Submission No 13

INQUIRY INTO COSTS FOR REMEDIATION OF SITES CONTAINING COAL ASH REPOSITORIES

Organisation: Delta Electricity

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Hon. Daniel Mookhey MLC
Committee Chair
Public Works Committee
Parliament House
Macquarie Street
Sydney NSW 2000

RE: INQUIRY INTO COSTS FOR REMEDIATION OF SITES CONTAINING COAL ASH REPOSITORIES

Delta Electricity ('Delta') welcomes the opportunity to make a submission to the *New South Wales Parliament Legislative Council – Public Works Committee inquiry into and report on the costs for remediation of coal ash repositories in New South Wales* (the 'Inquiry'). Delta owns and operates the Vales Point power station and the associated coal ash repository, commonly referred to as the Vales Point ash dam.

The attached submission by Delta covers the following areas of interest to the Committee:

1. an outline of the commercial framework pertaining to Vales Point and the option of a hand back of the site to the government;
2. background on the chemical and physical properties of coal ash showing that is predominantly comprised of inert material;
3. an outline of the ash dam design, construction history and operations demonstrating the safety and integrity of the ash dam structure;
4. an outline of oversight and compliance with current regulatory requirements;
5. an outline of the current closure plan and remediation requirements that will limit the ongoing legacy of the ash dam;
6. Delta's understanding of the groundwater quality surrounding the ash dam following a long term groundwater quality monitoring program shows that the groundwater surrounding the ash dam is not notably impacted by the ash dam; and
7. repurposing of the Vales Point ash dam with a 62 MW solar farm on 80 hectares of a section of the remediated ash dam, with potential for future expansion, demonstrates ongoing economic potential of the land impacted by the ash dam.

Delta is a member of the Ash Development Association of Australia (ADAA) and encourages the re-use of coal combustion products (i.e. coal ash). Delta has contracts in place with three companies for the re-use of fly ash, bottom ash and cenospheres. About 20% of coal ash produced at Vales Point is re-purposed as a result. Higher utilisation rates would be preferred but

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are limited by the industrial demand for ash. The issue of increasing the re-use of coal combustion products is addressed in the ADAA submission, which is endorsed by Delta.

A key matter in the terms of reference for the Inquiry is to understand the government liability and timing for remediating the Vales Point site, amongst others. Delta has prepared this submission, relying on scientific evidence and third-party reports, in order to inform the Committee of the current situation at Vales Point. Delta's submission shows the dam structure to be safe and well regulated to ensure ongoing integrity. The Vales Point ash dam meets best practice requirements for ash dam rehabilitation by employing a progressive cap and cover approach. Some 20% of the Vales Point ash dam is already fully remediated and another 24% is currently being remediated. A likely outcome is that the NSW Government may be required to complete the ongoing capping and environmental monitoring of the Vales Point ash dam should ownership be transferred to the NSW Government at closure.

Delta submits that the Vales Point ash dam is safe, structurally sound and fully compliant with existing regulations. Successful remediation of the coal ash repository is evidenced by the progressive rehabilitation of the Vales Point ash dam that has enabled development of a 62 MW solar farm, with construction due to begin in 2020. The Vales Point ash dam is being managed in a way that will leave limited and defined activities for the ash dam land owner that can be conducted without material cost. The final form of the ash emplacement will not leave a negative environment legacy, but rather a site that supports an expanding capacity of renewable energy generation that will provide sufficient revenue to support ongoing environmental monitoring and potentially provide a return to the state from solar generation.

Yours sincerely

Justin Flood
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Delta Electricity Submission to Inquiry into costs for remediation of sites containing coal ash repositories

1. The commercial framework pertaining to Vales Point and the option of a hand back of the site to the government (Terms of Reference 1(a)(iv) and 1(b))

Vales Point power station was built by the Electricity Commission of NSW in the early 1960's and first commenced operations of the 'A' station in 1963. The 'A' station was removed from service in the 1980's. The 'B' station was also constructed by the Electricity Commission of NSW and comprises of two 660 MW units. It commenced operation in 1978/79.

Vales Point was sold to Sunset Power International Pty Ltd (trading as Delta Electricity) in December 2015, with operations on the site for over 50 years. A condition of the sale is the indemnity provided by the NSW Government to Delta for pre-existing contamination, legacy contamination and ash dam contamination in the 'Vales Point Post Closure and Put and Call Option Deed' ('Handback Deed').

Under the Handback Deed, Delta is responsible for contamination, if any, that occurs while it is responsible for operating the power station. Delta has agreed to enforceable obligations to report annually to the NSW Government, commission independent contamination reports every two years to confirm whether any contamination has occurred and facilitate site inspections by the NSW Government to ensure compliance with the Handback Deed.

Upon closure of Vales Point power station, the NSW Government has granted Delta a put option to transfer Vales Point power station back to the NSW Government after de-commissioning obligations have been met. There are no specific de-commissioning obligations pertaining to the ash dam aside from maintaining site security and de-powering the site. If Delta does not exercise the put option, the NSW Government has a call option allowing it to transfer Vales Point back to the NSW Government.

At closure, the remediation requirements for the Vales Point ash dam will depend upon the amount of recycling over time and the final level of the ash dam. There are 7 planned ponds within the ash dam proper at Vales Point. Ponds 1, 2 and 3 have been filled and remediated. With the current status of the ash dam, Ponds 4 and 5 are likely to be filled and also capped and rehabilitated. Assuming Ponds 6 and 7 will not be at capacity at station closure and the put and call option is triggered by either party, it is possible the NSW Government will be responsible for capping and rehabilitating the limited remaining areas of exposed ash.

Capping of the exposed ash is conducted to ensure ash remains in the ash emplacement area. The current requirement is for at least half a metre of fill to be placed over the top of the ash with stormwater directed away from the ash dam catchment to manage ash dam water levels and to limit the amount of water penetrating the capped ash emplacement. The fill must be compliant with the NSW EPA resource recovery requirements for Excavated Natural

Material and Virgin Excavated Natural Material. A layer of topsoil is then placed over the cap to allow for revegetation with native species.

The cost of capping is currently expected to be cost neutral as the revenue received from capping material providers will offset the operational costs of managing the site until rehabilitation is completed.

2. The chemical and physical properties of coal ash (Terms of Reference 1(f))

Coal combustion products include fly ash, bottom ash or boiler slag and are produced primarily from the combustion of coal. The term coal ash is interchangeable. Fly ash is predominantly a silt-sized non-plastic material that can be easily eroded by wind and rain, hence the requirement to ensure exposed ash areas are wet and to cap ash emplacements once it reaches capacity and is dewatered. Over 90 percent of fly ash particles are finer than 0.1mm. As a result, ash is able to be densely packed during compaction, resulting in comparatively low permeability values and minimising seepage of water through a fly ash embankment.

Coal ash is predominantly made up of silica (the major constituent of sand) and aluminium oxide (insoluble in water). The chemical properties of the Vales Point coal ash are presented in the table below.

Component	CAS Number	Concentration % wt/wt
Aluminosilicate mineral (most likely mullite) [$3Al_2O_32SiO_2$]	1302-93-8	70-75
Silica, Crystalline - Quartz (SiO_2)	14808-60-7	20-25
Calcium oxide	1305-78-8	3-4
Iron sulfides (FeS), e.g. pyrite	1309-36-0	<5
Potassium containing mineral (most likely orthoclase, muscovite or similar) [e.g. $KAlSi_3O_8$; $KAl_2(AlSi_3O_{10})(FOH)_2$]	12251-44-4 1318-94-1	<5
Trace Metals (total)	Not Available	<1
Mineralogy has been approximated from semi-quantitative XRD of <4 µm abstracted fly ash elemental analysis which indicated a typical concentration of 15.9% Al; 66.6% Si as SiO_2; 8.3% Fe; 3.5% Ca; 2.1% K; 0.17% Sr; 1.9% Ti; 0.21% S; 0.15 Zr; and 0.003% As.		

The concentrations of metals in samples of ash outlined in the above table are very low, and they are sparingly soluble in water. Consequently, the toxicity of ash to aquatic organisms would also be low.

The NSW EPA Resource Recovery Order for coal ash, issued under the Protection of the Environment Operations (Waste) Regulation 2014, imposes requirements on suppliers of coal ash. It specifies sampling, testing and analysis requirements on coal ash that is sold to third parties and applies limits to various elements of coal ash. All Vales Point coal ash sales fully comply with his order, ensuring the safe beneficial re-use of Vales Point coal ash.

3. Vales Point ash dam design, construction history and operations (Terms of Reference 1(a)(iv), 1(f))

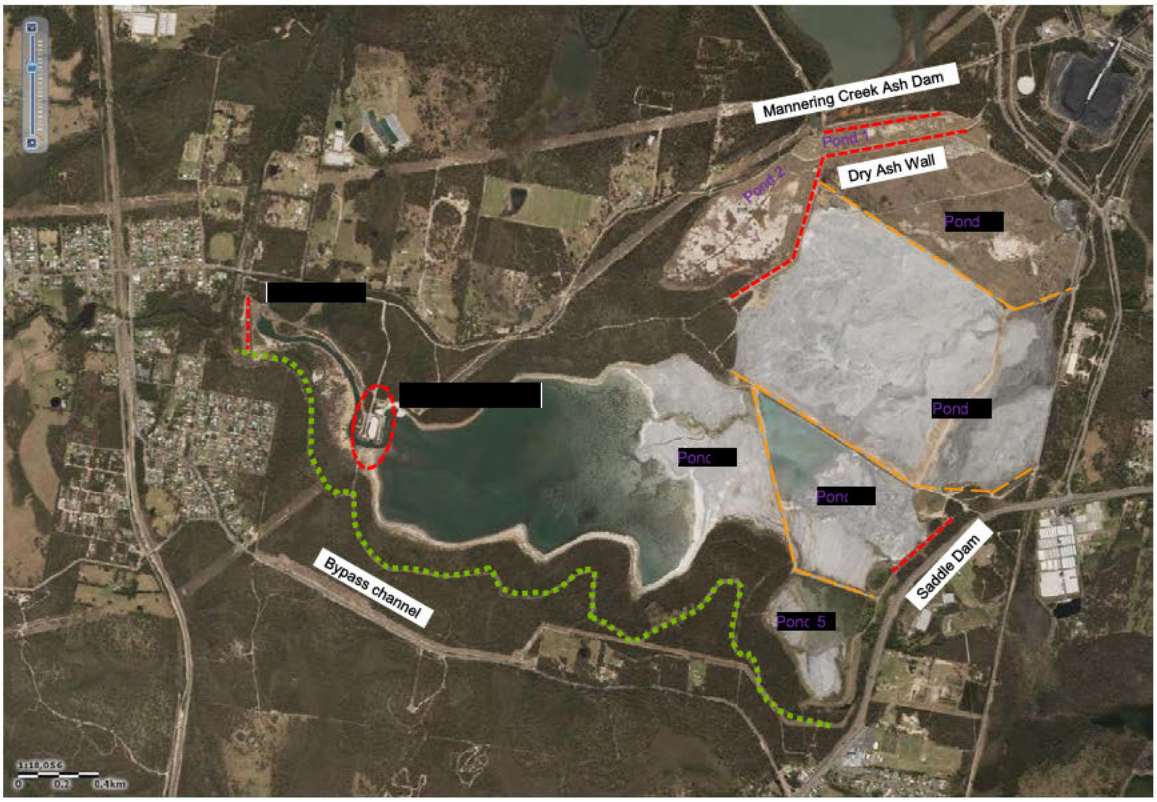
3.1 Ash Dam Construction

The Vales Point ash dam has an operational area of approximately 524 hectares of which:

- 108 hectares are already filled, capped and rehabilitated;
- 124 hectares are in the process of capping; and
- 292 hectares comprise active ash storage.

The ash dam is comprised of several embankments (refer Figure 1), developed in stages to suit the ash storage requirements of the Vales Point power station. The original dam was the Mannering Creek Ash Dam (constructed between 1960 and 1963). The foundation beneath this embankment consists of interbedded layers of alluvial and marine clay, silt and sand up to 15m thick, overlying sandstone and conglomerate bedrock. The upper foundation is predominantly a cohesive "clayey" material. It is a conventional zoned earth fill embankment, 11m high and 915m long with a crest level at RL 12m.

Figure 1 – Vales Point Ash Dam



The design of the Mannering Creek Ash dam embankment is such that it has been constructed with an impervious zone upstream of the embankment, providing an effective

natural barrier that ensures the structural integrity of the ash dam and provides protection from groundwater seepage.

The dry ash wall embankment (constructed between 1980 and 1996) is founded on up to 13m of hydraulically deposited ash material overlying the interbedded soil layers. It is 7m high (RL 19m) and is set back about 70m from the Mannering Creek embankment and is some 2,000m long with a 30m wide crest with gentle upstream and downstream slopes for stability and seepage requirements. The setback between the embankments contributes significantly to the overall stability of the dam. The embankment was progressively covered with 100mm of topsoil and vegetated with grass during the construction period.

The Wyee Dam embankment (constructed in 1983) is 6m high (RL 18.5m) and 280 metres long and prevents ash dam water from entering Wyee Creek. A return water system was installed in 1995 to stop the continuous discharge of ash dam water directly to Wyee Creek. The return water system promotes the beneficial reuse of the water in the power station and allows surplus water from the ash dam to be dispersed into Lake Macquarie via the power station outfall canal (a licensed discharge point under the Vales Point Environment Protection Licence).

3.2 Progressive Rehabilitation

The ash dam has been divided into ponds to optimise ash deposition within the emplacement area (refer Figure 1). Ponds 1 to 3 have been filled and capped while pond 4 has been filled to capacity and capping is underway. Pond 5 is almost at capacity and Pond 6 filling has commenced.

Ponds 1 and 2 sit behind the original Mannering Creek embankment (refer Figure 1) with Pond 3 at a higher level behind the dry ash wall. A subsoil drainage system was installed in the ash deposits in these ponds immediately upstream of the embankment to prevent seepage from the deposit in this area emerging at the original dam crest. Seepage collected from this drain is pumped back into the ash dam from a collection point in the original concrete lined spillway.

In 2006, various drainage works were carried out to improve drainage and prevent the ponding of rainwater. The sub soil drainage system in Pond 2 was extended to lower the water level in the ash deposit downstream of the dry ash wall.

Following capping of Pond 3, a lined spillway was installed on the compacted ash embankment to allow stormwater to discharge from the capped surface of pond 3 onto the surface of pond 2, where it is handled by the Pond 2 drainage system.

Ponds 1 through to 3 are already capped and rehabilitated and thus do not present a current or future liability for Delta, or the NSW Government should it assume responsibility for the Vales Point ash dam.

4. Regulatory Compliance and Dam Safety Reviews (Terms of Reference 1(d))

4.1 Dams Safety Act 2015

Operational practices are maintained at the Vales Point ash dam in accordance with Dams Safety NSW legislative and regulatory requirements. Surveillance of the ash dam includes the following inspections:

- routine monitoring inspections conducted weekly by Delta personnel;
- quarterly instrument monitoring conducted by an independent dam safety engineer;
- annual intermediate inspections conducted by an independent dam safety engineer; and
- 5 yearly comprehensive inspections conducted by an independent dam safety engineer.

Delta maintains full compliance with the regulatory requirements of the Dams Safety Act 2015. All reports for Vales Point ash dam are routinely submitted to Dams Safety NSW (previously the Dam Safety Committee). This ensures safety standards of the Vales Point ash dam are being maintained at all times and that the ash dam is safe.

4.2 Australian National Committee on Large Dams (ANCOLD)

Vales Point ash dam has a dam safety management program in place in accordance with the ANCOLD guidelines. ANCOLD prepares and issues guidelines which represent best engineering practice. These guidelines have been developed to share best Australian practice for large and small water and tailings dams that could present a risk to life for those downstream and are widely used across Australia. Compliance with ANCOLD guidelines again demonstrates that the Vales Point ash dam is safe.

4.3 Dam Stability Assessment 2009

Following the failure of the ash dam at Kingston Power Station in Tennessee in December 2008, Delta engaged its independent dam safety engineer to conduct a stability review into the causes of the Kingston failure and to determine whether a similar failure risk was present at Vales Point ash dam. The stability review comprised:

1. a review of the Vales Point ash dam construction and history;
2. Dynamic Cone Penetration testing to assess the surface properties of the ash dam in comparison to the design, to gauge if strength parameters adopted were still suitable for use; and
3. performed stability analysis for long term stability of the dam and short-term stability of the dam when subjected to a seismic event.

Further, it observed that the 1989 Newcastle earthquake was significant, with its epicentre only 25kms away from the Vales Point ash dam. A subsequent survey found no measurable deformations occurring as a result of the earthquake.

The results of the stability review found the dam to be stable in all scenarios. In particular, there are critical factors at Vales Point ash dam that ensures it will not suffer a similar failure to the Kingston ash dam. These include:

- a more favourable design geometry;
- a gradual downstream face and hydraulic gradient compared to Kingston;
- no foundation slimes beneath the dam foundation as was the case at Kingston;
- low water levels in the Vales Point ash deposits; and
- good management practices (arising from compliance with Dams Safety Act 2015).

The report found that the water level remained at a satisfactory level (approx. 2-3 m below ground level), since 2005 when disposal into pond 3 ceased. No seepage had been reported emerging from downstream face or foundation of the embankments. The low water level helps to maintain a satisfactory factor of safety for the ash dam when modelling stability.

Following over 40 years of operations, this stability assessment confirmed the integrity of the structure and design of the Vales Point ash dam.

4.4 Senate Inquiry (referencing power station ash dams)

In March 2019 the Federal Senate Environment and Communications References Committee published a report[1] that included a chapter on the rehabilitation of coal ash dams.

The report included a submission from a dam engineer expert. It outlined that the only example in the Australian context of a rehabilitated ash dam is Tallawarra power station near Wollongong. That site was decommissioned in the 1990s and is subject to ongoing monitoring, with no environmental issues of note arising since decommissioning.

The same expert was quoted as saying that all ash dam sites are unique, and as such require different approaches to decommissioning and rehabilitation. Cap and cover approaches to rehabilitating ash dam sites was reported to be the industry standard worldwide with best practice rehabilitation requiring progressive capping and covering the ash dam site. Delta notes that Vales Point meets this requirement for best practice ash dam rehabilitation with Ponds 1, 2 and 3 completed already.

Any ash dam rehabilitation project is a long-term undertaking, likely requiring the monitoring of:

- dam structure safety and performance against design predictions;
- vegetation regrowth against predictions;
- surface and groundwater quality improvement over time; and
- dust emissions reductions over time.

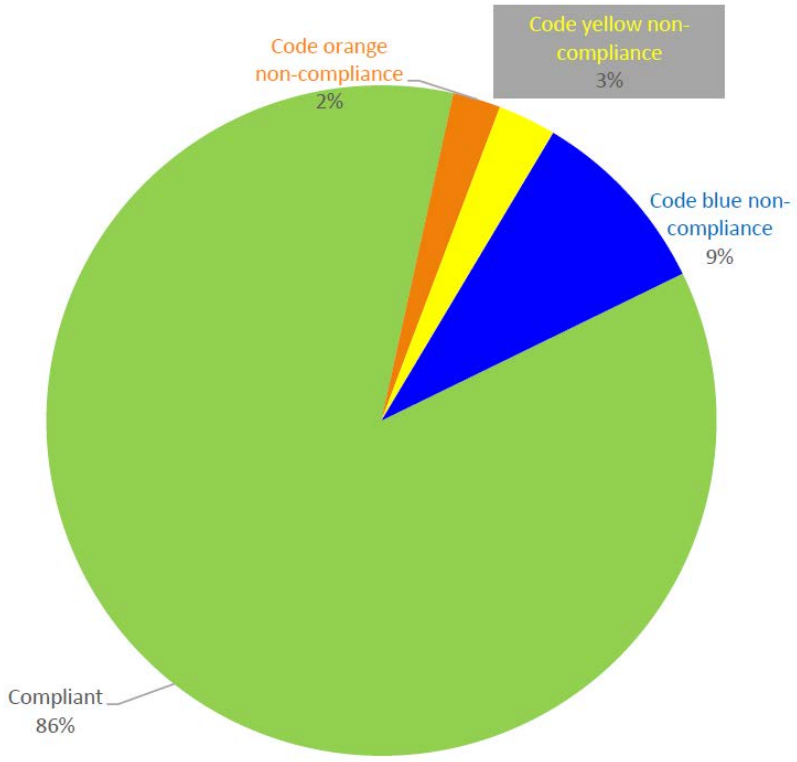
Delta maintains the above monitoring as part of the management plan for the Vales Point ash dam.

[1] https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/MiningandResources/Report

4.5 EPA Audit

In October 2015, the EPA conducted an audit of the Vales Point ash dam and all other ash dams in NSW to check compliance with its Environment Protection Licence and the Protection of the Environment Operations Act 1997. The audit was the first industry wide assessment of coal ash dams with the findings summarised in Figure 2. All ash dam owners were subsequently required to submit a response to the NSW EPA with an action plan demonstrating full compliance. The Vales Point response plan was immediately prepared and all actions completed. Delta continues to ensure ongoing compliance with its Environmental Protection Licence and the Protection of the Operations Act 1997.

Figure 2 – EPA Coal ash dams and emplacements audit assessment of compliance



The non-compliances that were identified at Vales Point were minor in nature and related to procedural or operating matters that were readily and immediately rectified. There was no issue raised in the audit report that related to dam safety compliance or the structural integrity of the ash dam.

4.6 Expected future obligations under current regulatory requirements

Under current regulatory requirements, the Vales Point ash dam will continue to be monitored by both the NSW EPA and Dams Safety NSW regulatory bodies.

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5. Vales Point ash dam closure plan and remediation requirements (Terms of Reference 1(a)(iv) and 1(b))

The ash dam management plan is prepared every 5 years and outlines the upcoming activities for the next 5 years of the Vales Point ash dam. In preparing the plan, it is assumed in the plan that power station closure will occur at the 50 year anniversary of the Vales Point B power station in 2029 when the ash dam will be almost at capacity. The actual closure date of the power station will be determined by economic, system security and technical circumstances rather than a set age of the power station.

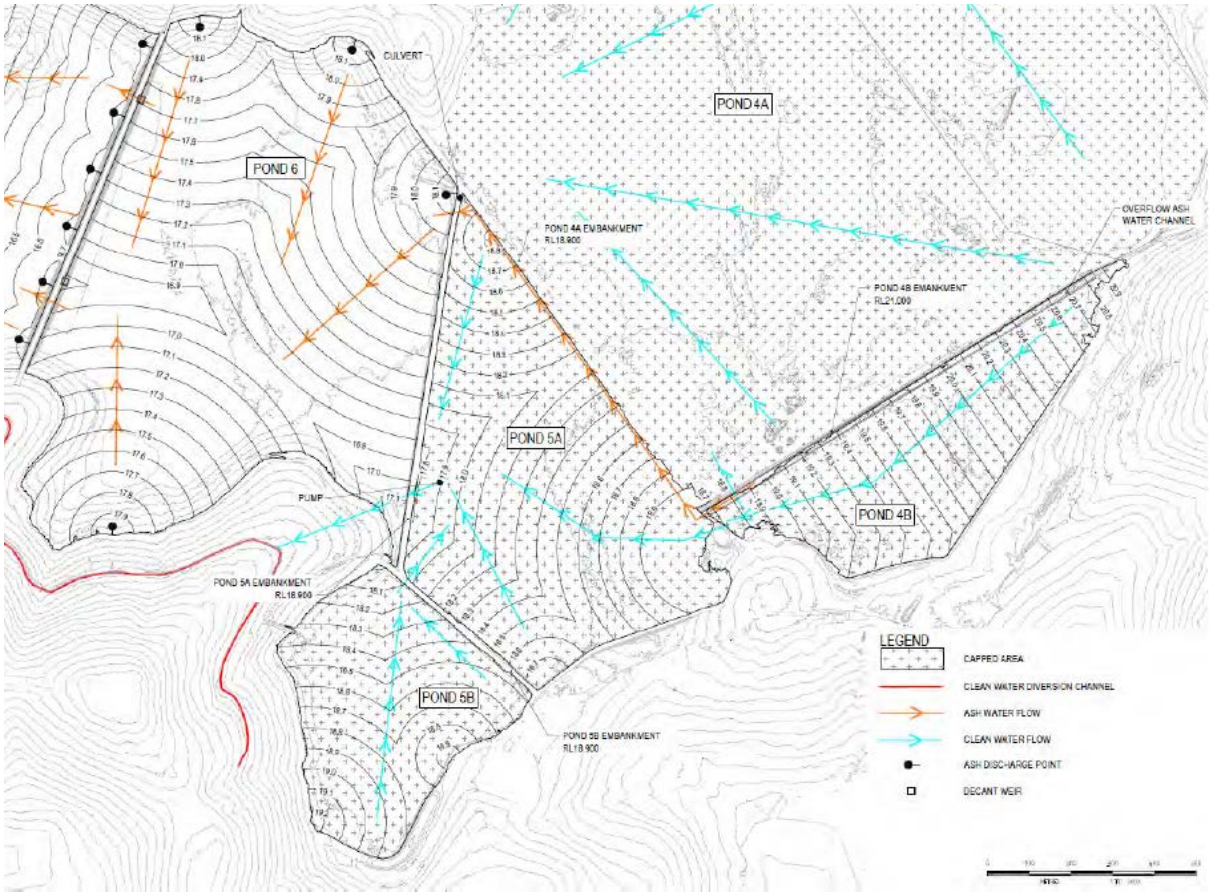
When each pond within the ash dam is filled, it is capped with 0.5m of sub-soil and topsoil and is then re-vegetated with native species. The slope of the cap of the ash dam is designed such that it directs clean surface water flow away from the ash dam catchment with the final graded level allowing for gravitational clean water flow towards Wyee Dam, once the ash dam is completely rehabilitated. The effect of the capping is three-fold:

1. the primary purpose of the cap is to contain the ash in the emplacement, preventing erosion by wind or rain as evidenced by effectiveness of the capping on Ponds 1, 2 and 3;
2. it limits the amount of water that enters the ash emplacement, thereby reducing the potential for leaching; and
3. it further adds to compaction of the ash emplacement, which along with the small particle size, decreases the permeability of the ash, further limiting the potential for water to migrate through the ash and leach trace elements.

Figure 3 shows how the progressive remediation of the ash dam is planned with clean stormwater that falls onto the progressively capped areas to be directed away from the active ash emplacement areas. The nature of ash emplacement is such that the surface of ponds at capacity is very even with only a gentle slope evident. The capping is then placed such that the surface gently slopes away from active areas of the ash dam, thus directing stormwater off the capped area. When all ponds have been capped, gravity will direct all stormwater to flow away from the ash emplacement and will not require any intervention to maintain the remediated ash dam.

As a result of the ash dam management plan at Vales Point, the site is well suited to additional solar capacity being installed as each ash pond is progressively capped and covered.

Figure 3 Progressive Plan for Ash Dam Water Management



6. Groundwater quality surrounding the ash dam (Terms of Reference 1(a)(iv))

Delta was required by the NSW EPA in 2015, as a condition of its Environment Protection Licence, to complete an assessment of groundwater in the vicinity of the Vales Point ash dam. As part of the assessment, groundwater data from bores around the ash dam were compared to groundwater data from background bores. The assessment provided to the EPA found that levels of trace elements found in the groundwater in the ash dam bores were not consistently elevated in comparison to the trace elements found in baseline bores that are located away from possible influence from the ash dam. The study concluded that any potential leaching of elements from the Vales Point ash dam into the groundwater table is not notably impacting the groundwater in the surrounding environment.

Since completion of the groundwater assessment, Delta has continued to monitor groundwater quality in both ash dam and background bores. There has been no change in the results of the bores subject of the study reported to the EPA in 2015 that would indicate a change in the situation.

7. 62 MW Vales Point solar farm project (Terms of Reference 1(c))

The Vales Point ash dam consists of a series of operational and closed ponds. As already outlined, Ponds 1 , 2 and 3 are closed and have been capped with soil and rehabilitated with native grasses.

Figure 3 Current state of Pond 3

Delta is proposing to establish a utility scale solar field on approximately 80 hectares of the ash dam. The proposed solar project is expected to have a capital investment of approximately $75m, generate 100 construction jobs over 9 months and up to 5 full time ongoing positions.

Development Approval

The NSW Department of Planning, Industry and the Environment granted approval for the project as a State Significant Development (SSD) under Part 4 of the Environment Planning and Assessment Act (1979). The approval identifies that the beneficial effects of renewable energy generation on land unsuitable for other development is considered to outweigh the mostly temporary adverse impacts and risks associated with the project that arise during construction.

Construction

Distributed energy resources and investment company Enernet Global and Delta Electricity announced the signing of a power purchase agreement for the sale of 87GWh of energy from a 62MW solar farm at the Vales Point ash dam in October 2019. Construction is planned to start in the first half of 2020. The innovative project will pioneer in Australia a fully-ballasted system tailored to optimise delivery on land where traditional driven or screw piles are not possible, enabling efficient delivery of the utility scale system on the rehabilitated ash dam surface.

This project will deliver ongoing lease payments for the NSW Government for the life of the solar farm, ensuring that any ongoing regulatory environmental monitoring requirements will be covered, especially if the remaining 400 hectares of the ash dam is also developed for use as a solar facility.

8. Conclusion

Delta submits that the Vales Point ash dam is safe, structurally sound and fully compliant with existing regulations. Successful remediation of the coal ash repository is evidenced by the progressive rehabilitation of the Vales Point ash dam that has enabled development of a 62 MW solar farm, with construction due to begin in 2020. The Vales Point ash dam is being managed in a way that will leave limited and defined activities for the ash dam land owner that can be conducted without material cost. The final form of the ash emplacement will not leave a negative environment legacy, but rather a site that supports an expanding capacity of renewable energy generation that will provide sufficient revenue to support ongoing environmental monitoring and potentially provide a return to the state from solar generation.

Dated
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