



**EnergyAustralia**

**ENERGY AUSTRALIA NSW  
Lamberts North Ash Repository  
LONG TERM ASH MANAGEMENT STRATEGY**

**November 2020**

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Report Title: Lamberts North Ash Repository – Long Term Ash Management Strategy

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# Executive summary

EnergyAustralia (**EA**) procured approval (PA 09\_0186) to emplace water conditioned ash (**WCA**) and brine conditioned ash (**BCA**) within the Lamberts North and South Ash Repository (**LNSAR**) in 2012. EA are currently emplacing WCA within the Lamberts North Ash Repository (**LNAR**). Only WCA has been placed in the LNAR to date.

Condition D1 within PA 09\_0186 requires EA to achieve an ash re-use goal of 40% by 31 December 2020 and to prepare an updated Long Term Ash Management Strategy to the Secretary every two years. During the September 2019 to August 2020 reporting period, EA achieved 100% ash re-use destined for the LNAR and therefore has complied with Condition D1 of PA 09\_0186. For clarity, no ash was emplaced within the LNAR over the 2019-2020 reporting period. However, BCA was emplaced within the Mt Piper Ash Repository.

This report is an update to the Long Term Ash Management Strategy originally submitted in 2012.

At the present time, further re-use of ash is primarily constrained by:

- Co-disposal of brine with ash as currently approved;
- Increased brine production from the recently commissioned Springvale Water Treatment Facility (which is independent of electricity generation and ash production);
- Prioritisation of using the ash to manage the brine;
- Restrictions around selling BCA in accordance with the Coal Ash Order 2014 and/or product specification requirements currently limits ash customers to only take WCA; and
- Reduced output from MPPS in response to market drivers, which results in reduced ash generation.

EA has identified some further opportunities to improve the re-use of its ash in the future and will continue to work with existing and new customers moving forwards.

# 1. Introduction and background

The Mt Piper Power Station (**MPPS**) comprises two 700 Megawatt (**MW**) coal-fired steam turbine generators, built in 1992 and 1993. The power station is located approximately 17 km northwest of Lithgow and five kilometres east of Portland. MPPS is fuelled using black coal sourced from the local area, with ash produced as a result of coal combustion by the transformation of the non-combustible mineral matter present in the coal.

The purpose of this Long Term Ash Management Strategy (this Report, also referred to more generally as Ash Management Strategy) is to provide an update on the status and outcomes of investigations regarding ash re-use. An update is required every two years from the commencement of the Mt Piper Ash placement activities within the Lamberts North and South Ash Repository (**LNSAR**) area in accordance with Project Approval 09\_0186, Condition D1.

This Report has been structured to provide context and progress in respect of achieving a 40% re-use of ash by 31 December 2020. It also provides a discussion on opportunities and challenges to achieve this goal and the limitations/variables associated with ash re-use at MPPS. The remaining sections of this Report include:

- Section 2 sets out the regulatory requirements associated with ash emplacement at LNSAR.
- Section 3 provides context around MPPS operations setting out the various operational constraints and variables that effect ash management and re-use at MPSS.
- Section 4 presents an update to the Ash Management Strategy and provides an appreciation around the constraints and opportunities around re-using ash from the MPPS.

## 1.1 Ash Emplacement

Ash produced at the MPPS is currently authorised to be emplaced within two separately approved Ash Repositories inclusive:

- Mt Piper Ash Repository (**MPAR**); and
- Lamberts North and South Ash Repository (**LNSAR**) (see **Section 2.1**).

Ash emplacement at the MPAR has occurred since the mid 1990's. The MPAR, originally approved in 1982 (Mt Piper development consent 80-10060), provides for approximately 13.5 million (**M**) tonnes of ash storage. Subsequent modifications to this consent have authorised the ash to be conditioned with brine, referred to as Brine Conditioned Ash (**BCA**). The majority of the ash produced at MPPS has been and still is, emplaced within the MPAR in accordance with the conditions set out within the above-mentioned development consent.

Condition 38A(iii) of consent 80-10060, restricts the placement of BCA within the MPAR to between the levels of 946m and 980m Australia Height Datum (**AHD**). As at November 2020, BCA can only be placed within the MPAR as the repository is operating above Reduced Level (**RL**) 946m. Other conditions within the consent requires the establishment of water monitoring programs, a water management plan and an annual monitoring report which sets out a summary and discussion of the results from the water monitoring program around the MPAR amongst other things.

## 2. Regulatory Requirements

### 2.1 Lamberts North and South Project Approval

The LNSAR was approved in 2012 (Project Approval (PA) 09\_0186) under the now repealed Part 3A of the *Environment Planning and Assessment Act 1979 (EP&A Act)*. The Approval authorises approximately 21.85 million (M) m<sup>3</sup> of ash storage capacity. The LNSAR authorises two separate areas including a northern and a southern ash emplacement footprint. The northern emplacement provides a capacity of approximately 6.8M m<sup>3</sup> and the southern emplacement provides a capacity of approximately 15M m<sup>3</sup> for ash emplacement. MPPS is currently (as at November 2020) operating within the northern footprint, referred to as the Lamberts North Ash Repository (LNAR). The southern footprint has not been used for ash placement at this time and is currently being utilised for approved coal mining activities.

A limitation on the LNAR is that BCA cannot be emplaced within the facility until the RL of operations reaches 946m. The current operational RL is around 941 – 944m. To this end, MPPS is currently and can only emplace fresh water conditioned ash (WCA) within LNAR.

Condition D1 of the LNSAR project approval (09\_0186), requires EnergyAustralia (EA) to achieve a goal of 40% ash re-use by 31 December 2020. Condition D1 is replicated below:

*D1. The Proponent shall prepare a long-term ash management strategy including a program for investigation and assessment of alternative ash management measures with a goal of 40% reuse of ash by 31 December 2020. The report shall be submitted to the Director-General six months prior to the commencement of operations. The Proponent shall report on the status and outcomes of its investigations to the Director-General every two years from the commencement of the operation of the project, unless otherwise agreed by the Director-General.*

The original Ash Management Strategy was submitted to the Director General on 30 July 2012. EA has provided an updated Ash Management Strategy every two years to the Secretary for the Department of Planning, Industry & Environment (DPIE), formerly known as the Director-General, as required by Condition D1. This Ash Management Strategy has been prepared to satisfy Condition D1 of Project Approval 09\_0186 and provides an update to the Ash Management Strategy submitted in 2018.

#### Compliance Status

**Table 2-1** sets out those specific conditions relevant to this Report and includes a comment regarding compliance against each condition. In this regard, the following two summary points are made:

1. In the context of the proportion of ash that could have been emplaced at the LNSAR (as WCA) but was sold/re-used, MPPS has exceeded the 40% ash re-use goal.
2. In the context of total ash production emplaced at both MPAR and LNSAR (together the Ash Repositories), MPPS has not achieved the 40% ash re-use goal.

**Table 2-1** presents the compliance status based on summary point 1 above as the condition is specific to the LNSAR approval. The compliance status in **Table 2-1** is based on the re-use of ash that would have otherwise been emplaced within the LNSAR which is subject to PA 09\_0186 including the 40% re-use goal.



**Table 2-1 Compliance Status of relevant Project Approval Conditions**

<b>Relevant Approval</b>	<b>Condition No.</b>	<b>Condition Summary</b>	<b>Compliance Status</b>	<b>Comment</b>	<b>Section where addressed within this report</b>
Project Approval 09_0186	D1	Ash Management Strategy	Compliant	The Lamberts North Ash Management Strategy has been prepared to satisfy Condition D1 of Project Approval 09_0186 and was submitted to the Director- General on 30 July 2012.	2.1
Project Approval 09_0186	D1	Two yearly update of status & outcomes into investigations to increase ash re- use.	Compliant	This report has been developed to satisfy this requirement.	4
Project Approval 09_0186	D1	Goal of 40% ash re-use by 31 December 2020.	Compliant	Lamberts North Ash Repository has obtained an average of 55% ash re-use since activities commenced in 2013	4

## 3. Current Operations

### 3.1 Power Generation

The following considerations provide some details around the current power generation requirements, demands and external factors that may directly or indirectly influence the re-use of ash at Mt Piper, these include:

- The current MPPS has capacity to produce 1,400 MW (33,600MWh per day). Over the last 12 months (September 2019 – August 2020), electricity generation has been 6,020,817MWh (approximately 50% of capacity);
- The influx of renewables (i.e. home solar, wind, etc) has resulted in a steep reduction in electricity demand generated from coal fired power stations. This has resulted in MPPS operating at a reduced capacity;
- To operate at 100% capacity, MPPS would be required to consume in the order of 5M tonnes of coal per annum. Over the last 12 months (September 2019 – August 2020), MPPS has consumed 2.56M tonnes. Respectively, the generation of ash has fallen from an anticipated 855,000 tonnes per annum to 672,002 tonnes, recorded over the September 2019 – August 2020 period;
- The non-combustible component of the coal (ash) generally ranges between 22-28% so the natural volumes of ash produced is dependent upon the quality of the coal; and
- Market conditions for electricity have consisted of periods of stable, reduced pricing with an overall increase in volatility. Over the last 5 years, prices have ranged between \$0 and \$14,000 per MW.

### 3.2 Water Management

For simplicity, and as it relates to this Ash Management Strategy, the water management system at the MPPS and the Ash Repositories consists of:

- Clean water (fresh and recycled);
- Brine (by-product from treating water to remove salts and impurities); and
- Dirty water (runoff from exposed or dirty areas that requires settlement treatment).

#### Clean Water

The MPPS has access to multiple water sources including:

- Coxs River System – Lake Lyall & Thompsons Creek Reservoir (via pumping)
- Fish River Water Supply
- Treated and recycled water via the Brine Concentrators, MPPS Water Treatment Plant and the Springvale Water Treatment Facility

Clean water is used for the cooling process during the production of electricity, which through evaporation, concentrates the salts within the cooling towers. As a result, clean water is required to limit the concentrations of salt within the cooling water. If salts build up in the water, the efficiency of the power generation process is severely compromised.



## Brine

The evaporative cooling process in the cooling towers at MPPS generates a brine waste stream. As water evaporates from the cooling towers, the concentration of salts contained in the circulating water increases, which would eventually impact upon the operation of the cooling system. A portion of the salty water is therefore regularly blown down and replaced with fresh “make up” water. The blow down water is recycled, with salts and impurities removed via the Brine Concentrators and the MPPS Water Treatment Plant. The brine wastewater is used to condition ash and is referred to as BCA. Volumes of Brine received from MPPS recycling processes have historically been in the order of 0.06 Megalitres (**ML**) per day.

In June 2017, Springvale Coal Pty Limited procured approval to construct and operate the Springvale Mine Water Treatment Facility (SSD 7592). This Water Treatment Facility incorporates a desalination process to reduce the salinity of the raw mine water dewatered from the Springvale Mine. This process also produces a brine by-product that is also used to condition the ash in accordance with the existing approvals and practices at the MPPS. Since commissioning in 2019, volumes of brine received from the Springvale Water Treatment Facility is generally in the order of 0.2ML per day. It is noted that a proportion of the brine is further refined to solid crystal form through the brine crystallisers.

The brine by-products from MPPS’s water recycling process and the above-mentioned Water Treatment Facility are the two brine sources used to condition ash (as BCA) prior to its emplacement. Conditioning ash using brine is currently the only approved method available to dispose of brine at MPPS. The co-disposal of brine and ash modifies the properties of the ash limiting its potential re-use options. The majority of ash re-used from the MPPS is either water conditioned ash or run of station ash.

The MPPS is generally a zero liquid discharge site (with the exception of licenced discharges authorised from the Coal Settling Pond), therefore any brine produced/received must either be stored, evaporated or used to condition the ash for disposal. As a result of the two brine streams, MPPS needs to manage in the order of 0.26ML of brine per day.

## Dirty Water

There are various sediment and settling ponds around the MPPS and the Ash Repositories that capture dirty storm runoff water. Dirty water is either treated to remove sediment, recycled or used for dust suppression on the LNAR.

## 3.3 Ash Management

A by-product of creating electricity at the MPPS is the generation of ash. The two kinds of ash production include “Fly ash” and “Bottom ash”. Fly ash is collected in fabric filters and has 0% moisture. Bottom ash is the heavy ash that falls from the furnace and is collected in a hopper. Prior to handling, the fly ash needs to be conditioned or “wetted” down. To enable the safe emplacement of the fly ash, typically the fly ash is conditioned with either fresh water (referred to as Water Conditioned Ash (**WCA**)) or brine (wastewater from the Brine Concentrators and/or the SMWTF containing salts and impurities).

### Ash Emplacement

Ash from the MPPS is transported by conveyor to the ash silos at the MPAR as part of the existing approved operations. Ash is then transported by heavy haulage vehicles (generally one or two

trucks) from the silos to the MPAR or the LNAR. Ash going to the MPAR is currently conditioned with brine and ash going to the LNAR is conditioned with fresh water. Ash to be emplaced within Ash Repositories needs to be conditioned with WCA or BCA to achieve a minimum moisture level of 18% to achieve the required compaction levels and maintain the structural integrity of the ash repository. Because the Bottom Ash is already wet and consists of relatively large particles, it can be readily emplaced within the Ash Repository.

The conditioned ash is then deposited at the working face where compactors and bulldozers work the material such that an adequate level of compaction (95%) is achieved and a stable landform created with appropriate drainage structures in place. Ash is placed in layers, normally in 0.5-1m lifts, and stepped to produce an overall batter slope of approximately 1(V):4(H) with benches added every 10m in vertical height change. Capping of exposed ash areas has been undertaken progressively as the approved design height is achieved. Progressive revegetation of batters will commence once the final perimeter batters are constructed.

### **Re-Use of Ash**

Ash to be re-used is generally supplied run of station which means, the ash can be directly dispatched from the power station into trucks. Small volumes of ash can be reclaimed from the Ash Repositories; however, this is currently limited to WCA only, noting that current ash customers do not have permission to utilise ash that has been conditioned with brine (BCA). Constituent concentrations associated with BCA lie outside Table 1 requirements stipulated within the Coal Ash Order 2014 and/or product specification requirements currently restricting its use.

## 4. Ash Management Strategy

### 4.1 Objective

The objective of the Ash Management Strategy is to provide the context around the current influences that restrict or encourage ash re-use, present the historic ash re-use trends and provide targeted opportunities to enable an increase in the re-use of ash where reasonable and feasible. These opportunities include potential prospects to better manage both the brine streams and the re-use of ash.

### 4.2 Management of Brine

As discussed in **Section 3.2**, both the MPPS Brine Concentrators and the Springvale Mine Water Treatment Facility generate brine. The brine is either stored or used to condition ash. The volumes of ash generally required to manage the brine streams (i.e. Condition ash to around 18% moisture) is set out below:

- 0.06ML brine per day from MPPS Brine Concentrators – approximately 100,000 tonnes per year
- 0.2ML of brine per day from the Springvale Water Treatment Facility – approximately 425,000 tonnes per year

As MPPS is generally a zero-liquid discharge (see **Section 3.2** for clarification), the current arrangements prioritise the use of brine to condition ash, which is then emplaced within the MPAR. If this was not the case, brine would have to be stored in ponds until it crystallised or further concentrated enabling its disposal.

### 4.3 Ash Re-Use Limitations

There are several variables that may limit the generation and/or re-use of ash including:

- Managing the brine streams through BCA practices – the disposal of brine requires a certain volume of ash to be produced such that conditioning, and compaction is effectively achieved. This has resulted in the prioritised use of ash to manage brine.
- Market conditions – the market conditions to utilise ash as a product component is variable.
- Energy demand – due to the influx of solar power and general decline in energy demand since the COVID-19 pandemic, energy demand from coal fired power stations has declined sharply. The generation of electricity by MPPS is sensitive to demand and when demand reduces, coal consumption declines along with a decline in ash generation.
- The quality of ash – variation in coal quality may impact on the constituents of the ash which may compromise its re-use application. Furthermore, brine conditioning also impacts on the ash constituents. BCA testing and analysis shows that it currently lies outside the requirements stipulated within the Coal Ash Order 2014 and/or product specification requirements. For this reason, only WCA can be utilised by the third-party users of coal ash.

- Coal quality - variations in coal quality result in varying quantities of ash. For example, MPPS receives coal that has an inherent ash that ranges between 22 – 28% ash. MPPS may receive large volumes of coal with a 28% ash content, followed by volumes of coal with 22% ash content. This impacts on the overall ash generated by the power station and consistency of supply to third parties.
- Licencing of third-party users – users of coal ash may have limitations on their approvals or licences regarding the receipt of coal ash.
- Outages and unforeseen downtime – maintenance outages and unforeseen downtime will impact on the ability of the power station to operate, impacting on the generation of ash.

All of the above factors influence the Ash Management Strategy and the capacity for the re-use of ash at LNAR. Despite this EA has been able to achieve a 55% long term average ash re-use at LNAR. This will continue to fluctuate over time depending on the above-mentioned factors influencing the electricity sector in NSW.

#### 4.4 Ash Re-Use

Fly ash has been used as a supplementary cementitious material due to its properties for over 30 years in NSW. In power generation, ash utilisation has traditionally been left to the markets to manage the fly ash facilities for off-site utilisation. This market has customarily favoured cement companies who can afford to install facilities to classify and load fly ash into trucks, and limits access to aggregate markets that are dependent on local road building projects which last for months rather than years. In order to combat this, EA has taken steps to permit the loading of run of station ash at MPPS. Notwithstanding, the ash (excepting BCA) from MPPS operations currently continues to be re-used through cementitious material and engineered road base.

In 2014, EA were approached by Nu-Rock with the plan to operate a pilot plant which would trial the use of ash in the production of construction products, including blocks, pavers and aggregates. Nu-Rock is currently operating a small production plant at Mt Piper to prove the use of their products and to assist them to move towards construction of a commercial scale plant, which is anticipated to use approximately 250,000 tonnes per annum of ash. A commercial plant would be subject to appropriate commercial and technical matters being agreed between EA and Nu-Rock, as well as agreements between Nu-Rock and third parties that would be required for a commercial scale project to proceed. This would significantly increase the amount of ash re-used and would enable ash reclamation from the ash repository. Nu-Rock has recently (October 2020) varied its EPL (20513) to enable it to receive 250,000 tonnes of coal ash per annum. This is an increase from 29,990 tonnes which existed prior to October 2020.

Ash production and re-use figures for Mt Piper Power Station are provided in **Table 4-1**. Volumes of ash produced by MPPS has fluctuated over the years in response to electricity demand, coal quality and the need to manage the brine streams. The Environmental Assessment that supported the PA 09\_0186, originally projected that MPPS would produce around 855,000 tonnes of ash per year. Ash production over the 2019-2020 period was approximately 79% of that originally contemplated. This is a reflection of the reduced electricity demand over the same period.

The majority of the ash produced throughout the 2019-2020 reporting period was emplaced as BCA within the MPAR. No ash was emplaced within the LNAR over the same reporting period. Around 150,677 tonnes of ash was re-used (not required for brine management). The majority of this ash was run of station that would have otherwise been WCA destined for the LNAR.

Table 4-1 Lamberts North Ash Re-use in tonnes and percentage

Reporting year: September - August	Total Ash Produced at MPPS	Ash placed in Lamberts North (t)	Ash Re-used	
			Total (t)	% of ash re-used that would have been placed within the LNAR
2013 - 2014	796,867	309,571	195,191	38.7%
2014 - 2015	590,858	180,907	195,891	52.0%
2015 - 2016	745,835	151,106	215,691	58.8%
2016 - 2017	830,936	302,926	225,810	42.7%
2017 - 2018	840,133	357,773	189,111	34.6%
2018 - 2019	749,055	152,792	220,959	59.1%
2019 - 2020	672,002	0	150,677	100.0%
<b>TOTAL</b>	<b>5,118,839</b>	<b>1,455,075</b>	<b>1,393,330</b>	<b>Average: 55.1% As Total: 48.9%</b>

Figure 1 presents the longer term 2013 – 2020 and the 2019-2020 ash re-use and ash emplaced at LNAR, noting that the portion of ash re-used would have otherwise been placed within the LNAR as WCA.

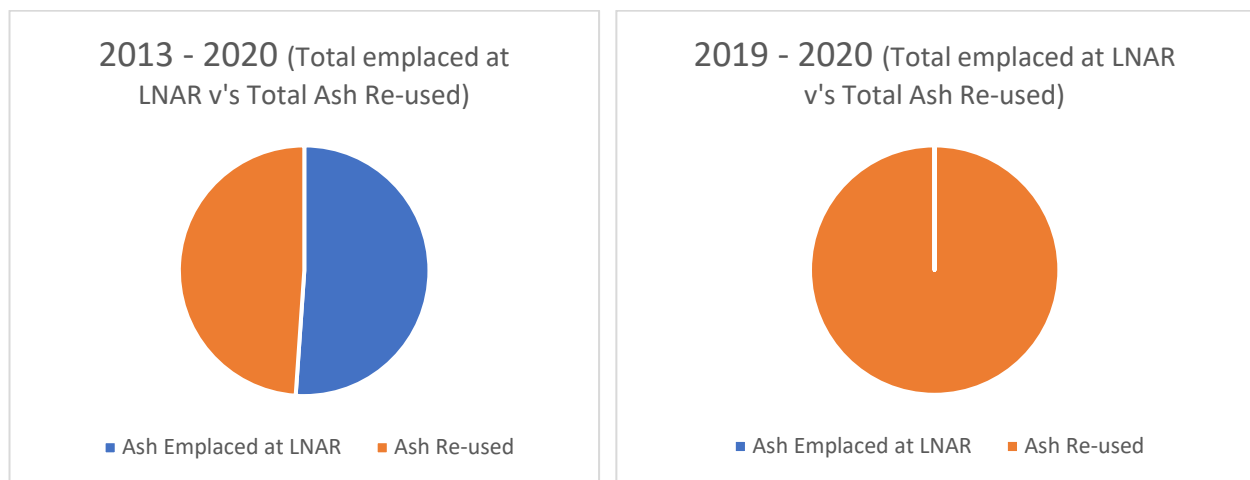


Figure 1. Ash Emplacement and Re-Use at LNAR

Table 4-1 demonstrates that the percentage of ash re-used associated with emplacement within the LNAR has exceeded the required 40% target (both as an average and total ash emplaced v's ash re-used since 2013). Table 4-1 also shows that the generation of ash over the years has fluctuated with significant downturns in 2014-2015 and 2019-2020. Ash re-use has generally been stable between the years 2013 – 2019 at around 200,000 tonnes per annum. Over the 2019 – 2020 period, there was a significant reduction in the overall re-use of ash, but this is in line with reduction of ash generation in general. The volume of brine generated over the 2019-2020 period

significantly increased with the commissioning of the Springvale Mine Water Treatment Facility. This resulted in a reduction of ash available for re-use and ash that could be emplaced as WCA.

## 4.5 Preliminary Forecast

**Table 4-2** presents a preliminary forecast for those components that result in the generation of ash and the re-use of ash. It is noted that this is a preliminary forecast and is subject to those limitations set out in **Section 4.3** as well as the risks/constraints presented in **Table 4-2**. The term of the preliminary forecast is limited to two years (out to 2022). An update to the Ash Management Strategy will be prepared in late 2022 to monitor progress against the preliminary forecast.

**Table 4-2 Lamberts North Ash Re-use in tonnes and percentage**

<b>Component</b>	<b>Sept. 20 – Aug. 21 Forecast (preliminary)</b>	<b>Sept. 21 – Aug. 22 Forecast (preliminary)</b>	<b>Risks/Constraints to achieve Preliminary Forecast</b>
Electricity Generation (MWh)	7,141,000	6,483,000	<ul style="list-style-type: none"> <li>• Production of solar and wind energy going into the grid</li> <li>• Weather conditions</li> <li>• Coal quality (could range between 21% – 28%)</li> <li>• Actual electricity demand</li> <li>• Major outages and maintenance</li> </ul>
Coal consumption (tonnes)	3.1Mt	2.7Mt	
Ash Generation (tonnes)	600k – 800k	600k – 800k	
Ash Sales – Forecast Existing customers (tonnes)	180k – 190k	200k – 210k	<ul style="list-style-type: none"> <li>• Security over ash supply volumes</li> <li>• Ability to secure markets</li> <li>• Ability to accept BCA as a product input</li> </ul>
Ash Sales - Forecast Small customers (tonnes)	0 – 2k	0 – 2k	<ul style="list-style-type: none"> <li>• Increase in market demand</li> <li>• Decrease in market demand</li> </ul>
Ash Sales - Forecast Nu-Rock (tonnes)	Up to 250k	Up to 250k	<ul style="list-style-type: none"> <li>• Dependent upon Nu-Rock facility to be able to physically use ash and their market commitments/sales</li> <li>• Ability to accept BCA as a product input</li> </ul>

## 4.6 Other Opportunities

Since 2013, EA has actively pursued alternate markets for the use of ash produced by the MPPS. Whilst this campaign has been successful, the ability to expand the market has been limited by

the downturn in electricity demand (particularly the 2019-2020 period) and the requirement to manage brine within a BCA product. Whilst trials are ongoing with third parties to re-use the BCA, run of mine ash and WCA is being reclaimed from the Ash Repositories on a campaign basis for re-use.

EA NSW is continuing to work with third parties with the goal of supplying ash including the reclamation of ash from the Mt Piper and Lamberts North ash Repositories for use in their products as noted above. These parties include Nu-Rock, and others that cannot be currently named for commercial reasons.

There are other opportunistic uses of fly ash that EA NSW is investigating with third parties. Mt Piper is equipped to be able to supply ash for these ad hoc opportunities, but historically, there has not been a significant demand from such projects.

EA has identified a number of opportunities to expand its market for the re-use of ash. Whilst some of these opportunities are in concept phase, their implementation and success will be based on detailed risk assessment, cost benefit analysis and the outcomes of stakeholder engagement (i.e. Customer demand and satisfaction). The program of investigation over the next two years will include the following, as a minimum:

1. Supporting existing and future ash customers to access ash that otherwise would have been disposed of to the LNAR;
2. Use of Ash (including the potential for WCA and/or BCA) for construction (remote customers will require dispatch and transport of ash)
3. Compartmentalised storage of BCA and reclamation of WCA from the existing Ash Repositories
4. Reduction of brine volumes requiring management through brine crystallisation processes (this may require third party involvement/management).
5. Review of the overall ash management arrangements at the LNAR.



## 5. References

ERM, 2020. Annual Environmental Monitoring Report – Water Management and Monitoring. Report prepared for EnergyAustralia: Project No: 0553983\_R01\_F01