Kerosene Vale

Ash Repository Area Stage 2

Annual Environment Management Report

May 2011 – April 2012

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Kerosene Vale Ash Repository Stage 2 Annual Environment Management Report for 2011-2012

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List of Acronyms

AEMR	Annual Environmental Management Report
CoA	Condition of Approval (also known as MCoA – Minister's CoA)
CEMP	Construction Environmental Management Plan- KVAR Stage 2B
DE	Delta Electricity
DECCW	Department of Environment, Climate Change and Water
DOP	Department of Planning (now Department of Planning and Infrastructure)
DP&I	Department of Planning and Infrastructure
EPL	Environment Protection Licence
ER	Environment Representative
KVAD	Kerosene Vale Ash Dam
KVAR	Kerosene Vale Ash Repository
KVAR 2	Kerosene Vale Ash Repository Stage 2
LLI	Lend Lease Infrastructure (Ash Placement Contractor)
mAHD	metres Australian Height Datum
MES	Malfroy Environmental Strategies Pty Ltd
OEMP	Operation Environmental Management Plan
PB	Parsons Brinckerhoff Australia Pty Ltd
RL	Relative Level
RMP	Repository Management Plan
SSCAD	Sawyers Swamp Creek Ash Dam

Executive Summary

Under Section 75J of the Environmental Planning and Assessment Act 1979, the Minister of Planning approved Delta to continue the disposal of ash at Kerosene Vale Ash Repository which is generated by the Wallerawang Power Station. This approval was dated the 26 November 2008. The project is commonly known as Kerosene Vale Ash Repository (KVAR) Stage 2 and is subject to a number of Departmental Conditions of Approval (CoA's).

Condition 7.3 of the Project Approval (Department of Planning, 2008) requires that Delta Electricity prepare and submit an Annual Environment Management Report (AEMR) for the approval of the Director-General, Department of Planning and Infrastructure (DP&I). This AEMR has been prepared to satisfy this requirement. The 2011-2012 AEMR has been completed by Delta Electricity's Strategy and Development Group, through an auditing process. The audit involved interviewing numerous contractors, accessing documentation relating to the project and carrying out visual inspections of the KVAR Stage 2 Site at Wallerawang. The audit was conducted in conjunction with the Departmental Conditions of Approval (CoA's), the requirements set out in the Operational Environmental Management Plan (OEMP 2009) and the new document called the Construction Environmental Management Plan (CEMP 2011).

Since the 1st Annual Environment Management Report was submitted, the ash placement strategy for Kerosene Vale Stage 2 Ash Repository (KVAR) has been updated. This is due to two factors:

- Centennial Coal declined interest in mining the area and subsequently relinquished their rights to extract coal from the site, and;
- Delta Electricity no longer required the realignment of Sawyer's Swamp Creek after new geotechnical information was obtained.

As a consequence the ash placement strategy has changed since the inception of the OEMP (2009) to a two-staged approach, with the second stage comprising parts 2A and 2B.

Lend Lease Infrastructure Services (previously Conneq) is the principal contractor at KVAR, and has been placing ash into Stage 2A of the repository since 2009. Delta and Lend Lease recognised that Stage 2A was reaching its capacity in early 2011. As such, a Construction Environmental Management Plan (CEMP) for KVAR Stage 2B was developed, and submitted to the DP&I in August 2011 with approval granted by the Director General in December 2011.

Earthworks started at Kerosene Vale Stage 2B in January 2012. As a result this report will reflect on both KVAR Stage 2A and the earthworks associated with KVAR Stage 2B up until the end of April 2012.

With key project guidance from Delta's External Plant Manager, Lend Lease has effectively mitigated and managed the potential noise, dust/air, surface and groundwater and other environmental impacts associated with the operation of the Kerosene Vale Stage 2 Ash

Repository. Observational evidence combined with data provided to Delta in Lend Lease's Monthly Client Service Reports indicate that Lend Lease has approached its contract of management with a view to not only meet the requirements laid out in the OEMP, but to improve on them. This has been achieved through an adaptive management system.

The findings contained in this report demonstrate that Delta has complied with all Project Conditions of Approval during the 2011-2012 reporting period. In addition, Delta has also complied with the environmental requirements of the OEMP, with the exception of one partial compliance in relation to reviewing the Noise Operational and Vibration Management Plan. Delta has complied with all requirements outlined in the CEMP.

1. Introduction

In 2001, there was an operational need for Delta Electricity to change from wet to dry ash-producing activities. In 2002, approval was granted to use the decommissioned Kerosene Vale Ash Dam area for dry ash storage. Stage 1 of the storage facility was designed to operate for a period of five years in a limited area over the Kerosene Vale Ash Repository. As this area began to reach capacity, Delta sought approval to expand the storage area.

On 26 November 2008, Delta Electricity received Project Approval from the Minister of Planning for the extension of the existing Kerosene Vale Ash Repository Area to permit the continued disposal of ash generated by the Wallerawang Power Station under Section 75J of the *Environmental Planning and Assessment Act 1979*. The project is commonly known as Kerosene Vale Ash Repository (KVAR) Stage 2 and is subject to a number of Departmental Conditions of Approval (CoA's).

Condition 7.3 of the Project Approval (DOP, 2008) requires that Delta Electricity prepare and submit an Annual Environment Management Report (AEMR) for the approval of the Director-General. Condition 7.3 which summarises the requirments of the AEMR is provided below:

The Proponent shall, throughout the life of the project, prepare and submit for the approval of the Director-General, an Annual Environment Management Report (AEMR). The AEMR shall review the performance of the project against the Operation Environmental Management Plan (CoA 6.4) and the Conditions of this Approval. The AEMR shall include, but not necessarily by limited to:

- *Details of compliance with the Conditions of Approval;*
- *A copy of the Complaints Register (refer to CoA 5.4) for the preceding twelve-month period (exclusive of personal details), and details of how these complaints were addressed and resolved;*
- *Identification of any circumstances in which the environmental impacts and performance of the project during the year have not been generally consistent with the environmental impacts and performance predicted in the documents listed under condition 1.1 of this approval, with details of additional mitigation measures applied to the project to address recurrence of these circumstances;*
- *Results of all environmental monitoring required under conditions 3.3 to 3.8 of this approval, including interpretations and discussion by a suitably qualified person; and*
- *A list of all occasions in the preceding twelve-month period when environmental goals/objectives/impact assessment criteria for the project have not been achieved, indicating the reason for failure to meet the criteria and the action taken to prevent recurrence of that type of failure.*

In March 2010, Parsons Brinckerhoff Australia Pty Ltd (PB) was engaged by Delta Electricity to prepare the first AEMR for the Kerosene Vale Stage 2 Ash Repository Area for the twelve-month period of April 2009 to March/April 2010.

The second and now third AEMRs for 2010-11 and 2011-2012, were prepared internally by Delta Electricity.

2. Purpose of AEMR

The purpose of this Annual Environment Management Report (AEMR) is to provide detail about operational activities carried out in the past reporting year (April 2011 to April 2012) at KVAR Stage 2 in relation to the Environmental Performance criteria specified in the approval documentation.

2.1. Project Setting

Ash placement commenced at Kerosene Vale Stage 2 Ash repository in April 2009. Consequently, Delta Electricity engaged Lend Lease Infrastructure (previously Conneq) as their principal contractor for the project. Lend Lease has used the following documentation for operational purposes throughout the 2011-2012 reporting period:

- Operation Environmental Management Plan (Parsons Brinckerhoff, 2008)
- Ash and Dust Repository Management Plan (Lend Lease, 2010)
- Construction Environmental Management Plan (Lend Lease and Delta Electricity, 2011)

The original ash placement strategy for KVAR Stage 2 (Figure 1) comprised of three stages- Stage 2A as an extension of Stage 1, Stage 2B to allow time for the re-alignment of Sawyers Swamp Creek and for material to be obtained from the pine plantation area to reinforce the stabilisation berm to the north of KVAR Stage 1 and Stage 2C as a final ash placement area once reinforcements had been carried out. Placement has not proceeded in this manner due to Centennial Coal relinquishing their right to extract coal from the areas of mining interest within KVAR Stage 2. Delta's structural engineers, after further investigation, agreed that if they moved the northern boundary of the repository 60m from the dam wall, at a depth of no more than 12m, the necessity for the stabilisation berm would be removed. Therefore, Delta agreed that it was no longer feasible to realign Sawyers Swamp Creek. As a result, this project was redesigned as a two stage project instead of a three. The new design of Kerosene Vale is outlined in Figure 2

As Stage 2A was nearing capacity (Lend Lease, March 2011), a Construction Environmental Management Plan (CEMP) for KVAR Stage 2B was developed in consultation with Delta Electricity's Western Strategy and Development section. This plan was submitted to the Department of Planning and Infrastructure in August 2011 and further approved in December 2011.

The CEMP provides information concerning the site, and changes to the original project specification that are still subject to the approvals, and primarily covers the requirements of ash placement during the Stage 2B operations, which includes a large excavation component.

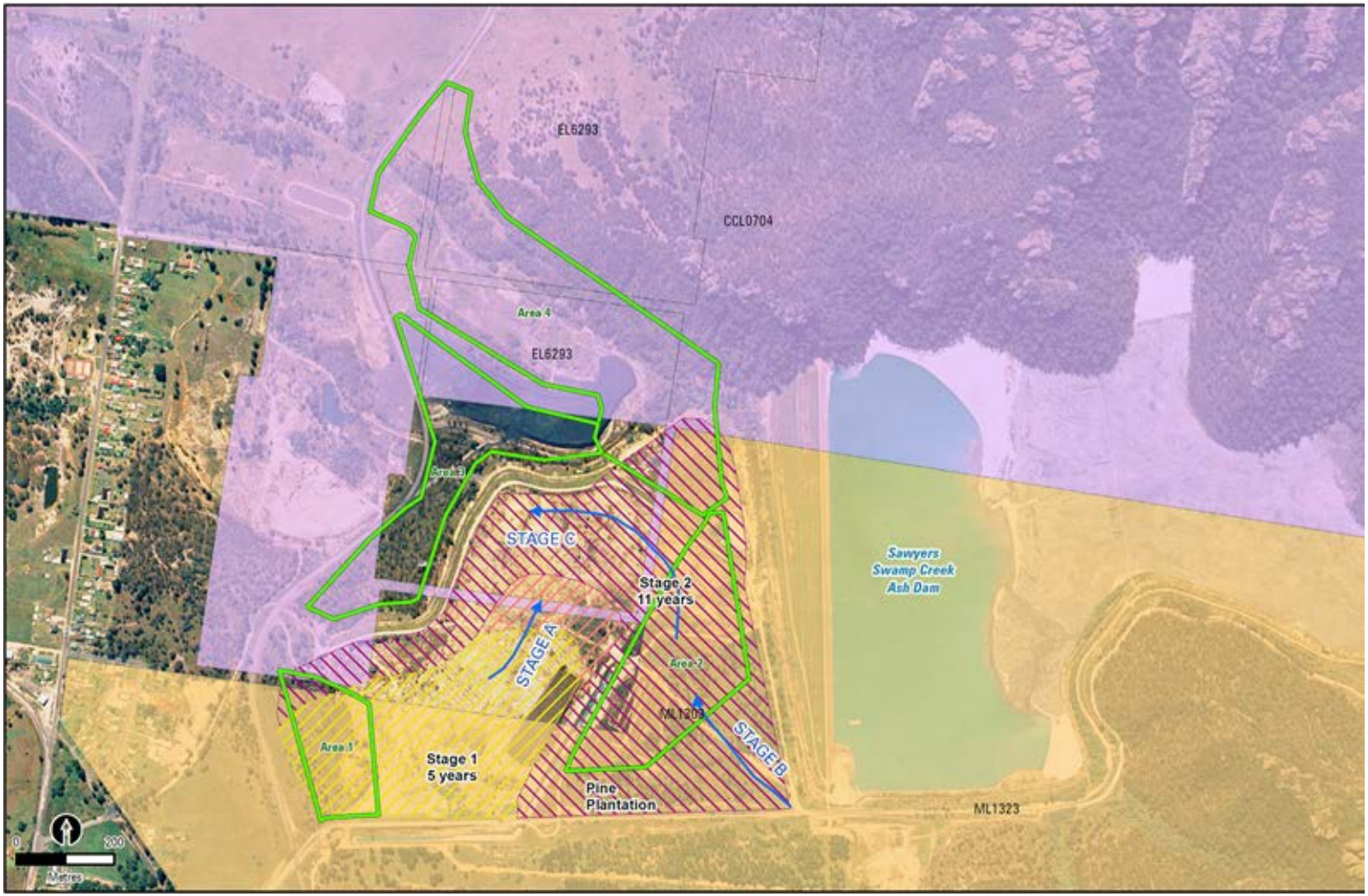

Figure 1 Original Kerosene Vale Ash Placement Strategy (Parsons Brinkerhoff, 2008)

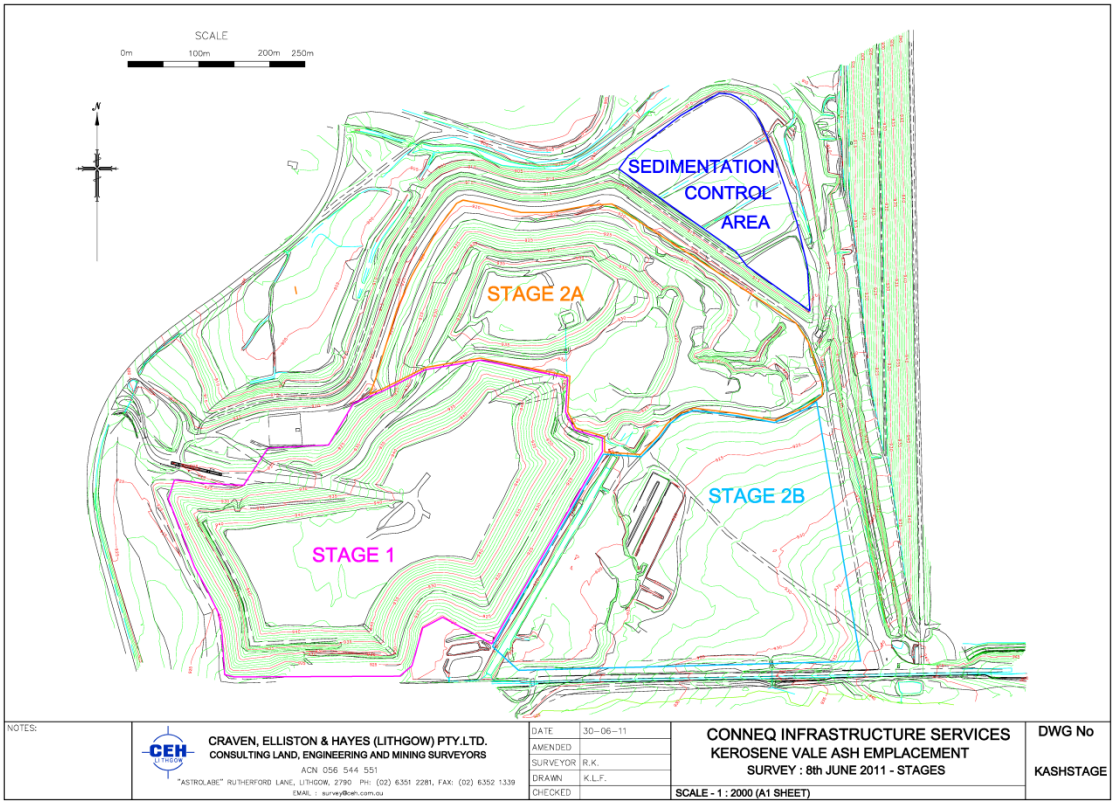

Figure 2 Revised Ash Placement Strategy for KVAR Stage 1, 2A and 2B

2.2.Site Characteristic and Context

The Kerosene Vale Ash Repository (KVAR) is situated in the Sawyers Swamp Creek Catchment, and receives significant amounts of runoff from the surrounding areas. The catchment area is located upstream of Sawyers Swamp Creek Ash Dam and is recognised as being highly diverse, with an abundance of threatened species and ecological communities.

The original ash placement operations were at the Kerosene Vale Ash Dam (KVAD) which was built around a former coal mine void that contained deposits of coal waste known as chitter. The void was filled with ash transported from the Wallerawang power station as slurry (i.e. wet ash placement). When the KVAD was full, it was capped with a clay capping. The next ash placement operation was at the Sawyers Swamp Creek Ash Dam (SSCAD) which saw wet ash placement take place from 1980 to 2003. Ash placement operations have now been nearly entirely converted to dry ash placement.

The first dry ash placement area was known as Kerosene Vale Ash Repository Stage 1, and was located on top of the clay capping of the KVAD. The KVAR Stage 2 placement works commenced in April 2009, with Stage 1 placement works finalised in January 2010.

The reasons for the conversion from wet to dry ash placement are primarily for the significant reduction in the potential for environmental impacts. Trace metals occur naturally in coal, with many retained in the ash when this coal is burnt at the Power Stations. There is therefore the potential in a wet ash placement system for those trace metals to be contained in the ash effluent from the boiler which is sluiced away to an ash dam (Little, 1984). Whilst

most metals form part of the ash itself, small concentrations of trace metals can dissolve and accumulate in the water systems interconnected with the ash dam.

As such, the conversion to dry ash storage at Kerosene Vale for Wallerawang Power Station was developed to ensure environmental and social impacts were minimised. Key benefits of the dry ash handling facility include:

- The potential for ash to be beneficially reused in its dry form;
- An approximate 80% decrease in the water required to transport ash;
- Decrease in discharges to the Coxs River in the long term;
- The option to progressively rehabilitate the Sawyers Swamp Creek Ash Dam; and
- A decreased flood risk for Kerosene Vale, Lidsdale and surrounding areas (Burrows, 2001).

It is the dry ashing operation that is the focus of this Annual Environment Management Report (AEMR).

3. Assessment of Compliance with Conditions of Approval (CoAs)

In assessing compliance with the CoAs the following compliance categories were used:

- Full Compliance
- Partial Compliance
- Non-Compliance
- Not Applicable

A detailed review checklist for each condition of approval is presented in Appendix A.

The Project Approval consists of 70 Conditions of Approval (CoAs). The following is a summary of the compliance assessment findings against the 70 conditions of approval:

- Compliance Findings – 43
- Not Applicable Findings – 26
- Partial Compliance Findings - 1
- Non-Compliance Findings – 0

3.1. Partial Compliance

As stipulated in the OEMP, the noise sub plan requires review every 2 years. The last review was completed in 2009.

Delta received a partial compliance finding for this item, as a review of the sub plan was not conducted in 2011. Since the 2010-2011 AEMR, two noise monitoring events were conducted in November 2011 and May 2012 (refer to Appendix E for results). Upon consideration of the review requirement, Delta in consultation with their acoustic specialists concluded that it would be more accurate to have at least three consecutive noise monitoring events before reviewing their existing noise sub plan. The third monitoring event is due to occur in November 2012. Delta proposes to have this review completed prior to the end of the 2012-13 reporting year.

4. Compliance with other Licenses, Permits and Approvals that Apply to the Project

The project is located within the operating area of Delta Electricity's Wallerawang Power Station, which holds Environment Protection Licence (EPL) No. 766.

The following sections of the EPL are relevant with respect to the operations of the Kerosene Vale Stage 2 Ash Repository Area:

L1 Pollution of Waters: except as may be expressly provided in any other condition of the Licence (EPL 766) the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997 (POEO Act): Prohibition of pollution of waters.

L5 Waste: the licensee must not cause, permit or allow any waste generated outside the premises to be received at the premises for storage, treatment, processing, reprocessing or disposal or any waste generated at the premises to be disposed of at the premises, except as expressly permitted by the licence. Only the following types of waste may be disposed of at the premises:

- Ash
- Mill pyrites
- Demineralisation and polisher plant effluents
- Chemical clean solutions
- Cooling tower sediments
- Ion exchange resins
- Fabric filter bags
- Brine conditioned fly ash
- Biomass co-firing ash
- Settling pond sediments
- Oil and grit trap sediments

L6 Noise Limits: Operational noise from the Kerosene Vale Ash Repository area must not exceed 40dB(A) LAeq(15 minute), at the nearest most affected noise sensitive location.

L7 Hours of Operation: Operational activities associated with the Kerosene Vale Ash Repository must only be carried out between the hours of 0700 and 2200 Monday to Sunday.

Table 2 EPL Compliance Assessment

EPL requirements	Finding	Relevant Section of AEMR
L1 Pollution of Waters	Compliance	Section 6.1.2 Surface and Groundwater Monitoring
L5 Waste	Compliance	Section 6.2.7 Waste Management
L6 Noise Limits	Compliance	Detailed review checklist for CoA3.2 (Appendix A), Section 5 Complaints Register and Section 6.1.1 Ongoing Operational Noise Monitoring
L7 Hours of Operation	Compliance	Detailed review checklists for MCoA2.8 and MCoA2.10 (Appendix A)

Based on the observations and findings detailed in each of the sections of this AEMR as outlined in the above table, the project has complied with the relevant requirements of Delta Electricity's Environment Protection Licence (No. 766).

5. Complaints Register (May 2011 to April 2012)

According to CoA 5.4, Delta uses a centralised management system to record its environmental incidents, OH&S matters and complaints. As part of the AEMR Audit, this system was reviewed. It was noted that there were no recorded complaints in relation to operations at the KVAR in the period from May 2011- April 2012.

6. Project Environmental Performance

In reviewing the environmental performance of the project, the requirements for environmental monitoring (as specified in the Conditions of Approval) as well as the OEMP management sub-plans were assessed. For the purposes of this report, the results of compliances with each of these documents are analysed separately below in sections 6.1 and 6.2.

As the ash placement contractor for KVAR Stage 2 operations, Lend Lease provides Delta with a monthly Client Service Report which contains details concerning environmental monitoring undertaken on site. These monitoring results intend to confirm targets outlined within the contractual agreement with Delta, and the monthly reporting process comprises part of an accredited Environmental Management System (Lend Lease, May 2011). This process also facilitates continual improvement as a process of adaptive management.

The following table outlines the ongoing operations conducted by Lend Lease as part of the management of KVAR.

Table 2 Ongoing operations at KVAR

	Item	Frequency
Data acquisition	Ash compaction testing	Monthly
	Static dust monitoring	Daily
	Water sampling for site surface water- upstream, downstream and dam wall	Monthly
	Groundwater levels along the dam wall	Weekly
	Water use- meters, wheel wash, sprinklers	Daily
	Groundwater piezometers, open bores and vibrating wire piezometers on APA	Weekly
Site Management	Ash placement to Stage 2- works continue on a restricted basis west of the exclusion zone	Ongoing
	Surface water management- including seepage from beneath Stage 1 and KVAD repositories	Ongoing
	Placement of furnace and fly ash mixture	Ongoing
	Irrigation/dust suppression to lower Sawyers Swamp Creek Ash Dam	Ongoing
	Development and implementation of work procedures and competency training	Ongoing
Planning	Update Repository Management Plan to incorporate changes to management and planning for Stage 2B repository operation	Annual
	Kerosene Vale Stage 1 revegetation	Ongoing
	Development of plans for alternate Ash haul Road	Under Development (in principle approved through CEMP)
Safety	Continued availability of re-breathers for all vehicles on site	Ongoing
	Site inspections relevant to the working plan for ash placement	Ongoing
Communication	Ash Repository Induction training package- “Base level training requirements” as defined by the OEMP	Ongoing for all personnel
	Ash Repository Work Procedures training package-defining technical details for repository staff	Ongoing for all personnel
Audit	Repository Management Plan six monthly audit by external specialist	Biannually
Review	RMP sprinkler application (dust suppression) rates and management	Ongoing/ Monthly

(Table information provided by Lend Lease, 2012)

6.1. Environmental Monitoring – Conditions of Approval

The Annual Environment Management Report is required to include the results of all environmental monitoring as stipulated under Conditions of Approval 3.3 to 3.8, including interpretations and discussion by a suitably qualified person. The environmental monitoring associated with Conditions of Approval (CoA) 3.3 to 3.8 includes the following:

CoA 3.3 - Ongoing Noise Monitoring

CoA 3.4 - Groundwater Monitoring

CoA 3.5 - Surface Water Quality Monitoring

CoA 3.6 - Hydrological Monitoring with respect to the Sawyers Swamp Creek Realignment

CoA 3.7 - Ecological Monitoring with respect to Sawyers Swamp Creek Realignment

CoA 3.8 - Air Quality Monitoring

In addition, the AEMR is required throughout the life of the project to be prepared and submitted annually to the Department of Planning and Infrastructure for the approval of the Director-General. The AEMR reviews the performance of the project against the Operational Environmental Management Plan (Parsons Brinckerhoff, 2008) and the Ministers Conditions of Approval.

Figure 3 outlines the various locations and categories of environmental monitoring that have been established at the Kerosene Vale Ash Repository for the duration of the Stage 2 operations as outlined in the OEMP.

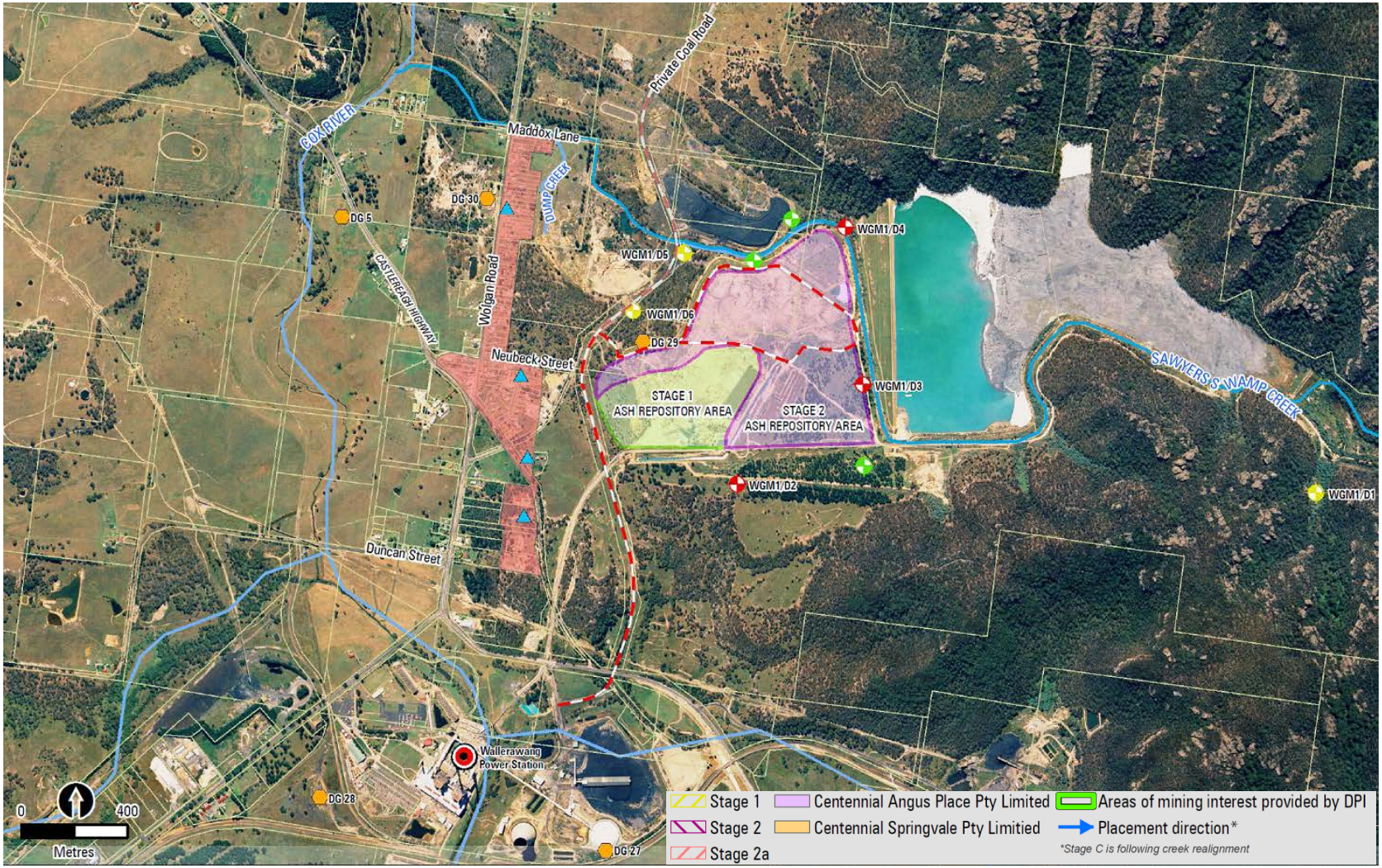

Figure 3 Environmental Monitoring Locations

6.1.1. Ongoing Operational Noise Monitoring

Delta received a non-compliance in regards to noise monitoring in the previous (2010/2011) AEMR reporting period (under CoA 3.3) for KVAR Stage 2. In response to this non-compliance, Delta engaged Aurecon to carry out regular noise monitoring reviews in Autumn and Spring of each AEMR reporting year, commencing November 2011.

Background

In 2009 the then Department of Planning reviewed and approved the Kerosene Vale Ash Repository Operational Noise Review (2009), indicating that the relevant requirements of condition 3.2 of the Minister's approval had been met.

Aurecon completed a noise review on 6th-7th November 2011 and 29th-30th April 2012, based on the requirements outlined in the Noise Monitoring Strategy in the OEMP Report (PB, 2009). Further detail and monitoring results are available in Appendix E. Both of these reviews involved testing the major noise emissions associated with the KVAR Stage 2 operations outlined below:

- Unloading of ash trucks at the repository;
- Placement and handling of ash at the repository site;
- Operation of trucks on the private haul road, trucks leave Wallerawang Power Station loaded with ash (travelling north) and return from the repository (travelling south).

The OEMP Noise Monitoring Strategy states that noise monitoring shall be undertaken at the nearest potentially impacted receivers to KVAR Stage 2 operations. Aurecon identified the most affected sensitive receivers below and their distance to the haul road in their report dated May 2012. Table 3 provides information about the most affected sensitive receivers.

Table 3 Most affected sensitive receivers and distance to haulage road

Representative sensitive receiver	Distance (m) to haulage road
60 Skelly Road	330
10 Skelly Road	240
21 Neubeck Street	160

Note* - Distance relates to property boundary or a point from the dwelling location

The noise monitoring in both November 2011 and April 2012 were carried out in the early morning and evening periods, when the noise impacts were likely to be most significant. Two types of testing were carried out including ambient noise and sound exposure levels.

According to the Aurecon Noise reviews (Nov 2011 & May 2012), the sound equipment used was maintained in accordance with Australian Standard 2659.1-1988 for both ambient and sound exposure levels. Noise monitoring was carried out for 15 minutes at a time for each location.

The noise monitoring results were compared against CoA 2.15 for compliance which stipulates that: Cumulative noise levels from KVAR Stage 2 and their associated haulage activities shall not exceed an LAeq (15 minutes) of 40 dB(A) at the nearest most affected sensitive receiver during normal hours of operation as defined by CoA 2.8.

The Aurecon Ongoing Operational Noise Measurement Reports dated November 2011 and April 2012 monitoring were compliant with Conditions of Approval associated with noise impacts (i.e. CoA 2.15, 3.1, 3.2, 3.3) and the requirements stipulated in the OEMP Noise Monitoring Strategy.

6.1.2. Surface and Groundwater Monitoring

Delta Electricity's groundwater and surface water quality monitoring program has been in place since the beginning of the Stage 2 project in 2009. This monitoring was implemented under CoA 3.4 & 3.5 and in accordance with the sub-plan which was developed as part of the OEMP (PB, 2008.

6.1.2.1. Background

In 2010 Delta Electricity engaged Aurecon Australia Pty Ltd to conduct an assessment of the quality of surface and groundwater in and around the Kerosene Vale Ash Dam (KVAD) and KVAR from October 2007 to March 2010. The purpose of this report was to determine if ongoing dry ash placement at KVAR Stage 2 and/or seepage from Sawyers Swamp Creek Ash Dam (SSCAD) were affecting local ground and surface water quality. Aurecon was subsequently engaged in 2012 to continue and finalise their investigations incorporating data from April 2010 to January 2012, with an additional focus on measuring the impacts of additional improvements and enhancements implemented on the SSCAD, KVAD and KVAR sites. The report has been provided in Appendix F

6.1.2.2. Groundwater Monitoring (CoA 3.5)

The groundwater at Kerosene Vale is regularly monitored at various locations to determine the extent of impacts, if any, of Stage 2 operations on the regional waters, and to examine the movement of water beneath the site and throughout the catchment.

Groundwater sampling for Kerosene Vale Ash Repository consists of monthly water sampling by LLI and Delta's contracted onsite laboratory service provider, Nalco, according to the following Australia Standard methods:

- Each site is bailed and allowed to recharge for 24 hours before the official sample is collected;
- The height/level of water in the bore at time of sampling is recorded; and
- Samples are sent to Nalco's NATA accredited laboratory in Botany, NSW, to perform the tests required.

Results from testing are returned monthly and distributed to Delta for dissemination and review. The Monthly Client Reports generated by LLI in relation to KVAR provide a rolling average of results from water samples taken at the main regional bores WGM/D2 (DW2), WGM1/D3 (DW3), WGM/D5 (DW5) and WGM1/D6 (Figure 6-1). These bores provide information about groundwater flow under KVAD and the dry ash repository of KVAR Stage 1 and Stage 2a (Lend Lease, May 2011).

A total of 13 groundwater bores are monitored in the area by Lend Lease and Delta (refer to Figure 4) which exceed the minimal monitoring requirements. The ANZECC guidelines (2000) for Irrigation and Ecosystem Protection are used to evaluate groundwater impacts as per the Groundwater sub-plan in the OEMP (2009). In addition to the ANZECC guidelines, local guidelines are also used (available in Appendix C of the OEMP as baseline data) which are based on the ANZECC (2000) guideline approach for estimating 90th percentile water

for naturally mineralised, highly disturbed groundwater. LLI's graphs provided in Appendix C use these guidelines as their trigger points.

6.1.2.3. Surface Water Monitoring

The OEMP for KVAR Stage 2 requires surface water sampling within and around the Sawyers Swamp Creek (SSC) at four locations: two on SSC, one on Dump Creek to the Northwest of the repository, and one in the SSC Ash Dam, to ensure operations are not impacting on catchment surface waters, and to comply with Section 120 of the Protection of the Environment Operations Act 1997.

Nalco Laboratory Site ID numbers 38, 39, 40 and 41 (Table 4, shaded cells) at Kerosene Vale have been sampled since January 2003, with sites 79, 80, 81, 83 and 84 commencing testing in January 2010. The remaining Nalco Laboratory sites (86, 87 and 88) commenced sampling in May 2010 (Appendix B).

The other sites (Table 4, unshaded cells) form part of Lend Lease's water sampling routine for a combined total of 18 locations that are regularly monitored for the project, with tests performed including the following at a monthly and/or 6-monthly frequency:

- pH;
- Alkalinity (CaCO3);
- Sulphate (SO4);
- Conductivity;
- Total Dissolved Solids; and
- Trace metals- including Mercury (Hg), Chloride (Cl), Fluoride (F), Aluminium (Al), Arsenic (As), Barium (Ba), Beryllium (Be), Boron (B), Cadmium (Cd), Calcium (Ca), Chromium (Cr), Copper (Cu), Lead (Pb), Magnesium (Mg), Molybdenum (Mo), Nickel (Ni), Potassium (K), Selenium (Se), Silver (Ag), Sodium (Na), Zinc (Zn), Iron (Fe), Manganese (Mn).

Tests for dissolved oxygen (O_2), turbidity, total phosphorus (TP) and total nitrogen (TN) were determined unnecessary in the previous AEMR reports due to Sawyers Swamp Creek not requiring realignment. However, these tests are conducted for surface waters upon specific request to the Nalco Laboratory and have been incorporated into routine sampling at the Western Environment team's request, as of August 2011.

Though no contaminated surface water is allowed to enter the catchment, surface waters are tested to ensure compliance with the ANZECC guidelines at receiving water sites. A Water Management Plan has been developed as part of the CEMP for the extended 2B placement area which proposes to construct a water control area comprising of a sediment basin, wetland storage and outlet detention to service the catchment of the Stage 2A and Stage 2B ash repository areas. This structure will capture all the water from the final batter surfaces.

6.1.2.4. Monitoring results in the past 12 months

In March 2010, the NSW Environmental Protection Authority (EPA) undertook a review of the Wallerawang Power Station Environment Protection Licence 766. As a result, a Pollution Reduction Program (PRP) was added to the revised Licence dated the 20th April 2010, to minimise discharges of salinity and trace metals from the Kerosene Vale site. The PRP required Delta Electricity to undertake the following work:

- Install and commission a seepage collection and return system to ensure that any seepage from SSCAD is intercepted, collected and return to SSCAD; and
- Upgrade or re-install the KVAD seepage collection and diversion system to ensure that any seepage from Kerosene Vale wet ash dam is intercepted by the collection and diversion system and returned to Lidsdale Open Cut void.

Subsequently, DE complied with the PRP by:

- Installing a seepage collection and return system to minimise seepage from SSCAD into Sawyers Swamp Creek in May 2010; and.
- Unblocking the KVAD toe drains and reinstating the seepage collection and diversion system to Lidsdale Cut in October 2010.

As part of the reinstatement of the KVAD toe drain seepage collection and diversion system, DE installed a new sub-surface drain to lower the groundwater table in the KVAD, in the area under the KVAR placement. The underground drainage system was designed to lower the groundwater level in KVAD to at least 1m below its clay capping, which forms the base of the KVAR dry ash placement. The underground system has been connected to the existing KVAD toe drain seepage collection system, so that the groundwater drained from under the KVAR area is diverted Lidsdale Cut, together with the groundwater drained from KVAD itself (Aurecon, 2012).

Delta further engaged Aurecon to carry out investigations to see if the above works improved surface and groundwater at sites around the KVAR and ultimately the receiving waters of the Sawyers Swamp Creek.

Aurecon concluded that the seepage collection and diversion systems have reduced salinity (conductivity), sulphate and trace metals in the KVAD groundwater and SSCAD seepage to Sawyers Swamp Creek. It has been found that the operations being performed at KVAR Stage 1 & 2 Areas are not having a detrimental impact upon the quality of the surface or groundwater within the area.

Table 4 Surface and Ground monitoring points at KVAR

Current Water Sampling Points Surface Water Monitoring KVAR 2011-2012							
Site #	**Nalco Lab Site ID**	**Reported Origin**	**Aspect**	**Sample ID**	**Note**	**Easting**	**Northing**
1	86	North KVAD Wall subsurface	Groundwater through-flow	North Wall	Monthly	229908	6302216
2	87	West KVAD Wall subsurface	Groundwater through-flow	WX 50 Outflow	Monthly	229661	6302244
3	88	Dirty Water Collection	Internal ash surface runoff	SW Pond 1	Monthly	N/A*	
4		KVAR North Holding Pond	Groundwater seepage, and stormwater runoff	North Holding Pond	Monthly	230225	6302106
5		Clean Water Collection near compound	Clean Water Runoff Pond 1	Clean Water Runoff-1	Monthly	229396	6301834
6		Clean Water Runoff & Holding Pond	Runoff permanent capping to northern Holding Pond Cooling Water (CW) Pond 2	CW Pond Runoff 2	Monthly	230112	6302059
7		Inflow of Sawyers Swamp Ck	Catchment Quality Comparison	SSC Upstream @ 0m	Indicative	230386	6301545
8		Sawyers Swamp Creek Upper	Catchment Quality Comparison	SSC @ 300m	Monthly	230284	6301969
9		Sawyers Swamp Creek Upper	Catchment Quality Comparison	SSC @ 600m	Monthly	230253	6302120
10	84	Sawyers Swamp Creek Upper	Catchment Quality Comparison	SSC @ 800m	Monthly	229954	6302256
11	83	Sawyers Swamp Creek Lower	Catchment Quality Comparison	SSC @ D5 (1200 m)	Monthly	229650	6302253
12	38	Sawyers Swamp Creek Ash Dam	Dam water	Return water canal	Monthly	229765	6301461
13	79	Sawyers Swamp Creek Ash Dam	SSCAD seepage into SSC	Seepage @ V notch	Monthly	230260	6302287
14	41	Sawyers Swamp Creek Lower	Catchment Quality Comparison	SSC @ WX7	Monthly	228957	6302712
15	40	Lidsdale Cut	Catchment Quality Comparison	LC @ WX5	Monthly	229490	6302227
16	39	Dump Creek	Catchment Quality Comparison	DC	Monthly	229112	6302668
17	80	West KVAD Wall surface right	KVAD Toe Drain seepage	Right	Monthly	229662	6302177
18	81	West KVAD Wall surface left	KVAD Toe Drain seepage	Left	Monthly	229688	6302194

Groundwater level monitoring via open wells and vibrating wire piezometers for KVAR- 2010 to 2011							
Site #	**Nalco Lab Site ID**	**Reported Origin**	**Aspect**	**Sample ID**	**Note**	**Easting**	**Northing**
19		South West KVAR subsurface	Groundwater through-flow	Sump 1	Monthly	229441	6301496
20		East KVAD Wall subsurface	Groundwater through-flow1	Sump 2	Monthly	230218	6302032
21	32	Groundwater Bore WGM1/D1	Regional	D1[2]	Upstream	231988.5	6301410
22	33	Groundwater Bore WGM1/D2	Regional	D2[2]	South East	229680	6301388
23	34	Groundwater Bore WGM1/D3	Regional	D3[2]	East below SCAD	230276.1	6301753
24	35	Groundwater Bore WGM1/D4	Regional	D4[2]	NE corner SSC	230160.7	6302350
25	36	Groundwater Bore WGM1/D5	Regional	D5[2]	Down-stream	229642.5	6302206
26	37	Groundwater Bore WGM1/D6	Regional	D6[2]	Up dip coal seam	229412	6302028
27	85	Groundwater Bore GW6	KVAD	GW6[2]	NW at SSC	229754	6302228
28	75	Groundwater Bore GW10	KVAD West Wall Toe Drain	GW10[2]	Toe Drains	229612	6301994
29	76	Groundwater Bore GW11	KVAD West Wall Toe Drain	GW11[2]	Toe Drains	229649	6302093
30	77	Groundwater Bore AP09	KVAD North Wall Toe Drain	AP09[2]	Toe Drains	229833	6302182
31	78	Groundwater Bore AP17	KVAD North Wall Toe Drain	AP17[2]	Toe Drains	229915	6302193
32		Groundwater Well APA02	KVAR Stage 2A	APA02	Stage 1A KVAR	229890	6301839.4
33		Groundwater Well APA09A	KVAR Stage 2A Above clay cap	APA09A	Stage 2A above clay cap north	229849	6302125.4
34		Groundwater Well APA09B	Stage 2A below clay cap	APA09B	Stage 2A KVAD water level north	229849.5	6302125.7
35		Groundwater Well APA10	Subsurface drain KVAD	APA10	Stage 2A KVAD water level west	229694.1	6302054.4
36		Groundwater Well APA11	Subsurface drain KVAD	APAD11	Stage 2A KVAD subsurface drain	229930	6301886

37		Groundwater Well APA12	Subsurface drain KVAD	APAD12	Stage 2A KVAD subsurface drain	229916	6301846
38		Groundwater Well APA13	Subsurface drain KVAD	APAD13	Stage 2A KVAD subsurface drain	229985	6301931
39		Groundwater Well APA14	Subsurface drain KVAD	APAD14	Stage 2A KVAD subsurface drain	230024	6301949
40		Groundwater Well APA15	Subsurface drain KVAD	APAD15	Stage 2A KVAD subsurface drain	230159	6301948
41		Groundwater Well APA16	Subsurface drain KVAD	APAD16	Stage 2A KVAD subsurface drain	230174	6301968
42		Groundwater Well APA17	Subsurface drain KVAD	APAD16B	Stage 2A KVAD subsurface drain	230169	6301969
43		Groundwater VWP[1] APA08	KVAR Stage 2A Above clay cap	APA08	Stage 2A above clay cap	229731.2	6301943.1
44		Groundwater VWP APA07	KVAR Stage 2A Above clay cap	APA07	Stage 2A above clay cap	229891.3	6302057.1
45		Groundwater VWP APA06	KVAR Stage 2A Above clay cap	APA06	Stage 2A above clay cap	230019.4	6302054.3
46		Groundwater VWP APA04	KVAR Stage 2A Above clay cap	APA04	Stage 2A above clay cap	229955.8	6301987.5
47*		Groundwater BH Cent KV_MB	Regional (Centennial Coal)	KV_MB1D	Upslope adjacent to SSCAD	230604.2	6301288.2
48*		Groundwater BH Cent KV_MB	Regional (Centennial Coal)	KV_MB1S	Upslope adjacent to SSCAD	230600	6301290
49*		Groundwater BH Cent KV_MB	Regional (Centennial Coal)	KV_MB6D	KVAR Stage 2B	229982.9	6301782.6
50*		Groundwater BH Cent KV_MB	Regional (Centennial Coal)	KV_MB6S	KVAR Stage 2B	229986.9	6301784.6
51*		Groundwater BH Cent KV_MB	Regional (Centennial Coal)	KV_MB8A	Offsite comparison- undisturbed	229166.4	6301607.4

1 VWP – Vibrating Wire Piezometer – Pressure Transducer located in fly ash

2 Water Quality Monitoring Results Available Groundwater KVAR Site - 2010 to 2011

* Previously Centennial Coal bores- now sampled by Delta

Water level measured only

Figure 4 Surface and Groundwater Monitoring Points

6.1.3. Hydrological Monitoring (CoA 3.6)

Delta Electricity has determined through an assessment conducted by its engineers and an adjusted ash placement strategy that there is no longer any need to realign Sawyers Swamp Creek. As such, the hydrological monitoring required under Condition of Approval 3.6 is not required.

6.1.4. Ecological Monitoring (CoA 3.7)

Delta Electricity has determined through an assessment conducted by its engineers and an adjusted ash placement strategy that there is no longer any need to realign Sawyers Swamp Creek. As such, the hydrological monitoring required under Condition of Approval 3.6 is not required.

6.1.5. Air Quality Monitoring (CoA 3.8)

The Air Quality monitoring carried out by Aurecon and Lend Lease are compliant with CoA 3.8 and 6.5 (d) as described below.

6.1.5.1. Background

Air Quality at KVAR Stage 2 has been monitored on a monthly basis since 2009 on Delta's behalf by Lend Lease and Aurecon.

There are two networks of dust gauges located in and around KVAR Stage 2. These are:

1. Delta Electricity's existing dust gauge network shown in Figure 5. These gauges are located outside the perimeter of the KVAR Stage 2 ash placement area and with the addition of new gauges 31 and 32 now satisfy the monitoring requirements of the OEMP. The purpose of these gauges is to monitor the air quality and determine whether dust generated on site is having any adverse impact on the local residents. Delta's ambient air contractor Aurecon monitors these gauges monthly and sends samples to a NATA accredited laboratory for analysis;

2. Eight "onsite" dust gauges are located on the perimeter of KVAR Stage 2, with an additional monitor located at the silos. These gauges have been installed for the purposes of workplace health and safety (Figure 6). These gauges are monitored by Delta's Principle Ash contractor Lend Lease.

Malfroy Environmental Strategies (MES) is Delta's independent Air Quality Specialist who has been engaged to conduct a review of all air quality monitoring data since 2008-09. In addition, they are also required to report the results against the requirements of the Air Quality Sub-Plan in the OEMP.

The most recent review was carried out in March 2012 where MES reviewed all the available air quality data available for KVAR Stage 2 from March 2010 to April 2012 (refer to Appendix G).

It should be noted that according to the Air Quality Sub-plan in the OEMP, the main focus area in relation to community impacts is the dust gauge network maintained by Delta and located external to KVAR Stage 2. Although the dust gauges monitored monthly by Lend Lease are mentioned in the report to provide a more conclusive dataset, the conclusions are mainly related to the outer perimeter gauges.

The monitoring process involves collecting samples monthly from each of the gauges and then having them analysed by a NATA accredited laboratory for the following (Malfroy, 2012):

- Insoluble solids, i.e. the matter that does not dissolve in water;
- Incombustible content (Ash-derived from coal combustion and other mineral matter derived from soil): this is the matter that remains after the sample has been combusted in the laboratory.

Insoluble solids and incombustible content analysed samples are used to provide information on the possible sources of dust. MES concluded in their March 2012 Air Quality Report that the use of permanent dust gauges in the field can often have a number of limitations which may affect the final result:

- They are more effective in collecting coarse particles then fine particles
- Results are often influenced by things like insects, bird droppings and even human interference;
- The collection period of a month makes the assessment of short-term individual events impossible; and
- Without further analysis it is difficult, if not impossible, to use dust gauge results to discriminate between a number of possible sources.

Notwithstanding these limitations, dust gauge data has the ability to provide some relevant information regarding the potential dust impacts arising at KVAR Stage 2 (Malfroy, June 2012)

Results for insoluble solids and incombustible material are expressed in g/m^2/month. For further information regarding the results of the MES Air Quality Review (2012), refer to OEMP compliance Section 6.2.4 Air Quality.

Stage 2B

Construction works for KVAR Stage 2B commenced in January 2012. The Construction Environmental Management Plan (CEMP) for Stage 2B operations addresses the above protocols and ensures regular testing is carried out both onsite and in the surrounding areas of KVAR Stage 2 in accordance with CoA 3.8. Lend Lease has moved dust gauges D3 & D8 from Stage 2A to Stage 2B to ensure that construction activities are correctly monitored for Work Cover purposes (as demonstrated by red arrows in Figure 6).

The CEMP stipulates that dust monitoring will be incorporated within the existing monitoring program stated above.

Figure 5 Dust Gauges located around KVAR (Google Earth, 2012)

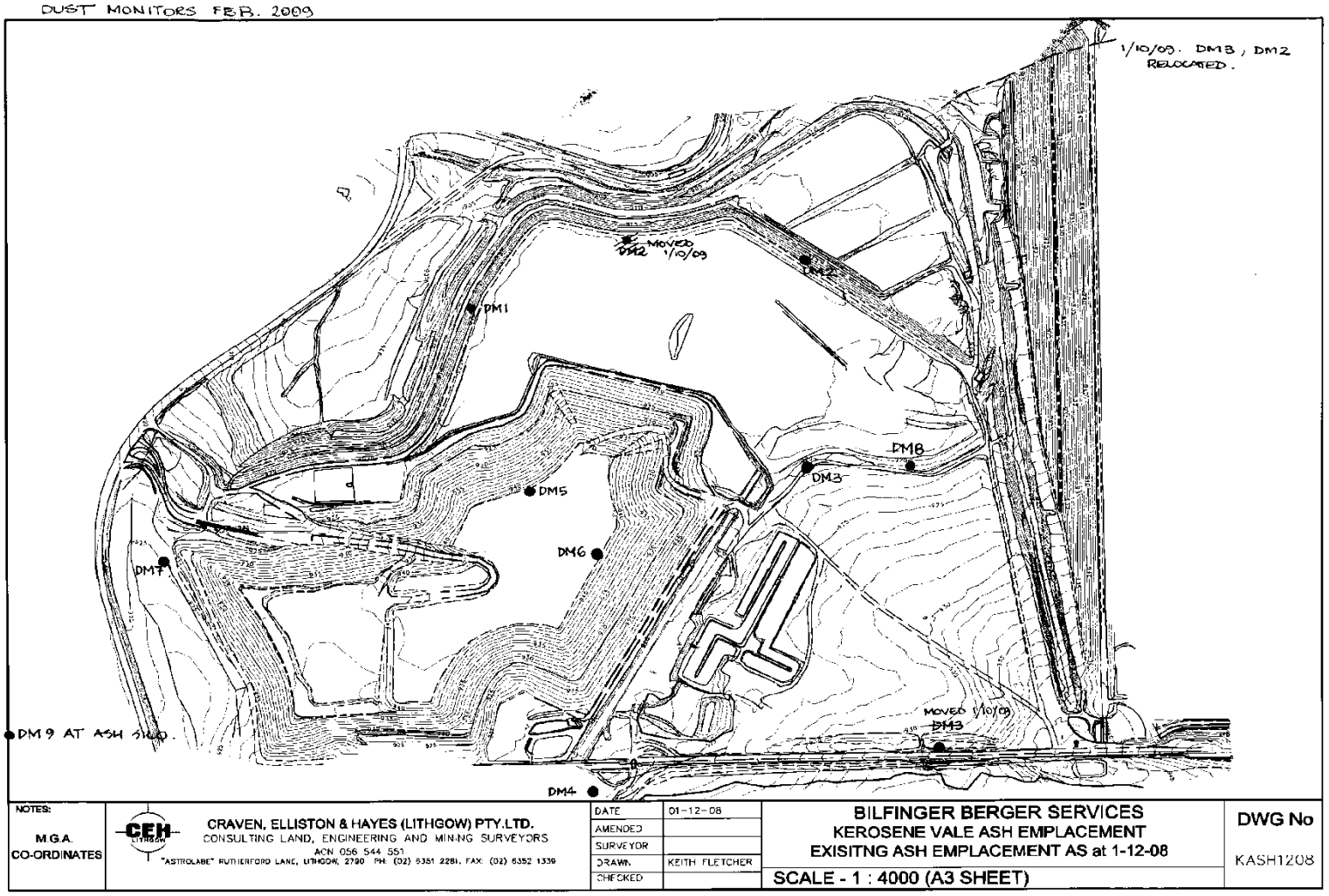

Figure 6 Dust Gauges on outer perimeter of KVAR Lend Lease (Bilfinger Berger Services, 2009)

6.1.5.2. Dust Suppression

Dust suppression is managed on KVAR Stage 2 by Lend Lease by undertaking the following measures:

- Washdown of security roadways, haul roads and vehicle access roads:
- Use of the perimeter sprays at the ash placement area;
- Mobile sprinkler system;
- Strategic ash placement operations;
- Final and temporary capping; and
- General maintenance of the ash placement area.

While sprinklers have been used to control dust within KVAR, monthly water use data is recorded to ensure best practice application for site stability and optimal water conservation. Water application (measured in sprinkler hours) is based on wind velocity, humidity and temperature. The water used for dust suppression in KVAR is sourced from the Sawyers Swamp Creek Ash Dam.

During the 2011/2012 reporting period, Lend Lease reviewed the original operational hours for sprinkler operations, outlined in table 5.

Table 5 Guide to sprinkler operational hours - Original

Temperature and Humidity	Wind Speed (h^{-1})	Sprinkler (h d^{-1})*
>25°C and <50%	>20kph	10 h $^{d-1}$
15 - 24 °C	<20kph	8 h $^{d-1}$
<15 °C and any %	<20kph	6 h $^{d-1}$

* Operation of sprinklers in extreme hot and dry conditions requires extended irrigation hours

After further investigation including analysing the previous year's weather data patterns, Lend Lease decided that a 4 hour sprinkler application (equivalent to 1800 litres per sprinkler per day) was more appropriate as noted in Table 6 below. This application now meets operational targets for general ash placement stability.

Table 6-- Guide to sprinkler operations - Amended

Temperature and Humidity	Wind speed (h^{-1})	Sprinkler (h d^{-1})
<15ºC and any %	<20 kph	4 h $^{d-1}$

Note: Operational irrigation hours would be extended as/if required under severe climatic conditions such as very high winds or hot temperatures.

Figure 7 below indicates a seasonal trend in sprinkler application in association with evaporation values. The sprinkler application system has been designed to optimise the effectiveness of sprinkler application to minimise trace metal infiltration to the surface and groundwater of the site area.

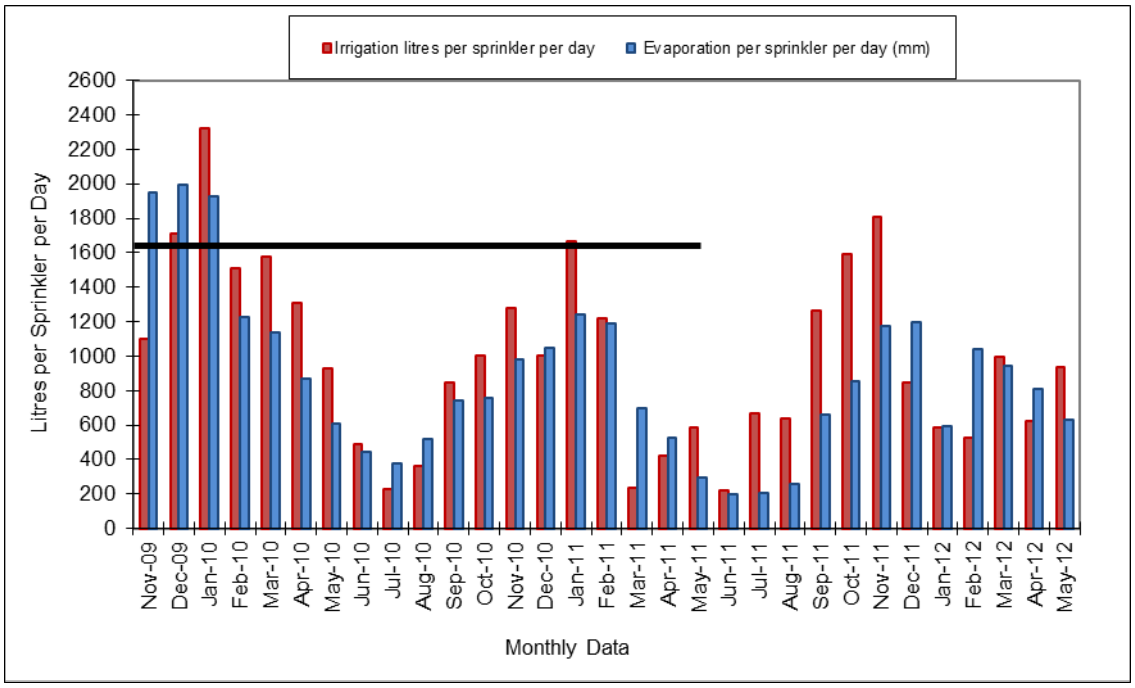

Figure 7 Litres of Water used Nov 2009- May 2012 (Lend Lease, 2012)

6.2. Environmental Monitoring – Operational Environmental Management Plan (OEMP)

The project's approved OEMP incorporates seven specific management sub-plans covering the following:

- Ash Delivery and Placement
- Operational Noise and Vibration
- Surface Water Quality
- Groundwater Management
- Air Quality
- Landscape and Revegetation
- Waste Management

The OEMP also covers inspections and audits.

Each management sub-plan consists of overarching targets and a series of management and mitigation measures. In reviewing the environmental performance of the project an assessment of all relevant documentation and several site visits were undertaken to determine whether the overarching targets were being met, and whether the management and mitigation measures were being implemented and deemed effective.

6.2.1. Ash Delivery and Placement

Delta Electricity has developed an extensive ash reuse strategy, developed in three stages with assistance from specialists in this area:

- Stage 1 – Ash Strategy Report (DMC, September 2010)
- Stage 2 – Quarry and Natural Aggregates Review (DMC, September 2010)
- Stage 3 and Stage 4 – Report Evaluation of Laboratory Results for Future Strategic Positioning (DMC, June 2011).

These reports include investigating markets for ash related products, such as aggregates (for use in road bases and construction materials), agriculture, and cement products.

Compliance: Based on the information reviewed and the site observations made, the operations of the Stage 2 Kerosene Vale Ash Repository are meeting the following targets of the Ash Delivery and Placement Sub Plan of the OEMP:

- Compliance with the normal hours of operation condition for at least 98% of the year and its stretch target of 100% of the year
  - Stretch Target has been achieved, i.e. 100% within normal hours;
- Reduction in the number of days operating under emergency conditions (less than 5 days/year and its stretch target of 0 days/year)
  - Stretch Target has been achieved, i.e.0 days/year; and
- Compliance with the ash placement and compaction procedures
  - In 2011 the yearly rolling average for dry density ratio was 95.5% while from Jan- April 2012 the rolling average has been 92.7%.

Delta continues to actively seek new and innovative ways to increase the quantities of ash utilisation in accordance with the Ash Utilisation Strategy. The points below outline some of the innovative ways Delta is planning to potentially reuse their ash in future:

- A trial project using fly ash as a road base in Wallerawang is planned to be constructed for the 2012/2013 financial year, in conjunction with the Roads and Traffic Authority (RTA) NSW (Pers. Comm, Flood, 2011).
- Delta has applied to the Office of Environment and Heritage to obtain an exemption under the EOA Act 1997, to allow application of Low pH ash to land through the Ash Development Association of Australia. Once granted, Delta hopes to roll out the use of ash road based products for use in road bases, particularly targeting Local Councils to specify the use of ash where it may be competitive, due to the proximity of the source. In addition, Delta has been working with Holcim and Metromix over the past 12 months to develop specifications for their quarry materials and hope to also engage Boral in the future. .
- In the longer term, Delta is developing an agglomeration strategy to enable sales of fly ash as a direct substitute for sand for use as an aggregate.

At this point in time, it is unlikely that Delta will achieve an ash re-use target of 20% or its stretch target of 40% by 2013. The quantity of ash reused from April 2011 – April 2012 is outlined below (Table 7) and remains significantly lower that the 20% target despite the installation of infrastructure at Wallerawang Power Station to increase supply to the aggregate and cement industries.

Table 7 Quantities of Ash reused April 2011- March 2012

Date	To Repository (Tonnes)	Re-used (Tonnes)	%
Apr-11	41,651	611	1.5%
May-11	61,618	949	1.5%
Jun-11	59,345	304	0.5%
Jul-11	52,476	791	1.5%
Aug-11	39,766	506	1.3%
Sep-11	54,069	586	1.1%
Oct-11	45,285	837	1.8%
Nov-11	43,917	987	2.2%
Dec-11	32,698	535	1.6%
Jan-12	35,926	262	0.7%
Feb-12	35,932	408	1.1%
Mar-12	29,829	573	1.9%
TOTAL	532,512	7,350	1.4%

6.2.1.1. Stage 2B – Ash Placement in relation to the CEMP.

As Stage 2A was reaching capacity, Delta sought approval to expand this area into Stage 2B, since Centennial Coal had not developed this area as planned in the initial stages of the project. A CEMP for KVAR Stage 2B was produced in conjunction with Delta Electricity's ash management contractors, Lend Lease Infrastructure. This document was submitted to the Director–General of the DP&I and approved in December 2011.

Stage 2B construction operations started in January 2012 and Delta is using the excavated materials from this area to help rehabilitate and cap the Stage 2A area. A review of earthwork activity undertaken by LLI since the start of construction indicates compliance with the CEMP. Stage 2B operations will continue to be managed under the guidance of the CEMP, OEMP and associated documentation.

6.2.2. Operational Noise and Vibration

Aurecon conducted ongoing operational noise monitoring along Delta's private haulage road during two monitoring events: 6 – 7th November 2011 and 29 – 30th April 2012. The reports concluded the following:

Compliance: Based on the noise monitoring findings of Delta's noise monitoring contractor Aurecon for KVAR Stage 2 operations, the results were compliant with the assessment criteria stipulated in the OEMP and the CoA 2.3-2.20. This was apparent in both the November and April reporting periods. These reports have been provided in Appendix E.

6.2.2.1. Background

This AEMR covers the third year of ash placement operations (May 2011 to April 2012). During this period, there have been no emergency operations as defined in the Project Approval's associated Conditions of Approval. As such, the operations of the Stage 2 Kerosene Vale Ash Repository were found to meet the OEMP target of achieving a significant reduction in the number of noise-related complaints during emergency operations (less than 5 per year, with a stretch target of zero). No noise complaints associated with KVAR2 were recorded for the period of May 2011 – April 2012.

In accordance with CoA 2.9, Delta engaged Lend Lease to carry out a Logistical Review for Haulage and Placement of Ash Operations at KVAR Stage 2A & 2B. This report was written in addition to Delta's previous feasibility studies that were undertaken in 2009. The report was sent to the Director-General of the DP&I in late April 2012 and is now pending approval.

This Logistical Review concluded that it was not feasible, nor possible to reduce the existing hours of operation between 7.00am and 10.00pm daily Monday to Sunday. This is primarily due to limited storage capacity at Wallerawang Power Station.

With respect to the management and mitigation measures specified in the approved OEMP, all OEMP requirements were found to be complied with, with the exception of one partial compliance in relation to reviewing the Noise Operational And Vibration Management Plan- Noise Sub-Plan.

After an initial review, Delta has determined that it would be more feasible and accurate if the review took place after three consecutive noise events, which have been scheduled in November and April of each reporting period. Therefore, once the third noise monitoring event has taken place in November 2012, Delta will conduct a review of the Noise Operational and Vibration Management Plan- Noise Sub-Plan.

6.2.3. Surface and Groundwater Quality

Delta Electricity's current surface and ground water quality monitoring program has been in place since the beginning of the Stage 2 project (2009), with significant background data also collected during pre-placement sampling regimes. The current monitoring was implemented under CoA 3.4 & 3.5 and in accordance with the sub-plan which was developed as part of the OEMP (PB, 2008).

Compliance: Delta Electricity has achieved compliance in the 2011-2012 reporting period for surface and groundwater monitoring in accordance to the sub-plan in the OEMP. For more

information refer to Appendix F - KVAR Stage 2 Water Quality Assessment report April 2010-January 2012)

6.2.4. Air Quality

Dust monitoring at KVAR Stage 2 has been conducted on a monthly basis since 2009. Significant background data has also been collected by Delta prior to KVAR2 ash placement activities.

Compliance: Delta Electricity has achieved compliance in the 2011-2012 reporting period for Air Quality in accordance with the requirements stated in the OEMP.

Within the Malfroy Environmental Strategies (MES) report titled Kerosene Vale Stage 2 Air Quality Review April 2010-March 2012 (Appendix G) , the following conclusions and recommendations were made:

Conclusions:

- The dust gauges from the first 3 years of KVAR Stage 2 operations are mostly within the OEMP trigger levels of 4 g/m2/ month, with the only exceedences observed located at sites which are distant to KVAR and unlikely to be related to Stage 2 operations.
- No complaints regarding dust emissions from KVAR Stage 2 were received by either Delta or Lend Lease
- It was not possible with the data available to make any comment regarding the OEMP objective of zero visible dust events in the vicinity of KVAR Stage 2 operations, although the camera installed at KVAR Stage 2 might be used to access performance of this objective.
- It is considered that the monitoring and reporting requirements of the OEMP are being met.

Recommendations:

- The OEMP Air Quality Sub-Plan should be reviewed and amended to cater for uncontrollable natural event(s) such as severe winds or dust storms coming from other locations. For example: The dust storm that swept across NSW and QLD in late September 2009 which measured more than 500km in width and 1,000km in length.
- A number of gauges in the OEMP networks are poorly located for the purpose of identifying impacts of KVAR Stage 2 and as such the OEMP dust gauge monitoring network should be reviewed.

Having reviewed all available information/data and from site inspections, the requirements of the OEMP were found to be complied with for 2011-2012

6.2.5. Landscape and Revegetation

Specific targets and indicators relating to landscape and revegetation are identified in Section 6.8 of the OEMP landscape and revegetation sub-plan:

Targets

- All areas of ash placement that have reached RL 940m to be rehabilitated or in process of rehabilitation as per revegetation program.

Indicators

- Evidence of final batters development involving implementation of slope and revegetation criteria.

Compliance: The Stage 2A Ash repository reached the specified RL of 940m in January 2012. To ensure that Stage 2B achieves maximum ash placement capacity, the CEMP indicates that a quantity of top soil and subsurface material is to be removed from the 2B footprint. The material extracted from that area is currently being used to permanently cap the Stage 2A Repository, which will later be revegetated with trees, shrubs and grasses over the next 12 months.

In addition to the above, Lend Lease have created a small revegetation area on top of the western batter of Stage 2A. This area is approximately 50m x 50m in size and consists mainly of natives. So far, rehabilitation in this area has been successful.

Based on the information reviewed and the site observations made, the interim landscaping/revegetation activities undertaken are considered to be consistent with the relevant OEMP target, given the project's progress to date.

Lend Lease proposes to trial green waste on its batters over the coming 12 months. This trial will aim to test the hypothesis that green waste will improve the current poor soil conditions in the area and help with rain infiltration, successful plantings and natural rehabilitation

6.2.6. Waste Management

Specific targets and indicators relating to Waste Management are identified in the Waste management sub-plan:

Targets:

- Waste disposal practices at KVAR are to reflect EPL conditions
- Wastes generated on site to be recycled or disposed of as per guidelines specified in waste management sub-plan

Indicators:

- 100% of material disposed of within the KVAR to correspond with the EPL criteria outlined in the waste management sub-plan
- Evidence of recycling system in use and site-generated waste being disposed of to an appropriate facility.

Compliance: Based on Lend Lease's monthly client reports to Delta, Delta's Environment Protection Licence Annual Return and site observations made throughout the course of the

reporting period, the operations of the Stage 2 KVAR operations have met the targets for waste management in the 2011-2012 year.

6.2.7. Inspections and Audits

The project OEMP provides guidance on inspections and audits to be undertaken during the operation of the Stage 2 Kerosene Vale Ash Repository. The specific sections of the OEMP that deal with inspections and audits are:

- Section 3.7.1 Environmental Inspections
- Section 3.8 Environmental Audits

Inspections and reviews currently undertaken by Delta include the following:

Daily Inspection undertaken by Delta's Contract Administrator. This daily inspection covers the following aspects of operations:

- Weather conditions
- People and Safety
- Dust Suppression
- Compaction
- Surface Water Run-off
- Corrective Actions

Monthly review of the project's overall progress and performance based on the Monthly Client Service Report prepared by Lend Lease Industrial Infrastructure. The Monthly Client Service reports include a section addressing environmental matters which covers the following aspects of operations:

- Ash placement
- Hours of operation
- Ash reuse
- Noise
- Sawyers Swamp Creek
- Groundwater levels
- Dust
- Ash moisture
- Field compaction and Compaction
- Daily checklist (as performed by Delta's Contract Administrator)
- Surface water management
- Wind – dust suppression
- Site areas
- Site water usage
- Catchment water quality (within ash placement area only)
- Surface water, ash conditioning water and sprinkler water quality (pH and EC)
- Revegetation
- Stack stability
- Survey
- Site management

These reports are submitted to and reviewed by Delta monthly, with all areas discussed in detail during regular client/contractor meetings.

In addition to these routine reviews, there are also a range of inspections and audits undertaken by Delta personnel including:

- Management Safety and Environmental Walkdowns
- Plant Operator Inspections
- Environment Team Site Visits
- Environmental Compliance and Facilities and Process Audits

6.3. Environmental Assessment Impacts and Performance Predictions

Chapter 16 of the Environmental Assessment (Justification and Residual Risk) made the following assessment:

Against the benefit of ongoing electricity production, the following key potential environmental impacts have been identified in association with the proposal:

- Noise impacts on the local community
- Aquatic ecology impacts associated with the realignment of Sawyers Swamp Creek
- Water quality impacts
- Dust and air emission impacts.

The EA and design process has identified proposed mitigation and management measures to prevent or minimise these impacts.

6.3.1. Noise impacts

Aurecon conducted an ongoing operational noise monitoring along Delta's private haulage road during the following dates 6 – 7th November 2011, 29 – 30th April 2012 (refer to Appendix E) . The reports concluded the following:

- The predicted noise receivers showed compliance with the assessment criteria, thus the operational noise emissions from KVAR Stage 2 are considered compliant with the Conditions of Approval 3.3 (Aurecon, Nov 2011 & Aurecon, May 2012) and the OEMP Noise Operation and Vibration Management noise sub-plan.

Based on the site observations made and the information reviewed, the potential noise impacts from the operation of the Kerosene Vale Stage 2 Ash Repository have been effectively mitigated and managed.

It is noted that there was one partial compliance identified with relation to documentation review, as detailed in Section 6.2.2.

6.3.2. Aquatic Ecology Impacts

As previously noted, Delta Electricity has advised that the realignment of the Sawyers Swamp Creek will not proceed. As such, the anticipated aquatic ecological impacts associated with the creek re-alignment will not eventuate.

6.3.3. Water Quality Impacts

Delta has achieved compliance in the 2011-2012 reporting period for surface and groundwater quality monitoring. According to the Aurecon 2012 report (Appendix F):

- Water quality within SSC has not been impacted by the Stage 2 Operations, and in some areas has improved as a result of infrastructure installed by Delta.
- Ground water quality underlying the sites has not been impacted by Stage 2 operations

6.3.4. Dust and Air Impacts

Based on the site observations made and the information reviewed, the potential dust/air impacts from the operation of the Kerosene Vale Stage 2 Ash Repository have been effectively mitigated and managed. For more information refer to Air Quality Report provided in Appendix G.

7. Conclusions

This document demonstrates that Delta and its associated principle contractors have met the majority of the Ministers Condition of Approval for KVAR Stage 2 project in the 2011-2012 AEMR reporting period. Out of the 70 conditions that were placed upon Delta in the early stages of the project (2009), 26 of these conditions are no longer applicable due to project redesign and not having to realign Sawyers Swamp Creek. These 26 conditions were identified in the report as being non applicable findings. Delta has however, achieved 43 compliances in the 2011-2012 reporting year.

One partial compliance was identified in the 2011-2012 AEMR reporting period in relation to the OEMP requirement to conduct a review of the Noise Operational and Vibration Management Plan every 2 years. This review should have been carried out in 2011, however Delta started their ongoing noise monitoring at a 6 monthly frequency in November 2011, which only provided 2 noise monitoring events for analysis in this reporting period. After discussions with Delta's environment group and acoustic specialists, it was determined that a minimum of 3 monitoring events are required prior to being able to get an accurate review of the data.

The KVAR Stage 2 Noise monitoring reports for November 2012 and May 2012 concluded that Delta had complied with all mitigation measures outlined in the OEMP, and also noted that no noise complaints were recorded for the period of May 2011 to April 2012.

Delta was also able to rectify the 1 non- compliance and 4 partial compliances identified in the 2009-2010 AEMR reporting period. The 1 non- compliance related to condition 3.3 and not having ongoing noise monitoring in place, on a 6 monthly frequency as identified in the OEMP. Delta rectified this by engaging an acoustic noise specialist to carry out this monitoring on a 6 monthly frequency, starting November 2011 to the end of the project.

The 4 partial non compliances were related and rectified by the following:

Condition 2.9- Delta complied with the first requirement, but not the second. A review of logistical arrangements was conducted by Delta's Principal Ash Placement Contractor Lend Lease, with the view of reducing the hours of operation in 2009, however was never finalised or submitted to the Director- General. In April 2012, the report was finalised and submitted to the Director General with up to date data.

Conditions 2.18/2.19/2.20 – Were again related to noise monitoring and measurement, and these conditions have now been satisfied by the implementation of the 6-monthly attended noise monitoring regime described above. It is also noted that certain requirements under these conditions were not necessary as Delta did not receive any noise complaints, and noise limits were not exceeded during the 2011-12 reporting period.

Key areas of environmental concern for this project include potential impacts on surface and groundwater quality, and impacts on air quality due to ash emplacement operations. Delta

worked with its environmental specialists during the reporting period to finalise the following reports:

The Kerosene Vale Ash Dam and Dry Ash Repository – Water Quality assessment April 2010 to January 2012 (Aurecon, 2012) concluded:

- Unblocking the Kerosene Vale Ash Dam toe Drains, installation of KVAR sub-surface drains and diversion of groundwater to Lidsdale Cut provided conditions that reduced salinity (conductivity), sulphate and metals in:
    - The KVAD local groundwater seepage to Sawyers Swamp Creek
    - Lidsdale Cut itself
    - Potentially at the Sawyers Swamp Creek receiving water site, but this could not be confirmed due to Springvale's mine water inflows to the creek.
- The installation of the V- notch collection and pump back system showed no effects on these changes in local groundwater or the upper Sawyers Swamp Creek.
- The decreases in the conductivity, sulphate and trace metals in KVAD groundwater and at Lidsdale Cut provide evidence that management of KVAR dry ash placement effectively prevents dry ash leachates from affecting the local groundwater quality. However, flow on effects to Sawyers Swamp Creek receiving water could not be confirmed due to interfering effects of other, non-ash related inputs in the creek.

The Kerosene Vale Stage 2 Air Quality Review Reports (Malfroy, 2012) concluded:

- Annual dust deposition results in the 2nd (2010) and 3rd (2011) years of KVAR Stage 2 operations were below the 4 g/M2/month at 6 or the 7 dust gauges stated in OEMP.
- The one dust gauge that exceeded 4g/m2/month in both 2010-2011 and 2011-2012 was unlikely to be related to KVAR Stage 2 operations due to its significant distance from the site.
- Some of the dust gauges referred in the OEMP are poorly located for the purposes of identifying impacts at KVAR Stage 2 and therefore the monitoring network should be reviewed.
- The dust gauge results from the first three years of operation do not indicate that KVAR Stage 2 operations have resulted in dust deposition levels above OEMP requirements, hence implementation of further control measures has not been required.
- No dust complaints were received during the 2nd and 3rd year of operation.
- It is considered that the monitoring and reporting requirements of the OEMP are being met.

In conclusion given the above results, only one corrective action is required in relation to conducting a 2 yearly noise review. In addition, it is advised that Delta review and implement recommendations arising from the specialist monitoring reports published during the 2011-12 reporting period. This will assist Delta in enhancing and improving data collection and monitoring, hence enabling accurate, feasible and environmentally sounds decisions for the future of KVAR Stage 2 project.

8. Recommendations

In light of the Conclusions above, the Western Environment Team as independent of the operations of KVAR Stage 2 operations, make the following recommendations:

- Delta to review all three consecutive noise events- November 2011 to November 2012 to see if there is any consistency between the events and if the noise sub-plan needs to be changed to meet the recommendations within the reports and to meet current legislative requirements;
- As part of the noise monitoring sub-plan review, after an initial 12 month period (2011-2012) and if considered reasonable, Delta to seek an exemption from continued noise monitoring from the Director-General, particularly if the record of no noise related complaints continues; and
- Delta to ensure that their principal ash repository contractors Lend Lease report monthly about the requirements contained in the CEMP, during the course of the construction works.

The above recommendations would ensure ongoing compliance with the Conditions of Approval for the project, as well as the requirements outlined in the Operation Environmental Management Plan.

9. References

Aiken, J (2012) Repository Site Management Plan (RMP)for Ash Placement Area, Wallerawang Power Station, on behalf of Delta Electricity, Wallerawang.

Aurecon (April 2010-January 2012) *Kerosene Vale Stage 2 Water Quality Assessment*, Delta Electricity. Wallerawang.

Aurecon (November 2011) *Kerosene Vale Ash Repository Stage 2 Ongoing noise Review, Delta Electricity,* Wallerawang

Aurecon (May 2012) *Kerosene Vale Stage 2 Ongoing Noise Review, Delta Electricity*, Wallerawang

Budd, K; Abdelmaseih, M; & Walker, S (2008). Kerosene Vale- Stage 2 Ash Repository Operation Environmental Management Plan. Parsons Brinckerhoff Australia Pty Ltd, Ernst and Young Centre, Level 27/680 George St, Sydney 2000.

Burrows, D. (2001). Wallerawang Ash Management Proposed Dry Ash Handling Facility. Hyder Consulting (Australia) Pty Ltd.

Delta Electricity, (2010) Kerosene Vale Stage 2 Annual Environment Management Report for 2010-2011, Wallerawang Power Station.

EC of NSW (1989). Mount Piper Ash Storage Environmental Impact Statement. Electricity Commissions of NSW Research and Investigation Section.

Harris, S (2009) Stage 2 Kerosene Vale Ash Repository operational noise review. September 2009. Parsons Brinckerhoff Australia Pty Ltd, Ernst and Young Centre, Level 27/680 George St, Sydney 2000.

Lend Lease (May 2012) Kerosene Vale Ash repository Monthly Client Report for Delta Electricity, Wallerawang.

Little, S. G. (1984). Heavy Metals in Water in and around NSW Power Stations. Electricity Commission of NSW Research and Investigation Section.

Malfroy Environmental Services Pty Ltd (April 2010- March 2012) *Kerosene Vale Stage 2 Air Quality Review,* Delta Electricity, Wallerawang.

10. Appendices

Appendix A – Audit Table for Conditions of Approval

Appendix B – Nalco Water Quality Data 2011-12

Appendix C – Lend Lease Water Quality Data 2011-12

Appendix D – Water Quality Sites Summary

Appendix E – KVAR Noise Compliance Reports (Nov 2011 | May 2012)

Appendix F – KVAD/R Stage 2A Water Quality Assessment Report

Appendix G – Air Quality Assessment Reports (periods ending 2010 and 2012)

Appendix H – AEMR Action Table – 2011-12 Reporting Period

Appendix A – Audit Table for Conditions of Approval

Appendix A-

Detailed review checklist and Recommendations for Conditions of Approval 2011-2012 AMER

Audit Table for Conditions of Approval

Terms of Approval

Minister's Condition of Approval 1.1
The proponent shall carry out the project generally in accordance with the: ▪ ***Major Project Application 07_0005;*** ▪ **Kerosene Vale – Stage 2 Ash Repository Area *(two volumes)* – Environmental Assessment*, prepared by Parsons Brinckerhoff and dated 1 April 2008;*** ▪ **Kerosene Vale – Stage 2 Ash Repository Area – Submissions Report*, prepared by Parsons Brinckerhoff and dated 30 May 2008; and*** ▪ **The conditions of this approval.**
Compliance Assessment Observations and Comments Based on the review undertaken, the Kerosene Vale Stage 2 operations have generally been carried out in accordance to the above requirements.
Compliance Assessment Finding Compliance.

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Minister's Condition of Approval 1.2
In the event of an inconsistency between: ▪ ***The conditions of this approval and any document listed from condition 1.1a) –1.1c) inclusive the conditions of this approval shall prevail to the extent of the inconsistency; and*** ▪ ***Any of the documents listed from the condition 1.1a) – 1.1c) inclusive, the most recent document shall prevail to the extent of the inconsistency.***
Compliance Assessment Observations and Comments Throughout implementation of the project, and during the course of the review of operations in preparing this AEMR, no inconsistencies were observed between the documents listed above.
Compliance Assessment Finding Compliance.

Minister's Condition of Approval 1.3
The proponent shall comply with the reasonable requirements of the Director-General arising from the Department's assessment of: ▪ ***Any reports, plans or correspondence that are submitted in accordance with this approval; and*** ▪ ***The implementation of any actions or measures contained in these reports, plans or correspondence.***
Compliance Assessment Observations and Comments Delta Electricity has not received any requests from the Director-General of the Department of Planning and Infrastructure in the 2011-2012 reporting period.
Compliance Assessment Finding Not Applicable.

Limits of Approval

Minister's Condition of Approval 1.4
This approval shall lapse five years after the date on which it is granted, unless the works that are the subject of this approval are physically commenced on or before that time.
Compliance Assessment Observations and Comments Approval was sort for Stage 2B operations in December 2011 by the Director- General of the Department of Planning. Stage 2B operations commenced in January 2012. (Read section 2.1 for full details) Therefore this condition is no longer applicable.
Compliance Assessment Finding Not applicable

Minister's Condition of Approval 1.5
The Proponent shall ensure that all licences, permits and approvals are obtained as required by law and maintained as required with respect to the project. No condition of this approval removes the obligation for the Proponent to obtain, renew or comply with such licences, permits or approvals.
Compliance Assessment Observations and Comments The Kerosene Vale Ash Repository Stage 2 project is within the jurisdiction of Environment Protection Licence (EPL) 766, as allocated to the Wallerawang Power Station. As discussed in Section 4 of this AEMR, the sections of the licence that are relevant to KVAR operations are: ▪ L1 Pollution of Waters ▪ L5 Waste ▪ L7 L6 Noise Limits ▪ Hours of Operation Based on the observations and discussion of Section 4, the project is generally complying with the requirements of Delta Electricity's EPL 766.
Compliance Assessment Finding Compliance.

Specific Environmental Conditions

Ash Management

Minister's Condition of Approval 2.1
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 2012. The report shall be submitted to the Director-General within six months of 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.
Compliance Assessment Observations and Comments
Following the first AEMR, Delta Electricity commissioned the report *Fly Ash: Strategy Development for Aggregates and Other Bulk Use Applications* (DMC, 2010). The report was developed in four (4) stages: ▪ Stage 1: Initial Strategy Development for the Bulk Use of Ash: Coarse and Fine Aggregate Applications; ▪ Stage 2: Natural Aggregate Resources in NSW Regions Served by Delta Power Stations; and ▪ Evaluation of Laboratory Results for KoAgg from Delta Power Stations- Future Strategic Positioning. Report on Results from the Laboratory Test Program (Stage 3) and Strategic Summary Position Development (Stage 4). These reports were completed in September 2010, September 2010 and June 2011, respectively, and submitted to DP&I in September 2011. This satisfies the above biennial reporting requirement. The next report will be due by September 2013. Ash reuse progress will be tracked in Delta Electricity's Annual Sustainability Report. Further detail regarding this tracking process can be read in Section 6.2.1
Compliance Assessment Finding Compliance.

Minister's Condition of Approval 2.2
To facilitate assessment of the viability of coal resources in the project area and provide a finite opportunity for their extraction, the Proponent shall undertake revised staging of ash placement activities as described in the document referred to in condition 1.1c) of this approval
Compliance Assessment Observations and Comments Delta's Asset Manager- External plant advised that Centennial Coal declined to extract the coal resources in the project area following the completion of their studies (Parksons Brinkerhoff, 2010). It was decided that ash would not be placed over the coal resource in the original Stage 1 area, (which as outlined in this report (Section 2.1) this area now constitutes Stage 2B of Kerosene Vale Ash Repository area) for at least 2 years- 2009-2011, which was a finite opportunity. Section 6.3 of the OEMP state the following: *Should the removal of coal resources from the nominated not be commenced by the date agreed by Delta and Centennial Coal. Delta reserved the right to commerce the placement of ash at the nominated areas under the provisions of the project approval. Delta will notify Centennial Coal of its intentions to commence the placement of ash at these locations.* As a result if Centennial Coal relinquishing their right to extra coal, Delta decided to seek approval from the DP&I to develop the Stage 2B area for construction of ash placement (now known as the CEMP) Works commenced in this area in January 2012. Delta has notified Centennial Coal of its proceeding with KVAR Stage 2B area. Delta has therefore met this condition.
Compliance Assessment Finding Compliance.

Noise Impacts

Minister's Condition of Approval 2.3
Construction activities associated with the project shall only be undertaken during the following hours: ▪ ***7:00 am to 6:00 pm, Mondays to Fridays, inclusive;*** ▪ ***8:00 am to 1:00 pm on Saturdays; and*** ▪ ***At no time on Sundays or public holidays.***
Compliance Assessment Observations and Comments In accordance with CoA 6.2 Delta produced a Construction Environmental Management Plan (CEMP) prior to the commencement of construction works for Stage 2B. Construction works have commenced (January 2012) and earthworks are being carried out in accordance with the CEMP requirements. Lend Lease has advised that all construction activities have been carried out within the hours of operation stipulated within this condition.
Compliance Assessment Finding Compliance

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Minister's Condition of Approval 2.4
Activities resulting in impulsive or tonal noise emission (such as rock breaking or rock hammering) shall be limited to 8:00 am to 12:00 pm, Monday to Saturday and 2:00 pm to 5:00 pm Monday to Friday. The Proponent shall not undertake such activities for more than three continuous hours and must provide a minimum one-hour respite period.
Compliance Assessment Observations and Comments Not applicable, as the requirement for rock breaking or hammering as not arisen. The CEMP stipulates that rock breaking activities will not be carried out during the construction of Stage 2B.
Compliance Assessment Finding Not Applicable.

Minister's Condition of Approval 2.5
Construction outside the hours stipulated in condition 2.3 of this approval is permitted in the following circumstances: ▪ ***Where construction works do not cause audible noise at any sensitive receiver; or*** ▪ ***For the delivery of materials required outside these hours by the Police or other authorities for safety reasons; or*** ▪ ***Where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.***
Compliance Assessment Observations and Comments Not applicable. Although Construction works have commenced, no construction has taken place outside the hours stipulated in condition 2.3 Refer to CoA 2.3 for further detail.
Compliance Assessment Finding Not Applicable.

Minister's Condition of Approval 2.6
The hours of construction activities specified under condition 2.3 of this approval may be varied with the prior written approval of the Director-General. Any request to alter the hours of construction specified under condition 2.3 shall be: ▪ ***Considered on a case-by-case basis;*** ▪ ***Accompanied by details of the nature and need for activities to be conducted during the varied construction hours; and*** ▪ ***Accompanied by any information necessary for the Director-General to reasonably determine that activities undertaken during the varied construction hours will not adversely impact on the acoustic amenity of sensitive receivers in the vicinity of the site.***
Compliance Assessment Observations and Comments Not applicable. Construction works commenced in January 2012, however no construction activities have taken place outside the hours stipulated in condition 2.3
Compliance Assessment Finding Not Applicable.

Minister's Condition of Approval 2.7
The construction noise objective for the proponent is to manage noise from construction activities (as measured by $L_{A10\ (15minute)}$ descriptor) so as not to exceed the background L_{A90} noise level by more than 10dB(A) at any sensitive receiver. ***Any activities that have the potential for noise emissions that exceed the objective must be identified and managed in accordance with the Construction Noise Management Plan (as referred under condition 6.3B) of this approval). The Proponent shall implement all reasonable and feasible noise mitigation measures with the aim of achieving the construction noise objective.***
Compliance Assessment Observations and Comments Aurecon on behalf of Delta conducted operational noise monitoring along Delta's private haulage road on the 29- 30th April 2012 and 6- 7th November 2012 . The noise measurements were carried at the three most affected sensitive receiver locations. Sound exposure level measurements of individual truck passes were carried out in both April and November 2011. Based on the SEL measurement results $L_{Aeq\ (15\ minute)}$ noise level was predicted at each of the assessment sensitive noise receiver. The predicted noise levels took into account only truck movements associated with Stage 2 KVAR works and excluded any coal truck noise. The predicted noise level at each of the noise receivers showed compliance with the assessment criteria, thus the operational noise from KVAR stage 2 are considered compliant again this Condition of Approval (Aurecon, April 2012)
Compliance Assessment Finding Compliance

Minister's Condition of Approval 2.8
Operational activities associated with the project shall only be undertaken from 7:00am to 10:00pm Monday to Sunday.
Compliance Assessment Observations and Comments
Lend Lease have advised that no operational activities have taken place outside the hours designated above.
Compliance Assessment Finding
Compliance.

Minister's Condition of Approval 2.9
Within six months of commencement of operation of the project the Proponent shall prepare and submit to the Director-General a review of the logistical arrangements for ash haulage and placement to determine the feasibility of reducing the hours of operation. If, as a result of the review, it is determined that ash haulage and placement times can commence later and/or finish earlier, the Proponent shall aim to observe the reduced hours whenever possible.
Compliance Assessment Observations and Comments
Since Ash Placement 2009, two reviews have been undertaken for ash haulage and placement to determine feasibility of reducing hours of operation one in January 2009 and another in April 2012. It is understood that the first report tilted *Wallerawang Power Station Review of Haulage Operational hours* (Australia Cost planners Pty Ltd) dated January 2009, was not submitted to DP& I. In April 2012, Delta Ash Management contractors for KVAR Lend Lease carried out a further review "KVAR Stage 2 Review of logistical Arrangements, which was further submitted to DP&I on the 26 April 2012 by Delta Electricity. Both reports, concluded that it was not feasible for Delta Electricity to permanently reduce the hours of operation along the haulage road (currently scheduled between 7.00am -10.00pm Monday to Sunday, refer to CoA 2.3), because Wallerawang PowerStation had limited on site storage capacity, prior to ash conditioning and placement.
Compliance Assessment Finding
Compliance.

Minister's Condition of Approval 2.10
Operations outside the hours stipulated in condition 2.8 of this approval are only permitted in the following emergency situations: ▪ ***Where it is required to avoid the loss of live, property and/or to prevent environmental harm; or*** ▪ ***Breakdown of plant and/or equipment at the repository or the Wallerawang Power Station with the effect of limiting or preventing ash storage at the power station outside the operating hours defined in condition 2.8; or*** ▪ ***A breakdown of an ash haulage truck(s) preventing haulage during the operating hours stipulated in condition 2.8 combined with insufficient storage capacity at the Wallerawang Power Station to store ash outside of the project operating hours; or*** ▪ ***In the event that the National Electricity Market Management Company (NEMMCO), or a person authorised by NEMMCO, directs the Proponent (as a licensee) under the National Electricity Rules to maintain, increase or be available to increase power generation for system security and there is insufficient ash storage capacity at the Wallerawang Power Station to allow for the ash to be stored.*** ***In the event of conditions 2.10b) or 2.10c) arising, the Proponent is to take all reasonable and feasible measures to repair the breakdown in the shortest time possible.***
Compliance Assessment Observations and Comments Lend Lease have advised that no operational activities have taken place outside the hours, as outlined in CoA 2.8. This includes the fact that no emergency situations have occurred to trigger the necessity for out of hour's operations. There have been no complaints or instances associated with out of hour's operations at KVAR, and no after Hours Haulage scenarios listed in Delta Electricity's notification log. Therefore this condition (CoA 2.10) is not applicable, as no trigger events have occurred to warrant out of hours operations.
Compliance Assessment Finding Not Applicable.

Minister's Conditions of Approval 2.11, 2.12, 2.13 and 2.14
2.11- In the event that an emergency situation as referred to under condition 2.10b) or 2.10c) occurs more than once in any two month period, the Proponent shall prepare and submit to the Director-General for approval a report including, but not limited to: ▪ ***The dates and a description of the emergency situations;*** ▪ ***An assessment of all reasonable and feasible mitigation measure to avoid recurrence of the emergency situations;*** ▪ ***Identification of a preferred mitigation measure(s); and*** ▪ ***Timing and responsibility for implementation of the mitigation measure (s).*** ***The report is to be submitted to the Director-General within 60 days of the second exceedence occurring. The Proponent shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Director-General.*** ***2.12- The Proponent shall notify the DECC prior to undertaking any emergency ash haulage or placement operations outside of the hours of operation stipulated in condition 2.8 of this approval and keep a log of such operations.*** ***2.13- The Proponent shall notify the Director-General in writing within seven days of undertaking any emergency ash haulage or placement operations outside of the hours of operation stipulated in condition 2.8 of this approval.*** ***2.14- The Proponent shall notify nearby sensitive receivers (as defined in the Operational Noise Management Plan required under condition 6.5a) of this approval) prior to 8.00pm where it is known that emergency ash haulage or placement operations will be required outside of the hours of operation stipulated in condition 2.8 of this approval.***
Compliance Assessment Observations and Comments None of the above are applicable- refer to the observations made against CoA 2.10.
Compliance Assessment Finding Not Applicable.

Minister's Condition of Approval 2.15
The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed an $L_{Aeq\ (15\ minute)}$ of 40 dB(A) at the nearest most affected sensitive receiver during normal operating hours as defined in condition 2.8 of this approval. ***This noise criterion applies under the following meteorological conditions:*** ▪ ***Wind speeds up to 3m/s at 10 metres above ground; and/or*** ▪ ***Temperature inversion conditions of up to 3^0C/100m and source to receiver gradient winds of up to 2m/s at 10m above ground level.*** ***This criterion does not apply where the Proponent and the affected landowner have reached a negotiated agreement in regard to noise, and a copy of the agreement has been forwarded to the Director-General and the DECC.***
Compliance Assessment Observations and Comments Delta Electricity scientific consultants Aurecon, conducted an ongoing operational noise monitoring along Deltas private haulage road during the following dates 6 – 7th November 2011, 29 – 30th April 2012 The predicted noise level at each of the noise receivers showed compliance with the assessment criteria, thus the operational noise from KVAR stage 2 are considered compliant again this condition of approval (Aurecon, Nov 2011 and April 2012) Refer to Section 6.1.1 for further information. Delta Electricity has not entered into any agreements regarding noise from KVAR with any potentially affected landholders, nor had any noise related complaints regarding the KVAR Stage 2 project.
Compliance Assessment Finding Compliance.

Minister's Condition of Approval 2.16
The Proponent shall implement measures to ensure noise attenuation of trucks. These measures may include, but are not limited to, installation of residential class mufflers, engine shrouds, body dampening, speed limiting, fitting of rubber stoppers to tail gates, limiting the use of compression breaking, and ensuring trucks operate in a one-way system at the ash repository where feasible.
Compliance Assessment Observations and Comments As identified in the first AEMR (PB, 2010), with commencement of Stage 2 operations, Lend Lease (then Bilfinger Berger Services) engaged a new fleet of Mercedes-Benz Actros trucks, which are compliant with the noise emission standards outlined above (CoA 2.15). No compression braking are used on the repository, trucks are well maintained with engines enclosed, mufflers in place, and proceed in a unidirectional format according to enforced speed limits. Routine maintenance of fly ash trucks is carried out to ensure engine and mechanical component efficiency, minimisation of exhaust breakout and the appropriate type pressure and tread requirements are me. With the additional production of ash in peak operating conditions (in this year's reporting period the peak time was between May 2011 & November 2011) a third truck has regularly been engaged for ash haulage, normally at rate of 4 hours per day. This truck is also complies with standards outlined in this condition. In April 2012, a speed assessment program was undertaken by Delta Electricity Ash Management Contractors Lend Lease. As a result of the program the speed limit within the ash repository areas is now only 20km/hr. Ash haulage operations comply with all noise emission requirements on the haul road.
Compliance Assessment Finding : Compliance

Minister's Condition of Approval 2.17

The Proponent shall liaise with the owner/operator of Angus Place Coal Mine with the aim of preparing a protocol which provides for a co-operative approach for the management and mitigation of noise impacts associated with coal and ash truck movements along the private haul road.

Compliance Assessment Observations and Comments

Delta Electricity regularly liaises with Centennial Coal through monthly fuel supply meetings. The protocol developed between Delta and Centennial includes the restriction of movement of trucks along the haul road between 6pm and 7am daily. Trucks are diverted from the haul road passage during these hours as necessary. Centennial Coal reports to Delta with any instances that may impact on background noise caused by truck movement through the monthly meetings, and are bound by their Environment Protection Licence 467. Information provided to Delta by Centennial regarding potential Angus Place noise impacts associated with coal and ash truck movements underneath this licence included hours of operation, noise level limits and pollutants.

Delta's Fuel Supply Co-ordinator, who regularly liaises with Centennial Coal reported that there have been no noise complaints received throughout the 2011/2012 reporting period.

Compliance Assessment Finding

Compliance.

Minister's Condition of Approval 2.18

Where noise monitoring (as required by conditions 3.2 or 3.3 of this approval) identifies any non-compliance with the operational noise criterion specified under condition 2.15 of this approval the Proponent shall prepare and submit to the Director-General for approval a report including, but not limited to:

An assessment of all reasonable and feasible physical and other mitigation measures for reducing noise at the source including, but not limited to –

- ***Construction of a noise barrier along the haulage road;***
- ***Alternative ash haulage routes,***
- ***Alternative methods of ash conveyance to the repository;***
- ***Identification of the preferred measure(s) for reducing noise at the source;***
- ***Feedback from directly affected property owners and the DECC on the proposed noise mitigation measures; and,***
- ***Location, type, timing and responsibility for implementation of the noise mitigation measure(s).***

The report is to be submitted to the Director-General within 60 days of undertaking the noise monitoring which has identified exceedances of the operational noise criterion specified under condition 2.15, unless otherwise agreed to by the Director-General. The Proponent shall implement all reasonable and feasible mitigation measures in accordance with the requirements of the Director-General.

Compliance Assessment Observations and Comments

Two operational noise monitoring reviews have been undertaken in the 2011/2012 reporting period one in November 2011 and the other April 2012 by noise specialists engaged by Delta. Both reports concluded that the predicted noise level at each of the noise receivers showed compliance with the assessment criteria, thus the operational noise from KVAR Stage 2 are considered compliant again this condition of approval (Aurecon, Nov 2011 and April 2012) .

Since the reports did not return any non-compliance's with CoA 2.15, Delta Electricity was not required to submit these reports to the Director General. However as per CoA 7.3 the noise reports have been included in these appendices.

Compliance Assessment Finding

Compliance

Minister's Condition of Approval 2.19
If, after the implementation of all reasonable and feasible source controls, as identified in the report required by condition 2.18, the noise generated by the project exceeds the criterion stipulated in condition 2.15 at: ▪ ***Any sensitive receiver in existence at the date of this approval; or*** ▪ ***Any residential dwelling for which an approval has been sought or obtained under the* Environmental Planning and Assessment Act 1979 *no later than six months after the confirmation of operational noise levels;*** ***Upon receiving a written request from an affected landowner (unless that landowner has acquisition rights under condition 2.20 of this approval and has requested acquisition) the Proponent shall implement additional noise mitigation measures such as double glazing, insulation, air conditioning and or other building acoustic treatments at any residence on the land, in consultation with the landowner.*** ***For the purpose of this condition and condition 2.20, confirmation of operational noise levels means:*** ▪ ***Completion of the operational noise review required under condition 3.2 this approval; and*** ▪ ***Implementation of any source controls, as required under condition 2.18 of this approval, should the operational noise review indicate noise levels in excess of the operational noise criterion specified in condition 2.15; and*** ▪ ***Monitoring of operational noise levels, as required under condition 3.3b) of this approval, following the implementation of any source controls.*** ***The additional mitigation measures must be reasonable and feasible. If within three months of receiving this request from the landowner the Proponent and landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Director-General for resolution, whose decision shall be final.***
Compliance Assessment Observations and Comments As mentioned in the comments of CoA 2.15 Delta Electricity has not entered into any agreements regarding noise from KVAR, nor had any noise related complaints regarding the KVAR Stage 2 project. Therefore, mitigation measures have not needed to be implemented. In addition, Delta has implemented an ongoing noise monitoring reviews in October and April of each reporting period. As previously mentioned under CoA. 2.18, both noise reviews that were carried out in 2011/2012 reporting period were compliant against the CoA 2.15 noise criteria. Since the reports did not return any non-compliance's with CoA 2.15, Delta Electricity was not required to submit these reports to the Director General. However as per CoA 7.3 the noise reports have been included in these appendices.

Compliance Assessment Finding

Compliance.

Minister's Condition of Approval 2.20

- ***If, after the implementation of all reasonable and feasible source controls, as identified in the report required by condition 2.18, the noise generated by the project exceeds the criterion stipulated in condition 2.15 by more than 5dB(A):***
- ***At a sensitive receiver in existence at the date of this approval; or***
- ***At any residential dwelling for which an approval has been sought or obtained under the* Environmental Planning and Assessment Act 1979 *prior to the landholder receiving written notification that they are entitled to land acquisition rights, as per condition 2.25 of this approval; or***
- ***Over 25% or more of the area of a vacant allotment in existence at the date of this approval, and where a dwelling is permissible under the* Environmental Planning and Assessment Act 1979 *at that date, with the exception of land that is currently used for industrial or mining purposes;***

The Proponent shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 2.22 to 2.24 of this approval.

Any landowner that has agreed to or property that has been the subject of, the application of additional noise mitigation measures under condition 2.19 of this approval waives the right to land acquisition.

Compliance Assessment Observations and Comments

Delta Electricity has received no written or verbal requests from landowners to acquire their land in the previous 12 months.

Compliance Assessment Finding

Compliance.

Land Acquisition

Minister's Condition of Approval 2.21
The land acquisition rights under condition 2.20 of this approval do not apply to landowners who have sought approval to subdivide their land after the date of this approval, unless the subdivision is created pursuant to condition 2.24 of this approval.
Compliance Assessment Observations and Comments Not applicable. No landholders have applied for approval to subdivide their land according to the land acquisition rights listed under condition 2.20 of the Minister's Conditions of Approval.
Compliance Assessment Finding Not Applicable.

Minister's Condition of Approval 2.22
Within three months of receiving a written request from a landowner with acquisition rights under condition 2.20 of this approval, the Proponent shall make a binding written offer to the landowner based on: ▪ ***The current market value of the landowner's interest in the property at the date of this written request, as if the property were unaffected by the project which is the subject of the project application, having regard to the:*** ▪ ***Existing and permissible use of the land, in accordance with the applicable planning instruments at the date of the written request; and*** ▪ ***Presence of improvements on the property and/or any approved building or structure which has been physically commenced at the date of the landowner's written request, and is due to be completed subsequent to that date, but excluding any improvements that have resulted from the implementation of condition 2.19 of this approval;*** ▪ ***The reasonable costs associated with:*** ▪ ***Relocating within the Lithgow local government area, or to any other local government area determined by the Director-General;*** ▪ ***Obtaining legal advice and expert advice for determining the acquisition price of the land, and the terms upon which it is required; and*** ▪ ***Reasonable compensation for any disturbance caused by the land acquisition process.*** ***However, if at the end of this period, the Proponent and landowner cannot agree on the acquisition price of the land, and/or the terms upon which the land is to be acquired, then either party may refer the matter to the Director-General for resolution.*** ***Upon receiving such a request, the Director-General shall request the President of the NSW Division of the Australian Property Institute to appoint a qualified independent***

valuer or Fellow of the Institute, to consider submissions from both parties, and determine a fair and reasonable acquisition price for the land, and/or terms upon which the land is to be acquired.

Within 14 days of receiving an independent valuer's determinations, the Proponent shall make a written offer to purchase the land at a price not less than the independent valuer's determination.

If the landowner refuses to accept this offer within six months of the date of the Proponent's offer, the Proponent's obligations to acquire the land shall cease, unless otherwise agreed by the Director-General.

Compliance Assessment Observations and Comments

Not applicable. No landholders have applied for approval to subdivide their land according to the land acquisition rights listed under condition 2.20 of the Minister's Conditions of Approval.

Compliance Assessment Finding

Not Applicable.

Minister's Conditions of Approval 2.23, 2.24 and 2.25

2.23- The Proponent shall bear the costs of any valuation or survey assessment requested by the independent valuer or the Director-General and the costs of determination referred to above.

2.24- If the Proponent and landowner agree that only part of the land shall be acquired, then the Proponent shall pay all reasonable costs associated with obtaining Council approval for any plan of subdivision (where permissible), and registration of the plan at the Office of the Registrar-General.

2.25- The Proponent shall provide written notice to all landowners that are entitled to rights under conditions 2.19 and 2.20 within 21 days of determining the landholdings were additional noise mitigation measures or land acquisition apply. For the purpose of condition 2.20b), this condition only applies where operational noise levels have been confirmed in accordance with the definition in condition 2.19.

Compliance Assessment Observations and Comments

Not applicable. No landholders have applied for approval to subdivide their land according to the land acquisition rights listed under condition 2.20 of the Minister's Conditions of Approval.

Compliance Assessment Finding

Not Applicable.

Sawyers Swamp Creek Realignment

NB: Delta Electricity decided upon commencement of the Project that the realignment of Sawyers Swamp Creek was not necessary. Therefore, the Conditions of Approval relating to Sawyers Swamp Creek realignment are ***Not Applicable***. This refers to Conditions of Approval 2.26 (a – m), 2.27, 2.28 and 2.29.

Surface Water Quality

Minister's Condition of Approval 2.30
The Proponent shall take all reasonable and feasible measures to prevent discharge of sediments and pollutants from the construction and operation of the project entering waterways. ***Note: Section 120 of the* Protection of the Environment Operations Act 1997 *prohibits the pollution of water except where expressly provided by an Environmental Protection Licence.***
Compliance Assessment Observations and Comments As discussed in section 6.1.2.4 no surface waters from Kerosene Vale Stage 2 Ash Repository are allowed to enter the Sawyers Swamp Creek Catchment. This is achieved through a series of collection ponds on site, with water reticulated around KVAR for the treatment of ash and dust suppression.
Compliance Assessment Finding Compliance.

Minister's Condition of Approval 2.31
Earthworks not associated with the realignment of Sawyer Swamp Creek shall not be undertaken within 50m of the creek where reasonable and feasible.
Compliance Assessment Observations and Comments A minimum buffer zone of 50m has been maintained along the riparian area of Sawyers Swamp Creek for all operations of KVAR Stage 2. Delta submitted a Construction Environmental Management Plan (CEMP) to the Director – General of the DP&I in August 2011, which was further approved under in December 2011. This plan was designed for the implementation of the construction works associated with the development of the Stage 2B ash repository area within KVAR. No earthworks activities have occurred within 50m of the Sawyers Swamp Creek over the past reporting period.
Compliance Assessment Finding Compliance.

Minister's Condition of Approval 2.32
All equipment, machinery and vehicles associated with the construction and operation of the project shall be operated and maintained in a manner that minimises the potential for oil and grease spills/leaks.
Compliance Assessment Observations and Comments Lend Lease supply Delta with Client Monthly Service Reports detailing site safety, ash placement, operations, environmental and maintenance aspects of site management. These maintenance records are provided monthly, and include general operations (truck maintenance and hours, ash analyses, sensor repairs, vent lines, line trips etc.), projects (unit outages, silo repairs and maintenance, valve repairs and maintenance etc.), incidents/near misses, training and safety. Monthly client service reports can be viewed upon request. Routine maintenance of fly ash trucks is carried out to ensure engine and mechanical component efficiency, minimisation of exhaust breakout and the appropriate type pressure and tread requirements are me.
Compliance Assessment Finding Compliance.

Air Quality Impacts

Minister's Condition of Approval 2.33
The Proponent shall construct and operate the project in a manner that minimises dust impacts generated by construction works and operational activities, including wind-blown and traffic generated dust, on the receiving environment. All activities on the site shall be undertaken with the objective of preventing visible emissions of dust from the site. Should such visible dust emissions occur at any time, the Proponent shall identify and implement all practicable dust mitigation measures, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.
Compliance Assessment Observations and Comments As outlined in section 6.1.5 (air monitoring), dust management within the site is included in the responsibilities of all operations, including: i. Wash-down of security roadways, haul road and vehicle access roads; ii. Use of perimeter sprays at the ash placement area; iii. Mobile sprinkler system; iv. Ash placement operations; v. Final capping of ash; and vi. General maintenance of the ash placement area (Lend Lease, 2009). Lend Lease have complied with all the above in this reporting period.
Compliance Assessment Finding Compliance.

Minister's Condition of Approval 2.34
The Proponent shall ensure that the load carrying compartment(s) of all ash haulage trucks are covered at all times except when loading or unloading ash material.
Compliance Assessment Observations and Comments Ash haulage to KVAR has been observed, and both core trucks and the additional truck were observed to be covered during transportation. No issues with load coverings were recorded for the 2011-2012 reporting period.
Compliance Assessment Finding Compliance.

Lighting Emissions

Minister's Condition of Approval 2.35
***The Proponent shall take all practicable measures to mitigate off-site lighting impacts from the project and ensure all external lighting associated with the project complies with* Australian Standard AS4282 1997 – Control of the Obtrusive Effects of Outdoor Lighting.**
Compliance Assessment Observations and Comments Lend Lease Industrial Infrastructure's Work Procedures Manual contains procedures that apply to all personnel and equipment operating at Kerosene Vale, including Lighting Towers – Outdoor Lighting. This procedure covers Mobile Lighting Towers for ash placement team operations for KVAR and details the responsibilities, application and procedures for using outdoor lighting for the project, within the project area. Use of lights at Kerosene Vale is to illuminate the tipping and turning area, lights must face south or east, operators must ensure the horizontal distance of the illuminated area is not less than 40m, and as access to the repository for ash transport is between 7am and 10pm lights must be extinguished by 10pm. The lights used at KVAR are the HILITE 4000 hired from Coates Hire Operations Pty Ltd. The specification sheets for these lights form part of the Work Procedures Manual for lighting.
Compliance Assessment Finding Compliance.

Construction Traffic and Transport Impacts

Minister's Condition of Approval 2.36

The Proponent shall ensure that construction vehicles associated with the project:

- ***Minimise the use of local roads (though residential streets and town centres) to gain access to the site;***
- ***Adhere to any nominated haulage routes identified in the Construction Traffic Management Plan as referred to in condition 6.3a) of this approval; and***
- ***Adhere to a Construction Vehicle Code of Conduct prepared to manage driver behaviour along the local road network to address traffic impacts (and associated noise) along nominated haulage routes.***

Compliance Assessment Observations and Comments

As outlined in the CoA 2.3 construction works and ash placement commenced in January 2012 at KVAR Stage 2B. The Construction Environmental Management Plan (CEMP) that is applicable to Stage 2B came into effect at the commencement of works. Section 2.2 of the CEMP contains Construction traffic Management Sub-Plan. This aim of the sub-plan is to manage construction traffic impacts by identifying vehicle volumes, haulage roads, road closures or traffic detours, detail for driver behaviour along haulage routes with compliance to the document procedures listed in the *Preparation of a Traffic Management Plan (RTA, 2001).*

Lend Lease has informed Delta that the haulage road is mainly used for the purposes of ash transportation. Therefore there is no need use the local roads in the area other than the plant hire contractors uses this road for entering or exiting their premises.. Prior to a recent upgrade of an existing track (used as a back access) to Stage 2B, trucks were required to traverse across Stage 2A. As a result, this has reduced the travel times, associated traffic noise and minimised dust in the area.

Compliance Assessment Finding

Compliance.

Heritage Impacts

Minister's Condition of Approval 2.37

The Proponent shall ensure that all construction personnel are educated on their obligations in respect of the protection of Aboriginal and non-indigenous heritage sites and items.

Compliance Assessment Observations and Comments

All Lend Lease project personnel are required to undergo site inductions and environmental training, before being granted access to Delta properties.

- The document "Environmental Management Controls for Cultural Heritage" (Reference BBS-WP-MP-WW-712.2.2) forms part of the Lend Lease Work Procedures Manual and applies to all personnel. The document details the following sequence of events (Flow Chart) where cultural heritage sites are concerned:
- Advice of this procedure is included in a site induction;
- [Heritage] sites may be characterised by rock fragments that are different to the natural material. Other indicators are mounds of shells and stones. Should earthworks uncover any other material which may be of Aboriginal (e.g. bones, stone axes, etc.) or early European origin, work in that area shall cease and the incident report to the Project Manager;
- European sites may also be encountered and equally the same precautions shall be taken to ensure these sites or objects are not damaged;
- The area will be clearly defined and isolated from other work areas. No artefacts or other potential heritage material shall be removed from the site;
- The Project Manager will immediately notify the Client and the environmental Coordinator of the finding. The administrative authority must be notified on the finding as defined in the Emergency Response Plan;
- All known significant sites are to be left undisturbed and where appropriate they shall be clearly identified by tagging and/or fencing. A site map shall also clearly identify areas to be protected. No access is permitted in these areas. It is the responsibility of the Project Manager to comply with the requirements of any archaeological study that may have been undertaken for the project;
- Work will not re-commence in that area until approval has been granted by the administrative authority and the Client; and
- All non-compliances will be immediately reported to the Project Manager.

No aboriginal or other cultural heritage sites have been identified at Kerosene Vale. All of Delta Electricity's cultural sites are listed in the Section 170 Heritage and Conservation Register.

Compliance Assessment Finding

Compliance.

Minister's Condition of Approval 2.38
If any previously unidentified heritage sites or items (Aboriginal and/or non-indigenous) are discovered during construction works or operational activities, all work likely to affect the heritage sites or item(s) is to cease immediately and the discovery of the objects shall be reported to DECC or the Department as relevant.
Compliance Assessment Observations and Comments
As outlined for CoA 2.37, Environmental Management Controls for Cultural Heritage are transcribed to all contractors and personnel before access to Delta Electricity property is granted. Details of the information disseminated are listed above (Refer CoA 2.37). Compliance with this Condition is not applicable, as no previously unidentified heritage sites or items have been discovered during Kerosene Vale Stage 2 operations.
Compliance Assessment Finding
Not applicable.

Waste Management

Minister's Condition of Approval 2.39
All waste materials shall be assessed, classified, managed and disposed of in accordance with* Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes *(EPA, 1999).
Compliance Assessment Observations and Comments
Lend Lease provides 'Monthly Ash Placement Work Instructions' for Wallerawang Power Station to address all issues of routine site maintenance as part of a monthly work program. Lend Lease must comply with the following for Waste Management at KVAR: ▪ Lend Lease are responsible for coordinating restricted wastes placed within the repository as outlined by the Environment Protection Licence 766 for Wallerawang Power Station and only EPL approved wastes can be kept within the premises. ▪ Types of wastes that Lend Lease has identified may be disposed of at the premises that are EPA approved includes ash and biomass co-firing ash, and wastes that may be disposed of to the repository at the discretion of Delta include demineralisation and polisher plant effluents, chemical clean solutions and cooling tower sediments. ▪ Under Lend Lease's Monthly work instructions, the types of waste that are not enabled include mill pyrites, ion exchange resins, fabric filter bags, brine conditioned fly ash, settling pond sediments or oil and grit trip sediments. These wastes are allowed under EPL 766 section L5.2 and Section 55 of the *Protection of the Environment Operations Act 1997*.
Compliance Assessment Finding
Compliance.

Minister's Condition of Approval 2.40
All waste materials removed from the site shall only be directed to a waste management facility lawfully permitted to accept the materials.
Compliance Assessment Observations and Comments
Lend Lease utilises Delta's waste management facilities for wastes generated in the operation of the repository, including waste oils, general waste and materials for recycling. These are stored in intermediate storage facilities at Wallerawang Power Station and routinely removed by Delta Electricity's waste contractors. The CEMP has addressed in section 2.2.4.4 that site management of wastes will be guided by the Environmental Protection License 766 within the Stage 2B area. All waste other those stated on the license approval are to be kept on site. All wastes associated with construction including fuels and oils will need to be removed from the site.
Compliance Assessment Finding
Compliance.

Minister's Condition of Approval 2.41
The Proponent shall not cause, permit or allow any waste generated outside the site to be received at the site for storage, treatment, processing, reprocessing, or disposal on the site, except as expressly permitted by a licence under the* Protection of the Environment Operations Act 1997*, if such a licence is required in relation to that waste.
Compliance Assessment Observations and Comments
No wastes generated outside the Kerosene Vale site are allowed to enter the area. To prevent the unlawful access to the repository area, regular security patrols are conducted over the site during operational hours. Both Lend Lease and Delta Electricity security personnel are required to report if they encounter any rubbish or wastes outside those that are allowed during routine operations.
Compliance Assessment Finding
Compliance.

Construction Noise Monitoring

Minister's Condition of Approval 3.1

The Proponent shall prepare and implement a Construction Noise Monitoring Program to confirm the predictions of the noise assessment detailed in the document referred to under condition 1.1b) of this approval and assess compliance against the construction noise criterion stipulated in condition 2.7 of this approval. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of, the DECC. The monitoring program shall form part of the Construction Noise Management Plan referred to in condition 6.3b) of this approval and must include monitoring of the construction noise generated during:

- ***i. The realignment of Sawyers Swamp Creek;***
- ***ii. Construction of the stabilisation berm;***
- ***iii. Excavation of the former pine plantation area;***
- ***iv. Relocation and construction of surface water management structures; and***
- ***v. Concurrent construction activities.***

The Proponent shall forward to the DECC and the Director-General a report containing the results of each noise assessment and describing any non-compliance within 14 days of conducting a noise assessment.

Compliance Assessment Observations and Comments

Delta reviewed there ash management strategy, after Centennial Coal relinquished their right to extract coal from the areas of mining interest within KVAR stage 2. As a result of this review, Delta no longer needed to realignment of Sawyers Swamp creek, nor did the other constructions activities outline in b), d) or e) need to occur. However CoA 3.1 (d) is still relevant as Stage 2B now lies in the area of the former pine plantation.

Construction works for KVAR Stage 2B commenced in January 2012. The Stage 2B operates under the provisions set out in the in the CEMP- Construction Noise Management Sub-Plan, in accordance with the CoA conditions 2-2.25. Within the CEMP, there is a section that provides detail about how construction activities should proceed in order to manage and minimise any future noise impacts (CEMP, 2011).

In addition, Delta has engaged their specialist's Aurecon to carry out an ongoing noise monitoring reviews in October and April of each reporting period. As previously mentioned under CoA. 2.18 both noise reviews that were carried out in 2011/2012 reporting period were compliant against the CoA 2.15 noise criteria.

Since the reports did not return any non-compliance's with CoA 2.15, Delta Electricity was not required to submit these reports to the Director General. However as per CoA 7.3 the noise reports have been included in an appendix at the back of this report.

Compliance Assessment Finding

Compliance.

Operational Noise Review

Ongoing Operational Noise Monitoring

Minister's Condition of Approval 3.3
The Proponent shall prepare and implement an Operational Noise Monitoring Program to assess compliance against the operational noise criterion stipulated in condition 2.15 of this approval, throughout the life of the project. The noise monitoring program shall be prepared in consultation with, and to the satisfaction of, the DECC. ▪ ***The noise monitoring program shall be prepared in accordance with the requirements of the*** **New South Wales Industrial Noise Policy** ***(EPA, 2000) and must include, but not be limited to:*** ▪ ***Monitoring during ash placement in the far western area of the site adjacent to the haul road; and*** ▪ ***Monitoring of the effectiveness of any noise mitigation measures implemented under condition 2.18 of this approval, against the noise criterion specified in condition 2.15 of this approval.*** ***Noise from the project is to be measured at the most affected point on or within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise criterion stipulated in condition 2.15 of this approval. Where it can be demonstrated that direct measurement of noise from the project is impractical, the DECC may accept alternative means of determining compliance (see Chapter 11 of the*** **NSW Industrial Noise Policy***). The modification factors in Section 4 of the* **NSW Industrial Noise Policy** ***shall also be applied to the measured noise levels where applicable.*** ***The Proponent shall forward to the DECC and the Director-General a report containing the results of any non-compliance within 14 days of conducting a noise assessment.*** ***Where monitoring indicates noise levels in excess of the operational noise criterion specified in condition 2.15 of this approval, the Proponent shall prepare a report as required by condition 2.18 of this approval.*** ***The monitoring program shall form part of the Operational Noise Management Plan referred to in condition 6.5a) of this approval.***

Compliance Assessment Observations and Comments

Since the completion of the Operational Noise Review (PB, 2009), Delta has now implemented an ongoing noise monitoring program to be carried October of April for each AMER reporting period.

The noise monitoring locations consist of three representative sensitive noise receiver areas(in accordance with the requirements outlines in OEMP) refer to section 6.1.1 for more information.

The noise monitoring reviews have been carried as per the requirements outlined in the KVAR Stage 2 Operational Noise and Vibration Management Plan (OVMP). The reviews took place on the 6-7th November 2011 and 29- 30th April 2012. As previously mentioned under CoA. 2.18 both noise reviews were compliant against the CoA 2.15 noise criteria.

Since the reports did not return any non-compliance's with CoA 2.15, Delta Electricity was not required to submit these reports to the Director General. However as per CoA 7.3 the noise reports have been included in these appendices.

Compliance Assessment Finding-

Compliance

Groundwater Monitoring

Minister's Condition of Approval 3.4
The Proponent shall prepare and implement a Groundwater Monitoring Program to monitor the impacts of ash placement activities on local groundwater quality and hydrology. The program shall be developed in consultation with, and to the satisfaction of, the SCA, and shall describe the location, frequency, rationale and procedures and protocols for collecting groundwater samples, as well as the parameters analysed and methods of analysis. The monitoring program shall be ongoing for the life of the project and include, but not be limited to: ▪ ***Monitoring at established bore sites (or replacement bore sites in the event that existing sites are damaged or lost) as described in the document referred to under condition 1.1b) of this approval; and*** ▪ ***A schedule for periodic monitoring of groundwater quality, depth and flow at all monitoring sites, at an initial frequency of no less than once every month for the first 12 months of operation.*** ***The monitoring program shall form part of the Groundwater Management Plan referred to in condition 6.5b) of this approval.***
Compliance Assessment Observations and Comments A Groundwater Monitoring Program in the form of the Groundwater Quality Sub-Plan was developed as part of the OEMP (PB, 2008) and provided to Delta to determine the minimum monitoring requirements for groundwater following receipt of approval from the DP&I. The OEMP (PB, 2008) Ground Water Quality Sub-Plan states that two new groundwater monitoring bores down gradient to the north of the ash repository and 1 new up-gradient well should be constructed. The previous AEMR returned a compliance assessment of Partial compliance for this CoA, as it was determined that the two new groundwater bores that were to be installed down-gradient and to the north of the Stage 1 area had not been put in (Aurecon, 2010). In the 2010-11 reporting period a total of 13 groundwater bores are monitored by Lend Lease and Nalco Laboratory , exceeding the minimum monitoring requirements. Results of groundwater monitoring are presented in Appendices B, C & D Further detail is provided in section 6.1.2.2 of this AEMR.
Compliance Assessment Finding Compliance.

Minister's Condition of Approval 3.5

The Proponent is to implement a surface water quality monitoring program to monitor the impacts of the ash placement activities on, and the realignment of, Sawyers Swamp Creek. The Program shall be developed in consultation with and to the satisfaction of the DPI (Fisheries) and SCA, and shall describe the location, frequency, rationale and the procedures and protocols for collecting water samples as well as the parameters analysed and methods of analysis. The program shall include, but not necessarily be limited to:

- ***Monitoring at the four existing water quality monitoring sites as described in the document referred to under 1.1b) of this approval;***
- ***Monitoring downstream of the realigned section of Sawyers Swamp Creek;***
- ***Monitoring at groundwater discharge points into Sawyers Swamp Creek;***
- ***Wet weather monitoring with a minimum of two events recorded within the first 12 months of both the operation of the project and post realignment of Sawyers Swamp Creek; and***
- ***A schedule for periodic monitoring of surface quality at all sites throughout the life of the project, at an initial frequency of no less than once every month for the first 12 months and must include, but not be limited to, dissolved oxygen, turbidity, total phosphorus and total nitrogen.***

The monitoring program shall form part of the Surface Water Management Plan referred to in condition 6.5c) of this approval.

Compliance Assessment Observations and Comments

Nalco Laboratory Site ID numbers 38, 39, 40 and 41 (Table 6-2, shaded cells) at Kerosene Vale have been sampled since January 2003, with sites 79, 80, 81, 83 and 84 commencing testing in January 2010. The remaining Nalco Laboratory sites (86, 87 and 88) commenced sampling in May 2010.

The other sites (Table 6-2, unshaded cells) form part of the Lend Lease monthly water sampling routine for a combined total of 18 locations that are regularly monitored for the project, with tests performed including the following:

pH;

Alkalinity (CaCO3);

Sulphate (SO4);

Conductivity;

Total Dissolved Solids; and

Trace metals.

Refer to section 6.1.2.3 of this AEMR for further detail.

Compliance Assessment Finding

Compliance.

Conditions of Approval 3.6 and 3.7 relate to ecological monitoring in response to the realignment of Sawyers Swamp Creek. As Delta Electricity did not need to realign the creek, and has no future plans to do so, CoA's 3.6 and 3.7 are not applicable.

Air Quality Monitoring

Minister's Condition of Approval 3.8
The Proponent shall prepare an Air Quality Monitoring Program, in consultation with, and to the satisfaction of, the DECC. The Program shall include but not necessarily be limited to, monitoring for dust at the monitoring sites identified in the document referred to under condition 1.1b) of this approval. The air quality monitoring program shall be ongoing for the life of the project, including final rehabilitation and stabilisation of the site. ***The monitoring program shall form part of the Air Quality Management Plan referred to in condition 6.5d) of this approval.***
Compliance Assessment Observations and Comments In February 2009, eight dust monitors were installed on and around KVAR, with an additional monitor located at the silo (Figure 6-4). Data collection commenced in March 2009, with results reported as a rolling site average (g m-2) unless otherwise stated. Dust monitoring results are recorded monthly with colour and textural observations. These results indicate that KVAR is managed effectively for dust and as such is in compliance with Conditions of Approval 2.33 and 3.8. In addition, Delta engaged Malfroy Environmental Strategies Pty Ltd to carry out an comprehensive assessment of Air Quality Monitoring for KVAR Stage 2. Malfroy have continued to analysis and report on the dust results over the past 3 reporting periods. The most recent report (April 2010 to March 2012) indicated that results in the past two reporting periods were compliant against the criterion outlined in the OEMP Air quality Sub-Plan.
Compliance Assessment Finding Compliance.

Compliance Monitoring and Tracking

Minister's Condition of Approval 4.1
Prior to each of the events listed below, the Proponent shall certify in writing to the satisfaction of the Director-General that it has complied with all conditions of this approval applicable prior to that event: ▪ ***Commencement of any construction works on the land subject of this approval; and*** ▪ ***Commencement of operation of the project.***
Compliance Assessment Observations and Comments Delta submitted a Construction Environmental Management Plan (CEMP) to the Director – General of the DP&I in August 2011, which was further approved in December 2011. This plan was designed for the implementation of the construction works associated with the development of the KVAR Stage 2B area. Construction works commenced in January 2012 and the Delta has used the CEMP during construction works to date. The Department of Planning indicated its satisfaction that Delta Electricity had met the relevant pre-operational requirements of this project before commencement in 2009. This included submission of a Pre-Operation Compliance Report, Compliance Tracking Program, and the Operation Environmental Management Plan.
Compliance Assessment Finding: Compliance

Minister's Condition of Approval 4.2

The Proponent shall develop and implement a Compliance Tracking Program for the project, prior to commencing operations, to track compliance with the requirements of this approval and shall include, but not necessarily be limited to:

- ***Provisions for periodic review of the compliance status of the project against the requirements of this approval and the Statement of Commitments detailed in the document referred to in condition 1.1c) of this approval;***
- ***Provisions for periodic reporting of the compliance status to the Director-General;***
- ***A program for independent environmental auditing in accordance with* AS/NZ ISO 19011:2003 – Guidelines for Quality and/or Environmental Management Systems Auditing*;***
- ***Procedures for rectifying any non-compliance identified during environmental auditing or review of compliance;***
- ***Mechanisms for recording environmental incidents and actions taken in response to those incidents;***
- ***Provisions for reporting environmental incidents to the Director-General during construction and operation; and***
- ***Provisions for ensuring all employees, contractors and sub-contractors are aware of, and comply with, the conditions of this approval relevant to their respective activities.***

The Compliance Tracking Program shall be implemented prior to operation of the project with a copy submitted to the Director-General for approval within four weeks of commencement of the project, unless otherwise agreed by the Director-General.

Compliance Assessment Observations and Comments

Environmental incidents that may occur in respect to Kerosene Vale Stage 2 operations are reported as according to the Operation Environmental Management Plan (OEMP) (PB, 2009) and are captured within Delta's Environmental Management System. Annual reporting requirements are also covered by the preparation of the Annual Environmental Management Report (AEMR), like this report.

- Sections of the Minister approved OEMP that relate to this Condition include:
- Section 3.8 Environmental Audits (CoA 4.2c);
- Section 3.8 Environmental Audits and Section 3.8.1 Non-Compliances (CoA 4.2d);
- Section 3.9 Environmental Incidents Management (CoA 4.2e);
- Section 3.9 Environmental Incidents Management (CoA4.2f); and
- Section 3.5 Environmental Awareness Training and Site Inductions (4.2g).

Lend Lease have included the directive in the Repository Site Management Plan (RMP) (Lend Lease, 2010) that formal site management processes be documented monthly and weekly in line with the OEMP and the RMP. The Monthly Client Service Reports are also used as a method for recording any incidences.

A training plan as outlined in the RMP provides a base level of environmental awareness and induction training for Lend Lease personnel including the below. This covers CoA 4.2g above.

- Hours of operation
- Haul road speed restrictions and transport protocols
- Location of nearest sensitive receptors
- Erosion and sediment controls
- Dust suppression techniques
- Water quality protection
- Waste management
- Heritage issues and management
- Storage and handling of chemicals, fuels and oils
- Spill prevention and response
- Site hazards
- Emergency preparedness and response
- Community communication protocols and procedures
- Incident/non-compliance reporting requirements.

Compliance Assessment Finding

Compliance

Minister's Condition of Approval 4.3 and 4.4
CoA 4.3 – Nothing in this approval restricts the Proponent from utilising any existing compliance tracking programs administered by the Proponent to satisfy the requirements of condition 4.2. In doing so, the Proponent must demonstrate to the Director-General how these systems address the requirements and/or have been amended to comply with the requirements of the condition. ***CoA 4.4 – The Proponent shall meet the requirements of the Director-General in respect of the implementation of any measure necessary to ensure compliance with the conditions of this approval, and general consistency with the documents listed under condition 1.1 of this approval.***
Compliance Assessment Observations and Comments This project has an approved OEMP (approved by the DP&I in April, 2009), and falls under Delta Electricity's ISO14001 accreditation and Environmental Management System. The Director-General has not issued any requests to implement any additional measures to ensure compliance with the relevant Conditions of Approval for the Kerosene Vale Ash Repository Stage 2 Project.
Compliance Assessment Finding Not applicable.

Community Information and Complaints Management

Provision of Information

Minister's Conditions of Approval 5.1 and 5.2
Prior to the commencement of the project, the Proponent shall establish and maintain a website for the provision of electronic information associated with the project. The Proponent shall, subject to confidentiality, publish and maintain up-to-date information on this website or dedicated pages including, but not necessarily limited to: ▪ ***The documents referred to under condition 1.1 of this approval;*** ▪ ***This project approval, Environment Protection Licence and any other relevant environmental approval, licence or permit required and obtained in relation to the project;*** ▪ ***All strategies, plans and program required under this project approval, or details of where this information can be viewed;*** ▪ ***Information on construction and operational progress;*** ▪ ***The outcomes of compliance tracking in accordance with the requirements of this project approval.*** ***5.2 – The Proponent shall make all documents required to be provided under condition 5.1 of this approval publicly available.***

Compliance Assessment Observations and Comments

The link to the relevant web page for Kerosene Vale Ash Repository Stage 2 operational information is below.

http://www.de.com.au/About-Us/Ash-management/Kerosene-Vale-Ash-Repository/default.aspx

A link to the Department of Planning's project page is included on the website where the following documents can be accessed:

- Major Project Application 07_0005
- Kerosene Vale – Stage 2 Ash Repository Area (two volumes) – Environmental Assessment prepared by Parsons Brinckerhoff and dated 1 April 2008.
- Kerosene Vale – Stage 2 Ash Repository Area – Submissions Report prepared by Parsons Brinckerhoff and dated 30 May 2008.
- Project Approval (Conditions of Approval) File S07/00001, dated 26 November 2008.
- The following two actions needed to be addressed in last year's AMER Audits Actions table in regards to this condition:
- *2010/2011 AMER when completed and approved by the Director General DP&I to place on the DE website.*

Due to confidentiality agreements between Delta and its Principal Ash Management Contractor Lend Lease, DE is not able to place any of its previous or future AMER's on Delta's website. However the public information available on the Delta Website Project Page, regarding the KVAR Stage 2 project, has been updated and sent to the DE Public Relations Manager for publication.

Compliance Assessment Finding

Compliance.

Minister's Condition of Approval 5.3
Prior to the commencement of the project, the Proponent shall ensure that the following are available for community complaints and enquiries during construction and operation: ▪ ***A 24 hour contact number(s) on which complaints and enquiries about construction and operational activities may be registered;*** ▪ ***A postal address to which written complaints and enquiries may be sent; and*** ▪ ***An email address to which electronic complaints and enquiries may be sent; and*** ▪ ***An email address to which electronic complaints and enquiries may be transmitted.*** ***The telephone number, postal address and email address shall be published in a newspaper circulating in the local area prior to the commencement of the project. The above details shall also be provided on the website required by condition 5.1 of this approval.***
Compliance Assessment Observations and Comments The website: http://www.de.com.au/About-Us/Ash-management/Kerosene-Vale-Ash-Repository/default.aspx lists the following contact details for the project: After hours complaints - call Wallerawang Power Station on 02 6352 8611 Postal address: Western Environment Manager Delta Electricity PO Box Q863, QVB NSW 1230
Compliance Assessment Finding Compliance.

Minister's Condition of Approval 5.4
The Proponent shall record the details of all complaints received through the means listed under condition 5.3 of this approval in an up-to-date Complaints Register. The Register shall record, but not necessarily be limited to: ▪ ***The date and time of the complaint;*** ▪ ***The means by which the complaint was made (e.g. telephone, email, mail, in person);*** ▪ ***Any personal details of the complainant that were provided, or if no details were provided a note to that effect;*** ▪ ***The nature of the complaint;*** ▪ ***The time taken to respond to the complaint;*** ▪ ***Any investigations and actions taken by the Proponent in relation to the complainant; and*** ▪ ***If no action was taken by the Proponent in relation to the complaint, the reason(s) why no action was taken.*** ***The Complaints Register shall be made available for inspection by the Director-General upon request.***
Compliance Assessment Observations and Comments Any complaints called in to Delta go via the switchboard (02 6352 8611) and are then redirected to the appropriate area of Delta Electricity operations. All complaints are recorded in the Ellipse system in the Incidents and Complaints register with all details captured including actions to be taken if necessary. If actions were necessary, a review of those actions is undertaken before the work order is closed. There have been no complaints received regarding Kerosene Vale Ash Repository for the reporting period.
Compliance Assessment Finding Compliance.

Environmental Management

Environmental Representative

Minister's Condition of Approval 6.1

Prior to the commencement of any construction or operational activities, or as otherwise agreed by the Director-General, the Proponent shall nominate for the approval of the Director-General a suitably qualified and experienced Environmental Representative(s) independent of the design, construction and operation personnel. The Proponent shall engage the Environmental Representative(s) during any construction activities, and throughout the life of the project, or as otherwise agreed by the Director-General. The Environmental Representative(s) shall:

- ***Oversee the implementation of all environmental management plans and monitoring programs required under this approval, and advise the Proponent upon the achievements of these plans/programs;***
- ***Have responsibility for considering and advising the Proponent on matters specified in the conditions of this approval and the Statement of Commitments as referred to under condition 1.1c) of this approval;***
- ***Oversee the implementation of the environmental auditing of the project in accordance with the requirements of condition 4.2 of this approval and all relevant project Environmental Management System(s); and***
- ***Be given the authority and independence to recommend to the Proponent reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts, and, failing the effectiveness of such steps, to recommend to the Proponent that relevant activities are to be ceased as soon as reasonably practicable if there is a significant risk that an adverse impact on the environment will be likely to occur.***

Compliance Assessment Observations and Comments

In March 2009 Delta Electricity nominated the Environment Manager- Western Nino Di Falco as the Environmental Representative prior to the commencement of operational activities. The Environmental Manager oversees the implementation of all operations at KVAR through the attendance at Monthly Client meetings with Lend Lease Industrial Infrastructure, regular liaison with the External Plant Manager, and guides the project through site visits, sampling and other regulatory activities to ensure compliance with the environmental requirements of the Conditions of Approval and all relevant licences.

The Construction Environmental Management Plan was developed by Lend Lease (in accordance with CoA 6.2 & 6.3) , and further reviewed by Delta's Environmental Representative for KVAR Stage 2 operations- Nino Di Falco, prior to being submitted to the DP&I. The CEMP was approved by the Director General in December 2011.

Compliance Assessment Finding

Compliance

Minister's Conditions of Approval 6.2 and 6.3

6.2 – Prior to the commencement of construction work, the Proponent shall prepare and implement a Construction Environmental Management Plan (CEMP). The CEMP shall outline the environmental management practices and procedures to be followed during construction. The CEMP shall be prepared in accordance with* Guideline for the Preparation of Environmental Management Plans *(DIPNR, 2004).

The Construction Environmental Management Plan for the project (or any stage of the project) shall be submitted to the Director General for approval at least four weeks prior to the commencement of any construction work associated with the project (or stage as relevant), unless otherwise agreed by the Director-General. Construction shall not commence until written approval has been received from the Director-General.

6.3 – As part of the Construction Environmental Management Plan for the project, the Proponent shall prepare and implement the following plans:

A Construction Traffic Management Plan, prepared in consult consultation with the RTA, the relevant Council and emergency services to manage the construction traffic impacts of the project, including but not limited to:

- ***Identifying construction vehicle volumes (construction staff vehicles, heavy vehicles and oversized loads) and haulage routes;***
- ***Identifying any road closures and/or traffic detours during the haulage of oversized loads as agreed to by the relevant roads authority;***
- ***Detailing a Construction Vehicle Code of Conduct to set driver behaviour controls to minimise impacts on the land uses along haulage routes (including noise minimisation measures); and***
- ***Complying with the document* Procedures for Use in the Preparation of a Traffic Management Plan *(RTA, 2011).***
- ***A Construction Noise Management Plan to detail how construction noise impacts would be minimised and managed. The Strategy shall be developed in consultation with, and to the satisfaction of, the DECC and shall include, but not necessarily be limited to:***
- ***Details of construction activities and an indicative schedule for construction works;***
- ***Identification of construction activities that have the potential to generate noise impacts on sensitive receivers;***
- ***Procedures for assessing noise levels at sensitive receivers and compliance;***
- ***Details of the reasonable and feasible actions and measures to be implemented to minimise noise impacts and, if any noise exceedence is detected, how any non-compliance would be rectified; and***
  - ***Procedures for notifying sensitive receivers of construction activities that are likely to affect their noise amenity.***

	▪ ***An Erosion and Sediment Control Plan to detail measures to minimise erosion and the discharge of sediment and other pollutants to land and/or water during construction works. The Plan must include, but not necessarily be limited to:*** o ***Identification of the construction activities that could cause soil erosion or discharge sediment or water pollutants from the site;*** o ***A description of the management methods to minimise soil erosion or discharge of sediment or water pollutants from the site, including a strategy to minimise the area of bare surfaces, stabilise disturbed areas, and minimise bank erosion; and*** ***Demonstration that the proposed erosion and sediment control measures will conform with, or exceed, the relevant requirements of*** **Managing Urban Stormwater: Soils and Construction** ***(Landcom, 2004).***
Compliance Assessment Observations and Comments A CEMP for construction works for Stage 2B was approved by the DP&I in December 2011. The CEMP contains the following : ▪ Excavation Plan ▪ Construction Traffic Management sub- plan ▪ Relevant Environments Aspects- Air Quality, lighting emissions, Heritage impacts, waste management ▪ Construction noise management sub-plan ▪ Noise monitoring program ▪ Erosion and Sediment Control Plan ▪ Risk Management and Risk Assessment The CEMP complies with this condition.	
Compliance Assessment Finding Compliance	

Minister's Conditions of Approval 6.4 and 6.5

6.4 – The Proponent shall prepare and implement and Operation Environmental Management Plan to detail an environmental management framework, practices and procedures to be followed during operation of the project. The Plan shall be consistent with* Guideline for the Preparation of Environmental Management Plans *(DIPNR, 2004) and shall include, but not be limited to:

- ***Identification of all statutory and other obligations that the Proponent is required to fulfil in relation to operation of the project, including all approvals, licences and consultations;***
- ***A description of the roles and responsibilities for all relevant employees (including contractors) involved in the operation of the project;***
- ***Overall environmental policies and principles to be applied to the operation of the project***
- ***Standards and performance measures to be applied to the project, and a means by which environmental performance can be periodically reviewed and improved, where appropriate;***
- ***Management policies to ensure that environmental performance goals are met and to comply with the conditions of this approval;***
- ***The additional plans listed under condition 6.5 of this approval; and***
- ***The environmental monitoring requirements outlined under conditions 3.3 to 3.5 inclusive and 3.8 of this approval.***

The Plan shall be submitted for the approval of the Director-General no later than four weeks prior to the commencement of operation of the project, unless otherwise agreed by the Director-General. Operation shall not commence until written approval has been received from the Director-General.

Nothing in this approval precludes the Proponent from incorporating the requirements of the Operational Environmental Management Plan into existing environmental management systems and plan administered by the Proponent.

6.5 – As part of the Operation Environmental Management Plan for the project, required under condition 6.4 of this approval, the Proponent shall prepare and implement the following Management Plans:

An Operational Noise Management Plan to detail measures to mitigate and manage noise during operation of the project. The Plan shall be prepared in consultation with, and to the satisfaction of, the DECC and include, but not necessarily be limited to:

- ***Procedures to ensure that all reasonable and feasible noise mitigation measures are applied during operation of the project;***
- ***Identification of all relevant sensitive receivers and the applicable criteria at those receivers commensurate with the noise limit specified under condition 2.15 of this approval;***

- ***Identification of activities that will be carried out in relation to the project and the associated noise sources;***
- ***Noise monitoring procedures (as referred to in condition 3.3 of this approval) for periodic assessment of noise impacts at the relevant receivers against the noise limits specified under this approval and the predicted noise levels as detailed in the report referred to under condition 1.1b) of this approval;***
- ***Details of all management methods and procedures that will be implemented to control individual and overall noise emissions from the site during operation;***
- ***Procedures and corrective actions to be undertaken if non-compliance against the operational noise criteria is detected; and***
- ***Provisions for periodic reporting of results to DECC.***

A Groundwater Management Plan to detail measures to mitigate and manage groundwater impacts. The Plan shall be prepared in consultation with, and to the satisfaction of, the SCA and include, but not necessarily be limited to:

- ***Baseline data on groundwater quality, depth and flow in the project area;***
- ***Groundwater objectives and impact assessment criteria;***
- ***A program to monitor groundwater flows and groundwater quality in the project area as required by condition 3.4 of this approval;***
- ***A protocol for the investigation of identified exceedences of the groundwater impact assessment criteria;***
- ***A response plan to address potential exceedences and groundwater impacts; and***
- ***Provisions for periodic reporting of results to the SCA.***

A Surface Water Management Plan to outline measures that will be employed to manage water on the site, to minimise soil erosion and the discharge of sediments and other pollutants to land and/or waters throughout the life of the project. The Plan shall be based on best environmental practice and shall be prepared in consultation with, and to the satisfaction of, the SCA and DPI (Fisheries). The Plan shall include, but not necessarily be limited to:

- ***Baseline data on the water quality and flow in Sawyers Swamp Creek up to the date of this approval;***
- ***Water quality objectives and impact assessment criteria for Sawyers Swamp Creek;***
- ***A program to monitor surface water quality in Sawyers Swamp Creek as referred to in condition 3.5 of this approval;***
- ***A protocol for the investigation of identified exceedences in the impact assessment criteria;***

- *A response plan to address potential adverse surface water quality exceedences;*

A site water management strategy identifying clean and dirty water areas for Stage A, B and C of the project and the associated water management measures including erosion and sediment controls and provisions for recycling/reuse of water and the procedures for decommissioning water management structures on the site; and

- ***Provisions for periodic reporting of results to the DPI (Fisheries) and the SCA.***

An Air Quality Management Plan to outline measures to minimise impacts from the project on local air quality. The Plan shall be prepared in consultation with, and to the satisfaction of, the DECC and include, but not necessarily be limited to:

- ***Baseline data on dust deposition levels;***
- ***Air quality objectives and impact assessment criteria;***
- ***An air quality monitoring program as referred to in condition 3.8 of this approval;***
- ***An assessment of alternative methods of ash placement to minimise the exposure of active placement areas to prevailing winds;***
- ***Mitigation measures to be incorporated during emplacement activities and haulage of ash;***
- ***An operating protocol for the repository irrigation system including activation rates, application rates and area of coverage;***
- ***A protocol for the investigation of visible emissions from the repository area;***
- ***A response plan to address visible emissions from the repository area; and***
- ***Provisions for periodic reporting of results to the DECC.***

A Landscape/Revegetation Plan to outline measures to minimise the visual impacts of the repository and ensure the long-term stabilisation of the site and compatibility with the surrounding land fabric and land use. The Plan shall include, but not necessarily be limited to:

- ***Identification of design objectives and standards based on local environmental values, vistas, and land uses;***
- ***A description of short- and long-term revegetation measures;***
- ***A schedule of species to be used in revegetation;***
- ***Timing and progressive implementation of revegetation works as placement areas are completed, including landscape plans; and***
- ***Procedures and methods to monitor and maintain revegetated areas during the establishment phase and long-term.***

Revegetation works must incorporate the use of local native species.

Compliance Assessment Observations and Comments
The Operation Environmental Management Plan was prepared by Parsons Brinckerhoff in 2009 including all of the required sections, and was submitted to the Department of Planning for approval.
Approval was granted in April 2009, and operations at KVAR Stage 2 commenced in September 2009.
Compliance Assessment Finding
Complies.

Environmental Reporting

Environmental Incident Reporting

Minister's Conditions of Approval 7.1 and 7.2
7.1 – The Proponent shall notify the Director-General of any environmental incident within 12 hours of becoming aware of the incident. The Proponent shall provide full written details of the incident to the Director-General within seven days of the date on which the incident occurred. ***7.2 – The Proponent shall meet the requirements of the Director-General to address the cause or impact of any environmental incident, as it related to this approval, reported in accordance with condition 7.1 of this approval, within such period as the Director-General may require.***
Compliance Assessment Observations and Comments No environmental incidents occurred within the May 2011 – April 2012 reporting period.
Compliance Assessment Finding Not applicable.

Annual Performance Reporting

Minister's Condition of Approval 7.3
The Proponent shall, throughout the life of the project, prepare and submit for the approval of the Director-General, an Annual Environmental Management Report (AEMR). The AEMR shall review the performance of the project against the Operation Environmental Management Plan (refer to condition 6.4 of this approval) and the conditions of this approval. The AEMR shall include, but not necessarily by limited to: ▪ ***Details of compliance with the conditions of this approval;*** ▪ ***A copy of the Complaints Register (refer to 5.4 of this approval) for the preceding twelve-month period (exclusive of personal details), and details of how these complaints were addressed and resolved;*** ▪ ***Identification of any circumstances in which the environmental impacts and performance of the project during the year have not been generally consistent with the environmental impacts and performance predicted in the documents listed under condition 1.1 of this approval, with details of additional mitigation measures applied to the project to address recurrence of these circumstances;*** ▪ ***Results of all environmental monitoring required under conditions 3.3 to 3.8 of this approval, including interpretations and discussion by a suitably qualified person; and*** ▪ ***A list of all occasions in the preceding twelve-month period when***

environmental goals/objectives/impact assessment criteria for the project have not been achieved, indicating the reason for failure to meet the criteria and the action taken to prevent recurrence of that type of failure.
The Proponent shall submit a copy of the AEMR to the Director-General every year, with the first AEMR to be submitted no later than twelve months after the commencement of operation of the project. The Director-General may require the Proponent to address certain matters in relation to the environmental performance of the project in response to review of the Annual Environmental Report. Any action required to be undertaken shall be completed within such period as the Director-General may require. The Proponent shall make copies of each AEMR available for public inspection on request.
Compliance Assessment Observations and Comments
This AEMR, of which this review checklist is a part, satisfies the requirements of Condition of Approval 7.3.
Compliance Assessment Finding
Compliance.

Appendix B – Nalco Water Quality Data 2011-12

Nalco Laboratory Test Results for Kerosene Vale Stage 2 Wallerawang - Surface Water Quality May 2011 to April 2012

Site ID	Reported origin	Sample Number	Date Sampled	pH	Conductivity uS/m	Alkalinity (CaCO3) mg/L	Chloride (Cl) mg/L	Fluoride (F) mg/L	Sulphate (SO4) mg/L	TDS mg/L	Sodium (Na) mg/L	Potassium (K) mg/L	Calcium (Ca) mg/L	Magnesium (Mg) mg/L	Arsenic (As) mg/L	Silver (Ag) mg/L	Barium (Ba) mg/L	Boron (B) mg/L	Cadmium (Cd) mg/L	Chrome (Cr) mg/L
38	Sawyers S Ck Ash Dam	1659503	12-May-11	4.60	180,000	10	26	2.200	830	1400	290	45	82	16	0.001	0.0005	0.052	2.1	0.003	0.002
39	Dump Ck	1659504	12-May-11	3.20	130,000	10	22	0.900	570	880	98	26	53	56	0.0005	0.0005	0.024	2.1	0.0003	0.0005
40	Sawyers Ck WX5	1659505	12-May-11	3.60	180,000	10	46	7.000	910	1500	140	92	120	57	0.003	0.0005	0.041	4.8	0.006	0.0005
41	Sawyers Ck WX7	1659506	12-May-11	7.50	120,000	250	26	2.600	430	880	170	39	56	31	0.031	0.0005	0.16	2	0.007	0.005
38	Sawyers S Ck Ash Dam	1693472	10-Jun-11	4.50	190,000	10	28	2.400	870	1300	290	42	84	16	0.0005	0.0005	0.041	2.2	0.003	0.0005
39	Dump Ck	1693473	10-Jun-11	3.30	150,000	10	22	0.900	640	920	110	26	59	59	0.0005	0.0005	0.022	2.6	0.0002	0.0005
40	Sawyers Ck WX5	1693475	10-Jun-11	5.80	89,000	10	17	2.600	380	620	57	40	68	23	0.006	0.0005	0.044	2.1	0.0036	0.001
41	Sawyers Ck WX7	1693476	10-Jun-11	8.30	110,000	360	12	1.600	190	670	210	18	25	14	0.004	0.0005	0.022	0.82	0.0006	0.0005
38	Sawyers S Ck Ash Dam	1747872	21-Jul-11	4.80	180,000	10	26	2.300	850	1400	300	45	91	15	0.0005	0.0005	0.031	2.1	0.002	0.0005
39	Dump Ck	1747873	21-Jul-11	3.30	150,000	10	24	0.900	660	950	110	28	62	62	0.0005	0.0005	0.021	2.6	0.0003	0.0005
40	Sawyers Ck WX5	1747874	21-Jul-11	4.80	100,000	10	28	3.700	460	730	77	51	72	30	0.002	0.0005	0.044	2.6	0.003	0.0005
41	Sawyers Ck WX7	1747875	26-Jul-11	8.10	110,000	360	12	2.000	220	690	210	22	28	15	0.002	0.0005	0.016	0.98	0.0006	0.001
38	Sawyers S Ck Ash Dam	1792642	30-Aug-11	4.90	180,000	10	28	1.900	850	1400	290	44	87	14	0.0005	0.0005	0.023	1.9	0.002	0.0005
39	Dump Ck	1792643	30-Aug-11	3.20	150,000	10	24	1.000	700	1100	120	29	67	63	0.0005	0.0005	0.021	2.6	0.0002	0.0005
41	Sawyers Ck WX7	1792646	30-Aug-11	8.00	98,000	360	12	2.100	180	660	190	18	25	13	0.009	0.0005	0.051	0.68	0.002	0.003
38	Sawyers S Ck Ash Dam	1825637	21-Sep-11	4.90	180,000	10	29	1.900	890	1300	310	48	96	15	0.0005	0.0005	0.024	2.1	0.002	0.0005
39	Dump Ck	1825638	21-Sep-11	3.20	170,000	10	25	1.100	780	1200	130	33	72	69	0.0005	0.0005	0.023	3.1	0.0003	0.001
41	Sawyers Ck WX7	1825640	21-Sep-11	8.30	110,000	420	11	2.100	200	770	240	21	28	14	0.005	0.0005	0.026	0.83	0.001	0.002
38	Sawyers S Ck Ash Dam	1868445	26-Oct-11	5.20	190,000	10	28	1.700	870	1400	290	46	94	15	0.001	0.0005	0.037	1.9	0.001	0.002
39	Dump Ck	1868446	26-Oct-11	3.10	170,000	10	24	1.100	750	1200	120	33	72	72	0.0005	0.0005	0.022	2.9	0.0002	0.001
41	Sawyers Ck WX7	1868447	26-Oct-11	6.50	150,000	190	23	1.800	690	1200	170	58	93	45	0.029	0.0005	0.19	3.2	0.02	0.027
38	Sawyers S Ck Ash Dam	1895615	15-Nov-11	4.40	180,000	10	26	2.300	840	1300	270	42	75	16	0.002	0.0005	0.098	2	0.0041	0.01
39	Dump Ck	1895616	15-Nov-11	3.10	180,000	10	26	1.100	810	1300	130	37	79	79	0.0005	0.0005	0.024	3.4	0.00024	0.0005
40	Sawyers Ck WX5	1895617	15-Nov-11	7.30	130,000	180	18	2.300	420	900	180	31	54	26	0.0005	0.0005	0.041	1.7	0.0016	0.0005
38	Sawyers S Ck Ash Dam	1933733	14-Dec-11	4.80	170,000	10	25	4.000	780	1300	260	39	70	15	0.001	0.0005	0.083	1.9	0.0037	0.004
39	Dump Ck	1933734	14-Dec-11	3.20	150,000	10	25	0.900	680	1100	110	31	70	65	0.0005	0.0005	0.021	2.8	0.0001	0.0005
40	Sawyers Ck WX5	1933737	14-Dec-11	7.30	56,000	78	13	1.000	160	380	81	13	20	10	0.0005	0.0005	0.032	0.63	0.0007	0.002
41	Sawyers Ck WX7	1933738	14-Dec-11	7.00	76,000	37	15	2.000	300	530	90	25	36	18	0.003	0.0005	0.049	1.4	0.002	0.004
38	Sawyers S Ck Ash Dam	1973047	11-Jan-12	5.00	170,000	10	27	2.100	800	1300	280	40	70	15	0.001	0.0005	0.079	1.8	0.003	0.001
39	Dump Ck	1973048	18-Jan-12	3.10	180,000	10	25	1.100	810	1200	140	38	78	74	0.0005	0.0005	0.023	3.3	0.0002	0.0005
40	Sawyers Ck WX5	1973049	18-Jan-12	7.60	54,000	91	14	0.900	140	370	78	9	19	10	0.0005	0.0005	0.033	0.51	0.0004	0.0005
41	Sawyers Ck WX7	1973050	18-Jan-12	6.40	92,000	20	17	1.300	390	660	100	29	45	23	0.002	0.0005	0.041	1.7	0.003	0.003
38	Sawyers S Ck Ash Dam	2018534	22-Feb-12	5.00	160,000	10	23	2.000	750	1100	280	38	66	14	0.002	0.0005	0.075	1.8	0.0028	0.0005
39	Dump Ck	2018535	22-Feb-12	3.90	110,000	10	21	0.500	490	740	90	24	55	48	0.0005	0.0005	0.02	2	0.0001	0.0005
40	Sawyers Ck WX5	2018536	22-Feb-12	7.30	71,000	130	13	1.200	190	420	110	18	24	11	0.002	0.0005	0.029	0.87	0.0015	0.001
41	Sawyers Ck WX7	2018537	22-Feb-12	7.60	60,000	110	12	1.500	160	350	85	15	24	13	0.004	0.0005	0.043	0.66	0.0019	0.003
38	Sawyers S Ck Ash Dam	2046302	14-Mar-12	5.10	130,000	10	20	1.500	570	890	220	32	52	11	0.001	0.0005	0.061	1.4	0.002	0.0005
39	Dump Ck	2046315	8-Mar-12	6.50	67,000	10	18	0.400	270	440	51	15	38	25	0.0005	0.0005	0.016	0.89	0.0001	0.0005
40	Sawyers Ck WX5	2046316	14-Mar-12	8.00	29,000	85	11	0.200	38	150	54	4	5.8	4	0.0005	0.0005	0.032	0.11	0.0001	0.0005
41	Sawyers Ck WX7	2046317	8-Mar-12	7.10	31,000	24	11	0.500	95	160	31	9	14	7	0.0005	0.0005	0.036	0.38	0.00055	0.0005
38	Sawyers S Ck Ash Dam	2096712	19-Apr-12	4.60	120,000	10	20	0.400	560	940	190	28	50	11	0.002	0.0005	0.061	1.4	0.002	0.001
39	Dump Ck	2096714	19-Apr-12	3.40	140,000	10	24	1.400	620	980	110	28	62	59	0.0005	0.0005	0.025	2.6	0.0002	0.0005
40	Sawyers Ck WX5	2096715	20-Apr-12	7.60	42,000	110	13	0.500	83	280	76	7	11	7	0.001	0.0005	0.032	0.29	0.0001	0.0005
41	Sawyers Ck WX7	2096716	19-Apr-12	5.20	80,000	10	16	3.000	350	560	91	29	37	18	0.001	0.0005	0.034	1.6	0.0029	0.002

Nalco Laboratory Test Results for Kerosene Vale Stage 2 Wallerawang - Surface Water Quality May 2011 to April 2012

Site ID	Reported origin	Copper (Cu) mg/L	Iron (Fe) - Filtered mg/L	Mercury (Hg) mg/L	Manganese (Mn) - Filtered mg/L	Lead (Pb) mg/L	Selenium (Se) mg/L	Zinc (Zn) mg/L	Molybdenum (Mo) mg/L	Nickel (Ni) mg/L
38	Sawyers S Ck Ash Dam	0.015	0.02	0.000025	1.4	0.0005	0.005	0.15	0.005	0.05
39	Dump Ck	0.003	4.3	0.000025	4.9	0.001	0.001	1	0.005	0.35
40	Sawyers Ck WX5	0.006	0.67	0.000025	8.2	0.004	0.002	1.2	0.03	0.63
41	Sawyers Ck WX7	0.015	0.02	0.000025	2.8	0.027	0.002	3.1	0.005	0.48
38	Sawyers S Ck Ash Dam	0.014	0.005	0.000025	1.4	0.0005	0.005	0.18	0.005	0.05
39	Dump Ck	0.002	5.7	0.000025	5.9	0.001	0.001	0.99	0.005	0.4
40	Sawyers Ck WX5	0.006	0.02	0.000025	2.8	0.002	0.004	0.52	0.15	0.21
41	Sawyers Ck WX7	0.002	0.04	0.000025	1.2	0.002	0.001	0.22	0.02	0.08
38	Sawyers S Ck Ash Dam	0.01	0.005	0.000025	1.4	0.0005	0.004	0.22	0.005	0.05
39	Dump Ck	0.003	6.3	0.000025	6.2	0.002	0.001	1	0.005	0.41
40	Sawyers Ck WX5	0.005	0.04	0.000025	3.7	0.001	0.002	0.59	0.03	0.28
41	Sawyers Ck WX7	0.002	0.01	0.000025	1.3	0.002	0.001	0.22	0.02	0.1
38	Sawyers S Ck Ash Dam	0.007	0.005	0.000025	1.3	0.0005	0.004	0.19	0.005	0.04
39	Dump Ck	0.005	6.4	0.000025	6.5	0.002	0.001	1	0.005	0.42
41	Sawyers Ck WX7	0.006	0.005	0.00005	0.83	0.005	0.001	0.74	0.01	0.11
38	Sawyers S Ck Ash Dam	0.008	0.005	0.000025	1.3	0.0005	0.004	0.19	0.005	0.04
39	Dump Ck	0.012	7.3	0.000025	7.3	0.002	0.001	1.2	0.005	0.49
41	Sawyers Ck WX7	0.007	0.005	0.000025	0.98	0.002	0.001	0.43	0.02	0.11
38	Sawyers S Ck Ash Dam	0.004	0.01	0.000025	1.2	0.001	0.006	0.18	0.03	0.03
39	Dump Ck	0.002	7.6	0.000025	7.6	0.002	0.001	1.2	0.005	0.49
41	Sawyers Ck WX7	0.052	0.02	0.000025	3.7	0.038	0.003	3.3	0.005	0.61
38	Sawyers S Ck Ash Dam	0.046	0.09	0.000025	1.1	0.003	0.018	0.27	0.005	0.07
39	Dump Ck	0.005	6.3	0.000025	8.2	0.002	0.001	1.3	0.005	0.54
40	Sawyers Ck WX5	0.003	0.005	0.000025	1.8	0.0005	0.001	0.36	0.005	0.15
38	Sawyers S Ck Ash Dam	0.031	0.04	0.000025	1	0.002	0.014	0.2	0.01	0.06
39	Dump Ck	0.004	4.3	0.000025	6	0.009	0.001	0.92	0.005	0.4
40	Sawyers Ck WX5	0.002	0.01	0.000025	0.6	0.0005	0.001	0.13	0.005	0.05
41	Sawyers Ck WX7	0.006	0.005	0.000025	1.7	0.005	0.001	0.52	0.005	0.15
38	Sawyers S Ck Ash Dam	0.021	0.09	0.000025	0.96	0.0005	0.014	0.16	0.02	0.05
39	Dump Ck	0.015	6.3	0.000025	7.3	0.002	0.001	1.1	0.005	0.48
40	Sawyers Ck WX5	0.002	0.02	0.000025	0.57	0.0005	0.001	0.07	0.005	0.02
41	Sawyers Ck WX7	0.006	0.25	0.000025	2.6	0.002	0.001	0.47	0.005	0.16
38	Sawyers S Ck Ash Dam	0.013	0.005	0.000025	0.91	0.0005	0.012	0.16	0.02	0.05
39	Dump Ck	0.002	0.27	0.000025	4.3	0.0005	0.001	0.57	0.005	0.27
40	Sawyers Ck WX5	0.003	0.005	0.000025	1	0.001	0.001	0.2	0.005	0.08
41	Sawyers Ck WX7	0.006	0.005	0.000025	0.6	0.004	0.001	0.34	0.005	0.08
38	Sawyers S Ck Ash Dam	0.008	0.02	0.000025	0.74	0.0005	0.008	0.12	0.02	0.04
39	Dump Ck	0.002	0.33	0.000025	1.3	0.0005	0.001	0.21	0.005	0.1
40	Sawyers Ck WX5	0.0005	0.23	0.000025	0.045	0.0005	0.001	0.03	0.005	0.005
41	Sawyers Ck WX7	0.002	0.01	0.000025	0.47	0.0005	0.001	0.1	0.005	0.04
38	Sawyers S Ck Ash Dam	0.009	0.31	0.00006	0.79	0.001	0.008	0.12	0.005	0.04
39	Dump Ck	0.003	3.3	0.000025	5	0.0005	0.001	0.85	0.005	0.34
40	Sawyers Ck WX5	0.002	0.02	0.000025	0.26	0.0005	0.001	0.03	0.005	0.01
41	Sawyers Ck WX7	0.005	0.08	0.000025	1.9	0.001	0.001	0.36	0.005	0.14

Appendix C – Lend Lease Water Quality Data 2011-12

Appendix D – Water Quality Sites Summary

Refer Table 4 and Figure 4: *Surface and Groundwater monitoring points at KVAR*

Appendix E – KVAR Noise Compliance Report:

E1 = November 2011 Report

E2 = March 2012 Report

aurecon

Project: Kerosene Vale Ash Repository Stage 2

Ongoing operational noise measurements

Prepared for: Delta Electricity

Project: 226131

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1. Introduction

Aurecon was engaged by Delta Electricity to carry out ongoing operational noise monitoring for the Kerosene Vale Stage 2 Ash Repository (KVAR) located in Wallerawang, NSW. The noise measurements were carried out on Sunday 29th April and Monday 30th April 2012, during the early morning and evening periods as per the requirements outlined in the KVAR Stage 2 Operations, Operational Noise and Vibration Management Plan (ONVMP).

1.1 Site details

The project site consists of an Ash Repository which services the nearby Wallerawang Power Station (WPS). The major noise emissions associated with the Stage 2 KVAR works are:

- Unloading of ash from trucks at the repository.
- Placement and handling of ash at the repository site.
- Operation of trucks on the private haul road; trucks leave WPS loaded with ash (travelling north) and return from the repository empty (travelling south)

Figure 1 shows the site layout and location of sensitive receivers relative to the major noise sources including WPS as well as major roads in the area. Table 1 outlines the most affected sensitive receivers and their distance to the haul road.

Table 1: Representative noise measurement locations

Representative sensitive receiver	Distance (m) to haulage road*
60 Skelly Road	330
10 Skelly Road	240
21 Neubeck Street	160

Note * - distance relates to the property boundary or a point 30 m from the dwelling location

It should be noted that coal supply trucks also utilise the private haul road. Their noise impacts are not considered to be part of the Stage 2 KVAR works and thus their noise impact is outside the scope of this report. On site it is extremely difficult to visually distinguish between coal supply trucks and ash trucks. Therefore, for the purpose of prediction of noise emissions from ash trucks alone, Kerosene Vale have provided truck movement numbers during the assessment periods.

Figure 1: Site details

2. Noise criteria

The applicable operational noise criteria are outlined in the Project Approval, Application No. 07_0005. The criteria are summarised in condition 2.15 as follows:

> *2.15 The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed a* $L_{Aeq\ (15\ minute)}$ ***of 40 dBA*** *at the nearest most affected sensitive receiver during normal operating hours as defined in condition 2.8.*
>
> *This criterion applies under the following meteorological conditions:*
>
> *a) Wind speeds up to 3 m/s at 10 meters above ground; and/or*
> *b) Temperature inversion conditions of op to 3°C/100 m and source to receiver gradient winds of up to 2 m/s at 10 m above ground level*

Normal operating hours in accordance with Conditions 2.8 are 7:00 am to 10:00 pm Monday to Sunday.

3. Noise measurements

3.1 Measurement methodology

Two types of measurements were carried out at the site: ambient noise and sound exposure levels. The measurements were carried out on Sunday 29 April and Monday 30 April 2012, during the early morning and evening periods, when the noise impacts are likely to be the most significant.

The ambient compliance noise measurements were conducted using a Larson Davis 831 Type 1 sound level meter which was set to 'A' frequency weighting, 'F' time weighting, and was fitted with an approved windshield. Measurements were typically taken at a height of 1.2 metres and at least 3.5 metre from any reflecting structure other than the ground. The measurement period at each location consisted of 15 minutes. A Larson Davis CAL200 was utilised to calibrate all sound level meters before and after each series of measurements with no significant calibration drift noted. The weather during the noise logging ranged from overcast to sunny condition, and wind speeds less than 5m/s at ground level. Measurements were typically taken in accordance with the Australian Standard *AS 1055 1997: Acoustics – Description and measurement of environmental noise*.

No meteorological measurements were taken during the noise survey to establish stability conditions or wind speeds at 10 metres above ground level.

The Sound Exposure Level (SEL) measurements were also carried out using a Larson Davis 831 Type 1 sound level meter which was set to 'A' frequency weighting, 'F' time weighting, and was fitted with an approved windshield. SEL is the equivalent one second A-weighted sound level which would produce the same sound energy as the actual event. The measurement was commenced when the truck was observed to pass a consistent location and stopped when the end of the truck passed a second consistent location. The reference locations were identified where the truck could be visually observed.

During both types of measurements no rain periods were experienced. Minimal wind was induced on the microphone with any light breeze periods being significantly below the 5 m/s threshold.

3.2 Measurement locations

The measurement locations were chosen to represent the three most affected sensitive receivers as outlined in the Operational Noise and Vibration Management Plan (ONVMP). The three most affected receivers prior to commencement of the measurements were identified based on the information in the Stage 2 Kerosene Vale Ash Repository operational noise review.

Due to the increased background noise level at each of the three noise monitoring locations it was difficult to assess individual truck noise events (Section 4). A fourth noise monitoring location was selected closer to the haulage route to measure individual truck pass-by events. Table 2 and Figure 2 outline the noise measurement locations.

Table 2: Representative noise measurement locations

Measurement location	Measurement distance (m) to haulage road	Representative sensitive receiver
A	300	60 Skelly Road
B	270	10 Skelly Road
C	160	21 Neubeck Street
D	95	-

Figure 2: Noise measurement locations

General observation regarding ambient noise environment as well as the truck movements and ash repository operations are described as follows. Individual truck noise varied significantly between trucks. The noise emissions were dependant on the speed travelled, driving technique and direction of travel. The variances were apparent even between the same types of vehicles. Truck pass-by numbers were higher during the morning period on both measurement days when compared to the evening truck counts. Operational noise from the Ash Repository was typically inaudible at the noise sensitive receiver locations during all the attended noise measurements.

The noise levels at all locations were affected by other ambient noise sources such as bird/insects life, domestic animals, passenger and freight train horn, domestic noise, extraneous noise from nearby construction site, background noise from the Wallerawang Power Station as well as intermittent traffic noise from nearby Castlereagh Highway and Wolgan Road. Due to high background noise from the activities mentioned above, truck engine noise was sometimes masked and was not clearly audible.

3.2.1 Location A (60 Skelly Road)

The background noise contributions at Location A were predominantly from the hum from Delta Electricity Wallerawang Power Station and traffic noise from Castlereagh highway. Faint traffic noise from Wolgan Road was also audible. The haulage road was clearly visible from this measuring location and the trucks moving on the haulage road could be easily identified except during the 07:42 measurement on 30/04/2012 where the visibility was slightly poor due to fog. The horn from the passenger/freight/coal train was clearly audible at this location for one instance during the entire measurement. There was audible noise of reversing alarm and heavy impact bangs from unloading during the 30/04/2012 - 07:42 measurement. After investigation is was apparent that these noises were originating from a nearby residential property adjacent to Wolgan Road, where some temporary construction work was underway and an excavator was working on site. Noise from birds and insects also contributed to the background noise at this location. The background noise level (LA90) was observed to be approximately 3 – 5 dBA higher specifically during the Monday morning measurement (50dBA) compared to 29/04/2012 and 30/04/2012 - 20:34 measurements (45 – 47 dBA). This increase in noise levels was determined to be essentially due to the additional contribution from Delta Power Station.

3.2.2 Location B (10 Skelly Road)

The background noise contributions at Location B were predominantly from the hum from Delta Electricity Wallerawang Power Station and noise from birds/ insects/ animals. Traffic noise from Wolgan Road was clearly audible at this location. The haulage road was clearly visible from this measuring location and the trucks moving on the haulage road could be easily identified except during the morning period measurement on 30/05/2012 where the visibility was poor due to extensive fog obstructing the vision. Noise of reversing alarms and impact bangs from the excavator working inside the residential property adjacent Wolgan Road was also audible at this location during the 30/04/2012 – 07:22 measurement. The background noise level (LA90) was observed to be approximately 6 – 9 dBA higher specifically during the Monday morning measurement (44dBA) compared to Sunday and Monday evening measurements (35 – 38) essentially due to the additional contribution from Delta Power Station.

3.2.3 Location C (21 Neubeck Street)

The background noise contributions at Location C were predominantly from the hum from Delta Electricity Wallerawang Power Station and noise from birds/insects/animals. Traffic noise from Wolgan Road was clearly audible and substantially contributed to the ambient noise levels. There was temporary noise from construction activities (including bucket bangs from excavator, engine idle noise, track slaps, loading and unloading, reversing alarm, etc) at the Lot 21, Neubeck Street during the 30/04/2012 – 06:59 measurement which pushed the background noise levels (L90) to 50 dBA. It has been confirmed by the client that these activities were not part of Kerosene Vale Ash Repository operations. Delta Electricity Power Station hum was clearly audible during the entire measurement at all locations. The trucks moving on the haulage road were not visible from this location because of an earth mound blocking the line of sight, although the trucks were clearly audible.

3.2.4 Location D

The noise data collected at Location D measured the Sound Exposure Levels (SEL) of individual truck pass-by events on 7/11/2011. At this closer location to the truck haulage road, each truck pass-by was clearly audible above other ambient noise sources.

3.3 Operating and meteorological conditions

Delta Electricity has provided the following information regarding the operations during the noise survey.

- The ash silos normally operate at approximately 83 – 85% capacity.
- Trucks were operating during all measurement periods moving from north to south and visa-versa on the haulage road east of Skelly Road. The number of trucks pass by varied from a maximum of 12 trucks (including north bound and south bound trucks during 29/04/2012 – 08:12 measurement at Location A) to minimum of 1 truck (including north bound and south bound trucks during 29/04/2012 – 18:53 measurement at Location B). The number of trucks counted during the measurement period included ash and coal trucks. Trucks were operating at a constant rate, with approximate 15-30 minute circuits for each truck from 7am – 10pm daily.

The meteorological conditions during the noise survey based on 5 minute data from the Mount Piper weather station are shown in Table 3. The weather station details are as follows:

- Location – South: 33° 21’ 46.0”, East: 150° 01’ 21.0”
- Elevation – 956 m
- Anemometer height – 10 m above ground level

Table 3: Meteorological conditions during noise survey

Time and date	Rainfall (mm)	Wind Speed (m/s)	Wind Direction (deg)	Relative Humidity (%)	Temp (°C)	Atmospheric Stability
29/04/2012 7:20	0.0	1.9	187	84	7.6	B
29/04/2012 7:25	0.0	1.3	185	82	8.0	B
29/04/2012 7:30	0.0	1.3	191	80	8.5	A
29/04/2012 7:35	0.0	1.3	193	79	8.9	B
29/04/2012 7:40	0.0	1.3	205	78	9.1	B
29/04/2012 7:45	0.0	1.1	193	76	9.5	A
29/04/2012 7:50	0.0	1.0	180	75	10.1	A
29/04/2012 7:55	0.0	0.3	177	74	10.6	A
29/04/2012 8:00	0.0	1.1	170	71	11.1	A
29/04/2012 8:05	0.0	1.6	160	69	11.3	B
29/04/2012 8:10	0.0	1.1	153	69	11.0	A
29/04/2012 8:15	0.0	1.4	193	70	11.1	A
29/04/2012 8:20	0.0	2.0	182	68	11.3	A
29/04/2012 8:25	0.0	1.8	182	68	11.3	B
29/04/2012 8:30	0.0	0.9	170	68	11.6	A
29/04/2012 18:30	0.0	1.8	138	86	8.7	C
29/04/2012 18:35	0.0	1.1	150	86	8.6	B
29/04/2012 18:40	0.0	0.9	181	86	8.6	A

Time and date	Rainfall (mm)	Wind Speed (m/s)	Wind Direction (deg)	Relative Humidity (%)	Temp (°C)	Atmospheric Stability
29/04/2012 18:45	0.0	0.6	164	86	8.5	A
29/04/2012 18:50	0.0	0.4	330	86	8.4	A
29/04/2012 18:55	0.0	0.6	189	87	8.3	A
29/04/2012 19:00	0.0	0.0	315	88	8.3	A
29/04/2012 19:05	0.0	0.9	183	88	8.2	A
29/04/2012 19:10	0.0	0.6	214	88	8.1	A
29/04/2012 19:15	0.0	0.6	252	89	8.0	A
29/04/2012 19:20	0.0	1.0	151	89	7.8	A
29/04/2012 19:25	0.0	1.3	148	89	7.8	C
29/04/2012 19:30	0.0	0.7	176	90	7.9	A
29/04/2012 19:35	0.0	0.4	171	90	7.9	A
29/04/2012 19:40	0.0	0.4	125	90	7.9	A
30/04/2012 6:55	0.0	0.9	280	99	3.8	C
30/04/2012 7:00	0.0	1.0	278	100	4.1	D
30/04/2012 7:05	0.0	1.0	271	100	4.2	C
30/04/2012 7:10	0.0	0.5	354	99	4.1	A
30/04/2012 7:15	0.0	0.8	15	99	3.9	D
30/04/2012 7:20	0.0	0.9	26	101	4.4	D
30/04/2012 7:25	0.0	0.8	28	101	5.0	D
30/04/2012 7:30	0.0	0.5	1	102	5.6	A
30/04/2012 7:35	0.0	0.1	304	102	6.1	A
30/04/2012 7:40	0.0	0.4	216	102	6.7	A
30/04/2012 7:45	0.0	1.1	220	102	6.9	C
30/04/2012 7:50	0.0	1.4	213	101	7.1	D
30/04/2012 7:55	0.0	1.2	232	100	7.1	D
30/04/2012 8:00	0.0	1.0	236	97	7.0	C
30/04/2012 19:55	0.0	1.7	49	87	9.2	A
30/04/2012 20:00	0.0	1.5	42	87	9.1	A
30/04/2012 20:05	0.0	1.3	54	88	9.2	A
30/04/2012 20:10	0.0	1.1	37	88	9.3	A
30/04/2012 20:15	0.0	1.3	32	88	9.3	A
30/04/2012 20:20	0.0	1.4	41	89	9.3	A
30/04/2012 20:25	0.0	1.2	19	89	9.3	A
30/04/2012 20:30	0.0	0.9	87	89	9.3	A
30/04/2012 20:35	0.0	0.9	79	89	9.3	A
30/04/2012 20:40	0.0	1.4	36	89	9.3	A
30/04/2012 20:45	0.0	1.4	49	89	9.4	B
30/04/2012 20:50	0.0	1.3	40	89	9.4	A
30/04/2012 20:55	0.0	1.3	37	89	9.3	A
30/04/2012 21:00	0.0	2.3	32	89	9.3	B
30/04/2012 21:05	0.0	1.9	13	89	9.2	C
30/04/2012 21:10	0.0	1.9	360	89	9.2	D
30/04/2012 21:15	0.0	2.2	12	90	9.1	D
30/04/2012 21:20	0.0	2.2	28	90	9.0	D
30/04/2012 21:25	0.0	2.5	30	90	9.1	C

Time and date	Rainfall (mm)	Wind Speed (m/s)	Wind Direction (deg)	Relative Humidity (%)	Temp (°C)	Atmospheric Stability
30/04/2012 21:30	0.0	1.9	23	90	9.1	B
30/04/2012 21:35	0.0	2.1	17	90	9.1	C
30/04/2012 21:40	0.0	2.0	31	90	9.0	B
30/04/2012 21:45	0.0	2.3	26	91	9.0	C
30/04/2012 21:50	0.0	2.3	21	91	9.0	C

Note *: Atmospheric stability class is determined using Sigma Theta data (not shown) and applying the Pasquill method. Pasquill-Gifford stability classes range from: A being highly Unstable, D neutral and G extremely stable.

As can be observed from the above meteorological data, the wind speeds were predominately low during the noise survey, with atmospheric stability ranging from unstable to neutral.

3.4 Results

3.4.1 Ambient noise measurements

The results from the 15 minute ambient noise measurements at each of the measurement locations are shown in Table 4.

Table 4: Noise measurement results (15 minute)

Location	Date	Time	Sound pressure level (dBA)				Number of truck Pass-bys and direction of travel*		
			L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	North	South	Total
C	29/04/2012	07:26	47	69	52	40	7	4	11
B	29/04/2012	07:48	49	69	49	35	8	3	11
A	29/04/2012	08:12	44	65	47	40	8	4	12
C	29/04/2012	18:29	39	62	40	36	1	2	3
B	29/04/2012	18:53	46	66	49	36	0	1	1
A	29/04/2012	19:21	43	60	44	42	1	2	3
C	30/04/2012	06:59	51	65	52	50	0	2	2
B	30/04/2012	07:22	47	56	50	44	4	2	6
A	30/04/2012	07:42	48	70	50	45	5	5	10
C	30/04/2012	19:55	39	53	41	35	4	2	6
B	30/04/2012	20:15	41	60	44	38	3	2	5
A	30/04/2012	20:34	43	55	45	41	3	3	6

Note * - truck counts include both coal and ash trucks

The measured $L_{Aeq\ (15\ min)}$ is generally in excess of the assessment criteria of $L_{Aeq\ (15\ min)}$ of 40 dBA. The high noise levels are mainly associated with local noise events such bird noise and traffic noise levels from surrounding roads as well as some truck pass-bys along the haulage route. The high background noise level is predominantly associated with the operation of the Wallerawang Delta Electricity Power Station.

3.4.2 SEL measurements

The individual truck pass-by noise event measurements at Location D are summarised in Table 5 which were conducted on 7th November 2011.

Table 5: SEL noise measurement results at Location D

Truck travelling direction	Average event time (s)	Average SEL (dBA)	No. of valid truck event measurements
South	28.9	68	8
North	18.1	70	9

4. Data analysis

As can be observed from the results presented in Table 4, the existing ambient noise levels $L_{Aeq\ (15\ min)}$ are predominantly in excess of the assessment criteria of $L_{Aeq\ (15\ min)}$ of 40 dBA. The background noise (LA90) from the various noise sources exceeded the noise criteria of 40dBA during most of the measurements. Noise contribution from the ash repository activities was masked by high background noise mainly from Delta Electricity Power Station. This signifies that noise emissions from the truck movements and ash repository cannot be assessed independently based on ambient noise measurements.

To assess the impact of the ash truck noise emissions, the influence of individual truck pass-by noise events have to be taken into account. Based on the SEL measurement results (shown in Table 5) and the number of truck movements provided by the Kerosene Vale Ash Repository, an $L_{Aeq\ (15\ min)}$ noise level was predicted, which takes into account the total number of truck pass-bys (only ash trucks), distance of noise source from the receiver and any potential barrier effects. These predictions are shown in Table 6 below. As per the information provided by the Kerosene Vale Ash Repository, there were 2 trucks moving on the haulage road at a frequency of 8 trips north to south and 8 trips south to north per hour from 07:00 to 22:00 during 29th and 30th April 2012. Based on the information provided above 4 truck movement (2 north bound and 2 south bound) per 15 minutes have been considered for calculating the contribution from ash trucks on the nearest sensitive receivers.

The noise emissions from the ash repository are considered to be below the assessment criteria as they were predominantly inaudible during the noise survey and could not be distinguished.

Table 6: Noise predictions from truck movements based on SEL measurements

Sensitive receiver	Distance to haulage road (m)	No. of average truck movements per 15min	Predicted $L_{Aeq\ (15\ min)}$ (dBA)	Criteria $L_{Aeq\ (15\ min)}$ (dBA
60 Skelly Road	330	4, (2 N, 2 S)	35	40
10 Skelly Road	240	4, (2 N, 2 S)	38	40
21 Neubeck Street	160	4, (2 N, 2 S)	36*	40

Note * - includes barrier attenuation from earth mound of approximately 5 dBA

It can be seen from the above result that the predicted $L_{Aeq\ (15\ min)}$ noise emissions based on the SEL measurements satisfy the required assessment criteria. Therefore the operational noise emissions from the Stage 2 KVAR are considered compliant to the Conditions of Approval.

5. Conclusion

Aurecon conducted ongoing operational noise monitoring for the Kerosene Vale Stage 2 Ash Repository (KVAR) located in Wallerawang, NSW. The noise measurements were carried out at the three most affected sensitive receiver locations on Sunday 29 April and Monday 30 April 2012. The assessment criteria are outlined in the Project Approval, Application No. 07_0005, with the criteria consisting of $L_{Aeq\ (15\ minute)}$ of 40 dBA from all ash haulage and placement associated operational noise emissions at the nearest sensitive receivers.

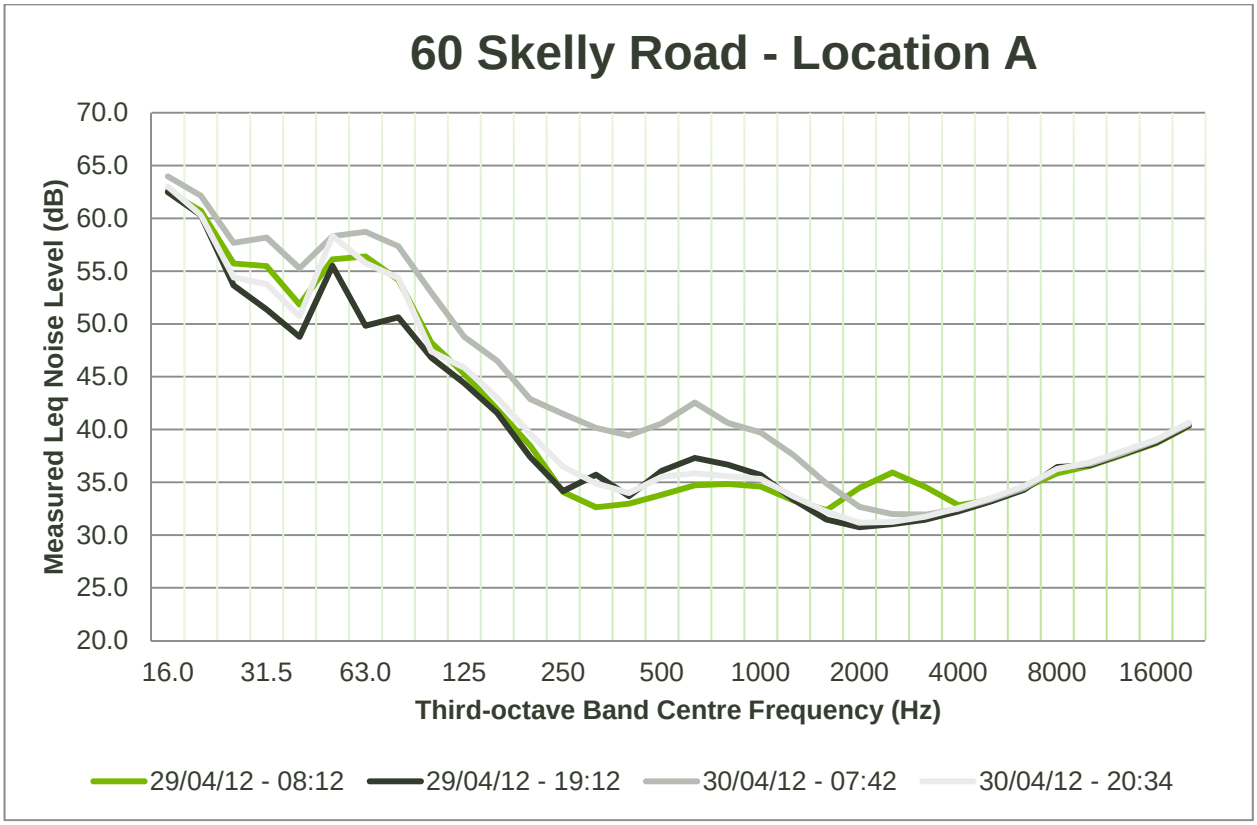
The primary contributors to the background and ambient noise levels at all the locations were from the traffic noise and hum from Delta Electricity Power Station. The noise contribution from KVAR Stage 2 activities alone could not be determined based on ambient noise measurements due to contamination from other ambient noises. Additional Sound Exposure Level measurements of individual truck pass-by events at a closer distance to the truck haulage road were carried out during the November 2011 noise monitoring. Based on the previous SEL measurement results and observations of truck movements on site, a $L_{Aeq\ (15\ min)}$ noise level was predicted at each of the assessment sensitive noise receivers. The predicted noise levels took into account only ash trucks movement associated with Stage 2 KVAR works, distance of the noise source from the receivers and potential noise barrier effect. The predicted noise level at each of the noise receivers showed compliance with assessment criteria, thus the operational noise emissions from the Stage 2 KVAR are considered compliant with the Conditions of Approval.

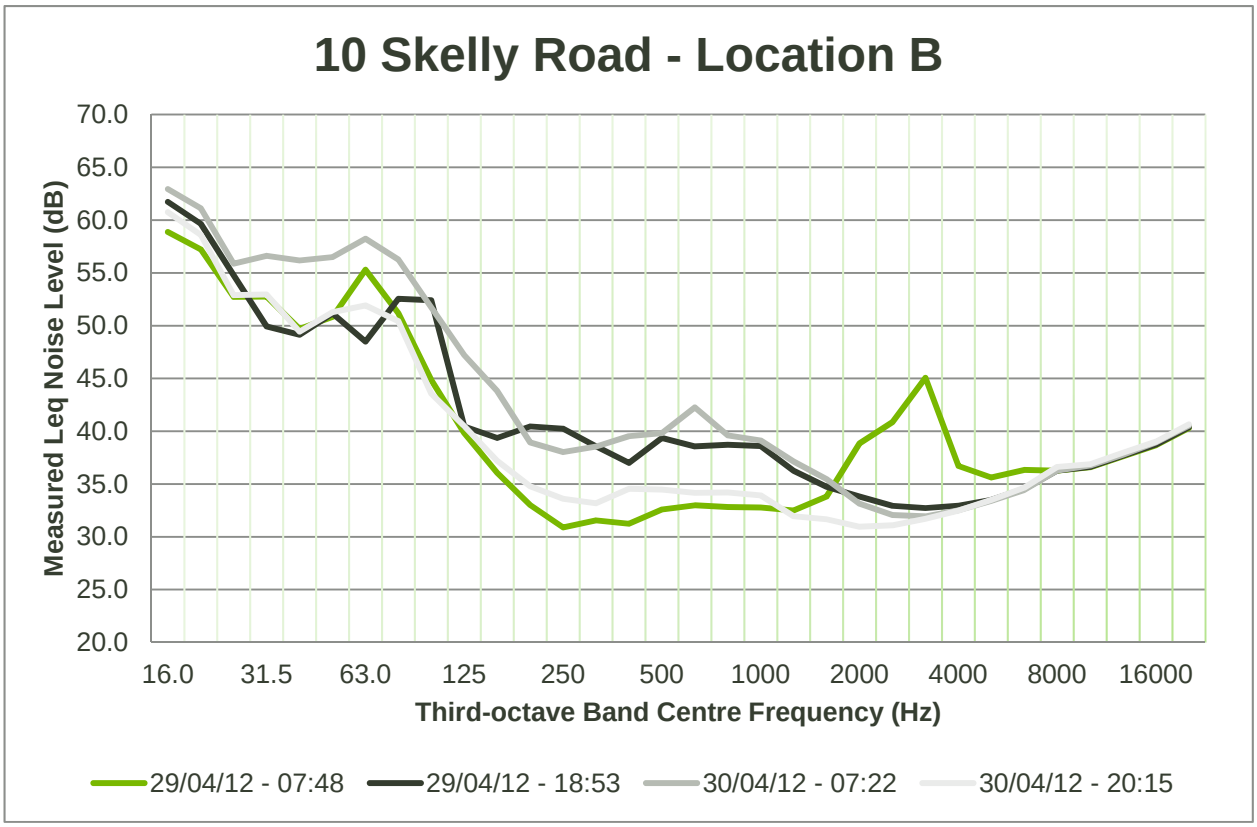
6. References

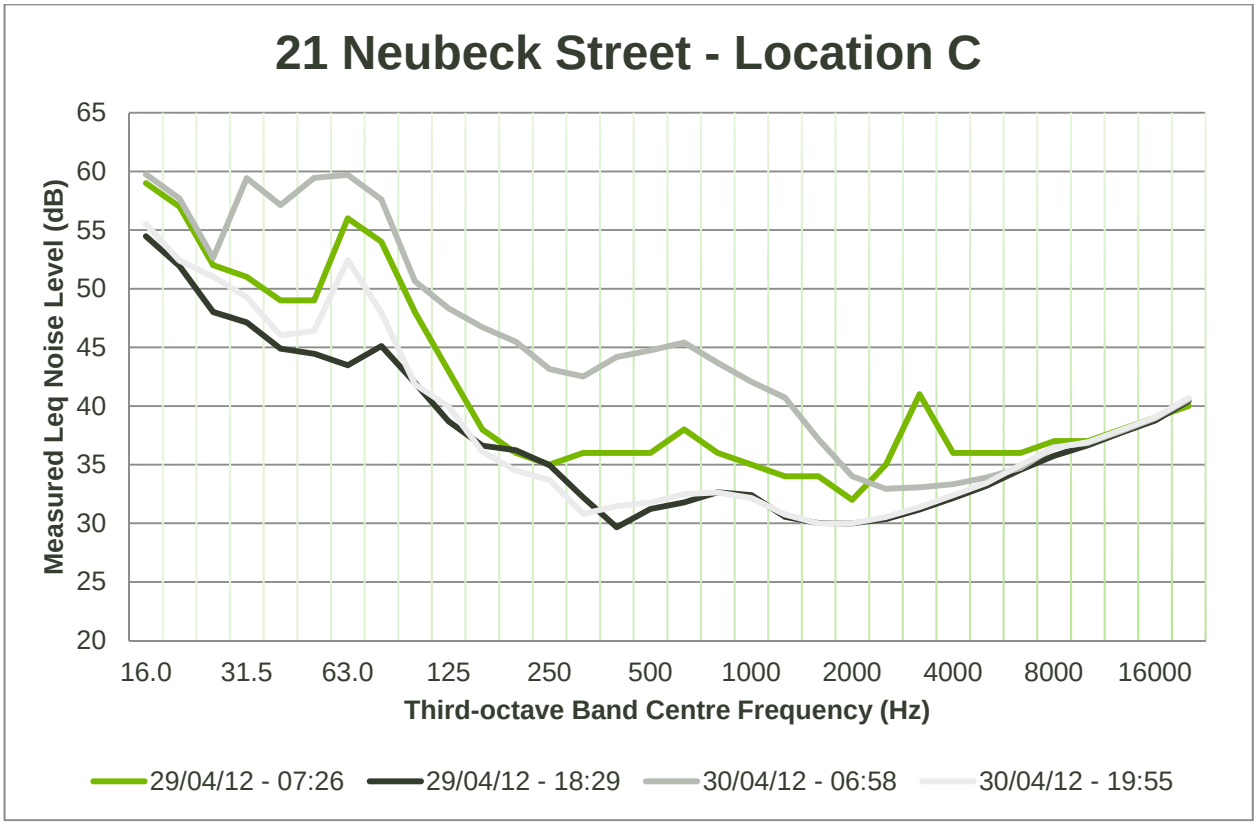
- Kerosene Vale Stage 2 Ash Repository, Operational Environmental Management Plan (OEMP), Parsons Brinckerhoff, April 2009, which includes:
  - Appendix A: KVAR Stage 2 Operations, Operational Noise and Vibration Management Plan (ONVMP), Parsons Brinckerhoff, April 2009
- Project Approval (PA), Application: No 07_0005, Delta Electricity, 26 November 2008, Department of Planning
- Stage 2 Kerosene Vale Ash Repository operational noise review, Parsons Brinckerhoff, September 2009

Appendix A

Noise measurement graphs


60 Skelly Road - Location A
Measured Leq Noise Level (dB)
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
16.0
31.5
63.0
125
250
500
1000
2000
4000
8000
16000
Third-octave Band Centre Frequency (Hz)
29/04/12 - 08:12
29/04/12 - 19:12
30/04/12 - 07:42
30/04/12 - 20:34


10 Skelly Road - Location B
Measured Leq Noise Level (dB)
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
16.0
31.5
63.0
125
250
500
1000
2000
4000
8000
16000
Third-octave Band Centre Frequency (Hz)
29/04/12 - 07:48
29/04/12 - 18:53
30/04/12 - 07:22
30/04/12 - 20:15


21 Neubeck Street - Location C
Measured Leq Noise Level (dB)
65
60
55
50
45
40
35
30
25
20
16.0
31.5
63.0
125
250
500
1000
2000
4000
8000
16000
Third-octave Band Centre Frequency (Hz)
29/04/12 - 07:26
29/04/12 - 18:29
30/04/12 - 06:58
30/04/12 - 19:55

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Project: Kerosene Vale Ash Repository Stage 2

Ongoing operational noise measurements

Prepared for: Delta Electricity

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1. Introduction

Aurecon was engaged by Delta Electricity to carry out ongoing operational noise monitoring for the Kerosene Vale Stage 2 Ash Repository (KVAR) located in Wallerawang, NSW. The noise measurements were carried out on Sunday 6 November and Monday 7 November 2011, during the early morning and evening periods as per the requirements outlined in the KVAR Stage 2 Operations, Operational Noise and Vibration Management Plan (ONVMP).

1.1 Site details

The project site consists of an Ash Repository which services the nearby Wallerawang Power Station (WPS). The major noise emissions associated with the Stage 2 KVAR works are:

- Unloading of ash from trucks at the repository.
- Placement and handling of ash at the repository site.
- Operation of trucks on the private haul road; trucks leave WPS loaded with ash (travelling north) and return from the repository empty (travelling south)

Figure 1 shows the site layout and location of sensitive receivers relative to the major noise sources including WPS as well as major roads in the area. Table 1 outlines the most affected sensitive receivers and their distance to the haul road.

Table 1 Representative noise measurement locations

Representative sensitive receiver	Distance (m) to haulage road*
60 Skelly Road	330
10 Skelly Road	240
21 Neubeck Street	160

Note * - distance relates to the property boundary or a point 30 m from the dwelling location

It should be noted that coal supply trucks also utilise the private haul road. Their noise impacts are not considered to be part of the Stage 2 KVAR works and thus their noise impact is outside the scope of this report.

Figure 1 Site details

2. Noise criteria

The applicable operational noise criteria are outlined in the Project Approval, Application No. 07_0005. The criteria are summarised in condition 2.15 as follows:

> *2.15 The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed an* $L_{Aeq\ (15\ minute)}$ ***of 40 dBA*** *at the nearest most affected sensitive receiver during normal operating hours as defined in condition 2.8.*

This criterion applies under the following meteorological conditions:

a) Wind speeds up to 3 m/s at 10 meters above ground; and/or
b) Temperature inversion conditions of op to 3°C/100 m and source to receiver gradient winds of up to 2 m/s at 10 m above ground level

Normal operating hours in accordance with Conditions 2.8 are 7:00 am to 10:00 pm Monday to Sunday.

3. Noise measurements

3.1 Measurement methodology

Two types of measurements were carried out at the site: ambient noise and sound exposure levels. The measurements were carried out on Sunday 6 November and Monday 7 November 2011, during the early morning and evening periods, when the noise impacts are likely to be the most significant.

The ambient compliance noise measurements were conducted using a Larson Davis 831 Type 1 sound level meter which was set to 'A' frequency weighting, 'F' time weighting, and was fitted with an approved windshield. The measurement period at each location consisted of 15 minutes. A Larson Davis CAL200 was utilised to calibrate all sound level meters before and after each series of measurements. The weather during the noise logging ranged from overcast to sunny periods.

The Sound Exposure Level (SEL) measurements were also carried out using a Larson Davis 831 Type 1 sound level meter which was set to 'A' frequency weighting, 'F' time weighting, and was fitted with an approved windshield. SEL is the equivalent A-weighted sound level which, if it lasted for one second, would produce the same sound energy as the actual event. The measurement was commenced when the truck was observed to pass a consistent location and stopped when the end of the truck passed a second consistent location. The reference locations were identified where the truck could be visually observed.

During both types of measurements no rain periods were experienced. Minimal wind was induced on the microphone with any light breeze periods being significantly below the 5 m/s threshold.

3.2 Measurement locations

The measurement locations were chosen to represent the three most affected sensitive receivers as outlined in the Operational Noise and Vibration Management Plan (ONVMP). The three most affected receivers prior to commencement of the measurements were identified based on the information in the Stage 2 Kerosene Vale Ash Repository operational noise review.

Due to the increased background noise level at each of the three noise monitoring locations it was difficult to assess individual truck noise events (discussed below). A fourth noise monitoring location was selected closer to the haulage route to measure individual truck pass-by events. Table 2 and Figure 2 outline the noise measurement locations.

Table 2 Representative noise measurement locations

Measurement location	Measurement distance (m) to haulage road	Representative sensitive receiver
A	300	60 Skelly Road

Measurement location	Measurement distance (m) to haulage road	Representative sensitive receiver
B	270	10 Skelly Road
C	160	21 Neubeck Street
D	95	-

Figure 2 Noise measurement locations

General observation regarding ambient noise environment as well as the truck movements and ash repository operations are described as follows. Individual truck noise varied significantly between trucks. The noise emissions were dependant on the speed travelled, driving technique and direction of travel. The variances were apparent even between the same types of vehicles. Truck pass-by numbers were higher during the morning period on both measurement days when compared to the evening truck counts. Operational noise from the Ash Repository was seldom audible at the noise sensitive receiver locations during all the attended noise measurements.

The noise levels at all locations were affected by other ambient noise sources such as bird life, domestic animals, background noise from the Wallerawang Power Station as well as intermittent traffic noise from nearby Castlereagh Highway and Wolgan Road. Due to these other noise sources not all of the truck events were clearly audible, or could be distinguished from the ambient noise levels.

3.2.1 Location A

Noise measurements at Location A were affected by bird noise as well as foliage noise. There was direct exposure to the truck noise as the trucks could be visually identified. Individual truck pass by events were observed to generate peak noise levels of up to 50 dBA. The use of airbrakes by some drivers was clearly audible. Bird life reached instantaneous noise levels in excess of 60 dBA. Background hum from the nearby power station as well as traffic noise from Castlereagh Highway was clearly audible with the sound pressure levels dependant on the time of day and meteorological conditions.

3.2.2 Location B

Location B was similar to Location A with measurements also affected by bird life and audible levels from the power station and highway. Other noise sources included domestic animal noise. Individual vehicle pass-bys along Wolgan Road, were clearly audible.

3.2.3 Location C

Location C was the closest position to the haulage road (representative of a noise-sensitive receiver), however there was no direct line of site of the trucks. An earth mound directly to the east of the property boundary acts as an acoustic barrier. This made it difficult at time to identify truck movement. Other audible noise sources during the noise survey included workshop activities, domestic gardening. Despite the increased distance (approximately 1300 m) to the Wallerawang Power Station, background hum was still clearly audible.

3.2.4 Location D

The noise data collected at Location D measured the Sound Exposure Levels (SEL) of individual truck pass-by events. At this closer location to the truck haulage road, each truck pass-by was clearly audible above other ambient noise sources.

3.3 Operating and meteorological conditions

Delta Electricity has provided the following information regarding the operations during the noise survey.

- The ash silos were at approximately 83 – 85% capacity during the noise survey.
- Two trucks were operating at a constant rate, with approximate 15 minute circuits for each truck. From 7am – 10pm daily this is the constant mode of operation. This signifies that the worst case

ash truck movements that could occur within a 15 minute periods are 4 drive-bys (2 in the northern direction, 2 in the southern direction)

The meteorological conditions during the noise survey based on 5 minute data from the Mount Piper weather station are shown in Table 3. The weather station details are as follows:

- Location – South: 33° 21' 46.0", East: 150° 01' 21.0"
- Elevation – 956 m
- Anemometer height – 10 m above ground level

Table 3 Meteorological conditions during noise survey

Time and date	Wind speed (m/s)	Wind direction (deg)	Relative Humidity (%)	Temp (°C)	Net Rad (W/m^2)	Atmospheric Stability*
6/11/2011 7:30	1.7	8	71	17.9	112	B
6/11/2011 7:35	2.2	17	67	18.5	116	C
6/11/2011 7:40	2.8	15	66	18.5	105	C
6/11/2011 7:55	2.4	17	65	18.9	108	B
6/11/2011 8:00	2.3	9	65	18.9	132	A
6/11/2011 8:05	1.4	326	65	18.9	47	A
6/11/2011 8:25	1.6	333	67	19.0	259	A
6/11/2011 8:30	2.9	340	65	19.5	210	C
6/11/2011 8:35	2.7	349	65	19.7	162	C
6/11/2011 18:30	2.5	301	70	18.6	21	B
6/11/2011 18:35	2.0	312	71	18.5	6	A
6/11/2011 18:40	1.5	301	72	18.3	-1	A
6/11/2011 18:50	2.4	301	74	18.0	-12	C
6/11/2011 18:55	1.7	324	74	18.0	-17	B
6/11/2011 19:00	1.1	326	75	17.9	-25	A
6/11/2011 19:10	1.6	334	76	17.6	-37	C
6/11/2011 19:15	1.3	348	76	17.5	-38	B
6/11/2011 19:20	0.9	329	77	17.4	-37	A
7/11/2011 7:30	3.1	250	81	17.6	118	B
7/11/2011 7:35	3.1	273	80	17.8	93	B

Time and date	Wind speed (m/s)	Wind direction (deg)	Relative Humidity (%)	Temp (°C)	Net Rad (W/m^2)	Atmospheric Stability*
7/11/2011 7:40	4.1	255	80	17.7	97	C
7/11/2011 7:50	3.3	257	80	17.7	100	C
7/11/2011 7:55	4.5	277	80	17.5	93	D
7/11/2011 8:00	3.1	281	81	17.5	46	B
7/11/2011 8:10	2.8	294	82	17.2	28	B
7/11/2011 8:15	2.7	287	82	17.2	47	A
7/11/2011 8:20	3.3	273	82	17.1	73	B
7/11/2011 20:55	0.8	191	77	18.7	-44	B
7/11/2011 21:00	0.9	189	78	18.4	-43	B
7/11/2011 21:05	1.5	205	79	18.1	-44	D
7/11/2011 21:15	0.8	142	79	17.8	-44	A
7/11/2011 21:20	0.7	268	80	17.6	-44	A
7/11/2011 21:25	1.0	228	81	17.4	-45	C
7/11/2011 21:35	1.0	258	83	16.9	-42	C
7/11/2011 21:40	1.3	261	84	16.7	-42	C
7/11/2011 21:45	0.5	240	85	16.6	-41	A

Note *: Atmospheric stability class is determined using Sigma Theta data (not shown) and applying the Pasquill method. Pasquill-Gifford stability classes range from: A being highly Unstable, D neutral and G extremely stable.

As can be observed from the above meteorological data, the wind speeds were predominately low during the noise survey, with atmospheric stability predominantly ranging from unstable to neutral.

3.4 Results

3.4.1 Ambient noise measurements

The results from the 15 minute ambient noise measurements at each of the measurement locations are shown in Table 4.

Table 4 Noise measurement results (15 minute)

Location	Date	Time	Sound pressure level (dBA)				Trucks Pass-bys and direction of travel*		
			L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	North	South	Total
C	06/11/2011	07:30	44	67	45	37	4	7	11
B	06/11/2011	07:55	44	62	46	38	9	7	16
A	06/11/2011	08:24	43	60	46	38	6	9	15
A	06/11/2011	18:29	41	56	43	38	4	3	7
B	06/11/2011	18:48	41	60	44	36	3	4	7
C	06/11/2011	19:09	44	65	45	38	2	5	7
A	07/11/2011	07:29	46	62	47	43	6	5	11
B	07/11/2011	07:49	47	67	49	40	7	6	13
C	07/11/2011	08:08	44	67	46	38	3	8	11
A	07/11/2011	20:56	41	61	41	37	1	2	3
B	07/11/2011	21:15	40	61	42	37	2	2	4
C	07/11/2011	21:35	43	59	44	39	1	1	2

Note * - truck counts include both coal and ash trucks

The measured $L_{Aeq\ (15\ min)}$ is generally in excess of the assessment criteria of $L_{Aeq\ (15\ min)}$ of 40 dBA. The high noise levels are associated with local noise events such mainly bird noise and traffic noise levels from surrounding roads as well as some truck pass-bys along the haulage route. The high background noise level is predominantly associated with the Wallerawang Power Station operation.

3.4.2 SEL measurements

The individual truck pass-by noise event measurements at Location D are summarised in Table 5.

Table 5 SEL noise measurement results at Location D

Truck travelling direction	Average event time (s)	Average SEL (dBA)	No. of valid truck event measurements
South	28.9	68	8
North	18.1	70	9

4. Data analysis

As can be observed from the results presented in Table 4, the existing ambient noise levels (L_{Aeq}) are predominantly in excess of the assessment criteria of $L_{Aeq\ (15\ min)}$ of 40 dBA. The background noise

(L_{A90}) from the consistent noise sources during all of the noise measurements was also very close assessment criteria. This signifies that noise emissions from the truck movements and ash repository operation cannot be determined based on ambient noise measurements.

To assess the impact of the ash truck noise emissions individual truck pass-by noise events have to be taken into account. Based on the SEL measurement results (shown in Table 5), a $L_{Aeq\ (15\ min)}$ noise level was predicted, which takes into account the number of ash truck pass-bys, distance noise correction and any potential barrier effects. These predictions are shown in Table 6 below.

The noise emissions from the ash repository are considered to be below the assessment criteria as they were predominantly not audible during the noise survey and could not distinguished.

Table 6 Noise predictions from truck movements based on SEL measurements

Sensitive receiver	Distance to haulage road (m)	No. of truck movements	Predicted $L_{Aeq\ (15\ min)}$ (dBA)	Criteria $L_{Aeq\ (15\ min)}$ (dBA
60 Skelly Road	330	4, (2 N, 2 S)	35	40
10 Skelly Road	240	4, (2 N, 2 S)	38	40
21 Neubeck Street	160	4, (2 N, 2 S)	36*	40

Note * - includes barrier attenuation from earth mound of approximately 5 dBA

It can be seen from the above result that the predicted $L_{Aeq\ (15\ min)}$ noise emissions based on the SEL measurements satisfy the required assessment criteria. Therefore the operational noise emissions from the Stage 2 KVAR are considered compliant to the Conditions of Approval.

5. Conclusion

Aurecon conducted ongoing operational noise monitoring for the Kerosene Vale Stage 2 Ash Repository (KVAR) located in Wallerawang, NSW. The noise measurements were carried out at the three most affected sensitive receiver locations on Sunday 6 November and Monday 7 November 2011. The assessment criteria are outlined in the Project Approval, Application No. 07_0005, with the criteria consisting of $L_{Aeq\ (15\ minute)}$ of 40 dBA from all ash haulage and placement associated operational noise emissions at the nearest sensitive receivers.

The ambient noise measurements identified significant other noise sources in the area. This meant that the noise emissions from the Stage 2 KVAR activities could not be sufficiently distinguished from the other ambient noise sources to carry out an assessment. Additional Sound Exposure Levels of individual truck pass-by events at a closer distance to the truck haulage road were carried out. Based on the SEL measurement results, a $L_{Aeq\ (15\ min)}$ noise level was predicted at each of the assessment sensitive noise receiver. The predicted noise levels took into account only truck movements associated with Stage 2 KVAR works and excluded any coal truck noise. The predicted noise level at each of the noise receivers showed compliance with assessment criteria, thus the operational noise emissions from the Stage 2 KVAR are considered compliant to the Conditions of Approval.

6. References

- Kerosene Vale Stage 2 Ash Repository, Operational Environmental Management Plan (OEMP), Parsons Brinckerhoff, April 2009, which includes:
  - Appendix A: KVAR Stage 2 Operations, Operational Noise and Vibration Management Plan (ONVMP), Parsons Brinckerhoff, April 2009
- Project Approval (PA), Application: No 07_0005, Delta Electricity, 26 November 2008, Department of Planning
- Stage 2 Kerosene Vale Ash Repository operational noise review, Parsons Brinckerhoff, September 2009

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Appendix F – KVAD/R Stage 2A Water Quality Assessment

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Project: Kerosene Vale Ash Dam and Dry Ash Repository

KVAR Stage 2A Water Quality Assessment April, 2010 to January, 2012

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Attachment 2: Wallerawang Power Station Ash Dam, Surface Water and Groundwater Quality (Stage 2A Data from May, 2010 to January, 2012).
(Attachment also contains: Pre-Dry Ash Placement Summary data before April, 2003)

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Summary

Aurecon has been engaged by Delta Electricity to assess:

- The potential water quality improvements in surface and groundwater quality due to installation of seepage collection and diversion systems at:
    - the Sawyers Swamp Creek Ash Dam (SSCAD) v-notch pump-back system
    - sub-surface drains under the dry ash Kerosene Vale Ash Repository (KVAR), which are located inside the Kerosene Vale Ash Dam (KVAD) and
    - diversion of the KVAD groundwater to Lidsdale Cut via the unblocked KVAD toe drains.
- The effects of the Stage 1 and Stage 2A dry ash placements on surface and groundwater receiving waters.

The seepage collection and diversion systems have reduced the salinity (conductivity), sulphate and trace metals in the KVAD local groundwater seepage to Sawyers Swamp Creek and in Lidsdale Cut itself. These reductions provided evidence that the Stage 1 and Stage 2A dry ash placements are not measurably affecting the surface and groundwater quality.

Potential effects on the water quality at the Sawyers Swamp Creek receiving water site could not be confirmed due to Springvale Mine water inflows and other, non-ash related, catchment inputs to the creek. Further monitoring is recommended to assess the situation once the Springvale Mine water has been stopped from entering the creek.

1. Introduction

In 2002, Delta Electricity obtained approval for conversion of the wet slurry ash placement process at Wallerawang Power Station to dry ash. Wet slurry ash placement in Sawyers Swamp Creek Ash Dam (SSCAD) was stopped[1] and dry ash was placed on top of the first wet ash dam, Kerosene Vale Ash Dam (KVAD). When the KVAD was full of ash, wet ash placement was directed to the SSCAD and ultimately the KVAD was capped with clay so dry ash placement could be undertaken.

The dry placement is called the Kerosene Vale Ash Repository (KVAR). Stage 1 of the placement was completed and capped in February, 2009. Approval was obtained for further placement in the Stage 2 Area at the KVAR in November, 2008. The Stage 2 Area is in two parts: Stages 2A and 2B. Placement in the Stage 2A area began soon after in April, 2009. Placement in the Stage 2B Area began on 19th January, 2012.

The locations of the various ash dams and repositories are shown in Figure 1 and are described in the next Section.

1.1 Background

In March, 2010, the NSW Environment Protection Authority (EPA) Branch of the Department of Environment and Climate Change (DECC) undertook a review of the Wallerawang Power Station licence L766. As a result, Pollution Reduction Programs (PRP) were added to the revised licence dated 20th April, 2010 to reduce discharges of salinity and trace metals. The PRPs required Delta Electricity to undertake the following work:

- U1 Works Program to reduce Salinity and Metals
    - U1.1 Install and commission a seepage collection and return system to ensure that any seepage from the Sawyers Swamp Creek Ash Dam is intercepted, collected, and returned to the Sawyers Swamp Creek Ash Dam.
    - U1.2 Upgrade or re-install the Kerosene Vale Wet Ash Dam (KVAD) seepage collection and diversion system to ensure that any seepage from the Kerosene Vale Wet Ash Dam is intercepted, collected, and returned to the Lidsdale Open Cut void.

Subsequently, Delta Western complied with the PRPs by:

- Installing a seepage collection and return system to minimise seepage from the SSCAD into Sawyers Swamp Creek (SSC) in May, 2010
- Unblocking the KVAD toe drains and reinstating the seepage collection and diversion system to the Lidsdale Cut in October, 2010.

As part of the reinstatement of the KVAD toe drain seepage collection and diversion system, Delta Western installed a new sub-surface drain to lower the groundwater table in the KVAD, in the area under the KVAR placement. The underground drainage system was designed to lower the groundwater level in the KVAD to at least 1 metre below it's clay capping, which forms the base of the KVAR's dry ash placement. This underground drainage system has been connected to the existing KVAD toe drain seepage collection system, so that the groundwater drained from under the KVAR area is diverted to Lidsdale Cut, together with the groundwater drained from the KVAD itself.

[1] Delta Electricity still have the capability to use the Sawyers Swamp Creek Ash Dam for the placement of economiser grit, mill rejects, residual ash from the wash down system and emergency ash placement if necessary

Seepage and surface runoff water collected in the Lidsdale Cut overflows to Sawyers Swamp Creek, downstream of the KVAD/R area. Groundwater drainage from under the KVAR Stage 1 area is directed to the power station return canal.

1.2 Aims and Objectives

Delta Electricity advised Aurecon that they have completed their annual review of the Development Consent conditions of approval for KVAR Stage 2 and require confirmation that there has been an improvement in the water quality in Sawyers Swamp Creek and the upper Coxs River after implementation of the SSCAD and KVAR seepage collection and diversion works, and that the KVAR is not interfering with local surface and groundwater quality.

One of the primary objectives of the design and operation of the KVAR is to have no adverse impact on the local ground or surface water quality. More specifically, this means that leachates from the dry ash placement should not increase concentrations of the various water quality characteristics in the receiving waters by more than the locally derived guidelines (based on the 90th percentile of the background, pre-placement sites) or the ANZECC (2000) guidelines for protection of aquatic life, whichever is higher.

As indicated in previous reports, it has been necessary to establish local guidelines for some elements, due to the effects of mineralisation (coal bearing strata) in the ash placement area. The ANZECC (2000) guideline default trigger values and the locally derived guidelines are shown in Table 1, Section 2.7.

1.3 Previous Report

The previous report (Aurecon, 2010) noted that the Operational Environmental Management Plan (OEMP) incorrectly assumed that the KVAR was a contaminated site and applied the DEC (2007) Contaminated Sites Guidelines for assessment of groundwater contamination under the dry ash placement itself rather than assessing effects on receiving waters. However, as ash is not classified as a hazardous material, the OEMP approach was not used in the 2010 report and the ANZECC (2000) guideline approach of assessing the likely impact of water quality and trace metals on receiving waters, which was used in previous reports, was continued to be used in the 2010 report. The ANZECC (2000) guideline approach was also used in this report.

As requested by Delta Electricity, a detailed investigation of the pathway that ash leachates from the KVAR may take in reaching the local groundwater and Sawyers Swamp Creek was undertaken in a previous investigation (Aurecon, 2010). Sampling of the groundwater under the dry ash placement by Delta Electricity showed that rainfall infiltration through the ash accumulated at the base of the ash due to difficulty in passing through the clay capping on top of the KVAD. Hence it was found that the initial Stage 2 Area dry ash placement was having insignificant or undetectable effects on surface or groundwater quality, including selenium, in receiving waters due to:

- limited rainfall infiltration into the groundwater due to the dry ash itself and compaction by machinery;
- placement of the dry ash on the clay capping of the KVAD and its limited permeability;
- the highly mineralised nature of the catchment
- effects of the blocked KVAD toe drains on local groundwater quality;
- attenuation of selenium in ash leachate due to uptake by local soils or mine spoil.

The benefits of the dry ash placement management and the clay capped KVAD were demonstrated by the improved Stage I groundwater quality before the KVAD toe drains became blocked in 2007. The insignificant or minor effects with dry ash were shown to have provided the expected outcome of the dry ash placement project. However, a definitive assessment of the effects of the initial Stage 2 dry ash placement was not possible due to effects of the blocked KVAD toe drains, which caused increases in salinity and trace metals in the groundwater under the dry ash placement, as well as in seepage to Sawyers Swamp Creek. As the toe drains were unblocked in February, 2011, improvements in water quality in the creek are expected to be shown by examination of the data in this report.

The 2010 assessment also noted improvements in water quality, particularly trace metals, in the SSCAD. The improvements were due to the ending of wet flyash placement (under normal operating conditions), and corresponding leachates, into the ash dam since conversion to dry ash placement at the KVAR. However, the lack of flushing of the ash dam pond caused an increase in salinity and boron in the pond and there was a corresponding increase in seepage from the dam into Sawyers Swamp Creek. Even with these increases, the concentrations in the creek remained below the local guideline trigger values at the receiving water site, WX7, the location of which is shown in Figure 1.

Note that, in this report, metals such as cadmium, lead and zinc are called trace metals and non-metals such as selenium, boron and fluoride are called trace elements.

1.4 Scope

Aurecon has been engaged by Delta Electricity to review all ground and surface water monitoring data at the KVAR, KVAD and in Sawyers Swamp Creek to identify any improvement or otherwise in water quality in Sawyers Swamp Creek after the reinstatement of the KVAD seepage collection and diversion system and the installation of the SSCAD seepage collection and return system. The assessment is to include possible improvements in water quality in the upper Coxs River due to implementation of these seepage collection and diversion works. Delta Electricity also requires the report to assess the interaction of current Delta Electricity activities at the KVAR on surface and groundwater quality in the area.

1.5 Information provided by Delta Electricity

In connection with the assignment, Delta Electricity has provided copies of:

- Plan of KVAD seepage diversion works;
- Map of SSCAD dam showing the location of the seepage return system;
- Water quality data in the upper Coxs River, up- and downstream of the junction with Sawyers Swamp Creek and a map of the location of sampling sites;
- Surface and groundwater quality data from 2010 to the present, including:
    - Sawyers Swamp Creek receiving water site, WX7
    - Water quality in the SSCAD and KVAD seepage detection bores;
    - Lidsdale Cut water quality;
    - Background surface and groundwater data
- Provided water quality data monitored by the ash placement contractor, Lend Lease Infrastructure (LLI) from:
    - Sawyers Swamp Creek
    - copy of groundwater level contours in the Stage 1 and 2 areas prepared by LLI to provide an indication of the direction of groundwater flow (see Figure 8);

- Copy of relevant correspondence with OEH on the water quality expectations
- Springvale mine water quality to address effects of a pipeline leak on Sawyers Swamp Creek (This is described in Section 3.1)
- SSCAD seepage flows via the v-notch weir
- Lithgow rainfall data from the Bureau of Meteorology from January, 2000 to January, 2012 (see Attachment 1).

This data and information was used to assess the effects of the seepage collection and diversion systems recently installed and to define the inputs affecting water quality for the period of operation of Stage 1, and the current operations of the Stage 2A placement, and their effects on local surface and groundwater quality.

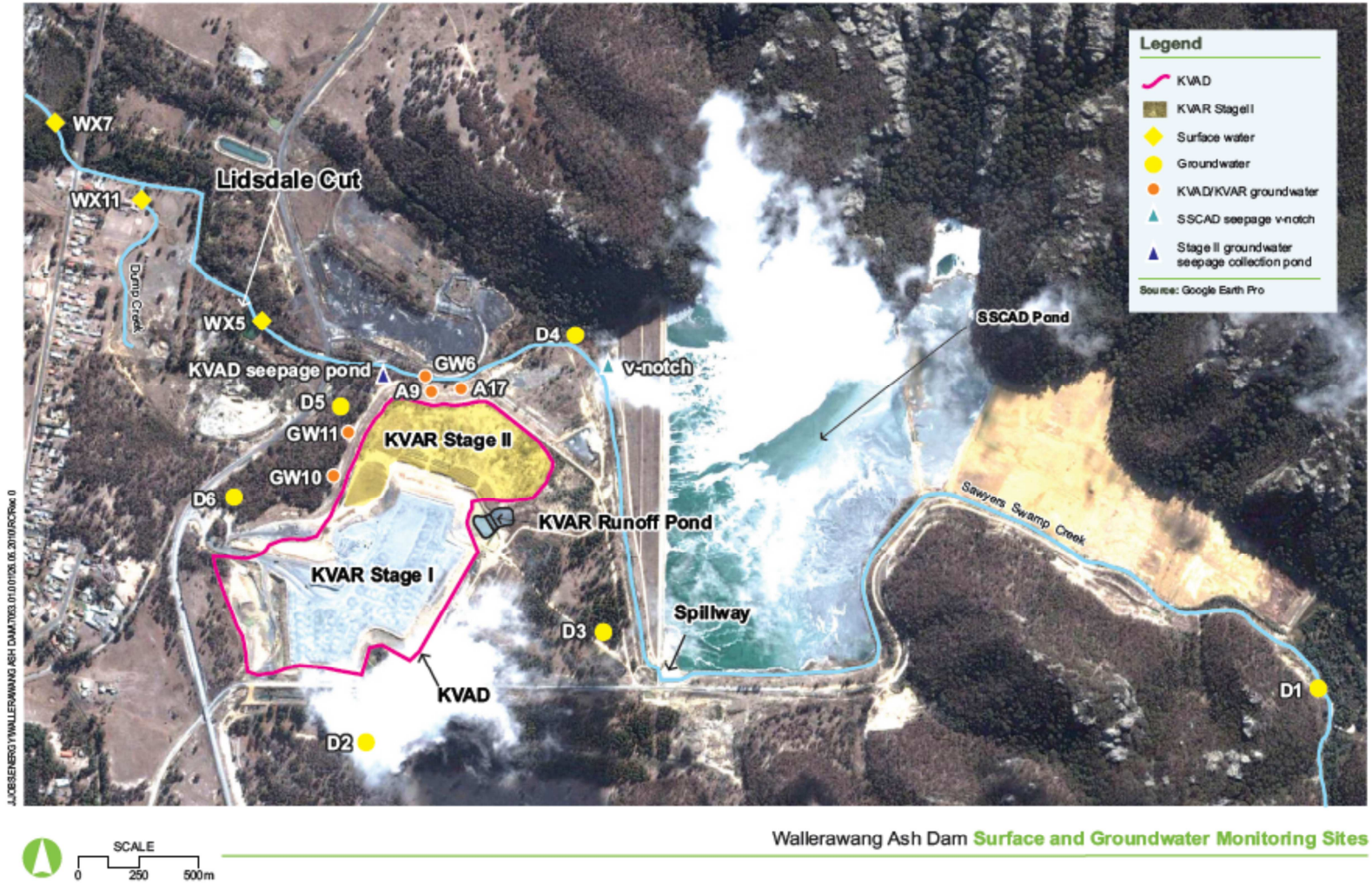

Figure 1 – Surface and Groundwater Monitoring Sites for Sawyers Swamp Creek Ash Dam and Kerosene Vale Dry Ash Placement Area

2. Surface and Groundwater Quality Monitoring

This Section provides an overview of the groundwater and surface water quality monitoring at the KVAD and KVAR used for assessment of effects, if any, of leachates from the KVAR on the local surface and groundwater quality. Due to local inputs from coal mining activities in the area, the assessment takes into account the local background conditions and provides the locally derived and ANZECC (2000) guideline trigger values, which apply as assessment criteria to the receiving waters.

2.1 Monitoring Design for Differentiation of Water Quality Sources

Surface and groundwater quality monitoring is undertaken by Delta Electricity for assessment of the environmental performance of the KVAR ash placement and seepage effects from the SSCAD. The assessment of the KVAR effects depends upon separating the effects of leachates from the KVAD, under the KVAR, local coal mine inputs and leachates and runoff effects, if any, from the KVAR itself that may reach the receiving water sites. To do this, the groundwater bore locations were established well before dry ash placement began in the following manner to allow for the effects of the various sources:

- Bore WWGM1/D1 is up-gradient of the SSCAD and samples groundwater from the escarpment behind the ash dam
- Bore WWGM1/D2 samples groundwater affected by local coal measures and is up-gradient of the KVAD and seepage from the SSCAD. This is the background groundwater quality for the KVAD and KVAR
- Bores WWGM1/D3 and D4 sample groundwater affected by seepage from the SSCAD, as well as the local coal measures, and are up-gradient of the KVAD and KVAR
- Bores WWGM1/D5 and D6 are down-gradient of the KVAD and KVAR and sample groundwater affected by seepage from these sources, as well as the local coal measures. These are the receiving groundwater bores where the local/ANZECC (2000) groundwater guideline trigger values apply for assessment of seepage effects from KVAD and KVAR.

Surface water quality monitoring locations were also established in Sawyers Swamp Creek before dry ash placement began. The assessment of the KVAR and SSCAD effects on the creek depends upon separating the effects of seepage from the SSCAD, KVAD and KVAR, as well as local coal mine inputs to the creek. This was undertaken in the following manner to allow for the effects of the various sources:

- Water quality site WX11, in Dump Creek, samples rainfall runoff and groundwater seepage from local coal measures and surface emplacements. This is the background water quality for Sawyers Swamp Creek, which also receives inputs from local coal measures and surface emplacements as it passes through the area downstream of the SSCAD
- The Lidsdale Cut discharge to the creek, WX5, samples inputs to Sawyers Swamp Creek from the local coal measures and surface emplacements as well as the KVAD toe drains
- Water quality site WX7, in Sawyers Swamp Creek, is downstream of the Lidsdale Cut discharge to the creek and downstream of the junction with Dump Creek. This site is the receiving waters where the local/ANZECC (2000) freshwater guideline trigger values apply for assessment of seepage effects from KVAD, KVAR and SSCAD.

The locations of the various groundwater and surface water sites are shown in Figure 1.

The water quality monitoring is undertaken to confirm that the local/ANZECC (2000) guidelines (as applicable) are met in the groundwater bores D5 and D6 and in Sawyers Swamp Creek and to enable contingency actions and investigations to be initiated in a timely manner if these limits are approached.

2.2 Recent installation of Seepage Collection and Diversion Systems

Delta Electricity has recently installed the following seepage collection and diversion systems to minimise effects of ash placement activities on the water quality in Sawyers Swamp Creek:

- re-instatement of the KVAD toe drains to Lidsdale Cut (February, 2010),
- installation of drains inside the KVAD, under the Stage 2 area, for seepage collection and connection to the KVAD toe drains for diversion to Lidsdale Cut (October, 2010),
- installation of a seepage collection and pump-back system at the main SSCAD dam wall V-notch seepage site (March, 2010).

As these works have further complicated the assessment of effects of the KVAR, this report has also taken into account the effects of these works on the water quality in Sawyers Swamp Creek, as well as the local groundwater. In addition, rainfall in the area increased just after the works were installed due to a “La Niña” event that continued during summer 2011/12 (see Section 2.5).

Delta Electricity ash placement contractor, LLI, routinely monitors water quality in Sawyers Swamp Creek upstream of Lidsdale Cut, and this water quality data was used to assess the effects of the above seepage collection and diversion systems. The contractor undertakes measurements of general water quality such as conductivity and pH, as well as some trace metals at various times and sites, on behalf of Delta Electricity as part of the management of the ash placement. Their measurements began in February 2010 and are continuing. Data to February, 2012 was used in this report.

Lend Lease Infrastructure has five water quality sampling sites in Sawyers Swamp Creek. Their locations are referenced by the SSCAD Spillway, the v-notch, and sites upstream and downstream of the KVAD Seepage Pond in Figure 1. The sampling sites, prefixed by SSC, are shown in more detail in Figure 8 and are described by:

- Upstream of the v-notch is located immediately downstream of the Sawyers Swamp Creek Ash Dam Spillway, where the SSC bypass water re-enters the creek (SSC upstream @ 0m). It is labelled as SSC at SSCAD Spillway in the water quality graphs in Section 3.
- Site near the v-notch is SSC @600m
- Site upstream of the KVAD seepage pond is located downstream of the V-notch at the KVAD’s north-eastern corner, near groundwater bore A17, at SSC @ 800m
- Downstream of the KVAD seepage pond is located near bore D5 at SSC @ 1200m.

Note that the KVAD downstream site is only downstream of the northern section of the original ash dam wall. In addition, see cautions regarding the use of the site upstream of KVAD in Section 3.1.

These data, together with the routine, long-term Sawyers Swamp Creek data collected by Delta Electricity at the receiving water site, WX7, were used to identify any improvement, or otherwise, in water quality in Sawyers Swamp Creek after the above works had been installed.

The assessment includes possible improvements in water quality in the upper Coxs River due to implementation of these seepage collection and diversion works.

2.3 Tracers for Dry Ash leachates

The main trace metals and elements of interest in the rainfall runoff from the KVAR ash placement area are selenium, sulphate, boron, nickel and zinc. These elements, except selenium, are also present in the local mineralised coal geology of the area and are mainly due to the placement of mine spoil and chitter in the catchment. Chitter contains pyrites, which release sulphate and trace metals into the local groundwater and surface waters. Hence, selenium is used here as a tracer of direct effects of the previous wet ash systems in the KVAD and SSCAD, as well as for the current dry ash placement on the local surface and groundwater.

Long-term trends in surface and groundwater quality generally use conductivity to trace salinity effects, which in the mineralised area, tends to follow that of sulphate. Sulphate and boron trends are used to show changes due to coal mining activities and flyash management is indicated by selenium concentrations. Boron is used to represent changes in other trace metals when the data shows their changes (increasing or decreasing) are similar. Selenium concentrations are examined for trends if they consistently exceed the ANZECC (2000) guideline of 5 ug/L.

2.4 Groundwater Levels

The water level in each groundwater bore is monitored to allow identification of the direction of water movement in the areas from up-gradient of the ash placement areas to Lidsdale Cut. The data are also used to confirm that the groundwater level in the KVAD is not reaching the dry ash placement above it.

Bores WWGM1/D5 and D6 are down-gradient of the ash placement and up-gradient of the Lidsdale Cut for early detection of leachates from the KVAR placement area. Effects of the KVAR on groundwater level changes at these bores are also monitored.

The monitoring data are shown in spread-sheet format in Attachment 2, including the minimums, maximums, means and post-dry ash median as well as the estimated baseline (pre-placement 90th percentile) and environmental goal concentrations. The data is also summarised in Tables in the body of the report.

2.5 Climatic Conditions

The average annual rainfall over the period of KVAR ash placement from 2003 to January, 2012 at the Lithgow gauge has remained low at 777 mm/year (Attachment 2), which is 90% of the long-term annual rainfall of 863 mm/year. During the period January, 2010 to January, 2012, the monthly average rainfall of 76.5 mm/month, was above the long-term average of 72 mm/month. According to the Bureau of Meteorology (BOM), there was a recent increase in rainfall, which was due to a “La Niña” event that formed in July, 2010 and peaked between late 2010 and early 2011 (http://www.bom.gov.au/climate/enso/feature/ENSO-feature.shtml). The event continued during summer 2011/12 such that the average monthly rainfall at the Lithgow rainfall gauge from November, 2011 to January, 2012 was 82 mm/month.

2.6 Methods

Routine surface and groundwater water quality monitoring in the area is undertaken monthly on behalf of Delta Electricity by Nalco Analytical Resources who measure conductivity, pH and temperature in the field with a calibrated instrument.

In house methods based upon Standard Methods (APHA, 1998) are used for the general water quality characteristics of alkalinity, sulphate, chloride, calcium, magnesium, sodium, potassium and total dissolved solids (TDS) and total suspended solids (TSS, also known as non-filterable residue, NFR). The trace metals and elements monitored are the same for surface and groundwater: copper, cadmium, chromium, lead, zinc, iron, manganese, mercury, selenium, silver, arsenic, barium, boron and fluoride. Molybdenum, nickel and beryllium have been monitored since July, 2007. Delta Electricity has advised that the in-house methods are equivalent to those specified in DEC (2004), which also uses Standard Methods. (In this regard, it is relevant to note that the groundwater and Sawyers Swamp Creek monitoring is not required under the POEO licence). Trace metals were unfiltered, except for iron and manganese.

Groundwater bores are bailed and sampled after allowing time for the water level in the bore to re-establish. The depth to the water level from the top of the bore is measured using a dip meter.

Since April, 2006 the detection limits (DL) for routine monitoring of most trace metals tested were lower than the ANZECC (2000) guidelines (Table 1). Particular attention has been directed at the trace metals arsenic, cadmium, chromium, copper, mercury, nickel and lead, as well as the trace element selenium, which have been analysed with a low detection limit. However, due to sample matrix interference, silver is currently analysed above the ANZECC guideline trigger value of 0.00005mg/L (see Section 2.10 and Attachment 2).

2.7 Guidelines

The OEMP requires that the ANZECC (2000) Ecosystem Protection Guidelines be used for assessing surface water quality and Irrigation and Ecosystem Protection Guidelines for groundwater. However, as used in previous reports, the principle of the ANZECC (1995) guidelines for protection of groundwater, where the potential future use of the water resource is considered, should also be taken into account. In this regard, the Irrigation, Ecosystem and additional guidelines for protection of livestock or drinking water, where appropriate, to provide a wider context of the ANZECC (2000) guidelines, to define acceptable ambient water quality at the KVAD/R Stage 2 receiving water sites, was used. The default guidelines for trace metals are shaded grey in the guideline tables and the default for most metals is the 95% species protection. The exceptions are for mercury and selenium, where the guidelines default is 99% species protection (see Table 1).

The ANZECC Guidelines for Groundwater Protection in Australia (1995) and the NEPC (1999) require the background water quality in groundwater bores to be taken into account. As the NEPC (1999) did not define the meaning of “background” concentrations, the baseline concentrations were defined in previous reports as the 90th percentile of the pre-placement concentrations, or the ANZECC guideline default trigger values, whichever is higher. The 90th percentiles, that are higher than the default trigger values, are used as the local guidelines.

2.7.1 Local Guidelines

Local guidelines are based on the ANZECC (2000) guideline approach of estimating local guidelines using the 90th percentile for naturally mineralised, highly disturbed groundwater (condition 3 waterbodies).

Due to local mineralisation effects, local guidelines were derived using the pre-KVAR Stage 1 placement 90th percentile of water quality characteristics that are naturally elevated in the area. They were determined using the water quality measured at the background bore, WGM1/D2, and at the Dump Creek Background site (WX11), before dry ash placement began, and are shown in Table 1. Elevated concentrations at the seepage detection bore WGM1/D5 and Lidsdale Cut (WX5) for pre-KVAR data were also taken into account.

The 90th percentile baseline concentrations for all the water quality characteristics monitored are also shown in Table 1.

The pre-KVAR data used was for the fifteen year period February, 1988 to April, 2003. Note that use of the 90th percentile means that about 10% of the pre-placement concentrations would be above the baseline.

2.7.2 Environmental Goals

From the above considerations, the ANZECC (2000) guideline default trigger values and the local guidelines, with cadmium, chromium, copper, lead, nickel and zinc hardness corrected, are called the environmental goals for the Wallerawang Power Station Sawyers Swamp Creek Ash Dam and the KVAR dry ash placements. The environmental goals for the various elements monitored are shown in Table 1. Note that some of the receiving water monitoring sites had pre-placement water quality and trace metals above the environmental goal concentrations due to local catchment and wet ash inputs before dry ash placement began. These are highlighted blue in the table.

Table 1 shows that the guidelines for groundwater may be different from those used in Swayers Swamp Creek, where the effects on aquatic life are considered. Note that the ANZECC (2000) guideline trigger values for cadmium, chromium, copper, lead, nickel and zinc were adjusted for effects of hardness.

As discussed in Section 2.7.5, the surface water guideline goals apply to the receiving waters of Sawyers Swamp Creek at WX7 (Figure 1). The groundwater goals apply to the seepage detection bore WGM1/D5 and Lidsdale Cut (WX5) and these are used for early warning of potential effects on the Sawyers Swamp Creek receiving waters. These goals are used for assessment of the Stage 2A effects in this report.

Table 1: Pre-dry Ash Placement Water Quality Baseline 90th Percentile at Background and Receiving Water Sites and resulting Guidelines or Goals for KVAD/R Groundwater, Lidsdale Cut and Sawyers Swamp Creek

Element (mg/L)	Background Groundwater (WGM1/D2)	KVAD & KVAR Groundwater (WGM1/D5)	Lidsdale Cut (WX5)		Dump Creek (WX11)	Sawyers Swamp Creek (WX7)	
	Pre-Placement (1988-2003) 90th Percentile	Pre-Placement (1988-2003) 90th Percentile	Pre-Placement (1992-2003) 90th Percentile	Groundwater Guidelines# or Goals	Pre-placement (1991-2003) 90th Percentile	Pre-placement (1991-2003) 90th Percentile	Surface Water Guidelines# or Goals
pH	5.4	4.5	6.9	6.5 – 8.0	8.0	7.6	6.5 – 8.0
Cond/ (µS/cm)	310	810	952	2600^	770	760	2200
TDS	258	550	650	2000++	772	584	1500^
SO4	61	328	359	1000	325	323	1000 ++
Cl	48	24	34	350	39	27	350 +
As	<0.001	0.008	<0.001	0.024	<0.001	<0.001	0.024
Ag	<0.001*	<0.001*	<0.001*	0.00005	<0.001	<0.001*	0.00005
Ba	0.114	0.148	0.054	0.7	0.050	0.043	0.7 +++
Be	-	0.006	-	0.1	-	-	0.1
B	0.10	1.7	2.16	**1.7**	1.45	2.33	**1.25**
Cd	0.001	0.004	<0.001	0.001	<0.001	<0.001	0.0015
Cr	0.041	0.041	<0.006	0.004	<0.001	<0.001	0.005
Cu	0.010	0.058	<0.005	0.005	0.002	<0.007	0.005
F	0.28	0.65	1.99	1.5	1.1	1.1	1.5+++
Fe	1.7	14.7	0.7	**1.7**	2.38	0.507	0.3+++
Hg	<0.0007*	<0.0006	<0.0002*	0.00006	<0.0002*	<0.0002*	0.00006
Mn	0.44	2.5	2.12	1.9	1.94	0.829	1.9
Mo	-	-	-	0.01	-	-	0.01 +
Ni	0.031	0.137	-	**0.137**	-	-	0.05
Pb	0.010	0.021	0.004	**0.01**	<0.001	0.003	0.005
Se	<0.001	0.001	0.001	0.005	0.003	0.003	0.005
Zn	0.114	0.505	0.304	**0.505**	0.28	0.153	**0.153**

Notes:

* Detection limit used was higher than ANZECC guidelines

' Groundwater conductivity derived from TDS 90th percentile of 2000 mg/L TDS/0.77; Creek TDS derived from 0.68 x 2200 µS/cm, which is the ANZECC (2000) low land river conductivity for protection of aquatic life

ANZECC (2000) guidelines for protection of freshwaters, livestock or irrigation water.

Cadmium, Chromium, Copper, lead, nickel and zinc adjusted for effects of hardness: Ca, Mg in WGM1/D5 22.3, 29.0 mg/L: in Sawyers Swamp Creek 51.6, 38.0 mg/L, respectively

Note: Chromium guideline is 1 ug/L for CrVI and adjusted for hardness effect

Local guidelines using 90th percentile of pre-dry placement data in **bold** (Note: Fe guideline of 0.3 mg/L only marginally lower than WX7 90th percentile so used ANZECC (2000) guideline)

\+ Irrigation water moderately tolerant crops; irrigation. Note: Molybdenum drinking is 0.05 mg/L

++ Livestock

+++ drinking water

The surface water conductivity guideline of 2,200µS/cm shown in Table 1 was based on the background Dump Creek site, WX11, and the Sawyers Swamp Creek receiving water site, WX7, both having the 90th percentile conductivity more than twice the ANZECC (2000) guideline default upland river trigger value of 350 µS/cm (upland rivers are defined as above 150m altitude). Local mineralisation effects were the cause, as shown by the Dump Creek site, so use of the upland value was not considered appropriate and the higher, ANZECC (2000) lowland (altitude below 150m) river conductivity trigger value of 2,200 µS/cm was used for protection of aquatic life in Swayers Swamp Creek (Connell Wagner, 2008).

Although the background groundwater bore, D2, 90th percentile conductivity was lower than the upland river trigger value of 350 µS/cm, the pre-dry ash placement 90th percentiles at the KVAD groundwater bore D5, as well as the Lidsdale Cut conductivities, were higher than in the creeks. As groundwater seepage into Swayers Swamp Creek would be slow, use of the creek trigger value was not considered appropriate for groundwater. The approach adopted was the ANZECC (1995) guidelines for protection of groundwater, where the potential future use of the water resource is taken into account. As shown in Table 1, the livestock drinking water guideline for salinity, of 2,000 mg/L TDS, was considered relevant to the assessment of groundwater in the area, should the groundwater be used for watering livestock in the future (Connell Wagner, 2008). The TDS was converted to the conductivity local trigger value of 2,600 µS/cm by dividing by the conversion factor 0.77, which was derived from the measured groundwater conductivity and TDS.

The potential water quality improvements due to installation of the seepage collection and diversion systems are assessed in Section 3 using changes in conductivity at the various receiving water sites. Effects of the KVAR Stage 2A placement on water quality and trace metal changes are assessed against the environmental goals, and according to the ANZECC guidelines, in Section 4 and discussed in Section 5.

2.7.3 Early Warning of Water Quality Changes

An early warning of changes in water quality that may potentially approach the relevant local guidelines set out in Table 1 is required for the ash repository management to allow time for investigations of the causes of changes and controls to be implemented if necessary. The approach used is the ANZECC (2000) guideline procedure for assessing changes in water quality. The ANZECC procedure is to compare the 50th percentile (median) in receiving waters with the 90th percentile of the background or pre-KVAR water quality at the receiving water sites. An early warning of changes is signalled when the post-placement 50th percentile exceeds the pre-placement 90th percentile water quality conditions. This approach is supplemented by the use of Control Charts to show concentration changes to local/ANZECC trigger values and the 90th percentile pre-KVAR conditions.

These procedures are applied to each down-gradient groundwater bore, the Lidsdale Cut and Sawyers Swamp Creek to assess long-term changes that are approaching the local/ANZECC trigger values.

2.7.4 Triggers for investigations and Management

With installation of the seepage collection system under the KVAR, most leachates from the KVAR will be collected by the KVAD toe drains and diverted to Lidsdale Cut. This can occur by two flow paths: (a) vertically through the clay capping of the KVAD and emerge in the KVAD toe drains mixed with groundwater from the KVAD or (b) intercepted by the seepage collection system under the KVAR, which is joined to the toe drains and diverted to Lidsdale Cut.

The locally derived and ANZECC (2000) guidelines used in this and the previous reports requires that if concentrations increase above background and approach the relevant local guidelines, and it can be reasonably expected that the changes are due to the KVAR placement, an investigation of the cause should be implemented. In practice, to allow for natural variability, the guideline protocol implies that, if the locally derived environmental goals are consistently exceeded, an investigation of causes and management action of the dry ash placement would be initiated. To allow for the locally enriched minerals in the area, the water quality in the background bore, up-gradient of the ash placement area (WGM1/D2) and changes from pre-KVAR to post-KVAR in bore D5, Lidsdale Cut and WX7 are also taken into account. Changes at the receiving waters due to the effects of seepage from the KVAD also have to be taken into account.

2.7.5 Receiving Waters

Previous reports identified the following receiving water sites for assessment of ash leachate effects from the KVAR dry ash placement:

- Groundwater bore WGM1/D5
- Lidsdale Cut (sampling site WX5)
- Sawyers Swamp Creek at site WX7.

The Sawyers Swamp Creek site is the final receiving water site for the SSCAD, the KVAD and KVAR seepages and the Lidsdale Cut discharge. This site receives inflows from the following sources:

- SSCAD residual seepage from the ash dam wall into Sawyers Swamp Creek, and the local groundwater, since the pump-back system was installed
- Sawyers Swamp Creek, in the areas where it flows through the coal measures upstream of the KVAR and KVAD
- Groundwater inflows, up-gradient of the KVAD/R and down-gradient of the SSCAD
- KVAD/R seepage to the creek where it flows past the downstream sections of the KVAD wall
- Lidsdale Cut discharge of the KVAD toe drains and KVAR sub-surface drains, including groundwater from the local coal measures and surface runoff into the Cut
- the local background catchment of Dump Creek.

Bore WGM1/D5 represents the groundwater receiving water site for seepage from the KVAD/R that was not collected by the KVAD toe drains or the KVAR sub-surface drains that are directed to the KVAD toe drains.

Lidsdale Cut is also a receiving water site that can provide early warning of changes due to seepage from the KVAR. Hence, WX7 is the final receiving water site for the ash placement areas. In this regard, the Lidsdale Cut and bore WGM1/D5 are used to provide early warning for potential effects

that may reach the surface water receiving water site, WX7, in Sawyers Swamp Creek. This approach was used in the previous report and has been used here for the current assessment.

As Delta Electricity does not routinely monitor the water quality in Sawyers Swamp Creek where it flows through the coal measures upstream of the KVAD/R, the only surface water background site is WX11 in Dump Creek. Hence, changes in surface water quality in Sawyers Swamp Creek at WX7 were assessed by comparison with the catchment background water quality in Dump Creek at WX11. The receiving water site, WX7, is downstream of Lidsdale Cut and the junction of Dump Creek with Sawyers Swamp Creek and upstream of the junction with the Coxs River (Figure 1).

2.8 Control Charts

Long-term plots are used to allow the identification of trends against the baseline and environmental goals. The trends are tracked using Control Charts (Standard Methods, 1995 and ANZECC guidelines for Monitoring and Reporting, 2000) and the significance of the changes are determined by comparison with the criteria of pre-placement 90th percentiles, post-placement medians, ANZECC (2000) guidelines or local guidelines. As the ANZECC guidelines apply to the receiving waters of Sawyers Swamp Creek, Lidsdale Cut and the KVAD and Stages I and II seepage detection bores D5 and D6, the trends over time are graphed against these environmental goals.

To keep the number of charts manageable, only those parameters of relevance to the Stage II dry ash placement, such as conductivity, sulphate, boron and selenium, or those showing significant unexplained increases above the levels expected from the Stage II Environmental Assessment (PB, 2008) are graphed.

Elevated sulphate and boron concentrations are associated with coal mining activities and can also be elevated in flyash leachate and mine spoil (PPI, 1999). The presence of boron in higher than background concentrations is often associated with other trace metals and elements such as fluoride, nickel and zinc. The data for these and other elements are shown in Attachment 2.

The data are also summarised in Tables in this report, or in spreadsheet format in Attachment 2, including the minimum, maximum and mean as well as the 90th percentile baseline, median post-conversion, ANZECC guidelines and local guideline concentrations.

2.9 KVAR Site Monitoring and Runoff Management

Rainfall runoff from the KVAR dry placement area is collected by an ash perimeter drain which directs the runoff to a Collection Pond (Figure 1). Some of the collected water is reused for dust suppression by spraying on the dry ash deposit. The collection pond is normally kept at a low level by continually pumping water to the power station return canal to prevent it from spilling into Sawyers Swamp Creek.

Delta Electricity's contractor for ash placement at the KVAR, Lend Lease Infrastructure Services (previously Conneq and Bilfinger Berger Services) has installed piezometers at the site for sampling the groundwater height and water quality (bores GW6, 10 and 11 and A9 and 17, shown in Figure 1). They also undertake some water quality monitoring at various sites in Sawyers Swamp Creek from the SSCAD diversion to near the north-west side of the KVAR. This data was used for assessment of the potential improvements in water quality due to installation of the seepage collection and diversion works.

2.10 Data Quality

The data contained in this report was provided by Delta Electricity and LLI and was checked for outliers using the ANZECC (2000) protocol. In accordance with the protocol, outliers of three times the standard deviation from the mean were removed from the dataset provided that no environmental changes had occurred that would account for such a significant change. Outliers have an asterisk next to the data in Attachment 3, thereby stopping the result from being used in statistical analyses by Excel.

As the database covers a long period of observations, it is likely that apparent changes in concentrations for trace metals such as silver, cadmium, chromium, copper and mercury may in fact be due to changes in the accuracy or detection limits of the analytical techniques used.

The OEMP requires the existing monitoring program to continue, with the addition of low detection limit analysis for trace metals (to ensure that the detection limit is lower than guideline values). All of the metals tested, except for silver, met these criteria. Silver has continued to be tested with a detection limit of ten to one hundred times the ANZECC (2000) guidelines. To comply with the OEMP, future silver analytical tests should be undertaken at less than the 0.00005 mg/L detection limit.

3. Effects of Installation of Seepage Collection Diversion and Return Systems on Sawyers Swamp Creek Water Quality

This Section assesses the likely effects of the KVAD, KVAR Stage 2 sub-drains and SSCAD seepage collection and return system on receiving water quality and trace metals, by following the requirements of the Wallerawang Power Station PRP:

- Install and commission a pump-back system to ensure that any seepage from the Sawyers Swamp Creek Ash Dam is intercepted, collected, and returned to the Sawyers Swamp Creek Ash Dam
- Upgrade or re-install the Kerosene Vale Wet Ash Dam (KVAD) seepage collection and diversion system to ensure that any seepage from the Kerosene Vale Wet Ash Dam is intercepted, collected, and returned to the Lidsdale Open Cut void
- Install a new sub-surface drain inside the KVAD under the KVAR Stage 2 Area and divert the collected seepage to Lidsdale Cut.

The result of the sub-surface drain under the KVAR was to lower the groundwater table, which kept the KVAR placement dry.

There was an increase in rainfall in the Lithgow area at the time of implementing the above works and this complicated the assessment of water quality changes. Accordingly, the water quality in Sawyers Swamp Creek over the period, from before to after installation of the seepage collection and return systems, was reviewed against the change in rainfall over the same period.

3.1 Sawyers Swamp Creek Ash Dam Pump-back System

In this sub-section, the water quality following installation of the ash dam seepage collection and pump-back system is assessed in relation to the water quality in Sawyers Swamp Creek. The monitoring in the creek near the v-notch is undertaken by the ash dam contractor (LLI) and only limited water quality data was collected. Conductivity was the only characteristic consistently monitored and it was used to indicate changes in water quality due to the pump-back system.

As described in Section 2.2, the site upstream of the v-notch is immediately downstream of the SSCAD spillway and the downstream site is located near KVAD's north-eastern corner (Figure 1). This (downstream) site appeared to be affected by seepage from the KVAD, and possibly from the coal handling activities adjacent to the creek and outside of Delta's boundary. Noting these factors, the KVAD north-eastern corner site was used as the v-notch downstream site.

As noted above, conductivity was used to indicate changes in water quality in Sawyers Swamp Creek from before and after implementation of the seepage works. The conductivity in the creek, up- and downstream of the v-notch was examined for changes from before and after installation in March, 2010. Sampling was also undertaken in the creek near the v-notch from July, 2011 and the changes from February 2010 to February, 2012 are shown in Figure 2.

The LLI dataset associated with the v-notch had missing data for both upstream and downstream sites. Accordingly, the periods of missing data are shown as dotted lines in Figure 2.

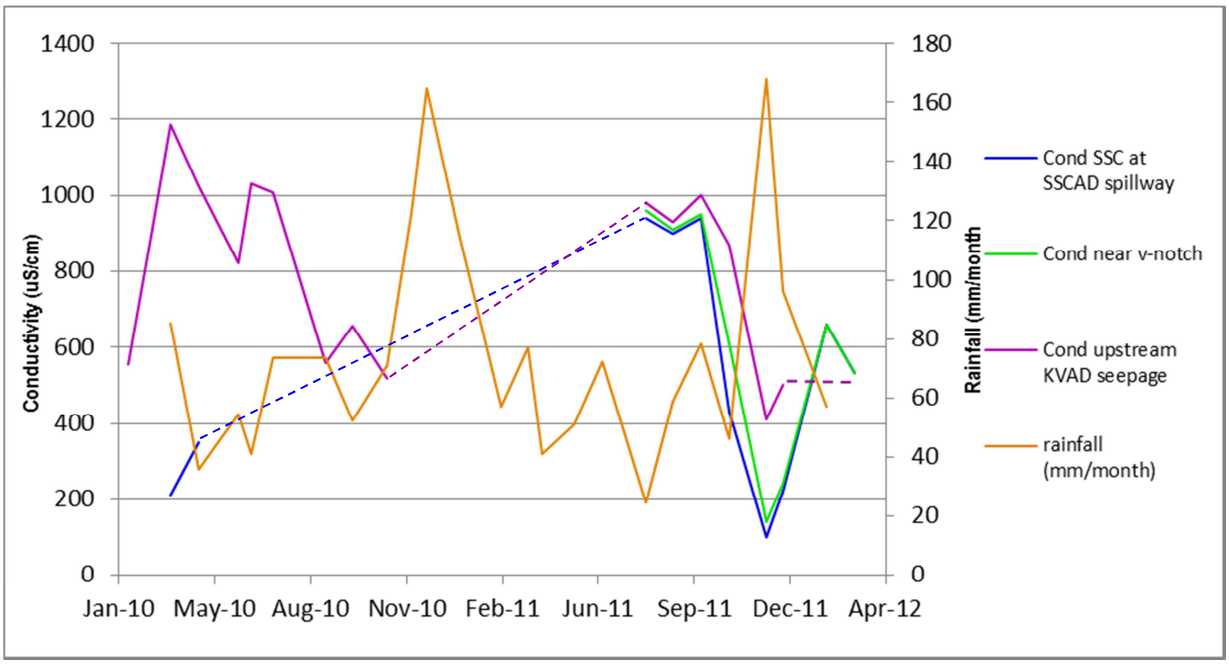

Figure 2 - Sawyers Swamp Creek Conductivity compared to Rainfall Variations from February, 2010 to February, 2012 at sites upstream of the v-notch (SSC at SSCAD spillway), near the v-notch and downstream of the v-notch (SSC site upstream of KVAD seepage pond). (Missing data for spillway and KVAD upstream sites shown as dotted lines).

Figure 2 shows that there was an increase in conductivity in the Sawyers Swamp Creek bypass water at the SSCAD spillway site (other than during the rainfall event from October to December, 2011) up to levels similar to those measured near the v-notch and at the KVAD upstream site.

It is understood that the emergency discharge valve on the pipeline from the Springvale Coal Mine to Wallerawang Power Station developed a leak from July, 2011 and mine water has been leaking into Sawyers Swamp Creek since then. The valve is on the EPA licensed discharge point LDP20 for Wallerawang Power Station. It is also understood that Delta Electricity is negotiating with Centennial Coal to temporarily depressurise the pipe to enable repairs to the valve.

Delta Western has advised that the leak in the Springvale Mine water pipeline was the cause of the high conductivity (about 1000 µS/cm) at the LLI spillway sampling site since July, 2011, as the leak causes relatively large flows of high conductivity water to enter the creek.

The small increase in conductivity near the v-notch, above that at the spillway (Figure 2), may have been due to minor seepage from the base of the ash dam wall upstream of the pump-back system. However, the conductivity of the water from the leak dominated the conditions in the upper Sawyers Swamp Creek and prevented an assessment of any potential improvements resulting from the v-notch pump-back system. It is suggested that Delta Electricity and Centennial Coal repair the leak and that an assessment of potential beneficial effects of the pump-back system be undertaken.

Figure 2 also shows that the KVAD upstream site had a higher conductivity than the creek background at the spillway, even with Springvale Mine water flowing down the creek. This is discussed in the next Section.

3.2 KVAD Seepage Collection and Diversion Effects

Figure 2 also shows that, other than during the rainfall events in December, 2010 and November, 2011, the conductivity at the KVAD upstream site remained in the same range before and after the pump-back was installed in March, 2010 and installation of the KVAD drains under the KVAR (October, 2010).

The much higher conductivity in February and March, 2010 at the KVAD upstream site, compared to that at the spillway site, suggests that seepage from the KVAD, and possibly the local coal placement, cause increased conductivity in the upper Sawyers Swamp Creek. Although the pipeline leak conductivity made comparisons uncertain since July, 2011, the limited 2010 observations are consistent with seepage into the upper Sawyers Swamp Creek from the KVAD and other external inputs in the northern area of the KVAD.

The effect of the relatively high conductivity in the mine water leak on conductivity further down Sawyers Swamp Creek was investigated by examination of changes at sites downstream of the KVAD and at the receiving water site WX7. The location of these sites is shown in Figure 1. The aim of the investigation was to identify potential effects on water quality of installation of the seepage collection from the KVAD under the KVAR and its diversion to Lidsdale Cut. It was expected that any effects of the pipeline leak on water quality in the creek would be identified as part of the investigation.

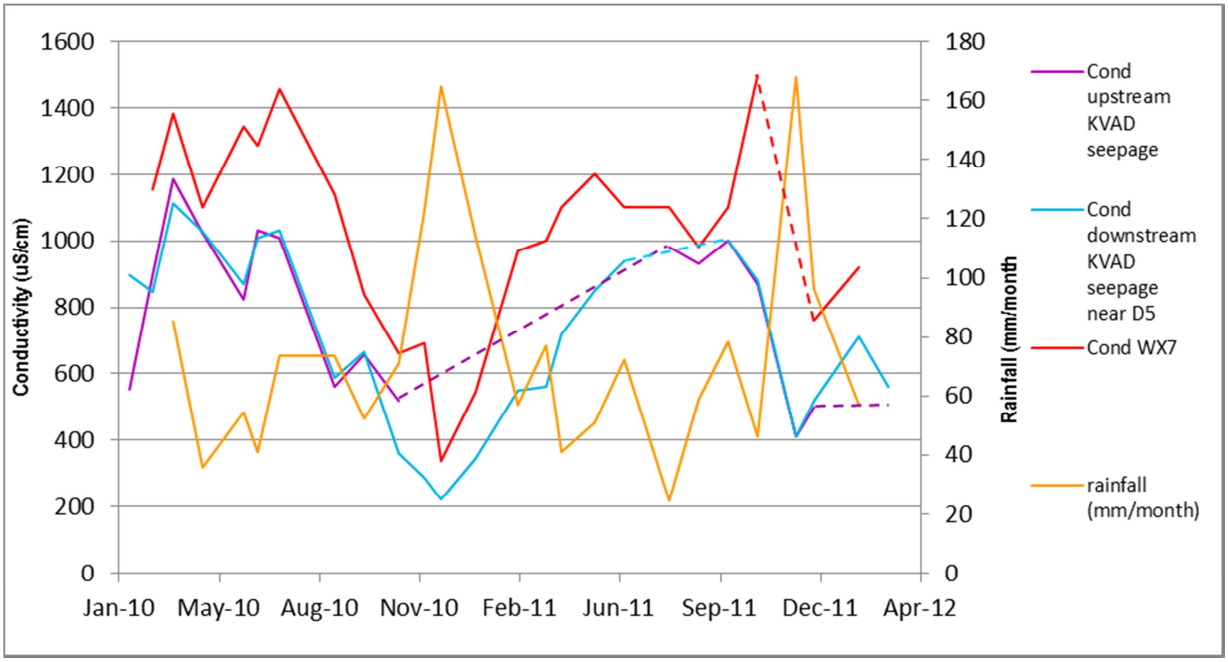

Figure 3 - Sawyers Swamp Creek Conductivity compared to Rainfall Variations from February, 2010 to February, 2012 at sites upstream KVAD to downstream of KVAD seepage (downstream site taken as the LLI site near the groundwater bore D5) as well as at Receiving Water Site WX7

Figure 3 shows that the conductivity at the KVAD upstream site and KVAD downstream site, located to the north-west of the KVAD/R placements, (Figure 1) tended to closely follow each other. This showed there was no significant change in conductivity over the relatively short distance between the up- and downstream creek sites in the northern section of the KVAD. The close relationship between these sites most likely reflects the effects of seepage inputs from the KVAD and external inputs from the catchment.

3.2.1 Sawyers Swamp Creek Receiving Water Site, WX7

As Figure 3 also showed that the conductivity at the receiving water site, WX7, was higher than both the LLI KVAD up- and downstream sites in Sawyers Swamp Creek, the cause was investigated.

The Delta Electricity routine monitoring data at WX7, from before and after the SSCAD pump-back began (March, 2010) and beginning of operation of the KVAD drains under the KVAR (October, 2010), was compared to the rainfall, as well as the conductivity at the Dump Creek site (WX11), which represent the mineralised background conditions in the area, and Lidsdale Cut (WX5) in Figure 4.

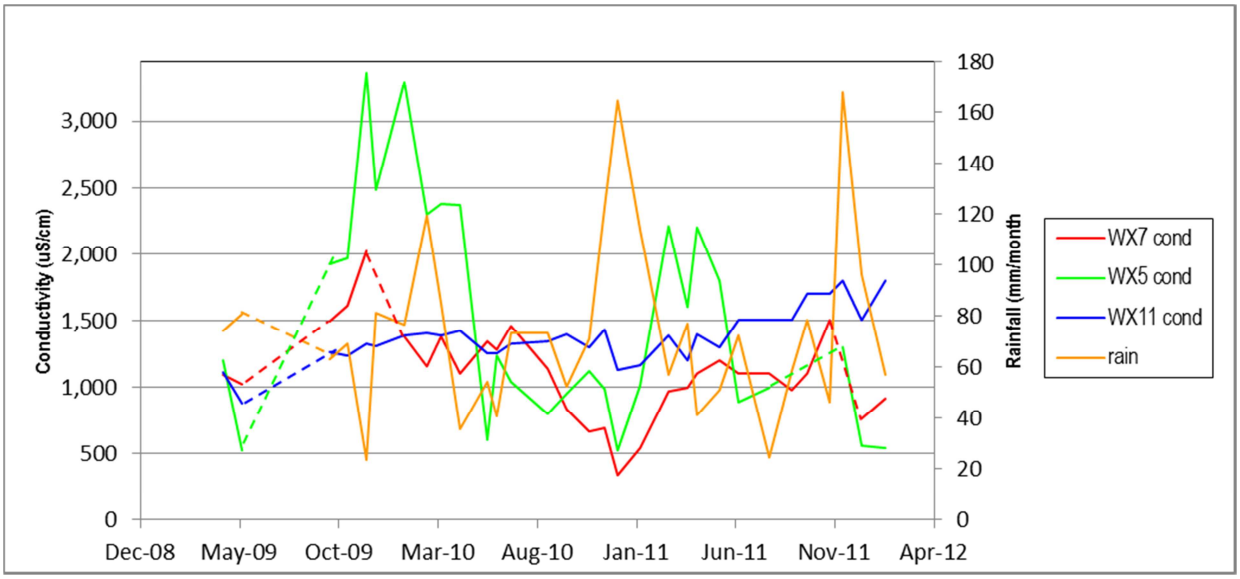

Figure 4 - Sawyers Swamp Creek Conductivity at Receiving Water Site WX7 compared to Rainfall variations and the Dump Creek Background site (WX11) and Lidsdale Cut (WX5) routine monitoring sites downstream of KVAD from January, 2009 to January, 2012

Figure 4 shows no changes in conductivity at WX7 that could be attributed the seepage collection and diversion works. The rainfall caused temporary decreases but the conductivity tended to return to pre-seepage collection levels.

Contrary to the changes at WX7, the conductivity in Dump Creek (WX11) increased, even with the increase in rainfall, indicating that the rain was leaching salts (and other elements – see Section 4.1) from material placed in the catchment by mining activities in the area. Dump Creek enters Sawyers Swamp Creek upstream of WX7 and appears to have added to the salinity at WX7, relative to that measured by LLI in the creek near bore D5 (see Figure 3).

3.2.2 Lidsdale Cut

In addition to inputs from Dump Creek to WX7, the KVAD toe drains direct seepage from the KVAD to Lidsdale Cut (WX5). Since October, 2010, groundwater collected from inside the KVAD, in the area under the KVAR Stage 2, has been added to the toe drains. This increased flow of KVAD groundwater into the Lidsdale Cut caused overflows to Sawyers Swamp Creek, due to the resulting increase in water level in the Cut. The overflow enters the creek upstream of both Dump Creek and WX7.

Figure 4 also shows significant changes in the conductivity in Lidsdale Cut. The conductivity in WX5 increased with increasing rainfall (before the drains were first connected) and after the connection, the conductivity decreased even with the wet weather and mostly stayed low. A high rainfall event from November, 2010 to January, 2011 was followed by a moderate increase in conductivity but subsequently decreased to low levels.

The changes in conductivity in Lidsdale Cut were investigated further by comparison with the conductivity in the groundwater bores, D5 and D6, down-gradient of the KVAD and the drawdown in the groundwater level under the KVAR as measured at the LLI piezometer APA10 (Figure 5). The piezometer was installed deep enough to sample the groundwater in the KVAD under the Stage 2 Area (see Figure 8).

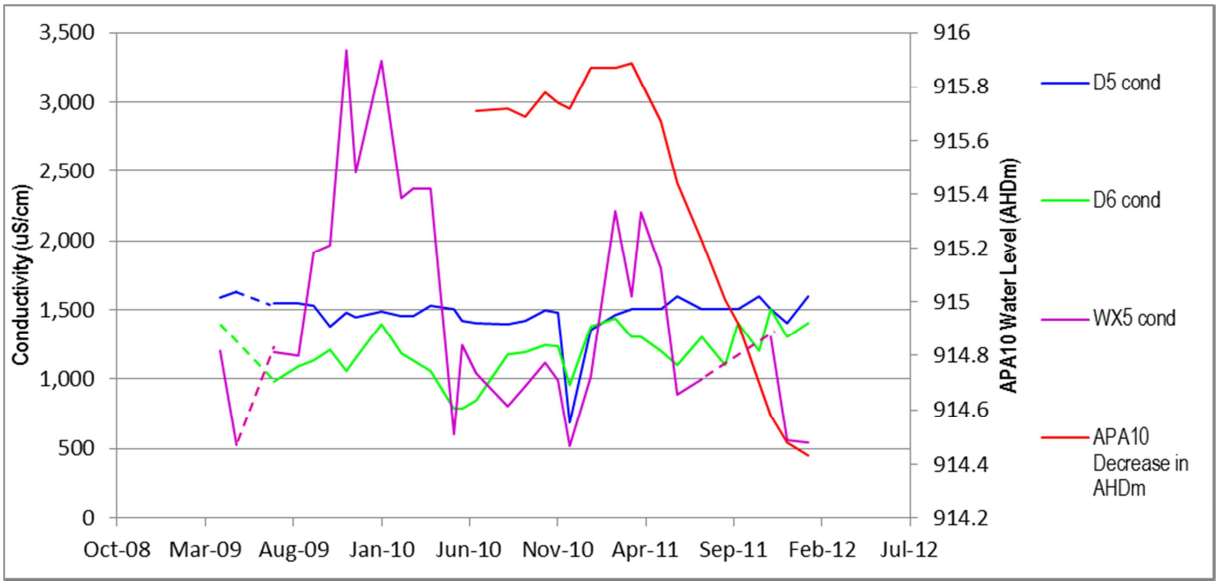

Figure 5 – Lidsdale Cut (WX5) Conductivity compared to KVAD Seepage Detection Bores D5 and D6 Conductivity and the KVAD Groundwater Level decrease at Piezometer APA10 from October, 2010 from January, 2009 to January, 2012

Figure 5 shows a reduction in conductivity at WX5 down to similar conductivity to that in bores D5 and D6 (closer to D6) from when the sub-surface drains under the Stage 2 Area were first connected to the KVAD toe drains in October, 2010. Note that the decrease in water level in the KVAD (as measured at APA10 – location is shown in Figure 8) was delayed but the initial connection of the sub-surface drains to the KVAD toe drains was apparently sufficient to reduce the conductivity in the Lidsdale Cut.

It was noted that the groundwater level at bore D5 was also decreased by about 1m but there was no change at bore D6. This is discussed further in Section 4.3.

Although there were significant rainfall events during the period (Figure 4), the groundwater bore conductivities in Figure 5 show no effects of rainfall on the overall D5 and D6 conductivity, other than a small increase at D6. Hence, it is likely that the lower conductivity in Lidsdale Cut (WX5) was mostly due to diversion of the low conductivity water under the KVAR rather than the increase in rainfall during the period. This suggestion will be confirmed by ongoing monitoring.

In summary, the obvious benefit of the seepage collection and diversion systems was the decrease in conductivity in the Lidsdale Cut. The assessment of the causes of water quality changes in Sawyers Swamp Creek suggests that the decrease in conductivity in Lidsdale Cut may have influenced the concentration at the receiving water site, WX7. Figure 4 shows that the conductivity at WX7 was lower than that in the Cut (WX5) until the conductivity in Dump Creek (WX11) reached or exceeded 1,500 µS/cm in June, 2011. From this time, the WX7 conductivity was similar to that in Dump Creek.

4. Stage 1 and Stage 2A Dry Ash Placement Effects on Surface and Groundwater Quality

This Section reviews the long-term trends in surface and groundwater quality and trace metals at receiving water sites for assessment of changes, if any, due to the KVAR Stage 1 dry ash placement and capping and the current Stage 2A placement. The assessment also included the effects of the seepage collection and diversion systems recently installed. Long-term trends in water quality and trace metals are examined for changes from pre- to post-dry ash placement in the following surface and groundwaters:

- Sawyers Swamp Creek Ash Dam since wet ash placement was stopped and dry ash placement began at the KVAR to take into account residual effects of seepage since the pump-back system was installed
- SSCAD seepage detection bores, WGM1/D3 and D4
- KVAD/R groundwater bores WGM1/D5 and D6
- Lidsdale Cut and changes due to the KVAR Stage 2 seepage collection and diversion system
- Sawyers Swamp Creek receiving water site, WX7.

A schematic outline of the SSCAD dam wall seepage to Sawyers Swamp Creek and the KVAD/R seepage flow paths to the KVAD toe drains and Lidsdale Cut is shown in Plate 1, which includes the recently installed KVAR sub-surface drains.

Plate 1. Schematic of Sawyers Swamp Creek Ash Dam and KVAD/R seepage flow paths to the KVAD toe drains and Lidsdale Cut

The water quality in the ash dam pond was previously shown to be improving due to the dry ash placement and containment of the water in the ash dam to prevent spilling into the creek (Aurecon, 2010). As discussed above, a seepage collection and pump-back system was recently installed to minimise effects of the ash dam on Sawyers Swamp Creek and the local groundwater quality. However, residual effects of seepage from the ash dam pond under the dam wall have to be taken into account in the assessment of the Stage 2A placement effects.

A major change in rainfall, from previously dry weather to wet weather, occurred during the Stage 2A period, and this further complicated the assessment of effects of the dry ash placement.

The aim of the management measures is for the receiving water quality of Sawyers Swamp Creek (WX7), the groundwater bore WWGM1/D5 and Lidsdale Cut (WX5) to meet the local/ANZECC (2000) guideline trigger values for the characteristics defined in Section 2.7.1 during the post-dry ash placement and seepage collection and diversion system periods.

4.1 Sawyers Swamp Creek Ash Dam Water Quality

The continuing changes in water quality in the SSCAD pond, from the time wet ash slurry ash placement was stopped in 2003, to the current Stage 2A period are summarised in Table 2. In the table, the ash dam concentrations are compared to the Dump Creek background concentrations and the local/ANZECC trigger value goals. The parameter values in the ash dam pond and in Dump Creek that exceed the goals are highlighted in blue.

Water quality and trace metal concentrations in the SSCAD are taken into account as part of the KVAR assessment because residual seepages from the SSCAD dam wall may affect the water quality in Sawyers Swamp Creek and the local groundwater. Although these inputs are expected to be minor with the recent installation of the v-notch pump-back system, they are up-gradient of the KVAR placement and need to be taken into account.

Table 2: Summary of Average Water Quality in SSCAD Pond for Pre- and Post-Stage 1, Initial Stage 2 and Stage 2A Periods Compared to Dump Creek Background (during Stage 1/Initial Stage 2 period and current wet weather period) and Surface Water Guidelines or Goals

Element (mg/L)	Pre-Placement (1996-2003) Average	Stage 1&Cap Post-placement (May, 2003-Mar, 2010) Average	Initial Stage 2 Post-placement (April, 2009-March, 2010) Average	Stage 2A Post-placement (April, 2010-January, 2012) Average	Background Dump Creek, WX11, (May, 2003-March, 2010) Average	Background Dump Creek, WX11, (April, 2010-January, 2012) Average	ANZECC (2000) Guidelines & Goals for Sawyers Swamp Creek
	SSCAD	SSCAD	SSCAD	SSCAD	WX11	WX11	
pH	5.4	5.9	6.9	7.1	4.2	3.3	6.5-8.0
Cond (µS/cm)	1219	2197	2142	987	832	1424	2200
TDS	858	1684	1573	763	541	963	1500
SO4	553	1125	973	361	351	640	1000
Cl	18	32	37	18	20	22	350
As	0.016	0.008	0.002	0.0034	0.0008	0.0005	0.024
Cd	0.012	0.0048	0.0022	<0.001	0.0005	0.0006	0.0015
Cr	0.005	0.0019	0.0007	0.0013	0.0019	0.0007	0.005
Cu	0.007	0.0055	0.0028	0.0046	0.004	0.0049	0.005
Fe	0.17	0.107	<0.01	0.05	1.42	4.23	0.3
Mn	1.2	1.06	0.67	1.96	2.85	5.75	1.9
B	4.7	4.1	2.15	1.39	1.35	2.47	**1.25**
F	9.3	4.71	2.16	1.46	0.56	0.81	1.5
Mo	0.152	0.051	0.071	0.012	0.006	0.008	0.01
Ni	0.129	0.07	0.035	0.155	0.223	0.368	0.05
Pb	0.002	0.002	0.001	0.004	0.003	0.002	0.005
Se	0.151	0.04	0.007	<0.002	0.002	<0.001	0.005
Zn	0.426	0.213	0.053	0.457	0.423	0.900	**0.153**

The water quality parameter values in the SSCAD have continued to decrease. Trace metals and elements have generally decreased, with selenium now being less than the detection limit, but the exceptions were for increases in manganese, nickel, and zinc since 2009/10. These increases appear to be due to leaching from the surface ash deposits in the SSCAD by rainfall runoff during the wet

2010/11 period. Boron continued to decrease but remained higher than the Dump Creek (WX11) background, as well as the local trigger value.

Contrary to the effects of rainfall in other parts of the catchment, the water quality parameter values and trace metal concentrations increased in Dump Creek during the wet 2010/11 period (Table 2). Increases occurred for conductivity, sulphate, iron, manganese, boron, fluoride, nickel and zinc in 2010 to January, 2012 and they were all higher than in the ash dam. The increased metal concentrations occurred as the pH decreased from 4.2 in 2009/10 to 3.3 in the current period. This suggests that the increased rainfall was leaching salts and trace metals from material placed in the catchment by mining activities in the area.

Long-term trends in conductivity and sulphate, as well as the trace metals boron, manganese, nickel and zinc in the SSCAD pond are shown in Figure 6. Their concentrations have all declined since 2003 but the metals have shown spikes in concentrations with the recent wet weather, which also caused the conductivity to decrease due to accumulated rainfall and freshwater inflows.

The conductivity sharply increased in January, 2012 as did sulphate, boron and zinc. The conductivity increase was also associated with an increase in selenium from less than detection to 0.014 mg/L (Attachment 2), the highest concentration since early 2008. These January increases suggest that the freshwater has infiltrated the ash deposit and leached the trace metals and selenium from the ash into the water in the dam.

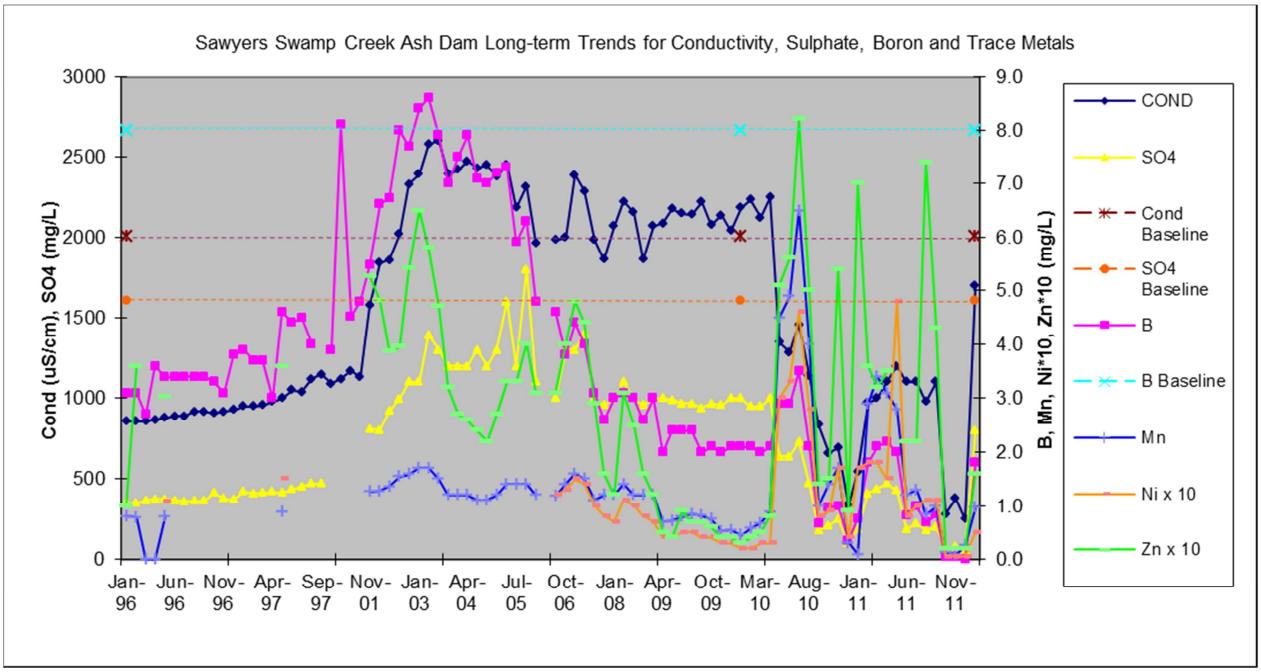

Figure 6 - Sawyers Swamp Creek Ash Dam Pond Long-term Trends in Conductivity, Sulphate, Boron and Trace Metals

The v-notch pump-back system was installed in March, 2010, just before the sharp increase in trace metals in May and would have prevented the main SSCAD seepage flow from entering Sawyers Swamp Creek. The residual seepage from the base of the dam wall, which is minor compared with the normal flow in the creek, is unlikely to cause a significant increase in concentrations in the creek, where it flows near the base of the dam wall.

Some evidence for this is provided by the trace metal measurements from February, 2010 to October, 2010 by LLI at the Sawyers Swamp Creek upstream of the KVAD. There was no flow of Springvale mine water down the creek at that time. LLI measured selenium at less the detection limit of 0.002 mg/L, boron between 0.07 and 1.1 mg/L; manganese <0.01 to 1.6 mg/L; nickel <0.01 mg/L and zinc between <0.01 and 0.06 mg/L. These concentrations were all lower than in the ash dam and the local guideline trigger values.

4.2 SSCAD Groundwater Quality

The SSCAD seepage detection bores, WGM1/D3 and D4, are located down-gradient of the SSCAD and up-gradient of the KVAD and KVAR Stage 1 and Stage 2A dry placement areas (Figure 1). Bore D3 samples groundwater affected by ash dam seepage from near the left abutment of the ash dam wall and bore D4 samples the right abutment. It is necessary to understand the effects of seepage from the SSCAD, if any, on the groundwater down-gradient of the dam wall at bores D3 and D4, as well as in the KVAD under the KVAR dry ash placements. These inputs can then be taken into account in assessing KVAR effects, if any, on the local groundwater at bores D5 and D6 and in Lidsdale Cut.

Changes in the SSCAD seepage detection bores have been assessed using data from pre-placement (90^{th} percentile baselines (before May, 2003 at bore D4) and the background bore, D2, compared to the post-placement medians for periods of Stage 1, including capping since April, 2009 (May, 2003 to March, 2010), during the initial Stage 2 dry ash placement (April, 2009 to March, 2010) and the current Stage 2A placement (April, 2010 to January, 2012), as shown in Table 3.

As bore D4 is located near the lower section of Sawyers Swamp Creek, where it passes the dam wall, the water quality and trace metals at this bore are expected to show any effects of residual seepage from the dam wall since the v-notch pump back system was installed. To assess changes in bore D4 during the current period, the medians have been compared to those during previous periods and its 90^{th} percentile baseline in Table 3.

Table 3: Median Water Quality for SSCAD Seepage affected Groundwater during Post-Stage I and Post-Stage II Compared to Current SSCAD, Groundwater Background, Seepage bore WGM1/D4 Baseline and Groundwater Guidelines or Goals

Element (mg/L)	SSCAD Seepage Affected Bores					Back-ground April, 2010 to January, 2012	D4 Baseline (Pre-Stage I 90th Percentile)	ANZECC Guideline Goals for Groundwater
	Stage 1 & Cap May, 2003 to March, 2010		Initial Stage 2 April, 2009 to March, 2010		Stage 2A April, 2010 to January, 2012			
	D3	D4	D3	D4	D4	D2	D4	
pH	6.2	5.9-8	6.2	5.8	5.8	4.7	6.8	6.5-8.0
Cond (µS/cm)	693	1276	771	1484	1500	320	728	2600
TDS	430	1120	460	1300	1200	230	510	2000
SO4	110	720	120	780	770	110	201	1000
Cl	82	27	100	33	33	23	45	350
Fe	0.10	46.50	0.01	39.0	43.0	0.04	86.0	**1.7**
Mn	0.63	17.0	0.69	17.0	18.0	0.46	6.5	1.9
B	0.03	1.20	0.03	1.5	1.50	0.03	0.49	**1.7**
F	0.05	0.05	0.10	0.10	0.10	0.05	0.24	1.5
Ni	0.130	0.040	0.130	0.040	0.050	0.050	0.023	**0.137**
Se	0.001	0.001	0.002	0.002	0.002	<0.001	0.002	0.005
Zn	0.065	0.080	0.090	0.090	0.080	0.080	0.060	**0.505**

The summary data in Table 3 shows no significant changes in water quality parameters or trace metals, including selenium concentrations in the D4 bore compared to the previous Stage 1 to 2A periods. As noted in previous reports, there has been an increase in conductivity, TDS, sulphate and boron in the groundwater since the pre-stage 1 period due to the effects of increased concentrations in the ash dam, and seepage through the v-notch, with conversion to dry ash and less flushing of the main dam pond.

Long-term changes in conductivity, sulphate and boron, which is used to represent changes in other trace metals, at bore D4 are shown in Figure 7. It can be seen that the effect of the SSCAD increases became evident in April, 2002 after which time they consistently exceeded their baselines, except during rainfall events. Effects of the large rainfall event of December, 2010 on concentrations can be clearly seen. Concentrations in the groundwater have all remained below the local groundwater guidelines during the current period. Reductions in concentrations of these elements at bore D4, if any, due to installation of the V-notch pump-back system will be confirmed by future monitoring.

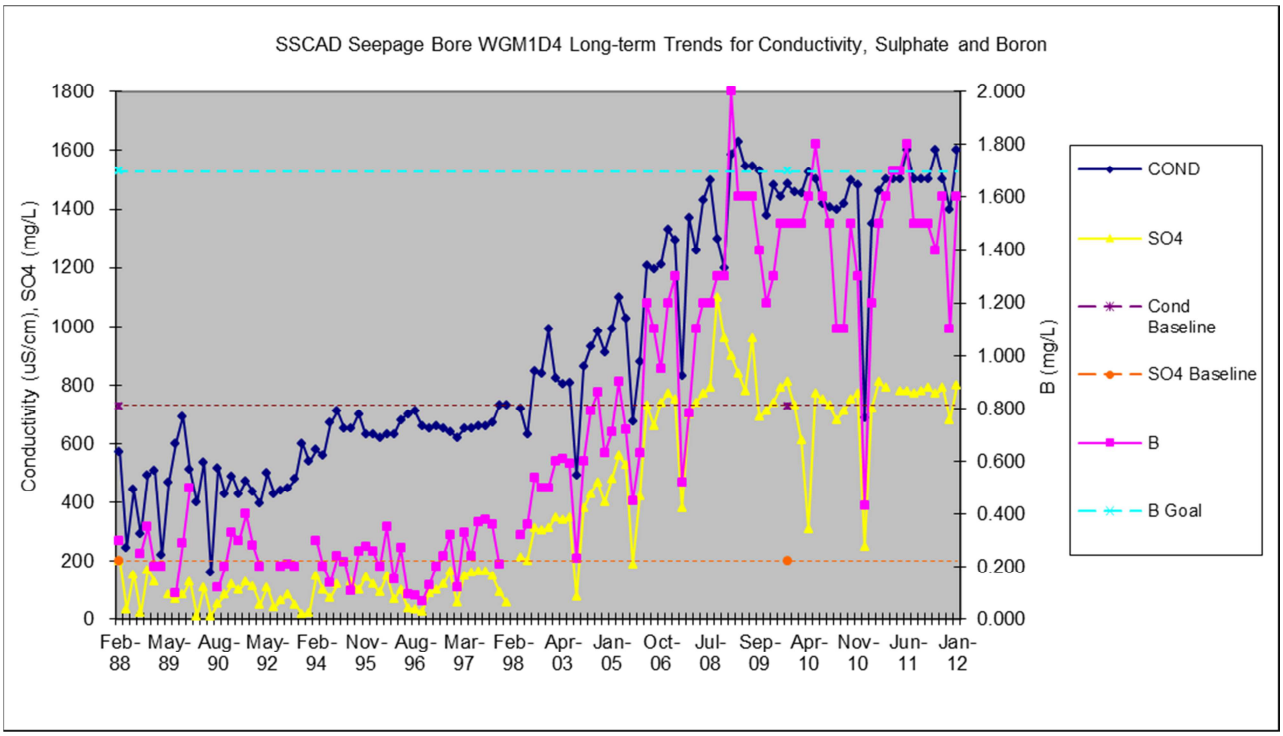

Figure 7 - Sawyers Swamp Creek Ash Dam Seepage Detection Bore WGM1/D4 Long-term Trends in Conductivity, Sulphate and Boron

4.3 KVAD and KVAR Groundwater Quality

The changes in the receiving waters at the groundwater bores WGM1/D5 and D6 are examined in this Section in relation to potential effects of the KVAR Stage 2A. Changes from pre-placement, during the Stage 1 placement and capping and during the initial Stage 2 dry ash placement are examined. However, before this was undertaken, the groundwater level contours in the area were examined to obtain an indication of the groundwater flow directions.

Understanding the groundwater flow directions was necessary because it was shown in Figure 5 that the conductivity in the Lidsdale Cut was reduced to be similar to that at bore D6 when the sub-surface drains under the Stage 2 Area were connected to the KVAD toe drains. In addition, bore D5 samples the groundwater seepage on its way to Sawyers Swamp Creek, which is nearby (Figure 1).

Figure 8 shows the groundwater levels in the area during late 2011 and the inferred flow directions from the high levels at the south of the SSCAD dam wall toward the low point, where bore D5 is located.

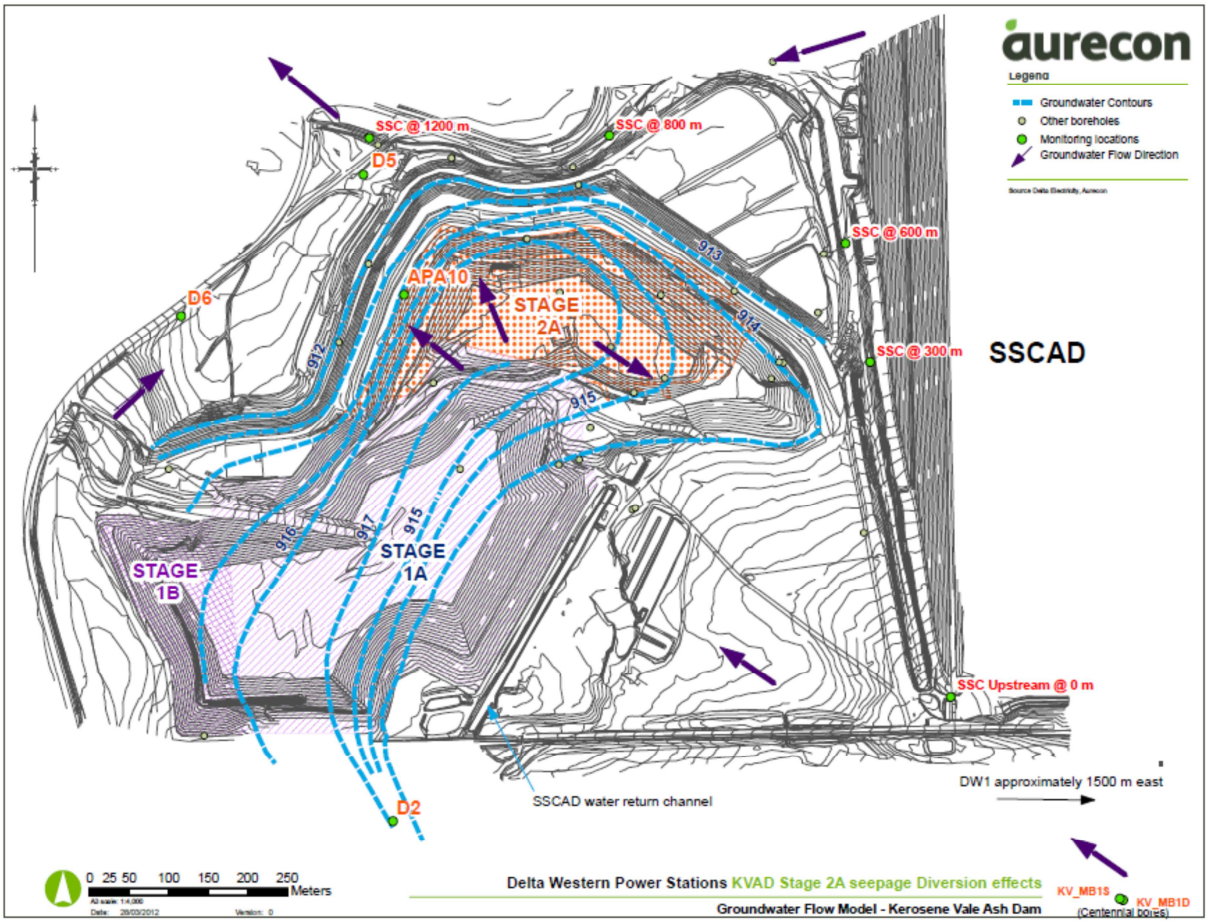

Figure 8 – Kerosene Vale Ash Dam and Stage 1 and Stage 2A Dry Ash Repository Groundwater Level (RL m) Contours with Inferred Flow Directions (from sketch provided by Lend Lease Infrastructure to Delta Electricity)

The groundwater contours show that the groundwater is mounding below the dry ash placement to a maximum height of RL917m, which is 1m below the assumed KVAD capping level of RL918. Figure 5 shows that the seepage collection and drainage systems decreased the water level in the KVAD, under the dry ash placement, by about 1.5m (as measured at AP10, Figure 8). This decrease has prevented groundwater from the KVAD reaching the base of the dry ash placement, as it did in 2009/10. Hence, the drainage works have achieved the objective of reducing the water level in the KVAD and stopped groundwater from the KVAD getting into the dry ash placement.

Note that the mounding below Stage 1 has meant that groundwater has to be drained from the south-western corner into the return canal. The mounding under Stage 2 has some of the groundwater flow directed towards the SSCAD. This has been intercepted by the drains under the Stage 2 area and directed into the KVAD toe drains.

Flow directions indicate the likely sources of groundwater that could affect the water quality in bores D5 and D6 as:

- Seepage water from the SSCAD pond (now collected at the v-notch and pumped back into the dam pond);
- Groundwater in the KVAD, under Stages 1 and 2A, flowing toward Sawyers Swamp Creek

- Background groundwater from up-gradient of the KVAD and SSCAD, which is measured at bore D2 and appears to flow around the southern edge of the KVAD to bore D6.

The flow directions suggest that residual seepage from the SSCAD main pond that enters the local groundwater would be intercepted by the drains installed under the KVAR Stage 2A area and directed to Lidsdale Cut via the KVAD toe drains.

The water quality in the drawn-down KVAD is apparently diluted by inflows of low salinity background groundwater and bore D6 has a lower median conductivity and sulphate than bore D5 as a result of these inflows (Table 4). The flow paths indicate that the low salinity background water flows mostly through the KVAD area, where it increases in conductivity by mixing with the KVAD groundwater, and then flows to D5 (Figure 8). This caused bore D5 to have higher conductivity, sulphate, boron and trace metals than bore D6.

Table 4: Median Water Quality for Dry Ash KVAD/KVAR Groundwater Seepage Bores during Post-Stage 1, Initial Stage 2 and Stage 2A Compared to Current Groundwater Background Bore WGM1/D2 and Bore WGM1/D5 Baseline and Groundwater Guidelines or Goals

Element (mg/L)	KVAD & KVAR Dry Ash Placement Monitoring Bores						Back-ground April, 2010 to January, 2012	D5 Baseline (Pre-Stage I 90th Percentile)	ANZECC Guideline Goals for Ground-water
	Stage I& Cap May, 2003 to March, 2010		Stage II April, 2009 to March, 2010		Stage 2A April, 2010 to January, 2012	Stage 2A April, 2010 to January, 2012			
	D5	D6	D5	D6	D5	D6	D2	D5	
pH	3.6	3.2	3.3	3.2	3.6	3.2	4.7	4.5	6.5-8.0
Cond (µS/cm)	1917	1110	2057	1154	1356	1216	320	810	2600
TDS	1600	600	1800	620	1000	730	230	550	2000
SO4	1100	350	1100	410	680	485	110	328	1000
Cl	18	56	17	57	15	48	23	24	350
As	0.001	0.005	0.001	0.006	0.001	0.001	0.0005	0.008	**0.024**
B	4.8	0.80	5.10	0.76	2.2	0.74	0.03	1.7	**1.7**
Cd	0.0024	0.0004	0.0029	0.0007	0.002	0.001	<0.0001	0.004	0.001
Cr	0.003	0.0026	0.0019	0.002	0.001	0.002	0.0008	0.041	0.004
Cu	0.013	0.003	0.010	0.003	0.008	0.005	0.001	0.058	0.005
Fe	4.85	38.0	14.00	41.0	1.7	14.5	0.04	14.7	**1.7**
Mn	8.55	3.6	11.0	3.9	7.5	3.5	0.46	2.5	1.9
Mo	0.005	0.008	0.005	<0.010	0.010	0.010	0.005	-	0.01
F	1.10	0.20	1.10	0.40	0.80	0.40	0.05	0.65	1.5
Ni	0.830	0.335	0.960	0.470	0.540	0.350	0.050	0.137	**0.137**
Pb	0.016	0.005	0.014	0.005	0.007	0.012	<0.001	0.021	**0.010**
Se	0.001	<0.001	<0.001	0.002	0.002	0.002	<0.001	0.002	0.005
Zn	1.50	0.335	1.50	1.30	1.10	0.895	0.080	0.505	**0.505**

Comparison of median concentrations at bores D5 and D6 (Table 4) with the up-gradient bore D4 (Table 3) for the Stage 2A period shows that boron, nickel and zinc, as well as fluoride in the KVAD/R bores were higher than at bore D4 and the background bore D2. In contrast, the KVAD/R bores have lower concentrations than D4 for conductivity and sulphate but are still higher than D2 and the D5 pre-dry ash placement background concentrations, indicating some influence of the KVAD. The KVAD bores had a lower pH of 3.2 to 3.6, compared to 5.8 at bore D4. This was probably the cause of higher levels of fluoride, nickel and zinc in the KVAD bores (Table 4). From this analysis, bore D5 was used as the main indicator of KVAD seepage effects, consistent with the flow directions indicated in Figure 8.

The low pH in bores D5 and D6 indicates pyrite oxidation (Deutsch, 2005) of the residual coal and chitter in the Kerosene Vale mine void underneath the KVAR. Pyrite oxidation and its associated acidification are known to release trace metals into groundwater.

The summary data in Table 4 shows a decrease in conductivity and sulphate, as well as the trace metals boron and lead, and relatively small decreases for manganese, nickel and zinc at bore D5 compared to the previous Stage 1 to 2A periods. There were no significant changes in concentrations of the other trace metals, including selenium which remained low.

The elements that had higher concentrations than the local guidelines during the Stage 2A period are highlighted in blue in Table 4. Of these, only boron at bore D5 and manganese, nickel and zinc, at both bores D5 and D6, were higher than the bore D5 pre-dry ash placement background concentrations. However, the decrease in concentrations of these elements during the stage 2A period, relative to that during Stage 1 and Initial Stage 2, suggests leachates from the dry ash, due to rainfall infiltration, have not reached the local groundwater in significant concentrations.

The long-term changes for conductivity, sulphate and boron in bore D5 from before dry ash placement, during Stage 1 and to the current Stage 2A placement are examined in Figure 9.

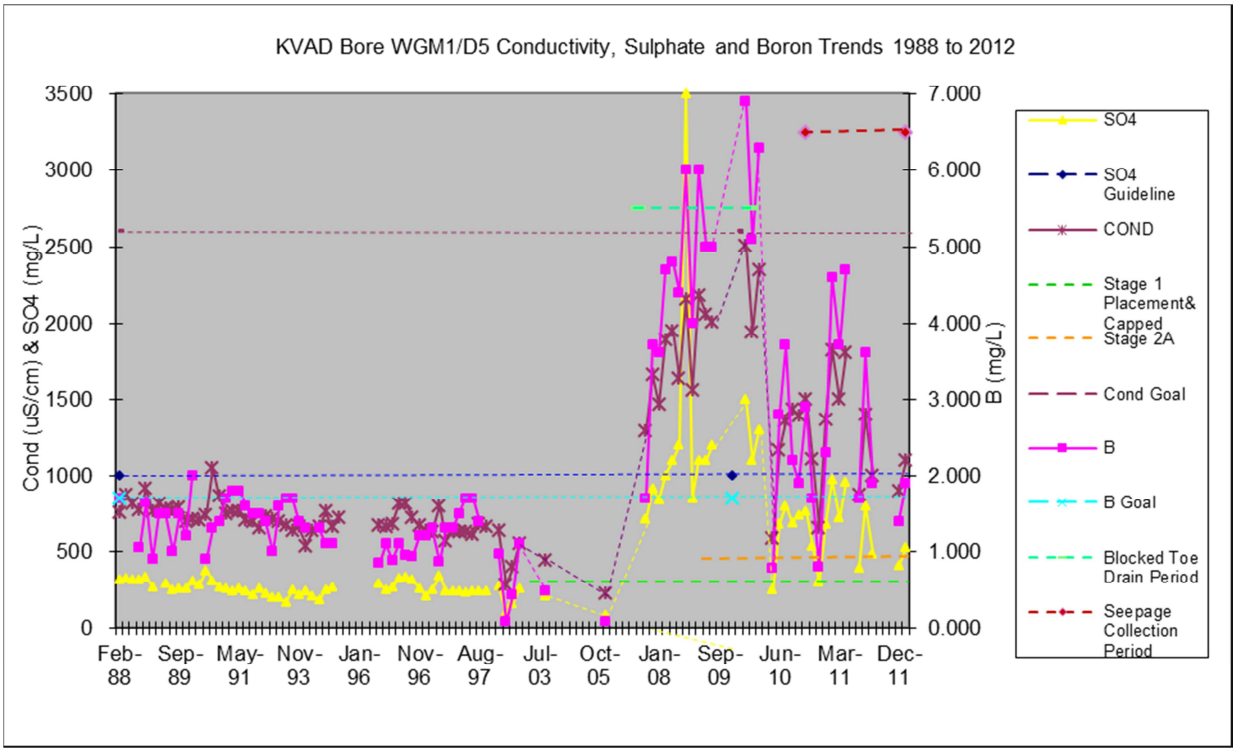

Figure 9 – Kerosene Vale Ash Dam Seepage Detection Bore WGM1/D5 Long-term Trends in Conductivity, Sulphate and Boron (Periods for Stage 1 placement and capped since 2003, Stage 2A, including initial Stage 2 since April 2009, Blocked toe drains and Subsurface drain seepage Periods are shown)

Increases in conductivity, sulphate and boron at bore D5 over the Stage 1 and initial Stage 2 periods was shown by Aurecon (2010) to be due to effects of blocked KVAD toe drains limiting the ability of the low salinity background water to flow into the KVAD groundwater and from there to bore D5. Conductivity, sulphate and boron concentrations varied from low levels in 2003-05 to the highest recorded in 2008-09.

Figure 9 shows that shortly after the toe drains were unblocked in February, 2010, the conductivity and sulphate concentrations decreased to below their local goals, but mostly remained above the pre-

dry ash placement levels. Although boron decreased since February, 2010, it remained mostly above its goal of 1.7 mg/L (Table 4). Further decreases were observed since mid-2011, during the Stage 2A period, after installation of the drains under the KVAR in October, 2010 (Figure 9).

As discussed above in Section 3.2.2, the lower concentrations in bore D5 during the Stage 2A period appear to be due to the increased ability of the low conductivity background water to enter the KVAD under the KVAR since the installation of the sub-surface drains.

The apparent lack of effects of the rainfall on bore D5 concentrations may be due to effective sealing of the KVAD capping by the dry ash placement. Evidence for this is the decrease in water level at bore D5, but no change at D6, and the lack of significant change in conductivity at bore D6 during the wet Stage 2A period, compared to the dry previous periods (Table 4). If the increased rainfall was causing additional low conductivity of the groundwater down-gradient of the KVAD, a decrease in conductivity would have also been observed at bore D6. In addition, the conductivity at the background bore D2 remained above 300 uS/cm for all the monitoring periods.

Hence, these observations and trends support the foregoing suggestion that leachates from the dry ash, if any, even with the increased rainfall, have not affected the local groundwater. The effects of wet and dry weather on the local groundwater quality and the indicated lack of dry ash leachate effects will be confirmed by ongoing monitoring.

4.4 Lidsdale Cut

Section 3.2.2 showed the KVAR Stage 2 seepage collection and diversion system was related to a decrease in conductivity in the seepage collection bores at the KVAD, which resulted in a decrease in Lidsdale Cut. Water Quality and trace metal changes in Lidsdale Cut are further investigated in this Section.

Table 5 shows water quality changes at Lidsdale Cut for the periods of pre-dry ash placement to Stage 1 and Capping, Initial Stage 2 and Stage 2A Dry Ash Placements. This information can be used to identify any links between the KVAD groundwater quality and that in the Lidsdale Cut. The changes are compared to the groundwater quality changes at bore D5 over the same periods.

Table 5: Median Lidsdale Cut Water Quality Compared to Groundwater Quality Changes at Bore WGM1/D5 during Stage 1 and Capping, Initial Stage 2 and Stage 2A Dry Ash Placement Relative to Background and Groundwater Guidelines or Goals

Element (mg/L)	KVAD & KVAR Groundwater (WGM1/D5)				Lidsdale Cut (WX5)				
	Pre-Placement (1988-2003) 90th Percentile	Stage1 &Cap Post-placement (May, 2003-March, 2010) 50th Percentile	Initial Stage 2 Post-placement (April, 2009-March, 2010) 50th Percentile	Stage 2A Post-placement (April, 2010-January, 2012) 50th Percentile	Pre-Placement (1992-2003) 90th Percentile	Stage 1 &Cap Post-placement (May, 2003-March, 2010) 50th Percentile	Initial Stage 2 Post-placement (April, 2009-March, 2010) 50th Percentile	Stage 2A Post-placement (April, 2010-January, 2012) 50th Percentile	Groundwater Guidelines# or Goals
pH	4.5	3.6	3.3	3.6	6.9	4.3	3.4	4.8	6.5 – 8.0
Cond/ (µS/cm)	810	1917	2057	1356	952	1178	1965	1011	2600^
TDS	550	1600	1800	1000	650	870	1500	740	2000
SO4	328	1100	1100	680	359	580	970	460	1000
Cl	24	18	17	15	34	18	19	21	350
As	0.008	0.001	0.001	0.001	<0.001	0.002	0.002	0.002	0.024
B	1.7	4.8	5.10	2.2	2.16	2.50	5.20	2.4	**1.7**
Cd	0.004	0.0024	0.0029	0.002	<0.001	0.0008	0.0008	0.0013	0.001
Cr	0.041	0.003	0.0019	0.001	<0.006	0.001	0.0013	0.001	0.004
Cu	0.058	0.0013	0.010	0.008	<0.005	0.003	0.003	0.004	0.005
F	0.65	1.10	1.10	0.80	1.99	3.10	6.70	2.60	1.5
Fe	14.7	4.85	14.00	1.7	0.7	0.54	3.05	0.04	**1.7**
Mn	2.5	8.55	11.0	7.5	2.12	3.70	6.30	4.10	1.9
Mo	-	0.005	0.005	0.010	-	0.005	0.010	<0.010	0.010
Ni	0.137	0.830	0.960	0.540	-	0.375	0.540	0.280	**0.137**
Pb	0.021	0.016	0.014	0.007	0.004	0.003	0.003	0.002	**0.01**
Se	0.001	<0.001	< 0.001	0.002	0.001	<0.001	0.001	0.002	0.005
Zn	0.505	1.50	1.50	1.10	0.304	0.360	1.20	0.520	**0.505**

Table 5 shows a decrease in the Lidsdale Cut median conductivity and sulphate, as well as the trace metals boron, fluoride, iron, manganese, nickel and zinc during the Stage 2A period to levels similar to those before the KVAD toe drains became blocked in April, 2007, and marginally above the baseline concentrations. There were no significant changes in concentrations of the other trace metals, including selenium which remained low.

The above mentioned Lidsdale Cut decreases during the Stage 2A period resulted in the conductivity and sulphate being lower than in the KVAD/R bore D5, as were most of the trace metals, with the exception of fluoride, which was higher than the groundwater concentration.

These observations are consistent with dilution of the water quality in the KVAD, as well as at bore D6, with inflows of low salinity and trace metals from the up-gradient background areas. The diluted groundwater is most likely collected by the KVAR sub-surface drains and directed to Lidsdale Cut, thereby causing the decreases in concentrations noted above.

Some of the Lidsdale Cut elements have concentrations higher than the local guidelines during the Stage 2A period (highlighted in blue in Table 5). As they have remained higher than the bore D5 pre-dry ash placement background concentrations, further reductions, if any to the baseline will be confirmed by ongoing monitoring.

Figure 10 shows the long-term trends for conductivity, sulphate and boron. As predicted (Aurecon, 2010), the water quality in the Cut improved as a result of the unblocking of the toe drains in February, 2010. This was expected to allow low salinity and trace metal background groundwater to flow into the Cut via the KVAD and the results of this can be seen in the control chart.

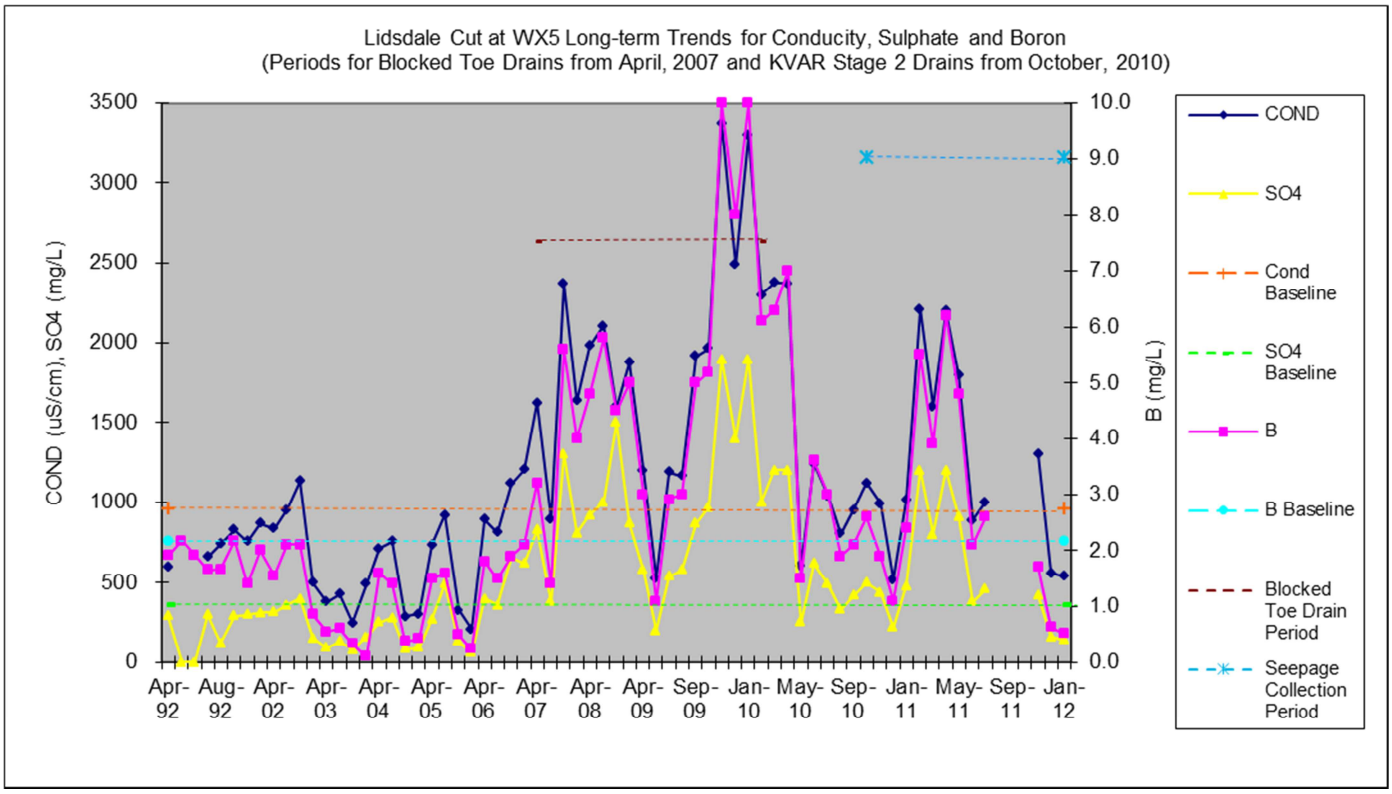

Figure 10 - Lidsdale Cut Long-term Trends in Conductivity, Sulphate and Boron Compared to the Pre-Stage I Baselines (Periods for Blocked toe drains from April, 2007 and KVAR Stage 2 Sub-surface drains from October, 2010 are shown)

A comparison of Figures 9 and 10 shows similar changes in conductivity, sulphate and boron in the Cut as in bore D5 since 1992. Although some effects of rainfall runoff into the Cut are evident, mainly during the most recent rainfall event from October to December, 2011, the variations in conductivity, sulphate and boron are similar, indicating that the water quality in the Cut is mostly determined by the toe drain inflow concentrations. As these inflows now include the KVAR sub-drains, which are intercepting KVAD groundwater, diluted by up-gradient background inflows, concentrations in the

Lidsdale Cut are expected to remain around the current levels, depending on effects of wet and dry weather. This expectation will be confirmed by future monitoring.

4.5 Sawyers Swamp Creek

Changes in the water quality and trace metals at the Sawyers Swamp Creek receiving water site (WX7) from pre-dry ash placement to the current Stage 2A dry ash placement have been examined in relation to potential effects of the conversion from wet ash storage at the SSCAD to dry ash placement at the KVAR. However, water quality and trace metals in the creek are affected by several other sources. Section 3.2.1 showed that the recent conductivity at the Sawyers Swamp Creek receiving water site (WX7) was affected by inflows from Dump Creek (WX11) due to leaching of salts by high rainfall from material placed in the catchment by mining activities in the area. In addition to Dump Creek, the water quality and trace metals in Sawyers Swamp Creek are also affected by the following inputs:

- residual seepage from the SSCAD dam wall that enters the creek (expected to be minor)
- groundwater seepage from the KVAD, as represented by groundwater bore D5, which enters the creek where it flows past the ash dam walls
- Lidsdale Cut, WX5, (with KVAD seepage and additional seepage diverted from under the KVAR area)
- recent leak at the Springvale Mine pipeline emergency discharge valve (Water quality data from 17th Feb to 7th August, 2009 is shown in Table 6 and is used to indicate the quality of the leakage water).

In addition to these inputs, the water quality at WX7 is potentially affected by leachates to the local groundwater from the Stage 1 placement (now capped) and the Stage 2A placement.

The main causes of water quality and trace metal changes at WX7 are examined in Table 6 by comparison of the periods of pre-dry ash placement, Stage 1 and Capping, Initial Stage 2 and Stage 2A Dry Ash Placements with the current WX11, the groundwater bore D5, WX5 and Springvale Mine water quality.

Table 6: Median Sawyers Swamp Creek Water Quality during Stage 1 and Capping, Initial Stage 2 and Stage 2A Dry Ash Placement Compared to Pre-placement Baseline and Creek Inputs from Lidsdale Cut, Springvale Mine Water, Dump Creek and Surface Water Guidelines

Element (mg/L)	Sawyers Swamp Creek (WX7)				Dump Creek (WX11)	KVAD/R Bore WGM1/D5	Springvale Mine Water	Lidsdale Cut (WX5)	
	Pre-placement (1991-2003) 90th Percentile	Stage 1 & Cap Post-placement (May, 2003-Mar, 2010) 50th Percentile**	Stage Initial Stage 2 Post-placement (April, 2009-Mar, 2010) 50th Percentile**	Stage 2A Post-placement (April, 2010-January, 2012) 50th Percentile	Stage 2A Post-placement (April, 2010-January, 2012) 50th Percentile	Stage 2A Post-placement (April, 2010-January, 2012) 50th Percentile	Indicative Water Quality Data ** 50th Percentile	Stage 2A Post-placement (April, 2010-January, 2012) 50th Percentile	Surface Water Guidelines# or Goals^
pH	7.6	6.4	7.9	7.3	3.3	3.6	8.4	4.8	6.5 – 8.0
Cond (µS/cm)	760	1105	1266	1100	1400	1356	1098	1011	2200
TDS	584	800	860	690	935	1000	845#	740	1500^
SO4	323	480	515	300	635	680	44	460	1000 ++
Cl	27	24	18	16	22	15	-	21	350 +
As	<0.001	0.002	0.002	0.004	<0.0005	0.001	0.008	0.002	0.024
B	2.33	2.2	2.0	1.40	2.45	2.2	0.055	2.4	**1.25**
Cd	<0.001	0.0002	0.0002	0.0007	0.0003	0.002	-	0.0013	0.0015
Cr	<0.001	0.0008	0.0008	0.0025	<0.0005	0.001	-	0.001	0.005
Cu	<0.007	0.002	0.0024	0.003	0.004	0.008	<0.01^^	0.004	0.005
F	1.1	0.90	1.00	1.7	0.85	0.80	1.28^^	2.6	1.5+++
Fe	0.507	0.03	0.02	0.02	4.2	1.7	0.19	0.04	0.3+++
Mn	0.829	0.820	0.165	1.7	5.6	7.5	0.015	4.10	1.9
Mo	-	0.005	<0.010	0.02	<0.01	0.010	-	<0.010	0.01 +
Ni	-	0.130	0.135	0.16	0.350	0.540	<0.01^^	0.280	0.050
Pb	0.003	0.002	<0.001	0.002	0.002	0.007	-	0.002	0.005
Se	0.003	<0.001	0.002	<0.002	<0.001	0.002	<0.002	<0.002	0.005
Zn	0.153	0.130	0.110	0.450	0.865	1.10	0.04	0.520	**0.153**

* DL greater than guideline **Springvale Mine affected ^applies to WX7 only ^^average #Condx0.77

** Mine emergency discharge data from Aurecon (2010) for 17th Feb to 7th Aug09

Table 6 shows a decrease in the Sawyers Swamp Creek conductivity, during the Stage 2A period, to be similar to that during the Stage 1 placement. As both WX11 and bore D5 seepage had higher conductivity (above 1400 µS/cm) than at WX7 (1100 µS/cm) during the period, the likely cause was a mixture of Lidsdale Cut and the similar mine water conductivity. There was also a decrease in sulphate at WX7, but it was reduced to be similar to the pre-Stage 1 levels. This decrease appears to be due to dilution of the creek water with the low sulphate mine water.

Changes in trace metal concentrations at WX7 caused by the mine water[2] were evident for:

- boron, diluted to less than the pre-Stage 1 levels by the low concentrations in the mine water
- fluoride, increased to be higher than during all the previous periods due to elevated concentrations in the mine water (the change was not due to inputs from Lidsdale Cut as the concentrations there decreased – see Table 5).

Although manganese showed an order of magnitude increase and zinc increased at WX7, the increases were not due to the mine water but caused by increases in Dump Creek (see Attachment 2). The increases were not due to inputs from Lidsdale Cut as the concentrations there decreased.

There was also an increase in nickel at WX7 (median from 0.160 during initial Stage 2 to 0.350 mg/L in Stage 2A), but the source was not able to be identified. The concentration of nickel in the mine water was previously reported as low (Table 6) and there were decreases for all the sources, except Dump Creek, during the Stage 2A period, including bore D5. Accordingly, seepage from the KVAD and KVAR would not have been the cause (Table 5). The increase in Dump Creek was only minor (average from 0.223 to 0.368 mg/L, Table 2, and median from 0.320 to 0.350 mg/L from initial Stage 2 to Stage 2A – see Attachment 2), so it does not appear to be the only cause of the increase. The increase was also not likely to be due to the dry ash placement because the concentration in Lidsdale Cut decreased during Stage 2A (Table 5). Hence, it is suggested that concentration changes and the source of the nickel at WX7 be investigated during the next reporting period.

Figure 11 shows the trends for conductivity, sulphate and boron at WX7 from before conversion from wet to dry ash to the current Stage 2A placement period. The concentrations initially increased before conversion, due to the effects of dry weather, and then decreased during the Stage 2A period due to prolonged wet weather that lasted from July, 2010 to summer 2011/12.

The SSCAD conductivity is super-imposed on Figure 11 and reduced by half to allow direct comparison with the WX7 conductivity on the same scale. Effects of the rainfall events of December, 2010 and November, 2011 on conductivity in the SSCAD and in Sawyers Swamp Creek are evident in the control chart. In addition, effects of the mine water discharge in 2009 and the pipeline leak in 2011 are evident as a decrease in sulphate and boron, but not conductivity, because the mine water has high conductivity as a result of its high alkalinity.

[2] Indicative water quality data for the mine water is shown in Table 6

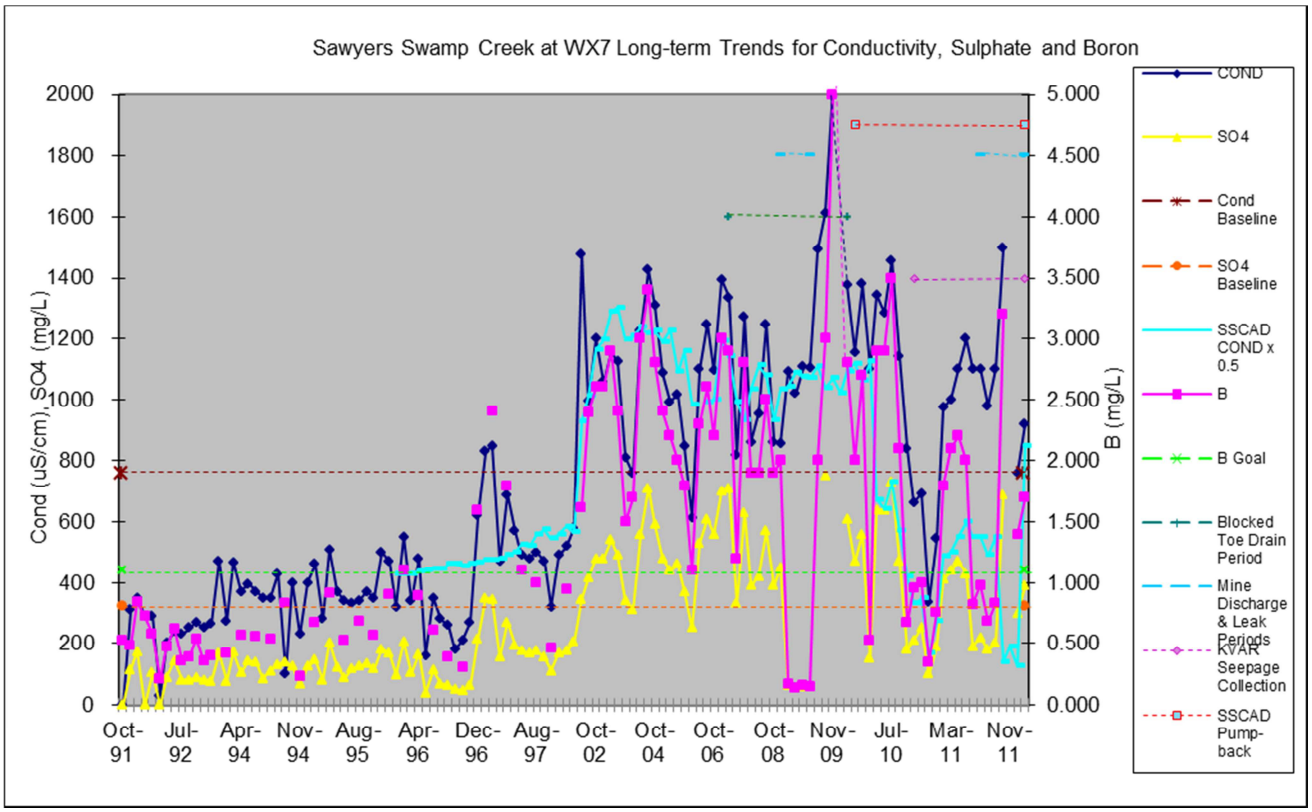

Figure 11 – Sawyers Swamp Creek Long-term trends in Conductivity, Sulphate and Boron showing effects of the Springvale Mine Discharge and compared to SSCAD Conductivity (halved) with Periods shown for the blocked KVAD toe drains, Springvale Mine water discharge and pipeline leak and beginning of the SSCAD pump-back and KVAR seepage collection and diversion to Lidsdale Cut

The WX7 creek site conductivity tended to follow that of the SSCAD pond conductivity until after installation of the pump-back system in February, 2010. Shortly after, the SSCAD conductivity decreased due to the increased rainfall and has remained relatively lower than in the creek since then.

Other than during high rainfall events, the increased rainfall did not cause the creek conductivity at WX7 to decrease in line with that in the ash dam pond. The reasons for the higher conductivity at WX7 since the pump-back system was installed are due to high conductivity input from Dump Creek, and later due to the increased flows to Lidsdale Cut from the KVAR sub-surface drains, as well as the mine water pipeline leak, that is understood to have begun in July, 2011. Hence, the apparent benefits of the pump-back system on water quality and trace metals in Sawyers Swamp Creek cannot be confirmed until the Springvale Mine pipeline emergency discharge valve leak is stopped and the rainfall returns to normal patterns.

Although no clear indication of effects on the Sawyers Swamp Creek receiving water site can be determined due to the various local inputs and climatic changes, the data from the KVAD/R seepage collection bores D5 and D6 and Lidsdale Cut indicated no detectable effects of the Stage 1 and Stage 2A dry ash placements on water quality and trace metals. Effects, if any, of the Stage 1 and Stage 2A placements on the creek receiving water site may become clearer with future monitoring.

5. Discussion

Installation of sub-surface drains in the KVAD, under the KVAR, was shown to decrease the groundwater level by about 1.5m, thereby preventing the KVAD groundwater from rising into the dry ash placement. Installation of the drains also appears to have allowed more low salinity background groundwater to flow into, and mix with, the KVAD groundwater. This reduced the conductivity and sulphate and trace metal concentrations in the KVAD seepage detection bore D5, which samples seepage flowing to Sawyers Swamp Creek.

The dry ash placement on top of the KVAD has apparently sealed the KVAD clay capping and prevented, or minimised, rainfall infiltration leachates from the dry ash entering the KVAD groundwater and adding to the seepage concentrations entering Sawyers Swamp Creek. This appeared to be the case even with the increased rainfall and indicates the benefits of the ash compaction, management and runoff controls used at the site. Sealing of the KVAD capping also suggests that the reduction in concentrations measured in bore D5 was mainly due to increased ability of the background groundwater to flow into the KVAD and that the dry ash placement has limited direct effects of rainfall groundwater recharge on the local groundwater.

Unblocking of the KVAD toe drains and diversion of the KVAD groundwater by the KVAR sub-surface drains to Lidsdale Cut, via the toe drains, also appears to have been the cause of the decreased conductivity and concentrations of sulphate and trace metals in Lidsdale Cut itself. Lidsdale Cut overflows to Sawyers Swamp Creek, so two sources of water quality and trace metal inputs to the Sawyers Swamp Creek receiving water site appear to have been improved by the installation of KVAR sub-surface drains.

An indication of the possible benefits of installation of the SSCAD seepage collection and pump-back system was that there ceased to be a direct relationship between the conductivity in the ash dam pond and that at the Sawyers Swamp Creek receiving water site. However, this is yet to be confirmed when the mine water discharge has been stopped. Although the conductivity was reduced in Lidsdale Cut, it was still higher than in the ash dam pond. By coincidence, the mine water had a similar conductivity to that in Lidsdale Cut, so the conductivity at the receiving water site was reduced to a similar level.

Although the conductivity was reduced at the Sawyers Swamp Creek receiving water site by the seepage collection and diversion systems, it was not possible to assess the benefits on the receiving water for the decreased concentrations of sulphate and trace metals due to effects of the Springvale Mine pipeline emergency discharge valve leak. The mine water caused a decrease in sulphate, but either increased or decreased concentrations of some trace metals, depending on the concentrations in the mine water.

Other than the mine water effects, Dump Creek caused increased salts and contributed to an increase in nickel concentrations at the receiving water site, due to leaching of minerals from the catchment with increased rainfall. Hence, a final assessment of effects on the Sawyers Swamp Creek receiving water site by the seepage collection and diversion systems will have to be done after the pipeline leak is repaired and when the rainfall patterns return to normal.

The decrease in conductivity, sulphate and trace metals in the KVAD and KVAR groundwater bore D5 and in Lidsdale Cut provide evidence that the Stage 1 and Stage 2A dry ash placements have not measurably affected the local groundwater or surface water quality.

Due to the various inputs to the lower reach of Sawyers Swamp Creek, an assessment of effects of the seepage collection and diversion works on the water quality in the upper Coxs River was not

possible at this time. It is suggested that this be undertaken after the pipeline leak has been repaired. The intervening period will provide an opportunity for Delta Electricity to collect more water quality data in the Coxs River, upstream and downstream of the junction with Sawyers Swamp Creek for a more definitive assessment.

6. Conclusions

The findings of this study of the seepage collection and return system and assessment of effects of the Stage 1 and Stage 2A dry ash placements on receiving waters lead to the following conclusions:

- Unblocking of the KVAD toe drains, installation of the KVAR sub-surface drains and diversion of the groundwater to Lidsdale Cut provided conditions that reduced the salinity (conductivity), sulphate and trace metals in:
    - the KVAD local groundwater seepage to Sawyers Swamp Creek
    - Lidsdale Cut itself, and
    - Potentially at the Sawyers Swamp Creek receiving water site, but this could not be confirmed due to Springvale Mine water inflows to the creek.

- High rainfall during the Stage 2A period infiltrated the ash deposit in the Sawyers Swamp Creek Ash Dam and reduced the salinity (conductivity and sulphate) but leached some trace metals from the ash into the water in the dam. Installation of the v-notch collection and pump-back system, before the increase in rainfall, showed no effects of these changes on the local groundwater and the upper Sawyers Swamp Creek

- Although there ceased to be a direct relationship between conductivity in the Sawyers Swamp Creek Ash Dam and the Sawyers Swamp Creek receiving water site after installation of the v-notch collection and pump-back system, an improvement in the water quality in Sawyers Swamp Creek conductivity could not be confirmed. It was not possible to confirm an improvement in the upper Sawyers Swamp Creek due to salinity inputs from the Springvale Mine pipeline valve. Increased concentrations in Dump Creek, due to leaching of minerals from the catchment due to the increased rainfall, prevented an assessment of benefits to the Sawyers Swamp Creek receiving water site.

- The decreases in conductivity, sulphate and trace metals in the KVAD groundwater and at Lidsdale Cut provide evidence that management of the KVAR dry ash placement effectively controls dry ash leachates from affecting the local groundwater quality. However, flow on effects to the Sawyers Swamp Creek receiving water site could not be confirmed due to the interfering effects of other, non-ash related, inputs to the creek.

7. Recommendations

From the study findings, following recommendations are made:

- Continue negotiations with Centennial Coal to have the Springvale Mine pipeline depressurised to enable repairs to the emergency valve to be effected. Following the necessary repairs, a more complete assessment of potential benefits of the seepage collection and return systems on water quality should be undertaken

- Delta Electricity to include the following Lend Lease Infrastructure (LLI) water quality sites in their routine monitoring programme in the upper Sawyers Swamp Creek, on a monthly basis, to confirm the effects of the seepage collection and diversion works:
    - The LLI site upstream of the v-notch immediately below the SSCAD spillway.
    - The LLI site in Sawyers Swamp Creek near the groundwater bore D5, which receives seepage from the KVAD and is upstream of the Lidsdale Cut inflow and the Sawyers Swamp Creek receiving water site.

- Select a new sampling site in Sawyers Swamp Creek, which is upstream of influence of the KVAD seepage and downstream of the v-notch

- Continue monthly water quality monitoring at the Delta Electricity routine groundwater and surface water monitoring sites and assess:
    - The effectiveness of the v-notch collection and pump-back system in minimising effects of seepage from the Sawyers Swamp Creek Ash Dam on salinity and trace metals in Sawyers Swamp Creek
    - The relative contributions of the KVAR seepage collection and diversion systems and rainfall conditions to improvements in the Lidsdale Cut conductivity, sulphate and trace metals
    - Changes in conductivity, sulphate and trace metals in Lidsdale Cut and the KVAD/KVAR groundwater
    - The effects, if any, of leachates from the Stage 2A dry ash repository on the local surface water quality at the Sawyers Swamp Creek receiving water site

- Investigate the source of the nickel at Sawyers Swamp Creek receiving water site during the next reporting period

- Collect additional water quality and trace metal data in the Coxs River, upstream and downstream of the junction with Sawyers Swamp Creek, for assessment of potential beneficial effects of the seepage collection and diversion works on the river.

8. References

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Attachment 1

Lithgow Rainfall Data from January, 2000 to January, 2012 (mm/month) from

Bureau of Meteorology

Year(s)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
2000	57	22.2	271.4	50.6	53.4	32.2	37.4	51.2	43	75	119.2	59	871.6
2001	105.4	90.6	89.6	84.4	28.8	9	63.2	30.8	46.4	58.8	80	26.6	713.6
2002	87.8	187	69.4	40.2	67.6	22.6	16.8	17	21.2	3	22	47.2	601.8
2003	3.6	135	41.8	38.4	54	43.2	20.6	0	18.6	82.4	121	68.8	627.4
2004	35	98.2	22.4	10.4	35.2	16.2	30.2	50.8	34.8	118.4	113.8	88.6	654
2005	102.8	104.6	55.8	28.6	14.2	117.2	59.2	24.6	87.6	116.5	159.4	48.4	918.9
2006	146.6	32.6	6.4	6.8	6.8	6.8	54.2	5.8	59.2	3.2	32.2	72.7	433.3
2007	92.6	141.4	72.1	44.6	56.6	223	24.9	65.4	9	37.8	134.7	67	969.1
2008	102	84.6	47.6	59.8	11	60.9	37.1	43.6	88.2	66.2	83.3	113.2	797.5
2009	25.2	165.8	28	74.5	80.9	44.5	35.9	48.8	63	69	23.6	81.5	740.7
2010	76.4	119.2	85.1	35.8	54.4	40.9	73.5	73.5	52.4	70.9	122.8	164.6	969.5
2011	114	57.2	77.2	41.2	51.2	72.4	24.6	58.7	78.4	46.2	168	96	885.1
2012	57.1												765.2

Attachment 2: Wallerawang Power Station Ash Dam, Surface Water and Groundwater Quality (Stage 2A Data from May, 2010 to January, 2012).
(Attachment also contains: Pre-Dry Ash Placement Summary data before April, 2003)

NOTE: Post-Dry Ash Placement Stage 1 and Initial Stage 2 Raw Data and Summary statistics are in Previous reports:

- Stage 1 Data from May, 2003 to July, 2007 in Connell Wagner, 2008
- Initial Stage 2 data from August/October, 2007 to April, 2010 in Aurecon, 2010)

Post-Dry Ash Placement Stage 2A Raw Data and Summary statistics from May, 2010 to January, 2012.

1. Water Quality Data and Summary for Sawyers Swamp Creek WX7 and Background at Dump Creek WX11
2. Water Quality Data and Summary for Lidsdale Cut WX5
3. Water Quality Data and Summary for SSCAD Groundwater Seepage Detection Bores WGM1/D3 and 1/D4
4. Water Quality Data and Summary for Background Groundwater Bore WGM1/D2
5. Water Quality Data and Summary for KVAD and KVAR Stage I and II Dry Ash Placements Seepage Detection Groundwater Bores WGM1/D5 and 1/D6
6. Water Quality Data and Summary for SSCAD Pond

1. Water Quality Data and Summary for Sawyers Swamp Creek WX7 and Background at Dump Creek WX11

a) SAWYERS SWAMP CEEK AT WOLGAN ROAD BRIDGE WX7 (mg/L)

Sawyers Swamp Creek WX7 Pre-Dry Ash Placement Summary 1991-April, 2003 (mg/L)																		
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	0.274	22	0.001	0.919	0.037		20	0.001	19	44042	0.001	0.004	0.612	0.291	0.0001	12	15
Maximum	<0.01	0.647	84	<0.05	2.900	0.045		57	<0.002	82	147800	<0.01	0.009	3.100	0.927	0.0002	36	39
Minimum	0.001	0.105	5	0.001	0.205	0.030		4	0.001	6	3000	0.001	0.001	0.110	0.050	0.0001	1	4
90th Percentile	0.001	0.4927	33	0.001	2.331	0.043		38	0.001	27	76000	0.001	0.007	1.1	0.507	0.0002	27	22

*Outliers

Continued……Sawyers Swamp Creek WX7 Pre-Dry Ash Placement Summary 1991-April, 2003 (mg/L)															
	Mn	**Mo**	**NO2+NO3**	**Na**	**NFR**	**Ni**	**Ortho P**	**Pb**	**pH**	**Se**	**SiO2**	**SO4**	**TDS**	**TOT P**	**Zn**
Average	0.635		0.061	40	21		0.006	0.002	7.0	0.002	12.2	160	308	0.017	0.099
Maximum	1.510		0.199	120	326		0.031	<0.01	9.3	<0.006	75.0	540	800	0.093	0.342
Minimum	0.153		0.009	11	2		0.001	0.001	6.1	0.001	0.1	38	20	0.001	0.004
90th Percentile	0.829		0.1158	86	23		0.013	0.003	7.6	0.003	22.4	323	584	0.047	0.153

*Outliers

Sawyers Swamp Creek WX7 Post-Stage 2A Ash Placement Data (mg/l) April, 2010 onward. (Data from August, 2007 to March, 2010 in Aurecon, 2010)																		
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
15-Apr-10	0.0005		420	0.002	0.52	0.02	0.001	18	0.0001	10	1,100	0.0005	0.002	1.500	0.05	0.000025	15	11
26-May-10	<0.001		20	<0.001	2.9	0.041		69	0.0003	27	1,344	<0.001	0.003	1.700	0.02	<0.00005	42	49
9-Jun-10	<0.001		<20	<0.001	2.9	0.04		68	0.0003	26	1,285	<0.001	0.002	0.400	0.05	<0.00005	41	48
1-Jul-10	<0.001	3.5	<20	<0.001	3.5	0.041		72	0.0004	20	1,458	<0.001	0.003	0.700	0.12	<0.00005	45	58
25-Aug-10	<0.001	2.5	40	<0.001	2.1	0.028		53	0.0003	21	1,140	<0.001	0.002	1.600	0.03	<0.00005	32	38
23-Sep-10	<0.001	0.9	220	0.002	0.67	0.022		21	<0.0002	12	838	<0.001	0.002	1.200	0.12	<0.00005	14	14
27-Oct-10	<0.001		70	<0.001	0.96	0.021		26	<0.0002	15	662	<0.001	0.001	1.200	0.01	<0.00005	17	16
19-Nov-10	<0.001		70	0.004	1	0.037		30	0.0008	15	694	0.002	0.006	1.800	0.01	<0.00005	19	19
9-Dec-10	<0.001	0.97	30	<0.001	0.35	0.05		15	<0.0002	13	336	<0.001	0.0037	0.500	0.02	<0.00005	7	9.3
12-Jan-11	<0.001	16	60	0.005	0.76	0.073		27	0.0008	16	545	0.002	0.007	1.200	0.02	<0.00005	15	15
24-Feb-11	<0.001	4.9	50	<0.001	1.8	0.047		48	0.0006	21	972	<0.001	0.002	2.100	<0.01	<0.00005	29	30
24-Mar-11	<0.001	1.2	30	<0.001	2.1	0.054		55	0.0006	25	1,000	<0.001	0.002	2.000	<0.01	<0.00005	36	32
8-Apr-11	<0.001	2.8	65	<0.001	2.2	0.063		58	0.001	24	1,100	<0.001	0.003	2.100	0.01	<0.00005	36	32
12-May-11	<0.001	53	250	0.031	2	0.16		56	0.007	26	1,200	0.005	0.015	2.600	0.02	<0.00005	39	31
10-Jun-11	<0.001	2.2	360	0.004	0.82	0.022		25	0.0006	12	1,100	<0.001	0.002	1.600	0.04	<0.00005	18	14
26-Jul-11	<0.001	2.3	360	0.002	0.98	0.016		28	0.0006	12	1,100	0.001	0.002	2.000	0.01	<0.00005	22	15
30-Aug-11	<0.001	21	360	0.009	0.68	0.051		25	0.002	12	980	0.003	0.006	2.100	<0.01	0.00005	18	13
21-Sep-11	<0.001	7.1	420	0.005	0.83	0.026		28	0.001	11	1,100	0.002	0.007	2.100	<0.01	<0.00005	21	14
26-Oct-11	0.0005		190	0.029	3.2	0.19		93	0.02	23	1,500	0.027	0.052	1.8	0.020	0.000025	58	45
15-Nov-11																		
14-Dec-11	0.0005		37	0.003	1.4	0.049		36	0.002	15	760	0.004	0.006	2	0.005	0.000025	25	18
18-Jan-12	<0.001	29	20	0.002	1.7	0.041		45	0.003	17	920	0.003	0.006	1.3	0.25	<0.00005	29	23

Continued…….Sawyers Swamp Creek WX7 Post-Stage 2A Ash Placement Data (mg/l) April, 2010 onward. (Data from August, 2007 to March, 2010 in Aurecon, 2010)															
Date	**Mn**	**Mo**	**NO2+NO3**	**Na**	**NFR**	**Ni**	**Ortho P**	**Pb**	**pH**	**Se**	**SiO2**	**SO4**	**TDS**	**TOT P**	**Zn**
15-Apr-10	0.14	0.02		220		0.04		0.0005	8.40	0.001		150	670		0.09
26-May-10	4.5	<0.01		140		0.3		0.001	6.7	<0.002		640	860.00		0.51
9-Jun-10	4.9	<0.01		130		0.33		<0.001	6.3	<0.002		640	980.00		0.56
1-Jul-10	6.5	<0.01		130		0.46		<0.001	4.1	<0.002		730	1100.00		0.82
25-Aug-10	4	<0.01		120		0.28		0.001	7.2	<0.002		470	760.00		0.5
23-Sep-10	1	<0.01		150		0.08		0.001	8.2	<0.002		180	510.00		0.14
27-Oct-10	1.4	<0.01		81		0.09		<0.001	7.6	<0.002		210	430.00		0.15
19-Nov-10	1.7	<0.01		82		0.17		0.006	7.2	<0.002		250	450.00		0.54
9-Dec-10	0.31	<0.01		37		0.04		<0.001	7.3	<0.002		99	240.00		0.09
12-Jan-11	0.09	<0.01		63		0.17		0.011	7.3	<0.002		190	390.00		0.7
24-Feb-11	2.9	<0.01		96		0.18		0.003	7.1	<0.002		410	690.00		0.36
24-Mar-11	3.4	<0.01		100		0.18		<0.001	6.8	<0.002		440	710.00		0.32
8-Apr-11	3.1	<0.01		130		0.15		0.002	7.3	<0.002		470	800.00		0.35
12-May-11	2.8	<0.01		170		0.48		0.027	7.5	0.002		430	880.00		3.1
10-Jun-11	1.2	0.02		210		0.08		0.002	8.3	<0.002		190	670.00		0.22
26-Jul-11	1.3	0.02		210		0.1		0.002	8.1	<0.002		220	690.00		0.22
30-Aug-11	0.83	0.01		190		0.11		0.005	8	<0.002		180	660.00		0.74
21-Sep-11	0.98	0.02		240		0.11		0.002	8.3	<0.002		200	770.00		0.43
26-Oct-11	3.7	190		170				0.038	6.50	0.003		690	1200		3.3*
15-Nov-11															
14-Dec-11	1.7	37		90				0.005	7.00	0.001		300	530		0.52
18-Jan-12	2.6	<0.01		100		0.16		0.002	6.4	<0.002		390	660		0.47

Sawyers Swamp Creek WX7 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																		
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0005	11	161.7	0.0082	1.59	0.052		43	0.0023	18	1006	0.0050	0.0064	1.60	0.05	0.000031	28	25.92
Maximum	0.0005	53	420.0	0.0310	3.50	0.190		93	0.0200	27	1500	0.0270	0.0520	2.60	0.25	0.000050	58	58.00
Minimum	0.0005	<10	20.0	0.0020	0.35	0.016		15	0.0001	10	336	0.0005	0.0010	0.40	0.01	0.000025	7	9.30
50th Percentile	0.0005	3	70.0	0.0040	1.40	0.041		36	0.0007	16	1100	0.0025	0.0030	1.70	0.02	0.000025	25	19.00

Continued……. Sawyers Swamp Creek WX7 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)															
	Mn	**Mo**	**NO2+NO3**	**Na**	**NFR**	**Ni**	**Ortho P**	**Pb**	**pH**	**Se**	**SiO2**	**SO4**	**TDS**	**TOT P**	**Zn**
Average	2.34	32.441		136		0.185		0.007	7.2	0.002		356	698		0.542
Maximum	6.50	190.000		240		0.480		0.038	8.4	0.003		730	1200		3.100
Minimum	0.09	0.010		37		0.040		0.001	4.1	0.001		99	240		0.090
50th Percentile	1.70	0.020		130		0.160		0.002	7.3	0.002		300	690		0.450

b) *Water Quality Data and Summary for Background at Dump Creek WX11*

Dump Creek WX11 Pre-Dry Ash Placement Background Summary 1991-April, 2003 (mg/L)																		
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	0.13	7	0.001	0.64	0.03		32	0.001	23	56732	0.001	0.002	0.539	1.36	0.0002	23	24
Maximum	0.001	0.38	16	0.001	3.30	0.05		71	0.001	83	137113	0.001	0.002	1.200	11.00	0.0002	36	42
Minimum	0.001	0.04	0	0.001	0.04	0.02		18	0.001	8	32000	0.001	0.001	0.200	0.03	0.0002	14	14
90th Percentile	0.001	0.30	15	0.001	1.45	0.05		58	0.001	39	77000	0.001	0.002	1.100	2.38	0.0002	31	35

Continued……..Dump Creek WX11 Pre-Dry Ash Placement Background Summary 1991-April, 2003 (mg/L)											
	Mn	**Mo**	**Na**	**NFR**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	0.63		76	5		0.001	6.6	0.002	209	559	0.09
Maximum	2.20		156	12		0.001	8.0	0.003	593	984	0.32
Minimum	0.09		39	2		0.001	3.6	0.001	88	362	0.00
90th Percentile	1.94		110	8		0.001	8.0	0.003	325	772	0.28

Dump Creek WX11 Post-Dry Ash Placement Data (mg/l) April, 2010 onward (Data from August, 2007 to March, 2010 in Aurecon, 2010)																		
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
15-Apr-10	0.0005		10	0.0005	2.1	0.022	0.005	51	0.0002	19	1,428	0.0005	0.005	0.800	3.5	0.000025	27	52
26-May-10	<0.001		<20	<0.001	1.9	0.02		50	0.0003	22	1,258	<0.001	0.004	0.700	3.6	<0.00005	24	50
9-Jun-10	<0.001		<20	<0.001	2.1	0.021		54	0.0023	21	1,252	<0.001	0.003	0.600	4.3	<0.00005	27	51
1-Jul-10	<0.001	1.1	<20	<0.001	2.2	0.02		49	0.0003	20	1,325	<0.001	0.005	0.700	4.3	<0.00005	22	50
25-Aug-10	<0.001	0.92	<20	<0.001	2	0.02		58	0.0003	23	1,341	<0.001	0.004	0.600	2.1	<0.00005	25	57
23-Sep-10	<0.001	1.1	<20	<0.001	2.2	0.024		67	0.0024	21	1,400	<0.001	0.008	0.800	3.9	<0.00005	28	61
27-Oct-10	<0.001		<20	<0.001	2.1	0.02		56	0.0002	20	1,302	<0.001	0.004	0.500	3.6	<0.00005	25	51
19-Nov-10	<0.001		<20	<0.001	2.5	0.022		63	<0.0002	21	1,436	<0.001	0.004	0.700	3.3	<0.00005	28	56
9-Dec-10	<0.001	0.51	<20	<0.001	1.9	0.031		65	0.0022	20	1,134	<0.001	0.0036	0.400	0.28	<0.00005	26	49
12-Jan-11	<0.001	0.61	<20	<0.001	2	0.02		54	<0.0002	20	1,164	<0.001	0.006	0.800	0.57	<0.00005	26	47
24-Feb-11	<0.001	0.99	<20	<0.001	2.7	0.027		60	<0.0002	20	1,390	<0.001	0.002	0.900	2.6	<0.00005	31	58
24-Mar-11	<0.001	0.8	<20	<0.001	2.4	0.024		55	<0.0002	20	1,200	<0.001	0.004	0.500	2.3	<0.00005	28	53
8-Apr-11	<0.001	1.4	<20	<0.001	2.9	0.03		62	0.0003	20	1,400	<0.001	0.004	0.900	4.1	<0.00005	33	60
12-May-11	<0.001	1.4	<20	<0.001	2.1	0.024		53	0.0003	22	1,300	<0.001	0.003	0.900	4.3	<0.00005	26	56
10-Jun-11	<0.001	1.2	<20	<0.001	2.6	0.022		59	0.0002	22	1,500	<0.001	0.002	0.900	5.7	<0.00005	26	59
21-Jul-11	<0.001	1.2	<20	<0.001	2.6	0.021		62	0.0003	24	1,500	<0.001	0.003	0.900	6.3	<0.00005	28	62
30-Aug-11	<0.001	1.4	<20	<0.001	2.6	0.021		67	0.0002	24	1,500	<0.001	0.005	1.000	6.4	<0.00005	29	63
21-Sep-11	<0.001	1.5	<20	<0.001	3.1	0.023		72	0.0003	25	1,700	0.001	0.012	1.100	7.3	<0.00005	33	69
26-Oct-11	0.0005		10	0.0005	2.9	0.022		72	0.0002	24	1,700	0.001	0.002	1.1	7.6	0.000025	33	72
15-Nov-11	0.0005		10	0.0005	3.4	0.024		79	0.00024	26	1,800	0.0005	0.005	1.1	6.300	0.000025	37	79
14-Dec-11	0.0005		10	0.0005	2.8	0.021		70	0.0001	25	1,500	0.0005	0.004	0.9	4.300	0.000025	31	65
18-Jan-12	<0.001	1.6	<20	<0.001	3.3	0.023		78	0.0002	25	1800	<0.001	0.015	1.1	6.3	<0.00005	38	74

Continued……..Dump Creek WX11 Post-Dry Ash Placement Data (mg/l) April, 2010 onward (Data from August, 2007 to March, 2010 in Aurecon, 2010)											
Date	**Mn**	**Mo**	**Na**	**NFR**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
15-Apr-10	5	0.005	98		0.34	0.002	3.30	0.001	610	890	0.78
26-May-10	4.5	<0.01	93		0.31	0.002	3.3	<0.002	530	690	0.8
9-Jun-10	5	<0.01	98		0.35	0.002	3.4	<0.002	580	850	0.82
1-Jul-10	4.9	<0.01	90		0.35	0.002	3.4	<0.002	600	890	0.86
25-Aug-10	4.8	<0.01	99		0.34	0.001	3.4	<0.002	570	840	0.81
23-Sep-10	5.4	<0.01	110		0.38	0.002	3.4	<0.002	630	960	0.87
27-Oct-10	5	<0.01	93		0.32	0.002	3.4	<0.002	560	870	0.72
19-Nov-10	6	<0.01	120		0.39	0.002	3.3	<0.002	670	950	0.82
9-Dec-10	4.3	<0.01	96		0.28	0.0011	4.2	<0.002	530	830	0.62
12-Jan-11	4.5	<0.01	97		0.28	0.002	3.6	<0.002	540	820	0.57
24-Feb-11	5.8	<0.01	110		0.38	<0.001	3.4	<0.002	650	970	0.76
24-Mar-11	5.3	<0.01	100		0.32	0.002	3.4	<0.002	560	810	0.68
8-Apr-11	6.1	<0.01	110		0.41	0.002	3.2	<0.002	650	970	0.97
12-May-11	4.9	<0.01	98		0.35	0.001	3.2	<0.002	570	880	1
10-Jun-11	5.9	<0.01	110		0.4	0.001	3.3	<0.002	640	920	0.99
21-Jul-11	6.2	<0.01	110		0.41	0.002	3.3	<0.002	660	950	1
30-Aug-11	6.5	<0.01	120		0.42	0.002	3.2	<0.002	700	1100	1
21-Sep-11	7.3	<0.01	130		0.49	0.002	3.2	<0.002	780	1200	1.2
26-Oct-11	7.6		120			0.002	3.10	0.001	750	1200	1.2
15-Nov-11	8.2	0.01	130			0.002	3.10	0.001	810	1300	1.3
14-Dec-11	6	0.01	110			0.009	3.20	0.001	680	1100	0.92
18-Jan-12	7.3	<0.01	140		0.48	0.002	3.1	<0.002	810	1200	1.1

Dump Creek WX11 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																		
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0005	1.1	10.0	0.0005	2.47	0.023		62	0.0006	22	1424	0.0007	0.0049	0.81	4.23	0.000025	29	58.82
Maximum	0.0005	1.6	10.0	0.0005	3.40	0.031		79	0.0024	26	1800	0.0010	0.0150	1.10	7.60	0.000025	38	79.00
Minimum	0.0005	<10	10.0	0.0005	1.90	0.020		49	0.0001	19	1134	0.0005	0.0020	0.40	0.28	0.000025	22	47.00
50th Percentile	0.0005	1.2	10.0	0.0005	2.45	0.022		61	0.0003	22	1400	0.0005	0.0040	0.85	4.20	0.000025	28	57.50

Continued…….Dump Creek WX11 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)											
	Mn	**Mo**	**Na**	**NFR**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	5.75	0.008	108		0.368	0.002	3.3	0.001	640	963	0.900
Maximum	8.20	0.010	140		0.490	0.009	4.2	0.001	810	1300	1.300
Minimum	4.30	0.005	90		0.280	0.001	3.1	0.001	530	690	0.570
50th Percentile	5.60	0.010	110		0.350	0.002	3.3	0.001	635	935	0.865

2. Water Quality Data and Summary for Lidsdale Cut WX5

Lidsdale Cut WX5 Pre-Dry Ash Placement Summary 1992-April, 2003 (mg/L)																		
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	2.43	14	0.001	1.70	0.042		28	0.001	26	74991	0.003	0.003	1.50	0.51	0.0002	39	17
Maximum	0.001	3.17	50	0.001	2.17	0.060		32	0.001	78	113402	0.010	0.005	2.20	1.00	0.0002	53	21
Minimum	0.001	0.70	1	0.001	0.54	0.030		24	0.001	15	37800	0.001	0.002	0.98	0.07	0.0002	16	8
90th Percentile	0.001	3.08	38	0.001	2.16	0.054		31	0.001	34	95200	0.006	0.005	1.99	0.70	0.0002	51	20

Continued……..Lidsdale Cut WX5 Pre-Dry Ash Placement Summary 1992- April, 2003 (mg/l)											
	Mn	**Mo**	**Na**	**NFR**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	1.41		62	7		0.003	4.7	0.001	266	518	0.219
Maximum	2.34		84	15		0.004	6.9	0.001	400	671	0.397
Minimum	0.21		31	3		0.002	3.2	0.001	92	400	0.072
90th Percentile	2.12		77	13		0.004	6.9	0.001	359	650	0.304

Lidsdale Cut WX5 Post-Dry Ash Placement Data (mg/l) April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)																		
Date	**Ag**	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
15-Apr-10	0.0005		10	0.0005	7	0.028	0.011	120	0.0007	28	2370	0.0005	0.007	5.6	3.2	0.000025	100	85
26-May-10	<0.001		<20	0.001	1.5	0.022		30	0.0002	13	603	<0.001	0.002	0.9	0.01	<0.00005	22	19
9-Jun-10	<0.001		<20	0.002	3.6	0.035		64	0.0005	21	1240	<0.001	0.003	2.4	0.18	<0.00005	53	46
1-Jul-10	<0.001	6	<20	0.003	3	0.042		57	0.0003	17	1039	0.001	0.004	2	0.03	<0.00005	43	38
25-Aug-10	<0.001	4.2	<20	0.002	1.9	0.049		44	0.0004	18	803	<0.001	0.003	1.5	0.03	<0.00005	30	29
23-Sep-10	<0.001	5.4	<20	0.002	2.1	0.051		55	0.0056	22	951	<0.001	0.004	2.4	0.03	<0.00005	36	33
27-Oct-10	<0.001		<20	0.003	2.6	0.045		62	0.0014	27	1119	0.002	0.004	3.3	0.05	<0.00005	48	35
19-Nov-10	<0.001		<20	0.002	1.9	0.05		59	0.0013	35	991	<0.001	0.003	3.1	0.04	<0.00005	42	29
9-Dec-10	<0.001	2.8	<20	0.0016	1.1	0.05		32	0.00069	12	519	<0.001	0.0025	1.6	0.01	<0.00005	19	15
12-Jan-11	<0.001	6.5	<20	0.002	2.4	0.059		68	0.0009	28	1011	<0.001	0.003	3.6	0.01	<0.00005	45	31
24-Feb-11	<0.001	22	<20	<0.001	5.5	0.048		150	0.005	11	2211	<0.001	0.004	13	0.97	<0.00005	120	62
24-Mar-11	<0.001	13	<20	0.008	3.9	0.054		110	0.005	40	1600	<0.001	0.006	6.2	0.1	<0.00005	89	49
8-Apr-11	<0.001	20	<20	0.007	6.2	0.045		140	0.005	43	2200	0.001	0.009	8.4	2.4	<0.00005	120	69
12-May-11	<0.001	16	<20	0.003	4.8	0.041		120	0.006	46	1800	<0.001	0.006	7	0.67	<0.00005	92	57
10-Jun-11	<0.001	8.1	<20	0.006	2.1	0.044		68	0.0036	17	890	0.001	0.006	2.6	0.02	<0.00005	40	23
21-Jul-11	<0.001	9.3	<20	0.002	2.6	0.044		72	0.003	28	1000	<0.001	0.005	3.7	0.04	<0.00005	51	30
30-Aug-11																		
21-Sep-11																		
26-Oct-11																		
15-Nov-11	0.0005		180	0.0005	1.7	0.041		54	0.0016	18	1,300	0.0005	0.003	2.3	0.005	0.000025	31	26
14-Dec-11	0.0005		78	0.0005	0.63	0.032		20	0.0007	13	560	0.002	0.002	1	0.100	0.000025	13	10
18-Jan-12	<0.001	2.8	91	<0.001	0.51	0.033		19	0.0004	14	540	<0.001	0.002	0.9	0.02	<0.00005	9	10

Continued…….Lidsdale Cut WX5 Post-Dry Ash Placement Data (mg/l) April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)											
Date	**Mn**	**Mo**	**Na**	**NFR**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
15-Apr-10	13	0.005	170		0.97	0.004	3.3	0.001	1200	1800	1.2
26-May-10	2.8	0.01	41		0.18	<0.001	5.4	<0.002	250	300	0.3
9-Jun-10	7	0.01	90		0.49	0.002	4	<0.002	620	930	0.61
1-Jul-10	5.5	0.01	80		0.4	0.002	5.1	<0.002	490	740	0.52
25-Aug-10	3.6	0.01	59		0.28	0.001	5.1	<0.002	330	520	0.45
23-Sep-10	4.5	0.01	72		0.33	0.001	4.9	<0.002	420	660	0.49
27-Oct-10	5	0.01	81		0.35	0.002	4.7	<0.002	500	820	0.6
19-Nov-10	3.8	0.01	72		0.24	<0.001	4.7	<0.002	440	700	0.46
9-Dec-10	2.1	0.01	36		0.14	<0.001	5.2	<0.002	220	370	0.36
12-Jan-11	4.1	0.01	79		0.28	0.002	4.6	<0.002	480	800	0.37
24-Feb-11	8.4	0.01	170		0.63	0.004	3.5	<0.002	1200	1500	1
24-Mar-11	7	0.1	130		0.5	0.003	4.3	0.005	800	1200	0.85
8-Apr-11	11	0.04	180		0.78	0.007	3.4	0.003	1200	1700	1.2
12-May-11	8.2	0.03	140		0.63	0.004	3.6	0.002	910	1500	1.2
10-Jun-11	2.8	0.15	57		0.21	0.002	5.8	0.004	380	620	0.52
21-Jul-11	3.7	0.03	77		0.28	0.001	4.8	0.002	460	730	0.59
30-Aug-11											
21-Sep-11											
26-Oct-11											
15-Nov-11	1.8	0.01	180		0.15	0.0005	7.30	0.001	420	900	0.36
14-Dec-11	0.6	0.01	81		0.05	0.0005	7.30	0.001	160	380	0.13
18-Jan-12	0.57	0.01	78		0.02	<0.001	7.6	<0.002	140	370	0.07

Lidsdale Cut WX5 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																		
	Ag	**Al**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0005	10	89.8	0.0027	2.90	0.043		71	0.0022	24	1197	0.0011	0.0041	3.76	0.42	0.000025	53	36.63
Maximum	0.0005	22	180.0	0.0080	7.00	0.059		150	0.0060	46	2370	0.0020	0.0090	13.00	3.20	0.000025	120	85.00
Minimum	0.0005	<10	10.0	0.0005	0.51	0.022		19	0.0002	11	519	0.0005	0.0020	0.90	0.01	0.000025	9	10.00
50th Percentile	0.0005	7	84.5	0.0020	2.40	0.044		62	0.0013	21	1011	0.0010	0.0040	2.60	0.04	0.000025	43	31.00

Continued……..Lidsdale Cut WX5 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)											
	Mn	**Mo**	**Na**	**NFR**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	5.02	0.026	99		0.364	0.002	5.0	0.002	559	871	0.594
Maximum	13.00	0.150	180		0.970	0.007	7.6	0.005	1200	1800	1.200
Minimum	0.57	0.005	36		0.020	0.001	3.3	0.001	140	300	0.070
50th Percentile	4.10	0.010	80		0.280	0.002	4.8	0.002	460	740	0.520

3. Water Quality Data and Summary for SSCAD Groundwater Seepage Detection Bores WGM1/D3 and 1/D4

a) Water Quality Data and Summary for WGM1/D3

WGM1/D3 Pre-Dry Ash Placement Summary 1988- April, 2003 (mg/L)																		
	Ag	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	115		0.010	0.05	0.292		18.7	0.001	64	62308	0.009	0.005	0.19	4.9	0.0004	8	20.0
Maximum	0.001	229		0.043	0.22	5.700		31.0	0.001	140	77320	0.026	0.040	0.73	21.0	0.0009	38	28.0
Minimum	0.001	8		0.001	0.005	0.080		6.3	0.001	25	34200	0.001	0.001	0.040	0.5	0.0001	1	2.0
90th Percentile	0.001	154		0.027	0.19	0.150		24.0	0.001	77	72000	0.020	0.010	0.33	9.4	0.0007	9	25.0

Continued…….. WGM1/D3 Pre-Dry Ash Placement Summary 1988- April, 2003 (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.592		69	0.080	0.008	6.0	0.001	94	349	10.0	920.2	0.061
Maximum	1.930		109	0.092	0.074	6.9	0.003	144	660	11.1	921.5	0.200
Minimum	0.080		31	0.071	0.001	4.6	0.001	20	125	8.7	919.1	0.010
90th Percentile	0.710		85	0.089	0.014	6.4	0.002	116	470	10.9	921.3	0.110

WGM1/D3 Post-Dry Ash Placement Data (mg/L) April, 2010 onward (data August, 2007 to March, 2010 in Aurecon, 2010)																				
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
16-Apr-10	0.0005	90		0.0005	0.04	0.088	0.0005	17	0.0001	100		776	0.002	0.003	0.05	0.005	0.000025	8		27
27-May-10	<0.001	110		0.002	0.03	0.107		20	0.0002	100		806	0.001	0.006	<0.1	0.02	0.00005	8		32
10-Jun-10	<0.001	80		<0.001	0.05	0.087		17	0.0002	94		698	<0.001	0.002	<0.1	<0.01	0.00005	8		26
1-Jul-10	<0.001	80	0.06	<0.001	0.03	0.079		15	0.0002	81		644	<0.001	0.002	<0.1	0.02	0.00005	7		24
26-Aug-10	<0.001	50	0.19	<0.001	0.03	0.068		13	0.0002	77		555	<0.001	0.004	<0.1	0.03	0.00005	6		20
24-Sep-10	<0.001	50	0.2	<0.001	<0.01	0.078		16	0.0002	100		636	<0.001	0.004	<0.1	0.05	0.00005	6		23
28-Oct-10	<0.001	40		<0.001	<0.01	0.105		19	0.0002	130		747	<0.001	0.002	<0.1	0.02	0.00005	7		26
19-Nov-10	<0.001	40		0.001	<0.01	0.097		18	0.0002	130		744	0.001	0.003	<0.1	0.03	0.00005	7		27
10-Dec-10	<0.001	40	0.28	0.0018	0.04	0.096		15	0.0002	110		660	<0.001	0.0038	<0.1	0.06	0.00005	7		23
13-Jan-11	<0.001	50	0.11	0.004	0.03	0.13		21	0.0002	160		872	<0.001	0.004	<0.1	0.23	0.00005	8		33
25-Feb-11	0.002	50	0.06	0.002	0.03	0.12		20	0.0002	180		940	<0.001	0.002	<0.1	0.03	0.00005	9		32
24-Mar-11	<0.001	50	0.07	0.003	0.04	0.11		19	0.0002	150		870	<0.001	0.002	<0.1	0.03	0.00005	8		31
8-Apr-11	<0.001	68	0.08	0.003	0.03	0.11		19	0.0002	150		900	<0.001	0.002	0.1	0.03	0.00005	8		30
12-May-11	<0.001	63	0.05	0.002	0.03	0.11		17	0.0002	130		840	<0.001	0.002	<0.1	0.01	0.00005	8		29
10-Jun-11	<0.001	51	0.15	0.001	0.04	0.088		15	0.0002	120		790	<0.001	0.002	<0.1	<0.01	0.00005	7		25
21-Jul-11	<0.001	69	0.07	0.002	0.01	0.078		14	0.0002	96		670	0.001	0.003	<0.1	1.1	0.00005	7		23
31-Aug-11	<0.001	39	0.13	0.001	0.01	0.12		21	0.0002	170		940	0.002	0.002	<0.1	<0.01	0.00005	8		33
22-Sep-11	<0.001	61	0.08	0.002	0.01	0.12		22	0.0002	180		1000	0.001	0.002	0.1	0.01	0.00005	9		37
26-Oct-11	0.0005	60		0.002	0.005	0.08		14	0.0001	100		680	0.002	0.002	0.05	0.6	0.000025	7		23
16-Nov-11	0.0005	64		0.002	0.005	0.076		14	0.0001	100		650	0.0005	0.002	0.05	0.71	0.000025	7		23
14-Dec-11	0.0005	50		0.0005	0.015	0.055		9.4	0.0001	67		470	0.0005	0.004	0.05	0.06	0.000025	5		15
18-Jan-12	<0.001	66	0.6	0.007	0.02	0.065		11	0.0002	60		480	0.001	0.007	0.1	7.8	0.00005	6		18

Continued…….WGM1/D3 Post-Dry Ash Placement Data (mg/L) April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
16-Apr-10	0.56	0.005	97	0.09	0.003	6.6	0.001	120	440	10.0	920.20	0.07
27-May-10	0.66	0.01	100	0.14	0.011	6.2	0.002	130	450	10	920.20	0.1
10-Jun-10	0.49	0.01	87	0.12	0.001	6.1	0.002	120	410	9.9	920.30	0.1
1-Jul-10	0.53	0.01	80	0.11	<0.001	5.9	0.002	98	390	9.9	920.30	0.1
26-Aug-10	0.34	0.01	70	0.11	0.001	6.1	0.002	79	360			0.2
24-Sep-10	0.51	0.01	75	0.13	0.001	6	0.002	84	430			0.1
28-Oct-10	0.73	0.01	91	0.12	0.001	6.1	0.002	97	460			0.1
19-Nov-10	0.74	0.01	89	0.12	<0.001	5.9	0.002	110	470	9.5	920.70	0.1
10-Dec-10	0.76	0.01	84	0.12	0.002	5.8	0.002	91	430			0.1
13-Jan-11	1.2	0.01	110	0.18	0.004	5.8	0.002	130	580	9.4	920.80	0.2
25-Feb-11	1.2	0.01	120	0.17	<0.001	6	0.002	150	590			0.2
24-Mar-11	0.76	0.01	120	0.16	0.001	5.7	0.002	140	500	9.4	920.80	0.2
8-Apr-11	1	0.01	110	0.16	0.001	6	0.002	140	540	9.5	920.70	0.2
12-May-11	0.85	0.01	110	0.13	<0.001	5.7	0.002	130	530	9.5	920.70	0.2
10-Jun-11	0.72	0.01	99	0.11	0.001	5.9	0.002	130	450	9.5	920.70	0.2
21-Jul-11	0.66	0.01	87	0.13	<0.001	5.9	0.002	98	530	6.5	923.70	0.2
31-Aug-11	0.98	0.01	120	0.15	0.002	5.7	0.002	140	540	9.5	920.70	0.2
22-Sep-11	1	0.01	130	0.17	<0.001	6	0.002	150	520	9.5	920.70	0.2
26-Oct-11	0.68	0.005	83	0.14	0.001	5.9	0.001	93	430	9.5	920.70	0.14
16-Nov-11	0.66	0.005	84	0.14	0.0005	5.9	0.001	93	450	9.4	920.80	0.14
14-Dec-11	0.44	0.005	63	0.09	0.002	5.7	0.001	66	330	9.8	920.40	0.1
18-Jan-12	0.75	0.01	64	0.16	0.002	5.9	0.002	64	370	10.6	919.60	0.08

WGM1/D3 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																		
	Ag	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0008	60	0.2	0.0022	0.03	0.094		17	0.0002	118	744	0.0012	0.0030	0.07	0.57	0.000045	7	26.36
Maximum	0.0020	110	0.6	0.0070	0.05	0.130		22	0.0002	180	1000	0.0020	0.0070	0.10	7.80	0.000050	9	37.00
Minimum	0.0005	39	0.1	0.0005	0.01	0.055		9	<0.0001	60	470	0.0005	0.0020	0.05	0.01	0.000025	5	15.00
50th Percentile	0.0005	56	0.1	0.0020	0.03	0.092		17	0.0002	105	746	0.0010	0.0020	0.05	0.03	0.000050	7	26.00

Continued…….. WGM1/D3 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.74	0.009	94	0.134	0.002	5.9	0.002	112	464	9.5	920.7	0.132
Maximum	1.20	0.010	130	0.180	0.011	6.6	0.002	150	590	10.6	923.7	0.240
Minimum	0.34	0.005	63	0.090	0.001	5.7	0.001	64	330	6.5	919.6	0.070
50th Percentile	0.73	0.010	90	0.130	0.001	5.9	0.002	115	450	9.5	920.7	0.140

b) *Water Quality Data and Summary for WGM1/D4*

WGM1/D4 Pre-Dry Ash Placement Summary 1988- April, 2003 (mg/L)																	
Date	**Ag**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	96	0.003	0.27	0.372		30.0	0.002	30	58408	0.005	0.012	0.15	54.6	0.0009	6	18.9
Maximum	0.001	282	0.012	0.61	6.700		58.0	0.004	86	98969	0.019	0.100	0.72	120.0	0.0033	46	47.0
Minimum	0.001	20.60	0.001	0.07	0.050		16.0	0.001	6.00	16100	0.001	0.001	0.001	0.1	0.0002	0	1.8
90th Percentile	0.001	168	0.006	0.49	0.330		43.8	0.003	45	72780	0.012	0.036	0.24	86.0	0.0020	7	26.8

Continued……WGM1/D4 Pre-Dry Ash Placement Summary 1988- April, 2003 (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	4.588		29	0.018	0.006	6.3	0.009	118	327	1.3	905.8	0.041
Maximum	12.000		82	0.024	0.022	7.3	0.100	350	768	1.5	906.3	0.100
Minimum	0.094		4	0.011	0.001	5.2	0.001	11	96	0.8	905.3	0.004
90th Percentile	6.500		42	0.023	0.011	6.8	0.002	201	510	1.4	906.0	0.060

WGM1/D4 Post-Dry Ash Placement Data April, 2010 onward (mg/l) (data from August, 2007 to March, 2010 in Aurecon, 2010)																			
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
16-Apr-10	0.0005	10		0.001	1.6	0.018	0.001	99	0.0001	14	1527	0.0005	0.005	0.05	27	0.000025	10		70
27-May-10	0.001	70		0.002	1.8	0.018		110	0.0002	34	1502	0.001	0.002	0.1	34	0.00005	11		75
10-Jun-10	0.001	80		0.001	1.6	0.019		97	0.0002	35	1419	0.001	0.001	0.1	35	0.00005	10		67
1-Jul-10	0.001	60	0.02	0.001	1.5	0.018		92	0.0002	34	1406	0.001	0.001	0.1	39	0.00005	10		67
26-Aug-10	0.001	20	0.01	0.001	1.1	0.018		99	0.0002	39	1397	0.001	0.001	0.1	50	0.00005	8		65
24-Sep-10	0.001	30	0.01	0.001	1.1	0.018		100	0.0002	33	1418	0.001	0.004	0.1	55	0.00005	9		65
28-Oct-10	0.001	20		0.001	1.5	0.018		100	0.0002	30	1497	0.001	0.002	0.1	43	0.00005	9		69
19-Nov-10	0.001	20		0.001	1.3	0.019		100	0.0002	34	1482	0.001	0.001	0.1	45	0.00005	10		70
10-Dec-10	0.001	50	0.07	0.001	0.43	0.048		64	0.0002	20	686	0.001	0.001	0.1	0.01	0.00005	7		26
13-Jan-11	0.001	20	0.02	0.001	1.2	0.031		100	0.0002	35	1351	0.001	0.001	0.1	43	0.00005	10		69
25-Feb-11	0.001	20	0.02	0.001	1.5	0.022		100	0.0002	31	1463	0.001	0.001	0.1	25	0.00005	10		70
24-Mar-11	0.001	26	0.01	0.001	1.6	0.021		110	0.0002	32	1500	0.001	0.001	0.1	24	0.00005	10		74
8-Apr-11	0.001	25	0.03	0.001	1.7	0.021		100	0.0002	31	1500	0.001	0.001	0.1	47	0.00005	11		70
12-May-11	0.001	46	0.02	0.001	1.7	0.02		110	0.0002	30	1500	0.001	0.001	0.1	46	0.00005	11		75
10-Jun-11	0.001	39	0.01	0.001	1.8	0.02		110	0.0002	31	1600	0.001	0.001	0.1	35	0.00005	10		75
21-Jul-11	0.001	33	0.01	0.001	1.5	0.019		100	0.0002	31	1500	0.001	0.001	0.1	55	0.00005	10		69
31-Aug-11	0.001	56	0.03	0.001	1.5	0.018		100	0.0002	33	1500	0.001	0.002	0.1	43	0.00005	10		70
22-Sep-11	0.001	25	0.02	0.001	1.5	0.017		100	0.0002	34	1500	0.001	0.002	0.1	47	0.00005	11		72
26-Oct-11	0.0005	50		0.0005	1.4	0.018		100	0.0001	32	1600	0.0005	0.0005	0.05	48	0.000025	10		73
16-Nov-11	0.0005	10		0.001	1.6	0.019		110	0.0001	34	1500	0.0005	0.002	0.05	36	0.000025	10		77
14-Dec-11	0.0005	23		0.0005	1.1	0.019		100	0.0001	37	1400	0.0005	0.0005	0.05	50	0.000025	10		62
18-Jan-12	0.001	20	0.01	0.002	1.6	0.017		110	0.0002	34	1600	0.001	0.006	0.1	29	<0.00005	11		76

Continued……WGM1/D4 Post-Dry Ash Placement Data April, 2010 onward (mg/l) (data from August, 2007 to March, 2010 in Aurecon, 2010)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
16-Apr-10	18	0.005	120	0.04	0.0005	5.6	0.001	310	1200	1.2	905.92	0.08
27-May-10	18	0.01	130	0.05	0.001	6.3	0.002	770	1200	1.2	905.92	0.09
10-Jun-10	17	0.01	120	0.04	0.001	6.2	0.002	750	1100	1.2	905.92	0.1
1-Jul-10	16	0.01	110	0.05	0.001	6.1	0.002	730	1200	1.1	906.02	0.09
26-Aug-10	14	0.01	110	0.05	0.001	5.5	0.002	680	1000			0.1
24-Sep-10	15	0.01	120	0.05	0.001	5.8	0.002	710	1200			0.09
28-Oct-10	18	0.01	120	0.05	0.001	5.9	0.002	750	1200			0.08
19-Nov-10	16	0.01	120	0.04	0.001	5.7	0.002	770	1200	1.1	906.02	0.08
10-Dec-10	4.2	0.01	43	0.01	0.001	6.2	0.002	250	500			0.05
13-Jan-11	16	0.01	110	0.05	0.001	5.1	0.002	720	1200	1.1	906.02	0.09
25-Feb-11	17	0.01	120	0.04	0.001	5.6	0.002	810	1200			0.08
24-Mar-11	18	0.01	120	0.04	0.001	5.6	0.002	790	1100	1.1	906.02	0.08
8-Apr-11	18	0.01	120	0.05	0.001	5.8	0.002		1200	1.2	905.92	0.08
12-May-11	19	0.01	130	0.05	0.001	5.9	0.002	780	1300	1.1	906.02	0.09
10-Jun-11	19	0.01	130	0.05	0.001	5.9	0.002	780	1200	1.1	906.02	0.09
21-Jul-11	18	0.01	130	0.05	0.001	5.9	0.002	770	1200	1.1	906.02	0.09
31-Aug-11	18	0.01	130	0.05	0.001	6.1	0.002	780	1200	1.1	906.02	0.08
22-Sep-11	18	0.01	130	0.04	0.001	5.8	0.002	790	1200	1.1	906.02	0.08
26-Oct-11	19	0.005	120	0.05	0.0005	6.1	0.00	770	1200	1.1	906.02	0.07
16-Nov-11	18	0.005	130	0.04	0.0005	5.5	0.00	790	1300	1.2	905.92	0.09
14-Dec-11	14	0.005	110	0.04	0.0005	5.6	0.00	680	1100	1.1	906.02	0.07
18-Jan-12	18	0.01	140	0.04	0.001	5.3	0.002	800	1400.00	1.2	905.92	0.07

WGM1/D4 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																		
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	34	0.021	0.0010	1.44	0.021		101	0.0002	32	1448	0.0009	0.0017	0.09	38.91	0.000045	10	68.45
Maximum	0.0010	80	0.070	0.0020	1.80	0.048		110	0.0002	39	1600	0.0010	0.0060	0.10	55.00	0.000050	11	77.00
Minimum	0.0005	10	0.010	0.0005	0.43	0.017		64	<0.0001	14	686	0.0005	0.0005	0.05	0.01	0.000025	7	26.00
50th Percentile	0.0010	26	0.020	0.0010	1.50	0.019		100	0.0002	33	1500	0.0010	0.0010	0.10	43.00	0.000050	10	70.00

Continued……WGM1/D4 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	16.65	0.009	119	0.044	0.001	5.8	0.002	713	1164	1.1	906.0	0.083
Maximum	19.00	0.010	140	0.050	0.001	6.3	0.002	810	1400	1.2	906.0	0.100
Minimum	4.20	0.005	43	0.010	0.001	5.1	0.001	250	500	1.1	905.9	0.050
50th Percentile	18.00	0.010	120	0.050	0.001	5.8	0.002	770	1200	1.1	906.0	0.080

4. Water Quality Data and Summary for Background Groundwater Bore WGM1/D2

WGM1/D2 Pre-Dry Ash Placement Background Summary 1988- April, 2003 (mg/L)																		
Date	**Ag**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.007	14	0.001	0.05	0.173		1.6	0.001	36	0.017	25534	0.013	0.007	0.17	1.1	0.0003	2	5.2
Maximum	0.020	138	0.002	0.30	3.000		13.0	0.001	104	0.021	44536	0.048	0.080	0.75	13.0	0.0009	5	16.0
Minimum	0.001	0.00	0.001	0.005	0.010		0.0	0.001	9.00	0.014	9720	0.001	0.001	0.001	0.03	0.0001	0	0.0
90th Percentile	0.016	24	0.001	0.10	0.114		5.0	0.001	48	0.020	31000	0.041	0.010	0.28	1.7	0.0007	4	9.0

Continued……WGM1/D2 Pre-Dry Ash Placement Background Data 1988-April, 2003 (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.301		32	0.027	0.008	4.6	0.001	45	160	5.9	914.3	0.067
Maximum	0.800		66	0.032	0.074	5.6	0.001	102	345	8.7	917.6	0.180
Minimum	0.035		11	0.023	0.001	2.9	0.001	6	10	2.7	911.5	0.012
90th Percentile	0.442		42	0.031	0.010	5.4	0.001	61	258	7.3	917.2	0.114

WGM1/D2 Post-Dry Ash Placement Data April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)																				
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
16-Apr-10	0.0005	10		0.0005	0.1	0.039	0.001	1.7	0.0001	38		419	0.0005	0.003	0.05	4	0.000025	3		13
27-May-10	<0.001	<20		<0.001	0.12	0.043		1.7	<0.0002	41		412	<0.001	0.001	<0.1	4.9	<0.00005	2		13
10-Jun-10	<0.001	<20		<0.001	0.03	0.046		1.2	<0.0002	13		308	<0.001	<0.001	<0.1	0.03	<0.00005	4		22
1-Jul-10	<0.001	<20	0.28	<0.001	0.01	0.047		1.1	<0.0002	17		315	<0.001	0.001	<0.1	0.05	<0.00005	4		21
26-Aug-10	<0.001	<20	0.36	<0.001	0.01	0.042		1.4	<0.0002	12		307	<0.001	<0.001	<0.1	0.04	<0.00005	4		25
24-Sep-10	<0.001	<20	0.33	<0.001	<0.01	0.043		1.3	<0.0002	13		312	<0.001	0.001	<0.1	0.03	<0.00005	4		25
28-Oct-10	<0.001	<20		<0.001	<0.01	0.043		1.4	<0.0002	13		312	<0.001	<0.001	<0.1	0.04	<0.00005	4		25
19-Nov-10	<0.001	<20		<0.001	<0.01	0.042		1.3	<0.0002	14		305	<0.001	0.001	<0.1	0.03	<0.00005	5		25
10-Dec-10	<0.001	<20	0.26	<0.001	0.02	0.04		1.6	<0.0002	14		309	<0.001	<0.001	<0.1	0.02	<0.00005	5		24
13-Jan-11	<0.001	<20	0.24	<0.001	0.02	0.044		1.5	<0.0002	17		298	<0.001	<0.001	<0.1	0.03	0.00008	5		26
25-Feb-11	<0.001	<20	0.29	<0.001	0.05	0.043		1.7	<0.0002	24		355	<0.001	<0.001	<0.1	0.02	<0.00005	4		21
24-Mar-11	<0.001	<20	0.32	<0.001	<0.01	0.051		1.2	<0.0002	20		310	<0.001	0.001	<0.1	0.02	<0.00005	5		22
8-Apr-11	<0.001	<20	0.2	<0.001	0.04	0.041		1.2	<0.0002	32		320	<0.001	0.001	<0.1	0.56	<0.00005	4		16
12-May-11	<0.001	<20	0.35	<0.001	0.14	0.041		2.7	<0.0002	27		490	<0.001	0.002	<0.1	2.7	<0.00005	4		23
10-Jun-11	<0.001	<20	0.3	<0.001	0.1	0.044		2.1	<0.0002	24		400	<0.001	0.002	<0.1	0.03	<0.00005	4		23
21-Jul-11	<0.001	<20	0.2	<0.001	<0.01	0.045		1.1	<0.0002	33		320	0.001	0.001	<0.1	0.04	<0.00005	3		19
31-Aug-11	<0.001	<20	0.26	<0.001	0.01	0.042		1.5	<0.0002	21		340	<0.001	<0.001	<0.1	0.07	<0.00005	4		23
22-Sep-11	<0.001	<20	0.28	<0.001	0.09	0.04		2.4	<0.0002	27		480	<0.001	0.001	<0.1	0.3	<0.00005	4		23
26-Oct-11	0.0005	10		0.0005	0.03	0.043		1.9	0.0001	24		380	0.001	0.0005	0.05	0.98	0.000025	4		23
16-Nov-11	0.0005	10		0.0005	0.09	0.042		2.9	0.0001	32		510	0.0005	0.002	0.05	0.17	0.000025	4		25
14-Dec-11	0.0005	10		0.0005	0.02	0.043		1.2	0.0001	19		300	0.0005	0.0005	0.05	0.02	0.000025	4		22
18-Jan-12	0.001	20	0.34	0.001	0.03	0.038		1.2	0.0002	26		320	0.001	0.006	0.1	0.02	0.00005	4		19

Continued……..WGM1/D2 Post-Dry Ash Placement Data April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
16-Apr-10	0.45	0.005	50	0.05	0.0005	4.4	0.001	120	260	7.2	913.00	0.09
27-May-10	0.42	<0.01	54	0.05	0.001	4.7	<0.002	110	230	7.3	912.90	0.09
10-Jun-10	0.37	<0.01	16	0.05	0.001	4.9	<0.002	110	180	6.4	913.80	0.08
1-Jul-10	0.35	<0.01	21	0.05	0.001	4.6	<0.002	100	210	6.8	913.40	0.07
26-Aug-10	0.42	<0.01	16	0.05	0.001	5	<0.002	110	200			0.08
24-Sep-10	0.45	<0.01	18	0.05	<0.001	5	<0.002	110	250			0.07
28-Oct-10	0.48	<0.01	17	0.05	<0.001	5.3	<0.002	100	210			0.07
19-Nov-10	0.47	<0.01	17	0.05	0.001	5	<0.002	110	210	5	915.20	0.08
10-Dec-10	0.51	<0.01	16	0.06	<0.001	5.2	<0.002	100	230			0.08
13-Jan-11	0.52	<0.01	19	0.05	0.001	5	<0.002	98	230	5.2	915.00	0.09
25-Feb-11	0.53	<0.01	30	0.06	<0.001	4.6	<0.002	120	240			0.09
24-Mar-11	0.43	<0.01	21	0.05	0.001	4.7	<0.002	92	190	5.9	914.30	0.07
8-Apr-11	0.4	<0.01	31	0.04	0.001	4.7	<0.002	86	200	7.6	912.60	0.07
12-May-11	0.8	<0.01	45	0.08	0.004	3.8	<0.002	160	320	7.8	912.40	0.13
10-Jun-11	0.58	<0.01	35	0.06	0.002	4.2	<0.002	130	230	7.3	912.90	0.1
21-Jul-11	0.35	<0.01	29	0.04	<0.001	4.9	<0.002	82	260	7.5	912.70	0.07
31-Aug-11	0.5	<0.01	26	0.06	0.002	4.8	<0.002	100	190	7	913.20	0.08
22-Sep-11	0.74	<0.01	44	0.08	0.002	3.8	<0.002	150	240	7.4	912.80	0.11
26-Oct-11	0.62	0.005	32	0.06	0.001	4.5	0.001	120	240	7.2	913.00	0.1
16-Nov-11	0.78	0.005	50	0.09	0.002	3.8	0.001	160	330	7.5	912.70	0.15
14-Dec-11	0.45	0.005	18	0.05	0.0005	4.7	0.001	92	210	5.5	914.70	0.07
18-Jan-12	0.40	0.01	27	0.04	0.001	4.8	0.002	91	210	7.3	912.90	0.06

WGM1/D2 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																			
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0006	12	0.3	<0.001	0.05	0.043	0.001	2	<0.0002	23		356	0.0008	0.0016	0.06	0.64	0.000038	4	21.73
Maximum	0.0010	20	0.4	<0.001	0.14	0.051	0.001	3	0.0002	41		510	0.0010	0.0060	0.10	4.90	0.000080	5	26.00
Minimum	0.0005	10	0.2	0.0005	0.01	0.038	0.001	1	0.0001	12		298	0.0005	0.0005	0.05	0.02	0.000025	2	13.00
50th Percentile	0.0005	10	0.3	0.0005	0.03	0.043	0.001	1	0.0001	23		320	0.0008	0.0010	0.05	0.04	0.000025	4	23.00

Continued……WGM1/D2 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	0.50	0.006	29	0.055	0.001	4.7	0.001	111	230	6.8	913.4	0.086
Maximum	0.80	0.010	54	0.090	0.004	5.3	0.002	160	330	7.8	915.2	0.150
Minimum	0.35	0.005	16	0.040	0.001	3.8	0.001	82	180	5.0	912.4	0.060
50th Percentile	0.46	0.005	27	0.050	0.001	4.7	0.001	110	230	7.2	913.0	0.080

5. Water Quality Data and Summary for KVAD Dry Ash Placement Area Seepage Detection Groundwater Bores WGM1/D5 and 1/D6

a) Groundwater Bore WGM1/D5

WGM1/D5 Pre-Dry Ash Placement Background Summary 1988-April, 2003 (mg/L)																		
Date	**Ag**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	18	0.004	1.29	0.166	0.006	12.4	0.002	20	0.061	701	0.017	0.019	0.41	6.9	0.0003	16	20.3
Maximum	0.001	90	0.013	2.00	1.700	0.006	23.0	0.005	90	0.075	1050	0.055	0.080	1.02	17.0	0.0007	23	34.0
Minimum	0.001	1	0.001	0.08	0.010	0.006	5.2	0.001	8	0.047	283	0.003	0.001	0.10	0.1	0.0002	7	8.0
90th Percentile	0.001	51	0.008	1.70	0.148	0.006	19.7	0.004	24	0.072	810	0.041	0.058	0.65	14.7	0.0006	19	26.0

Continued……..WGM1/D5 Pre-Dry Ash Placement Background Summary 1988-April, 2003 (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	1.630		61	0.125	0.010	3.8	0.001	259	470	4.8	899.6	0.338
Maximum	3.970		127	0.140	0.050	5.4	0.002	380	1913	8.8	902.0	2.630
Minimum	0.520		7	0.110	0.002	2.8	0.001	92	48	2.3	895.4	0.032
90th Percentile	2.500		70	0.137	0.021	4.5	0.002	328	550	8.3	901.7	0.505

WGM1/D5 Post-Dry Ash Placement Data April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)																				
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
16-Apr-10																				
27-May-10	0.001	20		0.001	0.79	0.013		21	0.0011	4		583	0.001	0.008	0.4	0.14	0.00005	14		24
10-Jun-10	0.001	20		0.003	2.8	0.035		38	0.012	10		1167	0.005	0.044	0.9	0.25	0.00005	28		63
1-Jul-10	0.001	20	38	0.003	3.7	0.038		41	0.011	13		1356	0.005	0.054	0.5	0.41	0.00005	30		76
26-Aug-10	0.001	20	23	0.001	2.2	0.029		39	0.0017	14		1432	0.001	0.005	0.4	2.6	0.00005	30		69
24-Sep-10	0.001	20	23	0.001	1.9	0.027		42	0.0018	15		1394	0.001	0.008	0.4	14	0.00005	32		73
28-Oct-10	0.001	20		0.001	2.9	0.022		40	0.0019	18		1505	0.001	0.004	0.3	6.9	0.00005	31		70
19-Nov-10	0.001	20		0.001	1.7	0.026		31	0.0016	12		1106	0.001	0.004	0.5	1.9	0.00005	22		50
10-Dec-10	0.001	20	13	0.001	0.8	0.045		22	0.0019	6		658	0.0011	0.0061	0.7	0.22	0.00005	10		25
13-Jan-11	0.001	20	18	0.001	2.3	0.029		37	0.002	18		1368	0.001	0.006	0.9	2.1	0.00005	27		63
25-Feb-11	0.001	20	23	0.001	4.6	0.028		49	0.002	27		1823	0.001	0.009	1.1	3.3	0.00005	37		87
24-Mar-11	0.001	20	19	0.001	3.7	0.033		45	0.002	20		1500	0.001	0.011	1	1.6	0.00005	30		70
8-Apr-11	0.001	20	31	0.002	4.7	0.042		49	0.0002	29		1800	0.006	0.03	1	3	0.00005	41		86
12-May-11																				
10-Jun-11	0.001	20	13	0.001	1.7	0.027		31	0.002	13		870	0.001	0.006	0.8	0.29	0.00005	17		38
21-Jul-11	0.001	20	41	0.002	3.6	0.04		51	0.015	28		1400	0.004	0.029	1	0.13	0.00005	28		75
31-Aug-11	0.001	20	15	0.001	1.9	0.026		36	0.002	18		1000	0.002	0.009	0.9	0.65	0.00005	20		45
22-Sep-11																				
26-Oct-11																				
16-Nov-11																				
14-Dec-11	0.0005	10		0.0005	1.4	0.033		31	0.002	15		900	0.0005	0.002	0.7	1.7	0.000025	16		37
18-Jan-12	0.001	20	14	0.001	1.9	0.023		38	0.00095	22		1100	0.001	0.004	0.8	28	0.00005	26		49

Continued……WGM1/D5 Post-Dry Ash Placement Data April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
16-Apr-10												
27-May-10	2.7	0.01	25	0.23	0.004	3.7	0.002	250	390	8	896.19	0.54
10-Jun-10	7.3	0.01	77	0.56	0.0036	4.2	0.002	680	1000	6.1	898.09	2.1
1-Jul-10	8.2	0.01	97	0.63	0.035	4	0.002	800	1200	7	897.19	3.3
26-Aug-10	8.4	0.01	91	0.57	0.009	3.4	0.002	690	990			1.2
24-Sep-10	8.4	0.01	100	0.59	0.007	3.7	0.002	740	1200			1.2
28-Oct-10	8.7	0.01	100	0.57	0.006	3.4	0.002	760	1100			1.1
19-Nov-10	6	0.01	67	0.42	0.005	3.4	0.002	540	780	3	901.19	0.85
10-Dec-10	3.7	0.01	35	0.35	0.0045	3.8	0.002	300	490			0.9
13-Jan-11	7.5	0.01	98	0.54	0.007	3.3	0.002	680	1000	2.9	901.29	1.1
25-Feb-11	10	0.01	140	0.67	0.009	3.2	0.002	970	1400			1.2
24-Mar-11	8.7	0.01	100	0.54	0.008	3.3	0.002	720	1100	3	901.19	0.97
8-Apr-11	11	0.01	140	0.68	0.026	3.4	0.002	960	1400	6.4	897.79	2.2
12-May-11										7.9		
10-Jun-11	5.2	0.01	45	0.33	0.024	3.7	0.002	390	590	4.1	900.09	0.67
21-Jul-11	8.8	0.01	110	0.61	0.029	4	0.002	800	1300	8	896.19	4
31-Aug-11	6.2	0.01	61	0.35	0.018	3.6	0.002	490	720	4	900.19	0.78
22-Sep-11												
26-Oct-11												
16-Nov-11												
14-Dec-11	5.1	0.005	49	0.36	0.003	3.5	0.002	410	620	3.1	901.09	0.89
18-Jan-12	6.1	0.01	77	0.4	0.002	4.2	0.002	530	850	7.2	896.99	0.63

WGM1/D5 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																			
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0010	19	22.6	0.0013	2.51	0.030		38	0.0036	17		1233	0.0020	0.0141	0.72	3.95	0.000049	26	58.82
Maximum	0.0010	20	41.0	0.0030	4.70	0.045		51	0.0150	29		1823	0.0060	0.0540	1.10	28.00	0.000050	41	87.00
Minimum	0.0005	10	13.0	0.0005	0.79	0.013		21	<0.0001	4		583	0.0005	0.0020	0.30	0.13	0.000025	10	24.00
50th Percentile	0.0010	20	21.0	0.0010	2.20	0.029		38	0.0020	15		1356	0.0010	0.0080	0.80	1.70	0.000050	28	63.00

Continued……..WGM1/D5 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	7.18	0.010	83	0.494	0.012	3.6	0.002	630	949	5.4	899.0	1.390
Maximum	11.00	0.010	140	0.680	0.035	4.2	0.002	970	1400	8.0	901.3	4.000
Minimum	2.70	0.005	25	0.230	0.002	3.2	0.002	250	390	2.9	896.2	0.540
50th Percentile	7.50	0.010	91	0.540	0.007	3.6	0.002	680	1000	6.1	899.1	1.100

b) *Groundwater Bore WGM1/D6*

WGM1/D6 Pre-Dry Ash Placement Background Summary 1988-April, 2003 (mg/L)																	
	Ag	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	27	0.003	0.78	0.184		22.3	0.002	53	94830	0.011	0.016	0.14	93.3	0.0004	7	25.4
Maximum	0.001	390	0.015	1.10	1.900		33.0	0.009	160	143000	0.032	0.260	0.65	174.2	0.0009	48	34.0
Minimum	0.001	0	0.001	0.27	0.021		14.0	0.001	23	60100	0.001	0.001	0.001	0.1	0.0001	4	17.0
90th Percentile	0.001	39	0.005	0.98	0.210		27.0	0.003	65	110000	0.020	0.021	0.28	123.0	0.0007	9	30.0

Continued……..WGM1/D6 Pre-Dry Ash Placement Background Summary 1988-April, 2003 (mg/l)												
	Mn	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
Average	4.005		45	0.117	0.007	4.5	0.016	340	603	10.8	896.2	0.107
Maximum	5.400		90	0.210	0.023	5.8	0.100	536	902	11.4	896.9	0.566
Minimum	1.390		26	0.023	0.001	1.4	0.001	190	320	10.1	895.6	0.004
90th Percentile	4.810		55	0.191	0.013	5.5	0.043	381	736	11.2	896.6	0.232

WGM1/D6 Post-Dry Ash Placement Data October, 2007 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)																				
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
16-Apr-10	0.0005	10		0.007	0.6	0.024	0.008	12	0.0004	34		1055	0.005	0.007	0.4	3.5	0.000025	8		44
27-May-10	0.001	20		0.01	0.54	0.021		5.3	0.0011	24		784	0.002	0.005	0.6	0.88	0.00005	8		52
10-Jun-10	0.001	20		0.003	0.56	0.024		2.8	0.0017	25		789	0.001	0.006	0.7	1.2	0.00005	7		53
1-Jul-10	0.001	20	5.4	0.004	0.55	0.026		3.7	0.0019	24		844	0.001	0.005	0.7	0.74	0.00005	7		59
26-Aug-10	0.001	20	6.1	0.007	0.56	0.031		7.3	0.0061	47		1176	0.002	0.011	0.7	2	0.00005	7		72
24-Sep-10	0.001	20	4.1	0.004	0.6	0.03		13	0.0024	48		1194	0.004	0.008	0.6	7.2	0.00005	7		62
28-Oct-10	0.001	20		0.001	0.75	0.027		17	0.002	46		1239	<0.001	0.005	0.3	19	0.00005	7		52
19-Nov-10	0.001	20		0.002	0.8	0.027		20	0.0009	50		1231	0.003	0.004	0.3	34	0.00005	8		54
10-Dec-10	0.001	20	3.6	0.0015	0.43	0.025		8.8	0.0012	49		958	0.0023	0.0047	0.3	1.2	0.00005	7		47
13-Jan-11	0.001	20	3.9	0.001	0.86	0.031		26	0.002	55		1378	0.001	0.006	0.3	10	0.00006	9		55
25-Feb-11	0.001	20	4.6	0.001	0.93	0.028		27	0.003	54		1433	0.001	0.006	0.3	21	0.00005	8		52
24-Mar-11	0.001	20	5	0.001	0.72	0.024		18	0.003	40		1300	0.001	0.007	0.6	4.7	0.00005	8		62
8-Apr-11	0.001	20	2.1	0.001	0.92	0.024		26	0.001	53		1300	0.002	0.004	0.2	81	0.00005	8		45
12-May-11	0.001	20	2.3	0.001	0.85	0.024		24	0.001	48		1200	0.002	0.005	0.3	71	0.00005	9		51
10-Jun-11	0.001	20	3.2	0.001	0.6	0.022		13	0.001	27		1100	0.001	0.006	0.5	3.9	0.00005	7		54
21-Jul-11	0.001	20	3.6	0.001	0.93	0.025		25	0.0007	49		1300	0.002	0.003	0.5	78	0.00005	8		60
31-Aug-11	0.001	20	3.4	0.001	0.61	0.02		17	0.0006	35		1100	0.003	0.004	0.6	9.2	0.00005	7		59
22-Sep-11	0.001	20	2.8	0.001	0.84	0.02		24	0.0004	49		1400	0.003	0.003	0.4	56	0.00005	8		61
26-Oct-11	0.0005	10		0.0005	0.69	0.021		21	0.0006	41		1200	0.003	0.002	0.4	65	0.000025	8		58
16-Nov-11	0.0005	10		0.0005	0.85	0.023		26	0.00056	51		1500	0.001	0.004	0.4	48	0.000025	8		63
14-Dec-11	0.0005	10		0.0005	0.91	0.02		26	0.0004	49		1300	0.002	0.002	0.3	61	0.000025	8		57
18-Jan-12	0.001	20	2.0	0.001	0.91	0.017		27	0.0002	50		1400	0.003	0.003	0.2	120	0.00005	8		55

Continued……..WGM1/D6 Post-Dry Ash Placement Data October, 2007 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)												
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**WL1**	**WL AHD**	**Zn**
16-Apr-10	2.1	0.005	63	0.32	0.013	3.1	0.001	350	520	10.5	896.45	0.67
27-May-10	0.8	0.01	60	0.5	0.012	3.9	0.002	330	510	10.5	896.45	1.1
10-Jun-10	0.32	0.01	59	0.51	0.012	3.8	0.002	350	540	10.2	896.75	1.5
1-Jul-10	0.42	0.01	63	0.54	0.011	3.7	0.002	360	600	10.5	896.45	2
26-Aug-10	1.1	0.01	84	0.55	0.024	3.3	0.002	430	660			1.8
24-Sep-10	2.1	0.01	79	0.44	0.017	3.2	0.002	430	720			1.2
28-Oct-10	3	0.01	69	0.35	0.016	3	0.002	440	700			0.97
19-Nov-10	3.6	0.01	77	0.32	0.011	3.1	0.002	470	710	10.4	896.55	0.84
10-Dec-10	1.3	0.01	72	0.35	0.012	3.3	0.002	320	560			0.87
13-Jan-11	4.5	0.01	83	0.3	0.019	2.9	0.002	490	740	10.3	896.65	0.83
25-Feb-11	5.4	0.01	77	0.35	0.026	2.9	0.002	530	800			0.95
24-Mar-11	3.4	0.01	84	0.4	0.022	3	0.002	480	700	10.4	896.55	1.2
8-Apr-11	5.5	0.01	74	0.24	0.008	3.2	0.002	510	840	10.6	896.35	0.65
12-May-11	5.1	0.01	83	0.29	0.01	3.5	0.002	500	890	10.4	896.55	0.71
10-Jun-11	2.5	0.01	79	0.41	0.011	3.2	0.002	430	610	10.4	896.55	1.1
21-Jul-11	5	0.01	91	0.37	0.008	3.3	0.002	560	1000	10.3	896.65	0.86
31-Aug-11	3	0.01	93	0.41	0.009	3.5	0.002	490	780	10.6	896.35	0.92
22-Sep-11	4.8	0.01	90	0.34	0.012	3.1	0.002	560	800	10.5	896.45	0.7
26-Oct-11	4.3	0.005	81	0.37	0.009	3.7	0.001	490	810	10.5	896.45	0.84
16-Nov-11	4.9	0.005	84	0.35	0.009	3	0.001	520	910	10.5	896.45	0.93
14-Dec-11	5	0.005	86	0.31	0.009	3.2	0.001	540	920	10.5	896.45	0.65
18-Jan-12	5.4	0.01	88	0.26	0.002	3.1	0.002	580	1000	10.4	896.55	0.49

WGM1/D6 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																				
	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg
Average	<0.001	18	3.7	0.0023	0.73	0.024		18	0.0015	43		1190	0.0022	0.0050	0.44	31.75	0.000046	8		55.77
Maximum	0.0010	20	6.1	0.0100	0.93	0.031		27	0.0061	55		1500	0.0050	0.0110	0.70	120.00	0.000060	9		72.00
Minimum	0.0005	10	2.0	0.0005	0.43	0.017		3	<0.0001	24		784	0.0010	0.0020	0.20	0.74	0.000025	7		44.00
50th Percentile	0.0010	20	3.6	0.0010	0.74	0.024		19	0.0010	48		1216	0.0020	0.0050	0.40	14.50	0.000050	8		55.00

Continued……..WGM1/D6 Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)												
	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
Average	3.34	0.009	78	0.376	0.013	3.3	0.002	462	742	10.4	896.5	0.990
Maximum	5.50	0.010	93	0.550	0.026	3.9	0.002	580	1000	10.6	896.8	2.000
Minimum	0.32	0.005	59	0.240	0.002	2.9	0.001	320	510	10.2	896.4	0.490
50th Percentile	3.50	0.010	80	0.350	0.012	3.2	0.002	485	730	10.5	896.5	0.895

6. Water Quality Data and Summary for SSCAD Pond

SSCAD Pre-Dry Ash Placement Background Summary 1996-April, 2003 (mg/L)																		
Date	**Ag**	**ALK**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**CrIV**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.001	18	0.016	4.7	0.128	0.009	56	0.012	18	121893	0.005		0.007	9.3	0.17	0.0002	53	11
Maximum	0.001	53	0.039	8.6	0.152	0.009	140	0.020	74	257800	0.018		0.035	14.0	0.45	0.0002	110	18
Minimum	0.001	5	0.003	2.7	0.110	0.008	33	0.006	8	86000	0.001		0.001	7.2	0.03	0.0001	35	7
90th Percentile	0.001	28.4	0.034	8.0	0.142	0.009	107	0.020	28	200360	0.013		0.016	11.4	0.29	0.0002	88	15

Continued……..SSCAD Pre-Dry Ash Placement Background Summary 1996-April, 2003 (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	1.2	0.152	137	0.129	0.002	5.4	0.151	553	858	0.426
Maximum	1.7	0.190	380	0.150	0.005	6.5	0.379	1390	2170	0.650
Minimum	0.8	0.113	46	0.108	0.001	4.7	0.029	351	215	0.100
90th Percentile	1.7	0.182	287	0.146	0.005	6.0	0.298	1029	1604	0.580

SSCAD Post-Dry Ash Placement April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)																				
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**Co**	**COND**	**Cr**	**CrIV**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Li**	**Mg**
16-Apr-10	0.0005	10		0.0005	2.1	0.07	0.001	83	0.002	40		2,247	0.0005		0.01	2.500	0.03	0.000025	49		19
26-May-10	0.001	20		0.001	2.9	0.041		69	0.0003	27		1,344	0.001		0.003	1.7	0.020	0.00005	42		49
9-Jun-10	0.001	<20		0.001	2.9	0.04		68	0.0003	26		1,285	0.001		0.002	0.4	0.050	0.00005	41		48
1-Jul-10	0.001	<20	3.5	0.001	3.5	0.041		72	0.0004	20		1,458	0.001		0.003	0.7	0.120	0.00005	45		58
25-Aug-10	0.001	40	2.5	0.001	2.1	0.028		53	0.0003	21		1,140	0.001		0.002	1.6	0.030	0.00005	32		38
23-Sep-10	0.001	220	0.9	0.002	0.67	0.022		21	0.0002	12		838	0.001		0.002	1.2	0.120	0.00005	14		14
27-Oct-10	0.001	70		0.001	0.96	0.021		26	0.0002	15		662	0.001		0.001	1.2	0.010	0.00005	17		16
19-Nov-10	0.001	70		0.004	1	0.037		30	0.0008	15		694	0.002		0.006	1.8	0.010	0.00005	19		19
9-Dec-10	0.001	30	0.97	0.001	0.35	0.05		15	0.0002	13		336	0.001		0.0037	0.5	0.020	0.00005	7		9.3
12-Jan-11	0.001	60	16	0.005	0.76	0.073		27	0.0008	16		545	0.002		0.007	1.2	0.020	0.00005	15		15
24-Feb-11	0.001	50	4.9	0.001	1.8	0.047		48	0.0006	21		972	0.001		0.002	2.1	<0.01	0.00005	29		30
24-Mar-11	0.001	30	1.2	0.001	2.1	0.054		55	0.0006	25		1,000	0.001		0.002	2	<0.01	0.00005	36		32
8-Apr-11	0.001	65	2.8	0.001	2.2	0.063		58	0.0010	24		1,100	0.001		0.003	2.1	0.010	0.00005	36		32
12-May-11	0.001	250	53	0.031	2	0.16		56	0.0070	26		1,200	0.005		0.015	2.6	0.020	0.00005	39		31
10-Jun-11	0.001	360	2.2	0.004	0.82	0.022		25	0.0006	12		1,100	0.001		0.002	1.6	0.040	0.00005	18		14
26-Jul-11	0.001	360	2.3	0.002	0.98	0.016		28	0.0006	12		1,100	0.001		0.002	2	0.010	0.00005	22		15
30-Aug-11	0.001	360	21	0.009	0.68	0.051		25	0.0020	12		980	0.003		0.006	2.1	<0.01	0.00005	18		13
21-Sep-11	0.001	420	7.1	0.005	0.83	0.026		28	0.0010	11		1,100	0.002		0.007	2.1	<0.01	0.00005	21		14
12-Oct-11	0.0005	53		0.0005	0.04	0.016		21	0.0001	9		280	0.0005		0.001	0	0.07	0.000025	5		12
10-Nov-11	0.0005	80		0.0005	0.04	0.018		30	0.0001	11		380	0.0005		0.0005	0	0.06	0.000025	5		18
8-Dec-11	0.0005	59		0.0005	0.005	0.014		19	0.0001	7		250	0.0005		0.001	0	0.16	0.000025	4		11
18-Jan-12	<0.001	20	2.6	0.001	1.8	0.079		70	0.003	27		1700	0.001		0.021	2.1	0.09	0.00005	40		15

Continued……..SSCAD Post-Dry Ash Placement April, 2010 onward (data from August, 2007 to March, 2010 in Aurecon, 2010)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
16-Apr-10	0.89	0.03	370	0.03	0.0005	4.50	0.003	1000	1600	0.08
26-May-10	4.5	0.01	140	0.3	0.001	6.7	0.002	640	860	0.51
9-Jun-10	4.9	0.01	130	0.33	<0.001	6.3	0.002	640	980	0.56
1-Jul-10	6.5	0.01	130	0.46	<0.001	4.1	0.002	730	1100	0.82
25-Aug-10	4	0.01	120	0.28	0.001	7.2	0.002	470	760	0.5
23-Sep-10	1	0.01	150	0.08	0.001	8.2	0.002	180	510	0.14
27-Oct-10	1.4	0.01	81	0.09	<0.001	7.6	0.002	210	430	0.15
19-Nov-10	1.7	0.01	82	0.17	0.006	7.2	0.002	250	450	0.54
9-Dec-10	0.31	0.01	37	0.04	<0.001	7.3	0.002	99	240	0.09
12-Jan-11	0.09	0.01	63	0.17	0.011	7.3	0.002	190	390	0.7
24-Feb-11	2.9	0.01	96	0.18	0.003	7.1	0.002	410	690	0.36
24-Mar-11	3.4	0.01	100	0.18	<0.001	6.8	0.002	440	710	0.32
8-Apr-11	3.1	0.01	130	0.15	0.002	7.3	0.002	470	800	0.35
12-May-11	2.8	0.01	170	0.48	0.027	7.5	0.002	430	880	
10-Jun-11	1.2	0.02	210	0.08	0.002	8.3	0.002	190	670	0.22
26-Jul-11	1.3	0.02	210	0.1	0.002	8.1	0.002	220	690	0.22
30-Aug-11	0.83	0.01	190	0.11	0.005	8	0.002	180	660	0.74
21-Sep-11	0.98	0.02	240	0.11	0.002	8.3	0.002	200	770	0.43
12-Oct-11	0.130	0.005	20	0.005	0.0005	7.6	0.001	67		0.02
10-Nov-11	0.086	0.005	24	0.005	0.0005	7.9	0.001	82		0.02
8-Dec-11	0.250	0.005	14	0.005	0.0005	7.5	0.001	49		0.02
18-Jan-12	0.96	0.02	280	0.05	<0.001	5	0.014	800	1300	0.16

SSCAD Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)																			
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**CrIV**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	0.0009	131	8.6	0.0034	1.39	0.045		42	0.0010	18	987	0.0013		0.0046	1.46	0.05	0.000045	25	23.74
Maximum	0.0010	420	53.0	0.0310	3.50	0.160		83	0.0070	40	2247	0.0050		0.0210	2.60	0.16	0.000050	49	58.00
Minimum	0.0005	<10	0.9	0.0005	0.01	0.014		15	0.0001	7	250	0.0005		0.0005	0.20	0.01	0.000025	4	9.30
50th Percentile	0.0010	63	2.7	0.0010	0.99	0.041		30	0.0006	16	1050	0.0010		0.0025	1.65	0.03	0.000050	22	17.00

Continued……..SSCAD Post-Stage 2A Dry Ash Placement April, 2010 onward (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	1.96	0.012	136	0.155	0.004	7.1	0.002	361	763	0.331
Maximum	6.50	0.030	370	0.480	0.027	8.3	0.014	1000	1600	0.820
Minimum	0.09	0.005	14	0.005	0.001	4.1	0.001	49	240	0.020
50th Percentile	1.25	0.010	130	0.110	0.002	7.3	0.002	235	710	0.320

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Appendix G – Air Quality Assessment Reports:

G1 = 2009 – 2010 Report

G2 = 2010 – 2012 Report

Kerosene Vale Ash Repository Stage 2– Air Quality Review

April 2009 – March 2010

Prepared for

Delta Electricity

by

Malfroy Environmental Strategies Pty Ltd.

Drafted June, 2010

Finalised June, 2012

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SUMMARY

In 2002, Delta Electricity obtained approval for conversion of the wet slurry ash placement process at Wallerawang Power Station to dry ash. The dry ash repository was established at the Kerosene Vale open cut coal mine void site, on top of the original wet ash dam, Kerosene Vale Ash Dam (KVAD). When the KVAD was full of ash, wet ash placement was directed to the Sawyers Swamp Creek Ash Dam (SSCAD) from 1980, and ultimately the KVAD was capped with clay so dry ash placement could be undertaken.

The dry ash placement is called the Kerosene Vale Ash Repository (KVAR). Stage 1 of the placement was completed and capped in February 2009. Approval was obtained for further placement in the Stage 2 Area at the KVAR in November, 2008 with placement in the Stage 2 area commencing in April, 2009.

Stage 2 of KVAR (KVAR2) was subject to assessment under Part 3A of the Environmental Planning and Assessment Act 1979 and as required by the Approval Conditions, Delta Electricity prepared an Operation Environmental Management Plan (OEMP) prior to the commencement of KVAR2. The OEMP includes an Air Quality Management Plan, which includes monitoring and reporting requirements.

Malfroy Environmental Strategies Pty Ltd (M_E_S) has been engaged by Delta Electricity to review the air quality monitoring data collected during the first year of KVAR2 operations and to report on the results against the requirements of the OEMP.

Conclusions and recommendations arising from the review of the air quality monitoring data collected during the first year of KVAR2 operations appear below. In undertaking this data review some comments and observations are made on the operation of the air quality management plan.

1. The highest monthly dust deposition results in 2009 – 2010 were significantly influenced by huge regional dust events which swept across eastern Australia.

2. Care must be exercised in attempting to relate dust deposition results to potential dust sources. The contributing source, or sources, to an elevated result may be difficult to determine.

3. A number of gauges in the OEMP network are poorly located for the purpose of identifying impacts from KVAR2 and as such the OEMP dust gauge monitoring network should be reviewed.

4. The two, as yet to be installed, OEMP dust gauges in the residential area to the immediate west of KVAR2 will be of more relevance and use in identifying KVAR2 impacts than the more distant gauges, such as 27 and 28, and should be installed as soon as possible.

5. Consideration could be given to installing directional dust gauges, as well as standard dust gauges, to provide additional information regarding potential dust sources.

6. The dust gauge data from the first year of KVAR2 operations do not indicate that KVAR2 operations have resulted in dust deposition above the OEMP levels that trigger the requirement to implement additional control measures.

7. The OEMP requirement that: *If the 4 g/m^2/month limit is exceeded by more than 2 g/m^2/month a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken*, should be amended to require an assessment of the likely contribution of KVAR2 operations to the dust deposition levels prior to undertaking a review of the control measures.

8. No complaints regarding dust emissions from KVAR2 were received by either Delta Electricity or BBS during the first year of KVAR2 operations.

9. It is not possible with the data available to make any comment regarding the OEMP objective of *zero visible dust events in vicinity of KVAR2 operations*, although the camera installed at KVAR2 might be used in the future to assess performance against this objective.

10. Qualitative visual observations of collected dust samples provide support for the proposition that dust emissions from KVAR2 did not contribute adversely to measured deposition results in 2009 – 2010. Further support for this conclusion could be provided by the use of microscopic examination of a number of collected samples.

11. Interpretation of the dust gauge data might also be assisted by the installation of an anemometer at KVAR2.

12. The installation of a camera provides an excellent addition to the KVAR2 monitoring network and the images could be very useful in assessing potential impacts from KVAR2. It is suggested that the images collected to date be reviewed to ensure that they are suitable for the above purposes, should the need arise in the future.

1. INTRODUCTION

In 2002, Delta Electricity obtained approval for conversion of the wet slurry ash placement process at Wallerawang Power Station to dry ash. The dry ash repository was established at the Kerosene Vale open cut coal mine void site, on top of the original wet ash dam, Kerosene Vale Ash Dam (KVAD). When the KVAD was full of ash, wet ash placement was directed to the Sawyers Swamp Creek Ash Dam (SSCAD) from 1980, and ultimately the KVAD was capped with clay so dry ash placement could be undertaken.

The dry placement is called the Kerosene Vale Ash Repository (KVAR). Stage 1 of the placement was completed and capped in February 2009. Approval was obtained for further placement in the Stage 2 Area at the KVAR in November, 2008 with placement in the Stage 2 area commencing in April, 2009. The locations of the various ash dams and repositories are shown in **Figure 1**.

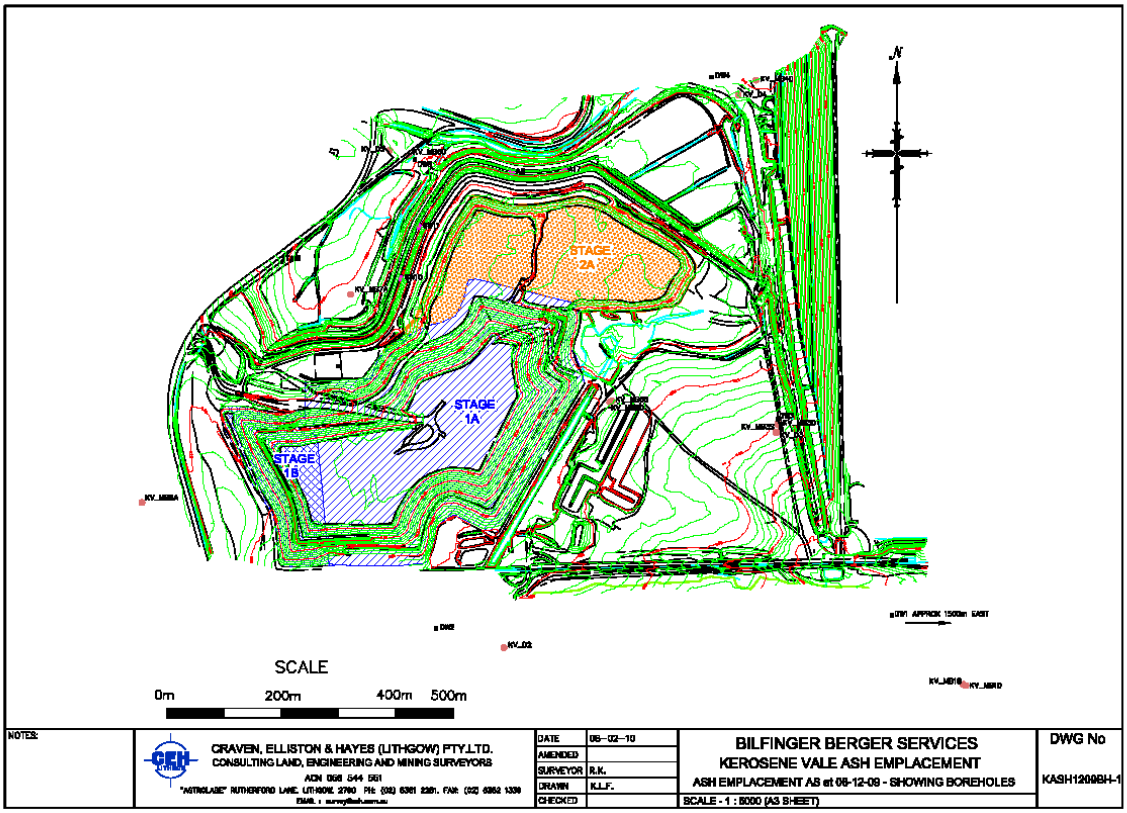


Figure 1: The location of Stage 1 and Stage 2 operations in the Kerosene Vale Ash Repository.

Stage 2 of KVAR (KVAR2) was subject to assessment under Part 3A of the Environmental Planning and Assessment Act 1979 and as required by the Approval Conditions, Delta Electricity prepared an Operation Environmental Management Plan (OEMP) prior to the commencement of KVAR2. The OEMP includes an Air Quality Management Plan, which includes monitoring and reporting requirements.

Malfroy Environmental Strategies Pty Ltd (M_E_S) has been engaged by Delta Electricity to review the air quality monitoring data collected during the first year of KVAR2 operations and to report on the results against the requirements of the OEMP. In undertaking this data review, some comments and observations are made on the operation of the air quality management plan.

2. The KVAR2 AIR QUALITY MANAGEMENT PLAN

The key objective of the KVAR2 air quality management plan is "*to manage resources effectively to ensure the prevention of conditions that may lead to visible dust emissions."* (PB 2009, p. 77)

The air quality management plan includes the following performance measures.

Targets:

- The local air quality in the vicinity of the KVAR is not impacted by Stage 2 operations;
- Zero incidence of dust-related complaints

Indicators:

- Zero visible dust events in vicinity of Kerosene Vale Ash Repository during Stage 2 operations
- Complaints register demonstrating zero occurrence of dust related complaints.

The Plan states that "*Through the use of dust suppression equipment and the implementation of air quality management procedures, dust events can be controlled*." (PB, 2009 p. 77)

The detailed list of management and mitigation measures in the Plan is included in **Appendix 1.** These measures are monitored by Delta's Ash Placement Contractor, Bilfinger Berger Services (BBS), and are reported at BBSs Monthly Contract Review Meetings. The measures include:

- Moisture conditioning of ash;
- Covering of ash loads in trucks;
- Wheel and undercarriage washes;
- Temporary capping of ash faces not currently in use and where irrigation systems are not in operation;
- Routine maintenance of truck washes, and washout/surface drainage pits;
- Routine washing of private haul roads within KVAR2;
- Use of water cart, as required;
- Dedicated sprinkler system;

2.1 Air quality monitoring

The air quality management plan includes the following monitoring requirements (PB, 2009):

- *A total of 7 deposition gauges shall be used to monitor dust emissions at the perimeter of the ash repository area, and at key locations adjacent to residential properties and Wallerawang Power Station. This includes the existing 5 dust deposition gauges and the installation of an additional 2 dust deposition gauges*

Note: The positioning of the additional 2 gauges has been reviewed by specialist consultants based on a review of local weather patterns and the sensitivity of surrounding properties and will be subject to landowner approval.

- *Samples shall be removed from the dust deposition gauges on a monthly basis by a NATA approved laboratory and assessed for compliance with the appropriate air quality criteria.*

- *The DECC amenity-based criteria for dust fallout is a maximum total dust deposition of 4 g/m²/month (annual). The Stage 2 operations shall aim to achieve compliance with this limit.*

- *If the 4 g/m²/month limit is exceeded by more than 2 g/m², a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken including:*

    - *increased application rates of the irrigation system at the ash working face*
    - *increased application rates of water on haul roads, particularly during high wind events*
    - *further reduction in the ash face working area below1.5 hectares*
    - *increased implementation of temporary capping such as PVA, lignosulphate or tar where un-worked ash faces still exist*
    - *the application of higher ash moisture rates through the silo humidifier*

2.2 Reporting

The air quality management plan includes the following reporting requirements (PB, 2009):

- *Delta Electricity shall issue a report to the DECC every 12 months from commencement of operations. The report shall contain the location, frequency, rationale and the procedures and protocols for collecting air quality samples as well as the parameters analysed and methods of analysis.*

- *The results and analysis of the monitoring data shall also be included and assessed against the air quality criteria (4 g/m²/month) and the baseline data provided in Table D of Appendix C. In the case of exceedences; the response taken must be documented within the report. Any deviations from the proposed monitoring program must also be justified.*

- *The Annual Environmental Management Report will be submitted to the Director-General complete with air quality monitoring data gathered throughout the year.*

This report explicitly addresses the above monitoring and reporting requirements.

3. THE MONITORING PROGRAM

3.1 OEMP dust gauges locations

The locations of the 5 existing dust gauges specified in the OEMP are shown in **Figure 2**.

The approximate distances of the existing gauges from the nearest KVAR2 boundary are shown in **Table 1**. With the exception Gauge 29, all other gauges are well beyond the perimeter of KVAR2 and from **Figure 2** it can be seen that, in some cases the gauges are nearby other potential dust sources, such as disturbed areas, mining activity and other power station operations.

Table 1: Existing dust gauges – distances from KVAR2

Gauge number	Approximate distance (m) from KVAR2
5	1,000
27	1,300
28	1,500
29	50
30	1,000

The OEMP specifies the installation of 2 new dust gauges in the residential area of Lidsdale approximately 200 and 600 metres to the west and south-west of KVAR2. Delta Electricity has indicated that installation of these gauges is scheduled to be undertaken by the end of 2010.

3.2 KVAR2 on-site gauges

In addition to the gauges included in the OEMP, BBS, maintain a network of 8 dust gauges located on the perimeter of KVAR2, inside the working-area of KVAR2 and one additional gauge at the silo at Wallerawang Power Station where ash is conditioned and transferred to truck for transport to KVAR2. The locations of these gauges are shown in **Figure 3**.

These gauges are primarily used for Workplace Health and Safety monitoring, and inclusion of these results is not a project Approval Condition or a requirement of the OEMP, however these data are considered in this report to provide a more comprehensive assessment of potential dust impacts from KVAR2.

Figure 2: The location of the 5 OEMP dust gauges

Figure 3: Location of dust gauges operated in and on the perimeter of KVAR2 operated by the site contractors. Note that DM9 is located at the ash silo about 1,500m to the south-west at Wallerawang Power Station.

3.3 Other Delta Electricity dust gauges

The existing dust gauges shown in **Figure 2** and **Table 1** form part of a broader regional network operated by Delta Electricity for several decades. The current Delta Electricity dust gauge network is shown in **Appendix 2** and data from the network are considered in this report.

3.4 Anemometer

There are plans to install an anemometer on-site at KVAR2 but until this occurs BBS has made use of wind data collected at the Mt Piper ash disposal area about 7 km to the north-west of KVAR2. The anemometer at this site is located on a 2 metre stand.

3.5 Frequency and methods

Table 2 presents details regarding the installation and operation of the dust monitoring network equipment.

The Delta Electricity and BBS gauges are maintained by, and samples analysed by, ACIRL Ltd who have NATA accreditation for the relevant Australian Standard.

Table 2: Frequency of Measurements and Monitoring Methods

Parameter	*Frequency of measurement*	*NSW Approved Method (AM)and Australian Standard (AS)*
Dust gauges	Monthly	• AM-1 Guide for the siting of sampling units (AS 2922 – 1987) • AM-19 Particulates – deposited matter – gravimetric method (AS 3580.10.1 1991)

The collected samples are analysed in the laboratory according to AS 3580 for:

- Insoluble solids: this is the matter that does not dissolve in water.
- Incombustible (ash)[1] content: this is the matter that remains after the sample has been combusted in the laboratory.

Results for insoluble solids and incombustible material are expressed as g/m^2/month.

The incombustible (ash) content provides an indication of the mineral content of the sample. The mineral content may be attributable to industry, but may also be attributable to other sources such as agriculture, unsealed roads and "natural" windblown dust.

Dust gauge data, including the ash and combustible fractions can provide information on possible sources of the dust but due to the time-scale over which data are collected (monthly) and the fact that many disparate sources can contribute to deposited dust, it is often not possible to use dust gauge data to positively identify the contributing sources.

4. RESULTS

Data are presented for the first year of ash placement in KVAR2, commencing in April 2009.

4.1 OEMP gauges

Table 3 presents the monthly dust deposition results for the 5 OEMP gauges for which data are available for the first year of operation of KVAR2. During late September 2009 and particularly on the 23rd and 26th much of eastern Australia experienced severe dust storms and the impact of these storms are evident in the September and October[2] dust gauge data for the Western Coalfields area. The dust storm impact is evident in **Table 3** which includes annual averages with all data included and with the September and October data excluded. For some gauges, the very high deposition rates in September and October increased the annual average by more than a factor of 2.

[1] Ash content does not refer to coal ash but could include ash from coal combustion and other mineral matter derived from soil, for example.

[2] The dust gauges were serviced on the 25th September, so the event of the 26th of September is included in the October dust gauge data.

Table 3: Dust gauge data from the OEMP gauges for the first year of KVAR2 operations (April 2009 – March 2010

Insol – Insoluble solids, g/m^2/month, **Ash** – Incombustible material, g/m^2/month; **Frac**. – Ash fraction of insoluble solids.

Gauge / Month	5			27			28			29			30		
	Insol.	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**
April	0.3	0.1	0.3	3.3	2.6	0.8	2.1	1.6	0.8	2.2	1.8	0.8	0.6	0.2	0.3
May	1.1	0.8	0.7	2.5	1.4	0.6	1.9	1.3	0.7	2.6	1.9	0.7	0.6	0.2	0.3
June	0.5	0.2	0.4	6.4	2.7	0.4	1.3	0.9	0.7	2.2	1.5	0.7	< 0.1	< 0.1	1.0
July	0.4	0.2	0.5	9.6	7.2	0.7	1.0	0.6	0.6	3.4	2.7	0.8	0.2	0.2	1.0
August	0.1	< 0.1	1.0	12.9	10.0	0.8	2.0	1.2	0.6	3.8	2.6	0.7	1.1	0.5	0.4
September	24.4	21.0	0.9	48.2	30.7	0.6	20.7	17.6	0.9	14.7	12.4	0.8	16.2	13.7	0.8
October	7.6	6.2	0.8	20.9	12.8	0.6	9.4	7.8	0.8	8.1	6.7	0.8	6.8	5.6	0.82
November	1.1	0.7	0.6	32.3	12.3	0.4	2.8	2.0	0.7	3.8	3.0	0.8	2.4	1.2	0.50
December	7.3 #	2.1	0.3	24.2	5.4	0.2	4.1	3.0	0.7	3.8	2.9	0.8	2.6	1.9	0.73
January	3.0	1.4	0.5	5.9	2.4	0.4	3.4	1.8	0.5	1.7	1.1	0.6	1.2	0.4	0.3
February	0.2	< 0.1	0.5	3.3	1.3	0.4	5.5	4.5	0.8	1.9	1.2	0.6	0.7	0.3	0.4
March	0.2	< 0.1	0.5	3.0	1.1	0.4	1.5	0.5	0.3	1.4	0.9	0.6	0.3	< 0.1	0.3
Average (1)	**3.9 (1.4)**	**2.8 (0.6)**	**0.6 (0.5)**	**14.4 (10.3)**	**7.5 (4.6)**	**0.5 (0.5)**	**4.6 (2.6)**	**3.6 (1.7)**	**0.7 (0.7)**	**4.1 (2.7)**	**3.2 (2.0)**	**0.7 (0.7)**	**2.7 (1.0)**	**2.0 (0.5)**	**0.6 (0.5)**
Months > 4 (1)	3 (1)	2 (0)	-	8 (6)	6 (4)	-	4 (2)	3 (1)	-	2 (0)	2 (0)	-	2 (0)	2 (0)	-
Months > 6 (1)	3(1)	2 (0)	-	7 (5)	5 (3)	-	2 (0)	2 (0)	-	2 (0)	2 (0)	-	2 (0)	2 (0)	-

1. Averages and months in brackets exclude September and October 2009 data.

bird droppings in gauge

With the September and October dust storm data excluded, only Gauge 27 recorded an annual average deposition rate exceeding the criterion of 4 (and 6) g/m^2/month. From **Table 1** and **Figure 2** it can be seen that Gauge 27 is located about 1,500 metres from KVAR2, on Wallerawang Power Station land and in close proximity to a live coal storage area and adjacent to a public road. Results from Gauge 27 are the highest of all gauges in most months (and often much higher) and tend to significantly elevate the monthly average of the 5 OEMP gauges (**Table 5**).

In contrast Gauge 29 is the closest of the OEMP gauges to KVAR2 and its annual average (excluding September and October data) was 2.7 g/m^2/month and with an "ash" fraction of 0.7. With September and October data excluded, no months at Gauge 29 recorded deposition above 4 g/m^2/month.

Figure 4 shows the annual average deposition rates of the incombustible ("ash") component of the deposited dust at the 5 OEMP gauges over 4 calendar years. The "ash" component is plotted on the basis that if emissions from KVAR2 were impacting in the local area, these impacts would appear as increased deposition of incombustible (ash) material. As would be expected results show year-to-year variation and in 2009 – 2010, the first year of KVAR2 operation, 2 of the 5 OEMP gauges (27 and 28) recorded the highest deposition over the 4 year period. Due to the relative distance of Gauges 27 and 28 from KVAR2 (**Table 1, Figure 2**), it is unlikely that the ash repository is the source of the elevated readings. This is further confirmed by the fact that deposition rates at the nearest OEMP gauge to KVAR2 (Gauge 29) did not increase during the first year of operation when deposition was the equal lowest of the four years.

Figure 5 shows similar results for the group of 15 "other" Delta Electricity gauges. In this case 5 of the 15 gauges (2, 9, 22, 23, and 24) recorded the highest deposition rate in 2009 for the 4 year period while a similar number recorded the lowest deposition rate in 2009 for the 4 year period.

Gauge 25 which recorded the highest deposition rates of all gauges in all years is notable as it is located within about 100m of KVAR2 and adjacent to the Wallerawang coal haul road. Vehicle generated dust from this road (due to re-suspension of fugitive ash particles) would appear to be the source of the high deposition rates at this gauge relative to the other gauges in the network.

4.2 KVAR2 gauges

The OEMP does not require that results from the on-site BBS on-site gauges be included in the annual report. The results for the first year are included in **Table 4** for completeness and also to demonstrate that gauges located at the perimeter of KVAR and to the west of the site (1, 4 and 7) nearer residential areas, recorded annual average deposition rates below 4 g/m^2/month (as an annual average and with September data excluded). Excluding September data, only two monthly results from these gauges exceeded 6 g/m^2/month.

Gauge 9 is located adjacent to the ash loading silo at Wallerawang Power Station and it would appear to be influenced by the ash operations, as indicated by the high average ash fraction of 0.8 compared with the other sites, which despite being located on or adjacent to the ash placement area are influenced by other dust sources which have a lower incombustible (ash) fraction.

With September data excluded on the basis of being significantly affected by regional dust storms, Gauges 2, 3, 5 and 8 recorded annual deposition rates equal to or exceeding 6 g/m^2/month. **Figure 2** shows that with the exception of Gauge 2 these gauges are located well inside the perimeter of KVAR2.

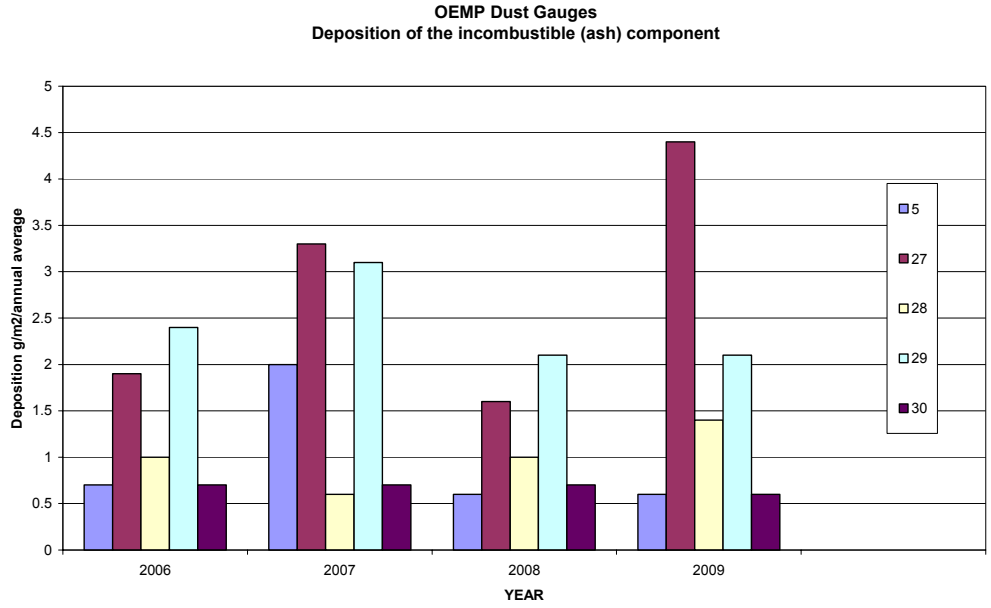


Figure 4: OEMP gauge "ash" deposition 2006 - 2009

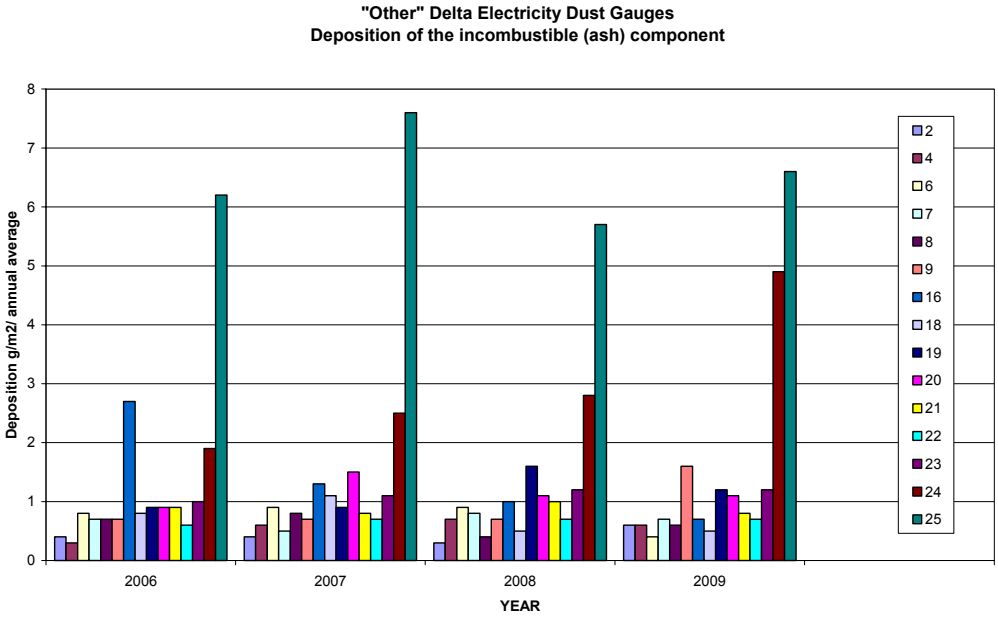


Figure 5: Ash deposition at other Delta Electricity gauges, 2006 – 2009.

Table 4: Dust gauge data from the on-site gauges for the first year of KVAR2 operations (April 2009 – March 2010)

Insol – Insoluble solids, g/m^2/month, **Ash** – Incombustible material, g/m^2/month; **Frac**. – Ash fraction of insoluble solids

Gauge / Month	1			2 (1)			3 (1)			4			5		
	Insol.	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**
April	0.9	0.6	0.7	1.9	1.4	0.7	1.5	0.9	0.6	1.2	0.9	0.7	1.3	1.0	0.8
May	1.7	1.5	0.9	-	-	-	1.2	0.7	0.6	1.2	0.9	0.7	0.2	0.0 (3)	0.00 (3)
June	0.6	0.4	0.7	0.7	0.4	0.6	-	-	-	0.4	0.1	0.2	0.5	0.4	0.8
July	0.4	0.1	0.3	-	-	-	7.7	3.4	0.4	0.4	0.2	0.5	1.1	0.5	0.4
August	5.1	3.6	0.7	-	-	-	0.9	0.5	0.6	1.9	1.4	0.7	2.1	0.9	0.4
September	10.8	9.3	0.9	-	-	-	11.1	9.4	0.8	20.6	17.7	0.9	15.5	13.6	0.9
October	3.7	3.0	0.8	-	-	-	40.8	33.8	0.8	-	-	-	29.9	17.7	0.6
November	3.0	2.5	0.8	3.0	2.2	0.8	9.0	6.2	0.7	3.0	2.0	0.8	20.0	11.6	0.6
December	2.0	1.2	0.7	6.0	4.8	0.8	6.0	3.7	0.6	1.0	1.1	0.8	6.0	3.1	0.5
January	14.1	6.5	0.5	16.6	10.6	0.6	1.7	1.2	0.7	1.8	1.2	0.7	9.2	6.2	0.7
February	2.9	2.5	0.9	1.6	1.0	0.6	9.4	5.5	0.6	0.7	0.3	0.4	6.6	4.4	0.7
March	1.3	0.9	0.7	12.9	6.2	0.5	12.1	7.9	0.6	1.7	1.4	0.8	23.4	8.6	0.4
Average (2)	3.9 (3.2)	2.7 (2.1)	0.7 (0.7)	6.0 (6.0)	3.8 (3.8)	0.7 (0.7)	9.2 (9.0)	6.7 (6.4)	0.6 (0.6)	3.1 (1.3)	2.5 (2.0)	0.7 (0.7)	9.7 (9.2)	5.7 (4.9)	0.6 (0.5)
Months > 4	3 (2)	2 (1)	-	3 (3)	3 (3)	-	7 (6)	5 (4)	-	1 (0)	1 (0)	-	7 (6)	6 (5)	-
Months > 6	2 (1)	2 (1)	-	2 (2)	2 (2)	-	6 (5)	4 (3)	-	1 (0)	1 (0)	-	6 (5)	5 (4)	-

1. Gauge location moved in August 2009. Gauge 2 moved to the east about <400> metres.
   Gauge 3 from dirt south-east boundary, to the edge extent of ash repository on eastern side within ash repository Stage II operations.
2. Averages and months in brackets exclude September 2009 data.
3. As reported

Table 4 (continued): Dust gauge data from the on-site gauges for the first year of KVAR2 operations (April 2009 – March 2010).

Insol – Insoluble solids, g/m^2/month, **Ash** – Incombustible material, g/m^2/month; **Frac**. – Ash fraction of insoluble solids

Gauge / Month	6			7			8			9		
	Insol.	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**
April	2.2	1.9	0.9	2.2	1.7	0.8	0.5	0.2	0.4	3.9	3.1	0.8
May	1.1	0.5	0.5	1.2	0.8	0.7	6.1	4.0	0.7	8.5	7.3	0.9
June	0.5	0.1	0.2	1.0	0.5	0.5	4.8	4.3	0.9	8.8	7.7	0.9
July	3.2	2.2	0.7	1.9	1.1	0.6	0.9	0.7	0.8	8.1	7.3	0.9
August	5.3	3.8	0.7	2.6	1.7	0.6	4.1	2.7	0.7	9.1	8.2	0.9
September	16.1	10.8	0.7	21.7	18.3	0.8	19.8	14.2	0.7	31.3	27.3	0.9
October	11.4	8.8	0.8	7.1	5.8	0.8	5.6	3.7	0.7	11.1	9.6	0.9
November	3.0	1.8	0.6	5.0	3.7	0.8	15.0	10.5	0.7	8.0	7.0	0.8
December	5.0	2.9	0.6	2.0	1.9	0.8	11.0	5.2	0.5	3.0	2.3	0.7
January	2.7	1.3	0.5	2.2	1.6	0.7	3.1	2.4	0.8	2.5	2.1	0.8
February	14.1	7.2	0.5	1.7	1.4	0.8	6.0	3.6	0.6	2.1	1.7	0.8
March	7.4	3.8	0.5	3.6	3.1	0.9	14.4	12.7	0.9	4.6	3.8	0.8
Average (1)	6.0 (5.1)	3.8 (3.1)	0.5 (0.6)	4.4 (2.8)	3.5 (2.1)	0.7 (0.7)	**7.6 (6.5)**	5.4 (4.5)	0.7 (0.7)	8.5 (6.4)	**7.3 (5.5)**	0.8 (0.8)
Months > 4	6 (5)	3 (2)	-	3 (2)	2 (1)	-	9 (8)	5 (4)	-	8 (7)	7 (6)	-
Months > 6	4 (3)	3 (2)	-	2 (1)	1 (0)	-	5 (4)	3 (2)	-	7 (6)	7 (6)	-

1. Averages and months in brackets exclude September 2009 data.

4.3 Monthly averages

Table 5 presents monthly average dust deposition rates across the OEMP and BBS gauges and shows deposition tended to be lower in the first half of the year than in the latter half of the year.

Table 5: Monthly dust deposition averages g/m2/month and ash fraction (including September and October data)

	Insoluble solids g/m^2/month		**Ash** g/m^2/month		**Ash fraction %**	
	OEMP	**BBS**	**OEMP**	**BBS**	**OEMP**	**BBS**
March 2009	1.6	3.4	1.2	2.5	0.7	0.7
April	1.7	1.7	1.2	1.3	0.6	0.7
May	1.7	2.7	1.1	2.0	0.6	0.6
June	2.1	1.9	1.1	1.7	0.6	0.6
July	2.9	3.0	2.2	1.9	0.7	0.6
August	4.0	3.9	2.9	2.9	0.7	0.6
September	24.8	18.4	19.1	15.1	0.8	0.8
October	10.6	15.7	7.8	11.8	0.8	0.7
November	8.5	7.6	3.8	5.3	0.6	0.7
December	8.4	4.8	3.1	2.9	0.6	0.7
January 2010	3.0	6.0	1.4	3.7	0.5	0.7
February	2.3	5.0	1.5	3.1	0.5	0.7
March	1.3	9.0	0.5	5.4	0.4	0.7

4.4 Ash fractions

Table 6 shows very little difference in the average ash fraction from OEMP gauges from the first year of operation of KVAR2 compared with the 2006 – 2008 average. The table also shows little difference in the average ash fraction of OEMP and BBS gauges, with the exception of BBS Gauge 9, located close to the ash silo transfer point.

Table 6: Ash fractions in OEMP, BBS and "other" gauges in the first year of KVAR2 operations (April 2009 – March 2010)

	Highest	Lowest	Mean 2009-10	2006- 2008
OEMP gauges				
5	0.9	0.3	0.6	0.6
27	0.8	0.2	0.6	0.6
28	0.8	0.5	0.7	0.5
29	0.8	0.6	0.8	0.8
30	0.8	0.4	0.7	0.6
BBS gauges				
1	0.9	0.3	0.7	-
2	0.9	0.4	0.7	-
3	0.9	0.4	0.6	-
4	0.9	0.3	0.6	-
5	0.9	0.4	0.5	-
6	0.9	0.2	0.6	-
7	0.8	0.5	0.7	-
8	0.90	0.4	0.7	-
9	**0.9**	**0.7**	**0.8**	-

5. COMPLAINT REGISTERS

Both Delta Electricity and BBS maintain registers which record the details of complaints received by members of the public and a description of any investigation into, and corrective action taken in response to, the complaint.

Since the commencement of KVAR2, neither Delta Electricity nor BBS have received any complaints related to emissions from the facility. There was one complaint in May 2009 regarding ash trucks operating on the coal haulage road with ash uncovered and therefore a potential source of dust in the ambient environment. Delta's complaint register noted that:

".....One of these trucks had a faulty cover but was required for use as no other trucks were available. Complainant satisfied with explanation of situation."

BBS produces a Monthly Monitoring Review Environmental Report for KVAR2, which includes a section on reporting dust related complaints. Since the commencement of KVAR2 reporting in early 2009 no complaints have been recorded.

6. AIR QUALITY MANAGEMENT PLAN REQUIREMENTS

Although addressed, at least in part, in previous sections, this section explicitly addresses the specific requirements of the KVAR2 OEMP and Air Quality Management Plan.

The key objective of the KVAR2 air quality management plan is "*to manage resources effectively to ensure the prevention of conditions that may lead to visible dust emissions."* (PB, 2009 p. 77)

While not specifically included in the M_E_S reporting brief, during an inspection of KVAR2 and surrounding areas on the 27th April, 2010, the range of management measures included in the OEMP to minimise dust emissions were observed to be operating and no visible dust was being generated by KVAR2 operations.

The OEMP includes the following performance measures:

Targets:

- The local air quality in the vicinity of the KVAR is not impacted by Stage 2 operations;
- Zero incidence of dust-related complaints

Indicators:

- Zero visible dust events in vicinity of Kerosene Vale Ash Repository during Stage 2 operations
- Complaints register demonstrating zero occurrence of dust related complaints.

With respect to the first target, data presented in Section 4 demonstrated that Stage 2 operations are not adversely impacting on dust deposition levels in the vicinity of KVAR2.

As noted in the previous section, both Delta Electricity and LLI have systems in place to receive, record and respond to complaints. During the first year of operation of KVAR2 no complaints directly related to dust emissions from the facility were received by either Delta Electricity or the site contractors.

It is not possible with the data available to make any comment regarding the indicator of *zero visible dust events in vicinity of KVAR2 operations*, although as discussed in the next section, the camera installed at KVAR2 might be used in the future to assess performance against this objective.

Air quality monitoring

The OEMP specifies 5 existing dust gauges and 2 new gauges. As discussed above, and further in the next section, the 2 new gauges have yet to be installed.

The OEMP adopts the aim of complying with the 4 g/m^2/month (as an annual average) amenity limit. As documented in **Table 3** and **Table 7** dust deposition at 4 of the 5 OEMP gauges was less than the 4 g/m^2/month (annual) in the first year of operation **(**subject to the omission of regional dust storm data).

Dust deposition at Gauge 27 exceeded 4 (and 6) g/m^2/month (annual) but as discussed previously, and further in the next section, elevated OEMP dust gauge results are not necessarily caused by emissions from KVAR2 and some of the OEMP gauges, and in particular Gauges 27 and 28 are poorly located for the purpose of identifying impacts from KVAR2. Therefore, the elevated results recorded at Gauge 27 are most unlikely to be significantly affected by emissions from KVAR2.

Reporting

The OEMP includes reporting requirements, such as *location frequency, rationale and the procedures and protocols for collecting air quality samples as well as the parameters analysed and methods of analysis.* These requirements are addressed in Section 3 of this report.

The reporting requirement for the OEMP data to be assessed against the 4 g/m^2/month criterion has been addressed immediately above.

The OEMP also requires the data *to be assessed against the baseline data provided in Table D of Appendix C* (of the air quality assessment). **Table 7** reproduces the data from the referenced Table D and adds to it more recently collected data, including from the first year of KVAR2 operations (April 2009 – March 2010).

Table 7 shows that average dust levels at the OEMP gauges vary from year-to-year, as expected. For 4 of the 5 gauges, deposition rates in the first year of KVAR2 were within the range recorded in previous years. The results do not indicate any change due to KVAR2 operations, particularly at Gauge 29 which is closest to KVAR2. Results from Gauge 29 during the first year of KVAR2 operations were the third lowest of the dry ash placement period (2002 – 2009 – 10).

As discussed above and elsewhere, Gauge 27 (and 28) is poorly located for the purpose of identifying impacts from KVAR2. The elevated results recorded at Gauge 27 are most unlikely to be significantly affected by emissions from KVAR2.

Table 7: Annual average dust deposition recorded by OEMP gauges

		Dust Gauge, Annual average g/m^2/annual average				
		DG5	**DG27**	**DG28**	**DG29**	**DG30**
From Table D	**2002**		1.7	2.2	1.2	0.8
	2003		1.3	2.1	7.4	0.8
	2004		1.8	1.3	5.3	0.7
	2005		5.7	2.0	4.9	1.0
	2006	1.2	3.2	4.9	3.0	1.0
	Jan – Jun 2007	1.0	3.9	1.8	3.0	1.1
More recent data	**2007**	2.7	5.0	1.1	3.7	1.0
	2008	1.0	2.8	1.8	2.6	1.2
	Apr 2009 – Mar 2010 (Excluding dust storms)	**1.4**	**10.3**	**2.6**	**2.7**	**1.0**
	Apr 2009 – Mar 2010 (Including dust storms)	3.9	14.4	4.6	4.1	2.7

7. DISCUSSION

Dust gauges are often positioned adjacent to dust generating activities to assess possible nuisance impacts at nearby receptors. As a passive collection system they are inexpensive to install but are subject to a number of limitations:

- They are more effective in collecting coarse particles than fine particles;
- Results are often influenced by things like insects, bird droppings and sometimes by human interference;
- The collection period of a month makes the assessment of short-term individual events impossible;
- Without further analysis it is difficult, if not impossible, to use dust gauge results to discriminate between a number of possible sources;

Notwithstanding these limitations, dust gauge data have the potential to provide some relevant information regarding the potential dust impacts arising from KVAR2.

The first is that huge regional dust storms which swept across eastern Australia[3] in late September contributed significantly to the highest monthly deposition rates in 2009 – 2010. While local sources would also have contributed to these events, their contribution is likely to be minor in comparison to the regional storms and any attempt to assess the potential impact of the local dust sources over the year needs to take these large-scale events into account.

Secondly, in relation to dust gauge samples, "ash" refers to the incombustible, inorganic fraction of the sample and the "ash" fraction of a sample can not be directly related to coal-ash. This point is illustrated by data from September 2009 during which time the KVAR2 dust gauge results were clearly influenced by the regional dust events. The ash fractions of the samples collected during this month were generally high, at about 0.82, indicating the dominance of inorganic, crustal material. BBS Gauge 9, which is located near the ash silo at Wallerawang Power Station shows ash fractions above 0.8 in most months and in this case most likely due to fugitive ash emissions from the transfer process. The emissions are the inorganic, incombustible remains following coal combustion. This point is considered in more detail later in this discussion, but here it is noted that a high "ash" fraction does not necessarily indicate ash from coal combustion.

Related to the above discussion is the OEMP's requirement that:
If the 4 g/m2/month limit is exceeded by more than 2 g/m2/month a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken…

This requirement appears to be based on the simplistic assumption that any measured increase in dust deposition at OEMP gauges is the result of emissions from KVAR2. A diverse range of sources (including regional dust storms, as noted above) can contribute to dust gauge results and, as noted previously, some OEMP dust gauges are poorly located for the purpose of identifying impacts from KVAR2. Care must be exercised in attempting to relate dust deposition results to potential dust sources. The contributing source, or sources, to an elevated result can not always

[3] See DustWatch website http://www.environment.nsw.gov.au/dustwatch/dwreports.htm

simply or easily be determined. It follows that prior to reviewing *the effectiveness of the (KVAR2) dust suppression regime* that some effort should be made to determine the likely contribution of KVAR2 operations to the dust event(s).

As noted above, dust gauges are most commonly used adjacent to, or in close proximity to, potentially "dusty" activities. With respect to the location of the OEMP gauges it should be noted that data obtained from gauges located at some distance from KVAR2 are unlikely to provide robust, useful information regarding potential impacts from the KVAR2. Of the existing 5 OEMP gauges it is considered that only Gauge 29, which is adjacent to KVAR2 (**Figure 2**) is likely to provide information which is useful in assessing potential impacts from KVAR2. With the dust storm event data removed, it was shown (**Table 3**) that no month recorded a deposition rate in excess of 4 g/m^2/month at Gauge 29.

It is considered that OEMP Gauges 5, 27, 28 and 30 are too far away to provide data relevant to assessing KVAR2 impacts. Gauge 5 might be considered to provide "background" data but the only use for gauge locations 27 and 28 should be to monitor potential dust deposition from Wallerawang Power Station's coal stack. The elevated results recorded at Gauge 27 are often associated with a relatively low "ash" fraction and are most unlikely to be related to KVAR2 operations. It is also noted that Gauge 27 is locate adjacent to a public road and the possibility of occasional human interference with the operation of the gauge can not be rule out.

Gauges 5, 28 and 29 recorded an annual average deposition rate of less than 4 g/m^2/month with the exclusion of the September dust storm data.

A comparison of dust data from the first year of operation of KVAR2 with data collected in previous years showed no indication of an increase in dust deposition levels, particularly at Gauge 29, the closest to KVAR2.

Currently 5 of the 7 gauges included in the OEMP are in operation. Two (as yet, un-numbered) gauges are to be located in the residential area of Lidsdale to the immediate west of KVAR2 **(Figure 2).** It is considered that gauges at these proposed locations will be of more relevance and use than the more distant gauges, such as 27 and 28, and should be installed as soon as possible. Consideration could also be given to installing directional dust gauges, as well as standard dust gauges, at OEMP sites to provide additional indication regarding potential dust sources.

While a number of results from the BBS gauges recorded annual results, equal to and above the criterion of 6 g/m^2/month it should be noted that these gauges (2, 3, 5 and8) are positioned primarily for monitoring Work Place Safety requirements, and are located well within the perimeter of KVAR2. Results from gauges located on the perimeter of the site (1, 4 and 7) were less than 4g/m^2/month on average (with September data excluded), indicating that elevated dust levels were not leaving the site (in these directions). It is also of note that the average ash fraction of gauges 2, 3, 5 and 8 varies between about 0.5 and 0.7, indicating sources with a significant combustible fraction contribute to the dust results on KVAR2. For example, Gauge 5 recorded a very high insoluble solid deposition rate of 23 g/m^2/month in March with a (low) ash fraction of 0.4. While emissions from KVAR2 may have contributed to the result, the low ash

fraction indicates a source (or sources) which was dominantly combustible (organic) contributed significantly to this result.

When the dust gauge material is analysed on a monthly basis for insoluble solids, ash and combustible fractions, the analysts provide a description of the collected material, based on visual inspection including colour, size (fine, coarse etc) and if possible the composition of the collected material, which might typically include the following: bugs, organics, plant material, spiders, bird droppings – as well as the more generic "dust". The colour of the collected dust is variously described as black, brown, grey and green (perhaps due to biological activity). If coal-ash from KVAR2 were making a significant contribution to deposited dust levels, it might be expected that the collected ash would be described as grey (the colour of the coal-ash varies from light to dark grey), on a regular basis.

BBS Gauge 9 is located at the ash transfer facility at Wallerawang Power Station – and 8 of the 12 monthly samples include "grey" as a descriptor, suggesting coal-ash may be contributing at this site –and this possibility is supported by the high "ash" fraction of about 0.84 at this site compared with other sites. Of the BBS gauges located at KVAR2 only 14 out of 98 monthly samples (about 15%) included "grey" as a descriptor. Similarly, of the 60 OEMP monthly dust samples only 8 out of 60 (about 13%) included grey as a descriptor. Half of these observations were from Gauge 29, which is positioned closest to KVAR2.

These qualitative visual observations provide further support for the proposition that dust emissions from KVAR2 did not contribute adversely to measured deposition results in 2009 – 2010. Further support for this conclusion could be provided by the use of microscopic examination of a number of collected samples. Such examination could distinguish between "ash" samples which are dominantly crustal material and "ash" samples resulting from coal combustion that are characterised by spherical particles of varying diameter.

Interpretation of the dust gauge data might also be assisted by the installation of an anemometer at KVAR2 as the current anemometer at Mt Piper, about 7km to the north-west and positioned 2 metres above ground level, is unlikely to provide data representative of conditions at KVAR2.

Finally, during the site inspection of KVAR2, the location of a permanently located camera was observed and Delta Electricity subsequently provided M_E_S with a sample of images taken by the camera. The camera scans the KVAR2 area taking photographs from 8 positions at intervals from about 10 to 30 seconds. It is considered that the camera provides an excellent addition to the monitoring network and that the images could be very useful in assessing potential impacts from KVAR2 – firstly, in confirming or dismissing KVAR2 as a source of visible dust and secondly, if the camera images confirm that "dusting" from KVAR2 occurred, identification of the conditions under which dusting occurred might then enable effective corrective measures to be implemented. It is suggested that the images collected to date be reviewed to ensure that they are suitable for the above purposes, should the need arise in the future.

8. CONCLUSIONS and RECOMMENDATIONS

1. The highest monthly dust deposition results in 2009 – 2010 were significantly influenced by huge regional dust events which swept across eastern Australia.

2. Care must be exercised in attempting to relate dust deposition results to potential dust sources. The contributing source, or sources, to an elevated result may be difficult to determine.

3. A number of gauges in the OEMP network are poorly located for the purpose of identifying impacts from KVAR2 and as such the OEMP dust gauge monitoring network should be reviewed.

4. The two, as yet to be installed, OEMP dust gauges in the residential area to the immediate west of KVAR2 will be of more relevance and use in identifying KVAR2 impacts than the more distant gauges, such as 27 and 28, and should be installed as soon as possible.

5. Consideration could be given to installing directional dust gauges, as well as standard dust gauges, to provide additional information regarding potential dust sources.

6. The dust gauge data from the first year of KVAR2 operations do not indicate that KVAR2 operations have resulted in dust deposition above the OEMP levels that trigger the requirement to implement additional control measures.

7. The OEMP requirement that: *If the 4 g/m^2/month limit is exceeded by more than 2 g/m^2/month a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken*, should be amended to require an assessment of the likely contribution of KVAR2 operations to the dust deposition levels prior to undertaking a review of the control measures.

8. No complaints regarding dust emissions from KVAR2 were received by either Delta Electricity or BBS during the first year of KVAR2 operations.

9. It is not possible with the data available to make any comment regarding the OEMP objective of *zero visible dust events in vicinity of KVAR2 operations*, although the camera installed at KVAR2 might be used in the future to assess performance against this objective.

10. Qualitative visual observations of collected dust samples provide support for the proposition that dust emissions from KVAR2 did not contribute adversely to measured deposition results in 2009 – 2010. Further support for this conclusion could be provided by the use of microscopic examination of a number of collected samples.

11. Interpretation of the dust gauge data might also be assisted by the installation of an anemometer at KVAR2.

12. The installation of a camera provides an excellent addition to the KVAR2 monitoring network and the images could be very useful in assessing potential impacts from KVAR2. It is suggested that the images collected to date be reviewed to ensure that they are suitable for the above purposes, should the need arise in the future.

9. REFERENCES

DEC (2005) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Department of Environment and Conservation, ISBN 1 74137 488 X, Sydney

DustWatch website http://www.environment.nsw.gov.au/dustwatch/dwreports.htm

Parsons Brinckerhoff (2009) Kerosene Vale Stage 2 Ash Repository Operation Environmental Management Plan. Prepared for Delta Electricity.

10. APPENDIX 1: THE AIR QUALITY MANAGEMENT PLAN

Prepared by Parsons Brinckerhoff for Delta Electricity.

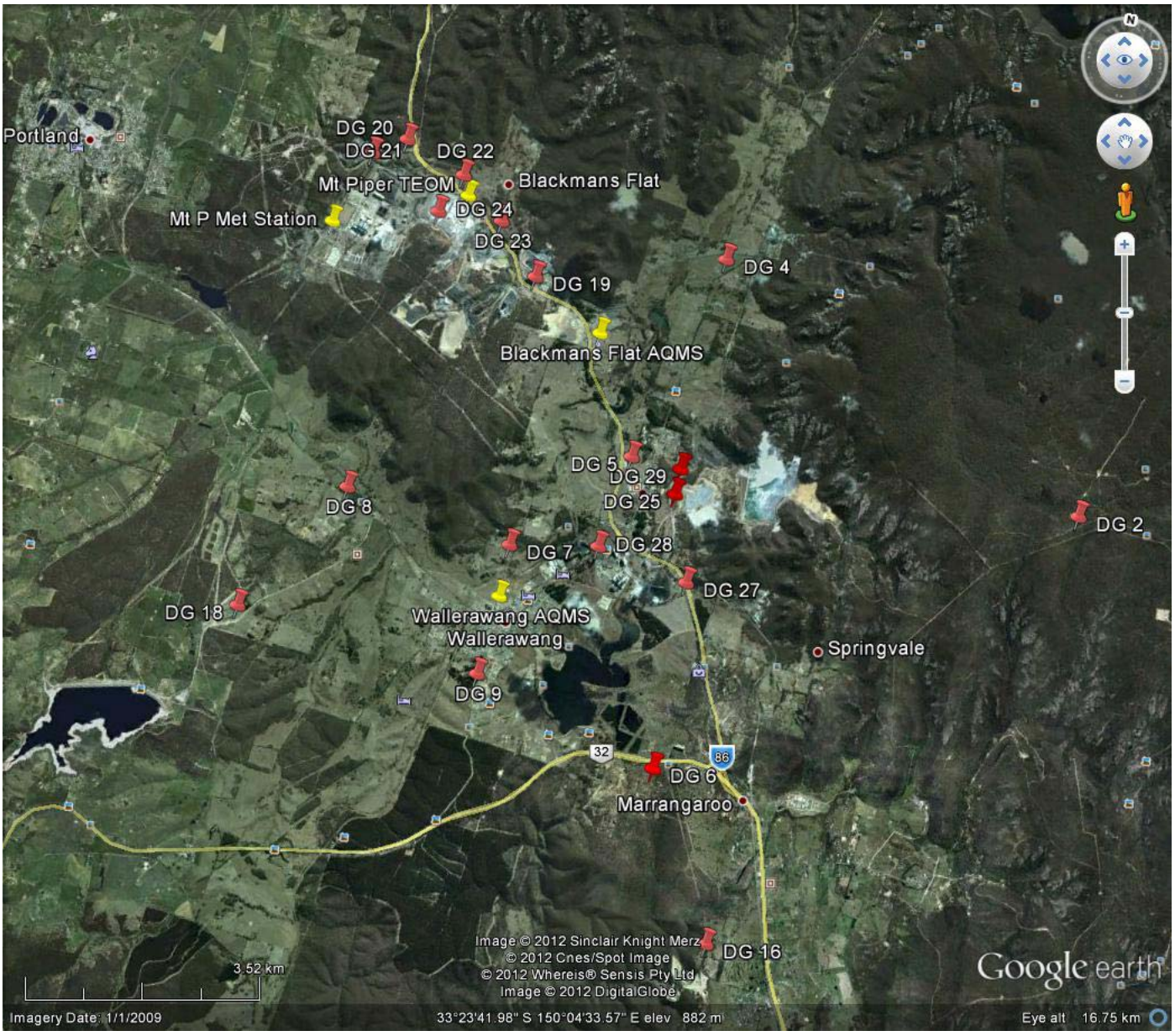
Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
General requirements	▪ Stage 2 operations shall be conducted in a manner that minimises dust impacts generated by operational activities including wind-blown and traffic-generated dust. All activities on the site shall be undertaken with the objective of preventing visible emissions of dust from the site. Should such visible dust emissions occur at any time, practicable dust mitigation measures shall be identified and implemented, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.	CoA 2.33	Ongoing	Site inspection checklist	Contractor
Ash haulage and placement	▪ Moisture levels in the ash remain shall be maintained at 15-20% until the material is placed in the repository area.	OEMP	Daily	Site inspection checklist	Contractor
	▪ All ash haulage trucks shall be fitted with remotely operated covers to completely cover the load whilst in transit between the ash silos and the repository. The load must be covered at all times except when loading or unloading ash material.	CoA 2.34	Daily	Site inspection checklist	Contractor
	▪ All ash haulage trucks shall go through the wheel and undercarriage washers prior to leaving the ash repository site and entering the private haul road.	OEMP	Daily	Site inspection checklist	Contractor
	▪ Temporary PVA, lignosulphate or tar capping shall be applied to seal ash faces, where ash is not currently being deposited, and where irrigation systems are not in operation and there is a probability of visible dust emissions occurring due to meteorological conditions.	OEMP	As required	Site inspection checklist	Contractor
	▪ A routine maintenance, inspection and cleaning regime shall be implemented for the two truck washes and adjacent washout/surface drainage pits within the repository site.	OEMP	As required	Site inspection checklist	Contractor

Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
Ash haulage and placement	▪ The private haulage roads shall be maintained in a clean condition by routinely washing the surface. This applies to the haul roads within the repository zone and does not include the private haul road from the power station. Particular attention must be paid during wet periods when muddy water is drawn from the repository area and deposited on the haul roads.	OEMP	As required	Site inspection checklist	Contractor
Dust controls	▪ A water cart shall be used to undertake dust suppression activities throughout the repository site, as required.	OEMP	As required	Site inspection checklist	Contractor
	▪ A dedicated water sprinkler and surface irrigation system shall be installed to cover the active ash placement area. The system will be in place prior to the commencement of ash placement activities and will be operated for the entire daily operating period or when 15 minute wind speed thresholds exceed 5 metres per second.	OEMP	As required	Site inspection checklist	Contractor
	▪ Note: Application rates and the coverage area shall have the capacity to ensure that no visible emissions from the repository area occur.				
	▪ In the event of visible dust emissions from the repository area, personnel shall notify the Site Manager or Repository Team Leader immediately, who will immediately direct the water cart operator to spray the area and review the location and application rate of the sprinkler system.	OEMP	As required	Site inspection checklist	Contractor
Air quality monitoring	▪ A total of 7 deposition gauges shall be used to monitor dust emissions at the perimeter of the ash repository area, and at key locations adjacent to residential properties and Wallerawang Power Station. This includes the existing 5 dust deposition gauges and the installation of an additional 2 dust deposition gauges. Note: The positioning of the additional 2 gauges has been reviewed by specialist consultants based on a review of local weather patterns and the sensitivity of surrounding properties and will be subject to landowner approval. Refer to Figure 6-5 for further details.	OEMP	Establishment prior to commencement of operations. Monthly to contribute to baseline data and monthly thereafter to monitor operations	Air monitoring records	Delta Electricity Specialist consultant

Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
Air quality monitoring	▪ Samples shall be removed from the dust deposition gauges on a monthly basis by a NATA approved laboratory and assessed for compliance with the appropriate air quality criteria.	OEMP	Monthly	Air monitoring report	Delta Electricity Specialist consultant
	▪ The DECC amenity-based criteria for dust fallout is a maximum total dust deposition of 4 g/m²/month (annual). The Stage 2 operations shall aim to achieve compliance with this limit.	OEMP	Ongoing	Air monitoring records	Delta Electricity Contractor
Air quality monitoring	▪ If the 4 g/m²/month limit is exceeded by more than 2 g/m², a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken, including: › increased application rates of the irrigation system at the ash working face › increased application rates of water on haul roads, particularly during high wind events › further reduction in the ash face working area below 1.5 hectares › increased implementation of temporary capping such as PVA, lignosulphate or tar where un-worked ash faces still exist › the application of higher ash moisture rates through the silo humidifier.	OEMP	Ongoing	Air monitoring records	Delta Electricity Contractor
Reporting	▪ Delta Electricity shall issue a report to the DECC every 12 months from commencement of operations. The report shall contain the location, frequency, rationale and the procedures and protocols for collecting air quality samples as well as the parameters analysed and methods of analysis.	CoA 7.3	Annually from commencement of operations	Report to DECC	Delta Electricity Specialist Consultant

Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
Reporting	▪ The results and analysis of the monitoring data shall also be included and assessed against the air quality criteria (4 g/m²/month) and the baseline data provided in Table D of Appendix C. In the case of exceedances; the response taken must be documented within the report. Any deviations from the proposed monitoring program must also be justified.	CoA 7.3	Annually from commencement of operations	Report to DECC	Delta Electricity Specialist Consultant
	▪ The Annual Environmental Management Report will be submitted to the Director-General complete with air quality monitoring data gathered throughout the year	CoA 7.3	Annually	Annual Environmental Management Report	Delta Electricity

11. APPENDIX 2: The REGIONAL DUST GAUGE NETWORK



Kerosene Vale Ash Repository Stage 2– Air Quality Review

April 2010 – March 2012

Prepared for

For Delta Electricity

By

Malfroy Environmental Strategies Pty Ltd.

Drafted June, 2012

Finalised October, 2012

Kerosene Vale Ash Repository Stage 2– Air Quality Review

April 2010 – March 2012

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SUMMARY

In 2002, Delta Electricity obtained approval for conversion of the wet slurry ash placement process at Wallerawang Power Station to dry ash. The dry ash repository was established at the Kerosene Vale open cut coal mine void site, on top of the original wet ash dam, Kerosene Vale Ash Dam (KVAD). When the KVAD was full of ash, wet ash placement was directed to the Sawyers Swamp Creek Ash Dam (SSCAD) from 1980, and ultimately the KVAD was capped with clay so dry ash placement could be undertaken.

The dry placement is called the Kerosene Vale Ash Repository (KVAR). Stage 1 of the placement was completed and capped in February 2009. Approval was obtained for further placement in the Stage 2 Area at the KVAR in November, 2008. The Stage 2 Area is in two parts: Stages 2A and 2B. Placement in the Stage 2A area began in April, 2009. Placement in the Stage 2B Area began on 19th January, 2012.

Stage 2A of KVAR (KVAR2A) was subject to assessment under Part 3A of the Environmental Planning and Assessment Act 1979 and was approved in November, 2008. As required by the Approval Conditions, Delta Electricity prepared an Operation Environmental Management Plan (OEMP) prior to the commencement of KVAR2A. As KVAR2A was nearing capacity, Delta was required to develop a Construction Environmental Management Plan (CEMP) to develop Section 2B. This was required as the OEMP for KVAR Stage 1 and 2 did not cover specific construction activities required for ash placement in Section 2B.

The OEMP includes an Air Quality Management Plan, which contains monitoring and reporting requirements, including the operation of seven dust deposition gauges in the vicinity of KVAR2.

In 2010, Malfroy Environmental Strategies Pty Ltd (M_E_S) was engaged by Delta Electricity to review the air quality monitoring data collected during the first year of KVAR2 operations (April 2009 – March 2010) and to report on the results against the requirements of the OEMP (M_E_S, 2012).

The current report presents the dust data collected in the second and third years of KVAR2 operations, from April 2010 to March 2012, and similarly reviews the results against the requirements of the OEMP.

Conclusions and recommendations arising from the review of the air quality monitoring data collected during the second and third years of KVAR2 operations appear below. In undertaking this data review some comments and observations are made on the operation of the air quality management plan.

1. Annual average dust deposition results in the second and third years of the Kerosene Vale Ash Repository Stage 2 (KVAR2) operations were below the criterion of 4 g/m^2/month at 6 of the 7 Operation Environmental Management Plan (OEMP) gauges.

2. Dust deposition results at the one gauge that exceeded 4 g/m^2/month in both 2010 – 2011 and 2011 – 2012 are unlikely to be related to KVAR2 operations.

3. A number of gauges in the OEMP network are poorly located for the purpose of identifying impacts from KVAR2 and as such consideration should be given to the reviewing the OEMP dust gauge monitoring network.

4. The dust gauge data from the first three years of KVAR2 operations do not indicate that KVAR2 operations have resulted in dust deposition above the OEMP levels that trigger the requirement to implement additional control measures.

5. The OEMP requirement that: *If the 4 g/m^2/month limit is exceeded by more than 2 g/m^2/month a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken*, should be amended to require an assessment of the likely contribution of KVAR2 operations to the dust deposition levels prior to undertaking a review of the control measures.

6. Should further, more detailed investigation into the potential impacts of KVAR2 and other sources be required in the future, consideration could be given to installing directional dust gauges in addition to the current standard dust gauges. Consideration could also be given to microscopic examination of a representative number of collected samples.

7. No complaints regarding dust emissions from KVAR2 were received by either Delta Electricity or the KVAR2 site contractor during the second and third years of KVAR2 operations.

8. It is not possible with the data available to make any comment regarding the OEMP objective of *zero visible dust events in vicinity of KVAR2 operations*, although the camera installed at KVAR2 might be used to assess performance against this objective.

9. It is considered that the monitoring and reporting requirements of the OEMP are being met.

1. INTRODUCTION

In 2002, Delta Electricity obtained approval for conversion of the wet slurry ash placement process at Wallerawang Power Station to dry ash. The dry ash repository was established at the Kerosene Vale open cut coal mine void site, on top of the original wet ash dam, Kerosene Vale Ash Dam (KVAD). When the KVAD was full of ash, wet ash placement was directed to the Sawyers Swamp Creek Ash Dam (SSCAD) from 1980, and ultimately the KVAD was capped with clay so dry ash placement could be undertaken.

The dry placement is called the Kerosene Vale Ash Repository (KVAR). Stage 1 of the placement was completed and capped in February 2009. Approval was obtained for further placement in the Stage 2 Area at the KVAR in November, 2008. The Stage 2 Area is in two parts: Stages 2A and 2B. Placement in the Stage 2A area began in April, 2009. Placement in the Stage 2B Area began on 19th January, 2012. The locations of the various ash dams and repositories are shown in Fugure1.

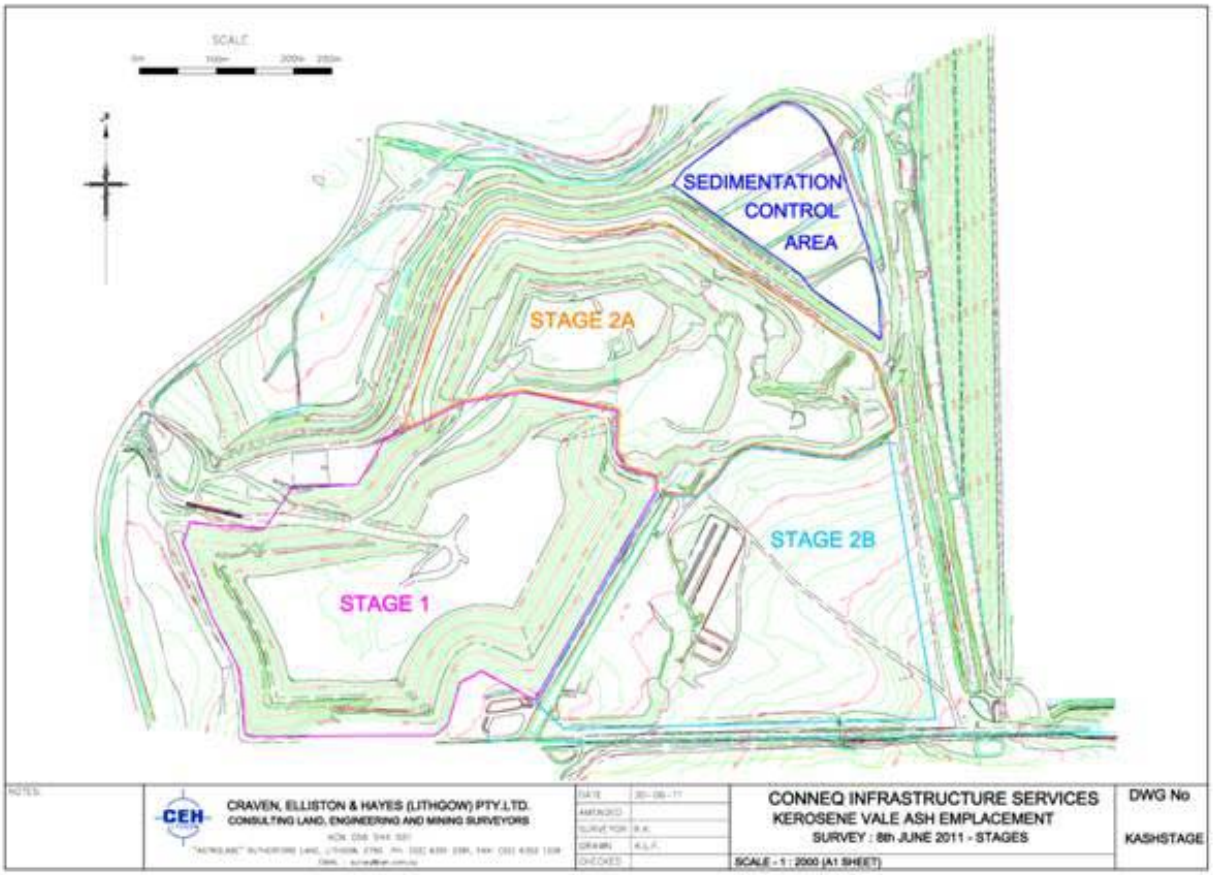


Figure 1: Location of Stage 1, 2A and 2B operational areas in the Kerosene Vale Ash Repository.

Stage 2A of KVAR (KVAR2A) was subject to assessment under Part 3A of the Environmental Planning and Assessment Act 1979 and was approved in November, 2008. As required by the Approval Conditions, Delta Electricity prepared an Operation Environmental Management Plan

(OEMP) prior to the commencement of KVAR2A. As KVAR2A was nearing capacity, Delta was required to develop a Construction Environmental Management Plan (CEMP) to develop Section 2B. This was required as the OEMP for KVAR Stage 1 and 2 did not cover specific construction activities required for ash placement in Section 2B.

Current KVAR Stage 2 activities are primarily being managed in accordance with the following documents and associated sub-plans:

- Operational Environmental Management Plan (Parsons Brinckerhoff, 2008)
- Construction Environmental Management Plan (Lend Lease and Delta Electricity, 2011)

The OEMP includes an Air Quality Management Plan, which contains monitoring and reporting requirements.

In 2010, Malfroy Environmental Strategies Pty Ltd (M_E_S) was engaged by Delta Electricity to review the air quality monitoring data collected during the first year of KVAR2 operations (April 2009 – March 2010) and to report on the results against the requirements of the OEMP (M_E_S, 2012).

The current report presents the dust deposition data collected in the second and third years of KVAR2 operations, from April 2010 to March 2012, and similarly reviews the results against the requirements of the OEMP.

2. THE KVAR2 AIR QUALITY MANAGEMENT PLAN

The key objective of the KVAR2 air quality management plan is "*to manage resources effectively to ensure the prevention of conditions that may lead to visible dust emissions."* (PB 2009, p. 77)

The air quality management plan includes the following performance measures.

Targets:

- The local air quality in the vicinity of the KVAR is not impacted by Stage 2 operations;
- Zero incidence of dust-related complaints

Indicators:

- Zero visible dust events in vicinity of Kerosene Vale Ash Repository during Stage 2 operations
- Complaints register demonstrating zero occurrence of dust related complaints.

The Plan states that "*Through the use of dust suppression equipment and the implementation of air quality management procedures, dust events can be controlled*." (PB, 2009 p. 77)

The detailed list of management and mitigation measures in the Plan is included in **Appendix 1.** These measures are monitored by Delta's Ash Placement Contractor, Lend Lease Infrastructure (LLI, formerly Conneq and Bilfinger Berger Services), and are reported at LLIs Monthly Contract Review Meetings. The measures include:

- Moisture conditioning of ash;
- Covering of ash loads in trucks;
- Wheel and undercarriage washes;

- Temporary capping of ash faces not currently in use and where irrigation systems are not in operation;
- Routine maintenance of truck washes, and washout/surface drainage pits;
- Routine washing of private haul roads within KVAR2;
- Use of water cart, as required;
- Dedicated sprinkler system;

2.1 Air quality monitoring

The air quality management plan includes the following monitoring requirements (PB, 2009):

- *A total of 7 deposition gauges shall be used to monitor dust emissions at the perimeter of the ash repository area, and at key locations adjacent to residential properties and Wallerawang Power Station. This includes the existing 5 dust deposition gauges and the installation of an additional 2 dust deposition gauges*

  Note: The positioning of the additional 2 gauges has been reviewed by specialist consultants based on a review of local weather patterns and the sensitivity of surrounding properties and will be subject to landowner approval.

- *Samples shall be removed from the dust deposition gauges on a monthly basis by a NATA approved laboratory and assessed for compliance with the appropriate air quality criteria.*

- *The DECC amenity-based criteria for dust fallout is a maximum total dust deposition of 4 g/m²/month (annual). The Stage 2 operations shall aim to achieve compliance with this limit.*

- *If the 4 g/m²/month limit is exceeded by more than 2 g/m², a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken including:*

  - *increased application rates of the irrigation system at the ash working face*
  - *increased application rates of water on haul roads, particularly during high wind events*
  - *further reduction in the ash face working area below1.5 hectares*
  - *increased implementation of temporary capping such as PVA, lignosulphate or tar where un-worked ash faces still exist*
  - *the application of higher ash moisture rates through the silo humidifier.*

2.2 Reporting

The air quality management plan includes the following reporting requirements (PB, 2009):

- *Delta Electricity shall issue a report to the DECC every 12 months from commencement of operations. The report shall contain the location, frequency, rationale and the procedures and protocols for collecting air quality samples as well as the parameters analysed and methods of analysis.*

- *The results and analysis of the monitoring data shall also be included and assessed against the air quality criteria (4 g/m²/month) and the baseline data provided in Table D of Appendix C. In the case of exceedences; the response taken must be documented within the report. Any deviations from the proposed monitoring program must also be justified.*

- *The Annual Environmental Management Report will be submitted to the Director-General complete with air quality monitoring data gathered throughout the year.*

3. THE MONITORING PROGRAM

3.1 OEMP dust gauge locations

The locations of the 5 dust gauges existing at the commencement of KVAR2 operations in 2009 and 2 new dust gauge locations required by the OEMP are shown in **Figure 2**. The 2 new gauges (31 and 32) are located in or near the residential area of Lidsdale and were installed in October, 2010. Gauge 31 is located about 100 metres south of where planned at the time of preparing the OEMP

The approximate distances of the gauges from the nearest KVAR2 boundary are shown in **Table 1**. With the exception of Gauge 29, all gauges are well beyond the perimeter of KVAR2 and from **Figure 2** it can be seen that, in some cases the gauges are nearby other potential dust sources, such as disturbed areas, mining activities and other power station operations.

Table 1: Existing dust gauges – distances from KVAR2

Gauge number	Approximate distance (m) from KVAR2 boundary
5	1,000
27	1,300
28	1,500
29	50
30	1,000
31	300
32	450

Figure 2: The location of the 7 OEMP dust gauges

3.2 KVAR2 on-site gauges

In addition to the gauges included in the OEMP, LLI, maintain a network of 8 dust gauges located on the perimeter of KVAR2, inside the working-area of KVAR2 and one additional gauge at the silo at Wallerawang Power Station where ash is conditioned and transferred to truck for transport to KVAR2. The locations of these gauges are shown in **Figure 3**.

These gauges are primarily used for Workplace Health and Safety monitoring, and inclusion of the results is not a project Approval Condition or a requirement of the OEMP, however these data are considered in this report to provide a more comprehensive assessment of potential dust impacts from KVAR2.

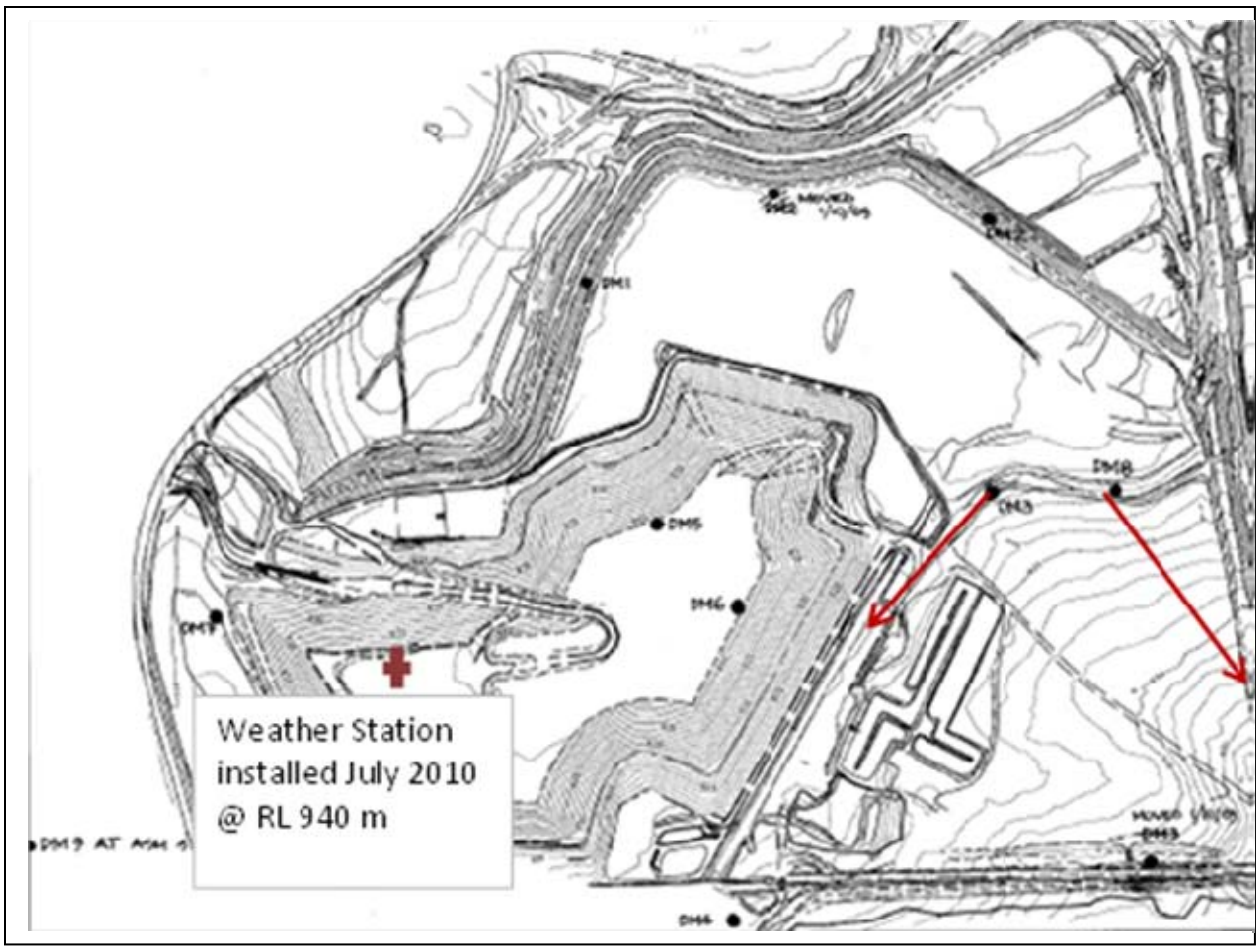


Figure 3: Location of dust gauges operated in and on the perimeter of KVAR2 by the site contractors.

Note that DM9 is located at the ash silo about 1,500m to the south-west at Wallerawang Power Station. Gauges 3 and 8 were relocated at time of Stage 2B commencement April, 2012, as indicated by the arrows.

3.3 Other Delta Electricity dust gauges

The existing OEMP dust gauges shown in **Figure 2** and **Table 1** form part of a broader regional dust gauge network operated by Delta Electricity for several decades. The current Delta Electricity dust gauge network is shown in **Appendix 2** and data from the network are considered in this report.

3.4 Anemometer

As was recommended in the 2009-10 Air Quality Review, a weather station, including an anemometer and rain gauge, was installed at the KVAR2 site in July 2010 to provide relevant climatic data to the site contractor. Prior to the availability of on-site data, the site contractor made use of wind data collected at the Mt Piper ash disposal area about 7 km to the north-west of KVAR2.

3.5 Frequency and methods

Table 2 presents details regarding the installation and operation of the dust monitoring network equipment.

The Delta Electricity and LLI gauges are maintained by, and samples analysed by ALS (formerly ACIRL Ltd) who have NATA accreditation for the relevant Australian Standard.

Table 2: Frequency of Measurements and Monitoring Methods

Parameter	*Frequency of measurement*	*NSW Approved Method (AM)and Australian Standard (AS)*
Dust gauges	Monthly	• AM-1 Guide for the siting of sampling units (AS 2922 – 1987) • AM-19 Particulates – deposited matter – gravimetric method (AS 3580.10.1 1991)

The collected samples are analysed in the laboratory according to AS 3580 for:

- Insoluble solids: this is the matter that does not dissolve in water.
- Incombustible (ash)[1] content: this is the matter that remains after the sample has been combusted in the laboratory.

Results for insoluble solids and incombustible material are expressed as g/m^2/month.

The insoluble solids and incombustible (ash) content of a collected dust sample can provide information on possible sources of the dust but due to the time-scale over which data are collected (monthly) and the fact that many disparate sources can contribute to deposited dust, it is often not possible to use dust gauge data to positively identify the contributing sources.

4. RESULTS

In this section data are presented for the second and third years of ash placement in KVAR2:

- April 2010 – March 2011
- April 2011 – March 2012

4.1 OEMP gauges

Tables 3 and 4 present the monthly dust deposition results for the 7 OEMP gauges during 2010 - 2011 and 2011 – 2012, respectively.

In 2010 – 2011 annual average dust deposition at 6 of the 7[2] gauges in the OEMP network was less than 3 g/m^2/month.

The annual average dust deposition was greater than 6 g/m^2/month at one Gauge (27). This was the result of deposition at Gauge 27 being greater than 6 g/m^2/month in six months of the year

[1] Ash content does not refer to coal ash, but could include ash from coal combustion and other mineral matter derived from soil, for example.
[2] Only 4 months of results available for gauges 31 and 32.

and greater than 20 g/m^2/month in 3 months. As can be seen from **Figure 2 and Table 1**, Gauge 27 is located about 1,500m from KVAR2 on Wallerawang Power Station land and in close proximity to a live coal storage area and adjacent to a public road. Dust deposition at Gauge 27 was higher, and often significantly and anomalously higher, than at the other 6 sites in 11 of the 12 months of the year. Given the location of Gauge 27 adjacent to a public road, human interference in the operation of the gauge can not be rule out. It is considered unlikely that KVAR2 is the source of high dust deposition at Gauge 27. The results from Gauge 27 are considered further in this section and also in Sections 6 and 7.

Results from Gauge 29, the closest of the gauges to KVAR2, exceeded 4 g/m^2/month in 3 months, averaging 2.6 g/m^2/month for the year. The average incombustible (ash) fraction of 0.7 was the highest of the OEMP gauges.

Deposition results for 4 months from the 2 new gauges (31 and 32) averaged 1.1 and 1.5 g/m^2/month. The highest monthly result was 2.8 g/m^2/month observed at Gauge 32 in February 2011.

Results for Gauges 5 and 30, to the north-west of KVAR2, were very low, averaging less than 1 g/m^2/month for the year with a very low incombustible fraction of less than 0.5.

In 2011 – 2012 (**Table 4**), the annual average deposition rates were generally lower than in the previous year. Excluding Gauge 27, the highest annual average was 2.1 g/m^2/month (5 annual averages were less than 2.0 g/m^2/month) with only one individual monthly average deposition in excess of 4 g/m^2/month.

As was the case in the previous year, results from Gauge 27 were significantly and anomalously high compared with results from the other gauges suggesting that results from this gauge should be used with caution when assessing potential impacts from KVAR2.

Full-year results for the 2 new gauges (31 and 32) were 1.0 and 1.6 g/m^2/month, respectively.

As in the previous year, results for Gauges 5 and 30 were very low, averaging less than 1 g/m^2/month for the year with a low incombustible fraction.

Results from Gauge 29 exceeded 4 g/m^2/month in 1 month averaging 2.1 g/m^2/month for the year. The average incombustible fraction of 0.7 was again the highest of the 7 gauges.

Table 3: Dust gauge data from the OEMP gauges for the second year of KVAR2 operations (April 2010 – March 2011)
Insol – Insoluble solids, g/m^2/month, **Frac**. – Incombustible (ash) fraction of insoluble solids.
Insoluble solid results of 0.1 g/m^2/month are reported Limit of Detection, in which case ash fraction not determined.

Gauge	5		27		28		29		30		31*		32*	
Month	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**
April	0.4	0.3	3.3	0.3	0.9	0.7	1.0	0.7	0.8	0.3	-	-	-	-
May	1.7	0.6	4.2	0.4	0.7	0.4	2.4	0.8	0.7	0.3	-	-	-	-
June	3.9	0.9	24.6	0.4	0.9	0.4	2.7	0.8	0.2	0.0	-	-	-	-
July	0.9	0.3	25.6	0.8	6.3	0.9	4.2	0.8	1.0	0.5	-	-	-	-
August	0.2	0.5	13.7	0.7	2.0	0.7	1.4	0.6	0.7	0.3	-	-	-	-
September	0.7	0.1	87.2	0.2	1.3	0.5	2.6	0.8	0.6	0.7	-	-	-	-
October	*0.1*	-	4.2	0.4	1.9	0.6	4.1	0.8	*0.1*	-	-	-	-	-
November	*0.1*	-	7.4	0.5	0.4	0.3	2.0	0.7	0.5	0.2	-	-	-	-
December	*0.1*	-	15.3	0.6	1.0	0.2	1.7	0.6	0.7	0.3	0.4	0.3	0.6	0.3
January	1.7	0.1	4.8	0.4	1.7	0.6	1.6	0.7	1.3	0.4	0.8	0.4	1.0	0.2
February	0.3	0.3	2.8	0.5	1.4	0.6	2.9	0.8	0.6	0.2	2.0	0.3	2.8	0.8
March	0.7	0.3	3.5	0.5	8.0	0.2	5.1	0.8	1.0	0.3	1.0	0.5	1.6	0.8
Average(1)	**0.9**	**0.4**	**16.4**	**0.5**	**2.2**	**0.5**	**2.6**	**0.7**	**0.7**	**0.3**	**1.1**	**0.3**	**1.5**	**0.5**
Average(2)		0.5		0.4		0.5		0.8		0.3		0.3		0.7
Months > 4	0	-	9	-	2	-	3	-	0	-	0	-	0	-
Months > 6	0	-	6	-	2	-	0	-	0	-	0	-	0	-

* Commenced December, 2010
1. Average of monthly incombustible fractions
2. Average = total annual incombustible / total annual insoluble

Table 4: Dust gauge data from the OEMP gauges for the third year of KVAR2 operations (April 2011 – March 2012)

Insol – Insoluble solids, g/m2/month, Frac. – Incombustible (ash) fraction of insoluble solids.

Gauge / Month	5		27		28		29		30		31		32	
	Insol.	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**
April	*0.1*	-	4.0	0.3	1.2	0.6	1.6	0.8	0.2	0.5	2.9	0.3	1.0	0.6
May	1.0	0.4	5.9	0.6	1.3	0.5	5.5	0.8	0.6	1.0	0.8	0.5	1.7	0.8
June	0.5	0.2	2.0	0.7	1.2	0.8	2.6	0.7	0.8	0.4	0.3	0.3	1.0	0.7
July	0.1	-	3.9	0.9	0.8	-	2.0	0.7	0.7	0.1	0.4	1.0	1.8	0.8
August	1.4	0.6	5.3	0.8	2.1	0.7	3.7	0.8	1.0	0.2	0.6	0.5	3.3	0.8
September	0.6	0.7	10.2	0.7	2.7	0.6	3.1	0.8	0.7	0.3	0.3	0.3	2.4	0.7
October	1.1	0.2	3.0	0.5	2.1	0.6	1.6	0.8	0.9	0.6	0.9	0.4	2.6	0.7
November	0.9	0.2	22.7	0.5	1.9	0.6	2.3	0.7	0.8	0.4	2.3	0.5	1.4	0.6
December	0.5	0.0	2.6	0.7	1.9	0.6	1.4	0.6	0.3	0.3	0.1	-	0.5	0.4
January	1.0	0.7	5.5	0.6	0.8	0.5	0.7	0.7	0.3	0.3	1.7	0.4	1.2	0.7
February	0.5	0.2	2.8	0.3	0.2	0.5	0.3	0.3	*0.1*	-	0.3	0.3	1.7	0.4
March	1.2	0.5	4.4	0.7	0.8	0.6	0.9	0.6	-	-	0.8	0.5	0.7	0.4
Average(1)	**0.7**	**0.4**	**6.0**	**0.6**	**1.4**	**0.6**	**2.1**	**0.7**	**0.6**	**0.4**	**1.0**	**0.5**	**1.6**	**0.6**
Average(2)		0.4		0.6		0.6		0.7		0.4		0.5		0.7
Months > 4	0	-	6	-	0	-	1	-	0	-	0	-	0	-
Months > 6	0	-	2	-	0	-	0	-	0	-	0	-	0	-

1. Average of monthly incombustible fractions
2. Total annual incombustible / total annual insoluble

Figure 4 shows the annual average deposition rates of the incombustible ("ash") component of the deposited dust at the 7 OEMP gauges and 15 other Delta deposition gauges in the region over 6 calendar years (and first 4 months of 2012). The "ash" component is plotted on the understanding that if emissions from KVAR2 were impacting in the local area, these impacts would show up in increased deposition of incombustible (ash) material. As would be expected, results show year-to-year variation. The relatively high deposition rates in 2009 at all gauges in the region are due to the exceptional dust storms which occurred over south eastern Australia in September of that year As reported in the previous year's report (M_E_S, 2012) and shown in **Table 7**, dust deposition during several dust storms significantly elevated annual dust deposition rates.

Excluding the unusual 2009 averages, **Figure 4** indicates that in most years, the deposition of incombustible material is less than approximately 1 g/m^2/month at most sites and that results in 2010 – 2012 were similar to, or lower, than those from between 2006 – 2008, prior to the commencement of KVAR2.

Figure 4 also shows that a number of gauges show consistently higher rates of incombustible material depositions than the bulk of the gauges, and in particular:

- Gauge 25 is notable as it is located within about 100m of KVAR2, but not included in the OEMP network, and adjacent to the Wallerawang coal haul road. Vehicle generated dust from this road (due to re-suspension of fugitive ash particles) would appear to be the probable source of the high deposition rates at this gauge relative to other sites in the network;
- Gauge 27, an OEMP gauge, has previously been discussed as being over 1km from the KVAR2 site, and probably impacted by activities unrelated to KVAR2;
- Gauge 24 is located nearby significant mining operations and the Mt Piper ash storage area (see Appendix 2 for location);
- Gauge 29 is the OEMP gauge nearest KVAR2 and Figure 4 indicates deposition of incombustible material was lower in 2010 – 2012 compared with 2006 – 2008. As shown in Tables 3 and 4, a high proportion of the deposition at Gauge 29 is incombustible.

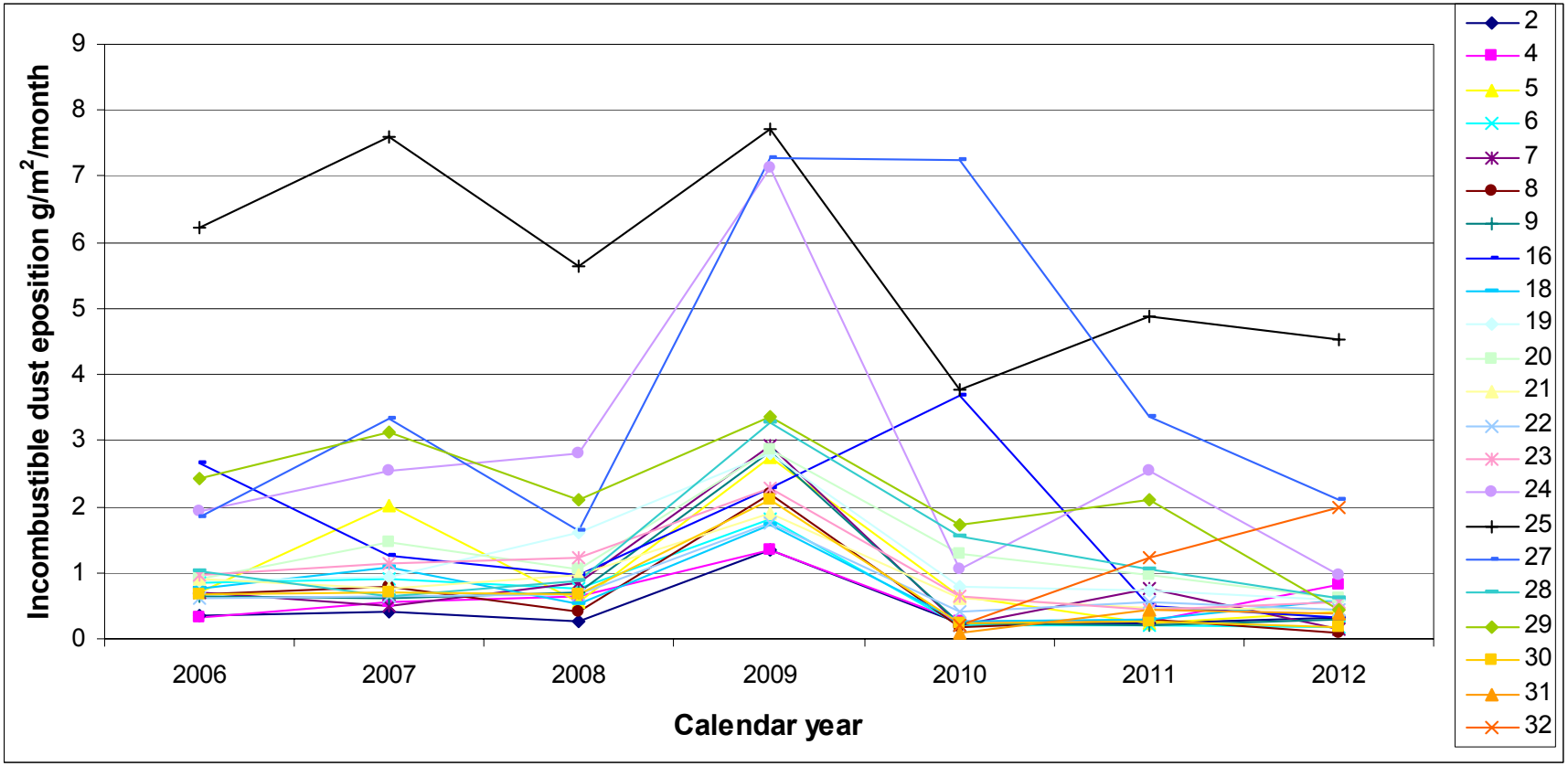


Figure 4: Annual deposition of the incombustible (ash) fraction of total dust deposition at the 7 OEMP gauges and 15 other Delta Electricity gauges.

4.2 KVAR2 on-site gauges

While the OEMP does not require that results from LLI's on-site gauges be included in the annual report, the results for the second and third years of operation are included in **Tables 5 and 6**, respectively, for completeness. These data demonstrate that gauges located at the perimeter of KVAR2 and to the west of the site (1, 4 and 7) nearer residential areas, recorded annual average deposition rates below 4 g/m^2/month in both years, with very few individual monthly results above 4g/m^2/month.

Gauge 9 is located adjacent to the ash loading silo at Wallerawang Power Station, about 1,500m from KVAR2, and it would appear to be influenced by the ash transfer operations at the silo. This is indicated by the high average ash fraction of 0.8 compared with the other sites, which despite being located on or adjacent to the ash placement area, are influenced by other dust sources with a lower incombustible (ash) fraction.

The highest on-site monthly deposition rates generally occur at Gauges 3, 5, 6 and 8, which from **Figure 3** can be seen to be located well inside the perimeter of KVAR2.

5. COMPLAINT REGISTERS

Both Delta Electricity and LLI maintain registers which record the details of any complaints received by members of the public and a description of any investigation and corrective action taken in response to the complaint.

No complaints were received by either organisation in relation to KVAR2 operations in the 2 years covered by this report (2010 - 11, 2011 - 12).

Since the commencement of KVAR2, Delta Electricity has not received any complaints directly related to emissions from the facility. There was one complaint in May 2009, which was documented in the previous report, regarding ash trucks operating on the coal haulage road with ash uncovered and therefore a potential source of dust in the ambient environment.

Table 5: Dust gauge data from the on-site gauges for the second year of KVAR2 operations (April 2010 – March 2011).

Insol – Insoluble solids, g/m^2/month, **Frac**. – Incombustible (ash) fraction of insoluble solids

Gauge / Month	1		2		3		4		5	
	Insol.	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**
April	0.1	-	0.4	0.3	11.6	0.8	2.3	0.5	10.2	0.4
May	1.0	0.8	2.0	0.7	2.2	0.8	1.6	0.7	25.9	0.5
June	3.2	0.5	1.0	0.5	0.5	0.6	1.2	0.3	4.7	0.6
July	0.5	0.4	1.6	0.6	19.0	0.8	1.5	0.6	3.2	0.4
August	4.1	0.8	1.1	0.7	5.9	0.9	0.8	0.5	1.7	0.5
September	2.0	0.8	7.3	0.7	3.4	0.6	2.5	0.6	6.4	0.5
October	11.0	0.8	2.4	0.8	1.9	0.8	3.0	0.5	50.4	0.5
November	3.2	0.8	0.6	0.7	1.3	0.8	2.7	0.4	11.6	0.8
December	2.7	0.7	0.3	0.3	1.6	0.6	1.3	0.2	14.2	0.7
January	3.6	0.9	1.2	0.8	0.1	-	0.2	-	3.1	0.7
February	3.6	0.9	2.5	0.8	5.9	0.7	3.0	0.7	6.3	0.7
March	0.8	0.6	3.1	0.9	1.2	0.8	1.4	0.7	29.2	0.6
Average(1)										
Average(2)	3.0	0.7	2.0	0.6	4.6	0.7	1.8	0.5	13.9	0.6
Months > 4	2	-	1	-	4	-	0	-	9	-
Months > 6	1	-	1	-	2	-	0	-	8	-

1. Average of monthly incombustible fractions
2. Weighted average = total annual incombustible / total annual insoluble

Table 5 (continued): Dust gauge data from the on-site gauges for the second year of KVAR2 operations (April 2010 – March 2011).

Insol – Insoluble solids, g/m^2/month, **Frac**. – Incombustible (ash) fraction of insoluble solids

Gauge / Month	6		7		8		9	
	Insol.	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**
April	10.8	0.5	2.2	0.7	1.7	0.6	6.9	0.9
May	2.9	0.4	1.8	0.7	4.3	0.7	7.5	0.9
June	3.7	0.5	0.3	0.3	0.2	0.0	5.6	0.9
July	7.3	0.6	2.1	0.8	1.1	0.5	6.4	0.8
August	7.2	0.7	3.2	0.8	5.0	0.9	5.6	0.8
September	4.0	0.8	1.0	0.7	5.2	0.8	4.2	0.9
October	5.1	0.3	3.6	0.8	5.5	0.9	6.4	0.9
November	11.5	0.5	2.8	0.8	1.5	0.7	4.5	0.8
December	12.2	0.3	3.6	0.8	1.8	0.6	4.4	0.8
January	4.2	0.5	1.6	0.8	0.3	0.7	2.5	0.7
February	5.1	0.5	4.9	0.8	7.8	0.9	10.8	0.3
March	6.5	0.8	3.2	0.8	0.9	0.8	8.8	0.8
Average(1)								
Average(2)	6.7	0.5	2.5	0.7	2.9	0.7	6.1	0.8
Months > 4	9	-	1	-	5	-	11	-
Months > 6	6	-	0	-	1	-	6	-

1. Average of monthly incombustible fractions
2. Weighted average = total annual incombustible / total annual insoluble

Table 6: Dust gauge data from the on-site gauges for the third of KVAR2 operations (April 2011 – March 2012).

Insol – Insoluble solids, g/m^2/month, **Frac**. – Incombustible (ash) fraction of insoluble solids

Gauge / Month	1		2		3		4		5	
	Insol.	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**
April	1.6	0.3	2.9	0.9	1.6	0.8	2.6	0.6	15.0	0.6
May	3.2	0.7	3.4	0.9	5.2	0.9	2.6	0.7	10.9	0.7
June	1.0	0.6	1.5	0.9	1.4	0.9	1.3	0.6	7.6	0.7
July	2.1	0.6	1.4	0.8	1.7	0.9	8.2	0.8	2.5	0.8
August	4.7	0.8	1.2	0.8	7.4	0.9	2.4	0.8	23.8	0.7
September	2.9	0.7	0.9	0.8	1.4	0.8	2.4	0.8	10.6	0.7
October	4.8	0.9	0.8	0.6	1.7	0.8	1.1	0.6	28.2	0.7
November	0.1	-	0.3	0.7	-	-	0.7	0.6	28.3	0.6
December	2.0	0.9	0.9	0.9	-	-	0.8	0.4	5.0	0.6
January	2.1	0.9	1.0	0.8	-	-	0.8	0.4	5.0	0.6
February	17.1	0.4	1.7	0.8	-	-	1.7	0.3	6.3	0.4
March	3.6	0.3	0.7	0.4	-	-	2.6	0.7	15.3	0.2
Average(1) ***Average(2)***	3.8	0.6	1.4	0.8	2.9	0.9	2.3	0.6	13.2	0.6
Months > 4	3	-	0	-	2	-	1	-	11	-
Months > 6	1	-	0	-	1	-	1	-	9	-

1. Average of monthly incombustible fractions
2. Weighted average = total annual incombustible / total annual insoluble

Table 6 (continued): Dust gauge data from the on-site gauges for the third year of KVAR2 operations (April 2011 – March 2012).

Insol – Insoluble solids, g/m^2/month, **Frac**. – Incombustible (ash) fraction of insoluble solids

Gauge / Month	6		7		8		9	
	Insol.	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**	**Insol.**	**Frac.**
April	0.5	0.2	0.9	0.6	0.1	-	2.0	0.7
May	7.0	0.5	3.5	0.8	3.4	0.8	13.9	0.9
June	0.8	0.6	1.2	0.8	2.8	0.9	4.7	0.9
July	0.7	0.6	2.0	0.8	10.5	0.9	19.4	0.9
August	13.0	1.0	3.1	0.8	3.7	0.9	17.7	0.9
September	3.4	0.6	2.0	0.7	2.0	0.9	9.7	0.8
October	3.8	0.8	3.0	0.8	0.9	0.9	1.8	0.7
November	5.1	0.8	1.8	0.8	-	-	4.8	0.9
December	2.7	0.4	1.2	0.8	-	-	2.0	0.8
January	2.7	0.4	1.3	0.8	-	-	2.1	0.8
February	7.2	0.6	0.9	0.8	-	-	4.6	0.8
March	0.9	0.6	0.3	0.3	-	-	0.7	0.7
Average(1) ***Average(2)***	4.0	0.6	1.8	0.7	3.3	0.9	7.0	0.8
Months > 4	4	-	0	-	1	-	7	-
Months > 6	3	-	0	-	1	-	4	-

1. Average of monthly incombustible fractions
2. Weighted average = total annual incombustible / total annual insoluble

6. AIR QUALITY MANAGEMENT PLAN REQUIREMENTS

Although addressed, at least in part, in previous sections, this section explicitly addresses the specific requirements of the KVAR2 OEMP and Air Quality Management Plan.

The key objective of the KVAR2 air quality management plan is "*to manage resources effectively to ensure the prevention of conditions that may lead to visible dust emissions."* (PB, 2009 p. 77)

While not specifically included in the M_E_S reporting brief, during an inspection of KVAR2 and surrounding areas on the 27th April, 2010, the range of management measures included in the OEMP to minimise dust emissions were observed to be operating and no visible dust was being generated by KVAR2 operations.

The OEMP includes the following performance measures:

Targets:

- The local air quality in the vicinity of the KVAR is not impacted by Stage 2 operations;
- Zero incidence of dust-related complaints

Indicators:

- Zero visible dust events in vicinity of Kerosene Vale Ash Repository during Stage 2 operations
- Complaints register demonstrating zero occurrence of dust related complaints.

With respect to the first target, data presented in Section 4 demonstrated that Stage 2 operations are not adversely impacting on dust deposition levels in the vicinity of KVAR2.

As noted in the previous section, both Delta Electricity and LLI have systems in place to receive, record and respond to complaints. During the first three years of operation of KVAR2 no complaints related to dust emissions from the facility were received by either Delta Electricity or the site contractors.

It is not possible with the data available to make any comment regarding the indicator of *zero visible dust events in vicinity of KVAR2 operations*, although as discussed in the next section, the camera installed at KVAR2 might be used in the future to assess performance against this objective.

Air quality monitoring

The OEMP specifies 5 existing dust gauges and 2 new gauges. With the installation of Gauges 31 and 32 (**Figure 2**) in October, 2010, all 7 gauges are operational.

The OEMP adopts the aim of complying with the 4 g/m^2/month (as an annual average) amenity limit. As documented in **Tables 3** and **4** and **Table 7** dust deposition at 6 of the 7 OEMP gauges was less than the 4 g/m^2/month (annual) in the second and third years of operation.

Dust deposition at Gauge 27 exceeded 4 g/m^2/month (annual) in both years and exceeded 6 g/m^2/month in 2010 - 2011 but as discussed previously, and further in the next section, elevated OEMP dust gauge results are not necessarily caused by emissions from KVAR2 and some of the OEMP gauges, in particular Gauges 27 and 28, are poorly located for the purpose of identifying

impacts from KVAR2. The elevated results recorded at Gauge 27 are most unlikely to be significantly affected by emissions from KVAR2.

Reporting

The OEMP includes reporting requirements, such as *location frequency, rationale and the procedures and protocols for collecting air quality samples as well as the parameters analysed and methods of analysis.* These requirements have been addressed in Section 3 of this report.

The reporting requirement for the OEMP data to be assessed against the 4 g/m^2/month criterion has been addressed immediately above and in Section 4.

The OEMP also requires the data *to be assessed against the baseline data provided in Table D of Appendix C* (of the air quality assessment). **Table 7** reproduces the data from the referenced Table D and adds more recently collected data to it, including data from the first three years of KVAR2 operations (April 2009 – March 2012).

Table 7 demonstrates that average dust levels at the OEMP gauges vary from year-to-year, as expected.

For 4 of the 5 gauges operating prior to the commencement of KVAR2, deposition rates in the first year of KVAR2 were within the range recorded in previous years, while deposition in the subsequent 2 years was generally lower than prior to commencement of KVAR2. The results do not indicate any adverse change due to KVAR2 operations, particularly at Gauge 29 which is closest to KVAR2. Results from Gauge 29 during toperation.

As discussed above, Gauges 27 and 28 are poorly located for the purpose of identifying impacts from KVAR2. The elevated results recorded at Gauge 27 are most unlikely to be significantly affected by emissions from KVAR2.

Table 7: Annual average dust deposition recorded by OEMP gauges

	Year	Dust Gauge, Annual average g/m^2/annual average						
		DG5	**DG27**	**DG28**	**DG29**	**DG30**	**DG31***	**DG32**
From Table D. Calendar years	**2002**	-	1.7	2.2	1.2	0.8	-	-
	2003	-	1.3	2.1	7.4	0.8	-	-
	2004	-	1.8	1.3	5.3	0.7	-	-
	2005	-	5.7	2.0	4.9	1.0	-	-
	2006	1.2	3.2	4.9	3.0	1.0	-	-
	Jan – Jun 2007	1.0	3.9	1.8	3.0	1.1	-	-
Calendar years	**2007**	2.7	5.0	1.1	3.7	1.0	-	-
	2008	1.0	2.8	1.8	2.6	1.2	-	-
KVAR2 April – March	**2009 – 2010 (Excluding dust storms)**	1.4	10.3	2.6	2.7	1.0	-	-
	2009 – 2010 (Including dust storms)	3.9	14.4	4.6	4.1	2.7	-	-
	2010 - 2011	0.9	16.4	2.2	2.6	0.7	1.1	1.5
	2011 – 2012	0.7	6.0	1.4	2.1	0.6	1.0	1.6

***** Last 4 months on the year only

7. DISCUSSION

Dust gauges are often positioned adjacent to dust generating activities to assess possible nuisance impacts at nearby receptors. As a passive collection system they are inexpensive to install and maintain but are subject to a number of limitations:

- They are more effective in collecting coarse particles than fine particles;
- Results are often influenced by things like insects, bird droppings and occasionally human interference;
- The collection period of a month makes the assessment of short-term, individual events impossible;
- Without further analysis, it is difficult, if not impossible, to use dust gauge results to discriminate between a number of possible sources.

Notwithstanding these limitations, dust gauge data, have the potential to provide some relevant information regarding the potential dust impacts arising from KVAR2 when used cautiously.

It is noted that in relation to dust gauge samples, "ash" refers to the incombustible, inorganic fraction of the sample and the "ash" fraction of a sample can not be directly related to coal-ash. This point was illustrated in the previous report (M_E_S, 2012) using data from September 2009, during which time the KVAR2 dust gauge results were clearly influenced by the regional dust events. The ash fractions of the samples collected during this month were generally high at about 0.8, indicating the dominance of inorganic, crustal material. KVAR2 Gauge 9, which is located near the ash silo at Wallerawang Power Station, shows ash fractions of 0.8, or higher, in most months and in this case the high ash content is probably due to fugitive ash emissions from the transfer process. The emissions are the inorganic, incombustible remains following coal combustion. This point is considered further later in this discussion, but here it is noted that a high "ash" fraction does not necessarily indicate ash from coal combustion.

Related to the above discussion is the OEMP's requirement that:

If the 4 g/m^2/month limit is exceeded by more than 2 g/m^2/month a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken…

This requirement appears to be based on the simplistic assumption that any measured increase in dust deposition at OEMP gauges is the result of emissions from KVAR2. A diverse range of sources (including regional dust storms, as noted above) can contribute to dust gauge results and, as noted previously, some OEMP dust gauges are poorly located for the purpose of identifying impacts from KVAR2. Care must be exercised in attempting to relate dust deposition results to potential dust sources. The contributing source, or sources, to an elevated result can not always simply or easily be determined. It follows that prior to reviewing *the effectiveness of the (KVAR2) dust suppression regime* that some effort should be made to determine the likely contribution of KVAR2 operations to the dust event(s).

As noted above dust gauges are most commonly used adjacent to, or in close proximity to, potentially "dusty" activities. With respect to the location of the OEMP gauges it should be noted that data obtained from gauges located at some distance from KVAR2 are unlikely to provide robust, useful information regarding potential impacts from the KVAR2. Of the existing 7 OEMP gauges it is considered that Gauge 29, which is adjacent to KVAR2 and Gauges 31 and 32 (**Figure 2**) are likely to provide information which is useful in assessing potential impacts

from KVAR2. In 2010 – 2011 and 2011 – 2012 the annual average deposition at these 3 sites was, at most, 2.6 g/m^2/month and exceeded 4 g/m^2/month in only 4 individual months. The trigger threshold of 6g/m^2/month was not exceeded in any single month during the reporting period for Gauges 29, 31 and 32.

It is considered that OEMP Gauges 5, 27, 28 and 30 are too far away to provide data relevant to assessing KVAR2 impacts. Gauge 5 might be considered to provide "background" data, but the only use for gauge locations 27 and 28 should be to monitor potential dust deposition from Wallerawang Power Station's operations, including the coal stack. The elevated results recorded at Gauge 27 are often associated with a relatively low "ash" fraction and are most unlikely to be related to KVAR2 operations, but as discussed in Section 4, may well be significantly influenced by human interference.

Results for Gauges 5 and 30 in 2010 – 2011 and 2011 – 2012 were very low, averaging less than 1 g/m^2/month in both years.

Dust data from the first three years of operation of KVAR2 showed no indication of an increase in dust deposition levels when compared with data collected in the years immediately preceding KVAR2 operations, particularly at Gauge 29, the closest to KVAR2. If considered necessary, further information on the contribution that ash particles from KVAR2 make to dust deposition beyond the site's perimeter could be provided by the use of microscopic examination of a number of collected samples. Such examination could distinguish crustal material and "ash" resulting from coal combustion, the latter being characterised by spherical particles of varying diameter. Consideration could also be given to installing directional dust gauges, as well as standard dust gauges, at OEMP sites to provide additional information on potential dust sources.

While a number of results from the KVAR2 on-site gauges recorded annual results equal to and above 6 g/m^2/month, it should be noted that these gauges are positioned primarily for monitoring Work Place Safety requirements and are located well within the perimeter of KVAR2. Results from gauges located on the perimeter of the site (2, 1, 4, 7) were less than 4g/m^2/month, on average, indicating that elevated dust levels were not leaving the site (in these directions). It is also of note that the average ash fraction of the on-site gauges of approximately 0.6 to 0.8, indicates that sources with a significant combustible fraction contribute to the dust results on KVAR2.

When the dust gauge material is analysed on a monthly basis for insoluble solids, ash and combustible fractions, the analysts provide a description of the collected material, based on visual inspection including colour, size (fine, coarse etc) and if possible the composition of the collected material, which might typically include the following: bugs, organics, plant material, spiders, bird droppings – as well as the more generic "dust". The colour of the collected dust is variously described as black, brown, grey and green (perhaps due to biological activity). If coal-ash from KVAR2 were making a significant contribution to deposited dust levels, it might be expected that the collected ash would be described as grey (the colour of the coal-ash varies from light to dark grey), on a regular basis.

LLS Gauge 9 is located at the ash transfer facility at Wallerawang Power Station – and 20 of the 24 monthly samples in 2010-11 and 2011-12 included "grey" as a descriptor, suggesting coal-ash may be contributing at this site –and this possibility is supported by the high "ash" fraction of about 0.8 at this site compared with other sites. Of the LLS gauges located at KVAR2, 79 out of 192 monthly samples (about 40%) included "grey" as a descriptor. The OEMP Gauge 29 is

closest to KVAR2 and 20 of the 24 samples (83%) included "grey" as a descriptor compared with 43 out of 128 (34%) for the remaining 6 OEMP gauges.

Finally, as commented upon during the previous annual report, the images collected from the camera installed at KVAR2 could be very useful in confirming or dismissing KVAR2 as a source of visible dust emissions. Should visible dust emissions be confirmed, data collected at the weather station on KVAR2, installed in July 2010, would be useful in recording the conditions under which dusting occurs, which then might enable effective corrective measures to be implemented. It suggested that the collected camera images and weather data be routinely reviewed to ensure that the instruments are working satisfactorily. It is also noted that another camera has been installed at the ash transfer silo at Wallerawang Power Station.

8. CONCLUSIONS and RECOMMENDATIONS

1. Annual average dust deposition results in the second and third years of the Kerosene Vale Ash Repository Stage 2 (KVAR2) operations were below the criterion of 4 g/m^2/month at 6 of the 7 Operation Environmental Management Plan (OEMP) gauges.

2. Dust deposition results at the one gauge that exceeded 4 g/m2/month in both 2010 – 2011 and 2011 – 2012 are unlikely to be related to KVAR2 operations.

3. A number of gauges in the OEMP network are poorly located for the purpose of identifying impacts from KVAR2 and as such the OEMP dust gauge monitoring network should be reviewed.

4. The dust gauge data from the first three years of KVAR2 operations do not indicate that KVAR2 operations have resulted in dust deposition above the OEMP levels that trigger the requirement to implement additional control measures.

5. The OEMP requirement that: *If the 4 g/m^2/month limit is exceeded by more than 2 g/m^2/month a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken,* should be amended to require an assessment of the likely contribution of KVAR2 operations to the dust deposition levels prior to undertaking a review of the control measures.

6. Should further, more detailed investigation into the potential impacts of KVAR2 and other sources be required in the future, consideration could be given to installing directional dust gauges in addition to the current standard dust gauges. Consideration could also be given to microscopic examination of a representative number of collected samples.

7. No complaints regarding dust emissions from KVAR2 were received by either Delta Electricity or the KVAR2 site contractor during the second and third years of KVAR2 operations.

8. It is not possible with the data available to make any comment regarding the OEMP objective of zero visible dust events in vicinity of KVAR2 operations, although the camera installed at KVAR2 might be used to assess performance against this objective.

9. It is considered that the monitoring and reporting requirements of the OEMP are being met.

9. REFERENCES

DEC (2005) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Department of Environment and Conservation, ISBN 1 74137 488 X, Sydney

DustWatch website

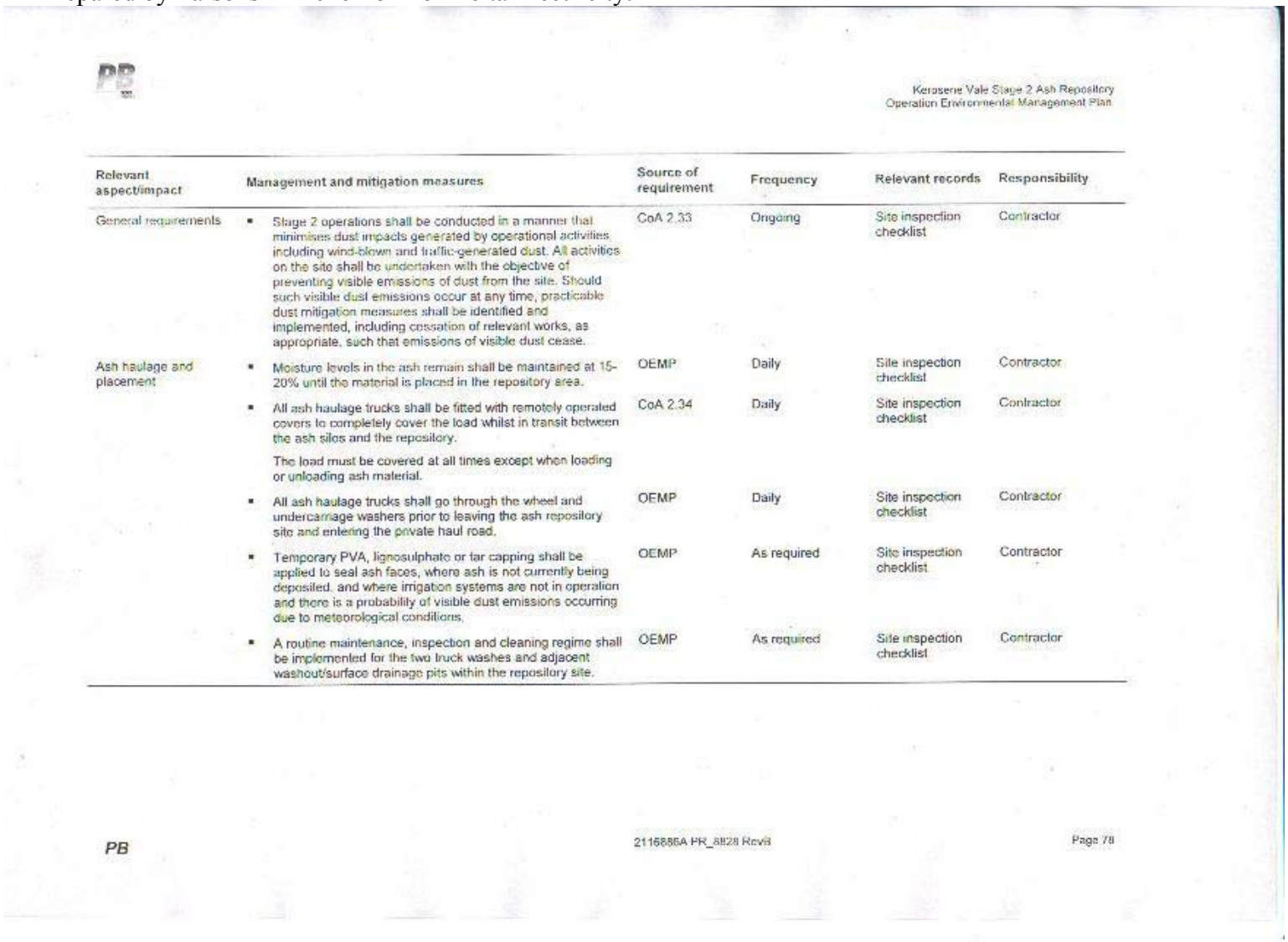
Lend Lease and Delta Electricity (2011) Kerosene Vale Ash Repository Stage 2B Construction Environmental Management Plan.

Malfroy Environmental Strategies (2012) Kerosene Vale Ash Repository Stage 2– Air Quality Review April 2009 – March 2010. Prepared for Delta Electricity

Parsons Brinckerhoff (2009) Kerosene Vale Stage 2 Ash Repository Operation Environmental Management Plan. Prepared for Delta Electricity.

10. APPENDIX 1: THE AIR QUALITY MANAGEMENT PLAN

Prepared by Parsons Brinckerhoff for Delta Electricity.



PB

Kerosene Vale Stage 2 Ash Repository
Operation Environmental Management Plan

Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
General requirements	▪ Stage 2 operations shall be conducted in a manner that minimises dust impacts generated by operational activities including wind-blown and traffic-generated dust. All activities on the site shall be undertaken with the objective of preventing visible emissions of dust from the site. Should such visible dust emissions occur at any time, practicable dust mitigation measures shall be identified and implemented, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.	CoA 2.33	Ongoing	Site inspection checklist	Contractor
Ash haulage and placement	▪ Moisture levels in the ash remain shall be maintained at 15-20% until the material is placed in the repository area.	OEMP	Daily	Site inspection checklist	Contractor
	▪ All ash haulage trucks shall be fitted with remotely operated covers to completely cover the load whilst in transit between the ash silos and the repository. The load must be covered at all times except when loading or unloading ash material.	CoA 2.34	Daily	Site inspection checklist	Contractor
	▪ All ash haulage trucks shall go through the wheel and undercarriage washers prior to leaving the ash repository site and entering the private haul road.	OEMP	Daily	Site inspection checklist	Contractor
	▪ Temporary PVA, lignosulphate or tar capping shall be applied to seal ash faces, where ash is not currently being deposited, and where irrigation systems are not in operation and there is a probability of visible dust emissions occurring due to meteorological conditions.	OEMP	As required	Site inspection checklist	Contractor
	▪ A routine maintenance, inspection and cleaning regime shall be implemented for the two truck washes and adjacent washout/surface drainage pits within the repository site.	OEMP	As required	Site inspection checklist	Contractor

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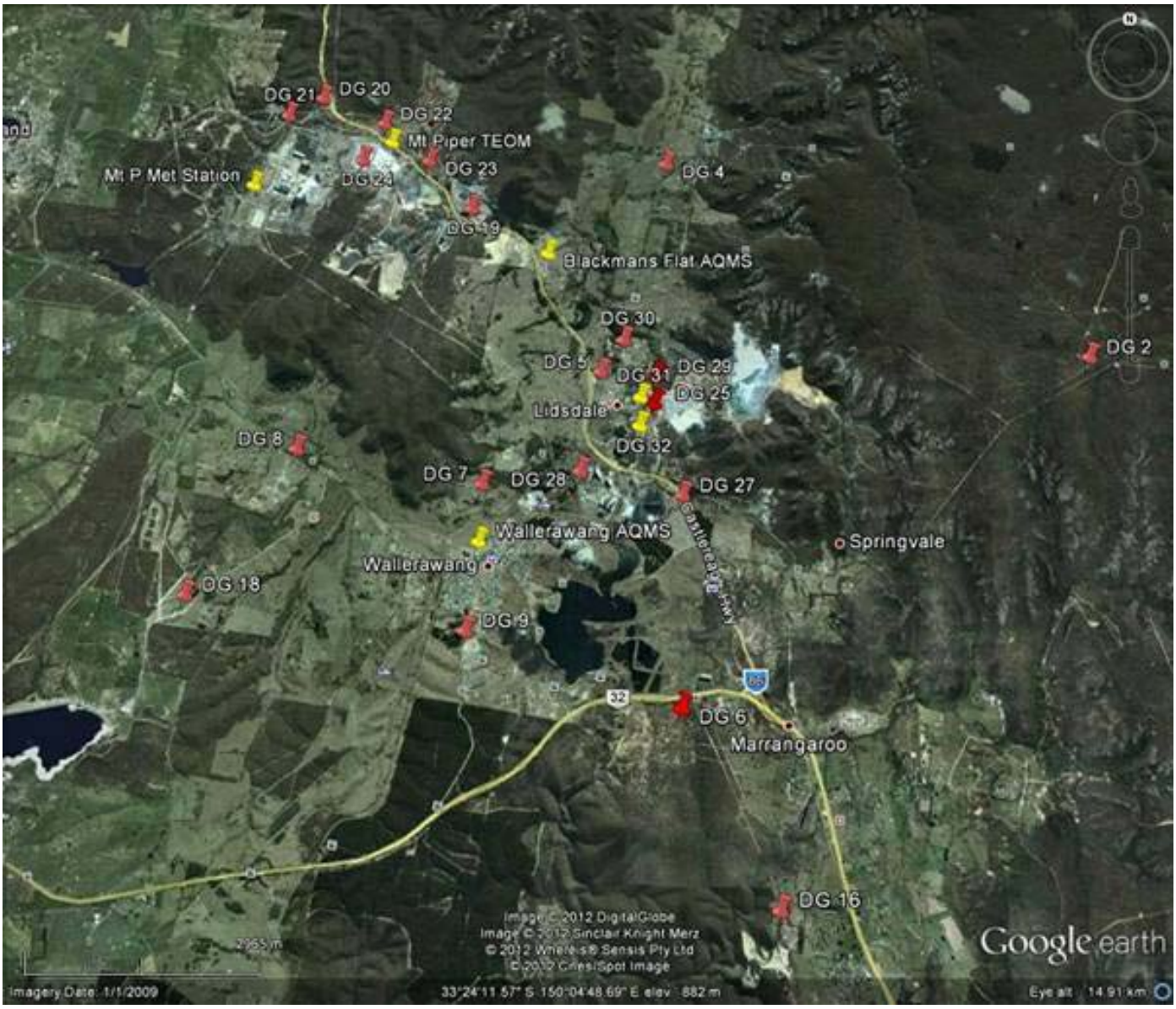
Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
Ash haulage and placement	▪ The private haulage roads shall be maintained in a clean condition by routinely washing the surface. This applies to the haul roads within the repository zone and does not include the private haul road from the power station. Particular attention must be paid during wet periods when muddy water is drawn from the repository area and deposited on the haul roads.	OEMP	As required	Site inspection checklist	Contractor
Dust controls	▪ A water cart shall be used to undertake dust suppression activities throughout the repository site, as required.	OEMP	As required	Site inspection checklist	Contractor
	▪ A dedicated water sprinkler and surface irrigation system shall be installed to cover the active ash placement area. The system will be in place prior to the commencement of ash placement activities and will be operated for the entire daily operating period or when 15 minute wind speed thresholds exceed 5 metres per second.	OEMP	As required	Site inspection checklist	Contractor
	▪ Note: Application rates and the coverage area shall have the capacity to ensure that no visible emissions from the repository area occur.				
	▪ In the event of visible dust emissions from the repository area, personnel shall notify the Site Manager or Repository Team Leader immediately, who will immediately direct the water cart operator to spray the area and review the location and application rate of the sprinkler system.	OEMP	As required	Site inspection checklist	Contractor
Air quality monitoring	▪ A total of 7 deposition gauges shall be used to monitor dust emissions at the perimeter of the ash repository area, and at key locations adjacent to residential properties and Wallerawang Power Station. This includes the existing 5 dust deposition gauges and the installation of an additional 2 dust deposition gauges. Note: The positioning of the additional 2 gauges has been reviewed by specialist consultants based on a review of local weather patterns and the sensitivity of surrounding properties and will be subject to landowner approval. Refer to Figure 6-5 for further details.	OEMP	Establishment prior to commencement of operations. Monthly to contribute to baseline data and monthly thereafter to monitor operations	Air monitoring records	Delta Electricity Specialist consultant

Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
Air quality monitoring	▪ Samples shall be removed from the dust deposition gauges on a monthly basis by a NATA approved laboratory and assessed for compliance with the appropriate air quality criteria.	OEMP	Monthly	Air monitoring report	Delta Electricity Specialist consultant
	▪ The DECC amenity-based criteria for dust fallout is a maximum total dust deposition of 4 g/m²/month (annual). The Stage 2 operations shall aim to achieve compliance with this limit.	OEMP	Ongoing	Air monitoring records	Delta Electricity Contractor
Air quality monitoring	▪ If the 4 g/m²/month limit is exceeded by more than 2 g/m², a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken, including: ‣ increased application rates of the irrigation system at the ash working face ‣ increased application rates of water on haul roads, particularly during high wind events ‣ further reduction in the ash face working area below 1.5 hectares ‣ increased implementation of temporary capping such as PVA, lignosulphate or tar where un-worked ash faces still exist ‣ the application of higher ash moisture rates through the silo humidifier.	OEMP	Ongoing	Air monitoring records	Delta Electricity Contractor
Reporting	▪ Delta Electricity shall issue a report to the DECC every 12 months from commencement of operations. The report shall contain the location, frequency, rationale and the procedures and protocols for collecting air quality samples as well as the parameters analysed and methods of analysis.	CoA 7.3	Annually from commencement of operations	Report to DECC	Delta Electricity Specialist Consultant

Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
Reporting	▪ The results and analysis of the monitoring data shall also be included and assessed against the air quality criteria (4 g/m²/month) and the baseline data provided in Table D of Appendix C. In the case of exceedances; the response taken must be documented within the report. Any deviations from the proposed monitoring program must also be justified.	CoA 7.3	Annually from commencement of operations	Report to DECC	Delta Electricity Specialist Consultant
	▪ The Annual Environmental Management Report will be submitted to the Director-General complete with air quality monitoring data gathered throughout the year.	CoA 7.3	Annually	Annual Environmental Management Report	Delta Electricity

11. APPENDIX 2: THE REGIONAL DUST GAUGE NETWORK



Appendix H – AEMR Action Table 2011-2012

Actions for Delta to complete to comply with 2011-2012 AMER

Task	Issue	Responsibility	Complete	Status
1	(CoA 1.1) Delta to send all the following KVAR Stage 2 reports to the relevant authorities: - Noise reports November 2011 and April 2012 - Water Quality Report April 2010 to January 2012 - Air Quality Review – April 2010- March 2012	Environment Manager Nino Di Falco	X	Reports completed by Contractors but under review by Delta. Send to authorities by end of July 2012
3	(CoA. 5.1 &5.2) Delta is required to maintain and keep up-to date information about construction and progress of the KVAR Stage 2A project on Delta's website.	Assets Manager Steve Marshall	✓	Updated Information approved and sent Julia Harvey – Commercial Operations on the 1 July 2012 for publication on the website.
4	(CoA 1.1) Delta is to make arrangements to have the OEMP noise sub- plan reviewed using up to date data. As part of ongoing best Management Practice to ensure representative control and management of noise issues.	Environment Manager Nino Di Falco	X	In order to do a thorough review of the noise sub-plan, Delta needs have at least 3 consecutive Noise reports. At the end of the 2011-2012 AMER reporting Period only 2 reports have been completed the next report is due in November 2012; therefore the review will be completed prior to the next AMER reporting period.
5	Delta to make sure that Lend Lease are updating their monthly reports to include the requirements outlined in CEMP	External Plant Rhys Alexander	✓	Email was send to Rhys Alexander 1 July 2012 to address this matter with Lend Lease.
6	To review and change where necessary the OEMP sub-plans including Air, surface and ground water, Ash Delivery and placement, landscape and revegetation , environmental management and environmental key targets to ensure they are keep up to date with current legislation and the changing climatic conditions of the site.	Environment Manager/ External Assets Manager in conjunction with Lend Lease	X	To be completed by next April 2013.