Mt Piper Power Station
Ash Placement Project

ENVIRONMENTAL ASSESSMENT

CHAPTER 2 – STRATEGIC PLANNING AND JUSTIFICATION

August 2010

Contents

2. Strategic Planning and Justification

This chapter addresses the key issue relating to strategic planning and justification. The Director-General's requirements are:

- *The environmental assessment must provide a strategic assessment of the project, including justification of the need, scale, scope and location for the project;*
- *The environmental assessment must include an overview of the relationship between the project and its relevance to the existing Mt Piper Power Station Units 1 and 2, the existing brine and ash co-placement area for the Mt Piper Power Station Units 1 and 2 and the proposed Mt Piper Power Station Units 3 and 4[1];*
- *The environmental assessment must also illustrate how the project will effectively respond to the management of flyash (generated by combustion of coal) and brine (the product of the water treatment process) generated by the existing Mt Piper Power Station Units 1 and 2 and must illustrate how the project will cater for the management and storage of potential waste products produced from the Mt Piper Power Station Units 3 and 4 (flyash and brine);*
- *The environmental assessment must also describe the strategy for developing and implementing short, medium and long term ash management options (including ash reprocessing, reuse and recycling options) with the aim of maximising the use of this potential resource and maximising the available emplacement area life.*

2.1. Need for the Project

2.1.1. Background

Ash removal, placement and storage are critical to the long-term ongoing operation of the existing Mt Piper Power Station. In the absence of a significant increase in reuse opportunities or an alternative area to place the ash produced during power generation activities, Mt Piper Power Station Units 1 and 2 would be required to either reduce production to extend the operational life of the existing ash placement area or close down the operations of the power station when the present ash placement area reaches capacity. Either of these outcomes would have associated impacts on the electricity supply to NSW and both are considered highly undesirable. As a result, this project involving the provision of further storage areas for ash is required to maintain the existing level of power supply in NSW.

[1] While the DGRs refer to Mt Piper Units 3 & 4, all documentation associated with the ash placement project will refer to it as Mt Piper Extension. This is in accordance with the documentation for the Mt Piper Extension project's concept approval.

By the end of 2009 approximately 10.1 million tonnes of ash from Mt Piper 1 & 2 had been placed in the present ash placement area, Area No. 1. Under planned operations, the approved ash storage area is expected to reach capacity by around 2015, well before the existing power station reaches the end of its economic life. Accordingly, there is a need to undertake planning activities and obtain approvals to enable the continued placement of ash once the existing ash placement area reaches capacity. The selection of additional ash placement areas is required to maintain the operation of the Mt Piper Power Station Units 1 and 2 and to provide for the operation of the proposed Mt Piper Extension should it be constructed as a coal fired plant.

In January 2010 Delta obtained concept approval (Application 09_0119) for the development of 2,000MW of new generating capacity at the Mt Piper site (known as Mt Piper Extension). This new capacity would be either coal fired or gas turbines and if it were to proceed as a coal-fired plant there would be a need for ash placement areas. This was addressed in the documentation seeking concept approval of the Mt Piper Extension project.

The Mt Piper Extension development site has been made available for sale to the private sector as part of the NSW Government's Energy Reform Strategy. Should the buyer seek project approval to build a coal-fired power station then there would be additional demand for ash storage facilities that would be best met by use of the same ash repository sites as those sought for Mt Piper Units 1 and 2. Accordingly, this environmental assessment includes provision for ash storage requirements of Mt Piper Extension should it be coal fired.

2.1.2. Current Ash Production

The existing power generation capacity at Mt Piper Units 1 and 2 results in the production of approximately 105,000 tonnes per year of furnace (bottom) ash and 750,000 tonnes per year of fly ash (total 855,000 tonnes per year). Fly ash is conditioned with water or wastewater to give 15% moisture content to facilitate its handling and to prevent dust emissions during transport by conveyor and placement. Furnace ash is transported by truck to the ash placement area and is placed separately from the fly ash. Given the existing ash re-use rate of about 200,000 tonnes per year and a combined ash density of 1.2 t/m^3, approximately 786,000 m^3 per year is placed in Area 1. **Table 2-1** outlines the current ash production details for Mt Piper Units 1 and 2. Based on the planned operations and power generation, the present ash placement area is expected to reach capacity by about 2015.

Table 2-1 – Current approximate ash production at Mt Piper Power Station

Mt Piper Power Station Units 1 & 2 (2 x 700 MW)	
Coal consumption	Average 3.8 Mt/yr (10,400 tonnes per day)
Ash production rate	Coal ash fraction (air-dried basis) 25.5% wt.
Ash production volume	855,000 tonnes per year
Ash split	Fly ash 85-90% (0.75Mt/yr), Bottom ash 10-15% (0.1Mt/yr)
Ash reused	200,000 tonnes per year
Ash required for placement	655,000 tonnes per year or 786,000m^3/year

Advanced water treatment processes within the Mt Piper plant are used to treat water produced at the plant that is not suitable for direct recycling and reuse or discharge to Neubecks Creek. The treatment process reduces the waste water volume by recovery of good quality water for reuse and concentrates salts in the residual waste brine. The reuse of treated water has been estimated to reduce demand for freshwater by about 100 ML/year. Brine production within the power station varies between about 8 and 15 ML/year and the brine product is then used for ash conditioning. Up to about 30% of fly ash is conditioned by brine.

Delta is currently undertaking environmental assessment for the installation of a 6 ML/day RO plant at Wallerawang Power Station. It is also proposed to treat the waste from this plant at Mt Piper and to dispose of the resultant brine as co-placement with ash at Mt Piper. This would add brine of up to 18 ML/year to be disposed of at Mt Piper through co-placement with ash.

The use of brine for ash conditioning is intermittent (about twice per year) and occurs when the ash is to be directed to the approved co-placement area and when conditions for use of brine are favourable. Brine is stored in ponds and, when used, is sent to the ash conditioning plant. At the plant it is used to condition ash to about 15% moisture prior to the ash being directed to the approved brine and ash co-placement site. The current approved area for co-placement of brine in ash is at the western end of the dry ash placement area. Here the brine conditioned ash is placed above a level of 946m AHD above a layer of freshwater conditioned ash and a basal layer of mine spoil. The brine is essentially immobilised in the pores of the dry ash and not leached out by the relatively low rate of rainfall infiltration in the area.

The use of brine for ash conditioning has the main benefit of providing a means of disposal of the concentrated salts which result from the water treatment processes. It also provides a saving of 8-15 ML/year of water that would not be needed for ash conditioning. Without disposal of brine waste in the ash storage area these water savings would not be able to be achieved.

2.1.3. Forecast Ash Production

The existing power station has been operating since 1992 and ash Area 1 has about 5 years of life remaining. Forecasting of ash placement based on a predicted further 32 years of further operation of the power station (to 2042-2045) indicates that there is a requirement for approximately an additional 21.2 million m^3 of new ash placement capacity (27 years x 786,000m^3/year), assuming no increase in ash re-use (ash re-use is discussed in Section 2.2).

If the proposed 2,000 MW Mt Piper Extension were to be built as a coal fired generation plant, this additional coal fired generation at Mt Piper could produce up to an additional 1.32 million m^3 of ash per year, or a combined total of approximately 2.1 million m^3/year. **Table 2-2** outlines the predicted ash production rates based on the existing plant operation and the additional units of Mt Piper Extension. The total predicted total ash generation for the existing power station from 2015 and the additional coal fired units for the first approximately 30 years of its operation is approximately 63 million m^3.

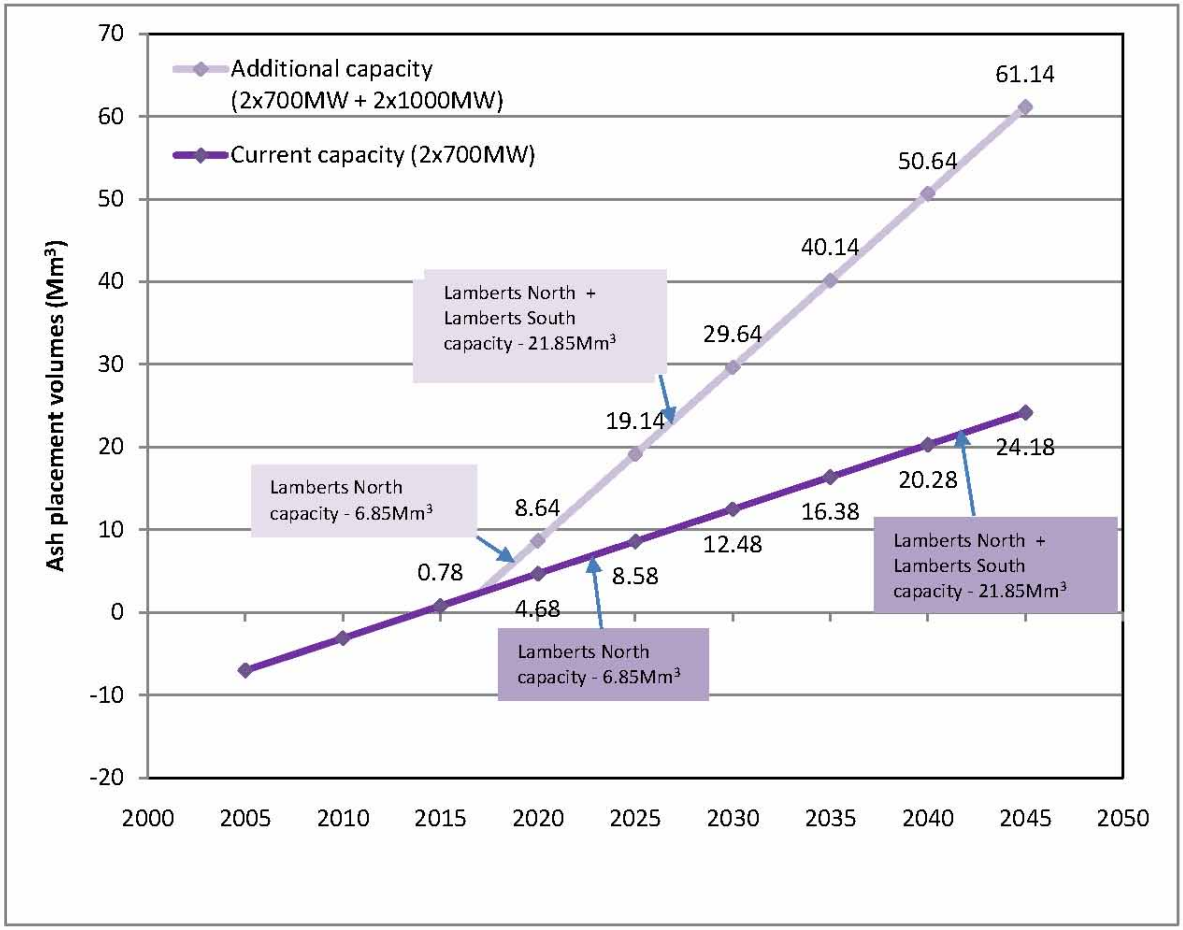
Table 2-2 – Predicted ash production at Mt Piper

Mt Piper Units 1 & 2 plus Mt Piper extension (2 x 700 MW + 2 x 1000 MW)	
Coal consumption	Average 10.4 Mt/a (28,500 t.p.d)
Ash production rate	Coal ash fraction (air-dried basis) 25.5% wt.
Ash production volume	2,500,000 tonnes per year
Ash split	Fly ash 85-90% (2.13Mt/a), Bottom ash 10-15% (0.25Mt/a)
Ash reused	200,000 tonnes per annum
Ash required for placement	2,300,000 tonnes per annum or 2,100,000m^3/a

Figure 2-1 illustrates the predicted ash volumes for operation of Mt Piper based on current generation capacity and the additional 2,000MW of capacity. For the purposes of this assessment it is assumed that the Mt Piper Extension project would begin operation from 2016/2017. This assumes the need for a project approval over 1-2 years and a construction period of about 5 years.

As with the existing ash placement area (Area 1), there will be a need for co-placement of brine with fly ash to allow for disposal of the brine product from the water treatment plant and a reduction in the demand for fresh water for ash conditioning. It should be noted that the amount of brine co-disposal will be contingent on water treatment at Mt Piper 1 and 2, Wallerawang and possibly Mt Piper Extension.

Figure 2-1 – Predicted ash volumes for current and additional Mt Piper generating capacities



Note: Predicted capacities at Lamberts South and Lamberts North are discussed in Chapter 3 – Project Description

2.1.4. Selection of Ash Placement Locations

Potential Sites

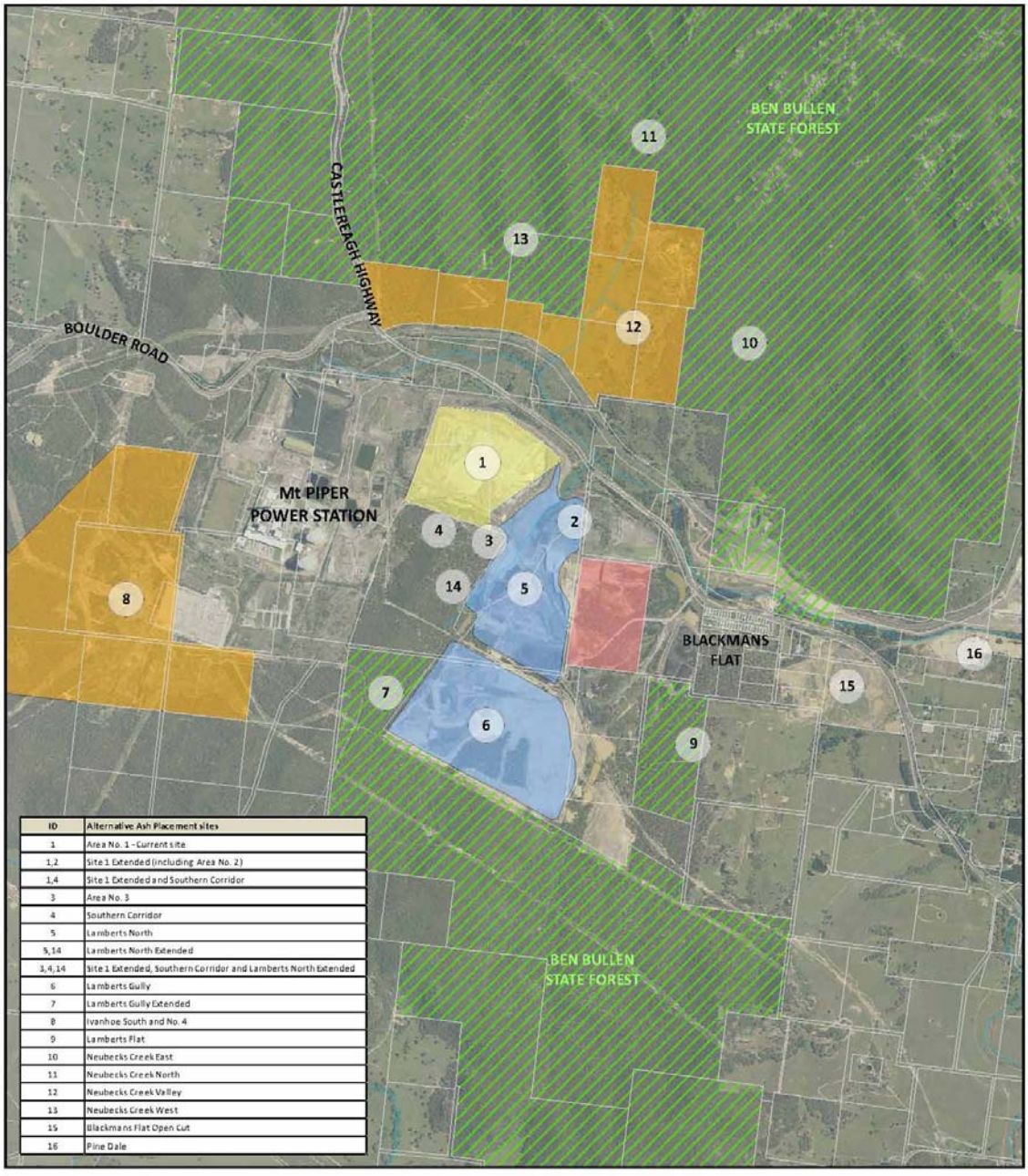
In 2006 Delta undertook a feasibility and site selection study in which potential ash placement sites were selected to be assessed and evaluated. In total, 25 potential ash placement sites were identified in the surrounding area located up to 13km from the power station. The study also allowed for consideration of potential expansion of the generating capacity of Mt Piper. Ash placement schemes were considered for two scenarios – the current generation capacity for units 1 and 2 and also the addition of a further 2000 MW of coal fired generation capacity. The volume of storage required and the probable area available at each of the sites indicated the need for multiple storage sites.

In the original potential ash storage site study, 25 potential sites were assessed. These are listed in **Table 2-3.**

Table 2-3 Potential Ash Storage Sites

Site	Identifier	Site	Identifier
Existing Area 1	1	Lamberts North Extended	14
Area 2	2	Blackmans Flat Open Cut	15
Area 3	3	Pine Dale Coal Mine	16
Southern Corridor - Site 1 Extended	4		
Lamberts North	5	Kerosene Vale Open Cut	17
Lamberts Gully (Lamberts South)	6	Baal Bone Open Cut	18
Lamberts Gully Extended	7	Cullen Valley Open Cut	19
Ivanhoe South (Ivanhoe No. 4)	8	Extension	20
Lamberts Flat	9	Pit West Open Cut	21
Neubecks Creek East	10	Invincible Open Cut	22
Neubecks Creek North	11	Renown East open Cut	23
Neubecks Creek Valley	12	Pit Top Open Cut	24
Neubecks Creek West	13	Ivanhoe North Open Cut	25

Sites 1-16 are shown according to their identifiers in **Figure 2-2**. Other sites listed were outside the area of the map. All sites generally comprise former coal extraction sites or areas proposed or under consideration for coal extraction. An assessment of each site was undertaken considering the potential volume available at each site, planning and operational issues and environmental and social impacts. As a means of ranking the identified sites, a Triple Bottom Line Assessment (TBL) was used to assess a variety of options against multiple criteria.



ID	Alternative Ash Placement sites
1	Area No. 1 - Current site
1,2	Site 1 Extended (including Area No. 2)
1,4	Site 1 Extended and Southern Corridor
3	Area No. 3
4	Southern Corridor
5	Lamberts North
5,14	Lamberts North Extended
1,4,14	Site 1 Extended, Southern Corridor and Lamberts North Extended
6	Lamberts Gully
7	Lamberts Gully Extended
8	Ivanhoe South and No. 4
9	Lamberts Flat
10	Neubecks Creek East
11	Neubecks Creek North
12	Neubecks Creek Valley
13	Neubecks Creek West
15	Blackmans Flat Open Cut
16	Pine Dale

LEGEND

Cadastre | State forest | (2) Alternative Ash Placement sites

Project approval areas | Concept approval areas | Ash area 1 | Council landfill site

0 1,000
Metres

Fig 2-2 Alternative Ash Placement Sites

Throughout the process a number of assumptions and observations were noted including:

- The sites closer to the power station were ranked more highly due to proximity and therefore minimising the need of transporting ash across, or on public roads and the added benefit a reduction in transportation costs;
- Many of the sites further from the power station site had smaller storage capacities as they were generally on smaller sites;
- Backfilling of underground workings was generally not considered practical due to the limited available space and excessive placement costs, and possible groundwater management issues;
- It was considered there would be minimal environmental disturbance at areas with prior disturbance by open cut mining.

Based on the recommendations of that feasibility study, Delta selected four sites (as shown in **Figure 2-3**) within the defined investigation areas, these being Lamberts North, Lamberts South, Neubecks Creek and Ivanhoe No. 4, for further consideration. The feasibility and site selection study found that, compared with the other options, the four preferred sites would:

- Optimise the economic costs and benefits;
- Enable the placement of ash within land owned by Delta Electricity or Centennial Coal;
- Enable the ash to be placed in areas that are either currently subject to open cut mining or intended for coal extraction;
- Enable the ash to be transported via conveyor or private haul roads and minimise the requirement to utilise public roads; and
- Minimise undesirable environmental and social impacts in already developed areas.

Sites that were not chosen for further study were generally further away from the Mt Piper Power Station site, requiring the construction of additional infrastructure and had limited storage capacity due to being small sites.

Primary Sites

Lamberts North and Lamberts South were regarded as the first priority (with project approval being sought) as they would be available by 2015 and are the closest, forming a logical extension of the existing Area 1. These sites also involve minimum cost and minimal environmental disturbance. They are currently being mined for coal and the mining would be completed before 2015, so the sites would be ready for ash placement when required. The total area available at the two sites would be about 21.85 million m^3. This would provide storage capacity for Mt Piper Units 1 and 2 until 2042-2045 and or for Mt Piper Units 1 and 2 plus Mt Piper Extension until 2026.

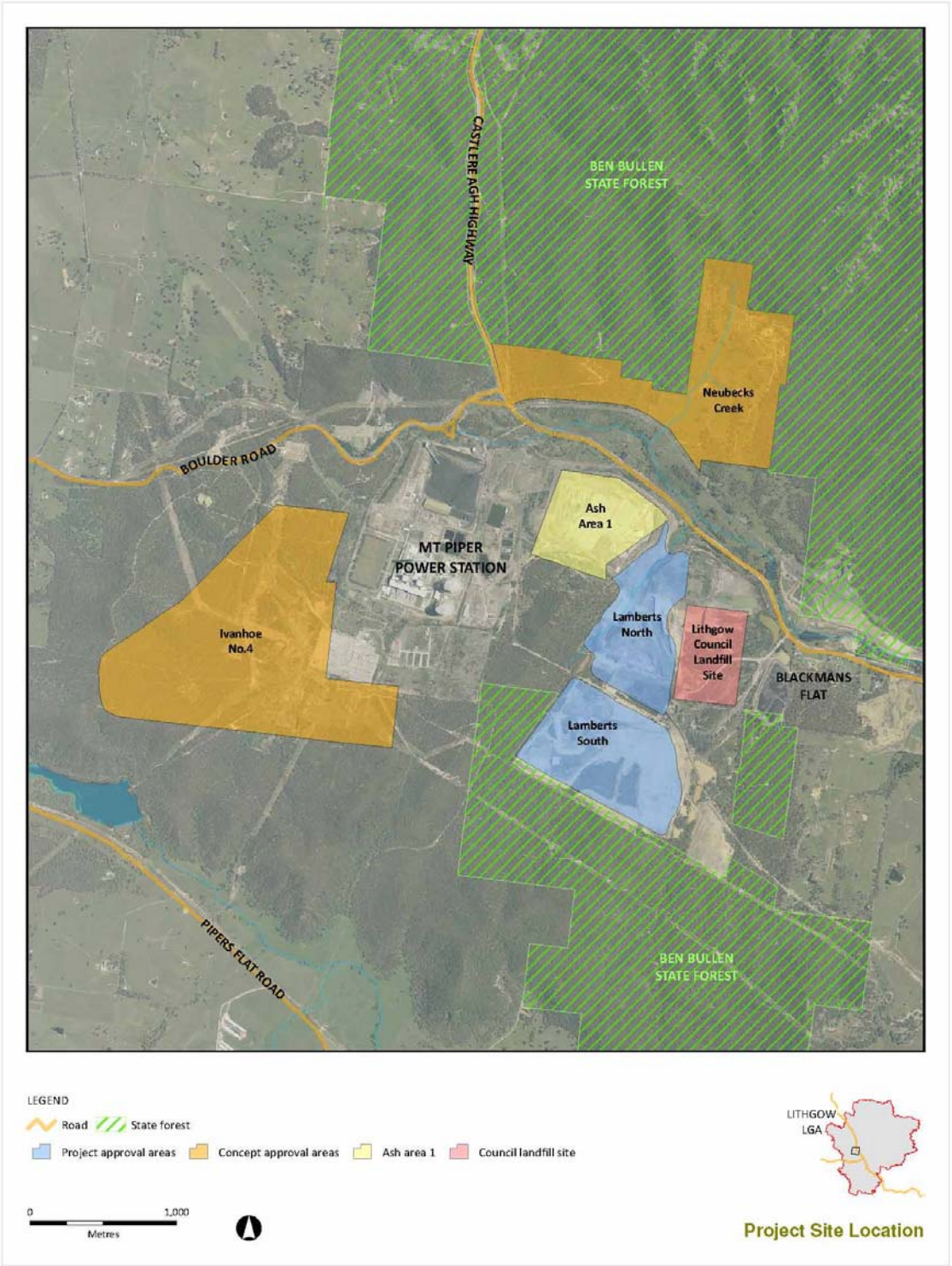


Figure 2-3 – Selected Ash Placement Sites

These volumes have been calculated assuming the ability to fill the area between the existing Area 1 and Lamberts North. This area comprises a drainage area known as the Eastern Drain or Huon Creek (it is in fact a drain or gully and for the purposes of this report will be called Huon Gully) to provide extra capacity for ash placement in a manner which would allow for logical, sequenced deposition of ash between Area 1 and Lamberts North[2]. The use of this drainage area for ash storage and provision of subsurface drainage (in the manner proposed in Chapter 3) would allow the ash storage areas to extend over the current channel providing extra capacity for the site. Without this assumption the volumes available would be reduced by 2.1 million m^3, representing about 3 years of storage for Mt Piper 1&2 or approximately 1.5 years of storage for Mt Piper 1&2 plus Mt Piper Extension.

Similarly, an area of Lamberts South is not being mined as it is not within the existing mine plan being implemented by Centennial Coal, due to high strip ratios and associated costs. This area would need to be used for ash placement as without it the area available to be filled would be reduced significantly by about 6.2 million m^3. This represents about 8 years of storage for the operation of Mt Piper 1&2 or about 3 years of storage for the operation of Mt Piper 1&2 plus Mt Piper Extension.

In both cases the loss of these areas for ash placement would result in a significant reduction in the longevity of these primary ash storage areas and would bring forward the need for the secondary sites (Neubecks Creek and Ivanhoe No.4).

Secondary Sites

Longer term sites for development were regarded as Neubecks Creek and Ivanhoe No 4. Although some mining activity has been undertaken at these sites in the past, there is a possibility of more extensive mining in these areas as there is still a considerable coal resource present.

Concept approval only is being sought for these sites as it is important to identify and plan for longer term storage areas. Whether these sites proceed and project approval is sought in the future would depend on whether Mt Piper Extension is constructed as a coal fired plant. If Mt Piper Extension does not proceed as a coal fired plant it is likely that Lamberts North and Lamberts South would provide adequate ash storage for the life of the existing Mt Piper Power Station.

The volume of ash storage available at Neubecks Creek is estimated at 12.9 million m^3 while Ivanhoe No. 4 has approximately 6 million m^3 available, and the total area available at the two sites is therefore estimated at approximately 19 million m^3. The estimated volumes are based on current geometrical data but this does not allow for loss in volume due to the final shaping of the storage areas.

[2] The status of this area as a creek or drainage channel is discussed in Chapter 3- Project Description and Chapter 7 – Water Management

2.2. Ash Reuse and Recycling

Ash from power generation activities can be beneficially reused for cement making, horticultural purposes, soil stabilisation, engineered fill and road bases, aggregates and geopolymers and zeolite production, subject to the quality of the ash produced. Opportunities for re-use are described in **Table 2-4**.

Delta will continue to investigate the reuse of the ash by-product of its power generating activities in each of the potential reuse areas. Through a process of supporting research and participating in market research and development, Delta has been working to stimulate interest in this co-product. Delta is a member on the board of the Ash Development Association of Australia (ADAA) and the Cooperative Research Centre for Coal in Sustainable Development (CCSD).

The ADAA strives to market ash for a broad range of uses and the CCSD is focussed on strengthening the collaborative links between industry, research organisations and government agencies.

As noted in **Table 2-4,** Delta (Mt Piper) currently sells approximately 200,000 tonnes per year of fly ash to the cement industry.

2.2.1. Use of Flyash

Flyash will continue to have a major role in the cement industry. The focus of the flyash re-use strategy is to be where the greatest potential impacts exist. The road base market has large potential as general purpose cement rather than as a structural item, while geopolymers have great potential for GP concrete.

There are many “niche” opportunities which are available in the cement industry. The exploiting of these opportunities depends on how Delta is positioned to gain advantage when the opportunities arise. This requires Delta to have detailed data at hand that can demonstrate relevance to the particular end user needs, so that these opportunities may exploited in a timely manner.

Delta has employed a firm with expertise in selling products that do not have a 'normal' use. This firm has been charged to identify opportunities for the re-use of flyash so that market opportunities may expanded and maximise the re-use of flyash.

Table 2-4 Reuse opportunities for ash

Reuse	Opportunities
Cement	Dry un-conditioned ash can be used in cement. Australian Standards for premix concrete allow for up to 40% of Portland cement to be replaced with fly ash .Delta (Mt Piper) currently on sells 18% or 200,000 tonnes of fly ash each year to the cement industry. Generally the market for cementitious reuse of ash is constrained by market forces and the geographical location of Mt Piper and generally limits the reuse of ash for this purpose.
Horticulture	Owing to the dominance of silt sized particles and porous nature of the components in fly ash, addition of the fly ash to soils may help to increase the water holding capacity and modify the permeability of otherwise unfavourable soils. Recent regulatory restrictions on the use of fly ash in horticultural applications have seen a significant drop in horticultural opportunities, although the ADAA has negotiated an exemption from the regulation to allow ash from Western Stations to be utilised in the field.
Soil stabilisation, engineered road fills and road bases.	Fly ash may also be added to otherwise well-sorted (poorly graded) sandy soils to fill void spaces increasing the overall density and aiding in compaction. In some cases the self cementing properties of the ash may actually help to bind the soils. Such stabilisation increases the capacity of the soil to support roads (Road Base) and maintain the soils stability for the lifetime of the structure. The fly ash and soil may be compacted into layers (structured fills), or in a mixture of fly ash soil water and Portland cement for flow able fills. Delta actively supports programs to test the properties of fly ash in these areas.
Aggregates and geopolymers	Coarse (Gravel sized) and fine (sand sized) aggregates for concrete and other applications can be produced, from fly ash, by partially or completely melting the ash. Alternatively, aggregates can be produced by binding ash particles into larger masses with a cementing agent. Delta in concert with the ADAA is actively researching both applications and methods for this process.
Zeolites	The abundant aluminosilicate glass component of the fly ash provides a potential raw material for zeolite synthesis. Zeolites are used in control release fertilisers, soil conditioners and ion exchange media, detergent builders, pesticide carriers and animal dietary supplements. There is little research being done in this area due to the high inherent costs and the location of 'normal' fertiliser production facilities.
Backfilling and landfill	A number of reviews and trials have been carried out by Delta to measure the effectiveness of fly ash in open cut voids and as a pumped medium in underground mine workings. Results of these trials are positive and Delta feels that these properties will lead to greater usage in the future.
Bottom Ash Use	Bottom ash can be used as part of stability berms and other site stability structures to minimise the need to use naturally extracted materials. Ongoing reviews and research into this type of application for large dams and civil structures is ongoing through the ADAA. Delta will continue to review opportunities to use bottom ash within site works and with third parties to minimise demand on natural resources and in an attempt to extend the life of any development resulting from this application.

2.2.2. Management Options

Delta Electricity has recently developed its ash reuse strategy further. The plan provides details of short, medium and long term goals for making utilisation or reuse of ash more achievable.

Key issues that are seen as impeding ash reuse currently are:

- Structure of agreements/contracts for taking ash;
- The structure of the existing plant to suit the purpose of easily removing ash;
- Logistical issues with getting ash from distant power stations to centralised markets;
- Consistency issues with ash dependent on certain critical operational factors.

To overcome or, at least minimise the impact of these items Delta's strategy is:

Short Term

- A simplified agreement document is being proposed for companies that wish to send a truck to site to collect ash. A legal review is currently underway;
- Delta is proposing to join research which is both relevant and timely within fleeting market opportunities -
  - CSRP through CURTIN University - researching Geopolymers
  - Research review through University of Wollongong - Researching early life strength issues in high ash concretes;
- Delta has joined the DECCW's Sustainability advantage to gain support and networking opportunities;
- Delta is currently considering joining the Waste Management Association of Australia for connection to potential opportunities.

Medium Term

- Delta will retain membership of the Ash Development Association of Australia (ADAA);
- Delta has entered into discussions with regulators with regard to impacts of ash reuse opportunities;
- Delta has contracted a marketing firm (DMC Advisory) to set up a marketing plan and strategy document for various applications;
- As part of marketing plan same firm is reviewing critical ash properties that make ash usable. From this a 'model' of affecting operational parameters is being designed so that consistency and marketability can be maintained within production constraints.

Long Term

- Delta is assessing the viability of changing the logistical profile of ash markets by supporting alternative transport options such as rail;
- Delta is supporting end users and potential end users on an ongoing basis.

2.3. Consequence of Not Proceeding

The "do nothing" option involves the discontinuing of ash placement once the existing Area 1 is filled. As discussed in previous sections, the removal of ash is critical to the long-term ongoing operation of Mt Piper Power Station. In order to maintain existing power station operations, ash needs to be either provided for beneficial reuse purposes and/or stored, possibly for re-use at a later date. Based on planned operations, the present ash placement area is expected to reach capacity by around 2015, well before the existing station reaches the end of its economic life. Therefore, failure to find new storage sites prior to this time could potentially result in reduced operation or closure of the power station as it is not feasible to secure full re-use over this period nor in the foreseeable future.

Currently, NSW has reserve capacity to meet both peak and base-load electricity demands. However, it is possible that NSW will experience a reserve deficit and reliability of supply may be compromised in the near future unless existing capacity is maintained and additional capacity is brought to the market.

Closure of Mt Piper Power Station from about 2015 if additional ash placement areas are not available would most probably result in an increase in the wholesale price of electricity due to demand-supply imbalance. It would also lead to an increase in the NSW CO_2 coefficient as Mt Piper is one of the most thermally efficient coal fired power stations in NSW.

Closure of the power station could also have flow-on negative social and economic impacts as the Mt Piper Power Station provides direct employment opportunities and economic opportunities to the region.

In summary, the "do nothing" option may result in interruptions to the power supply and have serious social, economic and environmental impacts.