Mt Piper Power Station Extension

ENVIRONMENTAL ASSESSMENT

CHAPTER 14 – ASSESSMENT OF OTHER ISSUES

- September 2009

Contents

14. Assessment of Other Issues

The Director-General's requirements:

Notwithstanding the key assessment requirements, the Environmental Assessment must include an environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of the additional key environmental impact(s) must be included in the Environmental Assessment.

14.1 General Environmental Risk Analysis

14.1.1 Overview

The Director-General of the Department of Planning requires Delta Electricity to prepare an environmental risk analysis to identify potential environmental issues associated with the construction and operation of the Mt Piper Power Station Extension.

The process began at the Project Application and Preliminary Environmental Assessment phase, and was further developed in the Environmental Assessment phase. The risk analysis process was used to scope the environmental investigations and guide project design.

Risk analysis enabled the Environmental Assessment to:

- Target those issues identified as key issues in the Preliminary Environmental Assessment. This took into account the significance of the potential environmental impacts and the effectiveness of the proposed management measures in minimising degradation or deterioration of the biophysical or social environment;
- Identify those potential impacts that are not key issues, including those that would be expected to respond well to appropriate mitigation measures and management;
- Identify residual impacts likely to remain after the application of the mitigation measures. Where significant residual impacts remain, this may require greater commitment to management strategies to mitigate the effect or, in some instances, a re-scope of the design at that location.

Identification of Key Issues

The Preliminary Environmental Assessment identified the issues considered to be the key issues pertaining to the proposed Mt Piper Power Station Extension, and these were used as the basis for the key issues in the Director-General's requirements (DGRs) for the project.

The DGRs identified the following key issues for consideration and assessment:

- Greenhouse gases;
- Air quality impacts;
- Water cycle management;
- Noise impacts;
- Ecological impacts;
- Heritage impacts;
- Visual impacts;
- Hazards and risk impacts; and
- Waste management.

These key issues have been the focus of the Environmental Assessment for the project.

14.1.2 Risk Analysis Methodology

The environmental risk analysis was undertaken in accordance with the principles of the Australian and New Zealand standard AS/NZS 4360:2004 – Risk Management. It involved:

- Ranking the risk of each identified potential impact by identifying the consequences of the impact and the likelihood of each impact occurring; and
- Considering the probable effectiveness of the proposed mitigation measures to determine the likely residual risk of each impact.

The first step involved an identification of the consequence levels, should an impact occur. The levels are defined in **Table 14-1**.

Table 14-1 Risk analysis consequence definitions

Consequence Level	Definition
Catastrophic	Would result in a major prosecution under relevant environmental legislation. Would cause long-term and irreversible impacts.
Major	Would result in a fine or equivalent under relevant environmental legislation. Would cause medium-term, potentially irreversible impacts.
Moderate	Would result in medium-term, reversible impacts.
Minor	Would result in short-term, reversible impacts.
Insignificant	Would result in minor, negligible impacts.

The next step involved a definition of the risk rating categories. This was done by considering the frequency of activities that may cause the impact and the probability (or likelihood) of the impact occurring during that activity. The level of likelihood was classed as:

- Very likely –the event is almost certain to occur in the course of normal or abnormal operating circumstances;
- Likely –the event is likely to occur in the course of normal operations;
- Unlikely – the event could occur in the course of normal or abnormal operating circumstances; and
- Very unlikely – the event may occur in exceptional circumstance only.

The risk rating categories determined through the analysis are summarised in **Table 14-2**.

Table 14-2 Risk rating categories

Risk rating score	Risk category	General description
1, 2 or 3	High	Detailed assessment and planning are necessary to develop appropriate measures to mitigate and manage the potential impacts.
4 or 5	Medium	Potential impacts can be mitigated through the application of relatively standard environmental management measures.
6	Low	Potential impacts either require no specific management measures or are mitigated adequately through other working controls (such as detailed design requirements, normal working practice, quality and safety controls).

The risk rating category of each potential impact was then determined by combining the consequence and likelihood according to the matrix in **Table 14-3**.

Table 14-3 Risk matrix

		Likelihood			
		Very likely	Likely	Unlikely	Very unlikely
Consequence	Catastrophic	1	1	2	3
	Major	1	2	3	4
	Moderate	2	3	4	5
	Minor	3	4	5	6
	Insignificant	4	5	6	6

As shown in **Table 14-3**, impacts were alotted a risk rating score of between one and six. One represents an impact with major to catastrophic consequences and likely to very likely to occur; six represents an impact with minor to insignificant consequences and unlikely to very unlikely to occur.

The potential effectiveness of the mitigation measures proposed was assessed and the degree of effectiveness of the mitigation measures was classed as:

- Very effective – the measure would increase the risk rating score by three points – for example, from three (high) to six (low).
- Effective – the measure would increase the risk rating score by two points – for example, from two (high) to four (medium).
- Partly effective – the measure would increase the risk rating score by one point – for example, from three (high) to four (medium).
- Not effective – the measure would not change the risk rating.

14.1.3 Environmental Risk Analysis

The environmental risk analysis was based on investigations and a review of the issues during the preparation of the Environmental Assessment, and knowledge from other major generation projects. The analysis also considered the input from various government agencies and other stakeholders during the consultation process. The analysis specifically considered the mitigation and management measures developed and put forward in the assessment chapters (Chapters 5 to 14) of this Environmental Assessment report as well as the principles for ecologically sustainable development. The results of the environmental risk analysis are presented in **Table 14-4**.

▪ Table 14-4 Environmental risk assessment results

Environmental issues									
Aspects	**Potential adverse impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Effectiveness**	**Factor**	**Residual risk rating**
Ecology	▪ Effects on threatened species and EECs. ▪ Effects on conservation areas	Major	Unlikely	3	Chap 6	Very effective	4	Medium
Greenhouse gas	▪ Substantial contribution to GHG levels in atmosphere	Major	Very likely	1	Chap 10	Partly effective	1	High
Heritage	▪ Effects on known or possible PADs) indigenous sites	Major	Very unlikely	4	Chap 7	Effective	5	Medium
Noise	▪ Effects on sensitive receivers (residential)	Moderate	Likely	3	Chap 8	Effective	4	Medium
Water cycle management	▪ Effects on surface receiving waters ▪ Effects on groundwater ▪ Effects on water sources ▪ Effecst on drinking water catchment	Major	Likely	2	Chap 5	Effective	4	Medium
Air quality	▪ Exceeding health criteria ▪ Interregional transport of smog components	Major	Likely	2	Chap 9	Effective	4	Medium
Visual	▪ Visual impacts on sensitive receivers (residential)	Moderate	Likely	3	Chap 11	Effective	2	Medium
Hazards and risk	▪ Risks associated with dangerous goods or gas on site ▪ Effects on aviation safety	Major	Unlikely	3	Chap 12	Effective	4	Medium
Waste management	▪ Discharge of solid and liquid wastes to the environment	Minor	Llikely	4	Chap 13	Effective	5	Medium

Environmental issues								
Aspects	**Potential adverse impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Effectiveness**	**Factor**	**Residual risk rating**
Economic and social issues	▪ Housing availability ▪ Social effects on existing community	Moderate	Likely	3	Chap 14	Effective	5	Medium
Land use implications	▪ Change in land use ▪ Effects on neighbourhood or potential development	Insignificant	Unlikely	6	-	-	6	Low
Traffic and transport	▪ Effects on road network performance	Moderate	Unlikely	4	Chap 14	Effective	5	Medium
Geology and Soils	▪ Subsidence ▪ Runoff	Moderate	Unlikely	4	Chap 14	Effective	5	Medium

14.1.4 Conclusions

The environmental risk assessment has identified the following key issue that would present a high level of residual risk:

- Greenhouse gas emissions.

The identification of this environmental aspect that is likely to have significant impacts despite the application of mitigation and management measures identified within each respective chapter, suggest that more detailed management strategies should be developed to appropriately address the impacts to meet an acceptable level. The uncertainty associated with the lack of commercial availability of carbon capture and storage and the uncertainty of the future of a CPRS result in a high residual risk associated with this.

Other issues that would have a medium residual risk include:

- Air quality impacts;
- Water cycle management;
- Noise impacts;
- Ecological impacts;
- Heritage impacts;
- Visual impacts;
- Hazards and risks; and
- Waste management.

The level of assessment undertaken for these issues has determined the likely extent of impacts and recommended appropriate mitigation/management required to ensure that the risk is abated.

Finally, the other environmental issues for the project which had a medium residual effects were:

- Soico-economic effects;
- Geology and soils;
- Traffic and transport.

Although these issues can be routinely managed through the implementation of standard management and mitigation measures, futher assessment was undertaken. This assessment is described in the following sections.

14.2 Socio-Economic

14.2.1 Methodology

Social impacts are commonly defined as "*events experienced by people as positive and negative changes in:*

- *Their way of life - the way people live, work, play and relate to one another, organise to meet their needs and generally participate as members of society;*
- *Their culture - beliefs, customs and values;*
- *Their community - its cohesion, character, services and facilities*" (Armour, 1992).

The assessment of social impacts is best undertaken in the project development stage where it can help:

- Promote the quality of life of individuals and communities now and in the future;
- Contribute to the efficient and cost effective use of resources in Government project planning and delivery; and
- Contribute to improved management of project planning and decision making processes.

In evaluating social impacts, it is important to recognise the multiplicity of individuals and groups within the affected population and the range of possible effects across these individuals and groups. The social impact assessment is particularly concerned with the equity of impacts, that is, the nature and distribution of potential impacts, especially with regard to the more vulnerable groups in society.

A social impact assessment is typically conducted as a five step assessment process:

- Step 1 – Community profiling, including demographic characteristics of the study area and identification of key stakeholders;
- Step 2 – Scoping of issues;
- Step 3 – Identify the likely social impacts of the project and its alternatives;
- Step 4 – Estimate and evaluate significance of social impacts according to:
  - Extent, significance and timeframe of potential impacts (including uncertainties)
  - Stakeholder group(s) affected
  - Feasibility of successful mitigation measures; and
- Step 5 – Consider identified social impacts and opportunities to mitigate negative impacts.

A range of information sources have been reviewed in the preparation of this social impact assessment to determine potential issues of concern during both the construction and operational stages of the project. These include:

- 2001 and 2006 Australian Bureau of Statistics Census data;

- The Mt Piper Construction Management Study (Connell Wagner, 2008b);
- Lithgow Social Plan 2006-2011, Lithgow City Council (2008); and
- Feedback from the annual community survey conducted by the Western Research Institute on behalf of Delta Electricity (2002-2005).

14.2.2 Community Profile

The community and business profile has been described with a view to identifying potential community issues and the structure of the community. This demographic and statistical data has been supplemented with qualitative information about community attitudes and social concerns.

Community, Business and Employment Profile

The Mt Piper Power Station is located in the Greater Lithgow local government area (LGA). The population in the Greater Lithgow area in 2006 was 19,399 (ABS, 2006), compared with 19,197 in 2001, 19,248 in 1996 and 20,253 in 1991 (ABS, 2001). Despite the 5.2% reduction in population between 1991 and 2001, the slight growth in 2006 indicates the decline in population may have been arrested.

The population in the area is predominantly Australian-born, with only about 8% of respondents in indicating they were born overseas. Of those born overseas, the main countries of birth were the United Kingdom, New Zealand, Germany and the Netherlands.

The indigenous population comprises about 3% of the Greater Lithgow population. About 92% of the population in the Greater Lithgow area indicated English was the only language spoken at home.

Table 14-55 provides the demographic age profile for the Greater Lithgow LGA.

- **Table 14-5 Age Profiles**

Age Group	Number of People	Percentage
0-14	4246	22.1
15-24	2341	12.2
25-44	5372	28.0
45-64	4765	24.9
65+	2448	12.8
Total	**19172**	**100**

The majority of residents in the area live in privately owned homes, with about 22% of the population in rental accommodation. High levels of home-ownership often indicate a very stable community.

According to the 2006 census data the unemployment rate in the Lithgow area was 8.5%, which was significantly higher than the national average at that time of 5.2%. The main employment industries in the Greater Lithgow LGA are presented in **Table 14-6**. Over time there has been a general decline in employment within the manufacturing industry and the construction industry, whereas there has been increased employment within the retail trade, health and community services and education.

- **Table 14-6 Industries of Employment**

Industry	Number of People Employed in the Greater Lithgow LGA	% of People Employed in the Greater Lithgow LGA
Construction	462	7.1
Education	461	7.1
Mining	775	11.9
Health and community services	749	11.5
Manufacturing	621	9.5
Accommodation and food services	650	10
Retail	866	13.3

Source: ABS, 2006

Community Services and Facilities

There are a range of community services within the Lithgow LGA which provide assistance and support to people with disabilities, senior citizens and other groups in the community. There are also numerous schools, churches, libraries, child care centres and other facilities located in the Lithgow LGA.

Public transport services within the Lithgow LGA are provided by a local bus operator, Jonas Bros Buses, which operates between Portland and Lithgow. The Lithgow Community Transport (Translinc) Inc provides a specialist service for frail aged and disabled people of the Lithgow Community who require transport to doctors, hospitals, dentists etc. The Blue Mountains train line connects Lithgow station to the suburban train network.

There are a number of scattered parks, lakes and dams in the Lithgow LGA, which are used for recreational activities such as picnicking, sailing, swimming and fishing. There are also numerous sporting facilities such as the Lithgow Athletics Club, sports stadium, showground, soccer fields, sporting ovals, tennis courts, bowling clubs, pool and golf course. Lithgow City Council aims to undertake an audit of all existing recreation facilities in the Lithgow LGA to identify the need for new recreation facilities and the need for upgrading of existing facilities.

14.2.3 Scoping of Issues

Attitudes and Values

Delta Electricity has developed a community relations program to inform to the community of Delta's operational activities and to develop avenues for community feedback. The following consultation activities are undertaken to provide a link between Delta and the community:

- Annual community survey;
- Bi-annual community stakeholder forums;
- Consultation with key community stakeholders such as local council;
- Sponsorship of local organisations;
- Interaction with the media to provide information about operational and community activities;
- Publication of reports eg. annual reports and state of the environment reports;
- Provision of work experience opportunities;
- Provision of the Energy Expo at Mt Piper Power Station; and
- Provision of daily tours of the power station.

Each year, Delta Electricity commissions an independent survey to evaluate the community's perception of Delta's operational impact and community relations program. The Western Research Institute conducted the most recent survey of Delta's Western Region, which encompasses the Mt Piper and Wallerawang Power Stations, in May and June 2005. A total of 310 surveys were completed. The results from this survey are summarised below:

- The majority of respondents (91%) had heard of Delta Electricity, of which 61% felt positively towards Delta Electricity;
- 46% of respondents could identify electricity generation as Delta's main activity and a further 20% identified Delta as being generally involved in electricity. In 2004, only 37% of respondents named electricity generation as Delta's main activity;
- The main sources of information about Delta Electricity are newspapers (21%) and direct contact with the company (15%). In 2004, direct contact with the company was the most common response (22%), followed closely by newspapers (20%);
- Recall of Delta's community support has risen from 59% in 2004 to 64% in 2005. The most commonly recalled sponsorships were for sporting teams and events;
- 47% of respondents expressed concern about waterway issues relating to drought, low water levels, water pollution etc. 5% were specifically concerned about the closure of Lake Lyell Dam.

- 82% of respondents indicated they have no concerns about Delta's operations in the area (a decrease from 89% in 2004). Of those who expressed concern, stack emissions, water usage and water pollution were the most frequently expressed concerns;
- 61% of respondents indicated they were either very or moderately concerned about environmental issues in the local area. The most frequently expressed concerns were air pollution (37%) and water pollution (27%);
- River health, waste processing programs and the rehabilitation and maintenance of creeks and dams were rated as being the top three environmental issues that Delta should be involved with.

The key issues arising from these surveys that were identified by the Western Research Institute (2005) are:

1) Attitude towards Delta Electricity – general recognition of Delta Electricity remained similar to last year. However, the overall perception of Delta with respect to their interaction with and importance to the community was more positive in 2005 than 2004. This growth may be attributed to greater media coverage of Delta's activities and sponsorships;
2) Drought – the community's concern about water related issues such as water usage, water pollution and river health was evident in their responses. Hence, it is important that Delta is seen to be using water efficiently and not causing detriment to river health;
3) Migration – residents who have lived in Lithgow for less than five years tend to have a lower level of recognition and feel less favourably towards Delta Electricity. Given the relatively high levels of population migration to Lithgow, it is important that Delta interacts with new residents;
4) Youth – 18-24 year olds feel the least favourably towards Delta Electricity. Hence, Delta may need to identify opportunities to interact with people in this age group.

14.2.4 Impacts during Construction

Employment

An important social and economic benefit of the construction stage of the proposed Mt Piper Power Station Extension is employment generation. Construction is expected to take 4-5 years to complete. It is estimated that the peak workforce of about 950 people would occur for a period of up to 10 months during the construction period.

Where practicable, construction materials would be sourced from the local area, thereby providing economic benefits to local businesses. These would include accommodation providers, food and general supplies, service stations, engagement of local contractors and purchase of supplies from local outlets.

Community

It is anticipated that a number of people in the local area would be employed during the construction of the proposed extension of the Mt Piper Power Station. Previous projects employed approximately 20% of the required construction workforce from the local community. This would mean there would be an influx of about 750 people from outside the Central West region during the peak construction period, representing a 4% increase in the local population.

This may result in some additional economic and social opportunity available to community the community through increased recreational club numbers. There would also be an increase in the use of existing health services for the 750 employees and some small increase in requirements for child care and education facilities, although the relatively low numbers of families expected would mean these latter demands would be minor.

Land Use and Property Effects

Site compounds and all construction activities would be undertaken within the Mt Piper site boundary and land use effects from this would be negligible. The increase of 750 people in the population may result effects on the rental market should a significant number of these seek rental accommodation. As the majority of the incoming construction staff would be single men and women, there may be an opportunity to provide one or two hostels for the construction staff and active encouragement of their use. These would be constructed off-site, and would require Council approvals.

Access and Movement

Deliveries of equipment and materials to the site would occur throughout the construction period. The worst-case would occur during the peak construction period when approximately 40 return trips per day may result. Vehicle movements would be spread throughout the day.

The movement of construction staff would be concentrated around 6-7am and 2-3pm. Traffic associated with the average number of construction staff would have only a small impact on average and worst delays at the intersection and intersection operation would remain at an acceptable level. However, during the peak construction period, the number of staff would be doubled, and the impact on intersection operation would be greater, particularly in the afternoon. The impact of construction traffic could be mitigated by staggering shifts to avoid the concentration of staff movement in the early afternoon. The Construction Environmental Management Plan (CEMP) and Traffic Management Plans would ensure that all construction traffic utilise existing arterial roads and all construction and employee vehicles park on the site.

Lifestyle and Character

Construction activities can potentially affect the character and amenity of an area. Residents who live adjacent to the main arterial roads such as the Castlereagh Highway may be affected by construction traffic, although these impacts are not expected to be significant. Due to the topography and vegetation surrounding the Mt Piper Power Station site and the distance to sensitive receptors, the visual and noise impacts are not expected to be significant.

Health and Psychological Effect

Construction activities would be undertaken within the designated construction hours, which are expected to be Monday to Friday 7am – 6pm and Saturday 8am – 1pm, and as a result, sleep disturbance is not likely to occur. Providing additional dust control measures are implemented during construction, no significant air quality impacts are expected from dust deposition.

Increased traffic in the local area, disturbance to current lifestyle and perceived risks associated with the construction stage, have the potential to cause stress or anxiety to some individuals. In order to minimise these potential impacts Delta would utilise its existing community relations program to keep the community informed about the project.

14.2.5 Impacts during Operation

Community

During site operation there would be a number of workers visiting the site, with most employees likely to commute from their usual place of residence. Hence, the impacts associated with community stability and population dynamics are considered to be minimal.

Employment

The operation of the new plant would require a further 50 employees, of whom 40 would be permanent employees and 10 would be contractors.

Land Use and Property Effects

The proposed extension would be constructed within the existing site boundary and therefore, no property acquisition would be required. Due to the surrounding topography, vegetation cover and land uses, no significant adverse land use or property impacts are anticipated.

The extended capacity of the Mt Piper Power Station would encourage new facilities to become established in the local area.

Access and Movement

It has been assumed that coal for the proposed coal option would be delivered via the private haulage road, by conveyor from nearby collieries or by overland conveyor from a new rail facility rather than trucked via public roads. Hence, the main traffic impact resulting from the operation of the extended facility would arise from the movement of additional staff. The largest increase in staff movement would occur around 6am, with up to 21 additional staff movements (assuming a car occupancy rate of one, given the relative isolation of the site and the hours of work for most employees). Across an average day, there would be an additional 62 staff movements. The effects of this extra traffic on the operation of the Castlereagh Highway / Boulder Road intersection have been assessed, showing there is no expected reduction in Level of Service and only a very minor increase in average delays on the right turn movements. Furthermore, the additional staff traffic would have an insignificant effect on the volume / capacity ratio of both the Castlereagh Highway and Boulder Road. Therefore, no significant impacts on access and movement are anticipated.

Lifestyle and Character

Noise from site operations could potentially affect the residential areas surrounding the site. However, noise modelling has shown that predicted noise levels would be within the project criteria under normal meteorological conditions. There is a potential to exceed slightly project criteria during temperature inversions.

Health and Psychological Effect

The proposed extension of the Mt Piper Power Station would not affect air quality in the area and consequently, the health of residents in the local area.

Due to the constant nature of noise emissions from the power station, it is not anticipated that sleep disturbance would occur.

A preliminary hazard analysis was undertaken to identify the hazards that may be associated with the operation of the Mt Piper Power Station. The analysis concluded there is a potential risk for injury impact resulting from the postulated chlorine releases at the power station. This risk was estimated to be below the risk criteria. The installed safeguards at the power station are considered adequate and within the “as low as reasonably practicable” (ALARP) range.

Stress and anxiety associated with perceived risks would be reduced through the provision of ongoing information about the power station, its operations and the management measures employed to minimise risks. This information would be provided through Delta’s existing community relations program.

Equity Issues

The electricity generated by the Mt Piper Power Station Extension would be distributed across New South Wales via TransGrid’s network of high voltage transmission lines and no particular sector of the community would either benefit or be disadvantaged.

14.2.6 Evaluation of the Significance of Impacts

During construction, the potential for adverse impacts would primarily be associated with increased numbers of workers in the area placing an increased demand on services within the area. A well defined plan for the provision of services to the increased population would be required to be in place before construction begins.

There is also the potential for construction traffic and activities which generate noise and/or dust. These impacts would be managed in accordance with the mitigation measures presented in this EA and the Construction Environmental Management Plan. Due to the distance between the construction site and sensitive receptors, the potential impacts are not considered to be significant.

During operation, the potential adverse impacts predominantly relate to air quality, noise and the visual environment. These impacts would be managed in accordance with the mitigation measures presented in this EA and the Operational Environmental Management Plan. Due to the surrounding topography, vegetation and the distance between the power station and sensitive receptors, the potential impacts are not considered to be significant.

The potential adverse impacts associated with the proposal are considered to be outweighed by the benefits associated with new plant such as the increased power generating capacity and the creation of jobs and associated economic benefits during construction and operation.

14.2.7 Conclusions

The safeguards and mitigation measures identified in this EA would ensure that many of the potentially adverse social impacts are minimised as far as practicable. The community would also be kept informed about the project to ensure they are aware of any upcoming works and the potential impacts which may occur, particularly during the construction period.

Mitigation measures would include:

- Construction
  - Provision of plans for services to the community;
  - Staggering shifts during construction to minimise the traffic impacts;
  - Implementation of recommended air quality controls;
  - Implementation of recommended noise controls; and
  - Liaison with the community to keep them informed about the construction works and schedule through the existing community relations program.
- Operation
  - Implementation of recommended air quality controls;

- Implementation of recommended noise controls;
- Liaison with the community to keep them informed about the site operation through the existing community relations program; and
- Landscaping to improve visual perception.

14.3 Traffic and Transport

14.3.1 Existing Road and Traffic Conditions

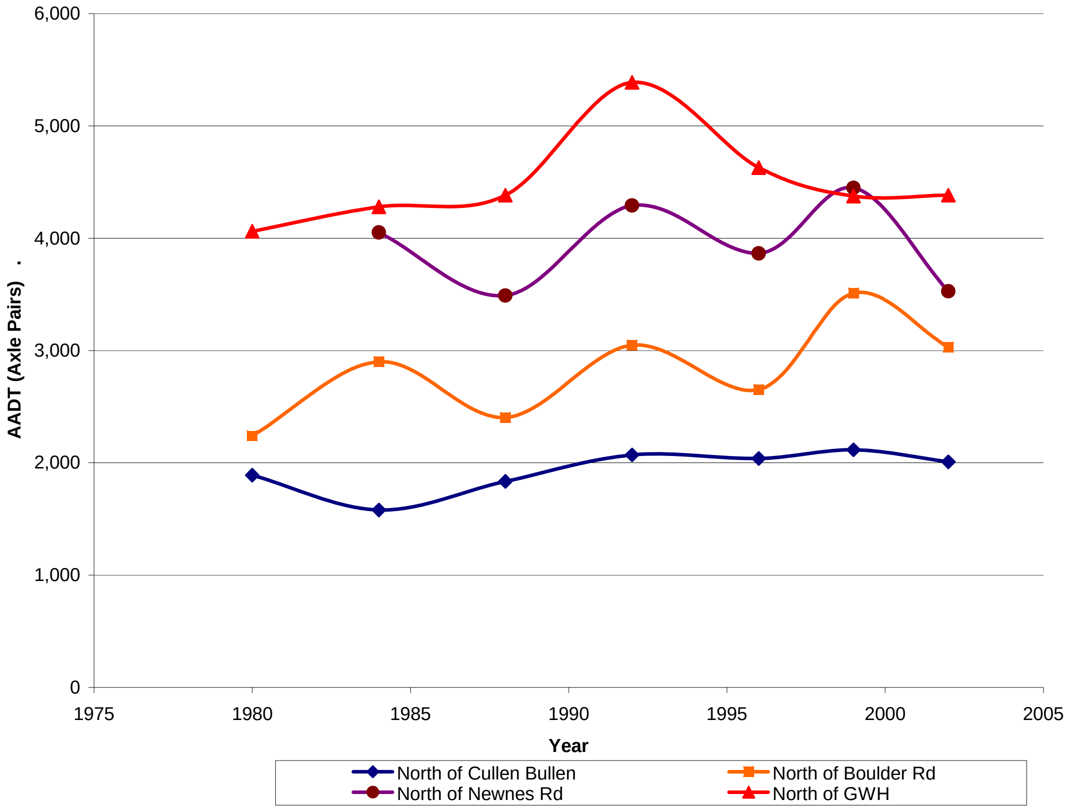
The Mt Piper Power Station is located at the intersection of the Castlereagh Highway and Boulder Road, approximately 17 km north-west of Lithgow. The Castlereagh Highway is a rural highway linking the Great Western Highway north-west of Lithgow with Mudgee and Central Western NSW. It is primarily a two lane undivided road with a 100 km/hour speed limit. Overtaking lanes are provided on many up-hill sections.

Adjacent to Mt Piper Power Station, the Castlereagh Highway is a two lane undivided road, with gravel shoulders and a speed limit of 100 km/hour. North of Boulder Road, the average annual daily traffic (AADT) is around 3,000 axle pairs (2002 RTA data), while north of the Newnes Road intersection (south of Boulder Road) the AADT is around 3,500 axle pairs. Data are shown in **Figure 14-1**. Traffic counts undertaken for this study confirm the validity of this figure and indicate that it is equivalent to around 3,000 vehicles per day comprising 13% heavy vehicles.

Historical traffic data show considerable variations in traffic volumes from year to year, but with a general upwards trend in most locations. North of Boulder Road, the growth trend is 1.15% per annum (2002 base). North of the Newnes Road intersection, the growth trend is basically flat. There is a decrease in traffic volume on the Castlereagh Highway as the distance north of the Great Western Highway increases. Changes in delivery patterns for coal trucks from year to year may be one explanation of the differences in growth rates between locations.

Boulder Road runs east-west and links Portland with the Castlereagh Highway. Immediately west of the Castlereagh Highway and adjacent to the Mt Piper Power Station, it has two eastbound lanes and one westbound lane, and a 60 km/hour speed limit. West of the power station, it has two lanes, no shoulders and an 80 km/hour speed limit. The most recent RTA volume data for Boulder Road was collected in 1988, when the AADT was around 1,000 axle pairs. Traffic counts collected for this study indicate that the daily volume is around 890 axle pairs or 650 vehicles, comprising 21% heavy vehicles.

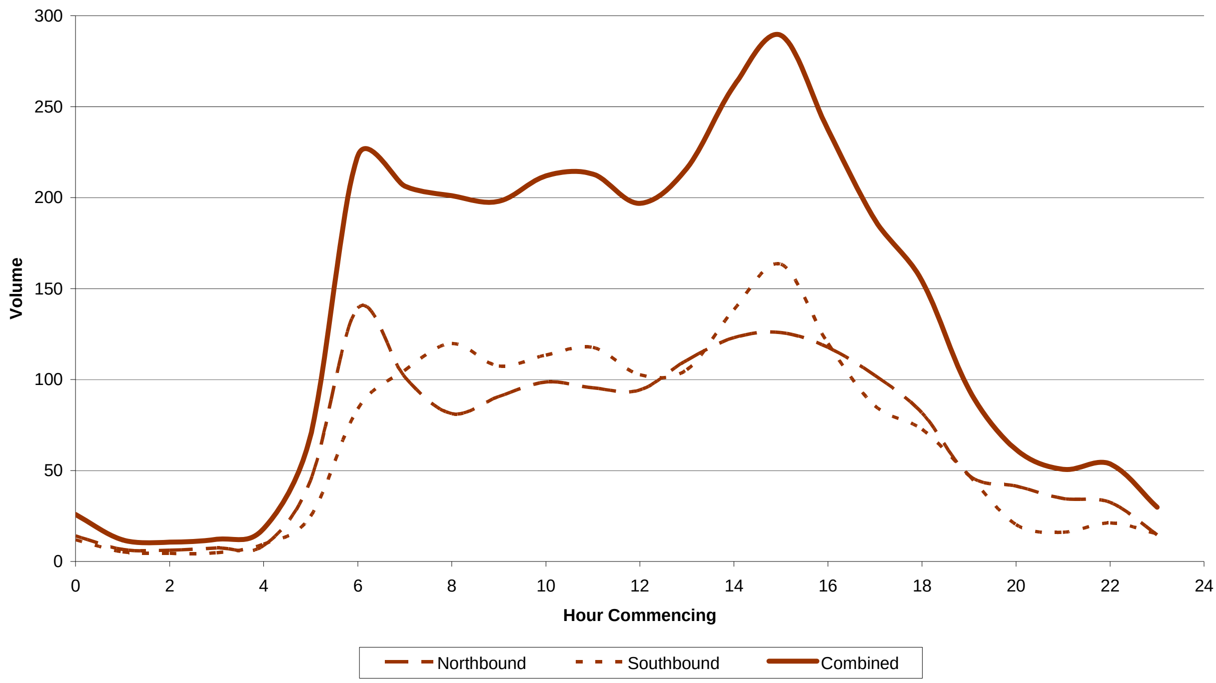
▪ **Figure 14-1 Historical Traffic Volume Data on the Castlereagh Highway**



Daily Profile

Figure 14-2 and **Figure 14-3** show the daily traffic volume data from the Castlereagh Highway and Boulder Road. The average weekday profile on the Castlereagh Highway shows two noticeable peaks: northbound around 6am, and southbound around 3pm. These peaks correspond with the movement of staff to and from the Mt Piper Power Station. Similar peaks occur in Boulder Road's average weekly profile, although due to the relatively low background level of traffic, they appear more pronounced.

▪ **Figure 14-2 Average Weekday Profile – Castlereagh Highway**

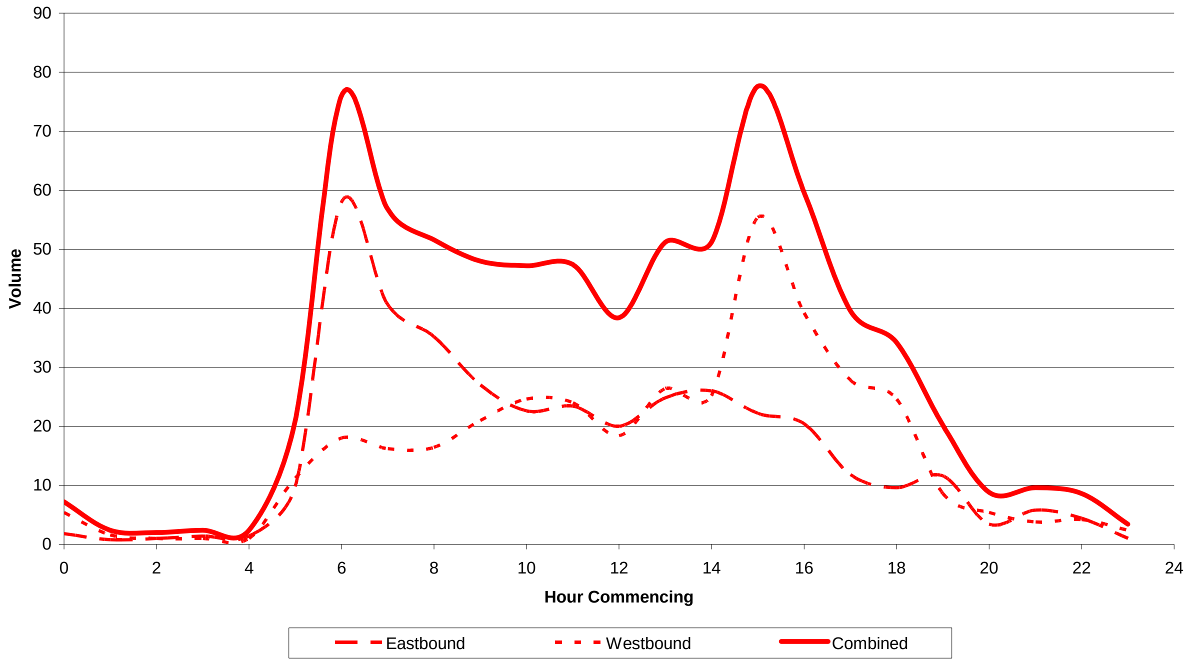


Capacity Analysis

The primary measure of performance for rural roads such as the Castlereagh Highway and Boulder Road is the peak hour volume / capacity ratio. Austroads (1998) specifies theoretical two-way capacities for rural roads, taking into account terrain, shoulder width and traffic composition.

The Castlereagh Highway has a two-way capacity of just over 1,900 vehicles per hour. Traffic counts undertaken for this study indicate a peak hour volume of 274 vehicles, resulting in a volume / capacity ratio of 0.14, indicating average speeds of greater than 93 km/hour and a Level of Service A. Boulder Road has a capacity of 1,500 vehicles per hour, and a peak hourly volume of just 62, with a volume / capacity ratio of 0.04, also indicative of Level of Service A. Thus both roads could be considered to have substantial spare capacity.

- **Figure 14-3 Average Weekday Profile – Boulder Road**



Intersection Operation

Traffic counts were undertaken at the intersection of Boulder Road and the Castlereagh Highway to coincide with the peak staff arrival and departure times. The results of intersection analysis show that acceptable operation is achieved during both peaks, and that there is significant spare capacity at the intersection.

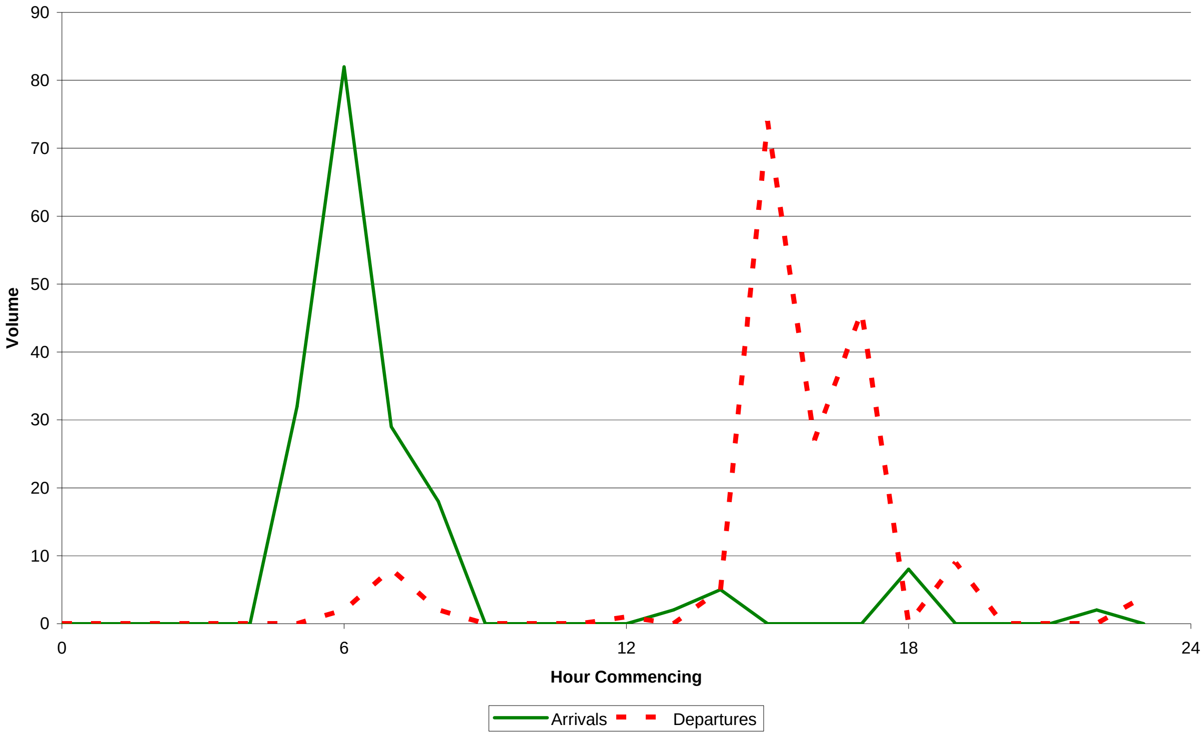
14.3.2 Existing Site-Related Traffic Activity

The Mt Piper Power Station currently operates 24 hours per day, with both shift and day staff. Coal is brought on-site by truck or conveyor from nearby collieries.

Staff

The maximum number of staff on-site at any one time is around 160, with around 150 of the staff being day workers. Staff movements are summarised in **Figure 14-4**. The peak time for staff arrivals is leading up to the shift starts between 6am and 9am, with the majority arriving between 6am and 7am. The peak for staff departure is between 3pm and 6pm. Approximately 65% of staff travel via the Castlereagh Highway, as opposed to travelling via Boulder Road and Portland.

▪ **Figure 14-4 Existing Staff Movements**



Coal Trucks

Most coal is delivered to the power station via overland conveyors or by trucks using the private haulage road between the power station and Angus Place mine. Coal is delivered by public road from Invincible (north of Mt Piper on the Castlereagh Highway) and Enhance Place (south of Mt Piper). Current contracts also have coal deliveries from Baal Bone (north of Mt Piper) and Cullen Valley (west of Cullen Bullen).

Of the 4 million tonnes per annum (mtpa) of coal currently supplied to the plant, about 1 mtpa is delivered by truck on public roads. This represents about 37,000 trucks per year (about 120 trucks per day over 6 days per week). About 80% of those trucks come along Castlereagh Highway from coal mines to the north and 20% come from the south. The balance of 3 mtpa comes via the dedicated haul road from the Angus Place mine or via conveyor from Springvale mine. For the purposes of this assessment, it has been assumed that these existing coal supply arrangements would continue, with the balance of the coal to supply the proposed extension arriving by conveyor from a new rail siding.

Service Vehicles and Visitors

There are approximately six trucks and six cars visiting the power station each day.

14.3.3 Traffic Impact Assessment

Construction Traffic

It is estimated that a peak workforce of about 950 people would be required, with that peak occurring after 2 to 3 years of the 4.5 year construction period. The majority of employees would work from 7am to around 3pm, with some starting later to finish at 6pm. Although it is expected that contractors would organise transport to and from the site for staff and some form of bus shuttle or car pooling would occur, for assessment purposes a car occupancy rate of one was used to estimate construction traffic generation.

Deliveries of equipment and materials to the site would occur throughout the construction period. Construction materials that would require transportation to the site would include concrete or the component materials (cement, sand and aggregate), steel reinforcement and piping. For assessment purposes, it was assumed that the key material would come from / go to Lithgow and Sydney via main arterials. Most of the site preparation and civil works would occur in the first year to 18 months of the construction period. From 12 months on substantial structural steel deliveries would occur to enable boiler house and turbine house erection to occur. This would be followed by a progressive build up in the delivery of large component items and completed equipment. The worst case scenario would involve the use of 600 vehicles over a month, resulting in around 40 return trips per day which would be spread throughout the day

The truck movements themselves would have an insignificant impact on traffic in the area. However, the movement of construction staff, which would be concentrated around 6-7am and 2-3pm, would impact on intersection operation and road capacity, particularly during the peak construction period.

For the majority of the construction period, traffic associated with construction staff would only have a small impact on average and worst delays at the intersection, and intersection operation would remain at an acceptable level.

For give-way controlled intersections such as Castlereagh Highway / Boulder Road, the NSW Roads and Traffic Authority specifies that Level of Service is to be based on the average delay for vehicles on the worst movement at an intersection. **Table 14-7** shows results for the worst movement in each scenario, as well as an overall weighted average delay for the whole intersection. Note that in many cases both right turn movements have similar average delays – only the movement with the highest delay is shown here.

Table 14-7 Intersection Operation

Scenario	Whole Intersection	Worst Movement		
	Delay per vehicle (seconds)		Level of Service	Average Delay per vehicle (seconds)
AM Peak Existing	5.1	SB Right Turn into Boulder Rd	A	13.2
AM Peak During Operation	6.8	SB Right Turn into Boulder Rd	A	13.4
AM Peak During Construction	9.4	EB Right Turn into Castlereagh Hwy	A	14.4
AM Peak During Construction Peak	10.6	EB Right Turn into Castlereagh Hwy	B	17.5
PM Peak Existing	5.8	SB Right Turn into Boulder Rd	B	18.6
PM Peak During Operation	6.8	SB Right Turn into Boulder Rd	B	18.6
PM Peak During Construction	11.0	SB Right Turn into Boulder Rd	B	18.6
PM Peak During Construction Peak	37.9	EB Right Turn into Castlereagh Hwy	D	53.8

During peak construction period, the number of staff would mean that the impact on intersection operation would potentially be significant, particularly in the afternoon. The worst delay at this time would be on the eastbound right turn, and would be at a level that indicates only marginal satisfactory operation.

Due to the large concentrated volume of construction staff traffic, there would be an increase in the peak volume / capacity ratio on both the Castlereagh Highway and Boulder Road. Castlereagh Highway would have a peak volume / capacity ratio of 0.32 during normal construction periods, and 0.5 during the peak construction period. In both cases, the average speed on the Castlereagh Highway would reduce to around 80-90 km/hour, but this does not result in capacity being exceeded, and satisfactory service would remain.

The impact of construction traffic could be mitigated by staggering shifts to avoid the concentration of staff movement in the early afternoon. This analysis has assumed that 80% of construction workers would travel during the peak hours around 6-7am and 2-3pm, but the impact could be reduced if a lower proportion worked these hours. There is substantial spare capacity outside of these peak hours.

Operational Traffic

It has been assumed there would be no increase in the amount of coal transported by public road to Mt Piper, and coal for the coal option would be delivered via the private haulage road, by conveyor from nearby collieries or by overland conveyor from a new rail facility.

The operation of the extended power station would require an additional 50 staff, totalling about 150 on site and comprising both shift and day workers. The largest increase in staff movement to and from the site would occur around 6am, with up to 21 additional staff movements (assuming a car occupancy of one, given the relative isolation of the site and the hours of work for most employees). Across an average day, there would be an additional 62 staff movements. The maximum number of staff on site at any one time would increase to 185 at around 1pm. These are shown in **Figure 14-5**.

The main traffic impact of the operation of the extended facility would arise from the movement of additional staff. The effect of this extra traffic on the operation of the Castlereagh Highway / Boulder Road intersection has been assessed, and there is no reduction in Level of Service, and only a very minor increase in average delays on the right turn movements. The additional staff traffic would have an insignificant effect on the volume / capacity ratio of both the Castlereagh Highway and Boulder Road.

14.3.4 Conclusions

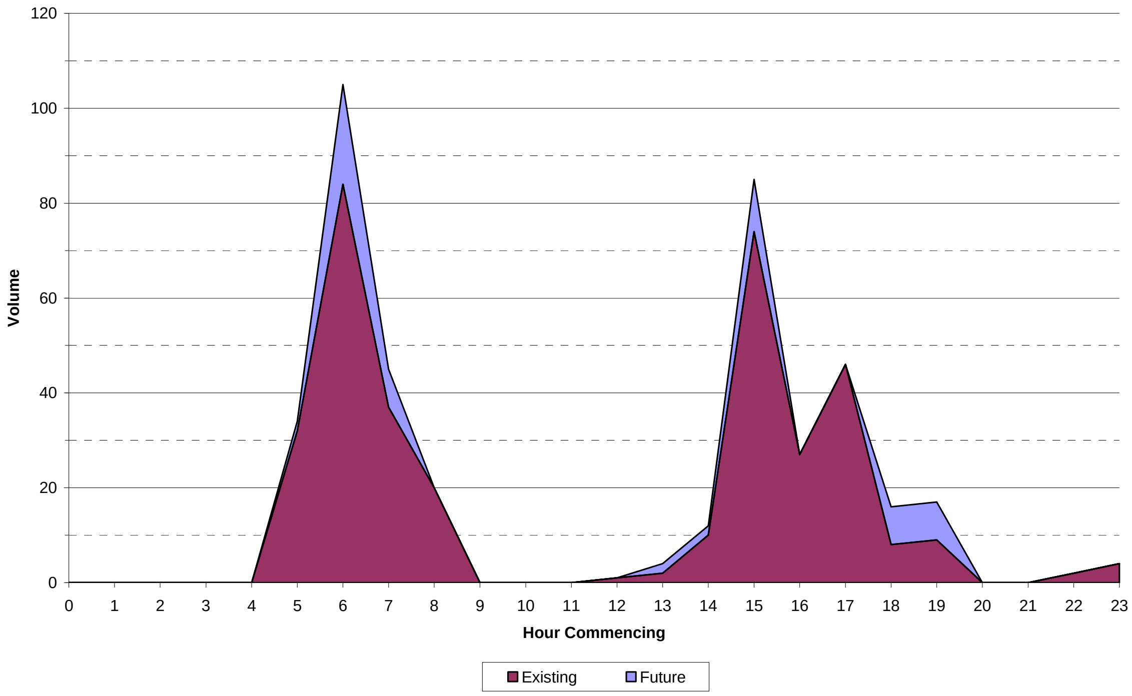
The road network surrounding the Mt Piper Power Station has significant spare capacity. The major traffic impacts of the proposal relate to the movement of staff to and from the site.

During construction, large numbers of additional staff would be required. For the most part, construction traffic would have only minor impacts on intersection operation and road capacity. However, during the peak construction period, the Castlereagh Highway / Boulder Road intersection would have an acceptable level of overall operation, although significant delays on the eastbound right turn movement could be experienced. The impacts of the construction traffic could be mitigated by staggering shifts to avoid the concentration of staff departures during the 2-3pm period and / or implementing car pooling and shuttle bus arrangements.

During normal operation, there would be an increase of up to 20 staff movements around 6-7am. However, this would not have an impact on intersection operation or road capacity.

Overall, the proposed extension of the Mt Piper Power Station would only have a negligible impact on traffic operation in the area.

- **Figure 14-5 Total Staff Movements with Expanded Facility**



14.4 Geology and Soils

14.4.1 Introduction

This section outlines the preliminary geology and soils assessment that was conducted for the proposed Mt Piper Power Station Extension. It describes the existing environment and identifies potential impacts on geology and soils that may arise from the construction and operation of the proposed extension. Further subsurface investigations would be carried out prior to detailed design of the power station extension.

14.4.2 Methodology

The assessment is based on visual inspections and available existing subsurface information. The work program comprised:

- Walkover inspections of the proposed site;
- Inspections of soils and bedrock geology, as exposed in road cuttings and in erosion scars in the vicinity of Mt Piper and in the Blackmans Flat area; and
- A review of published and unpublished information pertaining to the earth environment of the site and its regional context.

14.4.3 Existing Environment

The Mt Piper site is at the western edge of the Sydney geological basin, within rocks of the Permian-age Illawarra Coal Measures (Branagan, 1960; Morris, 1975). At the power station the coal measures are believed to be about 40m thick, overlying sandstones and siltstones of the Shoalhaven Group, and the sequence dips to the east at 1-2^0. The rock layers are relatively undisturbed by folding and faulting, although the 5m-throw Ivanhoe Fault strikes north-south immediately east of the existing power station. A thrust fault is also prominently exposed within the Lidsdale Seam in a road cutting about 600m northwest of the power station.

The geological sequence in the vicinity of Mt Piper is as follows, in descending order:

- Lidsdale Seam (1-1.5m): interbedded high ash coal and shale;
- Blackmans Flat Conglomerate (about 20m): coarse sandstone and conglomerate;
- Lithgow Seam (2-3m);
- Marrangaroo Conglomerate (about 20m) massive sandstone and conglomerate, with some boulders; and
- Shoalhaven Group (>20m): marine sandstone, siltstone and mudstone, sulphide-bearing and acid-generating in places.

Mining History

Coal mining commenced in the Wallerawang and Mt Piper district in about 1873 (Lithgow City Council, 2004) and it is likely that the miners were initially attracted by the presence of the thick Lithgow Seam at shallow depth. Other coalbeds mined in the area included the Irondale and Lidsdale Seams, although the tonnage extracted from these was much smaller than that yielded from the Lithgow Seam.

The closest mine to the power station, the Huon Colliery, (originally Wallaces Colliery) was a shallow underground mine working the Lithgow Seam, which commenced operations between 1900 and 1910. The underground workings of the Huon Extended No. 4 Colliery lie beneath the eastern portion of the existing power station, but the site of the proposed extension is believed to be underlain only by open cut workings. The Ivanhoe Colliery is located immediately to the west of the power station and there are signs of subsidence and severe surface disturbance as a result of shallow operations at this mine. The power station is located across the boundary between the existing Ivanhoe and Western Main colliery holdings, neither of which are understood to be presently active.

Several open cut mines commenced operations near Mt Piper post 1945, and portions of these pits lie beneath the proposed Mt Piper Extension site. It is not clear to what extent these open cuts were in previously un-mined coal, since some may have been simply pillar-removal operations in the unroofed Huon Colliery underground workings. The old open cuts were backfilled and levelled during the construction of the existing Mt Piper Power Station in the 1980s. Free-draining rockfill was placed on the worked-out Lithgow Seam floor and the remainder of the fill material was finer-grained.

Soils and Landforms

Few exposures of natural soil profiles are visible in the vicinity of the power station due to the pervasive ground disturbance that has resulted from past mining and construction activities. Where the natural soil could be observed it consisted of a duplex residual profile, with a silty light grey-brown A-horizon 0.1-0.2m thick overlying mottled orange and yellow clayey sand or sandy clay subsoil (B-horizon). The total soil profile depth is generally 1-1.5m deep, resting on weathered sandstone. The horizons are strongly differentiated (ie, this is a ‘texture contrast’ profile), with the non-erodible A-horizon overhanging dispersive clay subsoil.

As discussed above, the new plant would be located on ground which has either been cut or filled to create a level landform suitable for construction. In the excavated areas, the underlying sandstone is patchily visible across the floor, but this bedrock is most commonly covered by a veneer of slopewash, imported topsoil or road gravel. The fill material appears to comprise fragmented sandstone and conglomerate. Most of this material would have been obtained by ripping during construction, or from mine spoil dumps, and is overburden from the Lithgow Seam. Smaller amounts of imported excavation spoil and crushed rock (roadbase or ballast) were also noted.

Borehole logs from five groundwater observation holes in the area, of which one is close to the proposed works area, indicate that the spoil is composed of rock fragments, boulders and clay, and is 8-24m deep. Large boulders are recorded at the base of the boreholes, presumably placed there to facilitate under-drainage because of the voids left between them. The degree of compaction is given in the logs as loose to medium dense.

The fill surface did not show any obvious indications of contaminants, such as stained areas, leachate springs and protruding man-made objects. Apart from a few very widely scattered minor artefacts (wire strands, tile fragments, metal fragments) no potential pollutants were identified.

Coal measures rocks in the Sydney Basin are generally considered poor groundwater prospects because of low bore yields and water quality that is only fair to poor, ie. suitable for stock use but often non-potable. The seams themselves act as semi-confined aquifers of low hydraulic conductivity and moderate to high salinity when undisturbed. The underlying Shoalhaven Group rocks, which are present at depth but do not outcrop in the vicinity of the power station, contain small but significant amounts of fine sulphide minerals. These generate acid where exposed in road cuttings along the Great Western Highway at Marrangaroo and Mount Lambie.

Once mined, however, and especially following pillar extraction and subsequent ground subsidence, the coal measures rock mass above and close to the workings may increase in permeability and storage capacity by three orders of magnitudes or more. Discharging mine water from collapsed shallow workings, such as those in the Mount Piper area, tends to be low in salinity because of its accessibility to infiltrating rainwater, but acid in places. The most obvious indication of mine water discharge is typically rust-like iron oxide efflorescence at springs and along drainage lines trending downslope from old workings or seam crop lines.

14.4.4 Assessment of Impacts

Subsidence

The extensions would be largely located on fill material which is described on borehole logs as being of loose to medium dense consistency and up to 24m deep. This implies that the fill was placed without systematic compaction (rolling and watering in thin uniform layers), possibly using only the wheels of the earthmoving plant. If this should be the case, some additional settlement might be triggered by the new construction, through vibration (by movement of construction equipment or piling) and possibly surface infiltration or fill surcharging. This would especially be the case if driven piles are used to support the new generators and boilers. It should be emphasised, however, that any construction-triggered settlement would affect only the ground surface, not the existing piled structures, since these would be bearing upon rock at depth.

Soil Contamination

The walkover survey revealed no significant visible contamination in the surface soils, although it is possible that further subsurface investigations could turn up pockets of deleterious material buried with the spoil. Prior to construction and as part of the necessary site geotechnical study, a more detailed contaminated site assessment would be undertaken in accordance with the procedures outlined in the NSW EPA’s (1997) *Guidelines for Consultants Reporting on Contaminated Sites.* Soil samples would be collected from newly constructed boreholes (which would ultimately become groundwater monitoring wells) to assess the depth and horizontal extent of any potential contamination. The results would be compared to the National Environment Protection Measure (NEPM) health based investigated criteria for commercial / industrial use.

Sterilisation of Mineral Resources

Reserves of the Lithgow Seam in the vicinity of the power station have been long exhausted by open cut and underground mining. Since this is the lowest seam in the coal measures at this location, there is no possibility of the proposed development sterilising future deep colliery operations. No other mineral deposits have been reported in or close to the proposed development.

14.4.5 Geotechnical Implications

The geotechnical implications of the proposed extension, based on the preliminary geotechnical investigations undertaken for this assessment, are discussed below. Further geotechnical investigations would be required prior to undertaking detailed design, to more accurately identify the subsurface geotechnical conditions at the site.

Foundations

The site of the proposed new units is on level, featureless ground which appears to have been filled, although former open cut workings are confined mainly to the eastern half of the area. The fill material, visible in small bald surface patches, is white silty coarse sand (crushed sandstone, probably open cut overburden).

Minor differential surface settlement, of maximum trough depth (perhaps 0.2m), was noted in the south-eastern quarter of the site.

The key geotechnical issues in this area are likely to be:

- The depth to bedrock, which over much of the area would be either the floor of the mined-out Lithgow Seam or the buried bedrock topography, both now covered by fill;
- The composition and degree of compaction within the filling material, including the size and distribution of boulders which might constitute obstacles to piling;
- The depth to the water table and its seasonal fluctuations (which may be deduced from the records of the monitoring borehole network); and
- The presence or not of any remaining abandoned underground mine workings.

The depth to the base of the mine spoil is given in the observation well logs as 2.5m to 24m, with most thicknesses being less than 10m. None of these boreholes is within the footprint of the proposed new generator units, but the closest holes imply that the depth of fill is most likely to be less than 10m. The available information suggests that this fill has not been compacted to a high standard of bearing capacity. Hence, additional drilling and test pits, and possibly seismic refraction lines may be required to determine the subsurface rockhead profile. This would be undertaken at the detailed design phase.

A walkover survey of the proposed new coal storage area indicated that the level ground in the vicinity is a product of cutting and filling, with the maximum depth of cut (at the southern end) being in the order of 1m and the maximum fill height (close to the canal) about 3m. The floor of the canal also represents the likely lowest position of the water table in this area. The seepage is not iron-stained, suggesting that it is not derived from mine workings further upslope (to the west).

The fill material is mainly crushed sandstone, but includes a small proportion of waste coal and carbonaceous shale. Fill mounding, to a maximum height of about 1.5m, suggests that some placing was by means of end-dumping, without spreading and compaction.

14.4.6 Conclusions

The proposed extension of the Mt Piper Power Station would be undertaken in a landscape that has been heavily modified by past open cut and shallow underground coal mining, and by extensive cutting and filling during the 1980s construction of the existing power station. The bedrock unit below the proposed extension is a coarse sandstone of low to medium strength, which overlies the worked-out Lithgow Seam at depths of about 10m. The water table is locally present at depths of 3-8m and its groundwater is of low salinity (<300mg/L), although slightly acid (pH 5-6).

Based on walkover inspections and a review of available subsurface information, it is anticipated that the proposed extension would not have a significant impact on geology or soils. A minor amount of settlement in filled areas could occur due to piling, movement of construction plant, surcharging and water infiltration. Heavier structures are likely to be founded on piles set on buried bedrock at depth and, therefore, this settlement should only affect the ground surface and shallow footings. No coal resources are likely to be sterilised by the proposed works and no other mineral resources are known to occur beneath or near the proposed new plant.

Prior to detailed design, the extent, depth and composition of the filling materials within the footprints of the proposed new plant would need to be accurately mapped. Information may be available from records and studies dating back to the construction of the existing plant, although further sub-surface investigations would also be required.