficiency of the turbine and the impact during high temperature days on output is a reduction of 10 %. This would be approximately 30 MW for a 300 MW power station. Therefore in the event of a severe drought the turbine could run at a lower efficiency without water.

Table 4-2 Water Requirements for Evaporative Cooling

Water Demand Source	Water Demand Requirement for Operation at Maximum Capacity (kL/hr)	
	per turbine	total (2 turbines)
Evaporation	7.5	15
Blow Down	1.9	3.8
Make up from external source	9.4	18.8
Recirculated	13.1	26.2

Project Description

Chapter 4

4.2.4 Transformers and High Voltage Switchyard

The electrical transformers step the voltage from the generator at around 16 kV to 330 kV. These transformers would be located in a switchyard adjacent to the existing 330 kV lines running through the Development Site. Each gas turbine generator set would be connected to a switchyard operating at 330 kV. The transformers would have appropriate switchgear to ensure safe and reliable connection to the electricity network.

AGL has submitted a Connection Inquiry and a Connection Application to TransGrid, the network service provider, to determine their precise requirements for connection. The switchyard is proposed to be located adjacent to the power plant with a 1 km transmission line connection to the existing TransGrid transmission line traversing the Development Site. During the Connection Application process the switchyard design would be refined to address network issues.

4.2.5 Chemicals and Oil Management

Due to the nature of the facility, only minor quantities of chemicals and / or dangerous goods would be stored at the facility. A representative list of the type and quantities of chemicals to be used and stored at the proposed power plant is presented in **Table 4-3**.

Table 4-3 Chemical List

Product Name	Use	Quantity and Area Storage Location	Area of Plant where used
Diesel	Backup generator	1,000 litres in fixed tank	Backup generator
Turbine Oils	Lubrication of turbines and pumps	1,000 litres – bulk oil storage	Turbine building
Acetone	Cleaning Solvent	100 litres – workshop, storage	Throughout the facility
Insulating Oil	Transformers	1,000 litres	Bulk Oil Storage
Miscellaneous oils and lubricants	Lubrication of caustic and acid pumps, fire water pumps, transformer pumps	1,000 litres – bulk oil storage	Fire water pump station and switchyard
Wash Water Liquid	Gas wash water additive	1,000 litres – bulk chemical storage	Workshop / stores
Carbon dioxide and/or other proprietary fire protection gases such as Inergen and/or FM200	Fire protection and fuel line purging	As required	Throughout the facility
Scale inhibitor	Closed loop cooling system	100 litres	Closed loop cooling system
Nitrogen	Gas line purging, in cylinders	As required, in cylinders	Chemicals for maintenance / repair work and clean-up

Note: Brand names are for example only

Chapter 4

Project Description

Chemicals would be stored on-site in designated chemicals storage facilities that would be constructed in compliance with relevant Australian Standards, including but not limited to:

- *Australian Standard AS 1940 (2004) The Storage and Handling of Flammable and Combustible Liquids;*
- *Australian Standard AS 4452 (1997) The Storage and Handling of Toxic Substances;*
- *Australian Standard AS 3780 (2008) The Storage and Handling of Corrosive Substances;*
- *Australian Standard AS 4332 (2004) The Storage and Handling of Gases in Cylinders; and*
- *Occupational Health and Safety Act 2000 and Occupational Health and Safety Regulation 2001.*

Suitable spill control would be provided around the gas turbine generators. A number of other gas turbine generator controls and alarms would indicate a lubricating oil leak including the low oil pressure alarm, low oil pressure trip and low oil level alarm.

Packaged chemicals would be stored within the storage room in the main on-site control building or workshop. Separate spillage control would be provided for each of these products, for example by the use of pallet bunds.

4.2.6 Water

Water would be stored in tanks on-site for fire services, process water and domestic use. The process water is used in evaporative inlet air coolers, producing a small waste stream of blow down water which would be directed to an evaporation pond. Salts formed as a result of the evaporation process would be disposed of in an approved manner by an appropriately licensed contractor.

There are three viable sources of water available for process water. These are:

- the water supply main from the Macarthur Water Treatment Plant that runs through the eastern portion of the Development Site; and
- Sydney Catchment Authority's Upper Supply Canal that runs through the Development Site; and
- reuse of recycled water from a proposed Sewage Treatment Plant at Appin. If this Sewage Treatment Plant proposal proceeds, AGL would endeavour to use recycled water produced by Sydney Water as a primary water resource if the water quality is suitable and sufficient water quantities are available. As there is uncertainty about the location of the Appin Sewage Treatment Plant, the amount of water available and when it will operate, it is difficult for AGL to provide a commitment at this stage to exclusively using recycled water.

AGL is seeking approval to connect to the water main as the primary water source with approval also sought for the Upper Canal connection for use in the event water main connection is not available. The proposed sources of process water are discussed further in **Chapter 14 Water Management**.

Rainwater would be captured and stored on-site and used for non potable domestic uses (showers, toilet flushing), laundry and for the required maintenance activities. The very small volume of potable (drinking water) water would be supplied via the water main (if a connection is made) or rainwater.

Water for landscaping would be sourced from the plant's stormwater collection system and from other existing stormwater dams which are currently located on the Development Site.

4.2.7 Wastewater Management

Wastewater generated at the facility can be divided into:

- process wastewater – generated through operations associated with the generation of electricity;
- maintenance cleaning water; and
- sewage – associated with facilities provided for staff.

Process Wastewater

Process wastewater is generated at the facility by the process of blow down from evaporative air inlet coolers. The expected maximum volume of wastewater generated is 3.8 kilolitres (kL) per hour for E class turbines. This is discussed further in **Chapter 14 Water Management**.

Blow down water would initially be pumped to a holding tank. Water from the process is recycled back through the system for blow down until the water reaches a salinity that is unacceptable for the process. The recycled water that cannot be recycled through the blow down system would then be discharged to a pond where it would evaporate. Details of the evaporation pond would be confirmed during detailed design of the facility. An area has been dedicated for an evaporation pond as shown in **Figure 4-2**. The volume of blow down water generated by the plant depends on the amount of time the plant is operating, the number of turbines operating and the ambient temperature and humidity. It is therefore difficult to predict the storage volume required for blow down water. Should additional capacity be required then an additional pond would be constructed in the area to the east of the proposed pond.

In the unlikely event of overflow from the evaporation pond, water would be directed to the sedimentation pond. The wastewater holding tank and the natural evaporation pond would have provision for pump-out and off-site disposal if necessary.

Maintenance

It is expected that up to 12 kL per annum of wastewater could be generated from cleaning and maintenance at the plant. This wastewater would be collected in washing bays in a bunded area and then disposed of off-site by a licensed contractor.

Chapter 4

Project Description

Sewage

A small amount of wastewater would be generated by staff using the plant. This is estimated to be less than 80 kilolitres per annum. Sewage from amenities provided from staff would be directed to an on-site proprietary wastewater treatment system (such as Advanced Wastewater Treatment System or Ecomax system) to ensure that there is zero water discharge from the Development Site except for natural surface flows. Alternatively, a storage and pump system could be used to dispose of domestic wastewater off-site at an appropriately licensed facility. The sewerage system would comply with the requirements of Campbelltown City Council and the Department of Health.

4.2.8 Surface Water Management System

The site drainage systems would be segregated so that potentially contaminated surface water runoff would be kept separate from clean rainwater runoff. Detailed design of the power plant would ensure that only clean water flows into the stormwater system.

The surface water management system is discussed in detail in **Chapter 14 Water Management**.

Clean Water

Clean rainwater collected from the power plant catchment area would be directed to a sedimentation pond and associated earth bund and diversion drain. This would allow sediments to settle out. Overflow from the basin would be directed to the existing drainage lines through an underflow structure designed to trap any floating material. The outlet of the stormwater system from the bunded plant area would be designed to maximize the dispersion of these high flows and thereby minimize their potential to cause soil erosion downstream.

The system would receive surface runoff from roof drainage and drainage from undisturbed and paved areas, where contamination is unlikely to occur. Some roof runoff may be directed to storage tanks for on-site reuse.

Potentially contaminated surface water

Surface water from the facility that may potentially be contaminated could include:

- washwater from turbine washing and cleaning of other components;
- rainfall runoff from bunded plant areas; and
- accumulated water within bunds.

Water from these areas would be directed through oil and grit traps designed to remove any oil and minimise suspended solids to an acceptable level prior to discharge to the sedimentation pond. This system would also be fitted with a gross pollutant trap to collect any large material mobilised by stormwater. The outlet of the sedimentation pond would be designed to maximize the dispersion of high stormwater flows and thereby minimize their potential to cause soil erosion downstream.

The outlet from the sedimentation pond would operate automatically, however it would be able to be closed. In the unlikely event of a spill outside of the bunded areas but in the compound, the outlet could be closed and this volume captured. Potentially contaminated water would then be disposed of off-site by a licensed contractor.

4.2.9 Waste Management

Solid Waste

The normal operation of the facility would not be expected to generate significant quantities of solid waste. Most solid waste would be classified as “inert waste” and would be generated from spent filters – air, fuel and oil filters as well as:

- scrap metal – from packaging waste and plastic cabling;
- general maintenance – e.g. wood and cloth, office waste and chemical containers; and
- salts formed as a result of the evaporation process.

Solid waste would be segregated where possible into recyclable and non-recyclable waste products and disposed of appropriately by licensed contractors.

Liquid Waste

Liquid waste generated at the plant would include:

- waste oil; and
- solvents.

All liquid wastes would be contained on-site and where possible separated into recyclable and non-recyclable materials. All waste would be classified and disposed of by a licensed contractor in accordance with the EPA's *Environmental Guidelines: Assessment, Classification & Management of Liquid and Non-Liquid Wastes* (1999).

4.2.10 Power

During construction and site preparation phases it would be necessary to have power to the Development Site. Power would be supplied from the existing distribution system by connecting to the existing 66 kV transmission line.

4.2.11 Emergency Systems

A comprehensive fire alarm system monitored from the control room would be installed throughout the plant. A gas leak detection system would be installed and monitored at the facility control room. A water tank for fire protection would be constructed on-site.

Chapter 4

Project Description

Maintenance checks and training would be conducted to ensure operational preparedness of fire fighting equipment and the staff.

An Emergency Response Plan would be prepared for the facility for the construction and operational phases of the proposed development.

4.2.12 Landscaping

A landscaping design to rehabilitate parts of the Development Site and to provide a visual screen to adjacent landholdings is proposed and would be incorporated into the Conservation Area (refer **Section 4.2.13**). The design includes construction of a large earth mound about 6 m high and with a base of about 27 m to provide a visual screen for neighbours on the northern boundaries and to dispose of site-won fill. The earth mound would follow the contours of the Development Site to avoid concentration of surface water flows.

4.2.13 Conservation Area

Subject to consent conditions determined by the Minister for Planning, AGL would agree to permanently conserve vegetation communities in the area between the Nepean River and the Upper Canal as well as existing vegetation and fauna habitat around the facility footprint comprising approximately 170 ha of vegetation within the Development Site (refer to **Figure 4-11**). These initiatives for planting and conservation would contribute to the establishment of wildlife corridors between the Georges River and Nepean River.

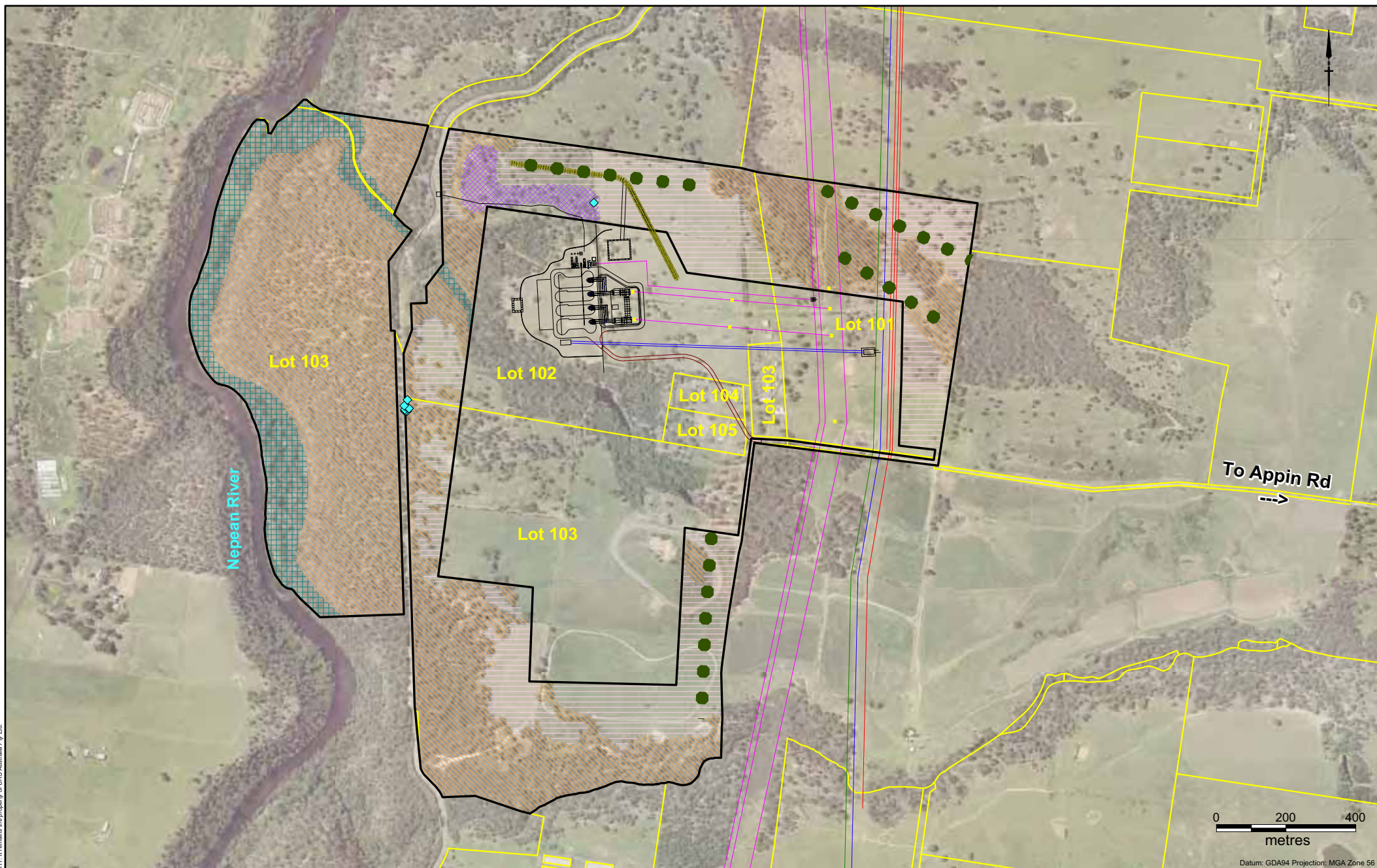
The land would be re-titled for conservation purposes in consultation with DECC, either through a Voluntary Conservation Agreement (VCA), a Biobanking Agreement, or some other enduring protection mechanism. A decision on which conservation mechanism is to be adopted would be made following the determination of the project and would depend on whether the Biobanking Scheme is operational and details of that Scheme.

The management of the Conservation Area would be funded by proceeds of the Biobanking Trust Fund if that mechanism is chosen, or from revenue from the operation of the power plant.

4.2.14 Buildings, Amenities and Security

Buildings would be constructed on-site to provide for administration, amenities, control room, security gatehouse, workshop and stores facilities (refer to **Figure 4-2**). The plant footprint would be surrounded by a chain mesh fence. Lighting would be installed for safe working and security purposes and would be designed such that light is contained within the Development Site.

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Legend

- | | | | | | | | |
|--|---|---|--|---|------------------------------------|--|------------|
|  | Potential Conservation Area |  | Pultanaea Recovery Area |  | River Flat Eucalypt Forest (RFEF)* |  | Grassland |
|  | Shale-Sandstone Transition Forest (SSTF)* |  | Previous URS records of P. Pedunculata |  | Habitat Corridor Plantings |  | Embankment |
- * = EEC under TSC Act

Client

AGL POWER
GENERATION (NSW)

URS

Project

AGL LEAFS GULLY
POWER PROJECT EA

Drawn: AJW	Approved: JP	Date: 05/11/2008
Job No: 43177607	File No: 43177607.009.wor	

Title

**PROPOSED CONSERVATION
AREA AND MANAGEMENT ACTIONS**

Figure: 4-11

0 200 400
metres

Datum: GDA94 Projection: MGA Zone 56

Chapter 4

Project Description

4.2.15 Access Road

An area of vegetation approximately 300m long and up to 10m wide would need to be cleared to construct the access road within the Right of Way.

As the Right of Way traverses undulating landscape, part of the access road would require either a cutting and landscaped batter or embankment and landscaped batter. The proposed road works would occupy most of the Right of Way.

The road would be of gravel construction and sealed for a 5.5 m width. The thickness of pavement appropriate for this standard of road, in accordance with Council's *Engineering Design Guide for Development* (2004), would be designed to carry a traffic load of 2×10^4 equivalent standard axles.

In cuttings, the width of reserve constrains what can be achieved and the road would be constructed with a one-way crossfall and a shallow table drain on the low side.

To avoid adverse impacts on drainage catchments local cross drain culverts would be provided at local gullies and depressions.

4.2.16 Appin Road and Intersection Upgrade

Works would be required on Appin Road at the intersection with the access road to facilitate construction traffic. The intersection upgrade works involve widening of the road within the road reserve and the addition of a slip lane to prevent traffic building up behind vehicles turning right into the access road. Refer to **Chapter 11 Traffic and Transport** for more detail on the proposed intersection upgrade.

4.3 Operating Hours and Staffing

The Leaf's Gully Power Project would be available to operate 24 hours a day, 7 days a week and could be operated remotely by AGL staff with contractors used for maintenance. In practice the plant would only run during periods of high electrical demand. AGL's experience with its peaking power stations in Victoria and South Australia suggest that the Leaf's Gully Power Project is likely to operate between 2 to 3 % of the year.

The actual operating times of the power would be largely dependent on supply and demand conditions in the electricity market. Operation of the plant is expected to occur mainly during morning and afternoon peak periods in summer and winter when demand rises due to weather conditions. However the power plant is required to be available to operate at any time should it be required to respond to high spot prices in the NEM, system emergency or security situations.

During the operational phase staff levels are expected to average around five personnel and generate around four to five vehicle movements in the peak.

Post construction maintenance of major items would occur once every three years at the most and require up to 100 personnel for a four to six week period. This activity is likely to generate some cars, trucks and cranes during a weekday.

4.4 Project Construction

The construction and operational timetable for Leaf's Gully Power Project would be dependent on growth in electricity demand and economic factors. Essentially, the project would be constructed in time to meet projected demand, subject to economic factors such as the price of fuel, equipment, labour costs and the exchange rate. The estimated duration of construction is 18 to 24 months although activity on-site may only be evident for 18 months.

It is anticipated that construction would most likely take place on weekdays from 7.00 am to 6.00 pm during weekdays and 8.00 am to 1.00 pm on Saturdays or in accordance with any Environment Protection Licence conditions. Construction activities would not normally be undertaken on Sundays or public holidays unless inaudible at residential receivers. Where the project requires construction work outside these hours, the regulatory authorities and affected stakeholders would be consulted and advised accordingly.

4.4.1 Construction

The following summarises the construction program.

- 24 - 30 month duration (inclusive of a 4 week annual holiday break);
- typical workforce 45 persons;
- peak workforce 140 persons (duration up to two months);
- around 4,600 truck deliveries of construction equipment and materials (e.g. backhoes, cranes, materials, etc). Construction equipment would be sourced locally (where available) and once delivered, would stay on-site for the duration of construction;
- six in total over-dimensional and / or over-mass escorted heavy transport convoys of pre-assembled gas turbine, generator and transformer units;
- between 2 and 20 truck deliveries per day of construction materials;
- the majority of the workforce is expected to be sourced from the Sydney region;
- typical peak hourly construction workforce traffic generation of 70 vehicle trips/hour; and
- peak workforce hourly construction workforce traffic generation of 140 vehicle trips/hour.

Chapter 4

Project Description

The power plant contractor, prior to commencement on the Development Site, would prepare detailed construction programs and methods. These would be dependent on the detailed design and would need to demonstrate compliance with conditions of consent issued for the Leafs Gully Power Project and other statutory requirements. Construction activities would include the following:

- mobilisation - establishing the site with equipment and facilities necessary to execute the construction phase;
- clearing – although AGL's preferred location on the Development Site minimises land clearing required for the arrangement of the plant, a small amount of preparatory clearing would be required to establish the plant. All cleared vegetation would be forwarded to a green waste facility for recycling or used for mulching as part of the site landscaping works. Topsoil removed during site clearing would be stockpiled and, where possible, reused during landscaping operations once construction was complete;
- bulk earthworks – A nominal platform level of RL 144.0 m has been adopted at the location of the exhaust stacks in order to minimise the top level of the stacks and resulting visual impact. As a result earthworks would not be balanced. Surplus soil would be used to form visual screening / earth mounds around the northern perimeter of the Development Site. A nominal east to west cross-fall of 3 % has been applied to the platform to provide adequate site surface drainage. Dust suppression and water containment would be employed during the bulk earthworks program to ensure that the effects on surrounding properties are minimised. Where excavation work extends into bedrock, suitable material would be reused as engineering fill on-site.
- establishing and preparing foundations - foundations for major plant items and buildings would be established on large raft footings founded in the clay or on weathered rock, depending on the depth of the rock and the configuration of the turbine supports. The detailed design and construction of the foundations will take into account future mine subsidence movements and include monitoring of ground movement;
- construction of buildings and plant – where possible, to minimise the construction time, prefabricated components would be imported to the site and erected during construction. Mobile cranes would be used to erect and complete the construction of heavy plant items; and
- demobilisation – removing all construction equipment and facilities and rehabilitating the Development Site where impacted by construction activities.

All plant, equipment, buildings and services would be supplied, erected, operated and maintained in accordance with the relevant Australian Standards and the Building Code of Australia. Where an appropriate Australian Standard may not exist, the most suitable ISO, British, American or approved alternative standard would be used.

Construction Equipment

It is expected that construction would require heavy loads of plant and equipment to be delivered to the Development Site. The main components, being the gas turbine, generator and transformers, would be assembled overseas and delivered using special haulage vehicles known as Class 1

Project Description

Chapter 4

Restricted Access Vehicles. These vehicles require special permits and escorts, temporarily disrupting normal traffic flows at defined times approved by relevant authorities. The major plant components requiring special haulage conditions are listed in **Table 4-4**.

Table 4-4 Gas Turbine equipment transport

Plant item	Number of items	Approximate weight (tonnes)	Maximum width (metres)	Maximum length (metres)	Maximum height (metres)
Turbine	2	343	5.4	11.2	5.2
Generator	2	230	3.8	10.7	4.2
Transformer	2	127	3.4	7.7	4.2

The remaining plant and equipment would be erected on the site. The Development Site and plant footprint is sufficiently large to permit laydown areas and parking within the site on existing cleared paddocks. During civil works to prepare the site, adequate safeguards are required for the protection of the Nepean River and Sydney Catchment Authority's (SCA) Upper Canal.

Major construction equipment types, estimated numbers and purpose are summarised in **Table 4-5**.

Table 4-5 Construction Equipment and Purpose

Equipment Type	Activity	Estimated Number
Bulldozers	Clearing of vegetation, removal of topsoil, development of internal roads and drainage swales	1
Scrapers	Removal of topsoil, development of internal roads and drainage swales and basins	2
Graders	Site levelling	2
Excavators	Excavation of soil, grading and levelling the site	5
Hydraulic Hammer	Rock excavation	2
Backhoe, Excavators	Trenching	3
Compactor, Rollers	Earth, road base, foundation and pad compaction	5
Cranes	Assembling fabricated building items and positioning plant equipment	2 (25 tonne) 1 (150 tonne) 1 (40 tonne) 5 (20 tonne)
Water Trucks	Moisture and dust control	2
Trucks	Haulage of excavated material, gravel, steel, and reinforcement, etc	5
Concrete Trucks	Delivery and pouring of concrete	8
Fuel and maintenance		2
Over dimensional vehicle	Transformer, gas turbine & generators (possible convoy of one multi-wheel transport unit with up to 3 tow vehicles & under private escort and police control)	6 convoys

Statutory Planning – Summary of Key Outcomes

The Leaf's Gully Power Project is subject to the development and assessment processes and requirements of Part 3A of the EP&A Act. A Project Application was accepted by the Department of Planning on 3 April 2008 including a supporting Preliminary Environmental Assessment. On 3 April 2008 the Director-General issued Environmental Assessment Requirements. These were then updated on 15 October 2008.

Other licences and approvals required for the Leaf's Gully Power Project include:

- Environment Protection Licence under the provisions of the *Protection of the Environment Operations Act 1997*;
- Section 15 approval to erect improvements within a mine subsidence district under the provisions of the *Mine Subsidence Compensation Act 1961*; and
- Notification to WorkCover to Keep Dangerous Goods under the *Occupational Health and Safety Regulation 2001* for the storage and handling of notifiable quantities of dangerous goods.

The Site is zoned, Zone No.1 – Non-Urban under Interim Development Order No. 15 – City of Campbelltown. The Leaf's Gully Power Project is permissible in the Non-Urban Zone with development consent.

Chapter 5

Statutory Planning

5.1 Introduction

A number of statutory planning controls need to be addressed for the purposes of the Leaf's Gully Power Project. This chapter reviews Commonwealth, State and local planning legislation and policies that apply to the Leaf's Gully Power Project to determine what approvals would be required to allow the proposed development to proceed.

5.2 State Legislation

5.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act), and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation), provide the framework for development and environmental assessment in NSW. Part 3A of the EP&A Act provides for a category of development known as Major Projects. *State Environmental Planning Policy 2005 (Major Projects)* (SEPP Major Projects) identifies categories of development which are considered to be Major Projects to which Part 3A of the EP&A Act applies.

The Leaf's Gully Power Project is considered to be a Major Project pursuant to clause 24 of Schedule 1 of the SEPP Major Projects entitled '*Electricity Generation*' as it is development for the purpose of electricity generation with a capital investment value of more than \$30 million.

The Minister for Planning also declared development subject to Part 3A and also a power generation project over 250 MW to be a "critical infrastructure project" in February 2008. The Leaf's Gully Power Project is therefore subject to the development and assessment processes and requirements of Part 3A of the EP&A Act. **Figure 5-1** illustrates the development and approvals process under Part 3A for the Leaf's Gully Power Station Project.

A Planning Focus Meeting (PFM) was held at Campbelltown City Council offices on 9 March 2006 and included an inspection of the Development Site. The PFM was attended by representatives of Department of Planning (DoP), the then Department of Environment and Conservation (now Department of Environment and Climate Change) and Campbelltown City Council.

The PFM provided a forum for discussion and consideration of issues to be addressed by AGL when considering planning approvals for the Leaf's Gully Power Project. These issues are summarised in section 4.2.1 of the Preliminary Environmental Assessment. The Project Application was accepted by the DoP on 3 April 2008 with the supporting Preliminary Environmental Assessment (PEA), requesting that the Leaf's Gully Power Project be assessed under the provisions of Part 3A. On 3 April 2008 the Director-General declared that the project was considered a Major Project and to be assessed under the provisions of Part 3A (refer to **Appendix A** for the Director-General's declaration).

On 3 April 2008 the Director-General of DoP issued to AGL, Environmental Assessment Requirements pursuant to section 75F(2) of the EP&A Act. AGL advised the DoP on 13 October 2008 that it sought to amend the Project Application to include works to upgrade and re-align the access road from Appin Road to the Leaf's Gully site. Under section 75F(3) of the EP&A Act, the Director-General may alter or supplement the Environmental Assessment Requirements if necessary and in light of any additional information that may be provided prior to the Proponent seeking approval for the project. The DoP reviewed the Environmental Assessment Requirements in light of the amended scope of the project and updated the project description of the project in the Environmental Assessment Requirements. The Environmental Assessment Requirements were reissued by the DoP on 15 October 2008 (refer to **Appendix A** for the Director-General's Environmental Assessment Requirements).

5.2.2 Environmental Planning and Assessment Regulation 2000

Clause 8F of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) describes the conditions under which owner's consent is required for applications made under Part 3A of the EP&A Act.

Clause 8F states that:

"(1) The consent of the owner of land on which a project is to be carried out is required for a project application unless:

(b) the application relates to a critical infrastructure project."

Clause 8F further states that:

"(3) If the consent of the owner of the land is not required under this clause, then the proponent is required to give notice of the application:

(c) in the case of a critical infrastructure project (other than a project that also comprises a linear infrastructure project or mining or petroleum production project)— to the owner of the land before the end of period of 14 days after the application is made."

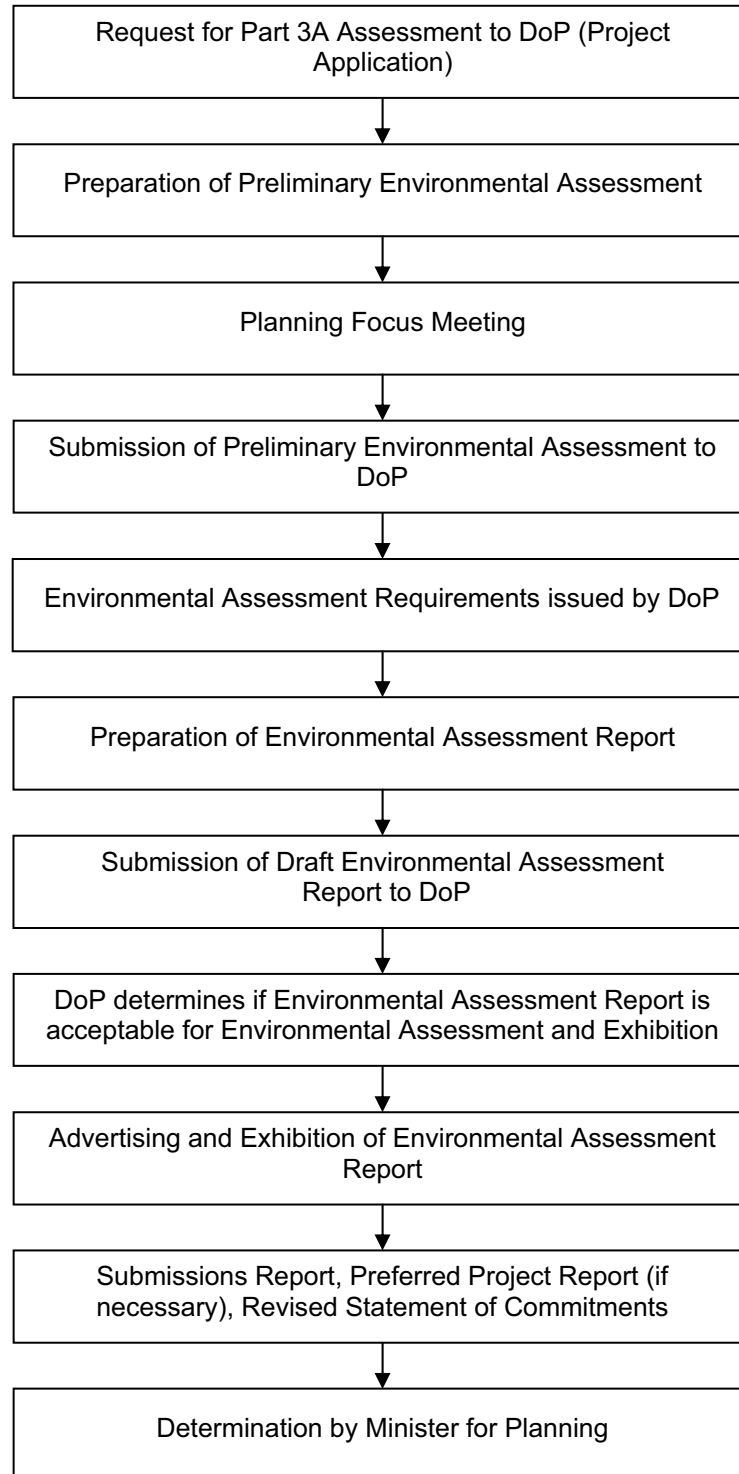
With respect to Leaf's Gully Farm owners consent has been provided by signing the project application.

With respect to the portion of access road being part of Lot 1 in DP 70208 burdened by the Right of Carriageway 10 m wide and an Easement for Services Access 10 m wide identified in Deposited Plan 633800, AGL has given notice to the owner of the land of the application before the end of period of 14 days after the application was amended to include the access road upgrade works.

Chapter 5

Statutory Planning

Figure 5-1 Approvals Process for Leafs Gully Power Project under Part 3A of EP&A Act 1979



5.2.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) relates to the management of pollution and waste disposal in NSW and is administered by the NSW Department of Environment and Climate Change (DECC). Under section 48 of the POEO Act, premise-based scheduled activities (as defined in Schedule 1 of the POEO Act) require an Environment Protection Licence (EPL). It is expected that the Leafs Gully Power Project would require licensing under the provisions of Schedule 1 the POEO Act as it is a scheduled activity (No. 17) being an “electricity generation” that supplies or is able to supply, more than 30 MW of electrical power. A licence would be required covering both construction and operation.

5.2.4 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation of threatened species, populations and ecological communities of animals and plants. It provides a framework for the assessment of any action that may impact on threatened species.

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of a proposed development on threatened species, populations or ecological communities (or their habitats) listed under the TSC Act. The so-called seven part test is used to determine whether a proposed development is likely to impose ‘a significant effect’ on threatened biota and thus whether a Species Impact Statement (SIS) is required to accompany a development application. Under Part 3A of the EP&A Act, however, there is no requirement for Section 5A of the EP&A Act to be addressed; hence there is no requirement for an SIS. Instead, the flora and fauna assessment must be prepared according to the Environmental Assessment Requirements, which refer to the draft *Guidelines for Threatened Species Assessment* (DECC 2005).

Notwithstanding the statutory requirements for Part 3A of the EP&A Act, the approach in the assessment has been to address Section 5A and complete the seven part test as a guide to assessing impacts on threatened biota that could be affected by the Project. This assessment is discussed further in **Chapter 13 Flora and Fauna** and presented in **Appendix K**. The assessment concluded that there would be no significant impact on the Shale Sandstone Transition Forest Endangered Ecological Community, located within the Development Site but outside the pant footprint.

Under Section 75U of the EP&A Act, the following Orders and Notices cannot be issued against the project, as it has been declared to be critical infrastructure project:

- an interim protection order (within the meaning of the TSC Act); and
- Division 1 (Stop work orders) of Part 7 of the TSC Act.

Chapter 5

Statutory Planning

5.2.5 Water Management Act 2000

The *Water Management Act 2000* (WM Act) provides for the protection of river and lakeside land in NSW, formerly held under the *Rivers and Foreshore Improvements Act 1948* for areas covered by a Water Sharing Plan. The Development Site is not subject to a Water Sharing Plan created under the WM Act and the licence and approval provisions under the WM Act do not apply to it. Approvals under the WM Act are not required as the project is being considered under Part 3A of the EP&A Act.

5.2.6 Waste Avoidance and Resource Recovery Act 2001

The objectives of the *Waste Avoidance and Resource Recovery Act 2001* are to encourage the most efficient use of resources, to reduce environmental harm, and to provide for the continual reduction in waste generation in line with the principles of ecologically sustainable development (ESD). To meet the objectives of the Act, a resource management hierarchy has been established, comprising:

- avoiding unnecessary resource consumption;
- recovering resources (including reuse, reprocessing, recycling and energy recovery); and
- disposal (as a last resort).

These measures would be incorporated into both the construction and operation of the proposed Leafs Gully Power Project.

5.2.7 Occupational Health & Safety Regulation 2001

Chapter 6A of the *Occupational Health & Safety Regulation 2001* (OHS Regulation) provides the requirements covering the premises where substances classified as Dangerous Goods are kept. These requirements include placarding of Dangerous Goods depots, annual notification requirements to NSW WorkCover Authority and requirements for a manifest.

The proponent would be required to notify WorkCover NSW of Dangerous Goods stored and handled above “manifest quantities” as listed in Schedule 5 of the OHS Regulation

5.2.8 Soil Conservation Act 1938

The *Soil Conservation Act 1938* (SC Act) administered by the Department of Lands is aimed at encouraging landholders to take soil conservation and erosion prevention measures and, where this fails, for the Department of Lands to order action to be taken. The SC Act is also important for the management of riparian vegetation. These matters are addressed in **Chapter 9 Soils, Geology and Groundwater**. The construction and operation of the proposed development would be undertaken pursuant to an approved Environmental Management Plan (EMP) which would manage riparian vegetation and the potential for soil erosion.

5.2.9 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997* (CLM Act) has been established to control the risk of harm to human health and the environment, and sets out criteria to determine whether these risks exist. It provides the Department of the Environment and Climate Change with the authority to declare sites for investigation and remediation or voluntary remediation agreements. The potential for contamination of the site is discussed in **Chapter 9 Soils, Geology and Groundwater**. The proposed development would operate in accordance with the relevant requirements established in the CLM Act.

5.2.10 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (NW Act) defines the roles of government, departments and private landholders in the management of noxious weeds. The NW Act establishes categorisation and controls actions for the various listed noxious weeds according to their potential to cause harm to the local environment. Weeds are categorised in Control Classes 1 through 4 and managed accordingly.

The environmental assessment considers these management measures in **Chapter 13 Flora and Fauna** and any mitigation measures would be included in the EMP for the construction and operation phases of the development.

5.2.11 Mine Subsidence Compensation Act 1961

Compensation for damage to buildings, roads, pathways, service infrastructure above and below the ground caused by mine subsidence are dealt with under the *Mine Subsidence Compensation Act 1961* (MSC Act). The MSC Act compensates the owners or renters of the land depending on the damages that occur. Subsidence caused by mining is addressed in **Chapter 9 Soils, Geology and Groundwater**. The proposed development is located within the South Campbelltown Mine Subsidence District which was proclaimed on 30 June 1976 under section 15(1) of the MSC Act. Approval is required from the Mine Subsidence Board to construct the proposed development. Approval would be sought once the detailed design is complete. To date the Mine Subsidence Board has approved the issue of mine subsidence parameters to be used in the design of the power station and associated infrastructure.

5.2.12 State Environmental Planning Policies

Below is a discussion of the State Environmental Planning Policies that substantially govern the proposed development.

SEPP No. 33 – Hazardous and Offensive Development (SEPP 33)

SEPP 33 applies to development for the purpose of potentially hazardous industries and potentially offensive industries. The proposed gas-fired power station constitutes a potentially hazardous and offensive industry as defined under Clauses 3 and 4 of SEPP 33 on the basis that if no measures were to be employed, the development would pose a significant risk to property and would emit

Chapter 5

Statutory Planning

polluting discharges. A Preliminary Hazard Analysis has been prepared which found that with the proposed mitigation measures the risk associated with this development would be very low. This is discussed in **Chapter 18 Preliminary Hazard Analysis** and presented in **Appendix O**. As such the Leaf's Gully Power Project would not be considered potentially hazardous or offensive under the provision of the SEPP.

SEPP No. 44 – Koala Habitat Protection (SEPP 44)

SEPP 44 applies to the Leaf's Gully Power Project because the Development Site is located within the Campbelltown Local Government Area (listed in Schedule 1 of SEPP 44 as land to which SEPP 44 applies).

A flora and fauna assessment has been prepared (refer **Chapter 13 Flora and Fauna** and presented in full in **Appendix K**) which identifies potential koala habitat within the Development Site.

Where potential habitat is identified, the area must be investigated for core koala habitat, defined as an area of land with a resident breeding population of koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population. Where core koala habitat is found to occur, SEPP 44 requires that a site-specific Koala Plan of Management is prepared. The potential koala habitat is reviewed in **Chapter 13 Flora and Fauna** and as core koala habitat was not identified on site, a Koala Management Plan is not required under SEPP 44.

SEPP (Major Projects) 2005

According to *State Environmental Planning Policy (Major Projects) 2005* (Major Projects SEPP) development categorised as a 'major project' requires assessment and approval of the Minister for Planning in accordance with Part 3A of the EP&A Act. The Major Projects SEPP defines certain types of development as comprising major projects. The Leaf's Gully Power Project comprises a major project under the requirements of the Major Projects SEPP, namely Schedule 1, Clause 24 *"Development for the purpose of a facility for the generation of electricity or heat or their co-generation (using any energy source, including gas, coal, bio-fuel, distillate and waste and hydro, wave, solar or wind power), being development that (a) has a capital investment value of more than \$30 million"*.

Accordingly, the proposed development will be subject to assessment by the Director General of the DoP and determination by the Minister for Planning in accordance with Part 3A of the EP&A Act.

It is noted that, in deciding whether or not to approve the carrying out of a project, the legislation states (Section 75J(3)(b) of the EP&A Act) that the Minister may (but is not required to) take into account the provisions of any environmental planning instrument that would not (because of section 75R) apply to the project if approved. The site of the proposed development is zoned under the City of Campbelltown Interim Development Order No. 15 as Non-Urban where the proposed development is permissible with development consent. Hence, the proposed development is not prohibited under the Plan.

Critical Infrastructure Projects

On 26 February 2008 the Minister for Planning declared certain power generating facilities to be 'critical infrastructure projects' being development that:

- has capacity to generate at least 250 MW; and
- is the subject of an application lodged pursuant to Section 75E or Section 75M of the EP&A Act prior to 1 January 2013.

The Project has the capacity to generate in excess of 250 MW and as noted above, an application has been lodged for the Project pursuant to Section 75M prior to 1 January 2013.

Therefore the project is considered to fall within the definition of a critical infrastructure project.

5.3 Commonwealth Legislation

Part 3 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides that an action which has, will have or is likely to have a significant impact on a matter of national environmental significance is a 'controlled action' and may not be undertaken without approval from the Commonwealth Minister for the Environment and Heritage, as provided for under the provisions of Part 9 of the EPBC Act. The EPBC Act provides a number of matters of national environmental significance for which Ministerial approval is required.

A search of the EPBC database has revealed that the subject site is not a World Heritage property, neither contains nor is close to any wetlands of international significance, and is not a marine environment. Therefore as the proposed development does not involve nuclear activities, the detailed flora and fauna survey then determines whether the Leaf's Gully Power Project will require referral to the Commonwealth Minister for the Environment.

The flora and fauna survey and assessment found the only matter of national environmental significance which is relevant to the Leaf's Gully Power Project is '*Nationally threatened species and ecological communities*'.

The EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Matters of National Environmental Significance) prepared by the Department of Environment and Heritage (now Department of Environment, Water, Heritage and the Arts) dated May 2006 set out criteria intended to assist in determining whether an action is a 'controlled action' which requires approval. In particular, the Guidelines contain criteria for determining whether a proposed action is likely to have a significant impact on a matter of national environmental significance.

The flora and fauna assessment contained in **Chapter 13 *Flora and Fauna*** and presented in **Appendix K** of this Environmental Assessment concludes that the Leaf's Gully Power Project is not likely to have a significant impact on nationally threatened species and ecological communities.

Chapter 5

Statutory Planning

The Leaf's Gully Power Project is therefore not a 'controlled action' under the EPBC Act and does not need to be referred to the Minister for Environment and Heritage.

5.4 Environmental Planning Instruments

According to Section 75R(3) of the EP&A Act, environmental planning instruments, approval for a project may (but is not required to) take into account the provisions of any environmental planning instrument for projects subject to Part 3A of the Act.

This section considers the provisions of such environmental planning instruments in relation to the Project.

5.4.1 Regional Environmental Plans

The Development Site is located in an area which is subject to *Sydney Regional Environmental Plan No. 20 – Hawkesbury Nepean River (No. 2 – 1997)*. Although the Development Site is located adjacent to the Nepean River, the plant footprint does not drain to the Nepean River due to the intervening Upper Canal. The entire portion of the Development Site adjacent to the Nepean River is proposed to be part of a Conservation Area proposed for the Project.

It is noted that while the development is adjacent to the Sydney Catchment Authority's Upper Canal it is not located within the hydrological drinking water catchment and therefore the *Drinking Water Catchments Regional Environmental Plan No. 1* which commenced on 1 January 2007, does not apply.

5.4.2 Local Environmental Planning Instruments

Interim Development Order No. 15 – City of Campbelltown

The Development Site is subject to the provisions of Interim Development Order No. 15 – City of Campbelltown (IDO 15). The Site is zoned, Zone No.1 – Non-Urban under IDO 15.

IDO 15 adopts part of the *Environmental Planning and Assessment Model Provisions 1970* (Model Provisions). The Leaf's Gully Power Project comes within the definition of 'generating works' contained in the Model Provisions. Development for the purposes of 'generating works' is permissible with development consent in the Non-Urban Zone under IDO 15 and therefore the Leaf's Gully Power Project is permissible in the Non-Urban Zone under IDO 15.

Consultation – Summary of Key Outcomes

A consultation program has been undertaken over five phases to initiate and maintain open communication with key stakeholders.

Formal consultation was conducted with stakeholders during the following five phases:

- Phase 1: May - June 2006 - Stakeholder and issue identification and provision of information to stakeholders.
- Phase 2: July 2006 - Stakeholders provided feedback on the environmental and socio-economic assessment studies and proposed mitigation strategies.
- Phase 3: November 2006 - Provision of information to stakeholders on key findings of the assessment.
- Phase 4: November 2006 - December 2006: Exhibition of the Environmental Assessment report and receipt of stakeholder submissions.
- Phase 5: October 2008 - Consultation carried out as part of the current application. This phase provided an additional opportunity to stakeholders to provide feedback, in particular in response to the revised project scope.
- The program has aimed at ensuring that all stakeholders were informed of the project parameters, the outcomes of the environmental and social assessment process, and given the opportunity to have input into the project throughout the assessment process.

For Phases 1 through to 3, consultations mostly took the form of one-on-one or group presentations. The following numbers of participants took part in the consultation process: 40 in Phase 1, 28 in Phase 2 and 26 in Phase 3. At the conclusion of the first round of consultation, feedback on community issues, concerns and questions was provided to AGL who then incorporated this feedback into the various Environmental Assessment studies. For the second round of the consultations, stakeholders were provided with a comprehensive review of the Environmental Assessment studies. Round 3 consultations aimed to outline key findings of the Environmental Assessment with one-on-one or group presentations with a total 14 stakeholder groups comprising 26 participants. A community information day was also held.

As a result of feedback from the local community, a number of modifications were made to the proposal. Mitigation of the visual impacts at the closest boundary on the northern perimeter in the form of a vegetated earth mound designed to fit with the natural topography is proposed. Rehabilitation of the northern part of the property is also proposed to link isolated remnant vegetation with the ecological community along the Nepean River and other planting to provide improved visual screening of the plant.

Based on the frequency of issues raised, the following issues dominated the concerns of landholders and non-landholders: visual amenity, future expansion of plant, air quality, traffic impacts and impact on land values.

Chapter 6

Consultation

As part of Phase 4 of the consultation process, a number of submissions were lodged with the DoP objecting to the Power Project. The key issues raised were visual impact, air quality, alternative sites, impacts on health and impacts on land use and property values.

As part of Phase 5 of the consultation process, a letter was sent to landholders/ occupiers within a 2km radius of the project site. Letters were also sent to Wollondilly and Campbelltown Councils, Department of Environmental and Climate Change, Mine Subsidence Board and the Sydney Catchment Authority. These letters sent to stakeholders outlined the proposed, and requested stakeholder feedback.

In addition to direct consultations, three Community Information Sheets (CIS) were produced and widely circulated throughout the community. These were distributed in May 2006, July 2006 and October 2006. In total 5,500 of each of the three CIS's were distributed to the same number of neighbouring communities of Appin, St Helen's Park, and Rosemeadow.

A website and Freecall 1800 phone line was developed for Phase 5 of the consultation process. The website outlined the proposal, provided links to relevant environmental studies, and provided an opportunity for stakeholders to provide feedback.

A media campaign was implemented, to raise awareness of the proposal to the wider community. In total, the proposal received over 100 mentions in the media over the 2006- 2008 period, mainly in the local print media.

While a number of social and environmental issues have been raised by local landholders in relation to the proposed development, these issues are generally localised to immediate properties surrounding the site. While it is acknowledged that neighbouring landholders are, for the most part, opposed to the construction of the plant, it is anticipated that the mitigation measures introduced by the company in response to community feedback, will work towards addressing landholder concerns. However, it would be necessary to ensure that ongoing dialogue with local landholders continues to effectively monitor the social and environmental impacts of the operation over time.

6.1 Introduction

The consultation strategy was designed to initiate and maintain open communication with key stakeholders to provide a forum to proactively respond to and work with key stakeholders. The first three phases of the consultation program were managed by Coakes Consulting and the last two phases were managed by URS.

The key stakeholders identified for consultation for the Leaf's Gully Power Project are:

- landholders;
- tenants;
- local business groups;
- environmental groups;
- Aboriginal groups;
- Local Government;
- State Government;
- Government authorities;
- local industry; and
- local community.

6.2 Consultation Phases

Table 6-1 summarises the phases of consultation undertaken between 2006 and 2008.

Table 6-1 Summary of Consultation Phases

Phase	Purpose	Timing	Coordinator
1	Scoping and providing stakeholders with initial project information	May – June 2006	Coakes Consulting with AGL Project Manager
2	Feedback from stakeholders	July 2006	Coakes Consulting with AGL Project Manager
3	Provision of information on key findings from assessment	November 2006	Coakes Consulting with AGL Project Manager
4	Exhibition of the environmental Assessment for 60 days and receipt of submissions from stakeholders	November 2006 – December 2006	DoP, URS and AGL
5	Providing stakeholders with project information. Feedback from stakeholders	October 2008	URS with AGL Project Manager

6.3 Objectives

6.3.1 Phase 1 - Scoping

The key objectives of the scoping phase were to ensure that stakeholders were:

- appropriately informed of the project parameters;
- aware of the approvals process;
- provided with a copy of Community Information Sheet 1; and

Chapter 6

Consultation

- provided with an opportunity to ask questions and to identify areas of concern in respect to the project.

6.3.2 Phase 2 - Feedback

The second phase of consultation involved providing feedback on the environmental and socio-economic assessment studies and provided an opportunity to outline any proposed mitigation strategies to address the issues raised by the community. Key objectives of this phase were to:

- provide feedback of environmental assessment study outputs;
- describe the elements of AGL's management plans for the Site;
- provide a copy of Community Information Sheet 2;
- provide key stakeholders with direct contact to members of AGL's project team; and
- provide stakeholders with further opportunity to ask questions and to identify areas of concern.

6.3.3 Phase 3 - Key Findings

The key objectives of this phase were to provide stakeholders with:

- an outline of key findings of the Environmental Assessment;
- provide the community with copies of Community Information Sheet 3; and
- provide a forum to discuss the key findings of the Environmental Assessment through an Information Morning held at Appin House on Saturday 11 November 2006.

6.3.4 Phase 4 – Exhibition and receipt of submissions

The key objective of Phase 4 was to:

- appropriately inform interested parties of the exhibition of the Environmental Assessment report, and that the exhibition period was for 60 days; and
- provide interested parties with the opportunity to prepare a submission to the DoP for consideration.

6.3.5 Phase 5 – Information and Feedback

The key objectives of this phase were to provide stakeholders with:

- information on the current project application, in particular with regards to the revised project scope; and
- an opportunity to ask questions and raise issues or concerns.

While the five phases of consultation would complete the planned consultation activities for inclusion in the Environmental Assessment, AGL would continue to respond to concerns raised by the community throughout the planning application and assessment period.

If the Leafs Gully Power Project is approved, ongoing consultation with the key stakeholders would be maintained during the key phases of construction and operation.

6.3.6 Additional Awareness Raising Activities

Media Campaign

In addition to the formal consultation program an ongoing media campaign has run throughout the Environmental Assessment process.

Key objectives of the media campaign were to provide the wider community with:

- an awareness of the project;
- an awareness of the issues that have been raised regarding the project; and
- information of how stakeholders could provide feedback.

Heritage Advertising

An advertisement inviting groups and individuals to register their interest in the Aboriginal cultural heritage assessment and management program was placed in the Campbelltown Advertiser on 13 October 2008 with registrations closing on 3 November 2008. Letters requesting registration of interested parties for a project in the Appin region were sent to:

- Tharawal Local Aboriginal Land Council;
- Register of Aboriginal Owners, Native Title Services;
- Campbelltown City Council; and
- DECC.

Further information is provided in **Section 15.3** and **Appendix M**.

6.4 Key Stakeholders

Stakeholders to be consulted were identified through a variety of methods including property title searches to identify neighbouring residents and landholders; phonebook searches; company searches; internet searches; and review of secondary data sources (e.g. community service directories).

6.4.1 Consultation Program

Table 6-2 summarises the mechanisms employed as part of the consultation program.

Chapter 6

Consultation

Table 6-2 Consultation Program

Stakeholder Group	Mechanism						
	Community Information Sheet	Personal Meeting	Advertisements in local papers	Letter	Website/ 1800 Number	Community Information Day	Media Campaign
Adjacent Landholders / Tenants	Phase 1 Phase 2 Phase 3	Phase 1 Phase 2 Phase 3	Phase 4 (DoP exhibition)	Phase 5	Website & 1800 Feedback Number open to all interested parties Phase 5	Information Day open to all interested parties - Phase 3	Ongoing media coverage throughout all Phases of the program.
State Government Agencies and Elected Members	Phase 1 Phase 2 Phase 3	Phase 2 Phase 3	Phase 4 (DoP exhibition)	Phase 5			
Local Government	Phase 1 Phase 2 Phase 3	Phase 1 Phase 2 Phase 3	Phase 4 (DoP exhibition)	Phase 5			
Community and environmental groups	Phase 1 Phase 2 Phase 3]	Phase 1 Phase 2 Phase 3	Phase 4 (DoP exhibition)				
Aboriginal groups	Phase 1 Phase 2 Phase 3	Phase 1 Phase 2 Phase 3]	Phase 4 (DoP exhibition) Phase 5	Phase 5			
Service providers	Phase 1 Phase 2 Phase 3	Not requested					
Relevant committees	Phase 1 Phase 2 Phase 3	Phase 1					
Appin, Rosemeadows and St Helens Park communities	Phase 1 Phase 2 Phase 3	Available on request No meetings requested	Phase 4 (DoP exhibition)				

Phase 1

Phase 1 was designed to introduce the project to key stakeholders, focusing primarily on adjacent landholders, local councils, and key community and special interest groups. Where possible, participant questions were addressed immediately. Where this was not possible, a commitment was made to follow up specific questions either at a later date or as part of the Phase 2.

The majority of Phase 1 consultations took place the week of 8 May 2006. In total 20 stakeholder groups comprising 40 participants were consulted. The majority of consultations were conducted by Coakes Consulting, however an AGL representative was present at a small number of these initial meetings.

Concurrent with the personal consultations, Community Information Sheet Number 1, "Leafs Gully Power Project" (refer to **Appendix B**), was distributed by letterbox drop to all households in the township of Appin, and the suburbs of Rosemeadow and St Helen's Park. Copies were also made available at key venues such as the Appin Bakery. Contact details of the project manager and principal social consultant were provided to enable residents to make a time to meet with the project team or obtain additional information on the proposal. No additional feedback was received in response to Community Information Sheet 1. The information sheet was also distributed to stakeholders as part of the consultations.

Phase 2

Phase 2 consultations took place in the week of 3 July 2006. In total 19 stakeholder groups comprising 28 participants were consulted. There were slightly fewer than Phase 1 as some participants elected to receive Community Information Sheet Number 2 (refer to **Appendix B**) only, without a personal meeting. Community Information Sheet 2 was distributed by letterbox drop in the week of 10 July 2006 to all households in the township of Appin, and the suburbs of Rosemeadow and St Helens Park. In addition to the consultation conducted by Coakes Consulting, AGL attended a Planning Focus Meeting in March with Campbelltown City Council, the Department of Planning and Department of Environment and Conservation representatives. AGL also addressed the Councillors of the City of Campbelltown in February 2006. AGL would seek to address the Councillors again prior to or during public exhibition.

Phase 3

Phase 3 consultations took place in the week of 6 November 2006. In total 14 stakeholder groups comprising 26 participants were consulted.

Community Information Sheet 3 was distributed by letterbox drop in the week of 6 November 2006 to all households in the township of Appin and the suburbs of Rosemeadow and St. Helens Park.

Phase 4

Phase 4 consultations took place through the exhibition period from 1 November 2006 to 18 December 2006. DoP coordinated the exhibition phase and the receipt and collation of stakeholder submissions for consideration by AGL.

Chapter 6

Consultation

Phase 5

Phase 5 consultations took place during October 2008. In total 81 stakeholders were consulted and 16 submissions were received regarding the proposal. For this phase of the consultation, the program was widened to include all landholders and occupiers within a 2 km radius of the Development Site (refer to **Figure 6-1**), as well as the broader Campbelltown and Wollondilly community. Methodology for this included a letter being posted to all landholders within the 2km radius, for which a postal address could be obtained. For those landholders that a postal address could not be sourced, a letter was placed in the property's post box. In addition, a letter was placed in the post box of properties that displayed evidence of a residential house, when the landholder's postal address was outside the 2 km radius. This ensured that tenants (occupiers) also received notification of the proposal. A short response time was requested to encourage a prompt reply from stakeholders; however, submissions were accepted past the date suggested, and were included in this Environmental Assessment.

A website and 1800 FREECALL number were set up to allow members of the public to ask questions and provide feedback.

Information letters were also sent to:

- Department of Environment and Climate Change;
- Sydney Catchment Authority;
- Mine Subsidence Board;
- Campbelltown City Council; and
- Wollondilly Shire Council.
- Refer to Appendix B which provides consultation resources for Phase 5

Media Campaign

A media campaign was run throughout the consultation program to raise awareness of the proposal. The proposal received over 100 mentions in the media, with the large majority of these occurring in local print media. AGL have developed a number of press releases and have briefed local journalists to ensure accuracy of information. Local print media have made reference to the website and 1800 number, thereby providing readers with an avenue to provide feedback.

Chapter 6

Consultation

6.5 Consultation Responses

6.5.1 Groups Consulted

Table 6-3 lists the groups consulted by category and the number of participants.

Table 6-3 Groups Consulted

Category	Affiliation / business	Number of participants per phase				
		1	2	3	4	5
Landholders	Kyluk Pty Ltd	1		1	Opportunity for comment provided through previous exhibition period.	All landholders/occupiers within 2 km radius were consulted = 76 landholders/occupiers
	Sheraton Homes Pty Ltd	1		1		
	Sebastian Holdings	1				
	Inghams Enterprises	1	1	1		
	Ellel Ministries	2		1		
	Neighbour (Appin Rd Gilead)	2				
	Winkim Holdings	5	3			
	Neighbour (Appin Rd Gilead)	4	2			
	Neighbour (Appin Road Gilead)	3	3	3		
	El Bethel Pty Ltd	1	1	1		
	Moreton Park Pty Ltd	1	1			
	Neighbour (Appin Road Gilead)		2	2		
	Neighbour (Appin Road Gilead)		2			
	Neighbour (Appin Road Gilead)		1	1		
Tenants	Neighbour (Appin Rd Gilead)	1	1			
Business	Appin Chamber of Commerce	6	1			
Environmental	National Parks Association	2	2	6		
	Cataract River Action Party	1				
	Upper Nepean River Users Association	1				
Aboriginal	Cubbitch Barta Aboriginal Group	1		2		
	Tharawal Local Aboriginal Land Council	1				1
Local Government	Wollondilly Shire Council	3	2	4		1
	Campbelltown City Council		1	1		1

Category	Affiliation / business	Number of participants per phase				
		1	2	3	4	5
State Authority	Sydney Catchment Authority	1	1			1
	Department of Planning	3				
	Department of Environment and Climate Change	5				1
	Mine Subsidence Board	1				1
National Authority	Civil Aviation Safety Authority	1				
Industry	Illawarra Coal	2				
State Government	Geoff Corrigan, Member for Camden Graham West, Member for Campbelltown Steven Chaytor, Member for Macquarie Fields Sharryn Hilton, Liberal Candidate for Wollondilly		3		1	
TOTAL CONSULTED		40		28	26	81
Other contacts made						
Neighbour		NA				
Declines						
Landholders	Presquartz Pty Ltd	NA				
Landholders	Neighbour. Appin Rd Gilead.	NA				
Unable to make contact						
Landholders	Neighbour. Moreton Park Rd	NA				
	Neighbour. Moreton Park Rd					
Tenants	Neighbour. Moreton Park Rd	NA				

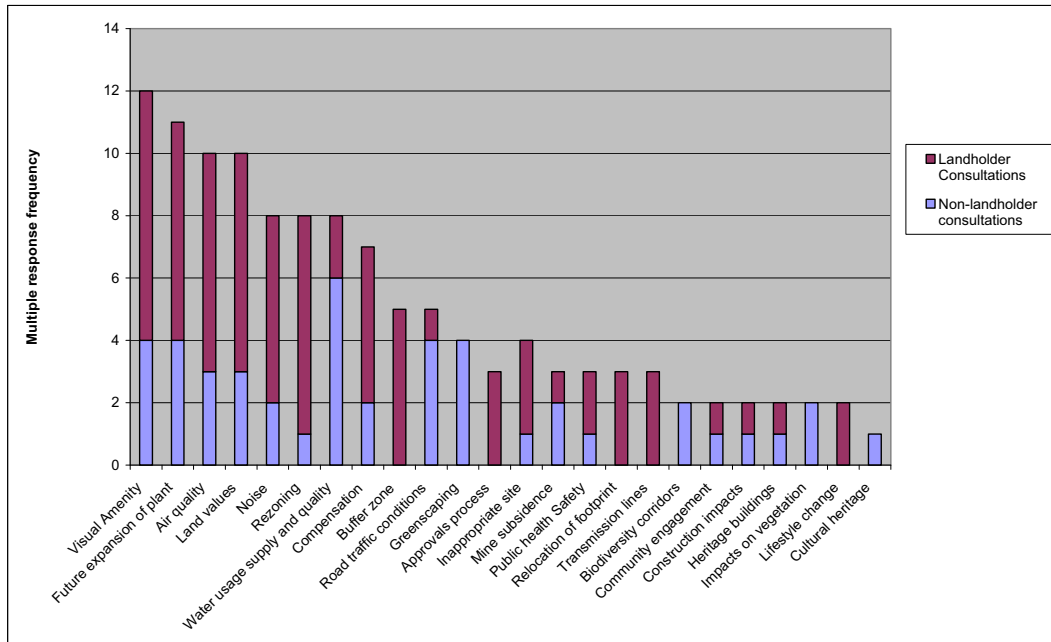
Note: Names have been withheld for privacy reasons

6.5.2 Issues Raised - Phase 1

Figure 6-2 shows summaries and shows the frequency of issues raised during Phase 1 of the consultation process.

Chapter 6

Consultation



Source: Coakes Consulting 2006

Figure 6-2 Frequency of issues raised

Table 6-4 provides a summary of the issues identified during Phase 1 of the consultation process and references where in this Environmental Assessment these issues are addressed.

Consultation

Chapter 6

Table 6-4 Summary of Issue Themes – Phases 1-3

Issue Theme	Summary	Relevant section of EA addressing concern
Awareness of the Proposed Project and Choice of Site	Except for a small number of local landholders, most participants either had not previously heard of the proposed Leaf's Gully Power Project, or had only heard of the project recently, either through the local media or direct contact by the company. Although most parties expressed appreciation of the consultation process, several were concerned that they had not been contacted prior to the formal commencement of the environmental and social studies.	Consultation
	Four participants (three landholders and one environmental group) explicitly questioned the choice of site, stating that other sites to the east around Wollongong or south outside of the greater Sydney area would be better suited to such a development.	Alternatives
	One of the participant groups questioned the extent of the consultation process and asked if the consultations would be expanded to include the Rosemeadow and St Helens Park residents and other community groups e.g. local schools. Mechanisms for involvement were also suggested by some participants, e.g. use of a website to provide information.	Consultation
	Other participants, mostly landholders, questioned the location of the project's "footprint" within the boundaries of the Leaf's Gully property. Several of those who had previous knowledge of the proposed plant suggested the plant was initially intended to be positioned closer to the training track currently located on the Leaf's Gully property	Alternatives
Environmental Impacts: Visual amenity, air quality, noise, and water	Visual amenity was one of the key issues raised by participants. For landholders, the provision of an adequate visual buffer provided via trees, greenscaping and the creation of a visual bund, was considered critical to address visual impacts. There were some concerns about whether visual pollution would be caused by emissions from the stacks. The night-time impacts of the plant, and any light pollution that might accompany the operation of the plant during both the construction and operational phases are also a concern. Of the non-landholder participants, most questions on visual amenity were related to the visibility of the stacks from Appin Road.	Visual Assessment
	The potential toxicity of emissions, and the contribution these emissions might make to the existing air quality of the Campbelltown area, was of particular concern and was linked by some participants to broader public health issues.	Air Quality
	Noise impacts were also raised in the context of the time of day of operations i.e. night time versus day time, and possible excessive start-up noise that might be associated with the plant at the beginning of an operating cycle. For example, one particular participant operates a Christian retreat centre in the nearby vicinity and expressed concern that noise impacts would be detrimental to their facility.	Noise Assessment

Chapter 6

Consultation

Issue Theme	Summary	Relevant section of EA addressing concern
	Issues relating to water were also raised, with several participants wanting to know where the plant's water would be sourced, what would happen to excess water, and what would be the impact on the Nepean River. The question of water run-off, for example, was raised in a number of the consultations, with one participant expressing concern about potential secondary impacts on the creek line.	Water
Impacts on Land Values, Rezoning, and Compensation	There was, generally speaking, broad acceptance that the region in which Leaf's Gully Farm is situated is increasingly becoming encompassed by the development of the south-west suburban corridor and that this development will change the current semi-rural lifestyle of the area. The majority of local landholders stated their intention was to retain ownership of their property in anticipation of the eventual rezoning of the area suitable for sub-division and suburban development. As such, the construction of a power plant was viewed negatively by local landholders because it was perceived to potentially inhibit future rezoning potential.	Land Use
	Concerns that the Leaf's Gully project will detrimentally impact land values and rezoning was most strongly expressed by landholders whose properties lay immediately adjacent to the proposed site. Of the ten landholder groups consulted, seven highlighted land values and future rezoning as their major areas of concern with several stating they had purchased their properties specifically in anticipation of eventual rezoning and the possibility of exploiting urban subdivision opportunities. Several of the landholders stated they took a long-term view to potential rezoning and were willing to wait ten or twenty years if necessary to realise any sub-division potential. They were concerned that the presence of a power plant in the area would inhibit this potential. Of the ten local landholders consulted, five raised the question of potential compensation. Of the ten non-landholder group consulted, a number of groups also raised the issues of land value and rezoning, though these issues were mentioned mostly in the context of noting the concerns of landholders rather than as an issue of personal concern.	Land use
"Buffer Zones" and Greenscaping of the Leaf's Gully Site	In addition to rezoning and land values, there was a perception that industrial development in the area would potentially affect livelihoods and be detrimental to the lifestyle currently afforded by the region. This concern was expressed particularly in respect to the aesthetic qualities of the area.	Land use, socio-economic

Consultation

Chapter 6

Issue Theme	Summary	Relevant section of EA addressing concern
"Buffer Zones" and Greenscaping of the Leafs Gully Site (continued)	Amongst the landholder consultations, there was considerable discussion around the issue of "buffer zones", with several participants wanting to know the precise distance between the proposed plant and their property boundaries, and whether the State Government or Campbelltown City Council could impose a mandatory "zone" of exclusion around the plant. This concern was raised in terms of both current and future planning requirements, with some participants questioning the potential for mandatory exclusion zones being imposed in the future.	Land Use and Planning
	Several non-landholding participants raised the possibility that AGL might consider greenscaping to improve visual amenity and to rehabilitate the Leafs Gully property. One participant suggested a greenscaping program should be implemented as part of a comprehensive plan of management for the Leafs Gully site, while others such as the Wollondilly Council and environmental groups suggested the proposed project offered an opportunity to revegetate the site using locally appropriate plants and seeds, thereby contributing to the preservation of flora in the area.	Visual Assessment Flora and Fauna
Operational Potential and Future Plant Expansion	Concern about potential expansion of the proposed power plant and its operational capacity in the future was one of the most dominant stakeholder issues. This concern was raised in eleven consultation sessions. There was a perception that the proposed peaking plant could extend operational capacity and operate as a base load plant at a later date. Stakeholders expressed concern that as the cost of electricity increases, so the capacity of the plant would also increase.	Project Need
	Some stakeholders expressed doubts as to why AGL would consider making such a financial investment in a plant that only operates 2-3% of the time, a figure stated in the Project Application and Community Information Sheet.	Project Need Alternatives
	There was a perception that once the plant was established other facilities would be constructed on the site in order to centralise operations. Concerns were also expressed about other potential impacts associated with the plant such as enhanced gas mining in the area to provide fuel supplies. There was a perception that the community would have limited opportunities to oppose future development and expansion in this regard.	Legislative Context Land Use and Planning
Road Traffic, Mine Subsidence, Public Safety, Flora and Fauna	Of the remaining issues, the condition of Appin Road and the impact of increased road traffic, particularly during the construction period, were raised by several participants, particularly non-landholders. Appin Road is recognised by locals as a particularly dangerous road which carries high volumes of traffic, and it was generally considered that the proposed plant would only contribute to this problem.	Traffic and Transportation

Chapter 6**Consultation**

Issue Theme	Summary	Relevant section of EA addressing concern
	Mine subsidence was raised in three of the consultations, with participants questioning the safety of building a power plant in an area currently earmarked for underground mining. A related area of concern was public safety and security, and the possibility of a power plant being targeted as part of terrorist activities or, alternatively, experiencing a catastrophic accident. One participant suggested that even if these fears were unfounded, people frequently “perceive” danger and that this could inhibit the area’s potential to attract newcomers. One participant group raised the question of the area’s status as a biodiversity corridor and koala habitat, and posed the question that the site could potentially contribute to biodiversity by enhancing these features of the local area.	Soils and Geology



6.5.3 Phase 1 -3 Consultation – Summary of Recommendations

Following the first round of community consultation, the following comments were made by Coakes Consulting to AGL in response to the issues raised:

1. Concern about land values and rezoning potential housing is likely to be the area of greatest sensitivity to the development of the project. It was recognised that issues of land values and rezoning are outside the influence or decision making authority of the company. However, it was recommended that AGL pro-actively engage with the local landholders to address their concerns and attempt to work with them to mitigate any perceived negative impacts where possible.
2. Early consideration should be given to initiatives to help mitigate negative environmental impacts or, alternatively, make a contribution to the enhancement of the area. Such initiatives could include greenscaping utilising locally sourced seeds and plants, or site rehabilitation to enhance the wildlife habitat. Wollondilly Council has a seed collecting nursery that could potentially act as a partner for any seeding programs. Similarly, inclusion of local environmental groups in rehabilitation programmes could bring a dual benefit of incorporating local knowledge, while promoting community engagement.

Following the second round of community consultation additional information was provided in response to concerns raised. In response to the comments documented above, AGL has conducted detailed noise modelling to ensure noise levels at the site boundary do not restrict the ability of landholders to realise future development potential. In addition, mitigation of the visual impacts at the closest boundary on the northern perimeter is proposed in the form of a vegetated earth mound designed to fit with the natural topography. Rehabilitation of the northern part of the property is also proposed to link isolated remnant vegetation with the ecological community along the Nepean River using seeds native to the area. These outcomes were delivered as a result of the consultation program conducted.

6.6 Phase 4 – Exhibition and Submissions to DoP

A number of submissions were lodged with the DoP objecting to the Leaf's Gully Power Project. **Table 6-5** presents the general nature of the issues that were raised in the submissions.

Chapter 6

Consultation

Table 6-5 General Summary of Issues Raised in Submissions to the DoP - Phase 4

Issue Theme	Summary	Relevant section of EA addressing concern
Project Need	Need for the project and the need considering other peak load power plants approved or proposed in NSW and that the capacity of the existing and proposed peak load power plants being in excess of the estimate shortfall by 2016 .	Project Need and Justification
Location of Power Station	Objections to the power station being located in the Campbelltown area and proximity to residential areas.	Alternatives to the Proposal
	Objections to the power station being located in the Sydney Basin on the basis of concerns about air quality.	
	Proposal will not result in a reduction of costs for the region or provide long term employment benefits.	
	Proposal will not generate electricity for use in the region.	
Operating Times	Potential for change to the proposed operating times. Once approved it will be difficult to say no to an expansion of the facility once operating. Difference in maximum operating time stated in EA (15%) and operating time stated in Community Information Sheet 1 (2-3%).	Project Need and Justification
Air Quality	Opposition to impact on local air quality. Negative impact of emissions including air pollution and greenhouse gases. Increase in air pollution and impact on an existing problem. Proposal will lead to deterioration of air quality in the Campbelltown, Wollondilly and Camden areas. Significant increase to air pollution in Campbelltown resulting from the proposal. Campbelltown already has a higher level of air pollution than the rest of the state.	Air Quality
	Opposition to impact on regional air quality and Sydney Basin airshed. Existing problems with air pollution and smog in the Campbelltown and south western Sydney area that would be compounded by the proposal.	Air Quality
	Objections to quantities of greenhouse gas emissions Objections to production of 550,000 tonnes of greenhouse gases which will compound problems in an already overpolluted Sydney basin. Proposal will produce significant greenhouse gas emissions.	Air Quality



Consultation

Chapter 6

Issue Theme	Summary	Relevant section of EA addressing concern
Health	Health impacts from air pollution from proposal, in particular respiratory problems and asthma.	Health Impacts
	Impact on asthma and respiratory illness as asthma is the most common long term illness of Campbelltown children. 550 000 tonnes of pollutant emissions will have serious long term health and social impacts. Proposal will impact air emissions causing health impacts on an area that has highest child asthma and related respiratory illness rate.	Health Impacts
Land use and property values	Impact on potential future land use in surrounding area. Difficulties in quantifying the extent to which the power station would impact future development given there have not been any land capability studies undertaken of the land to determine its suitability for urban uses. It is considered that any future urban development within the locality would only be sustainable as low density development with a likely 'buffer' between the power station and the residences. Incompatibility of proposal with urban development will lead to sub optimal form of urban development in Macarthur South generally and the Appin –Gilead Corridor in particular. EA fails to address the DoP Metropolitan Urban Development Program which in 2004 identified 1340 future residential allotments in the Gilead area resulting in additional residential allotments closer to the power station than has been identified in the EA.	Land Use and Property Impacts
	Proposal should be located with adequate buffer zones that protect existing uses and established habitation. Proposal is not consistent with planning principles of regional and sustainable land use. planning. Insufficient assessment of the impact of the proposed development on the development potential of land to the north and north-east for urban purposes.	Flora and Fauna Land Use and Property Impacts
Land use and property values	Compared the power station, mining in the area and urban development indicating that after coal is extracted in the period of 2010-2015 the area will become available for urban development. Impact of the proposal on regional land use and regional land use options as it sterilises or constrains land use in a large part of south western Sydney and Macarthur South.	Land Use and Property Impacts
	Use of remainder of property for another industrial development. Selling remainder of property for residential development.	Land Use and Property Impacts

Chapter 6

Consultation

Issue Theme	Summary	Relevant section of EA addressing concern
	Effects of proposal on property values. Property values will be impacted as a result of reduction in air quality, increased noise pollution and downgrading of the area from a rural to industrial landscape	Land Use and Property Impacts
Alternatives	Requests that other alternative sites are investigated. Other potential sites should be investigated further with detail provided in the EA on alternative sites or argument why these may have been more or less suitable. Consideration of alternative sites provided limited details of the sites and considered only the proximity of services and least cost options for AGL. Alternative sites should have been further detailed in light of the potential future development surrounding the chosen location. Assessment should address whether the other potential sites could have been used as a viable alternative.	Alternatives to the Proposal
	Location of proposal within the Leaf's Gully Farm is not in the centre of the property and has been chosen to be close to gas and electricity connections. States that the current location expects the Mount Gilead and Meadow Vale properties to be the proposal's buffer zone. Lack of justification for locating the power plant in its current position as opposed to other areas of the property.	Alternatives to the Proposal
	Proposal does not investigate renewable options. Proposal does not use renewable energy sources such as wind or solar and as a result will increase greenhouse gases. Approvals in Sydney region should only be given to projects which utilise renewable and non-polluting resources for the health of Sydney residents and setting an example for other towns and cities in greenhouse mitigation.	Alternatives to the Proposal
Visual	Visual impact assessment methodology does not take into account the number of viewpoints that will exist when the locality is developed for urban purposes and relies on areas of existing vegetation that will inevitably be modified when urban development takes place. Questions validity of the visual assessment and states that the selection of viewpoints does not adequately assess the intrusion of the plant.	Landscape and Visual



Consultation

Chapter 6

Issue Theme	Summary	Relevant section of EA addressing concern
	Objection to the visual impact of power station on Macarthur district. Visual impact of proposal with obtrusive structures conflicting with the surrounding area. Stacks will be visible from property which will have a detrimental affect on the outlook of the property.	Landscape and Visual
	Visual impact is out of keeping with local area. Views of upper portions of the stacks from residences would be an anomaly in the skyline views and would attract the eye as they would be incongruous.	Landscape and Visual
	Visual impact of air emissions rising 900m into air. Visual impact of plume	Landscape and Visual
	States that the visual screening bund is likely to look out of place within the existing rural landscape and topography and would be an anomaly in the typical rural landscape. Should the development proceed the bund should be built in a manner that integrates better with the surrounding landscape rather than resembling a vegetated wall.	Landscape and Visual
	Request that the colour of the stack be painted and maintained in a colour that will blend in with the surrounding landscapes	Landscape and Visual
	Visual impact of lighting. Although security lighting would be designed not to spill light outside the property boundary light would still be visible from elevated areas in higher topography in the surrounding locality.	Landscape and Visual
Water	Objection to the significant quantity of potable water use and impact on resource use of drinking water. Quantity of potable water use and impact on South Western Sydney's limited water supply.	Water Management
	Impact of proposal on Nepean River which is adjacent to the site.	Water Management Air Quality
Noise	Noise impact from the proposal will impact the neighbouring properties regardless of the noise goal established. Noise impact is out of keeping with local area.	Noise and Vibration
Access Road	The access road and its potential impacts have not been assessed as part of the application. Requests that the environmental impact of the proposed road should be addressed and a report on its impact be made available for public comment.	Project Description

Chapter 6

Consultation

Issue Theme	Summary	Relevant section of EA addressing concern
Bushfire Risk	Proposal is located within close proximity to vegetation that would pose a hazard in the event of a bushfire. Requests that the proponent prepare a detailed bushfire hazard report addressing the RFS Bushfire Protection Guideline. Leafs Gully is within identified hazard area according to Rural Bushfire Service Bushfire Prone Land Maps. Although only Leafs Gully is within the buffer, the property is still considered to be within bushfire prone land. Planning for Bushfire Protection states that development which should not be permitted includes power generating works. There has been no substantial analysis of the bushfire risk not only to the surrounding area but also to fire fighters and employees of the plant. States that this should be reason to refuse development application or warrant more detailed investigation of the potential risk the development would pose. Potential bushfire hazard risk to the power station.	Bushfire Assessment
Consultation	Queried adequacy of consultation and stated that community consultation was lacking Although a process of community consultation was carried out and concerns of residents recorded, considers that concerns of the surrounding residents have not sufficiently been considered.	Consultation
Flora and Fauna	Recognises Conservation Agreement for 65 hectares along Nepean River but does not believe this will not protect vital link between Georges River and Nepean Rivers. Notes that the wildlife corridor is a link between the coast and inland beyond the development site. Requests that the Conservation Agreement apply to all remaining land. Unacceptability of removal of 44 trees along Appin Road.	Flora and Fauna
	Maintaining corridors for fauna.	Flora and Fauna
	Impact on Threatened Species	Flora and Fauna
Heritage	Continued Aboriginal community consultation and involvement is warranted for all further works affecting Aboriginal cultural heritage issues.	Heritage
	Both Mount Gilead and Meadowvale have heritage value and object to impact of proposal on heritage value of properties.	Heritage



Consultation

Chapter 6

Issue Theme	Summary	Relevant section of EA addressing concern
Mine Subsidence	Impact of mine subsidence on the proposal. States that subsidence predictions should assess the maximum credible scenario possible and not the perceived mine plan at this stage. States that the assessment should incorporate both the Bulli and Balgownie seams being extracted by wide longwall blocks and that both seams are assumed to impact the maximum potential subsidence effects.	Soils, Geology and Groundwater
Traffic	Impact of proposal on traffic Increase in traffic volumes on Appin Road during construction and operation Impact of construction traffic on Appin Road which has existing safety concerns.	Traffic and Transport
Approvals and Assessment Process	Queries regarding the approvals process and the assessment undertaken.	Statutory Planning

Chapter 6

Consultation

6.7 Phase 5 – Current Consultation Activities

Table 6-5 provides a summary of the issues identified during Phase 5 of the consultation process and references where in this Environmental Assessment these issues are addressed.

Table 6-6 General Summary of Issues Raised - Phase 5

Issue Theme	Summary	Relevant section of EA addressing concern
Project Need	The proposal will provide greater energy supply security in the future	Project Need and Justification
	The power station could increase in size over time.	Project Need and Justification
	Operating house could increase over time.	
Project location	The footprint of the project is massive, covering an area of 10 hectares. The development is too close to surrounding residential areas, sensitive Sydney water catchment areas and wildlife areas	Project Description
	The power station is unsuitable and disruptive to the surrounding farm areas. The development will bring noise pollution, unsightly buildings and plant, and traffic to the area.	Landscape and Visual, Traffic and Transport, Noise and Vibration
Future Residential Development	The area is suitable to future residential development, and is required to meet the housing needs of the people of Sydney and NSW. It is bad planning to mix power stations in with residential development.	Land Use and Property Impacts
	The potential impact of the power station on future land release in the area and subsequent effects on marketability, viability and take-up of a major future supply of housing should be assessed	Land Use and Property Impacts



Consultation

Chapter 6

Issue Theme	Summary	Relevant section of EA addressing concern
Alternatives	AGL was not comprehensive enough in it's search for an alternative site.	Alternatives to the Proposal
Flora and Fauna	The proposal will conserve local koalas	Flora and Fauna
	The proposal will maintain corridors for wildlife	Flora and Fauna
	The proposal could endanger local wildlife	Flora and Fauna
	The impact on aquatic ecology has not been assessed. Given the proximity to Leaf's Gully Creek and the Nepean River an assessment of such impact should be included.	Flora and Fauna
	The future management of flora and fauna on and off the site, not being the subject of a compulsory conservation agreement, should be determined.	Project Description, Flora and Fauna
Land use	The proposed development is preferential to residential development, in particular the preservation of a 'green zone'.	Land Use and Property Impacts
Employment	The proposal will provide employment opportunities	Socio- Economic
	The proposal will employ only 6 people	Socio-Economic

Chapter 6

Consultation

Issue Theme	Summary	Relevant section of EA addressing concern
Air Quality	Increase in air pollution and impact on an existing problem. Negative impact of emissions including air pollution and greenhouse gases. Air emissions would comprise carbon monoxide, carbon dioxide and nitrogen oxides. Proposal will lead to deterioration of air quality in the Campbelltown, Wollondilly and Camden areas. Significant increase to air pollution in Campbelltown resulting from the proposal. Campbelltown already has a higher level of air pollution than the rest of the state. Significant and long term health and social impacts on children and the community as a result of air pollution. The air quality studies do not take into account planned urban expansion. This impact on urban atmospheric pollution must also be accounted for it an accurate estimate of environmental effects is to be determined. The assessment should take into proper account of local inversions, plumes and the height of stacks which discharge into the atmosphere.	Air Quality
Health	Health impacts from air pollution from proposal, in particular respiratory problems and asthma. Huge financial costs to governments as a result of health impacts caused by air pollution. The total health costs of annual emissions of common ambient air pollutions from all sources in the greater metropolitan area, for the years 2000 – 2002, were conservatively estimated to be between \$1 billion and \$8.4 billion per annum (DEC 2005).	Health
Visual Impact	The placing of stacks in the area is conflicting with the current landscape	Visual
	The height of the stack is visual pollution	Visual
Water	The proposal could threaten the city's water supply	Visual
Heritage	The Northern Illawarra Aboriginal Collective were not consulted with regards to the development. Permission should be sought prior to walking on the area or handling Traditional Cultural Materials.	Heritage



Consultation

Chapter 6

Issue Theme	Summary	Relevant section of EA addressing concern
Consultation	Insufficient time allocated to preparing submissions	Consultation
Greenhouse Gases	The Environmental Assessment does not satisfactorily assess the cumulative climate impact.	Air Quality
Traffic and Transport	The construction of a road to link the plant to Appin Road has not been assessed. Details of the road connecting the proposed Power Station to Appin Road and the provision of the owner's consent needs to be included in the Environmental Assessment.	Project Description
Bush Fire	The potential bush fire hazards associated with the site and development type and any associated risks need to be determined.	Bush Fire Assessment

Chapter 6**Consultation****6.8 Future Consultation****6.8.1 Exhibition and Submissions**

The approvals process provides stakeholders with the opportunity to comment on the proposal formally through the exhibition phase of the Project.

Following exhibition of the Environmental Assessment, copies of all submissions or a report of all issues raised will be provided to AGL and relevant Government authorities. AGL will review the submissions and respond to issues raised.

The Director-General will prepare an assessment report on the Leafs Gully Power Project, which will take into account comments from relevant Government authorities as well as other stakeholders and the community. The assessment report will be provided to the Minister for Planning who will determine whether to grant approval for the Project and conditions under which the facility will operate in accordance with the EP&A Act.

6.8.2 Further Consultation

AGL would ensure that ongoing dialogue with local landholders continues to effectively monitor the social and environmental impacts of the development over time.

This may include initiatives such as:

- Consultation with landholders in proximity to the site during key phases of project development i.e. pre-construction, construction and initial operation.
- Ongoing consultation with local landholders and key community groups to inform them of development progress.

Air Quality Assessment – Summary of Key Outcomes

The air quality assessment comprised of four elements: regional air quality, local air quality, greenhouse gas assessment and aviation safety.

Regional Air Quality

The regional air quality assessment focuses on photochemical smog which is the air pollution phenomenon of concern in the south western parts of Sydney. Ozone is the major component of photochemical smog and is created by the complex reaction of sunlight with oxides of nitrogen (NO_x) and volatile organic compounds (VOC's). NO_x is comprised of both nitrogen dioxide (NO_2) and nitric oxide (NO), with NO_2 being the primary concern in air quality guidelines.

For the preliminary regional air quality assessment the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) was engaged to assess the regional formation of ozone and NO_2 using simplified calculations to assess the potential impact over a year. While the proposed plant will only operate for up to 15 % of the year, a worst-case scenario was modelled with a 300 MW plant operating at full capacity continuously for a 12 month period. Under that scenario there was a maximum increase of NO_x of 0.4 parts per billion (ppb) and a maximum increase of NO_2 concentration of 3.7 ppb over a small area north west of the plant. The plume from the plant largely results in minimal change in ozone levels with some areas experiencing a minor reduction in ozone levels. This reduction is caused by the consumption of ozone by nitric oxide (NO) emitted by the plant.

For the detailed regional air quality assessment the CSIRO was engaged to assess the regional formation of ozone and NO_2 when the plant is operational under different conditions on five selected ozone event days. Ozone event days are days with meteorological conditions known to be conducive to photochemical smog events and were selected by the Department of Environment and Climate Change (DECC) as a basis for the assessment.

The ozone formation within the whole Sydney region was assessed comparing the relative changes in peak ozone concentration predictions from the current situation in Sydney to various scenarios involving operation of the Leaf's Gully Power Project. The modelling found that there is no adverse impact on photochemical smog formation occurring as a result of the power plant operation.

While the proposed plant will only operate for up to 15 % of the year, a worst-case scenario was modelled where a 600 MW plant operated for 24 hours continuously on an ozone event day. Under that scenario there is a maximum increase of 6.8 ppb of ozone and 2.5 ppb of NO_2 occurring over small areas to the south west of the plant. Within the Sydney region, increases in ozone and NO_2 are minor and cover relatively small areas. The plume from the proposed power plant largely results in no change in ozone levels with some areas experiencing a minor reduction in ozone levels. This reduction is caused by the consumption of ozone by nitric oxide (NO) emitted by the plant. In addition, it is noted that the impacts from a 300 MW station (*i.e.* the subject of the current Project Application) on the modelled ozone "event" days would be lower than those of the modelled 600 MW station.

Chapter 7

Air Quality

The Leafs Gully Farm site is a strategically important site due to its location on the high voltage transmission network to service the high demand area of Sydney and Wollongong during times of system constraints. There are economic benefits that will follow for the State Government (as the owner of the transmission network) in avoided transmission losses and avoided capital expenditure when compared to other developments outside the Sydney airshed.

There are strong technical and economic reasons for the location of peaking power generation in the Sydney airshed. The regional air quality assessment demonstrates a minor impact on the Sydney airshed while the local air quality assessment demonstrates that emissions from the development are within criteria set by the DECC.

Local Air Quality

The local air quality assessment focuses on emissions from the proposed power plant during operation and their impacts on the local scale (within approximately 10 km of the Development Site). This modelling was conducted by URS using The Air Pollution Model (TAPM) and assessed the power plant emissions of NO_x, carbon monoxide (CO), sulphur dioxide (SO₂), particulate matter (particulate matter less than 10 microns in diameter, PM₁₀) and Hazardous Air Pollutants (HAP).

This involved assessing existing (or background) concentrations of the abovementioned pollutants for the site using data from nearby DECC air monitoring stations. The background data was found to comply with criteria.

Dispersion modelling predicted the impact of the plant emissions on local air quality based on a worst-case scenario of 24-hour operation under all atmospheric condition. This modelling found that ground level concentrations of NO₂, PM₁₀, CO, SO₂ and HAP are all below the DECC criteria. The impacts on local air quality from this development would be minor and adverse impacts are unlikely.

Greenhouse Gases

Greenhouse gas emissions from open cycle gas-fired plant is approximately two-thirds that of an equivalent coal-fired base load plant. The greenhouse gas emissions of the proposed Leafs Gully Power Project are estimated to be 0.29 million tonnes of CO₂-e per year based on 1,314 hours of operation (that is, 15 % of the year). This would represent 0.37 % of greenhouse gas emissions from power generation in NSW or 0.10 % of all power generation in Australia.

Aviation Safety

A plume rise assessment was undertaken on the basis that the plant was operating at full load for the entire year. The results showed that under the worst case scenario, the Obstacle Limitation Surface (OLS) may be exceeded during approximately 80 % of the year, with an average vertical velocity of 4.3 metres per second (m/s) at 172 m above ground level. Whilst this assessment is considered conservative with respect to the modelled operating times and operating conditions, consideration should be given for the plant to be designated a hazard to aircraft operators in the area. Ongoing consultation with the Civil Aviation Safety Authority (CASA) is required to ensure aviation safety.

Air Quality Outcomes

The assessments described above are conservative and are generally based on continuous operation, which is in excess of that proposed, to ensure operational impacts under all atmospheric conditions have been assessed. As a peaking power plant, the proposed Leaf's Gully Power Project would only operate for up to 15 % of the year and air quality impacts that may occur would be lower than if it were operating continuously. Notwithstanding this, AGL propose that the actual NO_x emissions would be measured throughout operation, using a Constant Emissions Monitoring System (CEMS).

Construction

Notwithstanding the low potential for adverse particulate impacts, emissions of particulates (dust) would be controlled through the implementation of mitigation measures, which would be incorporated into the CEMP. This would include, but not be limited to, dust suppression, stockpile stabilisation, and construction access road management.

Chapter 7

Air Quality

7.1 Introduction

In order to assess the likely impact of the proposed Leaf's Gully Power Project on local and regional air quality, the study consisted of four primary components, namely:

1. Assessment of impact on photochemical smog in Sydney's Regional Airshed.
2. Assessment of local air quality.
3. Assessment of greenhouse gases.
4. Assessment of stack emissions on aviation.

The impact on ambient air quality with respect to regulatory emission limits and ground level concentration criteria of the primarily gaseous emissions has been assessed by URS. The local air quality assessment involved atmospheric dispersion modelling and has been conducted in accordance with DECC's *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005) (referred to herein as the *Approved Methods*). The assessment of the impact of local air quality used a largely conservative approach, in accordance with the *Approved Methods*. This chapter provides summary of this assessment and the full assessment is presented in **Appendix D**.

CSIRO was engaged by AGL to perform detailed photochemical smog modelling of a 600 MW gas fired power plant at Leaf's Gully. The CSIRO photochemical smog report titled *Photochemical Smog Assessment for a Proposed Power Plant in Appin, NSW, Report ET/IR874* (August 2006) has been prepared for the Alstom GT13E2 and the GE LMS 100 Turbine options. The findings of the CSIRO report are summarised in this chapter and are provided in full in **Appendix E**. It is noted however that this Project Application does not consider the GE LMS 100 turbine.

AGL commissioned CSIRO to conduct a preliminary study to assess the potential impact on photochemical smog formation of a 300 MW gas fired power plant at Leaf's Gully. The CSIRO preliminary assessment report is titled *Preliminary Assessment of the Impact of NO_x Emissions From a Proposed Appin Gas Fired Power Station On Photochemical Smog In The Sydney Region*, Report ET/IR696R 9 (June 2004). The findings of the CSIRO report are summarised in this chapter and are provided in full in **Appendix F**.

A comprehensive greenhouse gas assessment including quantitative modelling has been conducted and is presented in **Appendix D**.

An aviation safety assessment has also been conducted for the project to determine compliance with the Civil Aviation Safety Authority's (CASA) Advisory Circular "Guidelines for Conducting Plume Rise Assessments" (June, 2004). This assessment is summarised in this chapter and presented in full in **Appendix D**.

7.1.1 Issues Raised in Community Consultation

During community consultation, the potential toxicity of emissions and the contribution these emissions might make to the existing air quality of the local area, was a concern and was linked by some participants to broader public health issues. These issues have been addressed in the local and regional air quality assessment and also in **Chapter 8 Health Impact Assessment**.

7.1.2 Project Description

The plant is proposed to be developed with two gas turbines each in the 100-160 MW size range. The gas turbine manufacturer has not yet been determined at this stage of the design process, and several turbine designs are being evaluated. The Alstom GT13E2 (Alstom) has been used in modelling as being representative of E class turbine units (rigid frame type), currently being considered by AGL. A summary of the gas turbine parameters is shown in **Table 7-1**.

Table 7-1 Proposed Gas Turbine for AGL Leafs Gully

Designer	Model	Rated Output
Alstom	GT13E2	158 MW

7.2 Existing Environment

7.2.1 Climate and Meteorology

A summary of climatological data collected at the Camden Airport by the Bureau of Meteorology (BoM) is provided in **Appendix D**. Whilst the weather stations at Campbelltown and the Picton Council Depot are the closest known meteorological stations to the site, the data collected is limited. As the Camden site has been recording all major atmospheric parameters for several decades, and is in close proximity to the site, it was considered appropriate to use this station to discuss climate of the area. The Camden Airport Meteorological Station is located approximately 15 km to the north west of the site. These data indicate that the region experiences hot summers and mild winters. The records indicate that average daily temperatures for summer are approximately 28-29°C and can exceed 40°C in January and February. The area has a moderate rainfall, with a mean annual rainfall of 828 mm reported over an average of 109 rain days per year.

The meteorological data used in the assessment was generated using CSIRO's The Air Pollution Model (TAPM) and further discussed in **Section 7.6.1** and in **Appendix D**. Communications with NSW EPA in August and September 2006 resulted in further assessment of the TAPM generated meteorological data to ensure the data was not under or over estimating calm periods. In order to further understand the calm conditions in the locality, URS obtained meteorological data from the Automatic Weather Station (AWS) at Jacks Gully landfill, currently operated by WSN Environmental (formerly Waste Services, NSW). The assessment of the predicted meteorology (refer to **Appendix D**) at the Leafs Gully site was shown to be consistent with general atmospheric parameters.

Chapter 7

Air Quality

7.2.2 Background Air Quality

The choice of the background concentrations for use within the local air quality modelling should be representative of the area in which it is utilised, and for this purpose DECC monitoring data from the Macarthur monitoring stations were interrogated as they represented the closest background air quality monitoring stations to the site.

The *Approved Methods* requires that the peak concentration measured over at least a 12 month period is used from the published monitoring reports as the background concentration. This results in a conservative assessment as concentrations of an individual pollutant may vary hour by hour such that the peak period may be significantly elevated due to unusual events. Hence the use of the peak concentration as a constant background concentration is considered conservative.

The Macarthur monitoring station is located on the University of Western Sydney Campus in Campbelltown, 11 km north west of the proposed site. The Campbelltown campus is located adjacent to the Hume Highway and between the heavily trafficked Narellan and Menangle Roads. As a result, concentrations of traffic related pollutants such as NO₂, PM₁₀ and CO are likely to be higher than elsewhere in the region.

Monitoring has been undertaken at the site since January 2003. The air quality assessment used the data set of the measured pollutants namely nitrogen oxides and particulate matter, monitored at the station during 2006.

A summary of the background concentrations used in the dispersion modelling is shown in **Table 7-2**.

Table 7-2 Summary of DECC Macarthur Monitoring Station Background Data used in Local Air Quality Modelling

Species	Averaging Time	Background Concentration (µg/m ³)	Air Quality Criteria (µg/m ³)
NO ₂	1 hour maximum	134.7	246
	Annual average	23.1	62
CO	15 minute maximum	-	100,000
	1 hour maximum	2500	30,000
	8 hour maximum	2300	10,000
SO ₂	10 minute maximum	-	712
	1 hour maximum	27.5	570
	24 hour maximum	9.7	228
	Annual average	1.5	60
PM ₁₀	24 hour maximum	43.7	50
	Annual average	17.2	30

7.3 Potential Discharges to Air During Construction

The active construction phase is anticipated to take approximately 18 months and would involve the construction of concrete footings for the generator units, the formation of unsealed site roads, installation of the units, construction of a switchyard and transmission connection, installation of the gas lateral and gas receiving station, fencing, commissioning and other minor works.

During the construction phase, there is the potential for dust to be generated due to the excavation and handling of soils, site grading activities and vehicle movements. Given the undeveloped nature of the Site, there is considered to be no significant potential for dust emissions from construction activities to contain contaminants, or for the works to give rise to odorous emissions, consequently emissions during construction have not been quantified. In addition to this, the distance to the nearest residential dwellings (approximately 1.5 km) provides a sufficient buffer zone between the main work area and neighbouring land uses to prevent nuisance dust impacts.

The Upper Canal is located some 300 m from the main footprint of development. Works for construction of the earth mound would be approximately 150 m from the Upper Canal at their closest point. Construction activities would have mitigation measures in place, as summarised in **Table 7-13**, and are unlikely to adversely impact on adjacent areas such as the Upper Canal due to screening by vegetation. In addition, the predominant wind directions for autumn and winter, when the majority of earthworks are proposed to occur, are from the south west indicating that dust, if generated on site, would generally be blown away from the Upper Canal.

Notwithstanding the low potential for adverse particulate impacts, emissions of particulates (dust) would be controlled through the implementation of mitigation measures, which would be incorporated into the CEMP. This would include, but not limited to, dust suppression, stockpile stabilisation, and construction access road management.

7.4 Potential Discharges to Air During Operation

The following modelling scenarios were undertaken:

- E class turbine (Alstom) Start Up
- E class turbine (Alstom) Full Operation

These conditions represented worst case conditions in relation to operational conditions. The Alstom requires approximately 30 minutes for Start Up, consequently, the Alstom Start Up Scenario was modelled based on one turbine operating under Start Up conditions for the full hour, whilst the other turbine ran on Operational conditions for the hour.

Other operating scenarios which were considered but not modelled included **Part Load** and **Shut Down** conditions. The worst emissions generally occur during start up, which requires approximately 30 minutes for the Alstom, consequently modelling the **Part Load** and **Shut Down** scenarios were not modelled, as Start Up Scenario was considered to represent worst case plant conditions.

Chapter 7

Air Quality

Estimated pollutant emission rates for the proposed Leaf's Gully Power Project turbines are shown in **Table 7-3**. Emission rates were estimated as the product of estimated stack concentrations and the estimated exhaust flow rate shown in **Table 7-3**.

The emissions were entered into the model as point sources and all turbines were assumed to emit continuously, 24 hours per day. This is a highly conservative approach as the proposed power plant would operate during peak periods of electricity demand as a peaking station. Whilst an accurate prediction of the operating times cannot be made, it is expected that the plant would be required to operate for up to 15 % of the year.

Table 7-3 Stack Parameters and Modelling Scenarios

Stack Parameter	Units	Alstom GT13E2	
		Operational	Start up
Stack Height (above ground level)	m	35	35
Stack Diameter	m	6	6
Nominal Capacity	MW	160	160
Exit Temperature	°C	532	398 ^B
Exit Velocity	m/s	40	27 ^B
Mass Flow Rate	kg/s	537	NA
Stack Emissions			
NO _x (as NO ₂)	g/s	19.3	27.2 ^A
CO	g/s	4.6	366.1 ^A
SO ₂	g/s	4.9	2.2
PM ₁₀	g/s	4.4	4.4
Benzene	g/s	0.003	0.030
Toluene	g/s	0.027	0.328
Ethylbenzene	g/s	0.007	0.081
Xylene	g/s	0.013	0.162
Formaldehyde	g/s	0.149	1.793
Total PAH	g/s	0.0005	0.006

^A: NO_x and CO emissions during Start Up events are provided in **Appendix D**.

^B: Stack Emissions and selected Stack Parameter data estimated based on proportional data taken from Table 11-5, Parsons Brinckerhoff (2005).

NA : Not Applicable

7.5 Regional Air Quality Assessment

This component of the air quality study assessed the potential impacts of emissions from the proposed Leaf's Gully Power Project on regional ozone concentrations. CSIRO Energy Technology was commissioned to assess the potential photochemical smog formation associated with emissions from the proposed Leaf's Gully Power Project.

Ozone is a photochemical oxidant and the major component of smog. While ozone in the upper atmosphere is beneficial to life by shielding the earth from harmful ultraviolet radiation from the sun, high concentrations of ozone at ground level are a major health and environmental concern. Ozone is not emitted directly into the air from anthropogenic sources but is formed through complex chemical reactions between precursor emissions of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x). These reactions are stimulated by sunlight and temperature so that peak ozone levels typically occur during warmer periods of the year. Because the reactions are not linear, reducing or adding additional amounts of NO_x or VOC emissions to a given air parcel does not necessarily result in an equivalent decrease or increase in ozone concentration.

Meteorological conditions play a very important role in the distribution of these compounds and in the rates at which they react. Stagnation or recirculation episodes, which are also common, can allow emitted pollutants to accumulate over periods of several days.

Previous studies carried out to assess the photochemical smog formation in the west and south west regions of the Sydney basin, where the new NO_x plume from the proposed Leaf's Gully Power Project would be located, have shown that the area can be subject to high ozone episodes. The ozone problem in the south west and north west of the Sydney basin can be directly influenced by upwind sources located to the north and the east of the region. Because of the existing photochemical smog state of the region it is necessary to show that the new source would not deteriorate the current air quality. In order to provide advice on the potential impact of emission changes due to the new emissions, it is important to characterise the current air quality of the selected area and to determine the photochemical smog state of air masses that have the potential to generate high ozone events.

7.5.1 About the Photochemical Smog Modelling

CSIRO Energy Technology was commissioned to conduct a preliminary study to assess the potential impact on photochemical smog formation of a 300 MW gas fired power plant at Leaf's Gully. Full details of this preliminary modelling are presented in **Section 7.5.2** below. This modelling was conducted for an entire year with a simplified chemical reaction scheme model.

CSIRO Energy Technology was also commissioned to assess the potential photochemical smog formation associated with emissions from the Leaf's Gully Power Project. This was conducted for a previous configuration of the Leaf's Gully power plant, which had assumed a project of 600 MW capacity. This modelling was conducted using detailed chemical reaction models and for specific ozone "event" days, representing the worst-case photochemical impacts from the 600 MW station. This modelling is discussed in detail in **Section 7.5.4** below.

Table 7-4 provides a summary of the assessments conducted for regional air quality.

Chapter 7

Air Quality

Table 7-4 Summary of Studies

Aspect	Preliminary Smog Modelling	Detailed Smog Modelling
Output of turbines modelled	300 MW	600 MW
Type of model	Simplified chemical reaction	Detailed chemical reaction models
Timeframe	Over one year	For a worst case scenario of specific ozone "event" days

The detailed photochemical smog modelling presented below was conducted assuming a 600 MW power plant. It therefore overestimates the likely photochemical impacts of the proposed power plant of 300 MW. It is not possible to state that photochemical impacts for the 300 MW power plant will be half those of the 600 MW power plant, as photochemical reactions do not progress as a linear function of pollutant concentration. However, the impacts from a 300 MW station on the modelled ozone "event" days would be lower than those of a 600 MW station.

Conducting the type of detailed photochemical modelling that CSIRO performed is expensive and time consuming. Because the proposed power plant would have a smaller environmental footprint than the original 600 MW station, the detailed photochemical modelling conducted for the 600 MW station has been retained. It therefore overestimates the likely photochemical impacts from the currently proposed 300 MW station. Both the preliminary (300 MW station) and the detailed (600 MW station) photochemical modelling are discussed below.

7.5.2 Preliminary Photochemical Smog modelling

CSIRO was commissioned to conduct a preliminary study to assess the potential impact on photochemical smog formation of a 300 MW gas fired power plant at Leafs Gully. The CSIRO TAPM three-dimensional air pollution modelling system was used which is an appropriate choice for a preliminary assessment of photochemical impacts. Power plant emissions were supplied by AGL and the regional emissions inventory for NSW industrial, commercial, residential, motor vehicle and biogenic emissions was prepared by CSIRO from data supplied by the NSW EPA. The TAPM model was run for an entire year for a baseline scenario (no power station) and then modelled to include the AGL 300 MW station. The potential NO_x, NO₂ and O₃ impacts of the 300 MW station were determined by subtracting the base-case results for these species from those of the power station plus base-case results.

7.5.3 Summary of Results of Preliminary Regional Air Quality Modelling

The CSIRO preliminary regional air quality modelling results of the proposed 300 MW gas fired power station showed the following:

- the maximum 1-hour difference in NO_x concentration shows an increase by up to 0.4 ppb and equates to less than 0.05 % of the maximum hourly NO_x within the modelled domain;

- an increase of the 1-hour NO_2 concentration by a maximum of 3.7 ppb over a small area near Penrith;
- an increase of the maximum 1-hour O_3 concentration by up to 1.9 ppb and a potential for decrease of up to 4 ppb resulting from the titration of ozone with the power station nitric oxide; and
- a similar pattern for the maximum 4-hour average O_3 with an increase up to 1.8 ppb in the west and suppression of up to 3 ppb in the east over the sea.

In general, predicted values of NO_x , NO_2 and O_3 ground level concentrations due to the additional NO_x emissions from the proposed 300 MW Leaf's Gully Power Project are not significantly increased from the existing concentration levels.

As examples, the difference in maximum 1-hour ozone concentration is shown in **Figure 7-1** whilst **Figure 7-2** shows the difference in maximum 4-hour average ozone concentration.

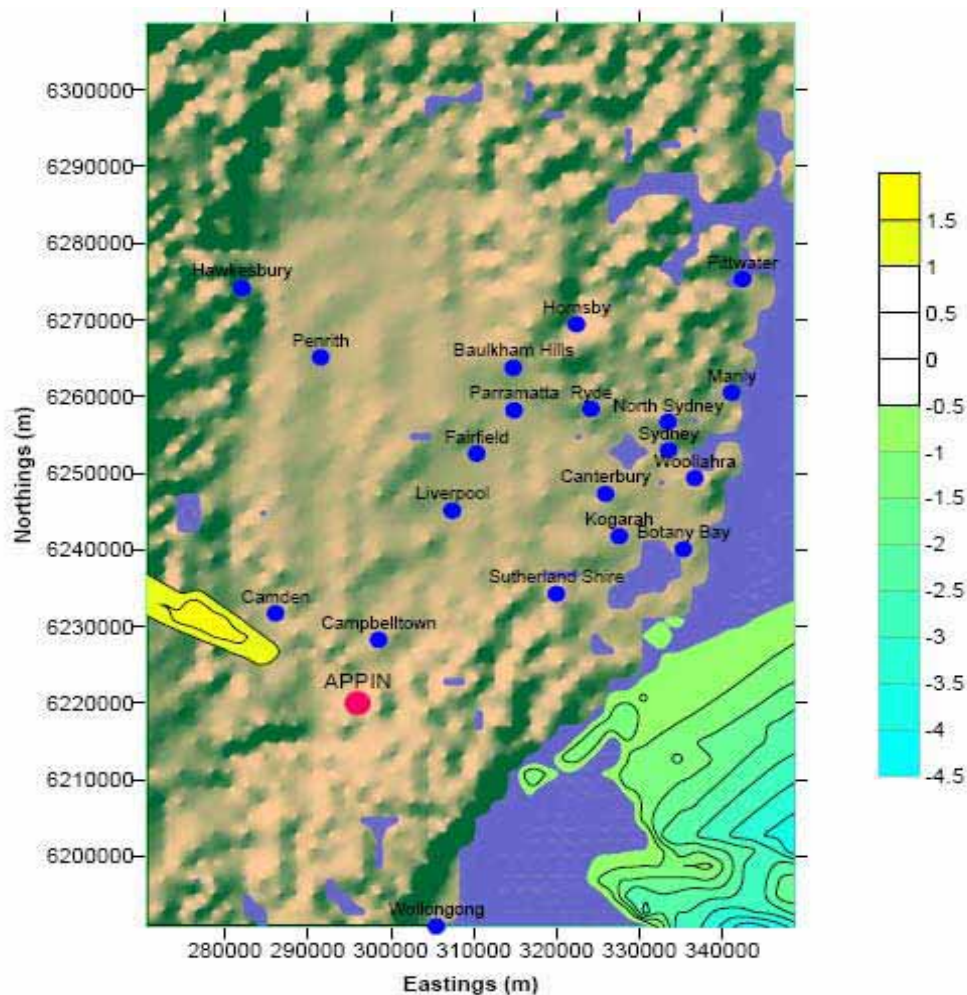


Figure 7-1 Predicted differences (scenario – base case) of maximum 1 –hour ozone concentrations (ppb) due to the proposed Leaf's Gully gas fired power plant

Chapter 7

Air Quality

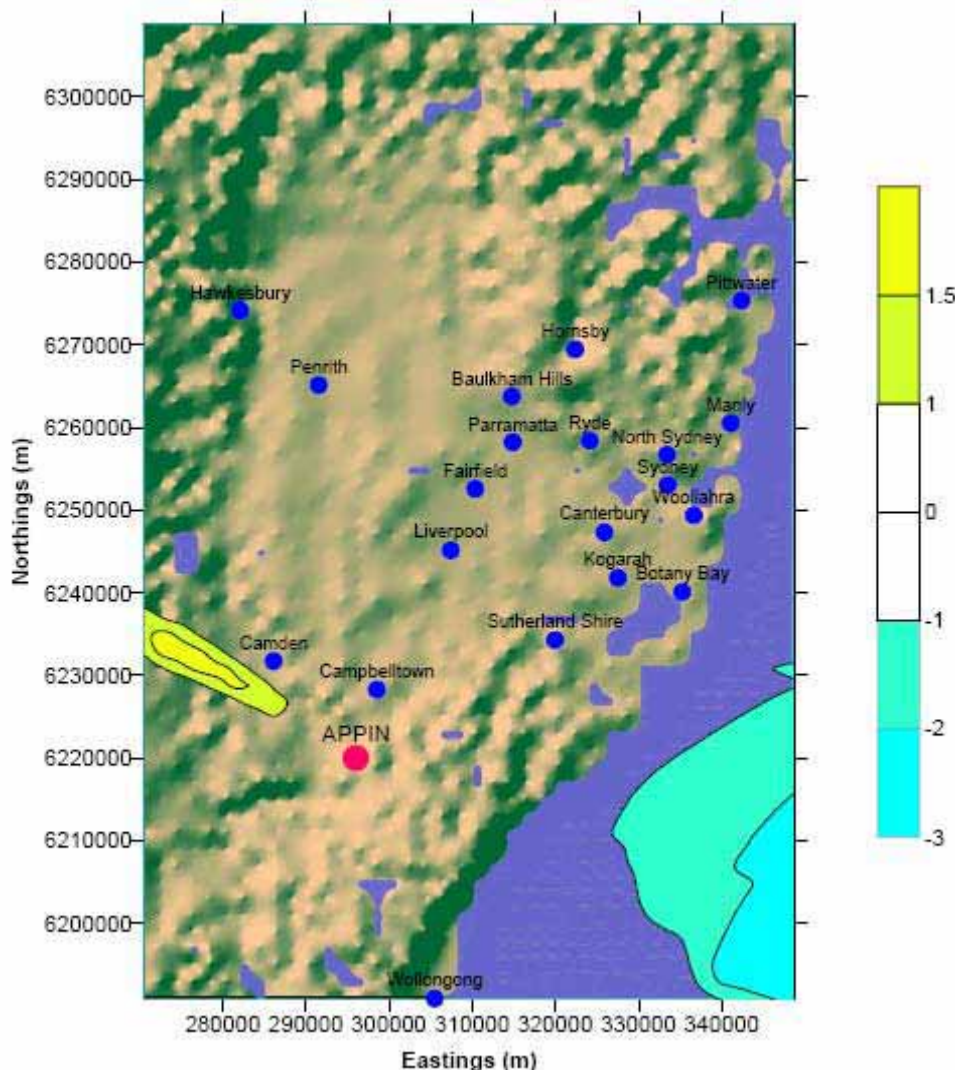


Figure 7-2 Predicted differences (scenario – base case) of maximum 4-hour average ozone concentrations (ppb) due to the proposed Leaf's Gully gas fired power plant

7.5.4 Detailed Photochemical Smog Modelling

In order to appropriately create a model to assess the effects of photochemical smog, existing data from days when the meteorological conditions were known to be conducive to photochemical smog events were used and the effects of the Leaf's Gully Power Project were added to these conditions to present a 'worst case' scenario of the impact. Five selected ozone event days with these meteorological conditions were proposed by the DECC Atmospheric Science Section as a basis for the photochemical smog assessment. The selected modelling days were December 20, 2000, January 12, 2001, January 22, 2001, February 10, 2004, and November 27, 2004.

The impact of the proposed Leaf's Gully Power Project on ozone formation within the Sydney region was assessed by comparing the relative changes in peak ozone concentration predictions for the existing situation (without the input of additional NO_x from the proposed plant) with the proposed situation (with the input of additional NO_x from the proposed plant). For the purposes of the assessment, the existing situation was called the 'base case' and the scenarios including proposed plant were called 'test cases'. In addition, four test cases were modelled to account for different times of the day on each of the five selected days. Although these scenarios were modelled for both the Alstom and LMS turbines, it is noted that this Project Application does not consider the LMS turbine option. A summary of the scenarios is presented in **Table 7-5**.

Table 7-5 Scenarios Modelled in the Photochemical Smog Assessment

Scenarios ^A	Time of emissions
Base case	Only the emission inventory
Test case A	Continuous hourly NO _x emissions
Test case B	Proposed NO _x emissions only at 8 and 9 am
Test case C	Proposed NO _x emissions only at 1 and 2 pm
Test case D	Proposed NO _x emissions only at 3 and 4 pm
Test case E	Capping emissions within the boundary layer

^A: These scenarios were modelled for both the Alstom and LMS turbines although it is noted that this Project Application does not consider the LMS turbine option.

Base case model simulation results were obtained from DECC's Atmospheric Science Section. These simulations were carried out using the emission inventory data without the proposed new NO_x sources. Model test case simulations were performed in which emissions from different stack characteristics were added to the inventory. The assessment was carried out by developing a set of test-case emission scenarios which, when compared to the base case scenarios, enabled the net power station impacts to be evaluated.

As the plant is proposed to be operated when needed, that is, as a peaking plant, the expected NO_x emissions would therefore be emitted at any time of the day for a short period. This type of operation was also included in this study where the following discrete emissions were considered:

- morning NO_x emissions assumed to be released at 0800 and 0900 hours to cover morning energy demand if required; and
- two afternoon NO_x emission periods at 1300 and 1400 hours for the first afternoon period, and at 1500 hours and 1600 hours for the second period.

A final hypothetical scenario suggested by DECC was also considered. This was a scenario which required capping all emissions within the boundary layer to allow for maximum ground level impact to be evaluated. This option was obtained by reducing the stack temperature to 150 °C as proposed by the DECC scientists. It is noted that this could not occur in practice, so is considered hypothetical.

Chapter 7

Air Quality

The modelling used the Alstom turbine (Alstom Option) as a representative case for the emissions from a rigid frame turbine.

7.5.5 Summary of Results of Regional Air Quality Modelling

The modelling results did not show any substantial adverse impacts on photochemical smog formation that may be produced as a result of potential use of a power plant. The study found that two proposed configurations of the plant would produce a maximum local increase of 6.8 ppb of ozone and 2.5 ppb of NO₂. However, these increases were predicted to occur over small areas to the south west of the plant and represent only a maximum increase of 6.8 % and 2 % of the NEPM guidelines of ozone and NO₂ respectively (refer to **Section 7.6.2**). As examples, the maximum 1 hour averaged ozone concentration for 12 January 2001 is shown in **Figure 7-3**, whilst **Figure 7-4** shows the maximum 4 hour averaged ozone concentration on 10 February 2004.

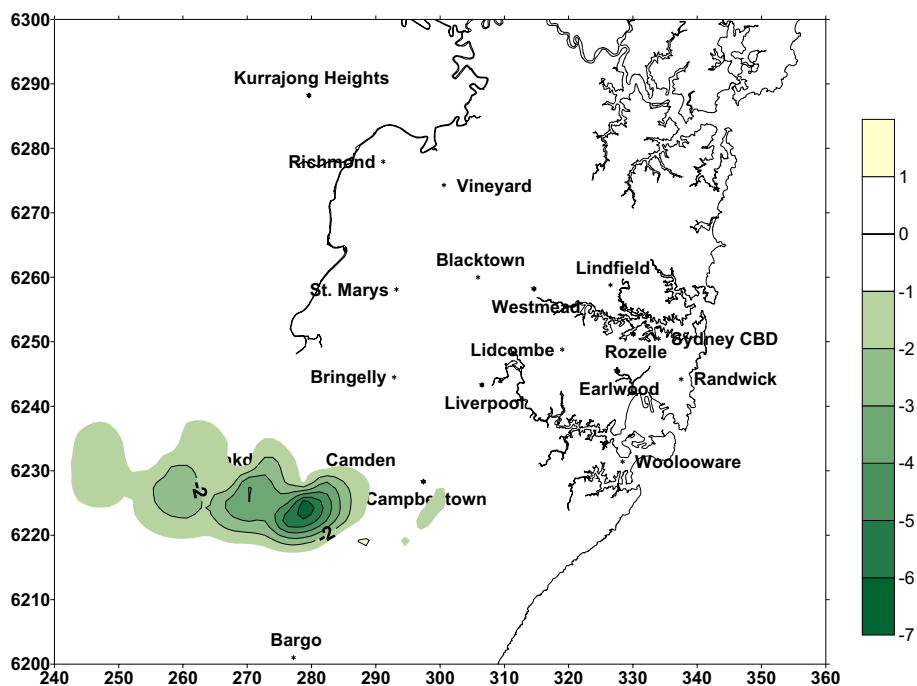


Figure 7-3 Contours of the daily maximum 1-hour O₃ average: differences (ppb) between base case and test case scenarios for January 12, 2001 simulation

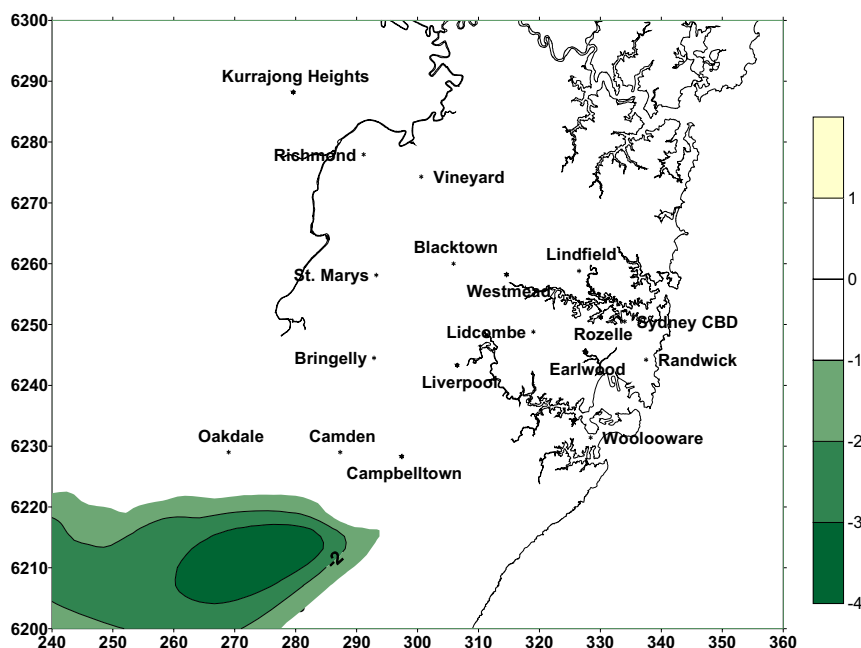


Figure 7-4 Contours of 4-hour ozone average differences (ppb) between: base case and test case scenarios for February 10, 2004 simulation

Although ozone concentrations were shown in instances to be enhanced, **Figure 7-4** shows a large area to the west of the plant having a decrease in ozone (shown by the green areas). This is primarily due to the consumption of ozone by NO.

Whilst the modelling predicts both increases and decreases in ozone from the proposed plant, the modelling results did not show any substantial adverse impacts on photochemical smog formation that may be produced as a result of potential use of the power plant. Increases in ozone formation are over a relatively small area with largely no change to ozone levels in the majority of the region. The diagrams produced show reductions in ozone formation over broad areas where the plume from the power plant is located.

Regional Air Quality Mitigation Measures

While the impact of the proposed development on the Sydney airshed is minor as described in previous sections of this Chapter and any impact is within DECC guidelines there is a push by the community and government for an improvement in air quality in the south west of Sydney. Methods for controlling NO_x emissions from the proposed Leaf's Gully Power Project were detailed in **Chapter 3** of this Environmental Assessment, with NO_x being a precursor to photochemical smog production. Dry Low NO_x (DLN) emission technology presents the most viable NO_x emission technology and is widely used on turbines of the size proposed for Leaf's Gully Power Project.

Chapter 7

Air Quality

Summary

As demonstrated in **Chapter 2**, the Leaf's Gully Farm site is a strategically important site due to its location on the high voltage transmission network to service the high demand area of Sydney and Wollongong during times of system constraints and the economic benefits that will follow for the State Government, as the owner of the transmission network, in avoided transmission losses and avoided capital expenditure when compared to other developments outside the Sydney airshed.

There are strong technical and economic reasons for the location of peaking power generation in the Sydney airshed. The regional air quality assessment demonstrates a minor impact on the Sydney airshed, while the local air quality assessment indicates that impacts associated with emissions from the development are within criteria set by the DECC.

7.6 Local Air Quality Assessment

7.6.1 Methodology

The Director General's Environmental Assessment Requirements require the air quality assessment to be prepared in accordance with the *Approved Methods*. The *Approved Methods* identify the following stages in an air quality impact assessment:

- 1) Input data collection.
- 2) Dispersion modelling.
- 3) Processing dispersion model output data.
- 4) Interpretation of dispersion modelling results.
- 5) Preparation of an impact assessment report.

These stages are further discussed below.

Input data collection

The first step in the impact assessment is the collection of information required to complete the dispersion modelling. This includes development of an air emissions inventory, compilation of meteorological data, background air quality data and terrain data. A summary of the meteorology and background data is presented in **Section 7.2**.

Dispersion modelling

For Step 2 of the assessment it is noted that the following three dispersion models are generally endorsed by DECC for development approvals:

- AUSPLUME;

- The Air Pollution Model ('TAPM'); and
- CALPUFF.

To ensure a robust modelling method was used, both TAPM and AUSPLUME were used in the air quality assessment to predict ground level concentrations.

Dispersion Modelling Scenarios

The emissions were entered into the model as point sources and all turbines were assumed to emit continuously, 24 hours per day. This is a conservative approach as the station operates as a peaking station and it is expected that the plant would be required to operate for up to 15 % of the year, in a normal year. This approach is appropriate for the estimation of short-term concentrations of pollutants from the power station. Annual average concentrations of pollutants due to operation of the power station will be overestimated due to the intermittent operation associated with its role as a peaking plant.

Two operating scenarios (start up and operating) were considered to address the varying emission characteristics. The modelling scenarios are discussed further in **Section 7.4**.

Meteorological modelling

Meteorological modelling was conducted to compile a meteorological file generated from the CSIRO model, TAPM. TAPM encompasses site-specific factors such as terrain influences, regional-scale winds and inversions to predict ground-level concentrations. The main advantages of the proposed modelling system over simpler dispersion models such as AUSPLUME are that:

- The effects of convective turbulence on plume grounding are better represented in TAPM; and
- Any complex three-dimensional behaviour affecting plume dispersion cannot be handled by AUSPLUME.

Through a number of verification studies (e.g. CSIRO 2005), TAPM has been identified as a suitable model of choice to simulate these situations. Further detail of the TAPM meteorological modelling is discussed in **Appendix D**.

As site specific meteorology was not available, the meteorological data used in the dispersion modelling was generated using TAPM. To further augment the meteorological data, local meteorological data from the DECC automatic weather station, located at Macarthur (11 km north west of the Development Site), was also incorporated into TAPM. This method for developing site specific meteorological data is provided in **Appendix D**.

To ensure the meteorology used in the modelling was suitable, a screening validation was performed in order to evaluate the scale of the TAPM predictions against AUSPLUME predictions when running both worst case synthetic meteorology and TAPM generated meteorology. The results of this screening study indicate that despite the more conservative nature of the AUSPLUME predictions, the

Chapter 7

Air Quality

cumulative impacts are within criteria. The conservative nature of the screening assessment implies with a high level of confidence that air impact assessment criteria will not be breached by the proposed plant.

Processing and interpretation of dispersion modelling results

Step 4 of the impact assessment is the interpretation of dispersion modelling results. The outputs of the dispersion modelling are added to existing maximum background concentrations of pollutants to determine the predicted ground level concentrations. These ground level concentrations are compared with the DECC's impact assessment criteria. DECC states in the *Approved Methods* that "compliance indicates the proposal is unlikely to result in adverse air quality impacts" (DEC, 2005 p.3).

Preparation of an impact assessment report

The impact on ambient air quality with respect to regulatory emission limits and ground level concentration criteria of the primarily gaseous emissions has been assessed by URS. The local air quality assessment involved atmospheric dispersion modelling and has been conducted in accordance with the *Approved Methods*. This chapter provides a summary of this assessment and the full assessment is presented in **Appendix D**.

7.6.2 Air Quality Criteria

There are three main types of air quality criteria relevant to industrial developments such as the Leafs Gully Power Project:

Emission Standards – which are maximum allowable pollutant emission concentrations (stack concentrations) specified for particular types of equipment;

Air Impact Assessment Criteria – which are designed for use in air dispersion modelling studies and air quality impact assessments for new or modified emission sources; and

Ambient Air Quality Standards – which set standards against which ambient air quality monitoring results may be assessed.

In general, Emission Standards and Air Impact Assessment Criteria are used to evaluate the expected impact of air emissions on air quality and the effectiveness of plant design and associated mitigation measures. The main objective of these criteria is to ensure that the resulting local and regional ambient air quality meets the relevant Ambient Air Quality Standards.

Emission Standards

The *Protection of the Environment Operations (Clean Air) Regulation 2002* ('the Regulation') sets emission limits for air impurities from stationary plant and equipment. The current standards, taken from Schedule 3 (Electricity Generation) of the Regulation, relevant to the proposed Project are

presented in **Table 7-6** for NO_x. The plant is classified as a Group 6 source, as it will commence operation after 1 September 2005.

Table 7-6 Emission Standards for Electricity Generation

Pollutant	Applicability ^A	Limit ^B
NO ₂ or NO or both as NO ₂ equivalent	Any turbine operating on gas, being a turbine used in connection with an electricity generating system with a capacity of 30 MW or more	70 mg/m ³ as NO ₂

Note:

^A: An activity is designated to "Group 6" if it commenced to be carried on, or to operate, on or after 1 September 2005, as a result of an environment protection licence granted under the Protection of the Environment Operations Act 1997 pursuant to an application made on or after 1 September 2005.

^B: Concentrations expressed at reference conditions (273K, dry, 1atm, 15% O₂).

Local Air Impact Assessment Criteria

The *Approved Methods* specifies a range of impact assessment criteria for toxic and odorous air pollutants. The impact assessment criteria for those pollutants associated with the proposed plant are shown in **Table 7-7**.

Table 7-7 DECC Impact Assessment Criteria for Modelled Pollutants

Pollutant	Concentration		Averaging Period
	(ppm)	(µg/m ³)	
Criteria Pollutants			
SO ₂	0.25	712	10 minutes
	0.20	570	1 hour
	0.08	228	24 hours
	0.02	60	Annual
NO ₂	0.12	246	1 hour
	0.03	62	Annual
PM ₁₀	-	50	24 hour
	-	30	annual
CO	87	100,000	15 minutes
	25	30,000	1 hour
	9	10,000	8 hours
Hazardous Air Pollutants ^A			
Benzene	0.009	29	1 hour
Ethylbenzene	1.8	8,000	1 hour
Formaldehyde	0.018	20	1 hour
Total PAH ^B	-	0.4	1 hour
Toluene	0.09	360	1 hour
Xylenes	0.04	190	1 hour

^A The hazardous air pollutants relevant to this type of combustion emission have been sourced from US EPA (2000).

^B PAH = Polycyclic Aromatic Hydrocarbons. For the purpose of this assessment, Total PAH includes naphthalene.

Chapter 7

Air Quality

Ambient Air Quality Criteria

In August 2006 the NSW EPA updated and re-issued 'Action for Air' - the NSW Government's 25-year Air Quality Management Plan, which was originally published in 1998. In this plan the DECC adopted a number of regional ambient air quality goals for a range of air pollutants. The ambient air quality goals adopted were taken from the National Environment Protection Measure (NEPM) for Ambient Air Quality, published by the National Environment Protection Council (NEPC). This measure sets out national standards and goals for six common ambient air pollutants (NEPC, 1998), namely NO₂, CO, photochemical oxidants (as ozone), SO₂, lead and particulates as PM₁₀.

When reviewing the standards and goals set out in the NEPM for Ambient Air Quality, it should be noted that they are designed for use in assessing regional air quality and are not intended for use as site boundary or atmospheric dispersion modelling criteria. It should also be noted that the DECC impact assessment criteria shown in **Table 7-7** are essentially identical to the NEPM Ambient Air Quality Standards. Thus for the purposes of the assessment, the Air Impact Assessment Criteria and Ambient Air Quality Standards are in effect, the same criteria.

7.6.3 Summary of Potential Local Air Quality Impacts

The local air quality assessment focused on primary gaseous emissions from the proposed power plant and their impacts on the local scale (within approximately 10 km of the proposed Site) with respect to regulatory emission limits and ground level concentration criteria. This modelling assessed the impact of power plant emissions including NO_x, CO, SO₂, PM₁₀ and HAP.

A summary of the potential worst case air quality impacts from an E class turbine (Alstom) is provided in **Table 7-9** and selected dispersion model contour plots are provided in **Appendix D**. The results generally show the worst case impact area to be approximately 10 km to the north east of the plant.

With respect to individual pollutants, the local air quality assessment concluded the following:

- Operation of the plant is not predicted to result in NO₂, PM₁₀, CO, nor SO₂ ground-level concentrations in excess of relevant ambient air quality guidelines.
- Stack emission concentrations are predicted to be below relevant emission criteria.
- Concentrations of pollutants for longer averaging times (24 hour and annual averages) are overestimated, as the operating scenario has been run on the basis that is operating full time. This is an unlikely scenario and it is expected the plant would be required to operate for up to 15 % of the time, in a normal year.

The start up scenario has been run on the basis of one turbine starting up per hour for every hour of the year, as discussed in **Section 7.4**. This is an exceedingly unlikely scenario and it expected that the plant would operate for up to 15 % of the year, and start up will comprise approximately 1% of the total plant operating time. These conclusions are discussed in more detail below.

AGL propose that the actual NO_x emissions would be measured throughout operation, using a Constant Emissions Monitoring System (CEMS).

Nitrogen Dioxide

The ground level guidelines for oxides of nitrogen are limited to NO₂, the principal species of concern in terms of health effects. For this assessment, it has been assumed that all emitted NO_x exists in the form of NO₂. Given that emissions of oxides of nitrogen exist in the atmosphere as both NO₂ and NO this assumption is considered conservative.

The Operating Scenario showed a peak impact approximately 8 km north east of the plant. For the Operating Scenario, both the 1 hour and annual averages were shown to have cumulative concentrations of NO₂ below guidelines.

The Start Up Scenario showed a peak impact approximately 12 km south east of the plant, with the secondary impact area approximately 10 km to the north east of the plant. For the Start Up Scenario, the 1 hour averages were shown to have cumulative concentrations of NO₂ below guidelines.

It should again be further noted that the plant is expected to operate for less than 15% of the year, and that the modelling results shown in **Table 7-1** represent the worst case short-term (1 hour) predictions based on the plant operating for every hour of the year with all emitted NO_x present as NO₂, consequently the impacts are likely to be significantly less than modelled.

In addition, the annual average NO₂ concentrations, when modelled under the Operating conditions were shown to be below criteria of 62 µg/m³. Given the background concentration of 23.1 µg/m³, and the predicted cumulative impact from operation of the site showed concentrations at or less than 0.3 µg/m³, long term impacts are negligible.

Carbon Monoxide

The maximum cumulative impact on CO was shown to be during the Start Up Scenario at a 15 minute averaging period, with a predicted concentration of 4,873 µg/m³, which is below the criteria of 100,000 µg/m³. Similarly, the 1 hour and 8 hour concentrations of CO are well below their respective guideline levels. Consequently, no adverse impacts on local air quality are expected as a result of the intermittent discharge of CO from the proposed power plant.

Sulphur Dioxide

For the proposed development, the maximum cumulative predicted ground level concentration of SO₂ is 50.1 µg/m³ as a 10 minute average and occurs under Operating conditions. This is well below the 10 minute criteria for SO₂ of 712 µg/m³. Likewise, the 1 hour, 24 hour and annual concentrations of SO₂ are well below their respective guideline levels for both the Start Up and Operating Scenarios.

Chapter 7

Air Quality

Particulate Matter (as PM₁₀)

Particulate matter was assessed using a data set for 2006 and four events were shown to have high background PM₁₀ concentrations approaching the criteria of 50 µg/m³ (24 hour averaging). These peak concentrations were associated with unusual events, namely bushfires, and consequently were dismissed as extraordinary events. The maximum measured 24 hour average background concentration of PM₁₀ was shown to be 43.7 µg/m³, which is approaching the criteria limit of 50 µg/m³.

The maximum predicted increase in ground level concentration of PM₁₀ from the scenarios modelled was during Start Up mode, with a concentration of 1.12 µg/m³, and a maximum cumulative impact of 44.8 µg/m³, which is below the criteria limit of 50 µg/m³. Given the low predicted impact of PM₁₀, as expected from gas fired turbines, it is considered that PM₁₀ impacts on local air quality would be minor.

Hazardous Air Pollutants

Hazardous air pollutants from gas fired turbines are generally not considered to be a pollutant of concern, and this has been illustrated in the results. Even under worst case operating conditions, the species assessed were all significantly below the air quality criteria. The highest HAP, in terms of percentage of guideline, formaldehyde, with a maximum predicted concentration of 1.035 µg/m³ (Start Up Scenario), representing 5 % of the NSW EPA guideline of 20 µg/m³.

Table 7-8 Summary of Potential Worst Case Ground Level Concentrations

Species	Averaging Time	Background Concentration ($\mu\text{g}/\text{m}^3$)	Predicted Concentration ($\mu\text{g}/\text{m}^3$)	Cumulative Impact ($\mu\text{g}/\text{m}^3$)	Air Quality Criteria ($\mu\text{g}/\text{m}^3$)
Start Up					
NO₂	1 hour maximum	134.7	33.2	167.9	246
	Annual average	23.1	0.3	23.4	62
CO	15 minute ^A	3,404	1469	4,873	100,000
	1 hour maximum	2,580	439.2	3,019	30,000
	8 hour maximum	2,280	158.6	2,439	10,000
SO₂	10 minute ^A	39.4	9.6	48.9	712
	1 hour maximum	27.5	6.8	34.3	570
	24 hour maximum	9.7	1.3	11.0	228
	Annual average	1.5	0.06	1.6	60
PM₁₀	24 hour maximum	43.7	1.12	44.8	50
	Annual average	17.2	0.053	17.3	30
Benzene	1 hour average	-	0.021	0.021	290
Toluene	1 hour average	-	0.188	0.188	360
Ethyl benzene	1 hour average	-	0.049	0.049	8,000
Xylenes	1 hour average	-	0.090	0.090	190
Formaldehyde	1 hour average	-	1.035	1.035	20
Total (PAH)	1 hour average	-	0.0035	0.0035	0.4
Operating					
NO₂	1 hour maximum	134.7	29.6	164.3	246
	Annual average	23.1	0.2	23.3	62
CO	15 minute ^A	3,404	9.3	3,414	100,000
	1 hour maximum	2,580	7.1	2,587	30,000
	8 hour maximum	2,280	2.1	2,282	10,000
SO₂	10 minute ^A	39.4	10.8	50.1	712
	1 hour maximum	27.5	7.5	35.0	570
	24 hour maximum	9.7	1.2	10.9	228
	Annual average	1.5	0.04	1.54	60
PM₁₀	24 hour maximum	43.7	1.09	44.8	50
	Annual average	17.2	0.04	17.24	30
Benzene	1 hour average	-	0.002	0.002	290
Toluene	1 hour average	-	0.018	0.018	360
Ethyl benzene	1 hour average	-	0.005	0.005	8,000
Xylenes	1 hour average	-	0.009	0.009	190
Formaldehyde	1 hour average	-	0.101	0.101	20
Total (PAH)	1 hour average	-	0.0003	0.0003	0.4

Note:

^A: The sub-hour concentrations were based on both stacks operating at peak emissions for the whole hour.

Chapter 7

Air Quality

7.7 Greenhouse Gas Assessment

The Director-General's Environmental Assessment Requirements specify that both direct and indirect emissions from the project be assessed. This has been conducted using the Australian Greenhouse Office's quantitative methodology. Individual contributions to the total site emissions were estimated from the use of natural gas for stationary energy generation, diesel fuel in vehicles and diesel fuel for stationary energy generation. These were compared to the estimated annual power output from the proposed Project to assess the greenhouse gas intensity of the project (total kilograms of CO₂-equivalent per MWh of power sent out). The full greenhouse gas assessment is presented in **Appendix D**.

7.7.1 Greenhouse Gas Assessment Methodology

The greenhouse gas emission inventory for the proposed Leafs Gully Power Project is based on the methodology detailed in the relevant emission factors in the Department of Climate Change's "*National Greenhouse Accounts (NGA) Factors, 2008*", which updates and replaces the "*AGO Factors and Methods Workbook 2006*". These emission factors are utilised in the reporting of greenhouse gas emissions under the *National Greenhouse and Energy Reporting Act 2007*.

The Greenhouse Gas Protocol is based on the concept of emission "scopes".

- **Scope 1: Direct greenhouse gas emissions.** Direct greenhouse gas emissions occur from sources that are owned or controlled by the company, for example:
 - Emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.;
 - Emissions from chemical production in owned or controlled process equipment.
- **Scope 2: Electricity indirect greenhouse gas emissions.** This accounts for greenhouse gas emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated.
- **Scope 3: Other Indirect greenhouse gas emissions.** This is an optional reporting class that accounts for all other indirect greenhouse gas emissions resulting from a company's activities, but occurring from sources not owned or controlled by the company. Examples include extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.

7.7.2 Greenhouse Gas Inventory

The greenhouse gas inventory for the proposed Leafs Gully Power Project reports Scope 1 and Scope 3 emissions, to account for the direct (Scope 1) and indirect (Scope 3) emissions from the project. For the purpose of this inventory, the operational boundary is defined as the boundary of the power station site. Scope 3 emissions are limited to:

- upstream emissions from the production of natural gas used for electricity generation; and

- upstream emissions from the production of diesel consumed by on-site vehicles and for auxiliary power generation.

The projected usage of natural gas for power generation, kilometres for diesel truck movements on site as well as diesel usage for auxiliary power generation are presented in **Table 7-9**. These data were used to estimate the annual CO₂ emissions from operation of the proposed Leaf's Gully Power Project.

Emissions from purchased electricity were not included in the assessment as these were estimated by AGL to be negligible. As the site would not have on-site landfills or purchase steam from elsewhere, these parameters have not been included. Greenhouse gas emissions from clearing of vegetation on site have not been included, as the footprint of the proposed Leaf's Gully Power Project is largely cleared and used for grazing, with only a few isolated paddock trees remaining.

Table 7-9 Estimated gas consumption, diesel usage and power production per year

Parameter	Value	Units
Amount of gas combusted per year	84,800	tonnes
Distance travelled in on-site diesel vehicles	730	km
Diesel used in on-site generators, auxiliaries etc	1,000	L
Electricity delivered to grid (annually)	412.4	GWh

Table 7-10 shows the greenhouse gas emission inventory and project lifetime emissions for the proposed Leaf's Gully Power Project, conducted using the quantitative assessment methodology that is outlined above. Greenhouse gas emissions from combustion of natural gas account for approximately 99.999% of the total direct site greenhouse gas emissions. Individual greenhouse gases are therefore only quoted for direct emissions from this source.

Table 7-10 Greenhouse Gas Inventory for Proposed Leaf's Gully Power Project

Parameter	Value	Units
Total Greenhouse Gas Emissions	285,583	t CO ₂ -e per year
	0.286	Mt CO ₂ -e per year
Greenhouse gas intensity – total emissions	692*	kg CO ₂ -e per MWh
Greenhouse gas intensity – direct emissions only	542	kg CO ₂ -e per MWh
Total Greenhouse Gas Emissions (Operating duty of 3% over a project life of 30 years) ^	1.7	Mt CO ₂ -e per 30 years
Total Greenhouse Gas Emissions (Operating duty of 15% over a project life of 30 years) ^	8.6	Mt CO ₂ -e per 30 years

Notes

* = Annual sent out generation of 412.4 GWh provided by AGL.

^ = Estimates have been provided for both typical operation (3% of a given year) and maximum proposed operation (15% of a given year).

Chapter 7

Air Quality

7.7.3 Management of Greenhouse Gases

Generation of electricity by gas power stations currently represents the most efficient fossil-fuel based method of generating base load electricity. The relative emissions of greenhouse gases per unit of electricity generated from power stations is called the greenhouse gas intensity, reported in kg CO₂-e per MWh of power sent out. Gas-fired electricity generation has approximately two-thirds the greenhouse gas intensity of coal-fired generation for open-cycle gas power stations, reducing to half of the greenhouse gas intensity for combined cycle gas power stations.

A comparison of the emissions intensity from the proposed Leafs Gully Power Project to other electricity generators in NSW is provided in **Table 7-11**, with the comparisons taken from the NSW Energy Directions Green Paper 2004. The Project is expected to be well below the current NSW pool average and coal-fired power generation. The emission intensity from the proposed Leafs Gully Power Project is comparable to typical natural gas open-cycle plants that operate as base-load stations.

Table 7-11 Greenhouse Gas Inventory for Proposed Leafs Gully Power Project

Electricity generator	Basis of emission calculations	Greenhouse gas emission intensity
NSW generator pool for 2008, comprising a composite of all forms of electricity generation in NSW	See Fact Sheet, the NSW Pool Coefficient (www.greenhousegas.nsw.gov.au)	954 kg CO ₂ -e/MWh
Example of existing coal fired generation	Direct and indirect	970 kg CO ₂ -e/MWh
Natural gas open-cycle plant	Direct and indirect	700 kg CO ₂ -e/MWh
Example of Australian natural gas combined cycle plant (2)	Direct and indirect	480 kg CO ₂ -e/MWh
Leafs Gully Power Project	Direct and indirect	692 kg CO ₂ -e/MWh

Total greenhouse gas emissions in Australia for 2006 (DECC, 2008 *National Greenhouse Gas Inventory*) were estimated to be 576.0 million tonnes of CO₂-e, while NSW was estimated to emit 160 million tonnes CO₂-e from all sources (28 % of emissions from all states). Most of the greenhouse gas emissions in NSW come from stationary energy sources (49 % of NSW emissions). The proposed Leafs Gully Power Project is estimated to release 0.29 million tonnes of CO₂-e per year, representing 0.37 % of the stationary energy emissions in NSW, or 0.18 % of all sources of greenhouse gas in NSW in 2006.

The greenhouse gas production from the proposed Leafs Gully Power Project represents 0.10 % of the stationary energy emissions in Australia, and 0.05 % of all sources of greenhouse gas in Australia, based on the 2006 inventory. When comparing production of the same GWh of electricity between different fuels, the proposed Leafs Gully Power Project provides (approximately) 108,000 tonnes CO₂-e less (or 27 % less) than that of a coal fired power plant operating for the same electricity production.

Australia's future greenhouse gas inventory data are not possible to forecast with certainty. The 2006 inventory data shows that national emissions across all sectors rose by 4.2 % from 1990 to 2006. The largest sector increase was the stationary energy sector, followed by transport, showing a rise due to population growth and electricity demand for resources. The land use sector showed a decrease in emissions over this period, largely due to a reduction in vegetation clearing. Since the future trends are unknown, the greenhouse gas emissions from the proposed Project cannot be meaningfully compared to future emissions from other sources of greenhouse gases in Australia over the life of the project.

AGL is committed to complying with all mandatory government programs, and is a voluntary participant in Federal and State government greenhouse gas reduction programs (AGL Greenhouse Gas Reduction Program):

- Federal Government's Mandatory Renewable Energy Target (MRET);
- The NSW Greenhouse Gas Abatement Scheme;
- The Greenhouse Challenge; and
- Sustainable Energy Development Authority Energy Smart Business Program.

AGL's greenhouse gas reduction projects have covered:

- purchase and generation of electricity from renewable energy sources;
- installing cogeneration technology to recover waste heat from electricity generation;
- extraction of landfill gas and use for electricity generation;
- use of compressed natural gas for transport;
- leak reduction for gas distribution systems; and
- recovery of useful hydrocarbons from refinery off-gases.

These projects contribute to AGL's overall strategy to reduce the greenhouse gas intensity and impact of its operations.

AGL is a participant in the NSW Greenhouse Gas Abatement Scheme (GGAS) as an energy retailer. AGL also has significant investment in renewable energy generation capacity, including investment in hydro, landfill gas-fired power stations, wastewater treatment gas-fired power stations and interests in wind farms. Although AGL is not proposing to implement any additional greenhouse gas offsets for this project, AGL is committed to reducing greenhouse gas emissions and it is further noted that much of the operations within AGL's portfolio do not produce greenhouse gas emissions.

Chapter 7

Air Quality

7.8 Aviation Safety

Due to the plume rise from the stack emissions, an aviation hazard analysis based on the predicted impacts of the proposed facility has been performed and is presented in **Appendix D**. The statistics have been compiled in coordination with the CASA Advisory Circular “*Guidelines for Conducting Plume Rise Assessments*” (June, 2004). In areas where there exists an exhaust plume with a vertical velocity greater than 4.3 m/s at the Obstacle Limitation Surface (OLS) of 110 m, a hazard analysis is required.

This assessment involved use of the CSIRO’s TAPM model which was used to create site-specific meteorological data, including meteorology for the upper atmosphere. TAPM was also used to calculate plume rise trajectories for the turbine emissions.

The modelling results show that as expected for an open cycle gas turbine facility, the plant would produce exhaust plumes with vertical velocities (w) that exceed 4.3 m/s above the OLS for a significant proportion of the year (when modelling the plant running at full load all hours of the year). The maximum, minimum and average heights at which the plume velocity is greater than 4.3 m/s are provided in **Table 7-12**.

Table 7-12 Maximum, Minimum and Average Critical Plume Extents

E class turbine (Alstom GT13E2)	Critical Vertical Plume Extent (m)	Critical Horizontal Plume Extent (m)
Maximum	962	316
Minimum	60	59
Average	172	125

Based on the TAPM assessment for 2006, the OLS is exceeded during approximately 80 % of the year, with an average vertical velocity of 4.3 m/s at 172 m above ground level. Whilst this assessment is considered extremely conservative with respect to the modelled operating times and operating conditions, consideration should be given for the plant to be designated a hazard to aircraft operators in the area.

7.9 Summary of Mitigation Measures

Table 7-13 presents a summary of the air quality mitigation measures.

Table 7-13 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
As part of the detailed design of the development, the assumptions and emission estimates used in this assessment will be reviewed and should the expected emission rates alter detrimentally, the modelling will be revised to ensure that DECC air quality standards and goals will be met.	✓		
Nitrogen oxide emissions would be measured throughout operation, using a Constant Emissions Monitoring System (CEMS).			✓
Undertake further liaison with CASA regarding aviation safety.	✓		✓
Throughout the design process, opportunities to minimise emissions to air will be investigated and implemented wherever possible to ensure that off-site impacts are kept to a minimum.	✓		
Emissions of particulates (dust) would be specifically controlled through the implementation of mitigation measures, which would be incorporated into a construction environment management plan (CEMP) including but not limited to dust suppression, stockpile stabilisation, and construction access road management.		✓	
All major access roads would be sealed and vehicle speeds on unsealed areas would be controlled to minimise dust.		✓	✓

Health Impact Assessment – Summary of Outcomes

An assessment of the possible health consequences arising from operation of the proposed Leafs Gully Power Project was prepared by Associate Professor David McKenzie, Head, Respiratory and Sleep Medicine, Prince of Wales Hospital and Dr Elizabeth Brown Research Fellow, Prince of Wales Medical Research Institute, titled *“Natural Gas Power Stations, Air Quality and Respiratory Disease”*.

Of the potential emissions from the proposed plant the highest impact on ambient air quality is likely to be from nitrogen dioxide (NO₂) because natural gas is relatively clean burning with low particulate and sulphur dioxide emissions. In the worst case situation for the proposed 300 MW natural gas power station (during simultaneous startup of both turbines), maximal emissions of NO₂ added to the highest ambient pollution levels (during an unusual weather event) are predicted to result in levels below the NSW criteria. The assessment stated that:

“At these levels any health impact would be difficult to detect. At the projected levels of the potential pollutants considered in the air quality impact document there is unlikely to be any adverse effect on mortality, lung development in children and adolescents, decline in lung function or rates of asthma development.”

Chapter 8

Health Impact Assessment

8.1 Introduction

An assessment of the possible health consequences arising from operation of the proposed Leaf's Gully Power Project was prepared by Associate Professor David McKenzie, Head, Respiratory and Sleep Medicine, Prince of Wales Hospital and Dr Elizabeth Brown Research Fellow, Prince of Wales Medical Research Institute, titled "*Natural Gas Power Stations, Air Quality and Respiratory Disease*".

This chapter provides a summary of the assessment which is presented in full in **Appendix G**.

8.2 Methodology

The assessment was conducted in the following steps:

- 1) Literature review of potential health impacts caused by predicted emissions from gas fired power stations.
- 2) Assessment of potential health impacts caused by predicted emissions from the power station project.
- 3) Comparison between impacts of predicted emissions with other common exposure sources.

8.3 Summary of Health Impact Assessment

8.3.1 Literature Review

As part of the assessment, a search of the medical databases was conducted which failed to locate any reports of adverse health outcomes specifically attributed to gas fired power stations even though, it notes, many such stations are in use in relatively close proximity to populated areas in Australia and elsewhere, in some instances less than 500 m from the nearest residence.

Therefore the assessment reviewed literature concerning health effects of urban pollution and other sources of pollution and compared the levels of specific pollutants reported in those studies with the potential worst case impact of the proposed Leaf's Gully Power Project.

Urban air pollution includes solid particles of dust, pollens, fungal spores, vapours consisting of tiny droplets of unburnt hydrocarbons including benzene, toxic organic micropollutants, heavy metals and various gases including ozone, NO_x, CO and SO₂. Motor vehicles are the major source of air pollution in urban areas, contributing to the photochemical smog or haze seen on still days. The assessment concluded that many of the toxic components of urban pollution are not found in emissions from natural gas combustion.

Health Impact Assessment

Chapter 8

8.3.2 Assessment of Potential Health Impacts

The assessment noted that only a small proportion of the population is at risk from short-term exposure to pollution, for example the elderly, those with severe cardiopulmonary disease, frail infants and asthmatics.

The assessment stated that several studies have shown small increases in respiratory symptoms, asthma episodes, hospital admissions and deaths on high pollution days and some correlations with levels of common pollutants have been reported. These results have informed the setting of the criteria levels for common pollutants. However, the assessment noted that there are some inconsistencies: for example some authors have found that black smoke (mostly derived from diesel vehicle emissions) is more important than particulate levels as a whole.

Observations of historical pollutant levels in the vicinity of the proposed plant revealed occasional peak and 24 hour average levels that were relatively high, but were almost always below the criteria levels. The highest values occurred when there were bushfires in the area. The assessment concluded that the annual averages were comparable with the lowest values reported in the literature.

8.3.3 Comparison between Impacts of Predicted Emissions with Other Common Exposure Sources

Of the potential emissions from the proposed plant the highest impact on ambient air quality is likely to be from NO₂ because natural gas is relatively clean burning with low particulate and SO₂ emissions. In the worst case situation for the proposed 300 MW natural gas power station (during simultaneous startup of both turbines), maximal emissions of NO₂ added to the highest ambient pollution levels (during an unusual weather event) are predicted to result in levels below the NSW criteria. The assessment stated that:

“At these levels any health impact would be difficult to detect. At the projected levels of the potential pollutants considered in the air quality impact document there is unlikely to be any adverse effect on mortality, lung development in children and adolescents, decline in lung function or rates of asthma development.”

8.4 Mitigation Measures

As the health impact assessment concluded that there is unlikely to be any adverse effect on mortality, lung development in children and adolescents, decline in lung function or rates of asthma development, no additional mitigation measures further to those detailed in **Chapter 7 Air Quality** are proposed for the development.

Soils, Geology and Groundwater

Chapter 9

Soils, Geology and Groundwater – Summary of Key Outcomes

The underlying Hawkesbury Sandstone at the Development Site supports a regional aquifer with a water table to be found at variable depths, depending upon the local topography. Due to the presence of deeply incised gullies and drainage lines (such as Leaf's Gully) close to the proposed power plant footprint, it is considered that the water table under the area would be at some depth and most likely below the proposed depth of excavation.

At present the Development Site is unmined, however the proposed Leaf's Gully Power Project is located within Area 5 of the West Cliff Colliery. The Leaf's Gully Power Project may commence before extraction of coal and there may be some associated subsidence. Mine Subsidence Engineering Consultants Pty Ltd were engaged to conduct an assessment of the predicted subsidence that may be experienced if mining proceeds beneath the Site.

The subsidence predictions provided would be used to design the foundations for the Leaf's Gully Power Project such that should subsidence occur, the power plant would be able to withstand the predicted maximum subsidence impacts. The gas pipeline and electricity transmission line connections would be designed to allow for movement associated with mine subsidence.

The mitigation measures and safeguards would ensure that soils and groundwater are satisfactorily managed using suitable design, construction and management. Accordingly any impacts on soils and groundwater resulting from the construction and operation of the proposed Leaf's Gully Power Project are likely to be negligible.

Chapter 9

Soils, Geology and Groundwater

9.1 Introduction

This chapter presents an assessment of the soils, geology and groundwater of the site for the proposed Leafs Gully Power Project. The assessment is based on mine subsidence reports undertaken for AGL by Mine Subsidence Engineering Consultants (2006) and a preliminary desktop geotechnical assessment undertaken by URS (2006). The mine subsidence report is presented in full in **Appendix H**.

9.2 Existing Environment

9.2.1 Soils and Geology

The Development Site occupies undulating land, which falls relatively gently towards the Nepean River. Leafs Gully runs through the site from north west to south east. West of this is the Upper Canal operated by the Sydney Catchment Authority. The Nepean River forms the western most boundary of the Site. The Site is relatively cleared in the eastern most portion with some taller vegetation remaining along fencelines. West of the Upper Canal the Site is heavily vegetated.

The 1:100,000 Wollongong Geology Map shows the Site to be underlain by Hawkesbury Sandstone, with Wianamatta Shale approximately 1 km to the east of the site (i.e., in the vicinity of the Appin Road). However, the 1:100,000 Soil Landscape Map shows the site being covered by Blacktown Group soils, which are derived from Wianamatta Shale. This is not necessarily inconsistent, as the Hawkesbury Sandstone geology could be capped by slope wash from the adjacent Wianamatta Shales. However, experience in the area shows the overlying soils are more typical of residual Hawkesbury Sandstone, and it is therefore likely that the soil landscape mapping has not picked up the change from shale to sandstone geology between the Site and Appin Road.

The surrounding area generally has a thin layer of topsoil overlying silty clay and clay underlain by weathered sandstone at depths ranging from 0.5 m to 2.5 m.

The silty clay and clay soil can be expected to be predominantly of low to medium plasticity, and to have moderate shrink / swell reactivity to changes in moisture content.

9.2.2 Groundwater

It is unlikely that the thin topsoil layer supports a permanent groundwater table. The underlying Hawkesbury Sandstone supports an aquifer in the region with a water table to be found at variable depths, depending upon the local topography. The maximum depth of the excavation is anticipated to be approximately 12 m. However, due to the presence of deeply incised gullies and drainage lines (such as Leafs Gully the base of which is in the order of 5-10 m below the proposed excavation depth) close to the proposed power plant footprint, it is considered that the water table under the area would be at some depth and most likely below the proposed depth of excavation. This assessment is based on general knowledge of the behaviour of groundwater in Hawkesbury Sandstone and on an assessment of the topography and surface drainage pattern of the Site and is currently not supported

Soils, Geology and Groundwater

Chapter 9

by field data. This would be confirmed during detailed design by directly assessing the presence of groundwater and, if necessary in the future, its quality in relation to construction issues.

9.3 Mine Subsidence

The proposed Leaf's Gully Power Project Development site is located above the footprint of the proposed underground coal mining areas (known as longwalls) at West Cliff Colliery. As a result, the area has been identified in the South Campbelltown Mine Subsidence District. It is noted that there are currently no longwall coal mines under the proposed Site.

Although West Cliff Colliery are currently undertaking investigations to further define the footprint of the proposed longwalls and potentially reduce their length, a conservative assessment has been undertaken in this assessment assuming proposed Leaf's Gully Power Project is above the longwalls.

AGL engaged Mine Subsidence Engineering Consultants to provide subsidence predictions due to the extraction of the currently proposed longwalls and possible future longwalls at West Cliff Colliery. A summary of this report is provided below and is presented in full in **Appendix G**.

9.3.1 Coal Mining Longwalls

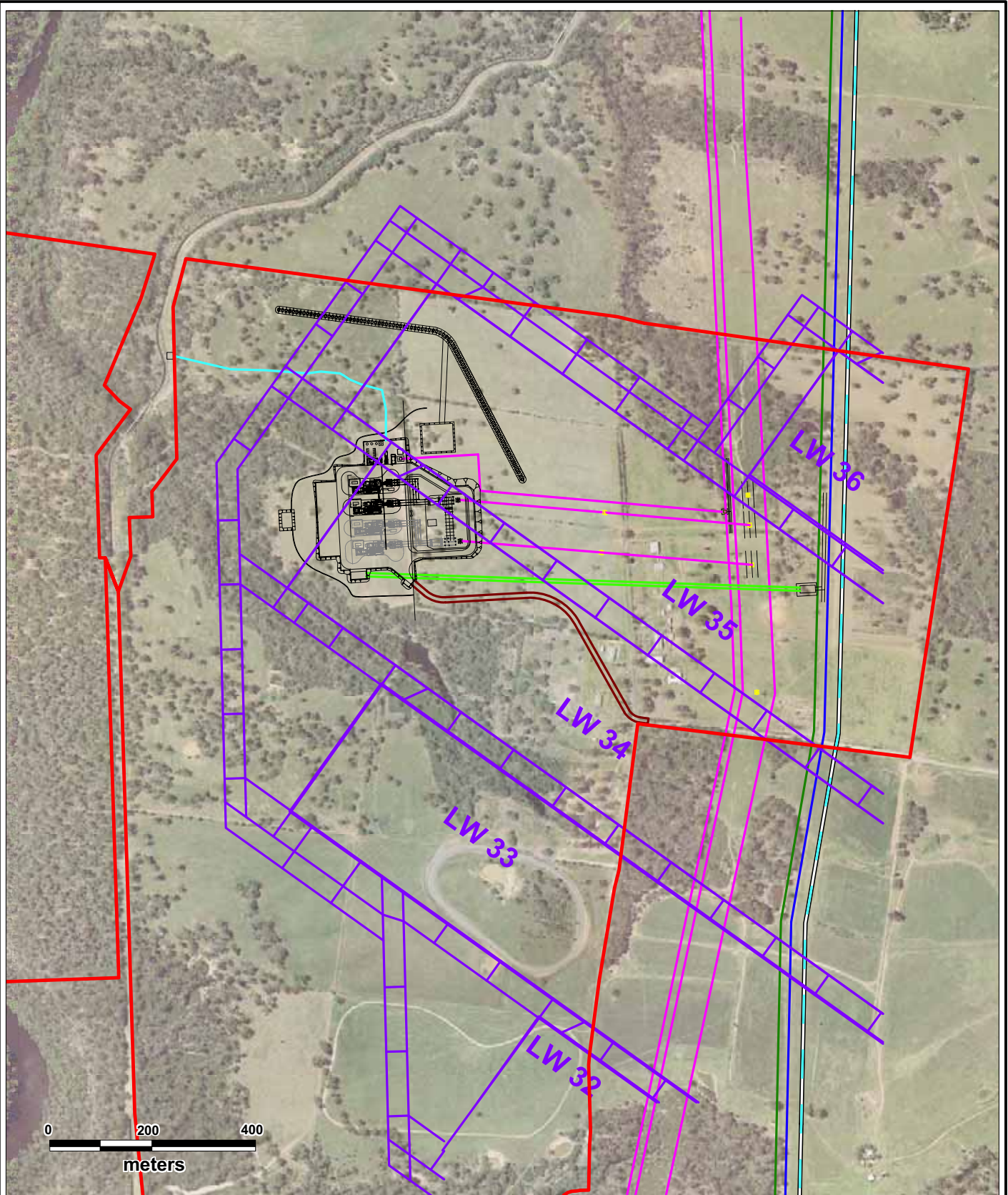
The West Cliff Colliery is operated by BHP Billiton Illawarra Coal. It was opened in 1976 and began longwall mining in 1982. The mine extracts coal from the Bulli Seam using one longwall and five continuous miners. Bulli coal is prime quality hard coking coal and is used for coke making. At present the area is unmined, however the location of the proposed Leaf's Gully Power Project is within Area 5 of the Colliery and potentially above proposed Longwalls 34 and 35 in the Bulli Seam. Although the proposed power plant is not located above Longwall 33, if construction of Leaf's Gully Power Project commences before extraction of this longwall there may be some associated subsidence and it was therefore included in the assessment. Refer to **Figure 9-1** for locations of the longwalls.

The proposed Longwalls 33 to 35 are 305 m wide and the proposed chain pillars (unmined areas between the longwalls acting as supports) are 40 m wide. The lengths of the longwalls are shown in **Table 9-1** below.

Table 9-1 Longwall Lengths

Longwall	Length
33	3910 m
34	4025 m
35	4195 m

The Bulli Seam is on average 520 m below the surface at the location of the proposed power plant and has an average thickness of 2.7 m. It is anticipated that the full seam thickness would be extracted. It is also possible that future longwalls will be extracted from the underlying Balgownie Seam, or adjacent to the current proposed longwalls in the Bulli Seam. Predictions were also calculated for the possible future longwalls using generic longwall layouts.



— Electricity Transmission Lines
— AlintaGN Pipeline (Gas)
— EGP Pipeline (Gas)

— Plant Layout
— Water Pipeline
 Property Boundary

— Proposed Access Road
— West Cliff Colliery Longwalls

Source: Mine Subsidence Engineering Consultants, 2006

Map compiled using Mapinfo StreetPro Data. © 2004 Mapinfo Australia Pty Ltd, URS Australia and PSMA Australia Ltd. URS Australia, Mapinfo Australia or PSMA Australia do not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that these companies shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title LAYOUT OF LONGWALLS AT WEST CLIFF COLLIERY IN RELATION TO LEAFS GULLY POWER PROJECT						
	<table border="1"> <tr> <td>Drawn: AJW</td><td>Approved: FINAL</td><td>Date: 10-07-06</td></tr> <tr> <td colspan="2">Job No: 43177401</td><td>File No: 43177401-028.wor</td></tr> </table>	Drawn: AJW	Approved: FINAL	Date: 10-07-06	Job No: 43177401		File No: 43177401-028.wor	Figure: 9-1
Drawn: AJW	Approved: FINAL	Date: 10-07-06						
Job No: 43177401		File No: 43177401-028.wor						

Soils, Geology and Groundwater

Chapter 9

9.3.2 Subsidence Parameters

Subsidence can occur in locations above longwall mining. Predictions of subsidence parameters have been calculated using a worst case scenario of longwall width to account for future potential changes to longwall mining methods. In addition, the prediction of subsidence parameters has taken into account four turbines being constructed on the Site although it is noted that this Project Application is seeking approval for only two turbines.

As well as locations above longwall mining, subsidence can also occur when adjacent to creek and river valleys that are influenced by longwall mining. As the proposed Leaf's Gully Power Project is located adjacent to Leaf's Gully and therefore, may be subjected to valley related movements, both types of subsidence are discussed below.

Normal ground movement

The normal ground movements resulting from the extraction of longwall panels are referred to as systematic subsidence movements. These movements are described by the following parameters:-

- **Subsidence** usually refers to vertical movements of a point, but subsidence of the ground actually includes both vertical and horizontal movements.
- **Tilt** is the change in the slope of the ground as a result of differential subsidence.
- **Curvature** is the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by the average length of those sections.
- **Strain** is calculated as the change in horizontal distance between two points on the ground, divided by the original horizontal distance between them. Tensile Strains occur where the distance between two points increases and Compressive Strains occur when the distance between two points decreases.

The expected maximum predicted subsidence at the Leaf's Gully Power Project, due to the extraction of the full extent of Longwalls 33 to 35 for a worst case scenario width of longwall, is 1650 mm. The expected maximum predicted tilt, due to the extraction of the full extent of Longwalls 33 to 35 is 8.5 mm/m. The maximum predicted tensile strain at the power plant, due to the extraction of the full extent of Longwalls 33 to 35 is 1.5 mm/m. The maximum predicted compressive strain, due to the extraction of the full extent of Longwalls 33 to 35 is 2.5 mm/m. The minimum predicted radii of curvature associated with the maximum predicted tensile and compressive strains are 10 km and 6 km, respectively.

The anticipated maximum predicted subsidence at the Leaf's Gully Power Project, due to the extraction of the full extent of Longwalls 33 to 35 and possible future longwalls within the Balgownie Seam for a worst case scenario width of longwall is 2600 mm. The expected maximum predicted tilt, due to the extraction of the full extent of Longwalls 33 to 35 and possible future longwalls within the Balgownie Seam is 12 mm/m. The maximum predicted tensile strain at the power plant, due to the extraction of the full extent of Longwalls 33 to 35 and possible future longwalls within the Balgownie

Chapter 9

Soils, Geology and Groundwater

Seam is 2.0 mm/m. The maximum predicted compressive strain, due to the extraction of the full extent of Longwalls 33 to 35 and possible future longwalls within the Balgownie Seam is 3.5 mm/m. The minimum predicted radii of curvature associated with the maximum predicted tensile and compressive strains are 8 kilometres and 4 kilometres, respectively.

Valley related movement

Where creeks and river valleys are located above or adjacent to extracted longwall panels, additional vertical movements in the bases of the valleys and horizontal movements in the valley sides are typically observed. These are referred to as valley related movements and can be described by the following parameters:-

- **Upsidence** is the reduced subsidence, or the net vertical movement within the base of a valley, and results from the buckling of near surface strata in the base of the valley which results from the redistribution of, and increase in the horizontal stresses in the strata immediately below the base of the valley as mining occurs.
- **Closure** is the reduction in horizontal distance between the valley sides. Closure also results from the redistribution of, and increase in the horizontal stresses in the strata as mining occurs.
- **Compressive Strains** occur within the valley as the result of valley closure and are calculated as the decrease in horizontal distance over a 20 metre bay length, divided by the bay length of 20 metres.
- **Tensile Strains** also occur adjacent to the valley as the result of valley closure, and are calculated as the increase in horizontal distance over a 20 metre bay, divided by the bay length of 20 metres.

As the Leaf's Gully Power Project is located adjacent to Leaf's Gully it may, therefore, be subjected to upsidence and horizontal movements due to closure as the result of the extraction of the current series of longwalls, and possible future longwalls.

The maximum predicted upsidence, due to the extraction of the full extent of Longwalls 33 to 35, is less than 5 mm, which would occur at the south-western corner of the power plant. If any of these longwalls were shortened, the maximum predicted upsidence at the power plant would be reduced. The maximum predicted horizontal movement due to closure, due to the extraction of the full extent of Longwalls 33 to 35, is less than 5 mm, and the associated tensile strain is less than 0.1 mm/m.

The predicted upsidence and closure movements due to possible future longwalls within the Balgownie Seam are less than those which would occur due to the current proposed longwalls within the Bulli Seam, and are insignificant when compared to the systematic movements. The additional predicted upsidence and closure movements due to possible future longwalls has therefore, been assessed as negligible.

Soils, Geology and Groundwater

Chapter 9

9.3.3 Summary of Predicted Subsidence Parameters

Power plant

A summary of the expected maximum predicted subsidence parameters for the Leaf's Gully Power Project, for the proposed longwalls within the Bulli Seam for a worst case scenario of longwall width, is provided in **Table 9-2**.

Table 9-2 Expected Predicted Total Subsidence, Tilt and Strain for the Leaf's Gully Power Project (Bulli Seam)

Parameter	Predictions for Leaf's Gully Power Project
Maximum Predicted Total Subsidence (mm)	1650
Maximum Predicted Total Tilt (mm/m)	8.5
Maximum Predicted Total Hogging Radius of Curvature (km)	10
Maximum Predicted Total Sagging Radius of Curvature (km)	6
Maximum Predicted Total Tensile Strain (mm/m)	1.5
Maximum Predicted Total Compressive Strain (mm/m)	2.5

A summary of the anticipated maximum predicted subsidence parameters for the Leaf's Gully Power Project, including the proposed longwalls within the Bulli Seam and possible future longwalls within the underlying Balgownie Seam for a worst case scenario of longwall width, is provided in **Table 9-3**.

Table 9-3 Anticipated Maximum Predicted Total Subsidence, Tilt and Strain for the Leaf's Gully Power Project (Bulli and Balgownie Seams)

Parameter	Predictions for Leaf's Gully Power Project
Maximum Predicted Total Subsidence (mm)	2600
Maximum Predicted Total Tilt (mm/m)	12
Maximum Predicted Total Hogging Radius of Curvature (km)	8
Maximum Predicted Total Sagging Radius of Curvature (km)	4
Maximum Predicted Total Tensile Strain (mm/m)	2
Maximum Predicted Total Compressive Strain (mm/m)	3.5

A summary of the maximum predicted upsidence, horizontal movements due to closure, and ground strains associated with the horizontal closure movements for the power plant, is provided in **Table 9-4**.

Chapter 9

Soils, Geology and Groundwater

Table 9-4 Maximum Predicted Total Upsidence, Horizontal Movement and Strains for the Power plant resulting from the Valley Related Movements at Leafs Gully

Parameter	Predictions for Leafs Gully
Maximum Predicted Cumulative Upsidence (mm)	< 5
Maximum Predicted Horizontal Movement due to Closure (mm/m)	< 5
Maximum Predicted Cumulative Compressive Strain due to Closure (mm/m)	< 0.1
Maximum Predicted Cumulative Tensile Strain due to Closure (mm/m)	< 0.1

The predicted valley related movements at the power plant are insignificant when compared to the predicted systematic subsidence movements at the power plant.

Gas Pipeline

A summary of the maximum predicted cumulative subsidence, tilt and strain along the proposed pipeline is provided in **Table 9-5**.

Table 9-5 Maximum Predicted Cumulative Subsidence, Tilt and Strain along the Proposed Gas Pipelines

Parameter	Longwall		
	After LW33	After LW34	After LW35
Maximum Predicted Cumulative Subsidence (mm)	< 20	380	855
Maximum Predicted Cumulative Tilt (mm/m)	< 0.1	2.3	3.8
Maximum Predicted Cumulative Tensile Strain (mm/m)	< 0.1	0.3	0.4
Maximum Predicted Cumulative Compressive Strain (mm/m)	< 0.1	0.6	0.7

The predicted valley related movements along the gas pipelines are less than those for the power plant, and are, therefore, negligible when compared to the systematic movements. If the gas pipelines are designed for the maximum predicted subsidence parameters due to the extraction of Longwalls 33 to 35, it is likely that the pipelines would also be able to accommodate the subsidence movements due to possible future longwalls in the underlying Balgownie Seam.

Electrical Services

Mining of proposed Longwalls 34 and 35 would be below proposed electrical services for the project. The maximum predicted systematic subsidence, tilt and strain along the electrical services are similar to, but slightly less than those for the gas pipelines, with similar overall profiles as outlined in the Mine Subsidence report contained in **Appendix H**. The predicted subsidence parameters for the electrical services should, therefore, be taken as being the same as those provided for the gas pipelines in the section above.

Soils, Geology and Groundwater

Chapter 9

9.4 Assessment of Potential Impacts

9.4.1 Construction Phase Impacts

Excavation

A nominal platform level of RL 144.0 has been adopted at the location of the exhaust stacks in order to minimise the top level of the stacks and resulting visual impact. The preliminary site preparation concepts show a maximum cut on the eastern side of the switchyard of about 6 m, with a nominal cut/fill line at RL 144. For detailed/confined excavation deeper than about 4 m below natural surface level, economical digging with a hydraulic excavator bucket may not be possible.

As a result of the nominated platform RL 144.0, earthworks would not be balanced and there would be large amounts of excess fill from this excavation that would be available for use elsewhere on the Site. This material would be used to construct a screening mound on the northern side of the Site. Where excavation work extends into bedrock, suitable material could be reused as engineering fill on the Site.

Based on experience with other gas turbine power plants, it is assumed that the turbine-generator sets would be founded on reinforced concrete rafts extending to about 1.5 – 2 m below the prepared site platform. Based on the conceptual site arrangement with a cut/fill line at about RL 144, this would result in the southern most turbine-generator blocks for the proposed plant founding on weathered rock typically 0 – 2 m below the base of the residual soils layer. The bearing pressure under the turbine-generator blocks would be quite low (probably less than 100 kPa), and both the residual soils and preliminary assessment suggest that the weathered rock would be able to easily accommodate such loadings with satisfactory settlement performance.

Potential foundation movement due to changes in moisture environment (shrink / swell movements) would be unlikely to be of concern for the turbine-generator blocks founded as described above.

Erosion of Disturbed Areas

During the construction period, approximately less than 10 % of total Site would be disturbed in order to construct the compound, visual screening mound, access roads, gas and water pipelines, and electricity supply. Rainfall on these disturbed sites may cause soil erosion and runoff may contain high levels of sediments which could then enter the natural drainage system. The soils at the site are likely to have a high percentage of fines, and may or may not be dispersible. Given the relatively flat slopes for most of the areas which would be disturbed, most of the disturbed sites are likely to present minimal erosion hazard and be classified Soil Loss Class 1. The screening mound, which is likely to have steep sides, is likely to be classified as a higher Soil Loss Class.

Chapter 9

Soils, Geology and Groundwater

Groundwater

It is considered that the water table under the area would be at some depth and most likely below the proposed depth of excavation. This would be confirmed during detailed design by directly assessing the presence of groundwater and if necessary in the future, its quality in relation to construction issues.

Mine Subsidence

Mine subsidence could affect a number of design details for the proposed Leaf's Gully Power Project including surface drainage, pavements, turbine foundations and general building foundations in the following manner:

- *surface drainage* could be affected by mine subsidence causing level changes and causing impacts to drainage pipelines and connections to manholes, headwalls and other structures.
- *pavements* could be affected by permanent post-subsidence deflections caused by mine subsidence which could cause alignment problems between the turbine and the alternator if not designed to account for this.
- *general building foundations* could be affected by strains and tilts induced by mine subsidence.

Soil Contamination

Given the undeveloped nature of the Site, with the exception of the residences, it is unlikely that soil has been significantly impacted by site based activities. As a result, it is unlikely that any soil contamination is present on the Site.

Evaporation and Sediment Pond

The in-situ materials or site-won fill would be structurally adequate for construction of evaporation ponds. However, the integrity of these materials as a low-permeability lining cannot be relied upon when the site is subjected to mine subsidence. Consequently there would be a risk that the high salinity blow-down could escape into the natural groundwater.

The insitu material or site-won fill would be structurally adequate for construction of sedimentation ponds receiving general site runoff. Although some potential decrease in water-tightness of the floor or walls as a result of mine subsidence could occur, this should be acceptable (and most likely self-healing via the sediment on the pond floor) and would be confirmed at the time of subsidence.

9.4.2 Operational Phase Impacts

Normal engineering practice is to implement regular inspections and maintenance of all operation areas to ensure proper performance of the facilities in accordance with their engineering design.

Soils, Geology and Groundwater

Chapter 9

There is potential for contamination at the site during operation from spills of fuel, oil or chemicals.

Surface water from the site that may be potentially contaminated by spills or leaks include:

- rainfall runoff from operational areas of the site; and
- accumulated water within bunds.

In addition, where flows are concentrated, soil erosion may occur. The impact of surface water flows is addressed in **Chapter 14 Water Management**.

9.5 Mitigation Measures

9.5.1 Construction

Excavation and foundations

For structures founded on engineered fill, or on natural material close to existing surface levels, an allowable bearing pressure of 150 – 200 kPa would be readily achievable, and these areas can be expected to behave typically as a “Class M” site as defined in the Residential Slabs and Footings code AS2870.

The turbine-generator sets would be founded on reinforced concrete rafts extending to about 1.5 to 2 m below the prepared site platform. This would be confirmed in the detailed design.

For foundations on weathered rock, for conceptual design purposes, the following allowable bearing pressures would be adopted:

- Weathered rock 2 – 4 m below natural surface: 800 kPa
- Weathered rock > 4 m below natural surface: 1.5 MPa

For detailed/confined excavation deeper than about 4 m below natural surface level, as economical digging with a hydraulic excavator bucket may not be possible, use of a rock-breaker or rock saw may be required.

Where fill is proposed to be beneath structures, it would be compacted to 98 % (Standard) dry density ratio at a moisture content in the range of ± 2 % Optimum Moisture Content. In areas where fill is not planned to be used as a permanent structural foundation, compaction to 95 % standard would be suitable.

For the sandstone-derived soils expected at the main power plant site, a California Bearing Ratio (CBR) of 6% can be used for preliminary design of pavements and hard stands.

Chapter 9

Soils, Geology and Groundwater

A Construction Soil and Water Management Plan would be developed and implemented as part of the CEMP for the construction works to ensure effective management of potential soil erosion issues. Construction would be planned to minimise the time that disturbed land is exposed. Disturbed areas would be quickly revegetated or covered with a non-erodable surface following construction. During the construction period water may be required for dust suppression.

Mine subsidence

Design of the earthworks (and particularly the surface drainage) would take into account possible level changes due to subsidence, and to provide adequate flexibility in drainage pipelines, and connections to manholes, headwalls and other structures.

Design of flexible pavements would avoid the use of cement-stabilised layers and avoid the use of rigid pavements wherever possible.

Design of the turbine-generator blocks would ensure they would structurally withstand the predicted subsidence movements. Design of turbine-generator blocks could include provision of enough stiffness in the turbine-generator subfoundation to avoid deformations or re-alignment after subsidence has occurred. Optimisation studies during detailed design would allow for the most cost effective compromise between turbine-generator block stiffness and possible downtime and re-alignment costs to be determined.

Any longwall mining which is actually carried out could be undertaken to a somewhat different plan to those assumed for the subsidence studies to date, and subsidence mitigation strategies would need to have the flexibility to accommodate such changes.

Mine subsidence would not affect the bearing capacity of foundations, or their settlement performance under dead and live load, but the structures would need to be detailed to accommodate the strains and tilts arising from the subsidence. There are well proven strategies available for buildings (eg lightweight construction, adjustable height piers, articulation etc), and for ancillary structures (eg flexible rather than rigid busbars in switchyards).

The timing of mining of longwall panels is never exact. Uncertainty of subsurface conditions, potential for equipment breakdown, emerging mining technologies and changes in global coal prices may all affect the way the mine is operated. Future longwall panels are planned but have not been approved and may change. Leafs Gully will be designed in accordance with expected Mine Subsidence parameters and would need approval from the Mine Subsidence Board for the detailed design. AGL would seek approval from the Mine Subsidence Board once detailed design of foundations has been completed following Project Approval, if granted.

Soils, Geology and Groundwater

Chapter 9

Evaporation and Sediment Pond

Provision of a synthetic liner (probably high density polyethylene) for the evaporation pond would be necessary to minimise the risk of the high salinity blow-down escaping into the deep natural groundwater system. The liner should not be covered by a “protective” soil layer, as is sometimes the case in other applications, as it is important that the liner be able to move relative to the underlying ground to accommodate concentrated strains from subsidence.

The insitu material or site-won fill would be structurally adequate for construction of sedimentation ponds receiving general site runoff and consequently the provision of a synthetic liner would not be necessary.

9.5.2 Operation

Management of surface water flows from the plant footprint are described in detail in **Chapter 14**. The outlet of the compound’s stormwater system would be designed to maximize the dispersion of these high flows and thereby minimize their potential to cause soil erosion downstream.

Appropriately bunded areas would be included for storage of fuels, oils and chemicals.

Areas within the plant area would be appropriately drained so that surface runoff would be prevented from infiltrating directly onto the ground and from reaching the groundwater.

9.5.3 Summary

The mitigation measures and safeguards would ensure that soils and groundwater are satisfactorily managed using suitable design, construction and management. Accordingly any impacts on soils resulting from the construction and operation of the proposed Leafs Gully Power Project are likely to be negligible. Mine subsidence would not affect the bearing capacity of foundations, or their settlement performance under dead and live load, but detailed design of the structures would need to accommodate the strains and tilts arising from the subsidence.

Table 9-6 presents the mitigation measures to address the soil and geological issues for the Leafs Gully Power Project.

Chapter 9

Soils, Geology and Groundwater

Table 9-6 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
A nominal east to west cross-fall of 3 % shall be applied to the platform to provide adequate site surface drainage.	✓		
Where excavation work extends into bedrock, suitable material would be reused as engineering fill on the site.	✓	✓	
Weathered sandstone from the proposed excavation to 12 m depth on the eastern side of the switchyard would be used; where practical; to create a reasonable all-weather surface for the site platform and laydown areas.	✓	✓	
Assess need for groundwater control and collection system.	✓		
Where practicable, material excavated from the site (except for say 150 mm of topsoil and root-affected material) would be suitable for use as engineered fill in any cut/fill operations.	✓	✓	
The visual screening mound located towards the northern perimeter of the Site would be constructed from excess fill generated in excavations where practical.	✓	✓	
A Construction Soil and Water Management Plan would be developed and implemented for the construction works to ensure effective management of potential soil erosion issues.		✓	
Construction would be planned to minimise the time that disturbed land is exposed.		✓	
Disturbed areas would be quickly revegetated or covered with a non-erodible surface following construction.		✓	
Use of cement-stabilised layers in flexible pavements and use of rigid pavements would be avoided, wherever possible to protect against subsidence effects.	✓		
All structures would be designed to accommodate the strains and tilts arising from the predicted subsidence. Approval of the structural design would be sought from the Mine Subsidence Board.	✓		
Provision of a synthetic liner (probably high density polyethylene) for the evaporation pond. The liner should not be covered by a "protective" soil layer.	✓		✓
Discharge from the sedimentation pond would be through an appropriately designed dissipating structure to minimise soil erosion potential in Leaf's Gully.			✓
Appropriately bunded areas would be included for storage of fuels, oils and chemicals.		✓	✓
Areas within the operational plant area would be appropriately drained so that surface runoff would be prevented from infiltrating directly onto the ground and from reaching the groundwater.			✓

Visual Assessment – Summary of Key Outcomes

A total of 28 view locations were identified and assessed as part of the visual assessment process. An assessment of the visibility rating for each of the 28 view locations indicated that:

- 15 of the 28 view locations were determined to have a **NIL** visibility rating;
- of the 28 view locations were determined to have a **LOW** visibility rating;
- 1 of the 28 view locations were determined to have a **MODERATE** visibility rating; and
- None of the 28 view locations were determined to have a **HIGH** visibility rating.

The visual assessment concluded that overall the Leaf's Gully Power Project would have a low visual impact on people in areas surrounding the site. The low visual impact would be due to a combination of the following factors:

- Existing trees and natural undulating landforms generally screen the majority of views toward the power plant site from surrounding areas.
- The two exhaust stacks, which are the tallest structures associated with the power plant, would only be directly visible from a limited number of surrounding properties, and views toward the exhaust stacks from these properties would generally be restricted to upper portions of the exhaust stacks, with views to the lower sections of the exhaust stacks and associated power plant infrastructure blocked by existing trees and undulating landform.
- Potential elevated view locations to the east and west of the Site, would generally view the upper portions of the two exhaust stacks against a backdrop of tree canopy along the Nepean River corridor. A small number of potential view locations would view the exhaust stacks above the tree canopy, with the exhaust stacks forming a component of the skyline view. These locations generally have long distant views toward the power plant site, where the upper portions of the exhaust stacks would form a very small component of the overall view.
- The use of dark colours and non-reflective materials would help to minimise the potential for visual contrast between the power plant structures and tree canopy background when viewed from the east and west of the site.
- In the longer term, tree and shrub planting on the proposed earth mound would screen potential views toward the proposed development site from view locations to the north and northeast of the site.
- Supplementary planting to enhance the habitat value of the Site would also have the potential to screen potential views toward the proposed development site from view locations to the east and west of the site.
- Lighting design would avoid direct line of sight from residences that are located to the east and west of the site.
- AGL have confirmed that no visible emissions would be discharged from the two turbine exhaust stacks.

Chapter 10

Landscape and Visual

10.1 Introduction

The visual assessment involved a comprehensive evaluation of the visual character of the landscape in which the Leafs Gully Power Project would be located and an assessment of the potential visual impacts that could result from the power plant.

A primary objective of this visual assessment was to determine the likely visual impacts of the power plant on people living and working in, or travelling through the landscape surrounding the proposed development site.

10.2 Methodology

The visual assessment undertaken for the proposed development adopted a methodology that has been utilised on a number of visual assessments for similar projects, and by other professionals undertaking visual studies for similar developments.

The methodology for this visual assessment comprised the following activities:

- desktop study addressing visual character of the region;
- fieldwork;
- assessment of visual impact of the power plant using:
 - visibility catchment of the power plant site;
 - identification and mapping of potential view locations;
 - analysis of cross sections;
 - analysis of visibility;
- visual simulations from key view locations; and
- identification of mitigation measures.

10.2.1 Desktop Study

A desktop study was undertaken to identify the potential view catchment of the power plant. This was carried out with reference to 1:25,000 topographic maps as well as 1:50,000 aerial photographs of the Development Site and surrounding area. The topographic maps and aerial photographs were also used to identify potential view locations that could be verified during the fieldwork component of the visual assessment.

The desktop study identified the visual character of the surrounding landscape including features such as the site context, landform and elevation.

The desktop study also identified and mapped a number of potential view locations from which the proposed development site, or upper portions of power plant structures, may be visible.

Whilst it is generally not feasible within the constraints of conducting an environmental assessment to assess each and every view that may exist toward the proposed Development Site, the desk top study sought to identify and assess key view locations, including views from residences, road corridors, public open space and public lookouts.

10.2.2 Field Inspection

The field inspection involved:

- a detailed inspection to determine the potential extent of visibility of the site;
- determination of the various view locations from which the power plant site could potentially be visible; and
- preparation of a photographic and written record of each view location assessed.

A 30 tonne crane with an extendable boom was located on the proposed Development Site to provide a visual reference during the fieldwork and to provide a height datum for the visual simulations. The crane was approximately located on the central alignment of the two exhaust stacks, around the 144 m AHD contour, by reference to physical features on the site previously identified on the aerial photographs.

A 50 m tape was attached to the crane, which was then extended to a similar height to the top of the two proposed exhaust stacks relative to ground level.

Photographs taken during the fieldwork were used for reference during the assessment process however each view location visited was recorded and noted in the field, and whilst photographic material provides a useful resource, it is not essential in the determination of visibility ratings.

10.2.3 Visual Impact Assessment

The potential visual impact of a proposed plant would result primarily from the combination of two factors:

- the level of visibility or extent to which the proposed plant structures would be visible from surrounding areas; and
- the degree of visual contrast between the proposed power plant structures and the landscape surrounding the site that would form a background that would be visible from surrounding view locations.

Chapter 10

Landscape and Visual

The visibility rating is generally determined by a combination of factors including:

- the category and type of situation from which people may view the proposed development (e.g. resident or motorist);
- the potential number of people with a view toward the development from any one view location;
- the distance between the viewer and the proposed development; and
- the duration of time for the viewer may view the development.

An underlying rationale for the visual assessment is that if people are not recorded as being present at a particular view location then there is likely to be a nil visual impact at that location. Therefore the visual assessment does not generally consider views from areas where people were not identified or recorded as being present at the time the assessment was carried out.

10.2.4 Visual Simulations

In order to illustrate how the power plant may appear following construction, a series of visual simulations were prepared from a number of the key view locations identified during the fieldwork. View locations from residential properties, or being representative of surrounding view locations, were selected for the production of visual simulations.

10.3 Elements of Leafs Gully Power Project

Details of the various components of the Project are described in detail in **Chapter 4**. A summary of the key visual aspects includes the following:

- proposed access road;
- power plant comprising
 - two gas turbines,
 - two 35m high exhaust stacks;
 - evaporative inlet air cooler;
 - control building;
 - workshop and store;
- switchyard and transformer;
- transmission lines and poles; and
- water pumping station.

The power plant would be constructed on a level platform at around the 144 m AHD contour. The platform would be created by cut and fill operations that are expected to generate excess fill material. The excess material would be used to create an earth mound immediately north of the power plant.

Electricity would be connected to the existing grid system by overhead transmission lines extending from the proposed switchyard to the existing power line corridor located approximately 1 km to the east of the power plant site.

The transmission lines would be supported by single concrete pole structures or lattice towers, between 22 m and 36 m high, located to the east of the power plant and switchyard. The poles would be installed at around the 163 m AHD contour. A sealed access road would be constructed from the existing entry to Leaf's Gully Farm running approximately northwest and west to the power plant site. The access road would generally not be visible from view locations beyond the Leaf's Gully site boundary identified in the assessment.

Should a water main connection not be available it is proposed to install a water pumping station in the proximity of the Sydney Catchment Authority Upper Canal. The pumping station would be a relatively small structure and generally not visible from the view locations identified in this assessment.

10.4 Visual Character of the Surrounding Landscape

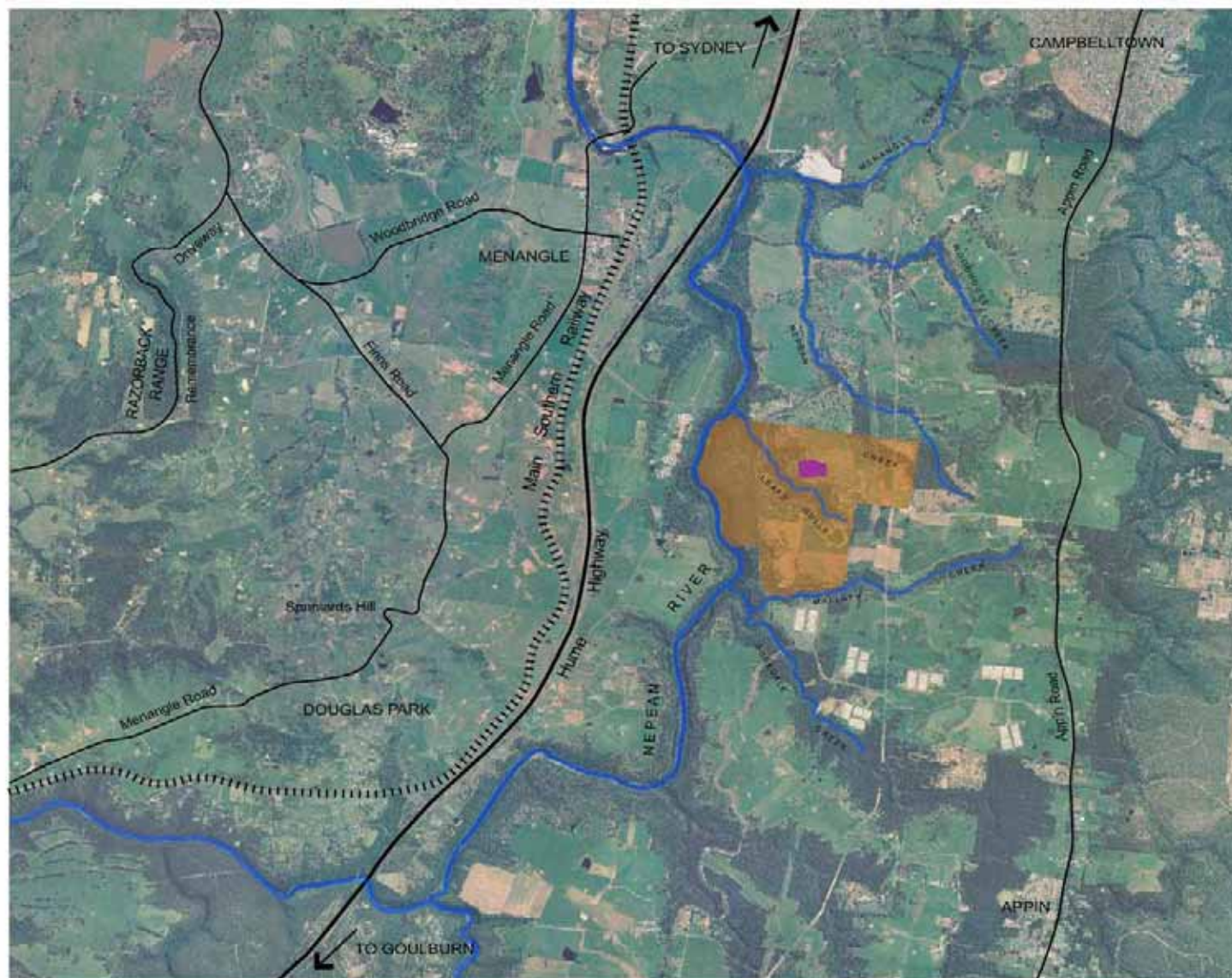
10.4.1 Site Context

The proposed Development Site is located approximately 5 km from the southern urban fringe of the Campbelltown local government area, and is accessed via a private sealed road extending approximately 2.5 km west of Appin Road. The location of the Leaf's Gully Farm property, the power plant site and the infrastructure features of the surrounding area are illustrated on **Figure 10-1**.

Leaf's Gully Creek extends approximately 2 km to the south and west of the power plant footprint, and generally drains northwest to the Nepean River. The side slopes of the gully are densely vegetated with mature native trees around 20 to 24 m in height.

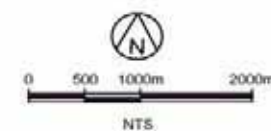
The power plant footprint is located on gently sloping land that falls west toward the Nepean River. The power plant footprint would be subject to some cut and fill earthworks to provide a suitably level construction platform. A cut batter slope would extend around the eastern portion of the power plant site adjacent to the switchyard area.

The landscape immediately surrounding the Development Site is predominantly rural in nature. The landscape has been largely cleared in the past for arable and livestock production, although vegetation has been retained along a number of the creek lines that flow to the Nepean River, and on surrounding hill tops and ridgelines.



LEGEND

-  Leafy Gully Farm property
-  Indicative power station footprint
-  River and creeks
-  Main Southern Railway
-  Main Roads and Highways



Client AGL POWER GENERATION (NSW)	Project AGL LEAFY GULLY POWER PROJECT EA	Title LOCATION PLAN
	Drawn: MT	Approved: AJH
	Date: 10.07.06	Figure 10-1
Job No. 43177401	File No.	

The landscape to the north and south of the Development Site is divided by a number of drainage lines that flow to the Nepean River, that give rise to a gently undulating landform between Appin Road and the Nepean River. Field patterns are generally defined by the drainage lines and scattered vegetation between them.

The power plant footprint contains a small number of clumped and individual trees, some of which would be removed to accommodate the power plant and associated infrastructure.

The landscape surrounding the Development Site contains a number of constructed elements that contribute to the local visual character including:

- a 330 kV and 66 kV transmission line corridor, with towers and transmission lines;
- Sydney Catchment Authority Upper Canal;
- Hume Highway/South western freeway;
- Main Southern Railway;
- communication towers located on distant ridgelines and hilltops; and
- Ingham's Appin Broiler Complex.

A transport corridor runs in an approximate north-south direction to the west of the Nepean River and contains the Hume Highway and main southern railway line. The Appin Road corridor runs north-south around 2.5 km to the east of the Development Site.

A small number of residential properties are located in the rural landscape around the Site. Some of the residential properties are not visually prominent due to screening by surrounding undulating landform or the presence of trees around them. Visibility from residential properties was determined during the desk top study and fieldwork carried out as part of the visual assessment process.

The enclosed visual experience while driving along Appin Road is largely determined by the presence of trees adjacent to the road corridor. Where views open out from the road corridor, undulating landform tends to limit the distance of available views. No views toward the power plant site were recorded from the Appin Road or from the Hume and Hovell Memorial to the east of Appin Road.

Key aspects of the visual character of the area surrounding the power plant are illustrated on **Figure 10-2**, and in the photographs taken from a number of selected viewpoints. The photographs are presented in **Figures 5, 6, 7, 8, 9, 10 and 11** in **Appendix N**.

Chapter 10

Landscape and Visual

10.4.2 Landform and Elevation

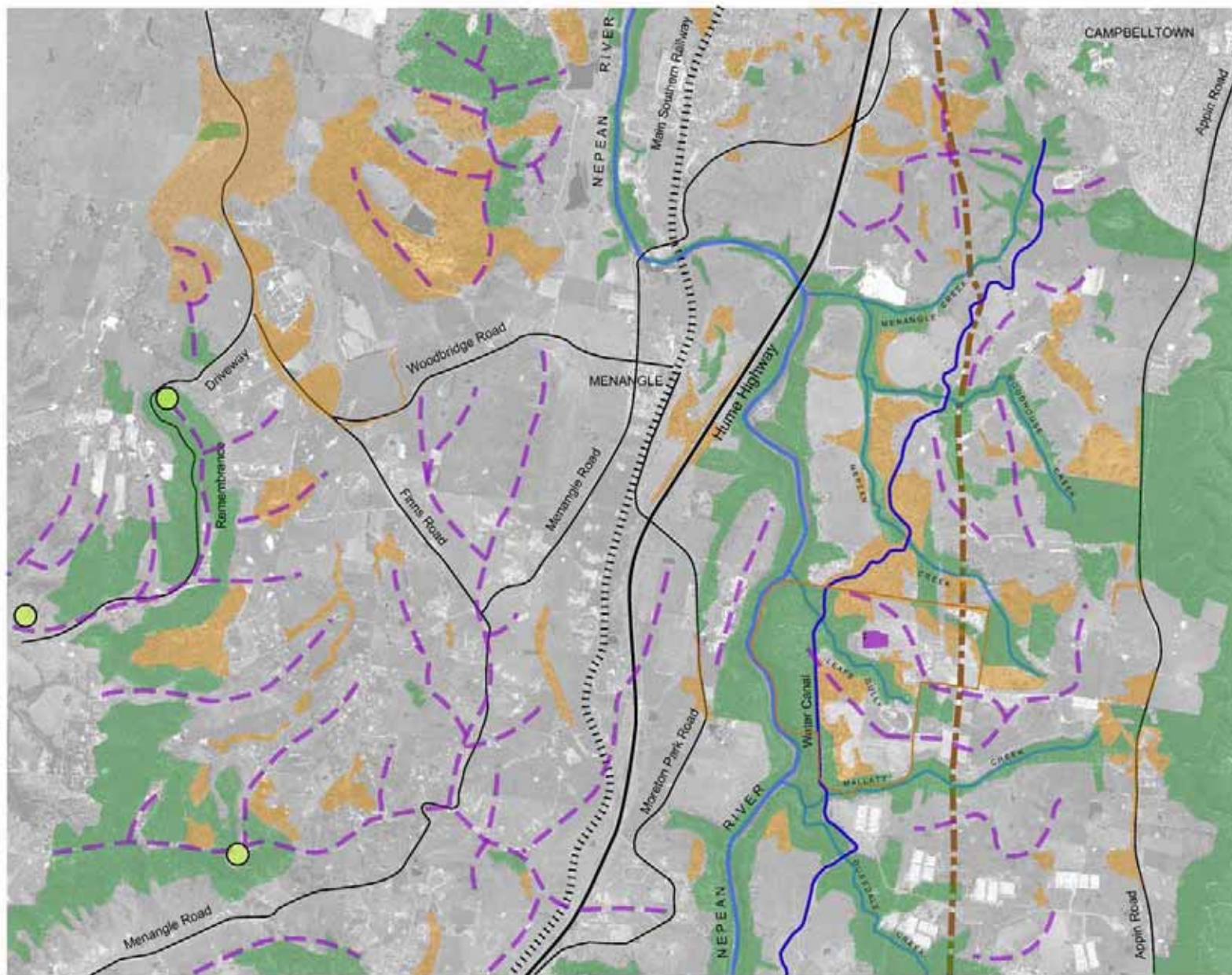
Landform is a key influence on the extent to which the power plant may be visible from surrounding areas. The major aspects are summarised below:

- The power plant would be located on the lower slopes of a spur between the Leaf's Gully and Nepean Creek drainage lines.
- The ground level at the base of the two exhaust stacks would be around 144 m AHD. The top of each 35 m high stack would be around 179 m AHD.
- Land immediately to the north, east and south of the site is characterised by a series of ridgelines and gullies. The Leaf's Gully farm access road crosses a ridgeline at around 215 m AHD below the Rourke hilltop at 224 m AHD.
- Land to the west of the site gently rises to the Razorback Range ridgeline at around 170 m AHD. A lower ridgeline with a series of spurs runs north south below Razorback Range from around 150 m AHD falling to 100 m AHD. A series of gullies extend in a general north south alignment between the ridgelines.
- A series of creeks and gullies flow generally west and northwest to the east of the Nepean River, with the power plant located on a low spur between two of these gullies.
- The Nepean River passes through a steep incised profile as it flows to the west of the site. The banks of the river fall for around 10 m to 15 m from top of bank to the river below.

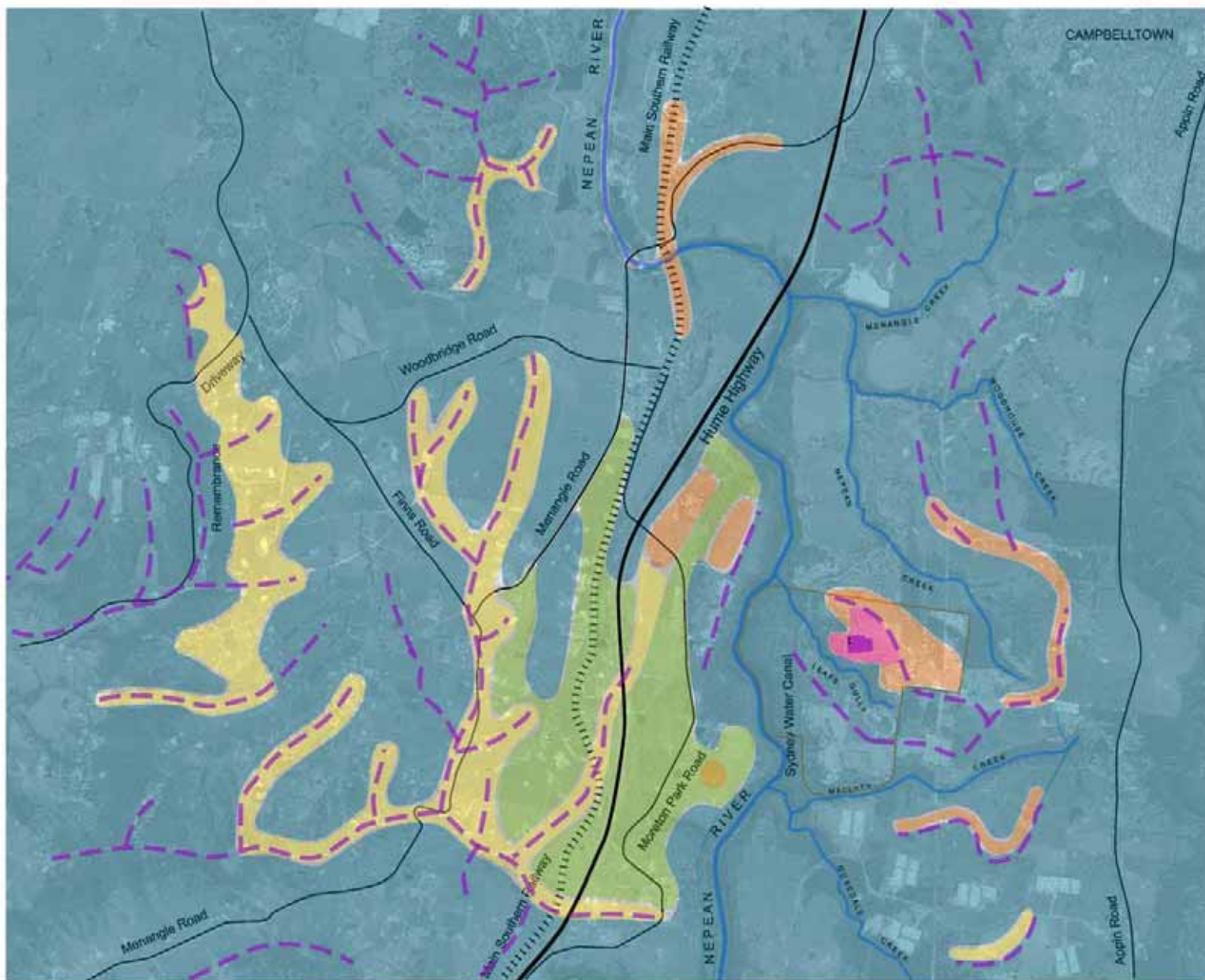
10.4.3 Potential View Catchment

The potential view catchment of the power plant is illustrated on **Figure 10-3** and key aspects are summarised by the following points:

- The primary view catchment of the power plant is generally restricted to local views within the Leaf's Gully property. The primary visual catchment includes views to the two exhaust stacks as well as other structures within the power plant and switchyard.
- The proposed Development Site is not visible from the Appin Road corridor where indirect views from the road are blocked by roadside vegetation and local undulating landform.
- Trees and undulating landforms generally block potential views to the proposed development site from the majority of view locations in the surrounding area. Secondary views to the upper portions of the two exhaust stacks were recorded from view locations at a number of surrounding properties, although some of these were from areas of vacant rural land.



Client AGL POWER GENERATION (NSW)	Project AGL LEAF'S GULLY POWER PROJECT EA	Title VISUAL CHARACTER
	Drawn: MT Approved: AH Date: 10/07/06 Job No: 43177401 File No:	Figure 10-2



LEGEND

-  Indicative power station footprint
-  Primary View Catchment
Areas of land from which the power station site and associated infrastructure would be visible and generally prominent within the immediate field of view.
-  Secondary View Catchment
Areas of land from which only a portion of the power station site and associated infrastructure may be visible. Views would be generally restricted to the upper portion of structures.
-  Ridgeline Views
Areas of land generally following ridgelines from which distant views to the power station site may be visible. Views would be generally distant and to upper portions of structures only.
-  Mid Slope Views
Areas of land from which intermittent views of the power station site may occur. Views would be restricted or partially screened by landform and vegetation.
-  Screened Views
Areas of land from which views of the proposed power station site are unlikely. Views would generally be screened by a combination of landform and vegetation.



0 500 1000m 2000m

1 : 40,000 approx at A3

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title POTENTIAL VIEW CATCHMENTS
URS	Drawn: M/T Job No: 43177401	Approved: A/H File No:
	Date: 10/07/06	Figure: 10-3

There were no dedicated public lookouts identified in the immediate area that would have potential views to the proposed development site. The public lookout located on the Razorback Range ridgeline is set back to the west of the Remembrance Driveway and affords extensive and panoramic views of the landscape generally to the south and southeast. Views from the lookout toward the site are generally blocked by the vegetated landform sloping away from the ridgeline.

10.5 View Locations

The visual assessment identified and mapped a number of potential view locations from which the power plant site, or upper portions of the power plant structures, may be visible.

In addition to the potential view locations identified by URS, some landowners requested URS visit a specific location on their property, to confirm if the crane used to simulate the height of the stacks was visible.

Although some specific locations were inspected at the request of individual landowners, they have not been included in the Visibility Matrix (**Table 10-4**) as, at the time of the site inspection, there were no residents, motorists or other people recorded at the location inspected by URS, who would potentially be impacted by the proposed development.

An underlying rationale for this visual assessment is that there is a nil visual impact recorded if, at the time of the site inspection, there were no people present at a particular location who could be impacted by the power plant.

Inherent in the methodology adopted for this visual assessment is the principle that the assessment is based on the conditions that were encountered at the time that the fieldwork was carried out. The visual assessment cannot determine potential visual impacts based on what may, or may not, occur in terms of future development in the locality of the proposed development.

Views from specific locations, including areas of vacant rural land that were inspected during the fieldwork have been included in **Table 10-1**.

Chapter 10

Landscape and Visual

Table 10-1 View Location Assessment

View Location	Comments
Leafs Gully Farm Lots 101, 102 & 103/DP716209 <i>(No view location number recorded)</i>	The four residences on the Leafs Gully Farm site would have potential views toward the power plant site. AGL's purchase of the site would include the Leafs Gully Farm residences located on the site. Whilst the residences may continue to be occupied during the construction period, the residences would potentially be converted to offices or demolished in the future.
<i>View Location 1</i> View from vacant land on corner of adjoining property Lot 1/DP 70208	A view to the top of the crane was recorded from an area of cleared vegetation on the northwest corner of an adjoining property. The roof of a Leafs Gully farm residence restricted the view to the crane to the upper portion only.
<i>View Location 2</i> Homestead on Lot 1/ DP70208	Undulating landform and vegetation block the view from the homestead toward the power plant site. A view of the crane was not recorded from this location.
<i>View Location 3</i> Hilltop location Lot 1/DP 70208	Trees and landform in the mid-distance generally block views west towards the power plant site from the hilltop. A view to the top of the crane between tree canopies was recorded from this location. Views to the lower section of the crane were blocked by vegetation.
<i>View Location 4</i> High point Leafs Gully access road	Extensive and distant views south and west from the private access road as it crosses the crest of the ridgeline at around 215m AHD. Views to the power plant site are generally blocked by landform and vegetation. A view of the crane was not recorded from this location.
<i>View Location 5</i> Ingham Enterprises – view from water tanks on hilltop. Lot 100, DP1045694	View towards the power plant site from the east is blocked by undulating landform and vegetation between the Ingham facility and the power plant site. The view from this location represents one of the highest elevated points on the Ingham Enterprises site at around 210m AHD. A view of the crane was not recorded from this location.
<i>View Location 6</i> Ingham Enterprises – West portion of the Lot 100, DP1045694	View toward the power plant site from the west of the Lot is blocked by undulating landform and vegetation along Mallaty Creek and Leafs Gully Creek that run between the Ingham facility and the power plant site. A view of the crane was not recorded from this location.
<i>View Location 7</i> Vacant land on 'Mount Gilead' property boundary Lot 2 DP807555	Direct views south toward the power plant site occur along a portion of the Leafs Gully and Mount Gilead property boundary. Views to lower portions of the crane were blocked by sloping landform. Views of the crane were also partially screened by existing trees along the property boundary, as well as trees within the Leafs Gully site.
<i>View Location 8</i> "Meadowvale" homestead. Lot 1 DP60288	The property has elevated and distant views to the south and west. The main residence and associated out buildings are located on the top of a spur at around 165m AHD. A line of tree planting provides shelter from the prevailing south-westerly wind and generally screens views toward the power plant site from the main residence. The upper portion of the crane was visible from land to the west of the windbreak. Views to lower sections of the crane were blocked by vegetation.
<i>View Location 8A</i> Access road to Meadowvale property	The mid and upper portion of the crane was visible from a short section of the access road to the Meadowvale property whilst travelling west.
<i>View Location 9</i> Vacant land Lot 21 DP700072	View location 9 was inspected at the request of the property owners. The upper portion of the crane was visible from the northern boundary of the property. Views to the lower section of the crane were blocked by vegetation.
<i>View Location 10</i> Residence Lot4 DP60288	Views toward the power plant site are blocked by a combination of landform and trees. A view of the crane was not recorded from this location.

Landscape and Visual

Chapter 10

View Location	Comments
<i>View Location 11</i> 'Mount Gilead' homestead DP807555	Views toward the power plant site from the homestead and associated buildings are blocked by a combination of landform and vegetation. A view of the crane was not recorded from this location.
<i>View Location 12</i> Menangle Road	The top section of the crane was noted in distant views (around 4.5km) from a section of Menangle Road between the railway bridge viaduct and the Hume Highway overpass.
<i>View Location 13</i> "Gillbulla" access road Lot 203 /DP590247	A view to the upper section of the crane was noted from a short section of the unsealed private access road leading up to the conference centre. Views to the lower section of the crane were blocked by vegetation.
<i>View Location 14</i> "Gillbulla" Lot 203 DP590247	Trees generally block views toward the power plant site from the rear of the main conference centre building. A view of the crane was not recorded from this location. The top section of the crane was visible from the southern boundary of the site adjacent to the tennis court. Views to the middle and lower section of the crane were blocked by vegetation.
<i>View Location 15</i> "Hillcrest Park" – former piggery site Lot 105 DP249189, Lot 1 DP550689, Lot2 DP248225	View southeast from top of spur above the Nepean River. The upper portion of crane was visible from this location. Trees along the Nepean River corridor blocked views to the lower section of the crane.
<i>View Location 16</i> Moreton Park Road at entry to property Lot 11 /DP249218	Views toward the power plant site were blocked by a combination of landform and vegetation along the river corridor. A view of the crane was not recorded from this location.
<i>View Location 17</i> West "Hillcrest Park" Lot 105 DP 249189	The top section of the crane was visible above the tree canopy from view locations to the west of the site. Trees along the river corridor blocked views toward the lower section of the crane.
<i>View Location 18</i> Dawsons Road	Distant views (around 5.5km) east toward and beyond the power plant site. The crane was not discernable from the background view. A view of the crane was not recorded from this location.
<i>View Location 19</i> Razorback Range	View east from the public lookout located to the west of the Razorback ridgeline. A view of the crane was not recorded from this location.
<i>View Location 20</i> Residence - Lot 11/DP249218	Resident contacted but unable to provide permission to access site.
<i>View Location 21</i> Parklea Horse Centre Lot 103/DP567913	Permission to access site denied.
<i>View Location 22</i> Residence - Lot 1/58067	Permission to access site denied.
<i>View Location 23</i> Residence – Lot 12/DP 744101	Owners not contactable. No permission received to access site.
<i>View Location 24</i> Appin Road	Views toward the power plant are blocked by a combination of undulating landform and trees alongside the road corridor. No views of the crane were recorded between the southern urban area of Campbelltown and Appin township.

Chapter 10

Landscape and Visual

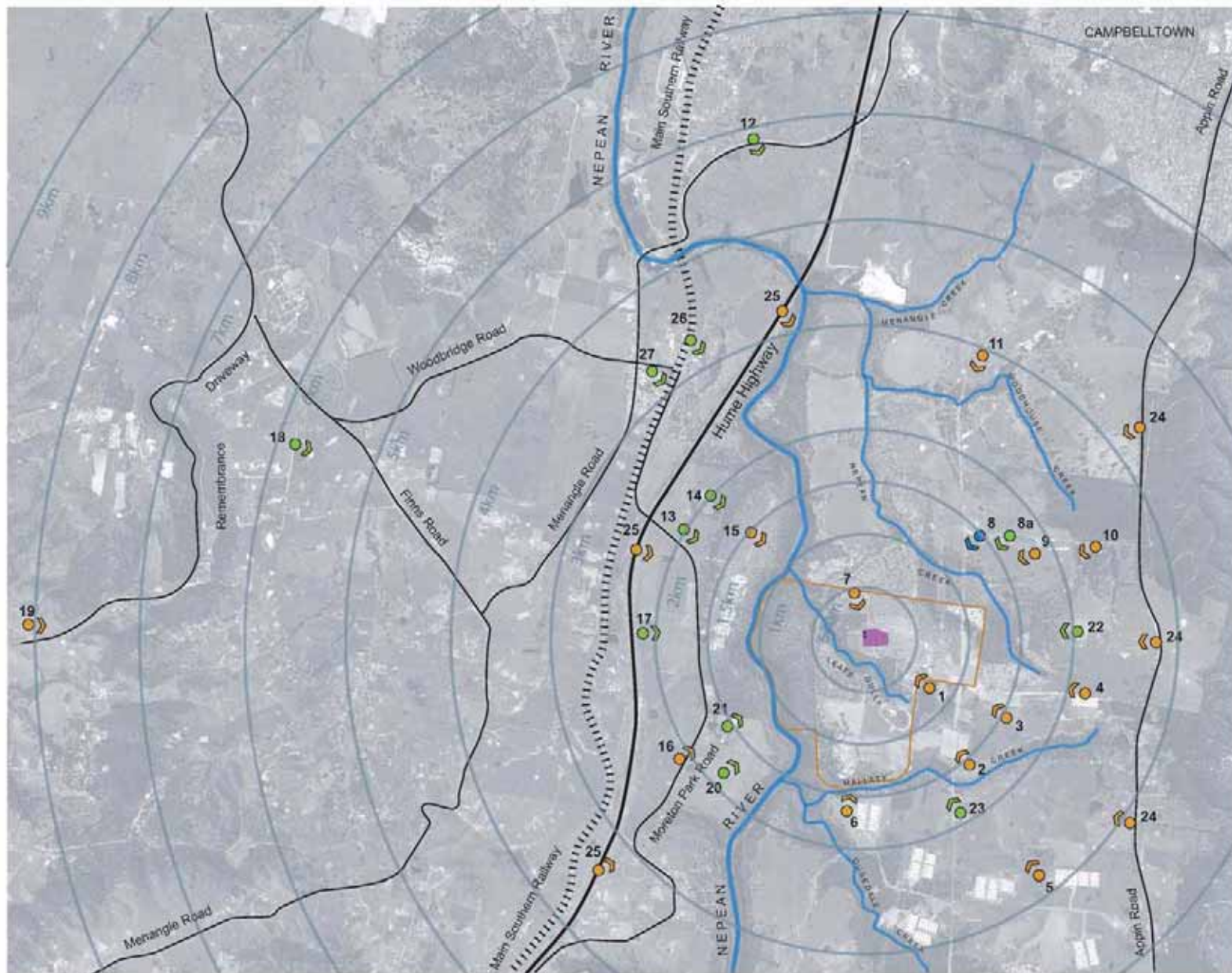
View Location	Comments
<i>View Location 25</i> South western freeway/Hume Highway	Views toward the power plant are blocked by a combination of undulating landform and trees alongside the river corridor. Views to the east from the northbound carriageway are intermittently blocked by vegetation planted in the median strip of the highway. A view of the crane was not recorded from this location.
<i>View Location 26</i> Main Southern Railway	Potential distant and short-term views toward the top of the crane may be possible travelling south where railway crosses river.
<i>View Location 27</i> St James Church	An assessment from the outside of the church indicated that there were no views likely to occur from the interior of the church toward the proposed development site. Views toward the development site from the north to north west of the church grounds are blocked by the church building. Views toward the development site from the east to north east of the church grounds are screened by vegetation. Views from the southern end of the church grounds, including the car park area, extend to distant views to the southeast, south and southwest, across the southern portion of Menangle village.

The view locations are illustrated on **Figure 10-4**.

View locations 20, 21, 22, & 23 were identified during the desktop study stage of the visual assessment. The four view locations were not visited and assessed during the fieldwork as permission for access had not been granted, or had been denied.

An assessment of views from these properties toward the site have been included in **Section 10.7** where it was considered the power plant site or exhaust stacks may be visible.

The assessment process carried out by URS in relation to potential views of the power plant from these view locations is described in detail in **Section 10.6**.

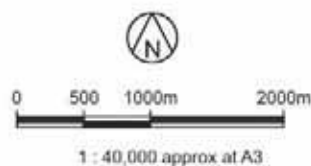


LEGEND

-  Indicative power station footprint
-  Leaf's Gully Farm property boundary
-  Nil visibility rating
-  Low visibility rating
-  Moderate visibility rating

VIEW LOCATIONS

1. View from vacant land on corner of adjoining property Lot 1/DP 70208
2. Homestead on Lot 1/DP70208
3. View from hilltop location on Lot 1/DP 70208
4. Leaf's Gully access road
5. Inghams Enterprises - view from water tanks
6. Inghams Enterprises - west
7. View from vacant land on "Mount Gilead" boundary.
8. "Meadowvale" Lot 1/DP60288
- 8a. "Meadowvale" residence access road.
9. Vacant land Lot 21/DP 700072
10. Residence Lot 4/DP 60288
11. "Mount Gilead" homestead, DP807555
12. Menangle Road
13. "Gillibulla" access road Lot 203/DP 590247
14. "Gillibulla" Lot 203/DP 590247
15. "Hillcrest Park" - former piggery site Lot 105/DP 249189, Lot 1/DP 550689, Lot 2/DP 248225
16. Moreton Park Road at entry to property Lot 11/DP 249218
17. West "Hillcrest Park" Lot 105/DP 249189
18. Dawsons Road
19. Razorback Range lookout
20. Residence on Lot 11/DP 249218
21. Parklea Horse Centre - Lot 103/DP 567913
22. Residence Lot 1/DP 58067
23. Lot 12/DP 744101
24. Appin Road
25. Southwestern Freeway / Hume Highway
26. Main Southern Railway
27. St James Church



Client AGL POWER GENERATION (NSW)	Project AGL LEAF'S GULLY POWER PROJECT EA	Title VIEW LOCATIONS AND VISIBILITY RATINGS
URS	Drawn: M*	Approved: JH
	Date: 10/07/08	Figure: 10-4
Job No: 43177401	Title No:	

Chapter 10

Landscape and Visual

10.6 Visual Assessment

10.6.1 Introduction

The potential visual impact of the power plant would result primarily from the combination of two factors:

- the level of visibility or extent to which the power plant structures would be visible from surrounding areas; and
- the degree of visual contrast between the power plant structures and the landscape surrounding the site that would form a background to potential views from surrounding view locations.

The potential visual impact from particular view locations is largely dependent on the level of visibility from that location, which in turn is dependent on a number of criteria that are defined in **Table 10-2**.

10.6.2 Visibility

Visibility is a measure of the extent to which particular structures of the power plant would be visible from surrounding areas, the relative number of viewers, the period of the view, view distance and context of the view.

The underlying rationale for this component of the visual assessment is that, if a part of the power plant is not visible from a particular area then the potential visual impact will be nil. Similarly, if the number of people who would potentially see the power plant is low, then the visual impact would be low compared to a situation in which a large number of people have the same view. Distance is a strong influence on potential visual impact as the proportion of the total view occupied by the structure decreases with distance, and atmospheric effects may reduce the visual contrast between the structure and the surrounding landscape.

10.6.3 Visual Contrast

Visual contrast between the power plant and the background against which it is viewed determines the capacity of the existing landscape setting to visually absorb the new structures without creating a significant change in visual character or producing a reduction in visual quality of the landscape. The capacity to absorb new development is dependent on existing structures, vegetation cover and landform.

At a distance, atmospheric effects could reduce the level of visual contrast between the power plant and the landscape setting in which it is viewed. The reduced visual contrast can result in a lower level of visual impact. If the exhaust stacks were dark in tone and non-reflective then the visual contrast would be further reduced.

Landscape and Visual

Chapter 10

10.6.4 Visual Assessment Criteria

The potential visual impact of the proposed new structures from key view situations has been assessed against the criteria described in **Table 10-2**.

Table 10-2 View Situation Assessment Criteria

Criteria	Definition
<i>Number of Viewers</i>	
High	>5,000 people per day
Moderate	1,000-5,000 people per day
Low	100-1,000 people per day
Very Low	<100 people per day
<i>View Distance</i>	
Long	>2km
Medium	500m – 2km
Short	200 – 500m
Very short	<200m
<i>Period of View</i>	
Long term	>120 minutes
Moderate term	1-120 minutes
Short term	<1 minute

The levels of visibility resulting from various combinations of the above criteria are listed in **Table 10-3**.

Table 10-3 Visibility Matrix Methodology

	Long Distance			Medium Distance			Short Distance			Very Short Distance		
Period of View	L	M	S	L	M	S	L	M	S	L	M	S
High No. of Viewers	M	L	L	H	M	M	H	H	M	H	H	H
Medium No. of Viewers	L	L	L	M	M	L	H	M	M	H	H	M
Low No. of Viewers	L	L	L	M	L	L	M	M	L	H	M	L
Very Low No. of Viewers	L	L	L	L	L	L	L	L	L	M	L	L

- **Period of View** L=long term, M=medium term , S=short term
- **Levels of visibility** L=low, M=medium and H=high

Table 10-4 presents the results of the visibility assessment from the various potential view locations identified during the desk top study and verified during the field inspection.

Chapter 10

Landscape and Visual

The sensitivity of some receptors are also taken into account during the assessment process. As an example, the 'Meadow Vale' property was determined to be a low visibility rating following the application of the visual assessment criteria; however consideration of the sensitivity of the receptor resulted in the visibility rating being upgraded to a moderate level.

10.6.5 View Cross-Sections Analysis

A series of cross sections from a number of view locations were prepared in order to illustrate the extent to which the exhaust stacks may be visible. The cross section locations include:

- View Location 2 - homestead on Lot 1/DP70208;
- View Location 7 - vacant rural land on the "Mount Gilead" south property boundary;
- View Location 8 - "Meadowvale" property;
- View Location 10 - residence on Lot 4/DP60288;
- View Location 11 - "Mount Gilead" homestead DP 807555;
- View Location 20 - residence on Lot 11/DP249218;
- View Location 24 and 22 - Appin Road and residence on Lot 1/DP58067; and
- View Location 27 - St James Church car park, Menangle.

The cross-section locations are presented in **Figure 12** in **Appendix P**. The cross-sections, which are presented in **Figures 13, 14 and 15** in **Appendix P**, are drawn at true scale without any vertical exaggeration. The cross sections illustrate the relatively small scale of the stacks within the large-scale landscape. The reduction in relative scale results from the long distances of the views.

The cross sections also illustrate the extent of potential views that are blocked, or generally restricted to upper portions of the exhaust stacks, by the undulating landform and tree cover that surrounds the site.

10.7 Visibility Matrix

Table 10-4 Project Visibility Matrix

View Location	Approximate Distance To Site	Category Of Viewer	Approx. Period Of View	Relative No. Of Viewers	Level Of Visibility	Visibility Rating
View Location 1 View from vacant land	Medium (800 m)	N/A	N/A	N/A	N/A	Nil
View Location 2 View from residence	Medium (1100 m)	Resident	Moderate to Long term	Very Low	Views from residence are blocked by landform	Nil
View Location 3 View from hilltop	Medium (1500 m)	N/A	N/A	N/A	N/A	Nil
View Location 4 High point on Leaf's Gully access road	Long (2100 m)	Motorist	Short term	Very Low	Views toward site are blocked by landform.	Nil
View Location 5 Ingham Enterprises view from water tanks	Long (2800 m)	Employee	Short term	Very Low	Views toward site are blocked by landform and trees	Nil
View Location 6 Ingham Enterprises West of lot	Medium (1800 m)	Employee/Resident	Short term	Very Low	Views toward site are blocked by landform and trees	Nil
View Location 7 View from vacant land on "Mount Gilead" property boundary	Short (300 m)	N/A	N/A	N/A	N/A	Nil

Chapter 10

Landscape and Visual

View Location	Approximate Distance To Site	Category Of Viewer	Approx. Period Of View	Relative No. Of Viewers	Level Of Visibility	Visibility Rating
View Location 8 "Meadowvale" homestead	Medium (1400 m)	Resident	Moderate to Long term	Very Low	Views from main residence generally screened by tree planting. Views to upper section of stacks from property around residence.	Medium
View Location 8A Access road to "Meadowvale" Homestead	Medium (1800 m)	Motorist driving west	Short term	Very Low	Views from access road to upper portions of stacks	Low
View Location 9 View from vacant land	Medium (1600 m)	N/A	N/A	N/A	N/A	Nil
View Location 10 Residence Lot 4 /DP60288	Long (2300 m)	Resident	Moderate to Long term	Very Low	Views toward site from residence and property are blocked by combination of landform and trees	Nil
View Location 11 "Mount Gilead" Homestead	Long (2900 m)	Resident	Moderate to Long term	Very Low	Views toward site from residence are blocked by a combination of landform and trees.	Nil
View Location 12 Menangle Road	Long (+4500 m)	Motorist	Short	Moderate to High	Indirect and distant views to upper section of stacks.	Low
View Location 13 "Gillbulla" access road	Medium (1800 m)	Motorist	Short	Very Low	Indirect view to upper section of stacks.	Low

ENVIRONMENTAL ASSESSMENT	
Landscape and Visual	Chapter 10

View Location	Approximate Distance To Site	Category Of Viewer	Approx. Period Of View	Relative No. Of Viewers	Level Of Visibility	Visibility Rating
View Location 14 "Gilbulla" conference centre	Medium (2000 m)	Resident or visitor	Moderate to long term from building, and moderate from property.	Low to Very Low	Trees generally block views toward site from conference centre building. View to top of stacks visible from south boundary of site.	Low
View Location 15 Hillcrest Park – former piggery site	Medium (1400 m)	N/A	N/A	N/A	N/A	Nil
View Location 16 View from Moreton Park Road at entry to property	Medium (2000 m)	Motorist or cyclist	Short	Very Low to Low	Views toward site blocked by a combination of landform and trees.	Nil
View Location 17 West Hillcrest Park Lot 105 /DP 249189	Medium (2000 m)	Resident	Moderate to Long term	Very Low	View toward upper section of stacks.	Low
View Location 18 Dawson Road	Long (+5000 m)	Resident	Moderate to Long term	Very Low	Distant view toward site, views of stacks would be generally indistinguishable from surrounding landscape.	Low
View Location 19 Razorback Range lookout	Long (+7500 m)	Visitor	Short to moderate	Very Low	Distant views toward site are generally blocked by landform.	Nil
View Location 20 Residence on Lot 11/DP249218	Medium (1800 m)	Resident	Moderate to Long term	Very Low	Possible view to upper sections of stacks.	Low

Chapter 10

Landscape and Visual

View Location	Approximate Distance To Site	Category Of Viewer	Approx. Period Of View	Relative No. Of Viewers	Level Of Visibility	Visibility Rating
View Location 21 Parklea Horse Centre – Lot 103/DP567913	Medium (1600 m)	Resident	Moderate to Long term	Very Low	Possible view to upper sections of stack, but generally blocked by trees along the river corridor.	Low
View Location 22 Residence on Lot 1/58067	Medium (2000 m)	Resident	Moderate to Long term	Very Low	Possible view to upper sections of stacks, but generally blocked by a combination of landform and trees.	Low
View Location 23 Residence on Lot 12/DP 744101	Medium (2000 m)	Resident	Moderate to Long term	Very Low	Possible view to upper section of stacks.	Low
View Location 24 Appin Road	Long (Varies according to location)	Motorist	Short to moderate	High	Landform and trees block views from road corridor toward power plant site.	Nil
View Location 25 Hume Highway/south west freeway	Long (Varies according to location)	Motorist	Short	High	Landform and trees block views from road corridor toward power plant site.	Nil
View Location 26 Main Southern Railway	Long (+2000 m)	Passenger	Short	Moderate	Indirect views from train on southbound track.	Low
View Location 27 St James Church	Long (+3000 m)	Church visitors or people attending services	Moderate	Very Low (less than 100 people per day)	Existing trees generally block views, and the exhaust stacks, if visible from this location, would be distant and partially obscured by vegetation	Low

10.7.1 Summary of Visibility Assessment

A total of 28 view locations were selected and assessed as part of the visual assessment process, and included views from:

- residences;
- vacant / rural land
- commercial facilities;
- public road corridors (motorists);
- private access roads; and
- rail corridor.

An assessment of the visibility rating for each view location indicated that:

- 15 of the 28 view locations have been determined to have a **NIL** visibility rating;
- 12 of the 28 view locations has been determined to have a **LOW** visibility rating;
- 1 of the 28 view locations have been determined to have a **MODERATE** visibility rating; and
- None of the 28 view locations have been determined to have a **HIGH** visibility rating.

The four existing residences at Leaf's Gully Farm on the site, if purchased by AGL, would not be maintained as residences, and therefore the Leaf's Gully Farm residences have not been included in the visibility matrix or visual assessment.

10.8 Visual Simulations

In order to illustrate how the power plant may appear following construction, a series of visual simulations were prepared from a number of the key view locations. Due to the low visibility of the power plant and the extensive time required to produce visual simulations, locations with sensitive receptors or being representative of surrounding view locations were selected for the production of visual simulations. The visual simulation view locations are illustrated in **Figure 10-5**. These included:

- View location 1 - vacant land on northwest corner of Lot 1/DP70208;
- View location 8 - "Meadowvale" property Lot 1/DP60288;
- View location 9 - vacant rural land on Lot 21/DP700072;
- View location 12 - Menangle Road;
- View location 13 - "Gilbulla" access road; and
- View location 17 - west of "Hillcrest Park" property Lot 105 DP 249189.

Chapter 10

Landscape and Visual

10.8.1 Methodology

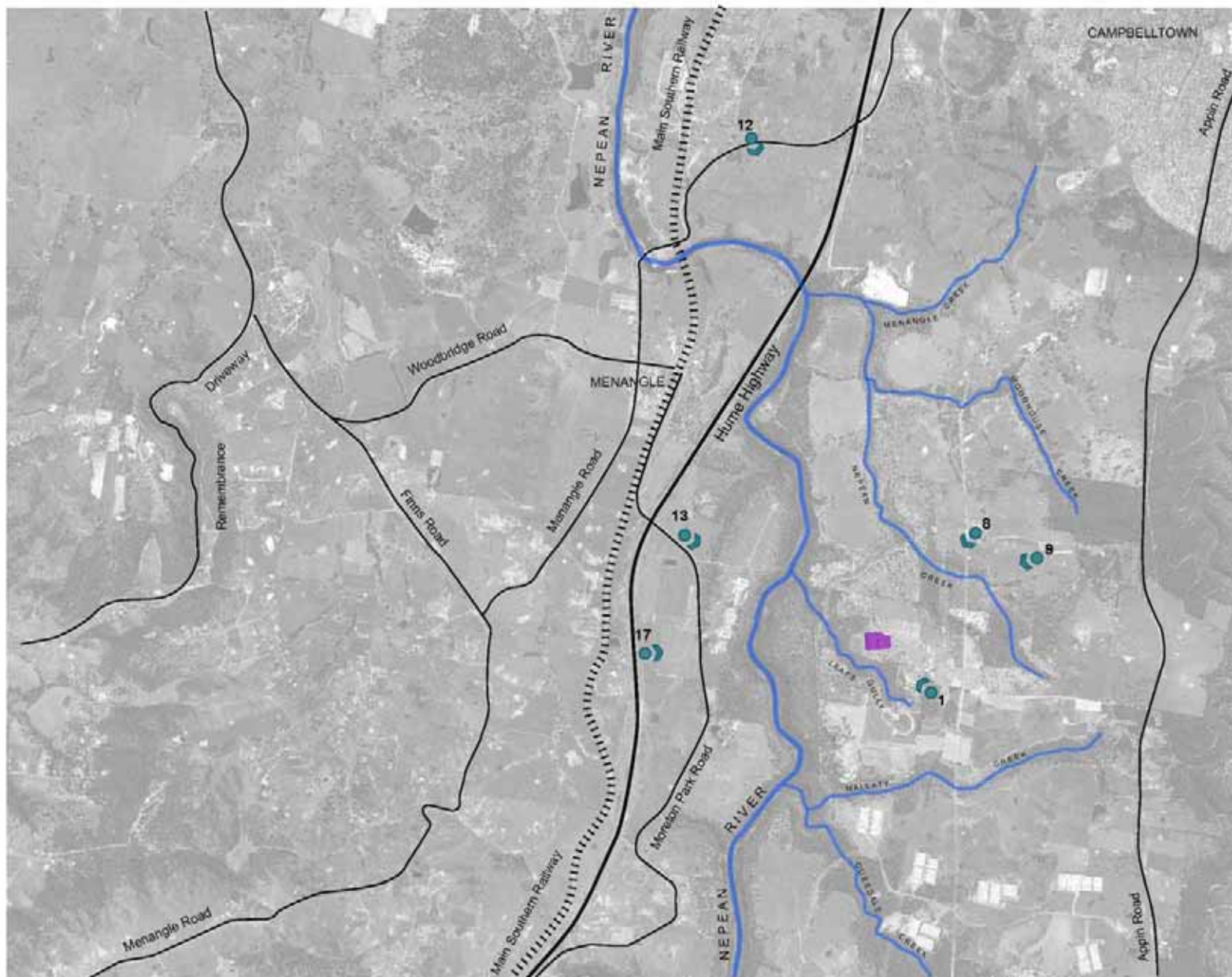
The visual simulations were generated through the following steps:

- Photographs were taken from each of the view simulation locations and then digitised.
- A standard 50 mm focal length camera was used to take the photographs, as this is generally accepted as most closely representing the primary view cone of the human eye.
- AutoCAD and 3d Studio Max were used for modelling visually significant components of the proposed structures, view locations (camera position), and surrounding digital terrain.
- The digital photographs were matched with the 3D model in 3D Studio Max software using camera angle location and direction as well as reference objects in the photographs. Lighting, material editing and surface rendering were also undertaken in 3DS Max.
- Finally the images were imported to Adobe Photoshop for final surface texturing to place the proposed structures within the context of the foreground and background elements of the photographs.

The visual simulations are illustrated on **Figures 10-6, 10-7 10-8, 10-9, 10-10 and 10-11.**

The vista (field of view) for each visual simulation photograph generally exceeds that of the binocular field of view for the average human eye (around 124 degrees) and in some images includes some areas of peripheral vision. The location of the crane was placed as close a possible to the centre of the photograph taken during the fieldwork. The total view for some images was determined by the available page width of the format for this report.

It should be noted that the boom of the crane may not necessarily be visible in some of the photographic images presented in this report. This is due to a combination of the narrow width of the boom, the distance between the view location and the crane, and the clarity of images following processing and printing. The location of the crane was intended as a reference point and the visibility of the crane was recorded and photographed at each view location.



LEGEND



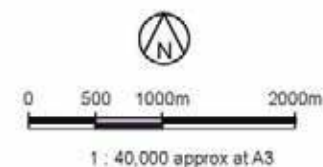
Indicative power station footprint



Visual simulation locations

SIMULATION FROM VIEW LOCATIONS

1. View from vacant land on corner of adjoining property Lot 1/DP 70208
8. "Meadowvale" Lot 1/DP 60288
9. Vacant land Lot 21/DP 700072
12. View from Menangle Road
13. "Gilbulla" access road Lot 203/DP 580247
17. West "Hillcrest Park" Lot 105/DP 249189



Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA			Title VIEW SIMULATION LOCATIONS
	Drawn: MT	Approved: JH	Date: 10/07/06	Figure 10-5
	Job No.: 43177401	File No.:		

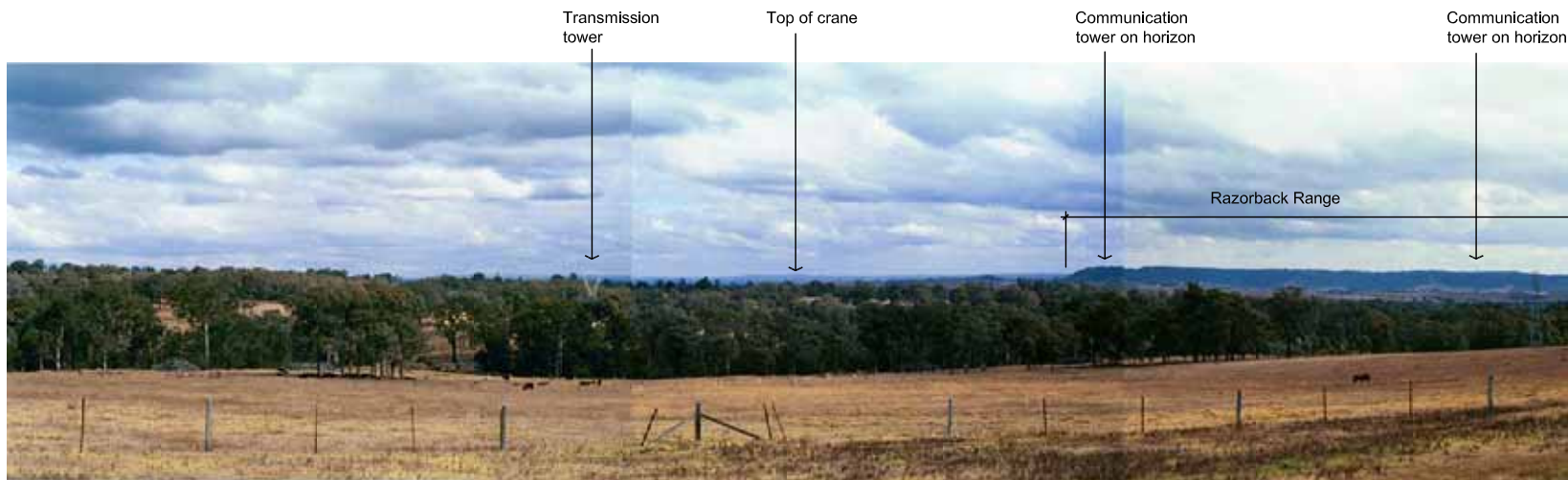


View Location 1: Existing view north west from corner of adjoining property

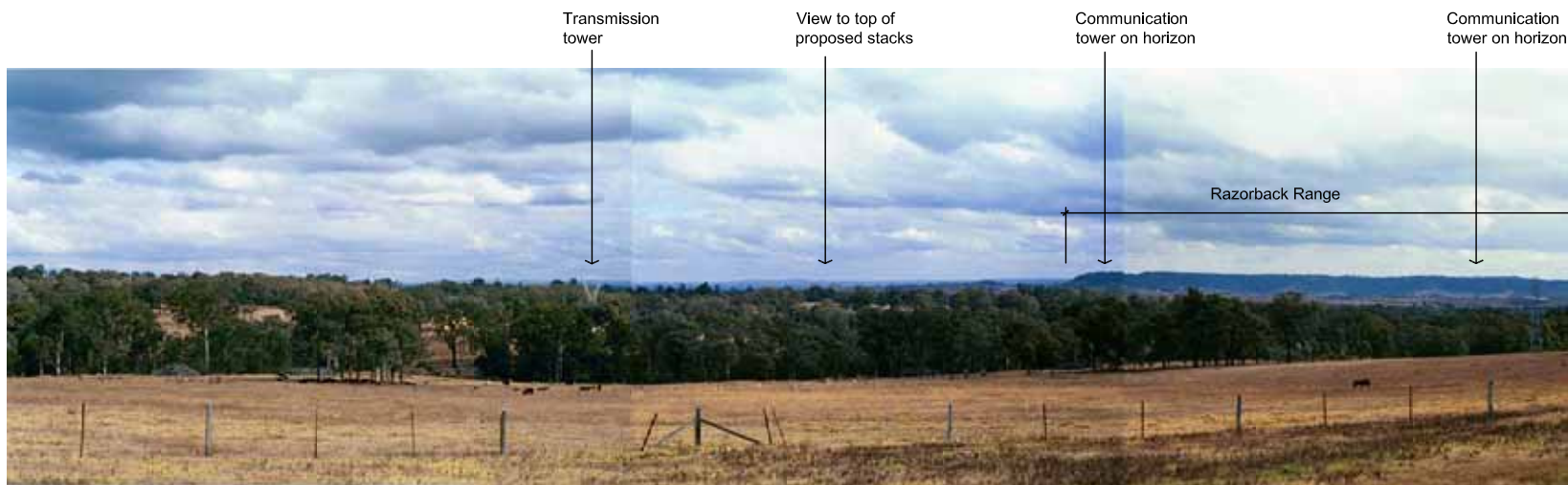


View Location 1: Proposed view north west from corner of adjoining property

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA			Title VIEW SIMULATION View Location 1
	Drawn: AH	Approved: NB	Date: 27.09.08	Figure: 10-6
	Job No: 43177607	File No:		

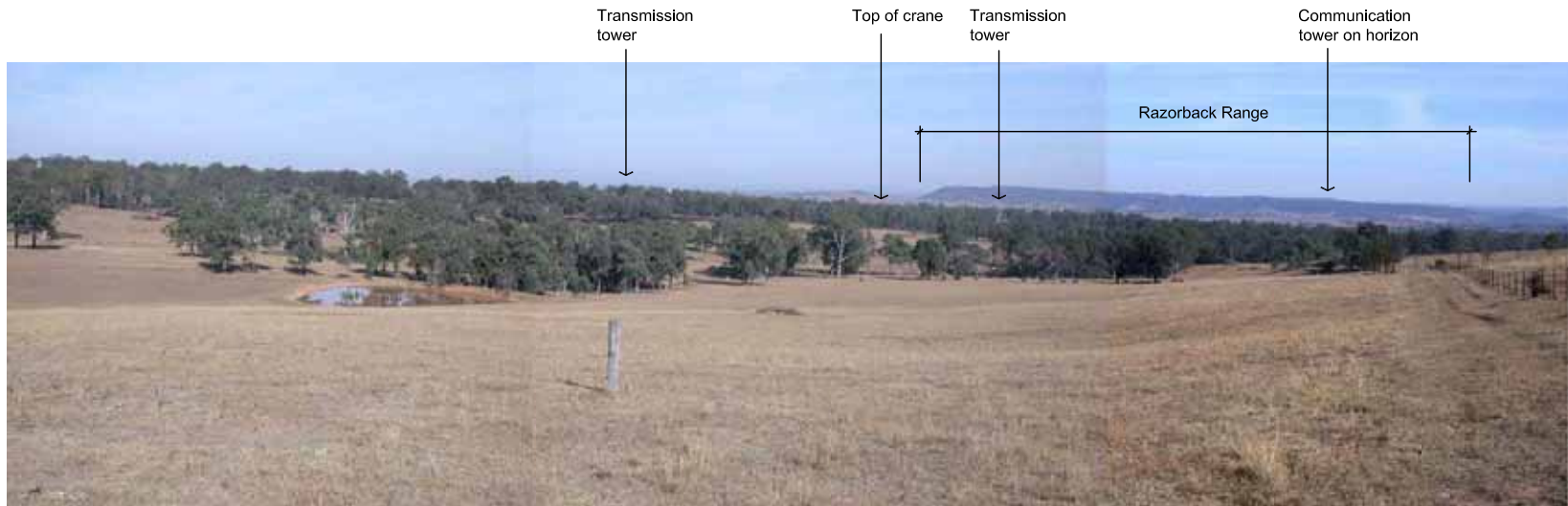


View Location 8: 'Meadowvale'. Existing view south from paddock adjacent to homestead

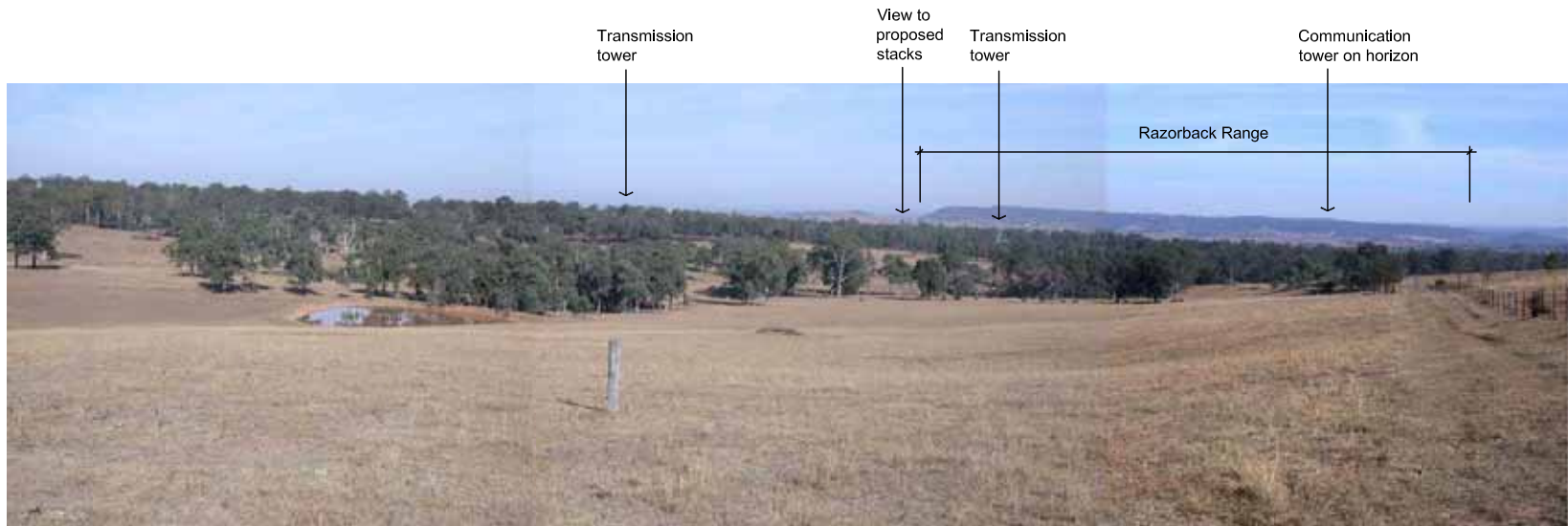


View Location 8: 'Meadowvale'. Proposed view south from paddock adjacent to homestead

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA			Title VIEW SIMULATION View Location 8
	Drawn: AH	Approved: NB	Date: 27.09.08	
URS		Job No: 43177607	File No:	Figure: 10-7



View Location 9: Existing view south west from vacant land Lot 21/DP 700072 on northern property boundary



View Location 9: Proposed view south west from vacant land Lot 21/DP 700072 on northern property boundary

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA			Title VIEW SIMULATION View Location 9	
	Drawn: AH	Approved: NB	Date: 27.09.08	Figure: 10-8	
	Job No: 43177607	File No:			

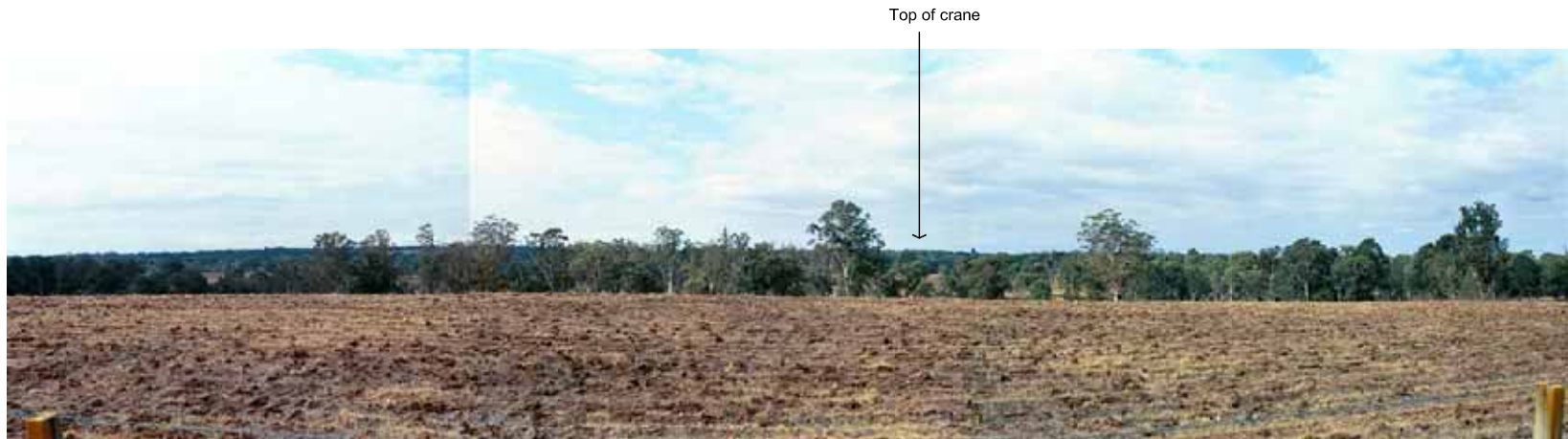


View Location 12: Existing view south west from Menangle Road



View Location 12: Proposed view south west from Menangle Road

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA			Title VIEW SIMULATION View Location 12
	Drawn: AH	Approved: NB	Date: 27.09.08	
URS		Job No: 43177607	File No:	Figure: 10-9

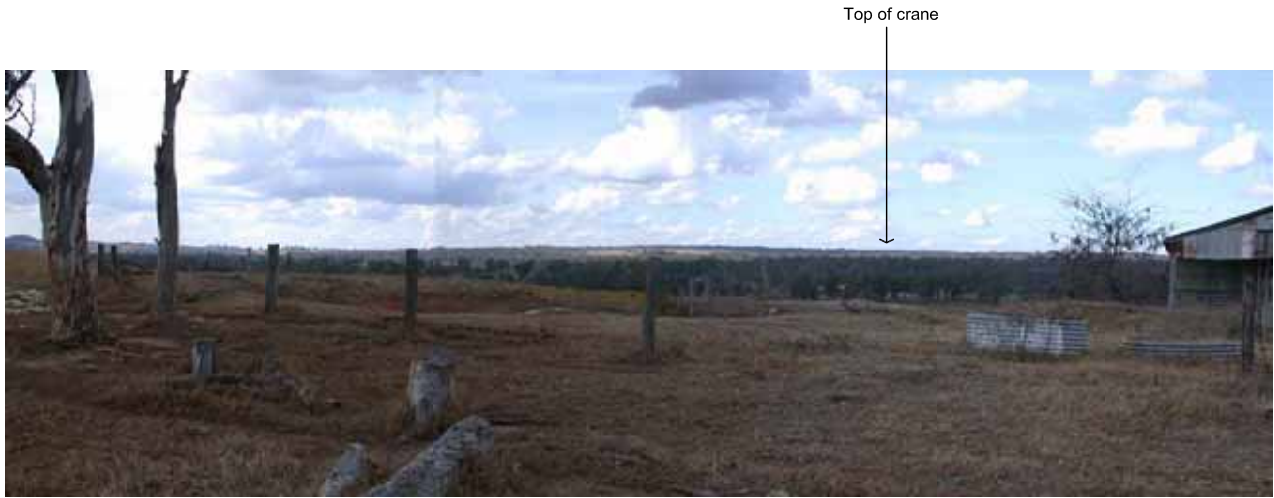


View Location 13: Existing view south east from 'Gilbulla' access road Lot 203/DP 590247



View Location 13: Proposed view south east from 'Gilbulla' access road Lot 203/DP 590247

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA			Title VIEW SIMULATION View Location 13
	Drawn: AH	Approved: NB	Date: 27.09.08	
URS		Job No: 43177607	File No:	Figure: 10-10



View Location 17: Existing view east from West 'Hillcrest Park' property



View Location 17: Proposed view east from West 'Hillcrest Park' property

Client AGL POWER GENERATION (NSW) URS	Project AGL LEAFS GULLY POWER PROJECT EA			Title VIEW SIMULATION View Location 17 Figure: 10-11
	Drawn: AH	Approved: NB	Date: 27.09.08 Job No: 43177607 File No:	

Chapter 10

Landscape and Visual

10.8.2 Summary of Visual Simulations

The visual simulations illustrate that the upper portions of the two exhaust stacks would not be visually prominent when viewed from the majority of surrounding view locations, and that the implementation of mitigation measures would help to minimise the visual contrast between the stacks and the surrounding landscape.

The visual simulations do not include the proposed earth mound or planting that would, over time, partially or completely screen the exhaust stacks from view locations to the north and north east of the site. The earth mound and tree planting has been illustrated on the cross sections shown in **Figures 13, 14 and 15 in Appendix P.**

10.9 Mitigation Measures

While the overall potential visual impact of the Leaf's Gully Power Project has been assessed as low, the following mitigation measures would potentially help to minimise the level of visual impact.

The mitigation measures involve a combination of screening of views (earth mounding and tree planting) and reducing the visual contrast between the visible portions of structure and the surrounding landscape.

10.9.1 Structures

The colour and texture of structures in the power plant should be dark in tone and utilise non-reflective materials unless required otherwise by a government authority. This would potentially minimise the visual contrast between the structures and the tree-covered embankments of the Nepean River that forms a background to a number of views locations surrounding the Site.

10.9.2 Earth Mounding

Some of the material excavated by earthworks to construct the power plant platform would be used to create an earth mound on the north and north east side of the power plant. .

The earth mound would be designed to compliment the existing landform that follows a spur to the north of the power plant footprint, and would also follow existing contours to prevent concentration of surface water flows. The design of the earth mound would also avoid construction of steep sided or overly engineered batters, and would be graded to allow for the installation and establishment of the proposed landscape treatments.

- The top of the mound would be around 6 m above existing ground level. Tree planting on the mound would, over time, be expected to increase the effective screening height to around 26 to 30 m above existing ground level.

- The vegetated mound would, in the long term, potentially screen or partially block views to the upper portion of the exhaust stacks from a number of view locations identified in this report.

10.9.3 Screen Planting

Broad scale tree and shrub planting would be carried out on the top and side slopes of the proposed earth mound as well as to other areas surrounding the power station site identified in the **Chapter 13 Flora and Fauna**. AGL would consult with suitably qualified consultants to develop a vegetation plan.

10.9.4 Lighting

Lighting associated with the power plant would be designed to avoid direct line of sight from homesteads to the east of the Site from which the upper portions of power plant stacks may be visible at night.

The top of the stacks would not have lighting unless required by the Civil Aviation Services Authority (CASA).

Large floodlights would generally not be used for normal operations.

Security lighting would be designed not to spill light onto neighbouring residences.

10.10 Mitigation Measures

A summary of the visual mitigation measures is presented in **Table 10-5**.

Chapter 10

Landscape and Visual

Table 10-5 Summary of Visual Mitigation Measures

Mitigation Measure	Implementation		
	Planning & Design	Construction	Operation
Colour and texture of structures in the power plant would be dark in tone and utilise non-reflective materials unless required otherwise by a government authority.	✓		
Create an earth mound on the northern side of the power plant to provide visual screening to views from the north generally in accordance with the landscape plan using excess fill generated from foundation excavations.	✓		✓
Broad scale tree and shrub planting would be carried out on the top and side slopes of the proposed earth mound as well as to other areas surrounding the power plant site identified in the Flora and Fauna section of the EA. AGL will consult with suitably qualified consultants to develop a vegetation plan.			✓
Woodland species indigenous to the area would provide additional screening potential to views from the north and east of the power plant site. These would be planted in accordance with a vegetation plan.			✓
Lighting would avoid direct line of sight from homesteads to the east of the site.	✓		✓
Top of the stacks would not have lighting unless required by CASA.	✓		✓
Large floodlights not to be used for normal operations	✓		✓
Security lighting would not spill onto neighbouring residences or onto the SSTF in Leafs Gully. This would be achieved through the use of down lights and motion sensor lighting.	✓		✓

Traffic and Transport – Summary of Key Outcomes

The Leaf's Gully Power Project is located off Appin Road at Gilead. The Site is accessed from Appin Road by a 2.3 km private road. This traffic and transport assessment found that the arterial road network can satisfactorily and safely accept the additional traffic generated by the development during the construction, operational and maintenance phases.

It is proposed that a separate right turn lane priority intersection be installed at the Appin Road / private access road intersection. This type of intersection limits the impact on Appin Road traffic flow and provides for safe area for queuing right-turning vehicles. It is proposed that the right turn opportunity be extended to include a separate lane access for a property driveway on the eastern side of Appin Road located opposite the access road for the site. Access to the site was assessed and it was concluded that due to constraints of the intersection, the few large rigid and articulated vehicles wishing to enter the site from the south would need to proceed to Copperfield Drive roundabout. As it is anticipated that most trucks would approach from the north, it is expected that there would not be significant impact on the Copperfield Drive roundabout. However, this would be confirmed in the detailed design phase once size and number of vehicles is confirmed.

Over-mass and over-dimensional loads such as the gas turbines, generators and transformers must be transported to site under RTA and NSW Police permit conditions and along approved routes. Temporary local widening and strengthening of the access road may be required to accommodate the large over-mass and over-dimensional transports.

AGL also propose to upgrade the existing private access road to comply with applicable standards for the purposes of constructing and operating the Leaf's Gully Power Project.

Chapter 11

Traffic and Transport

11.1 Introduction

This traffic and transport assessment addresses the traffic related impacts associated with the existing use and operation, construction and maintenance of the proposed Leaf's Gully Power Project. Development information used throughout the study has been supplied by AGL. The assessment was conducted by URS and is presented in full in **Appendix I**.

During community consultation, several participants raised the condition of Appin Road and the impact of increased road traffic, particularly during the construction period, as areas of concern. These issues have also been addressed in this chapter.

11.2 Existing Context

11.2.1 Road Environs

The regional road network is dominated by State Route 69 defined by Appin Road, Church Street and Bulli-Appin Road. Access to the plant is proposed via a narrow access road some five kilometres north of the township of Appin. Refer to **Figure 11-1** for the local and regional road network.

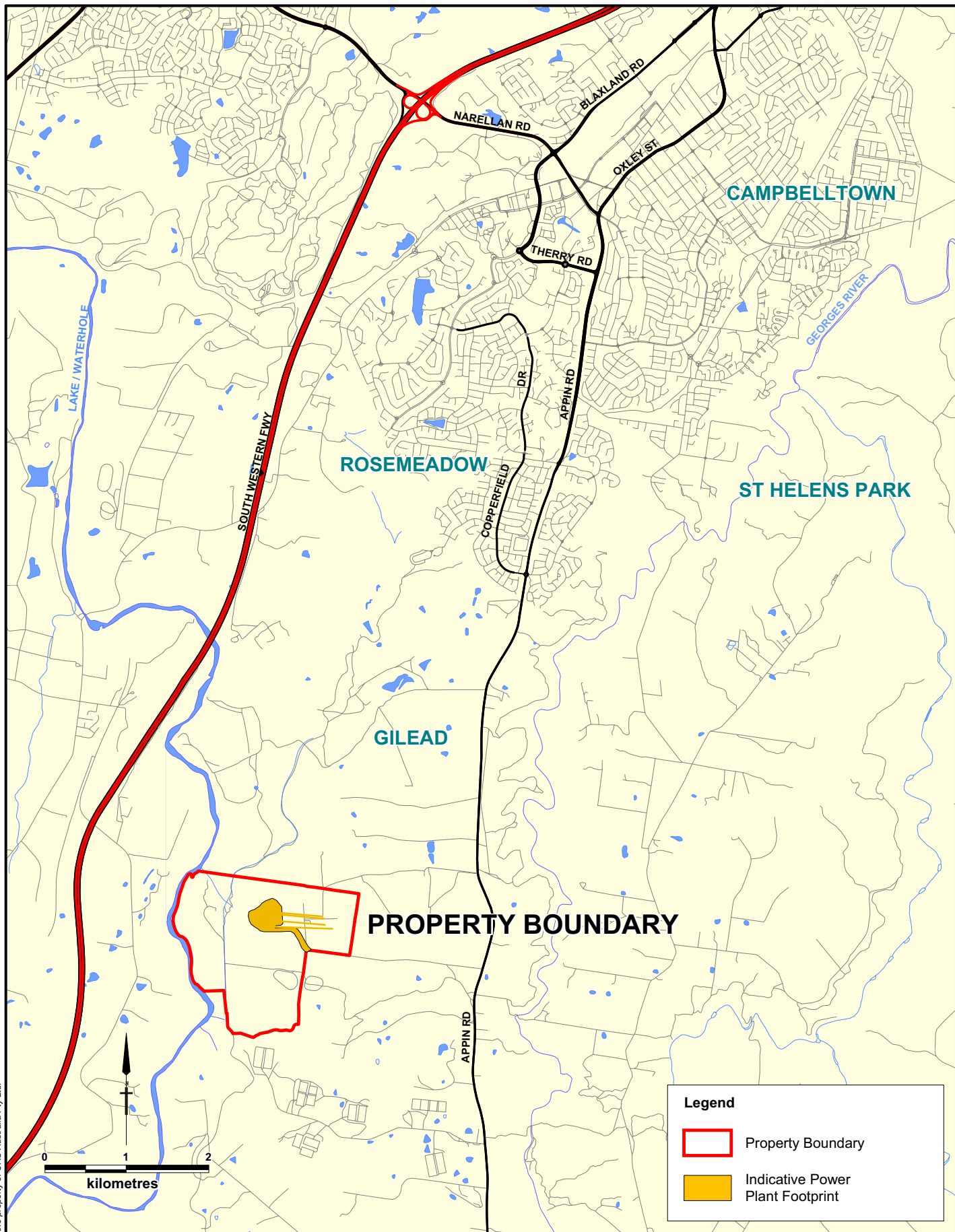
State Route 69

State Route 69 is the principal link catering for the movement of heavy vehicles and passenger cars between the proposed site and the metropolitan areas of Sydney and Wollongong.

Appin Road is a sealed, two-way, dual-lane state road under the control and maintenance of the Roads and Traffic Authority of NSW (RTA). The narrow tree lined corridor exhibits undulating and meandering alignments dictated by the surrounding topography.

Vehicle overtaking opportunity on Appin Road is generally limited and the speed limit within the study section is posted at 80 km/h. Posted curve warning and advisory speed signs identify occasional sharp bends and barrier linemarking is used to safely control overtaking movements.

Bulli-Appin Road connects the City of Wollongong with the township of Appin. A two lane road carriageway accommodating overtaking lanes through areas of steep gradient, adjoins Church Street and continues west to intersect with Appin Road and Wilton Road in Appin.



Map compiled using Mapinfo StreetPro Data. © 2004 Mapinfo Australia Pty Ltd, URS Australia and PSMA Australia Ltd. URS Australia, Mapinfo Australia or PSMA Australia do not warrant the accuracy or completeness of information in this publication and any person using or relying upon such information does so on the basis that these companies shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information.

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA	Title LOCAL AND REGIONAL ROAD NETWORKS
	Drawn: AJW Approved: FINAL Date: 15-05-06 Job No: 43177401 File No: 43177401-036.wor	Figure: 11-1

Chapter 11

Traffic and Transport

Access Road

The present access road to Leaf's Gully Farm is a narrow 10 metre wide road reserve, 2.3 km long, generally sealed single 2.75 m single lane in each direction. Passing opportunity on the access road is limited and other than immediately at the entrance, the next opportunity is approximately 270 m further west from Appin Road. Additional passing opportunity is also available at several crests located near the midway point. The access road is private access to the Leaf's Gully property only.

AGL propose to upgrade the existing access road to comply with applicable standards for the purposes of constructing and operating the Leaf's Gully Power Project.

Access Road / Appin Road Intersection

The present intersection of the access road with Appin Road is a priority-controlled tee junction with a short section of unsealed shoulder available for left turning traffic in Appin Road. There is no provision for a separate right turn lane, with right turning vehicles required to stand in the through lane.

Figure 11-2 shows the layout of the existing intersection. A paddock access and main farm driveway occur on the eastern side opposite. AGL proposes upgrade this intersection as part of the Leaf's Gully Power Project.

Table 11-1 below presents a summary of the surveyed traffic flows on Appin Road. This survey was commissioned by AGL for the Leaf's Gully Power Project. A summary of the results for the traffic survey are presented in **Appendix I**. Full survey data can be made available upon request.

Table 11-1 Traffic Flow on Appin Road (2006)
(Monday, 1st May to Sunday, 7th May)

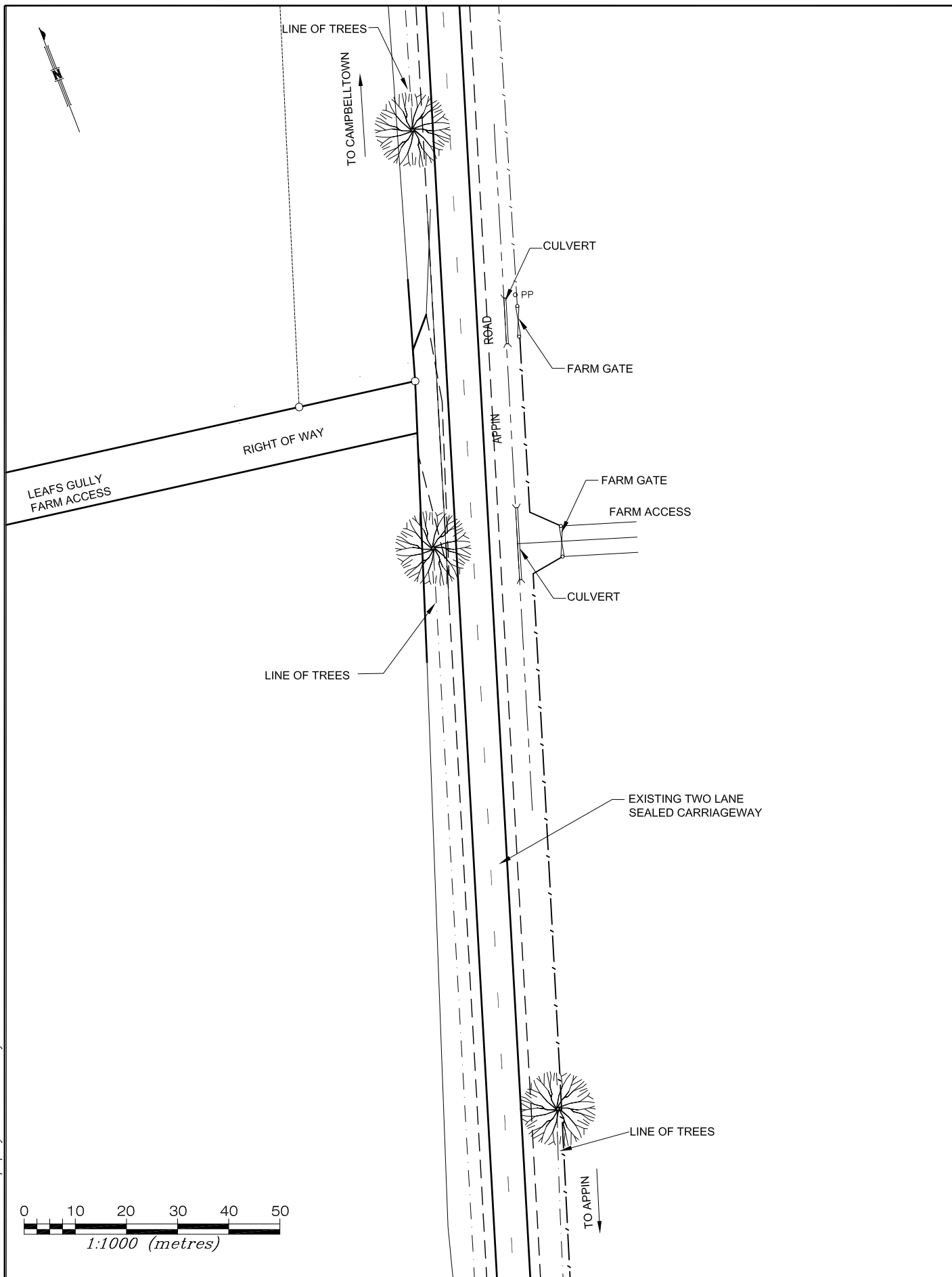
Direction of Travel		Northbound	Southbound	Two -way
DAILY (vehicles per day)	WEEK DAYS	4,613	4,719	9,332
	7 DAY AVERAGE	4,617	4,627	9,244
PEAK HOUR (vehicles per hour)	AM (7:00 to 8:00)	546	300	846
	PM (15:00 to 16:00)	307	526	834
SPEED (km/h)	85 th Percentile	71.3	67.0	69.1
	Average	61.7	59.1	60.4

The survey shows that the peak hour volumes, during the AM and PM peaks, are similar and in the order of 840 vehicles per hour and that the directional split of traffic on Appin Road is:

- AM peak hour 65 % northbound and 35 % southbound; and
- PM peak hour 37 % northbound and 63 % southbound.

Heavy vehicles make up approximately 9.5 % of total weekday traffic (Vehicle Classification Classes 3 to 12).

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Client AGL POWER GENERATION (NSW)		Project LEAF'S GULLY POWER PROJECT EA			Title EXISTING ACCESS ROAD INTERSECTION AT APPIN ROAD	
		Drawn: EX	Approved: FINAL	Date: 06/07/06	Figure: 11-2	Rev. A
		Job No.: 43177401	File No.: T2.dwg			A4

Chapter 11

Traffic and Transport

Operational Performance

Appin Road experiences a traffic flow in the order of some 9,330 vehicles per day (year 2006). Taking into consideration the characteristics of the local terrain and the overtaking opportunity, the road can be described as operating with a midblock performance Level of Service of **LoS 'E'**. That is, a carrying capacity of between 8,001 and 14,800 vehicles per day, (refer Austroads '*Guide to Traffic Engineering Practice, Pt.2 – Road Capacity – Table 3.9*').

By definition, **LoS 'E'** occurs when traffic volumes are at, or close to, capacity and there is little freedom to select desired speeds or to manoeuvre within the traffic stream. Traffic flow is unstable and minor disturbances can cause breakdown.

Traffic Growth

Trendline analysis of the historical Average Annual Daily Traffic (AADT) data from the count site located in the township of Appin (Count Station 07750) shows the annual traffic growth rate in Appin Road to be 2.85% per annum.

Extrapolation of existing traffic flows to future years indicates that the traffic flow in Appin Road will increase from 9,330 vehicles per day (year 2006) to 11,960 vehicles per day (year 2015) (refer to **Table 11-2**). The operational level of service will remain **LoS 'E'**, that is, between 8,001 and 14,800 vehicles per day.

**Table 11-2 Predicted Weekday Traffic Flow in Appin Road
(vehicles per day)**

Year	2006	2009	2011	2015
Daily Traffic Flow	9,332	10,138	10,714	11,965
Midblock Level of Service (LoS)	E	E	E	E

Note: Year Activity
 2009 – Coincident with Stage 1 construction
 2011 – Coincident with Stage 2 construction
 2015 – Coincident with major plant maintenance

Public transport through the area is catered for by road based bus trips on State Route 69. The primary operator, Busways, provides half hourly service during the morning and evening peak periods.

11.2.2 Access Road / Appin Road Intersection

Using the Intanal model (a specialist analytical assessment model for intersections) the average delay to traffic during the heavier morning peak was found to be 12.5 seconds per vehicle and the operational performance at the access road/Appin Road intersection is currently a **LoS 'A'**, i.e. a good operational level.

Currently, the access road to Leaf's Gully Farm provides private residential passage to some four properties resulting in seven trips, in both directions, during the morning and evening peak periods.

11.3 Traffic Generation

11.3.1 Construction Traffic Generation

The number of vehicle movements is summarised in **Table 11-3** and has been based upon usual construction practices and activities and the anticipated level of staffing that is expected for the construction of the two turbines. Operating hours and staffing is described in **Section 4.3** and construction vehicles described in **Section 4.4**.

Table 11-3 Construction Traffic Generation Predicted Average

Stage	Duration (Months)	Per Month		Per Week		Per Day	
		HV	LV	HV	LV	HV	LV
Construction	18	271	694	68	173	12	32

HV=Heavy vehicle

LV= Light vehicle

Over-dimensional & Over-mass Transport

The large gas turbine, generator and high voltage transformer components are to be imported into Australia and transported to site by special road convoy. A total of six over-dimensional and/or over-mass escorted truck convoys of pre-assembled gas turbine, generator and transformer units would occur in each stage.

It is anticipated the majority of heavy plant items would be transported from the Wollongong Metropolitan Area along State Route 69 during the construction stage.

When assessing the route to carry the heavy plant items, the following issues must be addressed:

- horizontal and vertical carriageway alignments;
- horizontal and vertical clearances to overhead obstructions (power lines, bridges, vegetation);
- bridge approaches;
- vehicle loading capacities on structures;
- roadside furniture (traffic signal hardware, directional signposting, lighting, poles) ; and
- temporary stop locations.

Chapter 11

Traffic and Transport

With the exception of the Appin Road intersection with the Leafs Gully access road (addressed in **Section 11.4.4**), no improvements or temporary upgrades of the state road network is envisaged at this time. Further assessment and planning is required during the detailed design phase to identify and cater for any necessary remedial treatments to facilitate passage once the actual weight and dimensions of the proposed plant equipment is known. Detailed route assessment studies have not been undertaken at this stage and must be undertaken during the detailed design phase when the equipment supplier is selected and the port for delivery of overseas equipment is known.

Management by experienced haulage contractors and liaison with the permit section of the RTA, NSW Police and local governments will be mandatory in ensuring the safety and amenity of the greater community.

11.3.2 Operational Phase

During the operational phase staff levels are expected to average some five full time persons generating eight to ten vehicle trips during the morning and evening peak periods. The peak periods can be defined as the time of day during which the largest number of vehicles populate the road carriageway. Generally, these time periods would coincide with vehicle trips associated with the journey to and from work by power plant employees, work related deliveries and local residents.

Currently there are four residential properties on site with seven persons residing on the property full time.

Therefore the operational traffic generated by the Leafs Gully Power Project is expected to be similar or less than the current traffic generated on the site.

11.3.3 Major Facility Maintenance Phase

Major maintenance is expected to generate some 87 vehicles in the peak hour and 180 over the day. Such activities would occur relatively infrequently, say every three years or more, and would last approximately four to six weeks.

11.4 Assessment of Potential Impacts

11.4.1 Construction Phase

The main impacts from construction generated traffic include:

- during the morning 7.00 to 8.00 AM peak hour when construction staff and early delivery vehicles coincides with the Appin Road peak;
- regular daily traffic generated by delivery trucks for equipment, plant, materials with intermittent peaks associated with concrete pours; and

- occasionally, outside of peak periods, the delivery of large equipment (turbines, generators, transformers) from Port to the site.

The impacts of the construction traffic have been reviewed with respect to:

- traffic capacity on Appin Road and the access road / Appin Road intersection;
- safety; and
- oversize vehicles.

11.4.2 Construction traffic volumes

Predicted traffic volumes during the construction phase are:

- typical average peak hour construction traffic generation during the one to one and a half months of high construction activity is 70 vehicle trips per hour;
- light traffic flow throughout the remainder of the working day;
- typical peak day traffic flow - 160 vehicles per day

11.4.3 Appin Road Performance

The analysis of the performance of Appin Road with the construction traffic volumes (undertaken using a conservative assumption of staged construction of four turbines) indicates that the change in midblock traffic volume is small (less than 2 %) and that the operation level of service remains between 8,001 and 14,800 vehicles per day and at LoS 'E'. Being close to capacity, the traffic flow in Appin Road is unstable and small disturbances in the stream can lead to breakdown.

11.4.4 Access Road / Appin Road Intersection

Intersection Arrangement

Appin Road is an 80 km/h two-lane two-way arterial road with minimum width traffic lanes and narrow shoulders. The road corridor is narrow and large trees are within close proximity of the carriageway edge.

The access road / Appin Road intersection is located on a level section of straight and at a point approximately midway between two bends. Barrier linemarking in Appin Road controls vehicle movement with overtaking opportunity currently permitted in the northbound direction only. Sight lines are available along Appin Road for motorists exiting the access road.

Chapter 11

Traffic and Transport

The existing situation for southbound vehicles accessing the site via a right turn from Appin Road is to store in the through traffic lane in Appin Road. Vehicles must then wait for suitable gaps in the opposing traffic stream to make the turn. To ensure the exposure of stationary vehicles is limited and traffic in Appin Road is not unduly inconvenienced, a priority-controlled intersection with a separate right turn lane (RTA intersection type '**CHR**') is proposed as part of the development. Refer to **Figure 11-3**. To accommodate the additional turn lane, widening of the existing two-lane carriageway and some tree clearing would be required.

Opportunity also exists to provide a short right turn storage lane for the farm driveway opposite and this has been included in the proposal.

Safety issues influencing the selection of the intersection arrangement included:

- travel speed of traffic;
- proximity of the bends in Appin Road;
- proximity of trees to the carriageway;
- proximity of the northern crest (200 to 300 m);
- width of carriageway and shoulders; and
- impact on traffic flow and potential for conflicts.

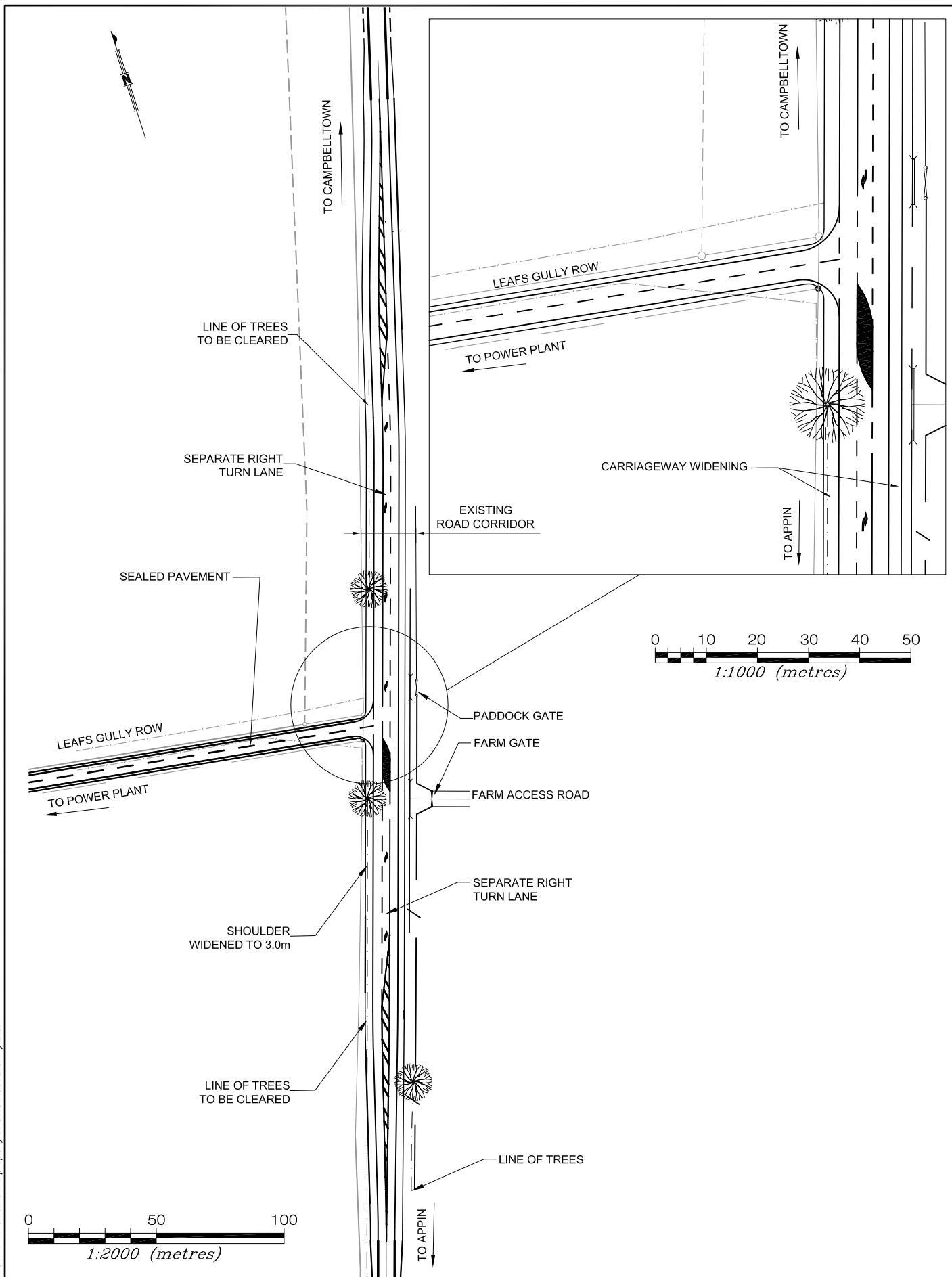
With a '**CHR**' layout, southbound vehicles on Appin Road traffic are unimpeded. The length of the turn bay allows for the deceleration of vehicles and storage of three cars or one articulate vehicle. Generally, the intersection has been designed to accommodate the left turn movement of a rigid truck within the confines of the sealed carriageways.

The proposed improvement to the intersection would maintain the integrity, safety and efficiency at the intersection, in accordance with current guidelines and standards.

The narrowness of the existing Appin Road corridor and the access road Right of Way (10 m) combined with the skewed angle of entry constrain the configuration of the intersection and restrict heavy vehicle movement.

As a result of the tightness of the turn, large vehicles such as large rigid and articulated vehicles (greater than 12.5 m), approaching the Site from the south, would not be able to turn left into the access road. These vehicles would be directed to approach from the north or if this is not feasible, continue north along Appin Road and return via the Copperfield Drive roundabout, entering the Site using the separate right turn lane. Sufficient signposting would be necessary to reinforce the banned left turn movement for oversize vehicles. As it is anticipated that most trucks would approach from the north, it is expected that there would not be significant impact on the Copperfield Drive roundabout. However, this would be confirmed in the detailed design phase once size and number of vehicles is confirmed.

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Client AGL POWER GENERATION (NSW)	Project LEAFS GULLY POWER PROJECT EA			Title PROPOSED ACCESS ROAD INTERSECTION AT APPIN ROAD	
	Drawn: EX Job No.: 43177401	Approved: FINAL File No.: 011.dwg	Date: 06/07/06	Figure: 11-3	Rev. A A4

Chapter 11

Traffic and Transport

Vehicles larger than 19 m (such as 25 m semi trailers) would require RTA approval for use in accordance with the *Route Assessment Guidelines for Restricted Access Vehicles* Edition 1, Revision May 2002.

Cars and other similar sized vehicles, approaching from the south would be able to turn left from Appin Road into the access road.

Intersection analysis

The operation of the Access Road / Appin Road intersection was modelled using a conservative estimate of construction traffic flows and a conservative assumption of staged construction of four turbines, although it is noted that this assessment is seeking approval for construction of two turbines. This modelling indicated that the intersection would continue to operate with a good level of service should construction generated traffic coincide with the heavier Appin Road morning peak. That is, the operational Level of Service for operation would be **LoS 'B'**, which is acceptable.

Over-dimensional, Over-mass Transportation

The gas turbine, generator and high voltage transformer components are to be imported into Australia and then transported to site by road. Typically the components might be up to 14 m in length and 5.0 m in width, 5.5 m in height and weigh up to 300 tonnes.

The number of over-dimensional trips is uncertain at this time but is likely to be six trips based on the heavy items of the turbine, generator and transformer. During the detailed design phase, the number of trips would be quantified and the necessary actions undertaken to ensure the safe and efficient passage along the route.

All over-dimensional and / or over-mass road transport convoys are required to operate under RTA and NSW Police permit conditions. The transport contractor would submit a '*Transport Plan*' for approval. The '*Transport Plan*' is to identify the transportation dates, the route, load statistics, make-up of the convoy (number of escorts, transport loader and tow vehicles proposed). This '*Transport Plan*' would take into account height restrictions at locations such as bridges etc, which can limit the height of the loads that can be transported.

11.4.5 Access Road

An area of vegetation approximately 300 m long and up to 10 m wide would be cleared to construct the access road within the Right of Way.

As the Right of Way traverses undulating landscape, part of the access road would require either a cutting and landscaped batter or embankment and landscaped batter. The proposed road works would occupy most of the Right of Way.

The road would be of gravel construction and sealed for a 5.5 m width. The thickness of pavement appropriate for this standard of road, in accordance with Campbelltown City Council's *Engineering Design Guide for Development* (2004), would be designed to carry a traffic load of 2×10^4 equivalent standard axles.

In cuttings, the width of reserve constrains what can be achieved and the road would be constructed with a one-way crossfall and a shallow table drain on the low side.

To avoid adverse impacts on drainage catchments local cross drain culverts would be provided at local gullies and depressions.

Further information and assessment is provided in **Appendix I**.

11.4.6 Operational Phase

The on-going operation of the plant would generate a regular daily generator of some eight to ten car trips/hour in peak periods which is significantly lower than levels of construction traffic generation, and can readily be accepted by the road network. The traffic generated by the operation of the plant would be similar to traffic currently generated at the Leaf's Gully Farm.

Major maintenance events are likely to occur once every three years and would require up to 100 contractors on site for a four to six week period. This activity would generate some 90 vehicle trips per hour in the morning and evening peaks.

Analysis of intersection performance during the maintenance phase showed that the proposed intersection would, in year 2015, operate at **LoS 'B'**, which is acceptable.

Parking would be catered for on site for plant employees and business vehicles in accordance with the RTA's Guide to Traffic Generating Developments, Australian Standards and council requirements. No impact or treatment is necessary to facilitate parking on the state road network, with the exception of any temporary stop locations identified during the haulage of over-dimensional plant equipment.

11.5 Mitigation Measures

Table 11-4 presents a summary of the traffic mitigation measures.

Chapter 11

Traffic and Transport

Table 11-4 Summary of Traffic Mitigation Measures

Mitigation Measure	Implementation		
	Design	Construction	Operation
Separate right turn lane priority intersection (RTA intersection type 'CHR') will be installed at the intersection of the access road and Appin Road. An additional right turn lane will be provided for the residence on Appin Road opposite the access road.	✓		✓
Large rigid and articulated vehicles approaching from the south to be directed north to u-turn at the Copperfield Drive roundabout and enter the site using the separate right turn lane.		✓	✓
Sufficient signposting would be installed as necessary to reinforce the banned left turn movement for oversize vehicles.		✓	✓
Undertake further assessments to identify and cater for any necessary remedial treatments to facilitate passage once the actual weight and dimensions of the proposed plant equipment are known.	✓		
Transport of over-mass and over- dimensional loads to be undertaken under RTA and NSW Police permit conditions and approved routes.		✓	

Noise and Vibration Assessment – Summary of Key Outcomes

The construction, operational, traffic noise and vibration impacts from the proposed Leaf's Gully Power Project have been assessed in accordance with the relevant policy guidelines published by the Department of Environment and Climate Change (DECC).

A typical worst case scenario has been modelled considering neutral and meteorological conditions that enhance noise propagation.

No exceedances of the NSW Industrial Noise Policy criterion for operation of the proposed development have been predicted. It is noted that during the tendering and detailed design process the plant would be designed to meet the specified noise limits and mitigation measures would be finalised at that stage. For the purposes of the assessment it was assumed that standard plant items are installed with an upgraded silencer on the air intakes and an upgrading of the façade enclosure for the turbine and generator enclosure is undertaken.

Noise impacts due to extra traffic along Appin Road (both during construction and operation) were found to be negligible. The assessment of construction noise considered noise emanating from vehicle movements along the access road.

A preliminary assessment of noise during the construction phase (two scenarios modelled) showed a 1 dB exceedance at residence 3, located approximately 1.5 km north east of the proposed plant, during Scenario 1 (a worst case month where activities, including earthworks, construction of the internal roads and construction of the slab is anticipated to occur simultaneously). This exceedance is considered negligible and would not be detected. No other exceedances at the existing residential receivers were predicted. These scenarios are to be confirmed with the Contractor prior to commencement. A Construction Noise Management Plan would be developed to ensure that noise and vibration during construction is managed.

No vibration impacts are envisaged to occur at either the residential receivers or the Upper Canal.

Chapter 12

Noise and Vibration

12.1 Introduction

The construction, operational and traffic noise and vibration impacts due to the proposed Leafs Gully Power Project have been assessed primarily in accordance with the following policy guidelines published by the DECC:

- *NSW Industrial Noise Policy (INP)*;
- *Environmental Criteria for Road Traffic Noise (ECRTN)*;
- *Noise Guide for Local Government (NGLG)*; and
- *Environmental Noise Control Manual (ENCM)*.

Vibration has been assessed by considering:

- The DECC's – *Assessing Vibration – A Technical Guideline (AVTG)*; and
- *German Standard 4150-3 – Structural Vibration - Part 3: Effects of Vibration on Structures (DIN4150-3)*.

The noise and vibration assessment was conducted by Wilkinson Murray Acoustical Consultants. This chapter presents a summary of the assessment and the full assessment is presented in **Appendix J**.

The Environmental Assessment Requirements (refer to **Appendix A**) state that the assessment must include:

- a noise impact assessment for the project, conducted in accordance with INP;
- consideration of noise impacts during each stage of the development and each phase of operation, with a particular focus on scenarios under which meteorological conditions characteristic of the locality may exacerbate impacts;
- an assessment of the construction noise impacts of the project, against the criteria provided in Chapter 171 of the *Environmental Noise Control Manual* (EPA, 2004); and
- clearly outline the noise mitigation, monitoring and management measures the Proponent intends to apply to the project.

12.2 Methodology

12.2.1 Assessment Process

The INP outlines processes to help strike a feasible and reasonable balance between the establishment and operation of industrial activities and the protection of the community from noise levels that are intrusive or unpleasant.

In summary, noise management in accordance with the INP involves the following main steps:

- 1) Determining the project specific noise levels for intrusiveness and amenity that are relevant to the Project.
- 2) Measuring and determining existing background and ambient noise levels, using the method relevant to the expected level of impact.
- 3) Where the proposed development is expected to produce annoying noise characteristics, adjustments are to be applied to the noise levels produced by the development in question.
- 4) Predicting or measuring the noise levels produced by the development in question, having regard to meteorological effects (such as wind, temperature inversions).
- 5) Comparing the predicted or measured noise level with the project-specific noise levels and assessing impacts.
- 6) Considering feasible and reasonable noise mitigation strategies where the project-specific noise levels are exceeded.
- 7) Negotiation between the regulatory / consent authority and the proponent and between the community and the proponent to evaluate the economic, social and environmental costs and benefits from the proposed development against the noise impacts.
- 8) The regulatory / consent authority sets statutory compliance levels that reflect the achievable and agreed noise limits for the development.
- 9) Monitoring of environmental noise levels from the development to determine compliance with the consent / licence conditions.

Steps 1 to 6 are included in this noise assessment. Steps 7 to 9 will follow as part of the approvals process.

12.2.2 Understanding Noise

The noise assessment process and noise measurement can be difficult concepts to understand. Some background information is provided below to assist this understanding.

Sound may be defined as any pressure variation that the human ear can detect. As the ear responds logarithmically to stimuli, it is more practical to express acoustic parameters as a logarithmic ratio of the measured value to a reference value. This logarithmic ratio is called a decibel or dB. The smallest perceptible change is about 1 dB.

The most common frequency weighting in current use is “A-weighting” providing results often denoted as dB(A), which conforms approximately to the response of the human ear.

For reference, **Table 12-1** presents the sound pressure levels of some common sources.

Chapter 12

Noise and Vibration

Table 12-1 Sound Pressure Levels of Some Common Sources

Sound Pressure Level (dB)	Sound Source	Typical Subjective Description
140	Propeller aircraft; artillery fire, gunner's position	Intolerable
120	Riveter; rock concert, close to speakers; ship's engine room	
110	Grinding; sawing	
100	Punch press and wood planers, at operator's position; pneumatic hammer or drilling (at 2 m)	Very noisy
80	Kerbside of busy highway; shouting; Loud radio or TV	Noisy
70	Kerbside of busy traffic	
60	Department store, restaurant, conversational speech	
50	General office	Moderate to quiet
40	Private office; Quiet residential area	Quiet
30	Theatre; quiet bedroom at night	
20	Unoccupied recording studio; Leaves rustling	Very quiet
10	Hearing threshold, good ears at frequency of maximum sensitivity	
0	Hearing threshold, excellent ears at frequency maximum response	

The most important factors affecting the way noise travels through the air and how it arrives at the receiver are:

- type of source (point or line);
- distance from source;
- atmospheric absorption;
- wind;
- temperature and temperature gradient;
- obstacles such as barriers and buildings;
- ground absorption;
- reflections;
- humidity; and
- precipitation.

12.2.3 Construction and Operation Noise

For this assessment, noise predictions were made using the Environmental Noise Model (ENM) modelling software algorithm. This is a point-to-point model that takes into account the attenuation factors, including distance, ground absorption, air absorption and the effects of adverse meteorological conditions. ENM predictions have been validated in the field in Australia on projects and is approved to be used in NSW by the DECC.

During the night time period, the worst case noise levels are likely to be experienced during both temperature inversions and wind. Temperature inversions are rarely present during the daytime or evening periods. Therefore, the most significant meteorological effect during the daytime and evening periods is wind. Acoustically neutral conditions have also been considered.

Hourly meteorological data from the Bureau of Meteorology's (BoM) Camden weather station located at Camden Airport was processed for the site and the inversion class of the area determined. The weather conditions that have been considered when calculating the noise levels for this project are presented in Appendix C in **Appendix J**.

Where there exists the possibility that instantaneous, short-duration, high-level noise events may occur during night time hours (10.00 pm-7.00 am), the DECC requires that consideration be given to the potential for the disturbance of sleep within residences.

The sleep arousal level adopted for this Project is 45 dBA L_{Amax} based on the adopted Rating Background Level (RBL) of 30 dBA plus 15 dBA during the hours of 10.00 pm to 7.00 am assessed external to a bedroom window.

12.2.4 Vibration

The construction plant and equipment relevant to vibration sources during construction would most likely be limited to rollers. However, should rock be encountered there may be the need to use an excavator fitted with a hydraulic hammer. Given that the nearest existing residential receivers would be at least 1000 m away from the closest area of works, the vibration levels would not be perceptible and therefore would not impact on the residences.

Once operational, all rotating plant items of the power station would be required to be correctly aligned and balanced. It is therefore unlikely that any vibration levels would be perceptible past the boundary of the Development Site, which is at least 350 m away and therefore there would be no impact on the existing residences.

The Upper Canal has been identified by the Sydney Catchment Authority (SCA) as potentially fragile due to its age and therefore they require an assessment of the vibration impact on this structure. The Upper Canal is located at least 350 m from the closest construction area. In the absence of any specific criteria for this structure, a very stringent 3 mm/s vibration limit has been adopted, guided by the German Standard DIN4150 Part 3, with reference to heritage listed structures. This vibration limit is considered to be very conservative, nonetheless, the anticipated vibration levels during the construction phase of this project would be less than 0.5 mm/s and significantly less during the operation.

Given the low risk associated with vibration impacts (both annoyance and structural damage) a detailed vibration assessment was not deemed necessary.

12.2.5 Traffic Noise

All road traffic movements (construction and operation) would travel along Appin Road and then via the access road into the Site. The functional category of this road is considered to be "sub-arterial" and the applicable noise criteria refer to a day time (7.00 am to 10.00 pm) $L_{Aeq(15hr)}$ 60 dBA level and a night-time (10.00 pm to 7.00 am) $L_{Aeq(9hr)}$ 55 dBA level (ECRTN). Traffic generating developments are allowed an increase of 2 dB above these limits once all reasonable and feasible mitigation is considered.

Chapter 12

Noise and Vibration

There would be minor increases in road noise during the peak construction activities, however, there is minimal risk of exceeding the 2 dB limit. During the operational stage, there would be minor, light vehicle activity as required and as such negligible impact expected. Given the low risk of exceeding the 2 dB limit, a further detailed assessment was not deemed necessary. In addition to the noise on Appin Road, the noise from the use of the access road for the plant has been considered as part of the assessment of operational noise.

12.3 Existing Environment

12.3.1 Residential Receivers

The six residential receivers surrounding the Development Site are identified in **Figure 12-1**.

12.3.2 Background Monitoring

AGL via their community consultant, Coakes Consulting, liaised with many of the nearby residences in order for a noise logger to be placed onto their land. With the exception of Residence 3, nearby residences preferred not to participate in the collection of noise data, and noise loggers were placed on the Development Site in strategic locations that were deemed representative of the noise currently experienced by the nearby residences.

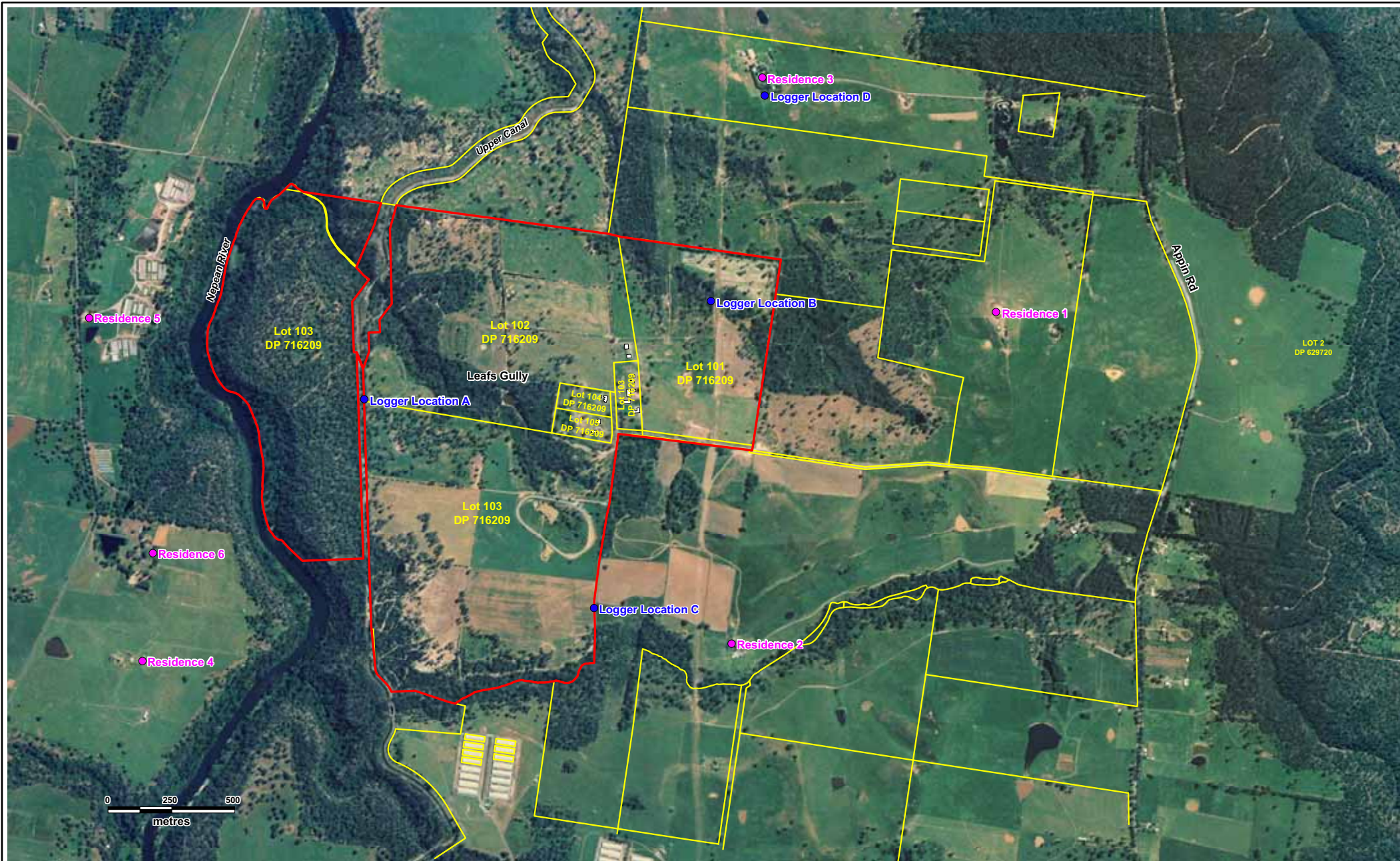
Figure 12-1 also shows the four noise monitoring locations (A to D) as well as the six residential receivers (1 to 6). The detailed measurement results are shown in graphical format in **Appendix J**.

Table 12-2 summarises the results of the noise monitoring.

Table 12-2 Measured Noise Levels – Unattended

Location	Representative of residence	Time Period ⁽¹⁾	Rating Background Level RBL (dBA)
Logger Location A	Residences 4, 5 and 6	Daytime	30
		Evening	32
		Night Time	33
Logger Location B	Residences 1 and 3	Daytime	36 ⁽²⁾
		Evening	36 ⁽²⁾
		Night Time	36 ⁽²⁾
Logger Location C	Residence 2	Daytime	28 ⁽³⁾
		Evening	31
		Night Time	31
Logger Location D	Residence 3	Daytime	30 ⁽⁴⁾
		Evening	31
		Night Time	28 ⁽³⁾

- Note: 1) The INP considers daytime (7.00 am-6.00 pm); evening (6.00 pm-10.00 pm); night time (10.00 pm-7.00 am). On Sundays and Public Holidays, daytime begins at 8.00 am and night time ends at 8.00am.
- 2) Level likely to be influenced by local environment, possibly wind, insects, frogs, however, development of operational noise criteria has not been affected.
- 3) The INP considers the lowest RBL as 30, any level lower is assigned a 30 dBA level.
- 4) A level of 31 dBA was derived from measured levels. However, given that there may have been influence from wind, a level of 30 dBA has been assigned (see Note 3).



Legend



Property Boundary

Residential Receivers



Logger Location

Datum: GDA94 Projection: MGA Zone 56

Client AGL POWER GENERATION (NSW)	Project AGL LEAF'S GULLY POWER PROJECT EA	Title BACKGROUND NOISE MONITORING LOCATIONS AND RESIDENTIAL RECEIVERS
	Drawn: AJW Approved: FINAL Date: 06/11/2008 Job No: 43177401 File No: 43177401-086.wor	Figure: 12-1

Chapter 12

Noise and Vibration

As required by the INP, extraneous noise and any effects due to adverse meteorological conditions such as rain or wind greater than 5 m/s at a height of 1.5 m have been excluded thus reducing the RBL used in this assessment.

With regards to exclusion of adverse weather conditions, hourly data from the BoM's Camden weather station located at Camden Airport has been used.

The measured noise levels, together with the charts suggest that the initial data collected (particularly during the evening and night and at Logger Location B) was influenced by the local environment and may be artificially elevating the background existing noise levels. At Logger Location B, the noise levels appear to be elevated compared to Logger Locations A and C. Furthermore the day, evening and night-time RBL are identical. This was possibly due to noise from insects, frogs or wind in the trees. The noise data measured at Location D is similar to the data collected at Logger Locations A and C and would be more reliable than the data measured at Location B.

The DECC has issued guidance for considering the situations where the calculated RBL for the evening is higher than that calculated during the day and the RBL for the night is higher than the RBL in the evening. The DECC guidance suggest that these situations may be from insect related noise or from temperature inversions. The objective of conducting long-term noise monitoring is to establish levels indicative of the entire year and in line with the expectation of the community (where the night is the quietest and the day the noisiest).

The INP considers the lowest RBL as 30, any level lower is assigned a 30 dBA level. Based on this analysis, the most appropriate RBL for all time periods and all locations for this Project is 30 dBA. This is the lowest permissible RBL as recommended within the INP.

12.3.3 Operational Noise - Continuous

NSW Industrial Noise Policy

The INP is designed to assess "industrial noise" using the more stringent of the following two approaches:

- intrusive noise impacts in the short term for residences; and
- amenity for particular land uses such as residences.

The INP's intrusive goal is set 5 dBA above the RBL for each time period (daytime, evening or night time) of interest. The RBL's are derived from the measured L_{A90} noise levels as per the DECC guidelines.

The amenity goal sets an upper limit to the total noise level (L_{Aeq}) in an area from all industrial noise (existing and future). The criterion depends on the time of day, area classifications and the relationship of the total measured L_{Aeq} (and contribution from existing industrial noise) to determine the Acceptable Noise Level for the development.

Noise and Vibration

Chapter 12

The potentially affected area is classified as “rural” by the INP. Given this, the “acceptable” amenity levels (L_{Aeq} dBA) which apply over the whole day, evening or night period are as follows:

- Daytime 50 dBA
- Evening 45 dBA
- Night time 40 dBA

It can be seen that the intrusive criteria will be at least 10 dBA more stringent than that of amenity, therefore a criterion of $L_{Aeq,15min}$ 35 dBA, based on 5 dBA above 30 dBA has been adopted for this development and applies within 30 m of the existing residences. This is the most stringent criterion possible based on the INP.

Summary

Table 12-3 summarises the INP requirements for operational noise.

Table 12-3 Operational Noise Criteria – INP Requirements

Location	Time Period ⁽¹⁾	Intrusiveness $L_{Aeq,15min}$ (dBA)
Residences 1-6	Daytime	35
	Evening	
	Night Time	

- Notes: 1) The INP considers daytime (7.00 am-6.00 pm); evening (6.00 pm-10.00 pm); night time (10.00 pm-7.00 am). On Sundays and Public Holidays, daytime begins at 8.00 am and night time ends at 8.00 am.
- 2) The INP considers the lowest RBL as 30, any level lower is assigned a 30 dBA level.

12.3.4 Operational Noise Criteria- Sleep Disturbance

The primary sleep arousal criteria adopted for this project is 45 dBA L_{Amax} during the hours 10.00 pm to 7.00 am assessed external to a bedroom window.

12.3.5 Construction Noise

Considering the construction duration, the following criterion is appropriate:

The L_{10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 5 dB(A).

It is anticipated that construction would most likely take place from 7.00 am to possibly up to 6.00 pm during weekdays and 8.00 am to 1.00 pm on Saturdays or in accordance with any Licence conditions. Should the contractor wish to work outside these “standard” hours, they will need to apply to the relevant authorities for approval. Given this, the criteria in **Table 12-3** apply considering construction would be greater than 26 weeks duration. Stage 1 construction would be approximately 18 months duration.

Considering construction will be greater than 26 weeks duration and based on the lowest permissible RBL of 30 dBA, the daytime construction noise criteria adopted for this project is 35 dBA $L_{A10, 15min}$ assessed within 30 m of the existing residences.

Chapter 12

Noise and Vibration

Table 12-4 summarises the criteria for construction noise.

Table 12-4 Criteria for Construction Noise

Location	Noise Criteria $L_{A10,15min}$ (dBA)
Residences 1-6	35

12.4 Assessment of Impacts

12.4.1 Operational Noise Assessment

Given the potential that this power station may operate at any time, the noise assessment addressed operating scenarios for all time periods.

Vehicles visiting the site during operations would travel along Appin Road and onto the access road. The predicted vehicle numbers do not represent an increase over current traffic movements on site (which presently has four occupied residences) so the noise impact to existing residences (nearest being some 600 m away) would be negligible and has not been modelled.

Proposed Conditions - Unmitigated

The unmitigated noise levels have been calculated using the ENM modelling software and are summarised in **Table 12-5**. Levels for neutral and enhanced weather conditions are also presented.

Table 12-5 Summary of Calculated Noise Levels to Existing Residences - Unmitigated

Residence Number	Time Period	Calculated $L_{Aeq,15min}$ Noise Level (dBA)		Noise Criteria $L_{Aeq,15min}$ (dBA)	Meets INP criteria Y/N
		Meteorological Condition			
		Neutral	Enhanced		
1	Daytime	25	25-28	35	Y
	Evening		27-29		
	Night Time		28-29		
2	Daytime	27	29-30		Y
	Evening		30-31		
	Night Time		30-31		
3	Daytime	30	32-38		N
	Evening		35-39		
	Night Time		38-40		
4	Daytime	29	32-33		Y
	Evening		33-34		
	Night Time		33-34		
5	Daytime	29	31-35		N
	Evening		36-37		
	Night Time		35-37		
6	Daytime	30	31-34		Y
	Evening		34-35		
	Night Time		33-35		

Noise and Vibration

Chapter 12

The calculated noise levels for neutral meteorological conditions meet the criteria at all residential receivers. During the day and evening periods and considering when the wind speeds are between 0.5 and 3 m/s (as per INP,) the noise level exceeded 10 % of the time is presented (considering all four seasons). Similarly, the noise level for the night time period considering meteorological conditions that enhance noise propagation (both temperature inversions and wind) are presented.

The noise predictions indicate the following:

- the noise predictions indicate that there is minor 1-2 dB exceedance of the criteria at residence 5 under weather conditions that enhance noise levels.
- the noise predictions indicate that there is a marginal exceedance of up to 5 dB of the criteria at residence 3 under weather conditions that enhance noise levels.

The exceedances of the criteria indicate that noise mitigation would need to be considered for the project.

Proposed Conditions - Mitigated

In order to address the exceedances predicted for the unmitigated scenario, consideration was given to appropriate noise mitigation measures that could be incorporated into the design. Modelling was then conducted considering the scenario of these measures being applied.

Detailed modelling has confirmed that the use of barriers for this project have limited capacity to reduce the noise levels, in particular due to height of the sources with respect to each residence and the adverse meteorological conditions. Given the limited benefit and other likely constraints, the use of barriers is not seen as a justified mitigation. A reduction in the noise levels at residences would therefore need to be achieved by controlling noise directly from each of the contributing sources.

It is noted that until the plant selection is finalised during the tendering process including details of the sound power levels (in octave bands), the mitigations can only be conceptual. This is due to the fact that not only would there be some differences in the overall noise levels of comparable plant items between manufacturers, the spectrum shape can also be different. These differences may require different designs of the respective mitigations. Therefore the following information is to be treated as conceptual only and provides typical mitigations to meet 35 dBA at the residence 3, being the most affected.

At residence 3, the main plant contributions are from the turbine and generator enclosure, stack, transformer, and air intake. Therefore, further reductions are required from the enclosure and stack.

Assuming the building for the turbine and generator is constructed from metal cladding, further noise level reductions can be achieved from upgrading the building enclosure from a single skin to a double skin and cavity construction. It is assumed that ventilation would be required and as such appropriate silencers would need to be appropriately sized and selected with consideration to the insertion loss so as not to reduce the effectiveness of the building envelope.

The final contribution from the enclosure (overall and spectrum shape) would depend on the final façade design. This form of mitigation was considered in the assessment to be simple and the provision of a higher acoustic rated building envelope considered to provide more flexibility to the reductions required from other plant items such as the stack.

Chapter 12

Noise and Vibration

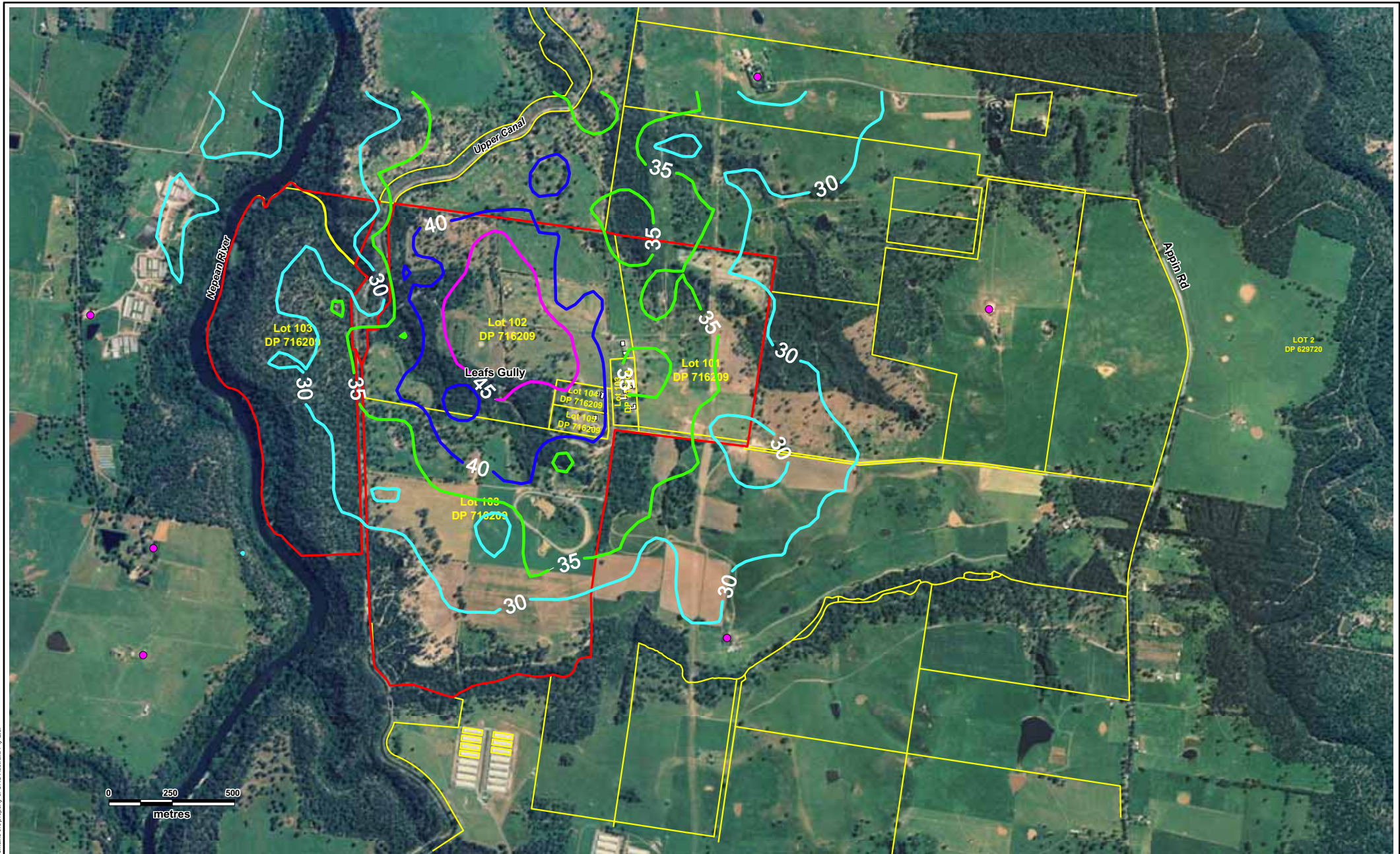
With respect to the stack, a reduction would be possible by upgrading the silencer. Again, these items are to be further assessed during the detailed design, where all relevant details of all final sound power levels of plant items including mitigation measures can be confirmed.

Table 12-6 is a summary of the noise levels resulting from the inclusion of a silencer and enclosure around the generator and turbine. As shown in **Table 12-6**, the mitigated noise levels achieve the INP criteria.

Table 12-6 Summary of Calculated Noise Levels to Existing Residences - Assuming Further Conceptual Mitigation

Residence Number	Time Period	Calculated $L_{Aeq,15min}$ Noise Level (dBA) Meteorological Condition		INP Criteria $L_{Aeq,15min}$ (dBA)	Meets criteria Y/N
		Neutral	Enhanced		
1	Daytime	22	22-26	35	Y
	Evening		24-26		
	Night Time		26-27		
2	Daytime	22	23-24		Y
	Evening		24-25		
	Night Time		24-25		
3	Daytime	26	28-32		Y
	Evening		29-33		
	Night Time		32-33		
4	Daytime	22	25-26		Y
	Evening		26-27		
	Night Time		26-27		
5	Daytime	23	24-27		Y
	Evening		28-29		
	Night Time		27-28		
6	Daytime	23	25-27		Y
	Evening		27-28		
	Night Time		27-28		

In addition to the calculated noise levels as presented in **Table 12-6**, **Figure 12-2** presents the 35 dBA noise contours for the worst case scenario being temperature inversions plus adverse wind occurring during the night-time period. It should be noted that the calculated (point to point) levels as presented in **Table 12-6** are more accurate than the contours.



Legend

- Property Boundary
- Residential Receivers
- 45 dB
- 40 dB
- 35 dB
- 30 dB

Note: Calculated (point to point) levels as presented in the assessment are more accurate than contours.

Datum: GDA94 Projection: MGA Zone 56

Client AGL POWER GENERATION (NSW)	Project AGL LEAFS GULLY POWER PROJECT EA			Title PREDICTED NOISE CONTOUR FOR OPERATION OF PROPOSED DEVELOPMENT WITH MITIGATION
	Drawn: AJW	Approved: FINAL	Date: 06/11/2008	Figure: 12-2
	Job No: 43177401	File No: 43177401-087.wor		

Chapter 12

Noise and Vibration

Low Frequency Noise

The INP recommendations for low frequency noise involve an assessment to be conducted on the difference between C and A weighting levels. The most common frequency weighting in current use is “A-weighting” providing results often denoted as dB(A), which conforms approximately to the response of the human ear. A “C-weighting” curve is also used, particularly when evaluating very loud or very low-frequency sounds.

If a 15 dB difference exists between the two weighting levels, a correction of 5 dB is to be applied. Using this approach the assessment identified that the proposed plant has the potential for low frequency noise.

However, recent international research has shown that the use of this difference approach is not suitable when the noise levels are low, since the low frequencies may then be below the threshold of hearing levels (A review of Published Research on Low Frequency Noise and its Effects, Report for Department for Environment, Food and Rural Affairs (UK) by Dr Geoff Leventhall, 2003). Current research suggests that (dBC-dBA) difference should not be used as an annoyance predictor, but as a simple indicator of whether further investigation may be necessary (Low Frequency Noise and Annoyance, Noise & Health 2004, 6:23, 59-72).

Recently the UK Department for Environment, Food and Rural Affairs (DEFRA) has developed a new procedure to assess low frequency noise. Using this approach the assessment found that it would be unlikely that low frequency noise impacts would result from the operation of the proposed plant.

AGL is committed to ameliorating any low frequency noise issues if they arise for the proposed plant consistent with the most recent low frequency noise assessment process that have been developed overseas in lieu of the INP, namely:

- Proposed Criteria for the Assessment of Low Frequency Noise Disturbance, 2005, Prepared for DEFRA by Dr. Andy Moorhouse, Dr. David Waddington, Dr. Mags Adams; and
- Procedure for the Assessment of Low Frequency Noise Complaints 2005, Prepared for DEFRA by Dr. Andy Moorhouse, Dr. David Waddington, Dr. Mags Adams.

Further investigations using the most recent research in lieu of the INP suggest that low frequency noise would not be at a level to cause annoyance to the closest residential receivers. Accordingly, a 5 dBA adjustment to the operational noise criteria is not required.

Potential for Sleep Disturbance

The potential for sleep disturbance within the residences would potentially be greatest during the early morning hours (notionally, 2.00 am-4.00 am) when background noise levels are at their lowest. It should be noted that this time period is not when the demand for a peaking power plant is likely to occur and as such operation of plant is unlikely. However, the potential for sleep disturbance has been assessed for completeness.

AGL have confirmed there are no sources in the development that would produce instantaneous, short-duration, high-level noise events. If a turbine begins (or ceases) operation in the early hours of the morning, this would not occur instantaneously but as a gradual process. Should a turbine be operating into the night or early morning period, the process is relatively steady state and free of instantaneous events. The mains pressure from the gas line will be adequate and therefore no gas compressor is required for this development.

Furthermore there is no reason for the site to be visited during the night-time period even if there is a need to operate the plant unless in the event of an emergency. Repairs or maintenance would be scheduled during the daytime period.

The assessment concluded that the potential risk of activities associated with the development that may disturb the sleep of nearby residences is negligible.

12.4.2 Construction Noise

To predict the typical worst case noise levels at typical construction stages over the duration of the project, the following typical scenarios have been considered:

- Scenario 1: A worst case month where activities, including earthworks, construction of the internal roads and construction of the slab is anticipated to occur simultaneously.
- Scenario 2: A worst case month where activities including, construction of the building, fitout and landscaping is anticipated to occur simultaneously.
- Scenario 3: This represents the activities occurring towards the end of the construction period associated with commissioning. This essentially is the noise that will be experienced during operation and as such is not assessed.

Conservatively, the noise generated by the average traffic movement along the access road is also modelled and added to the total noise generated for each construction scenario.

Results of Assessment

Table 12-7 summarises the calculated noise levels (unmitigated) at the existing residences for neutral conditions and also considering the noise emission from the average vehicle movement along the access road.

Table 12-7 Summary of Calculated Construction Noise Levels

Residence No.	Calculated Noise Level $L_{A10,15min}$ (dBA)		Noise Criteria $L_{A10,15min}$ (dBA)	Meets criteria Y/N
	Scenario 1	Scenario 2		
1	35	31	35	Y
2	33	32		Y
3	36	28		Minor exceedance
4	33	26		Y
5	31	27		Y
6	31	27		Y

Note: The more stringent criteria between Saturdays and weekdays is shown.

Table 12-7 shows that when assessed to all six residential receivers, only a negligible 1 dBA exceedance has been predicted at residence 3 during Scenario 1. A change in 1 dBA is negligible and cannot be detected by the human ear.

Chapter 12

Noise and Vibration

Mitigation Measures

Once the contractor is selected, the plant, processes and duration would be better known and a Construction Noise Management Plan is to be developed as part of the CEMP so that modelling assumptions can be confirmed and reasonable and feasible noise mitigation measures can be investigated if necessary. In brief, these may include:

- selection of quiet plant and processes;
- retrofitting reversing alarms that are quieter and display less annoying characteristics;
- use of temporary barriers;
- positioning of plant / processes; and
- limiting the “clustering” of plant / processes.

12.5 Mitigation Measures

Table 12-8 presents a summary of mitigation measures as a result of the noise assessment.

The proposed development would require licensing under the provisions of the POEO Act. This Environment Protection Licence administered by DECC is likely to include operation noise limits for the plant and requirements for compliance noise monitoring.

Table 12-8 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
A Construction Noise Management Plan is to be developed as part of the CEMP to confirm assumptions made in the assessment and to investigate reasonable and feasible noise mitigation measures if necessary.		✓	
The Construction Noise Management Plan would consider, if appropriate, the use of temporary barriers, the positioning of construction plant / processes, retrofitting reversing alarms that are quieter and display less annoying characteristics and limiting the “clustering” of construction plant / processes.		✓	
Include noise attenuation (such as an upgraded silencer on the stack and upgrading the façade enclosure for the turbine and generator) in detailed design such that the INP noise goals are met for the existing residences. These requirements would be referred to the preferred Tenderer.	✓		✓
Low frequency noise to be addressed during detailed design consistent with the most recent assessment process that has been developed overseas, in lieu of the INP.	✓		
Confirm assumptions used in operational noise modelling based on choice of final turbine system. Confirm requirements for mitigation.	✓		