



Introduction

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This Environmental Assessment (EA) has been prepared to support an application by Delta Electricity to the NSW Department of Planning for approval of the proposed rehabilitation of the existing coal fired generating Units 3 and 4 at Munmorah Power Station (the Proposal). The efficiency improvements that would result from the rehabilitation will mean the combined output of Units 3 and 4 will increase by around 100MW for the same fuel consumption. This is equivalent to providing the electricity needs for around 14,000 standard households.

To achieve a greater reduction in greenhouse gas emissions, the rehabilitation would make provision to enable gas to be used as a fuel source, either in combination with coal or as a replacement. This flexibility of fuel source recognises potential changes in the availability of gas along with legislative and market responses regarding the use of coal.

Recognising the potential for a more greenhouse gas constrained environment during the life of the power station, planning for the rehabilitation would also include provision to enable Munmorah Power Station to implement carbon capture options as these become technically and commercially available. This is consistent with NSW government objectives.

The proposed rehabilitation would improve the reliability and efficiency of these generating units such that they will be suitable to continue to generate base load electricity for the National Electricity Market (NEM) in the short to medium term (up to 20 years), while reducing the carbon footprint per unit of electricity generated.

The Director-General, under delegation from the Minister of Planning, formed the opinion on 19 June 2009, pursuant to Clause 6 of *State Environmental Planning Policy (SEPP) (Major Projects)*, that the project is of a kind described in Schedule 1 of the SEPP and is therefore a project to which Part 3A of *Environmental Planning and Assessment) Act 1979* (EP&A Act) applies. The Minister of Planning is the approval authority for the project.

The Proposal was also declared a 'critical infrastructure' project by virtue of the Minister of Planning's declaration of 26 February 2008, with respect to generating facilities with the capacity to generate at least 250 MW and for which the application is made prior to 1 January 2013.

The Director-General of the Department of Planning prescribed specific requirements for the scope and content of the Environmental Assessment (the DGR's) on 4 July 2009 following the Planning Focus Meeting held on 19 June 2009 and in consultation with the relevant government agencies (Appendix A).

This Environmental Assessment has been prepared in accordance with the requirements of Part 3A of the EP&A Act to support Delta Electricity's project application and addresses the requirements set out by the Director General.

1.2 Proponent

Delta Electricity is a State Owned Corporation that operates four large coal fired power stations in NSW (Munmorah, Vales Point, Wallerawang and Mt Piper Power Stations) and one major gas fired power station, Colongra, adjacent to Munmorah. Delta Electricity is also involved in the development of a range of other power projects including gas turbine power stations and cogeneration facilities fuelled by sugar mill waste.

Delta Electricity produces about 12% of the electricity used by the NEM. Reliability of supply and competitive pricing are important business performance criteria and each of Delta Electricity's plants is subject to routine performance monitoring and management reviews. Table 1.1 summarises Delta Electricity's generation and development projects.

The operation of a successful business is also of benefit to:

- Delta Electricity's stakeholder, the NSW Government
- consumers that receive reliable electricity supplies at competitive pricing
- employees of Delta Electricity who are remunerated for application of their knowledge and skills to assist the Corporation achieve its business objectives
- the local economy through direct employment and flow on benefits through the provision of services.

Delta Electricity has been very active in the investigation of future directions for its business and has identified feasible options for both new generation plants and existing plant improvements. The rehabilitation of Munmorah Power Station Units 3 and 4 has been assessed as one of Delta Electricity's feasible proposals.

Table 1.1 – Existing generation and development projects

Site	Capacity (MW)	Annual Generation 2007 (GWh)	Operational Status 2008
Munmorah	600	2,110	Intermediate
Vales Point	1,320	6,092	Base Load
Wallerawang	1,000	5,951	Intermediate
Mt Piper	1,320	9,297	Base Load
Total Coal Fired	4,240	23,450	
Broadwater Cogeneration Plant	30	200 ⁽¹⁾	Operational
Condong Cogeneration Plant	30	200 ⁽¹⁾	Operational
Hydro stations	0.57	1	Operational
Total Operational	8,540.57	23,851	
Colongra Gas Turbines	667	N/A	Under Construction
Bamarang Gas Turbine Project	400	N/A	Planning Approved
Marulan Gas Turbine Project	450	N/A	In Planning Approval

NOTE: ⁽¹⁾ – estimated using 80% capacity factor

It is recognised that the NSW Government has indicated its intention to include the Munmorah Rehabilitation Project as a Development Project which could be offered for sale as part of the NSW Energy Reform Strategy. Should this occur then it is proposed that the development approvals being sought would be transferred to the new project owner. In this regard the term Proponent has been included in this document to refer to Delta Electricity currently, or to the future project owner.

1.3 Project Location

Munmorah Power Station is located on the NSW Central Coast, approximately 150 km north of Sydney and 40 km south-west of Newcastle on land owned by Delta Electricity. It is also located adjacent to the coastal lagoons of Lake Munmorah and Lake Budgewoi, which form part of the Tuggerah Lakes system (Figure 1.1)

While the site is within the Wyong Shire Local Government Area (LGA), it is also near to the southern extent of Lake Macquarie LGA. The residential suburbs of Halekulani, Budgewoi, Buff Point, San Remo, Blue Haven, Doyalson and Lake Munmorah surround the site (Parsons Brinckerhoff, 2005) (Figure 1.2).

The Munmorah Power Station site comprises nearly 940 hectares, of which approximately 200 hectares is considered to be operational land consisting of the

power station site itself, the ash dam and associated infrastructure such as conveyors, canals, pipelines and storage areas. The remaining land considered undeveloped and comprises ‘buffer’ lands separating the surrounding residential areas from the power station. The site was subdivided to provide approximately 4.5 hectares for the development of the Colongra Gas Turbine Facility (Figure 1.2). Although the Colongra Gas Turbine facility is located within the existing power station site, it has a separate site boundary and operates under a separate Environmental Protection License (EPL).

Two decommissioned coal mines, Munmorah Colliery and Endeavour Colliery, are located adjacent the site. The Munmorah Colliery site is located immediately west of the power station and the Endeavour Colliery is located to the south-east of the site (Figure 1.2).

1.4 Munmorah Power Station

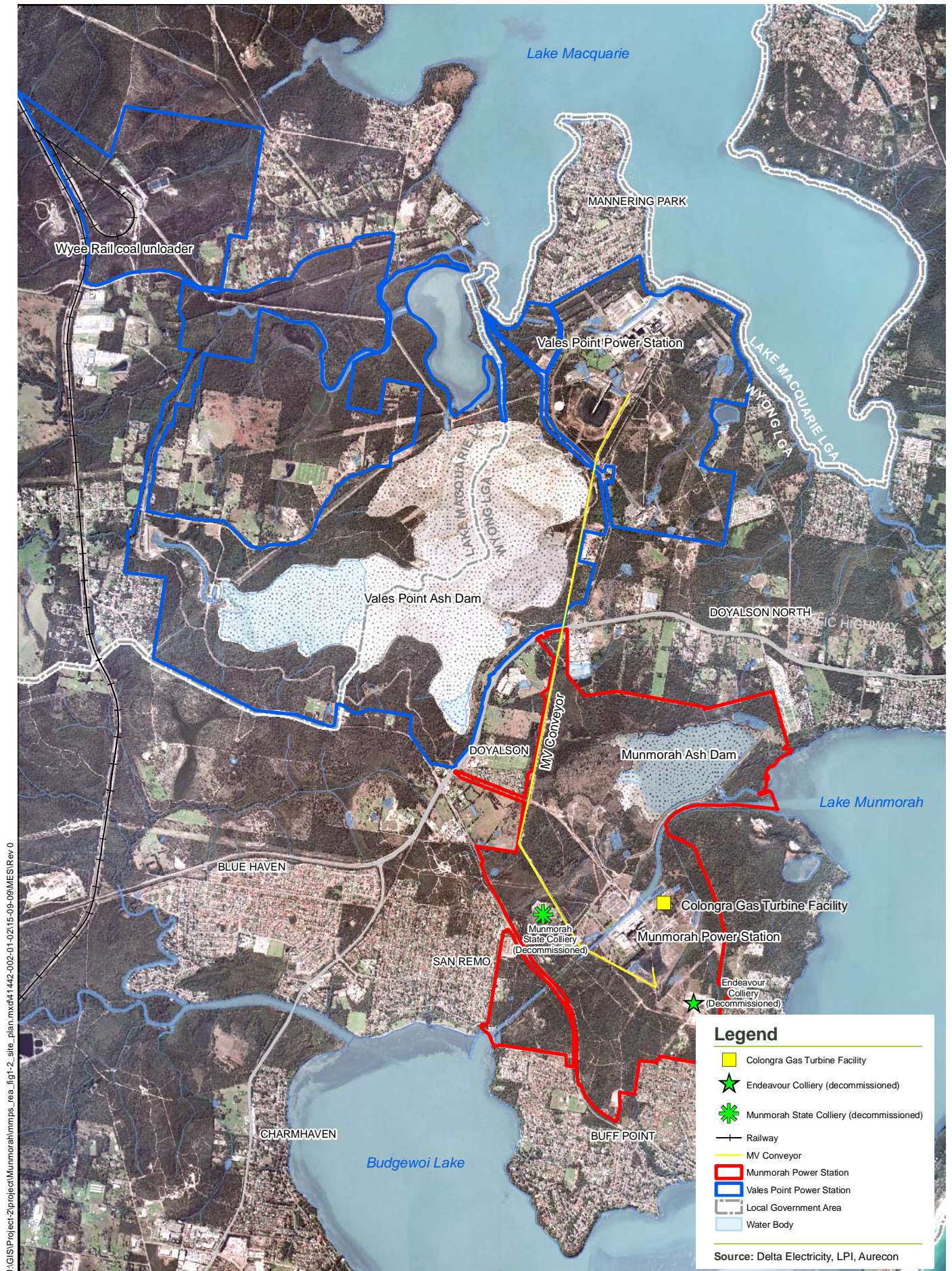
Figure 1.3 shows the layout and site plan for Munmorah Power Station

Munmorah Power Station was built as a result of a policy of relocating major power stations to the source of fuel to generate electricity at relatively low costs. The power station originally comprised four 350 MW generating units (1,400 MW total capacity) which were progressively commissioned between 1967 and 1969.

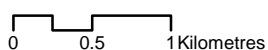


Munmorah Power Station **Rehabilitation Environmental Assessment**

FIGURE 1.1: Regional Locality Map



SCALE 1:48,000 @ A4



Projection: MGA

Munmorah Power Station **Rehabilitation Environmental Assessment**

FIGURE 1.2: Site Plan

While each unit attained 350 MW electrical output in the first few years of operation, the turbine heat rate required to achieve this was about 6% above design. All the units were down rated to 300 MW capability in 1984 and Units 1 and 2 were subsequently decommissioned in 1996. Units 3 and 4 were refurbished in 1989-1990 and have operated as intermediate plant with an average station capacity factor over the last 10 years of about 16%, usually with only one unit in service at a time (Worley Parsons, 2007).

Delta Electricity has ensured continuous improvement throughout life of the power station. This has included the installation of fabric filters in 1990/01, attemperation of cooling water, the implementation of noise mitigation measures, changes to the condenser cleaning process and recent minor plant refurbishment work.

Coal has been supplied by conveyor from two adjacent underground mines. The installation of the Wyee rail coal unloader in the 1980s facilitated the option for coal to be supplied from more distant sources. A conveyor system transports coal from the rail unloader to Munmorah Power Station. Coal can be delivered either into the station bunkers for immediate use, or to the coal storage area which can hold a reserve of up to 750,000 tonnes¹.

In 2006, extensive plant condition surveys were carried out on both units as part of the upgrade study. Capability testing of Unit 3, carried out in December 2006, indicated that the generation from the current plant, in its normal operating configuration, was limited to outputs of between 280 MW and 300 MW depending on fuel quality and ambient conditions.

1.4.1 Operation

Electricity is produced at Munmorah Power Station using pulverised coal-fired boilers and steam-driven turbo-generators. Figure 1.4 shows a schematic of the power station. The power station operations are further described in the following sections.

A conveyor delivers coal from the coal stockpile to coalbunkers inside the power station. Coal from the bunkers is fed to the pulverising mills (five mills per unit) where the coal is pulverised to increase the rate of combustion. After pulverising, the coal is blown into the boiler with a stream of preheated air.

The boilers are tangentially fired, down draught, radiant reheat, single-furnace, single-drum with

control assisted circulation. Here the coal is combusted and temperatures of ~1400°C are reached. The hot gases and radiant heat energy resulting from the combustion process convert the water in the boiler tubes into high pressure steam (16.5 MPa at 565°C) which has a flow rate of 309 kg/sec.

The turbines are four cylinder (high, intermediate and low pressure), tandem impulse reaction type, using reheat. The high pressure steam is injected into the turbine, which contains a shaft with a large number of blades. As the steam enters the turbine it expands, hits the blades and causes the shaft to rotate at high speed (3,000 rpm). For maximum efficiency, the steam is reheated in the boiler after its energy is partially spent in driving the high pressure cylinder in the turbine. Once reheated, the steam is reinjected into the intermediate pressure cylinder and as the heat and pressure dissipates, the steam passes into the twin double-flow low-pressure cylinders. The high pressure cylinder contains the smallest blades, while the low pressure cylinders contain the largest blades.

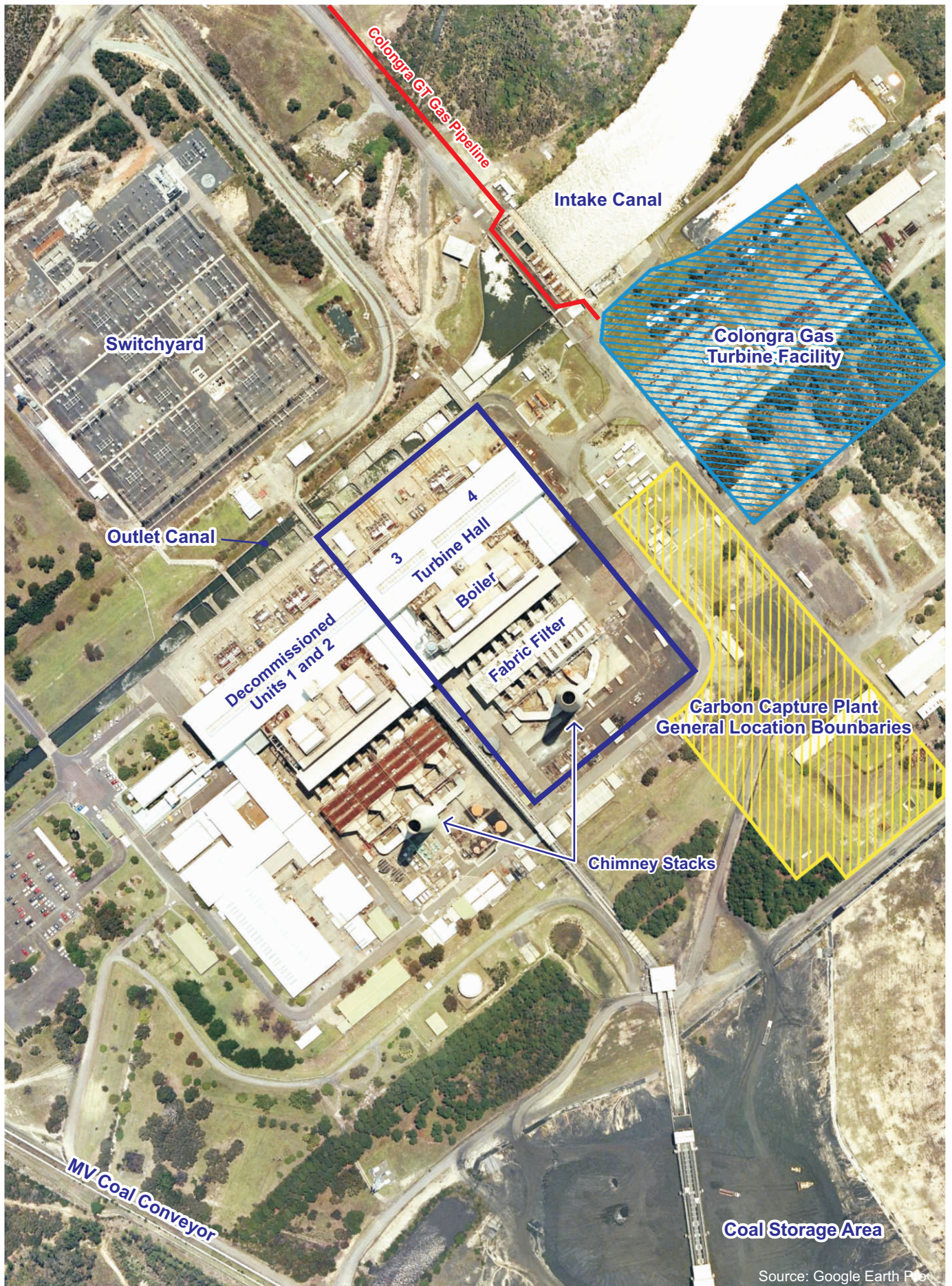
The generator has two main sections, the rotor, which is coupled to the turbine shaft and the stator, which is a series of coils grouped cylindrically in the stationary shell around the rotor. The rotor, which is an electro-magnet, rotates at high speed generating electricity (alternating current) in the stator. Each turbo-generator is approximately 41 m long and weighs 1,200 t.

The output of each of Munmorah's generators is fed into a 330 kV switchyard via step-up transformers. Here the electricity is fed into three 330 kV transmission lines. Two transmission lines supply electricity to Sydney and the other provides an interconnector with Vales Point Power Station.

Cooling water is required to convert spent steam from the turbines back into water for reuse in the boilers. The cooling water system is described in more detail in Section 1.4.2.

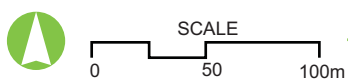
Fresh water for boiler purposes and general station usage is supplied from Wyong Shire Council.

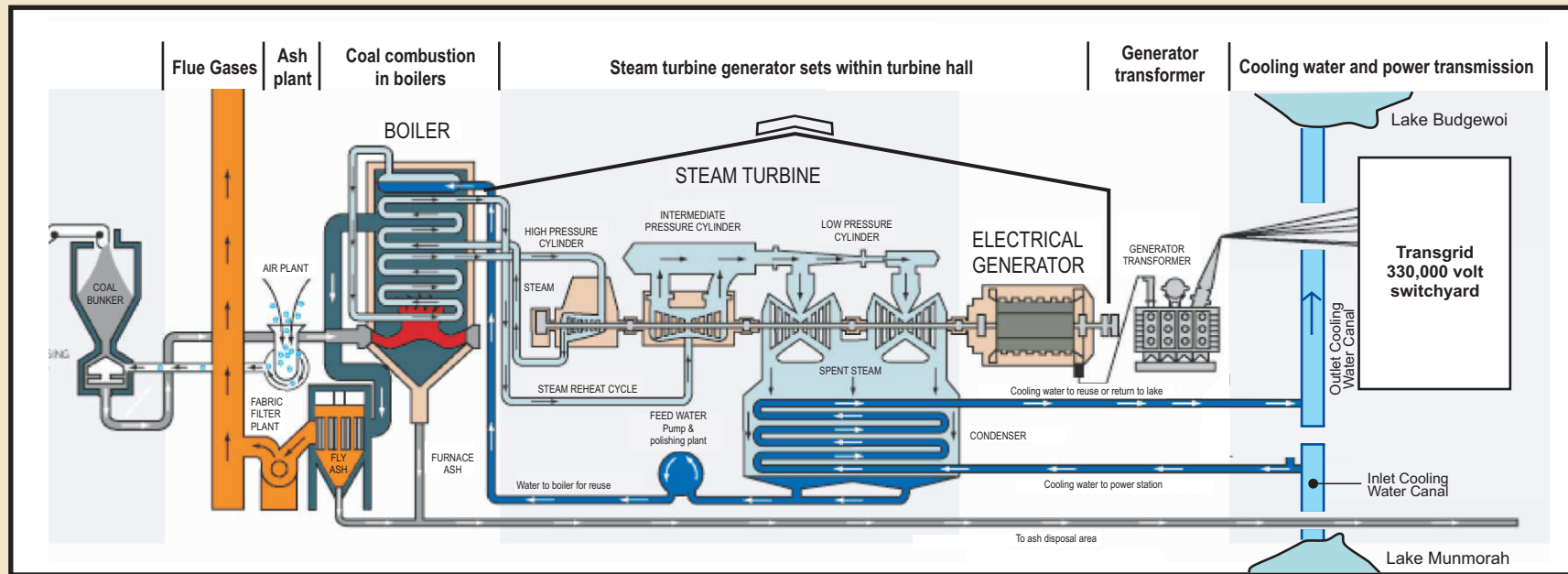
¹ <http://www.de.com.au>



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Source: Google Earth Pro





External view of turbine hall



Inside turbine hall units 3 and 4



Generator transformer outside turbine hall

Flue gases resulting from the combustion process are comprised of gaseous emissions (ie predominately nitrogen (N₂), carbon dioxide (CO₂), sulphur dioxide (SO₂), oxides of nitrogen (NO_x) etc) and particulates (fly ash). The flue gas passes through fabric filters (which remove ~99.9% of the fly ash) before discharging to the atmosphere via a stack 150 m in height. The fly ash is stored in hoppers before being flushed to the dust pit and then slurried to the Vales Point Ash Dam. The coarser furnace ash recovered from the boiler is crushed, stored in ash pits before being slurried to the Munmorah Ash Dam.

Flue gases are monitored in accordance with NSW EPA Licence conditions. Equipment for monitoring NO_x, SO₂, particulates and temperature provides information on the condition of the stack gases. Monitoring results are reported to the EPA each year.

1.4.2 Cooling water system

Cooling water passes through each unit's condenser where reject heat is transferred from the condenser to the cooling water. When the unit is at full output the design flow rate is about 13,500 l/s. The Munmorah cooling water system uses salt water drawn from Lake Munmorah through an inlet canal some 1.8 km long. After being used in the power station, the water is discharged via an outlet canal into Lake Budgewoi.

Screening system

A screening system is located on the inlet canal, to prevent debris and marine organism from entering the cooling system and the generating units. This system comprises trash tracks (initial screen for large debris items) and seven rotating drums.

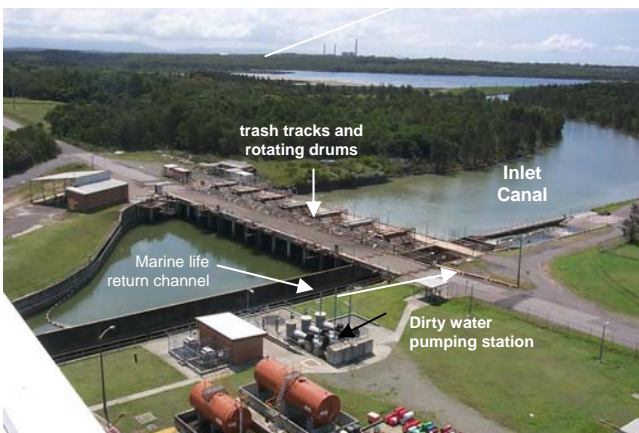


Plate 1.1 – Inlet canal with trash tracks and rotating drums

The trash tracks consist of vertical bars to divert large pieces of debris (eg driftwood, tree branches) and prevent large fish from entering the rotating drum

screening system. The water then passes through the rotating drum screens with a screening mesh of 10 mm to divert material that pass through the trash racks (ie fish, prawns and jellyfish, floating weed) from the cooling water before it enters the condensers. Screened marine life is flushed, with additional water from the intake canal, to the lake system via a channel to the outlet canal (Plate 1.1)

Condensers

Spent steam from the turbines is passed through the condensers, which consists of an array of tubes through which the cooling water is circulated. Here reject heat is transferred from the spent steam to the cooling water, resulting in the spent steam being converted back into water for reuse in the boilers

Cooling water for the condenser is drawn in from below the water level of the inlet canal. As the cooling water passes through the condenser, heat transfer results in a temperature increase of up to 10°C. The temperature increase is dependent on the temperature of the cooling water and the electricity load. Under all operating conditions, the cooling water outlet temperatures are within the DECCW licence (35°C to 37°C) limit. During warmer than average summer days condenser outlet temperatures can exceed the 35°C, but during times like this additional cooling water is provided through the attemperating pumps to bring the temperature back to within the limits prior to discharge to the Lake Budgewoi.

The main cooling pumps are capable of pumping up to 2,350 ML/day while the attemperation pumps, used during high temperature water conditions, have a capacity of up to 1,175 ML/day.

Outlet canal

The heated condenser water is discharged into the outlet canal. If required, mixing of the attemperated water occurs also occurs in the outlet canal. Antifoaming sprays are used to prevent excessive foaming as a result of the increased turbulence and a screen is used to prevent the foam from floating towards the outlet.

Prior to discharging to Lake Budgewoi, the cooling water passes through two oil skimmers and filters which remove pollutants collected on the water surface (Plate 1.2).



Plate 1.2 – Oil skimmer on outlet canal

The skimmed water is pumped to a settling pond before being discharged back into the outlet canal or into Lake Budgewoi.

1.5 Overview of the Proposed Rehabilitation

In the absence of significant rehabilitation the remaining generating units at Munmorah Power Station would not be suitable to continue to produce electricity. Options to improve the performance of Units 3 and 4 at Munmorah Power Station were investigated by Worley Parsons in 2007. The scenarios were defined by Unit output, projected plant life and plant reliability. The study concluded that returning the units back to the original design rating of 350 MW output for up to 20 years extended life at high reliability is the preferred option. This option, the subject of this Proposal, was subsequently adopted by Delta Electricity.

Dual fuel operations (firing on coal or gas or combinations thereof) were not part of the original Worley Parsons investigation. Recognising the environmental benefits of gas as a fuel source, Delta Electricity commissioned Aurecon to investigate the feasibility of dual fuel firing at Munmorah Power Station (Appendix C). This study also included a preliminary investigation into the requirements for making Munmorah carbon capture ready (Appendix D). These options are included in the proposed works listed below.

The proposed rehabilitation does not involve any significant changes to the current layout of the site and the majority of the works would occur within the existing plant layout of the power station.

The proposed works include the following.

1.5.1 Steam turbine components

The rehabilitation works would include an upgrade of Units 3 and 4 steam turbine components including the replacement of the HP and IP turbine rotors, replacement of HP and IP inner and possibly outer casings, replacement of blades/diaphragms in the LP turbines and replacement of steam valves/chests replacement (including loop pipes). The rehabilitation works are described in detail in Section 3.4.2.

1.5.2 Boiler components

Refurbishment of major boiler components would include refurbishment or upgrading of mills, replacement of primary air fans, PF system pipework and furnace tubes. The full list of rehabilitation works included in Section 3.4.3.

1.5.3 MV Conveyor

The current MV coal conveyor has insufficient capacity to supply coal for two units at 350 MW and 80% capacity factor and would require an upgrade above its current 350 t/h rating. The conveyor would be upgraded to an overall capacity of 1,600 t/hour and would be constructed within the existing 10 m fenced corridor. See Section 3.4.5 for more details.

1.5.4 Other refurbishment works

Other refurbishment works would include:

- replacement of instrumentation and control system
- provision for installation of carbon capture capability when technically and economically viable
- provision for coal and gas firing options
- upgrade of the following:
 - condenser air extraction silencer
 - circulating water system debris filter and ball cleaning system
 - feed pumps
 - air heater
 - economiser
- replacement of cooling water system arrangement for auxiliary plant
- rehabilitation of attemperation pumps
- removal of obsolete plant

- other minor upgrades to related ancillary plant and equipments.

The proposed works are described in more detail in Chapter 3.

1.6 Structure and Content of this Environmental Assessment

The content of this Environmental Assessment is largely determined by

- specific assessment requirements of the Director-General of NSW Department of Planning (Appendix A)
- relevant environmental impact assessment guidelines from key regulatory bodies (Departments of Planning, Environment and Climate Change, Primary Industries etc).

To satisfy the assessment requirements, various technical and environmental issues have been investigated by appropriate specialists. The reports resulting from these investigations form appendices to the Environmental Assessment. These investigations have been summarised in the main body of the Environmental Assessment, the aim of which is to

clearly state the potential impacts resulting from the rehabilitation and any safeguards or mitigation measures that need to be implemented.

The Environmental Assessment is intended to assist the reader to gauge the potential impacts of the Proposal. Specific key environmental issues are addressed generally in the following format:

- introduction to the specific issue in relation to the proposal
- description of assessment methodology
- existing character of the environment
- potential impacts relative to specific key issue
- measures proposed to mitigate the impacts
- conclusion

The Environmental Assessment describes the Proposal to the extent possible at this stage of planning and which can be clearly understood by the community while providing supporting studies for those that require more detail.

The table below summarises the matters covered by this Environmental Assessment

Table 1.2 – Overview of the Environmental Assessment chapters

Chapter	Description
2	Strategic justification and alternatives considered
3	Detailed description of the Proposal activities and stages and an outline of the proposed management of those activities
4	Outlines the planning context for the development and consultation involved
5	Outlines the identification of key environmental issues and the consultation process
6 to 12	Provides a review of relevant environmental issues, setting out the existing environment, potential environmental impacts, proposed mitigation measures and environmental risks and hazards and cumulative impacts
13	Proposal justification
14	Statement of Commitments
15	Reference list
Appendices	
A	Director-Generals Requirements
B	Community consultation documentation
C	Technical investigations for gas firing
D	Technical investigations for carbon capture readiness
E	Air Quality Assessment Air quality results for proposed coal sulphur option
F	Cooling water plume modelling
G	Hazard and Risk Assessment
H	Noise and Vibration Assessment

1.7 Contact Details for Further Information

For further enquiries regarding the Development Application process or the Proposal:

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