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Project: Kerosene Vale Ash Dam and Dry Ash Repository

Water Quality Assessment from April, 2013 to March, 2015 in relation to the Decommissioned Wallerawang Power Station

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Contents

Tables

Figures

Attachments

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Summary

This annual assessment report for 2014/15 reporting period has been prepared for the Kerosene Vale Ash Repository to address the requirements of the NSW Department of Planning and Environment's Consent conditions for monitoring to be undertaken to confirm that there have been no significant effects of the dry ash placement on the local surface or groundwater quality. Due to the locally mineralised conditions, the assessment is required to take these conditions into account, including any residual effects of the Kerosene Vale Ash Dam and Sawyers Swamp Creek Ash Dam.

The assessment found no likely effects on surface and groundwater quality of the Repository. This finding is consistent with that from previous reports and the predictions of the Stage 2 Environmental Assessment on the basis of limited rainfall infiltration into the dry ash placement.

As the dry ash placement has been decommissioned and is proposed to be capped, it appears that no further assessment of the Kerosene Vale Ash Repository will be required after it has been capped. This decision is suggested to be raised in future discussions between EnergyAustralia NSW and the NSW EPA.

The assessment of effects of the residual wet ash in the Kerosene Vale Ash Dam, which is beneath the Kerosene Vale Ash Repository, found no significant effects of its groundwater seepage on the local surface or groundwater. This was found to be due to depletion of ash related leachates from the long-held ash, leaving mainly leachates from the pre-existing coal waste/chitter in the mine void beneath the Repository.

Pumping of water from the Lidsdale Cut pond appears to have caused a drawdown of the local water table, including that at the Repository receiving groundwater bore WGM1/D5. The drawdown revealed the process whereby high concentrations of salts and trace metals, including aluminium, are released from pyrites in the coal waste/chitter in Lidsdale Cut, as well as inside the Kerosene Vale Ash Dam mine void. Hence, it is suggested that EnergyAustralia NSW investigate maintaining a higher water level in the Lidsdale Cut pond to minimise trace metal release from pyrites in the coal waste/chitter.

From these observations, it was suggested that the rare events of aluminium precipitation in Sawyers Swamp Creek appear to be due to leachates from the coal waste/chitter in the wider catchment during high rainfall runoff events that could cause oxidation of pyrites under the prevailing acidic conditions in the area.

Due to the effects of the Springvale coal mine discharge, the effects of the Sawyers Swamp Creek Ash Dam (SSCAD) on the creek was for no significant effects on the creek quality. Previous reports have shown that during periods when the mine water was not flowing down the creek, the ash dam seepage caused an increase in salinity in the creek but there was no effect on trace metals. The SSCAD seepage was found to have no effects on the groundwater up-gradient of the Kerosene Vale Ash Repository. However, some seepage from the northern section of the SSCAD wall was evident but the changes in salinity during 2014/15 indicated that most of the salinity may be from the wider catchment rather than the ash dam.

1. Introduction

EnergyAustralia NSW has advised that Wallerawang Power Station, including the Kerosene Vale Ash Repository (KVAR), ceased operation and subsequent ash production in March, 2014. Aurecon has been engaged to undertake the annual surface and groundwater quality assessment report for KVAR over the period April, 2014 to March, 2015, which includes the time since decommissioning. As the previous assessment report (Aurecon, 2014) ended on March, 2013, Aurecon's scope requires the inclusion of data from April, 2013 to provide continuity of long-term water quality changes to March, 2015.

The 2014/15 report is required for the NSW Department of Planning and Environment's Development Consent conditions for the Kerosene Vale Ash Repository. It was noted that the Wallerawang Power Station Environment Protection Licence (EPL) L766 of 19th June, 2015 has been retained by EnergyAustralia NSW.

To assess the effects, if any, of the dry ash KVAR placement, it is necessary to also consider the effects of other sources of surface and groundwater on the receiving waters of Sawyers Swamp Creek. These include the residual effects of the previous wet slurry Kerosene Vale Ash Dam (KVAD), which is under the KVAR, and to allow for other, non-ash related, catchment inputs and the local mineralised background conditions. In recent years, it has been necessary to assess influences of the Springvale Mine water discharge to Sawyers Swamp Creek, which was found to dominate the water quality in Sawyers Swamp Creek (Aurecon, 2014).

Previous reports found that the Stage 1 and Stage 2 dry ash placements of the KVAR were not measurably affecting the groundwater quality, when assessed in the context of the local coal area mineral effects (Connell Wagner, 2008 and Aurecon, 2014). In addition, although seepage due to limited rainfall infiltration through the KVAR dry ash may have combined with seepage from the KVAD, beneath the KVAR, and entered Sawyers Swamp Creek, no significant effects on the creek receiving water quality has been indicated. Recently, the dominant water quality and flow effects of the Springvale Mine water discharge[1] has made the effects, if any, of seepage from the KVAD/R and Lidsdale Cut (before seepage diversion in June, 2012), as well as from the Sawyers Swamp Creek Ash Dam (SSCAD), essentially undetectable (Aurecon, 2013, 2014).

The approach of assessing potential effects of the KVAR on surface and groundwater by taking into account the background conditions has been continued in the 2014/15 report.

1.1 Background

In 2002, Delta Electricity (now EnergyAustralia NSW) obtained approval for conversion of the wet slurry ash (KVAD) placement process at Wallerawang Power Station to dry ash. 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 placement began in April, 2009 and its second phase began on 19th January, 2012. This placement was ongoing until cessation of operations in March, 2014.

[1] The Springvale Mine water discharge to Sawyers Swamp Creek was intermittent since 2009, increased in 2012 and has been continuous since 2013

Two major issues related to the water quality in Sawyers Swamp Creek became evident in the previous 2013/14 report. EnergyAustralia NSW advised Aurecon that all the Springvale Coal mine water has flowed into the creek since 1st July 2013. This change occurred because the mine water was no longer required to be sent directly to the power station for cooling water, so the emergency Springvale Coal mine water discharge point to upper Sawyers Swamp Creek (LDP20, see Figure 2) was removed from the Wallerawang Power Station licence on 2nd August, 2012 and became part of the Springvale Colliery licence. This discharge meant that ash related seepage effects from the KVAR, KVAD and SSCAD, if any, on the water quality in Sawyers Swamp Creek became essentially undetectable, due to the large volume of Springvale Mine Water. It also meant that the creek monitoring site, WX7, ceased to be the overall receiving water site for the ash placement area.

The other main issue is that the Lidsdale Cut discharge to Sawyers Swamp Creek was stopped since July, 2012 and the pond water has been pumped to the ash dam return water system and from there back to the SSCAD. The blocking of the pond flow to the creek and its pumping out relates to the assignment of aluminium concentrations in Sawyers Swamp Creek in May, 2012, after heavy rainfall in February/March, 2012, to the discharge from Lidsdale Cut, and by implication to seepage from the wet ash placed in the KVAD, rather than from the naturally mineralised surrounding coal mine areas (see Figure 3). These changes mean that the Lidsdale Cut pond has ceased to be part of the groundwater receiving waters for seepages from the KVAD/R area, and only the groundwater bore D5 has been considered in this report as a groundwater receiving water site.

To further assess the sources of aluminium, the database from April, 2013 to March, 2015 has been included in this annual report. The aim is to define the current aluminium concentrations in Lidsdale Cut and influence of the KVAD seepage from the long-held stored ash in the KVAD. In this regard, it is understood that the Lidsdale Cut mine void was back-filled with coal waste/chitter, as were other areas around Sawyers Swamp Creek (see Figure 3), which may be the source of most of the aluminium deposited in the creek in early 2012.

1.2 KVAD Subsurface Drains

As a result of the placement of dry ash on top of the KVAD, groundwater from the KVAD rose up into the KVAR dry ash through cracks in the clay capping, so a new subsurface drain in the area under the KVAR placement was installed in October, 2010. The subsurface drains lowered the groundwater level so it did not reach the dry ash and seepage from the KVAD was collected and sent to Lidsdale Cut pond via the existing KVAD toe drains. A schematic of the seepage diversion system is shown in Figure 1. The internal bores GW10 and GW11 sample the groundwater in the KVAD, under the KVAR, on the western side. Last year's report (Aurecon, 2014) showed that the ground water level at bore GW10 had been drawn down following installation of the subsurface drains and EnergyAustralia NSW has advised Aurecon that GW10 bore is now dry.

Groundwater seepage flows from the northern section of the KVAD wall to Sawyers Swamp Creek are sampled by the piezometers AP9 and AP17 (shown in Figure 1) and they are also sampled for water quality. Most of this groundwater is directed to Lidsdale Cut by the toe drain pipes.

In combination with the KVAD seepage diversion system, EnergyAustralia NSW also installed a new seepage collection and return system at the Sawyers Swamp Creek Ash Dam to minimise seepage from the Ash Dam into Sawyers Swamp Creek. The system commenced operating in May, 2010 returning seepage water from the ash dam seepage v-notch, the main seepage point back to SSCAD as shown in Figure 1.

Figure 1: Schematic of Kerosene Vale Dry Ash Placement Area Seepage Diversion works

1.3 Scope

EnergyAustralia NSW advised that Wallerawang Power Station ceased operation in March 2014, so Aurecon has been requested to undertake this annual surface and groundwater quality report. The annual report, for the 12 months from April, 2014 to March, 2015, is required for the NSW Department of Planning and Environment's Development Consent conditions for the Kerosene Vale Ash Repository (KVAR). EnergyAustralia NSW has advised that they expect the EPA will require evidence that the KVAR during the operating and decommissioned periods has not significantly affected surface and groundwater in the area.

Accordingly, Aurecon has been engaged by EnergyAustralia NSW to review all ground and surface water monitoring data at the KVAR, KVAD, and Sawyers Swamp Creek Ash Dam (SSCAD), as well as in Sawyers Swamp Creek at the WX7 (Figure 2) receiving water site. The study follows on from the findings described in Aurecon (2014) of the effects of improved collection of the KVAD seepage and its diversion to nearby Lidsdale Cut pond[2], noting that, since July, 2012, Lisdale Cut seepage has been diverted from the creek by pumping to the SSCAD.

The assessment is to include an investigation of the source of aluminium in Sawyers Swamp Creek in 2012, after a heavy rainfall event that occurred earlier. EnergyAustralia NSW requested this investigation because the previous report indicated that the source in 2012 was not the Lidsdale Cut discharge to the creek.

The EnergyAustralia NSW Work Scope also requires the water quality data to be assessed according to the Operational Environmental Management Plan (OEMP) procedure of assessing the data against the existing baseline conditions, while the ANZECC 2000 – Freshwater Aquatic Ecosystems guidelines should be used as a reference point. However, previous Aurecon reports, approved by Delta Electricity, showed that the OEMP requirement to use the groundwater beneath the KVAR (that is, inside the KVAD beneath the KVAR) as the receiving waters is not relevant to the site. Accordingly, as set out in the first annual report (Connell Wagner, 2008), the local and ANZECC (2000) guideline trigger values have been applied to the final receiving water site WX7 in Sawyers Swamp Creek. Aurecon has continued, and will continue, to use the relevant parts of the OEMP in the assessment of the water quality data.

1.4 Aims and Objectives

The aims and objects of this report are to assess the effects of the decommissioned KVAR with the understanding that the power station has been decommissioned and that the Lidsdale Cut water is being pumped to the SSCAD.

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.

[2] Lidsdale Cut is a previous open-cut coal mine that has been filled with chitter, leaving a small pond of water to allow the local groundwater seepage to flow into the nearby Sawyers Swamp Creek

As noted in all the reports since 2008, the ANZECC (2000) guideline approach of assessing the likely impact of water quality and trace metals in the residual seepages from the KVAR and KVAD on the receiving surface and groundwater was continued to be used in this report. This included 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.

1.5 Previous Report

Aurecon (2014) undertook the 2012/13 annual water quality report, to May, 2013, for assessment of potential effects, if any, of the Kerosene Vale Ash Repository (KVAR) dry ash placement on the local surface and groundwater. The assessment included the effects of seepage diversion from the previously wet ash placement in the Kerosene Vale Ash Dam (KVAD), located under the KVAR, on Sawyers Swamp Creek. The KVAD seepage was collected in subsurface drains and diverted to the toe drains, which are directed to the nearby Lidsdale Cut where it overflowed into Sawyers Swamp Creek (SSC) until July, 2012.

In relation to the Lidsdale Cut seepage, it was suggested (Aurecon, 2014) that the increased aluminium and trace metals in Sawyers Swamp Creek in May, 2012, shortly after the February/March, 2012 flood, originated from the local coal mine groundwater or coal waste/chitter in the area and was unlikely to be related to the KVAR or KVAD.

The 2012/13 report noted that that the 20ML/day flow of Springvale Coal mine water discharge had dominated the water quality in the creek. This meant that seepage from the rainfall infiltration effects from the KVAR, if any, Sawyers Swamp Creek Ash Dam (SSCAD) wall seepage, as well as KVAD seepage diversion and discharges from Lidsdale Cut were not apparent at the receiving water site, WX7, in Sawyers Swamp Creek.

The KVAR 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
- collection of the dry ash rainfall runoff and diversion to the SSCAD via the previous wet ash system’s water return canal
- placement of the dry ash on the clay capping of the KVAD and its limited permeability
- the sub-surface drain under the KVAR:
    - lowered the groundwater table, which kept the KVAR placement dry
    - reduced effects of the KVAD seepage on the local groundwater quality
- effects of Springvale Mine water discharge into Sawyers Swamp Creek
- the highly mineralised nature of the catchment.

1.6 Information provided by EnergyAustralia NSW

In connection with the assignment, EnergyAustralia NSW has provided copies of:

- Relevant Lend Lease Infrastructure (LLI) KVAR management reports and water quality data in runoff collection ponds, including the decommissioned period
- Relevant information on the status of the decommissioned power station that may affect the local water quality conditions
- Location of any new water quality sampling sites established as part of the decommissioned power station
- Copy of surface and groundwater quality data from April 2013 to May, 2015 including:
    - Sawyers Swamp Creek receiving water site, WX7
    - Groundwater quality in the SSCAD and KVAD seepage detection bores
    - Lidsdale Cut pond water quality and confirmation that water quality sampling is being undertaken in the pond itself
    - Background surface and groundwater data
- Water quality data for the SSCAD pond to define the pond water quality
- SSCAD dam wall seepage water quality and flows via the v-notch weir to the collection and
- Copy of recent, relevant correspondence with EPA on the water quality expectations for Sawyers Swamp Creek
- Springvale mine water quality data
- Lidsdale Cut pump-back flow rates
- Any additional water quality sampling by NALCO relevant to the study.

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

1.7 Data Quality

The data contained in this report was provided by EnergyAustralia NSW and LLI. The EnergyAustralia NSW and LLI data 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 could account for such a significant change. Outliers have an asterisk next to the data in Attachment 2, 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. As the laboratory has not been able to test at the required detection limit, and in the absence of any reason to suppose that silver might be an issue in this case, it is suggested that silver be removed from the sampling program.

1.8 Structure of the Report

Due to the many changes that have taken place in recent years, the structure of the report had to be changed to allow for the changed approach to assessing the effects of the dry ash placement, as well as the previous two wet ash placement areas. Hence, the structure is:

Section 2 describes the surface and groundwater monitoring program and the ANZECC (2000) and locally derived guideline trigger values. The assessment of the KVAR on surface and groundwater by estimation of rainfall infiltration, use of published ash leachates, estimated stream flows in Sawyers Swamp Creek and groundwater flows is shown in Section 3. The estimated effects of the KVAD is shown in Section 4 and the Sawyers Swamp Creek Ash Dam surface and groundwater effects is presented in Section 5.

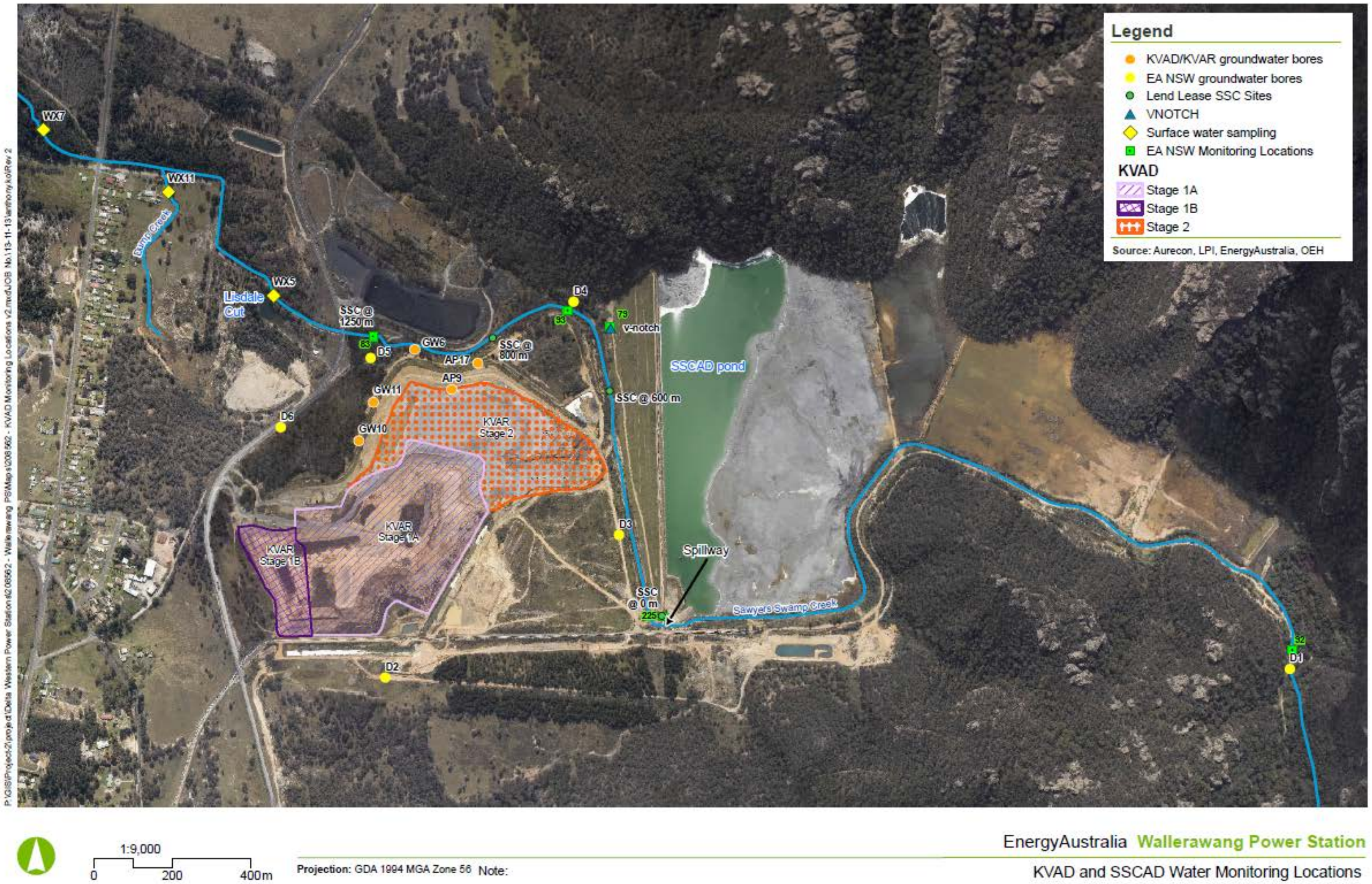

Figure 2: Surface and Groundwater Monitoring Sites for Sawyers Swamp Creek Ash Dam and Kerosene Vale Dry Ash Placement Area

2. Surface and Groundwater Quality Monitoring

This Section provides an overview of the groundwater levels and surface and groundwater quality monitoring at the KVAR used for assessment of effects, if any, of leachates on the local surface and groundwater quality. Due to the inputs from the KVAD, which has the long-held wet ash placed in a coal mine void, containing coal waste and chitter in the bottom of the void, as well as from the local mining activities in the area (Figure 3[3]), the assessment takes into account the background conditions and provides the locally derived and ANZECC (2000) guideline trigger values, which apply as assessment criteria to the receiving waters. The discharge of Springvale Mine water to Sawyers Swamp Creek has also been taken into account.

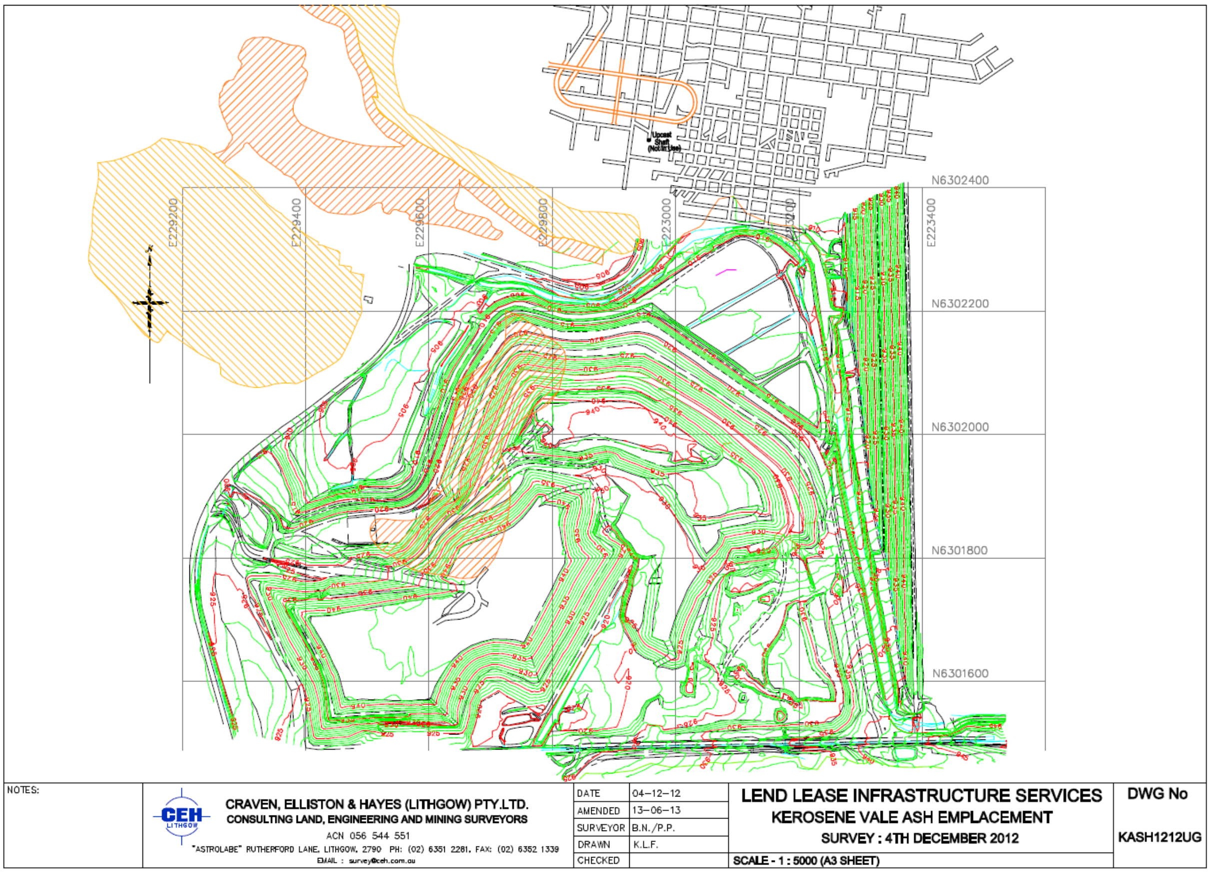

Figure 3. Location of original Kerosene Vale Ash Dam open-cut mine void used to store ash (hashed to right), Lidsdale Cut open-cut mine void filled with coal waste/chitter (hashed to left) and north of the Sawyers Swamp Creek: Centennial Coal surface coal emplacement on top of filled open-cut mine (hash to right, bordered by coal waste/chitter filled open-cut hashed to left) and plan of underground coal mine workings

[3] Note that the mine area plan shown in Figure 3 was provided without a legend so the areas have been described in the Figure name based on discussions with EnergyAustralia NSW.

2.1 Monitoring Design for Differentiation of Water Quality Sources

Surface and groundwater quality monitoring is undertaken by EnergyAustralia NSW for assessment of the environmental performance of the KVAR ash placement as well as seepage effects from the KVAD and SSCAD. The locations of the surface and groundwater sampling sites for the various ash dams and repositories are shown in Figure 2 and are described in this Section.

The assessment of the KVAR effects on receiving water sites depends upon separating the effects of leachates from the KVAD, which is beneath the KVAR, local coal mine inputs and leachates and runoff effects, if any, from the KVAR itself. To do this, groundwater bore locations were established to provide baseline conditions well before dry ash placement began and the bores are located up- and down-gradient of the KVAR and KVAD as well as for the SSCAD. In addition, the location of piezometers measuring the levels of groundwater infiltration through the KVAR dry ash placement, which tends to accumulate above the clay capping on top of the KVAD, at about RL180m, are shown in Figure 2.

The water quality monitoring is undertaken to confirm that the local/ANZECC (2000) guidelines (as applicable) are met in the groundwater receiving water bores D5 and D6 and in Sawyers Swamp Creek at the final surface water receiving water site, WX7. The results of the monitoring are to enable contingency actions and investigations to be initiated in a timely manner if these limits are approached.

2.1.1 Groundwater Monitoring

Piezometers installed in the Stage 2 area of the KVAR measure the amount of rainfall infiltration, accumulating above the KVAD clay capping. The previous report found that some rainfall infiltration was occurring but the piezometers are too small to sample for water quality and trace metals, so assessment of the potential effects on the local groundwater and surface water receiving waters had to be estimated (see Section 3).

To allow for the effects of various local sources of groundwater flowing under the KVAR into the KVAD and SSCAD areas, the up-gradient bores (WGM4/D1 and D2) are used as background. The down-gradient bores (WGM4/D3 and D4) are located for detection of the SSCAD seepage. Figure 6 indicates that the groundwater at bore D4 mainly flows to Sawyers Swamp Creek. However, as the groundwater seepage is expected to be slower than that from the much higher hydraulic head in the SSCAD, the SSCAD seepage effects on the creek, if any, would be expected to override any groundwater effects.

Bores WGM4/D5 and D6 are the seepage detection bores for the KVAD, as well as potential for rainfall infiltration and surface runoff from the KVAR to enter and mix with the KVAD groundwater seepage. It is understood that surface runoff from the KVAR is contained on site and in collection ponds (see Section 2.2), so the potential for effects of the KVAR are for limited amounts of groundwater to seep into the KVAD beneath the KVAR. These down-gradient bores also sample the combined effects of the local coal mine up-gradient inputs as well as those from the SSCAD and the KVAD and the KVAR. Details of the monitoring design were set out in Aurecon (2012).

2.1.2 Surface Water Monitoring

The surface water monitoring sites comprise:

- Lidsdale Cut (WX5), which discharged to Sawyers Swamp Creek until June, 2012

- The final receiving water site, WX7, in Sawyers Swamp Creek, which is downstream of Lidsdale Cut and the local background site, WX11, in Dump Creek and upstream of the junction with Sawyers Swamp Creek and the upper Coxs River (Figure 2).

Site WX5 samples the Lidsdale Cut pond which receives groundwater inflows from the local coal mine open-cut, surface runoff and the KVAD toe drains, which previously entered Sawyers Swamp Creek but has been pumped to the SSCAD since July, 2012. EnergyAustralia NSW has advised Aurecon that sampling the water quality in the Lidsdale Cut pond from July, 2012 to September, 2013 was not undertaken due to drawdown of the void water level by the pumps that direct the water to the SSCAD. Sampling of the pond recommenced in October, 2013.

2.1.3 Sampling in Upper Sawyers Swamp Creek

As recommended in the previous report (Aurecon, 2014), monitoring at selected sites in the creek (Figure 2) has been undertaken by EnergyAustralia NSW and the ash repository contractor (LLI) has continued to monitor at all five sites shown in Figure 2. The sites labelled “@” are monitored by LLI but only limited water quality data, such as conductivity, is collected. EnergyAustralia NSW samples at numbered sites, eg 93, which have detailed monitoring, including conductivity, alkalinity and trace metals and sampling began in June, 2012.

The sites SSC@600m and site 93 were not monitored during 2014/15, so the only sites monitored were SSC@0m (located at the SSCAD spillway), at Site SSC@800m (about 300m downstream) of the SSCAD v-notch seepage and at Site@1250m downstream of the KVAD, see Figure 2.

EnergyAustralia NSW added a new site in Sawyers Swamp Creek, upstream of the SSCAD, site 92, which is the creek background water quality site. This site is also the original Delta Electricity upstream site, WX1, which has not been sampled since March, 1992, so the data for this site during the current reporting period has been added to Attachment 2 in Part 3.

These data, together with the routine, long-term Sawyers Swamp Creek data collected by EnergyAustralia NSW at the receiving water site, WX7, were used to identify any further improvements, above that found in the previous report, or otherwise, in water quality in Sawyers Swamp Creek as a result of the many changes mentioned above.

2.2 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. 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 (Figure 2). Water quality data for the runoff collection ponds is shown in Attachment 2 Section 7.

EnergyAustralia NSW’s contractor for ash placement at the KVAR, Lend Lease Infrastructure Services has installed piezometers at the site for sampling the groundwater height of groundwater infiltration which accumulates above the clay capping on top of the KVAD. The previous report noted that some piezometers in the KVAR Stage 2 area showed groundwater levels above that of the clay cap, which indicated rainwater infiltration. However, the piezometers were too narrow to be sampled for water quality, so the assessment of the potential effects on seepage to Sawyers Swamp Creek, leaking through cracks in the clay cap into the KVAD groundwater, as well as the local groundwater, was undertaken by estimation of the rainfall infiltration, as described in Section 3.1.

The bores GW10 and 11 and AP9 and AP17, shown in Figure 2, sample the groundwater in the KVAD beneath the KVAR. The data from these bores, together with the local groundwater monitoring, as well as surface water quality monitoring in Sawyers Swamp Creek, was used to assess the surface and groundwater quality at the receiving water sites. The assessment was undertaken for the conditions of no surface discharge from Lidsdale Cut to Sawyers Swamp Creek and the Springvale Mine water discharge as the main flow in the creek.

2.3 Tracers for Dry Ash leachates

As mentioned in previous reports, 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. The background conditions in Sawyers Swamp Creek, upstream of the SSCAD (site 92) shows that aluminium is naturally elevated in the area and averaged 0.71 mg/L during 2012/13 (Attachment 2, Section 7), so it has not been used as a tracer for the dry ash placement.

However, as mentioned above, aluminium concentrations in Lidsdale Cut, the KVAD and in the local groundwater bores, as well as in groundwater at KVAR have been examined to determine the source of aluminium that appears occasionally in Sawyers Swamp Creek after heavy rainfall events.

The elements used as ash leachate tracers, 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 the direct effects of the KVAR, as well as the previous wet ash systems in the KVAD and SSCAD 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 selenium concentrations are used as an indicator of flyash management effects. Selenium concentrations are examined for trends if they consistently exceed the ANZECC (2000) guideline of 0.005 mg/L. Boron is used to monitor the effects of coal mining activities and can be used to represent potential effects of other trace metals.

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 monitor any rainfall infiltration accumulating above the clay capping in the KVAR, as well as confirming that the groundwater level in the KVAD is not reaching the dry ash placement above it since the subsurface drains were installed.

Bores WGM1/D5 and D6 are situated down-gradient of the ash placement and up-gradient of the Lidsdale Cut to provide 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 90^{th}

percentile) and environmental goal concentrations. The data are also summarised in Tables in the body of the report.

2.5 Climatic Conditions

The average annual rainfall at the Lithgow gauge over the period of KVAR ash placement from 2003 to March, 2015 decreased from that during the previous reporting period in 2013/14 to 770 mm/year (Attachment 1), which is 89% of the long-term average annual rainfall of 863 mm/year. During the period April, 2014 to March, 2015, the monthly average rainfall was only 54 mm/month and was well below the long-term average of 72 mm/month every month, except during December, 2014 and January, 2015. A high rainfall event occurred in December and January of 174 and 125 mm, respectively.

Since the Stage 2A placement began in April, 2010, there has been a series of wet summers due to above average rainfall events. These occurred in summer 2010/11 (November, 2010 to January, 2011 with a total of 401mm), 2011/12 (February/March, 2012 with a total of 342 mm), February/March, 2013 (total of 297 mm) and 299mm in December and January, 2015 while the 2014 summer was relatively dry (see Attachment 1).

2.6 Methods

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

In house methods[4] based upon Standard Methods (APHA, 1998) are used for the general water quality characteristics of alkalinity, sulphate, chloride, calcium, magnesium, sodium, potassium, 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 but beryllium was stopped in April, 2010 and aluminium has been monitored since July, 2010.

EnergyAustralia NSW 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 pipe is measured using a dip meter and the water surface elevation is calculated to AHD(m) after allowing for the pipe height.

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 has continued to be analysed above the ANZECC guideline trigger value of 0.00005mg/L since November, 2001 (see Attachment 2).

[4] Nalco has NATA accreditation Number 1099 and accredited for ISO/IEC 17025

2.7 Guidelines

As used in previous reports since 2008, the principle of the ANZECC (1995) guidelines for protection of groundwater, where the potential future use of the water resource is considered, has been taken into account. In this regard, the Irrigation, Ecosystem and additional guidelines for protection of livestock or drinking water has been used, where appropriate, to provide a wider context of the ANZECC (2000) guidelines, to define acceptable ambient water quality at the KVAR Stage 2 receiving water sites.

The ANZECC Guidelines for Groundwater Protection in Australia (1995) and the NEPC (1999, update in May, 2013) require the background water quality in groundwater bores to be taken into account. As the NEPC (1999), and the updated 2013 version, did not define the meaning of “background” concentrations for groundwater, the baseline concentrations were continued to be defined as the 90th percentile of the pre-placement concentrations, or the ANZECC guideline default trigger values, whichever is higher. Use of the background 90th percentiles is taken from the ANZECC (2000) guideline procedure for condition 3, highly modified catchments, which generally occur in mineralised areas.

Local guidelines are based on the ANZECC (2000) guideline approach of estimating local guidelines using the 90th percentile for naturally mineralised, highly disturbed groundwater. Hence, the background 90th percentiles that are higher than the default trigger values, are used as the local guidelines. The local and ANZECC guideline trigger values used are called the Environmental Goals and are shown in Table 1.

The groundwater background concentrations use the pre-placement data from the background bore, WGM1/D2, and elevated concentrations at the seepage detection bore WGM1/D5 and Lidsdale Cut (WX5) were also taken into account. The surface water background concentrations use the pre-placement data at Dump Creek, WX11, which is the local background for the mineralised area. The pre-KVAR data at WX7 was also taken into account. The 90th percentile baseline concentrations for all the water quality characteristics monitored are shown in bold in Table 1.

As discussed in Section 2.1, 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, but not Lidsdale Cut (WX5) since July, 2012 (see Section 4.5), 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 2 effects in this report.

In recent times, the level of groundwater in bore D5 has decreased due to lowering of the groundwater under the KVAR by the toe drains and sub-surface drains and sample collection has been limited at times (see Section 4.4).

Aluminium is not included in Table 1 due to the elevated concentrations in the 90th percentile of 5.7 mg/L at background groundwater bore WGM1/D1, which is located up-gradient of the SSCAD, and lack of KVAR pre-placement data to establish a baseline at bores D5 and D6. The source of aluminium in Sawyers Swamp Creek is investigated in Section 4.3 in relation to the water quality changes that have occurred in Lidsdale Cut since pumping began.

A hydrological flow chart which explains how the various flows and discharges enter Sawyers Swamp Creek and the local groundwater is shown in Figure 6, Section 4.

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

	Groundwater				Surface Water		
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

As set out in Connell Wagner (2008), the adoption of 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 90th percentile conductivity of more than twice the ANZECC (2000) guideline default upland river trigger value of 350 µS/cm (upland rivers are defined as above 150m altitude).

The 90th percentile concentration at the Dump Creek site demonstrates that this was caused by local mineralisation effects, so use of the upland value was not considered appropriate. As a result, 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 Sawyers Swamp Creek (Connell Wagner, 2008). This approach has proven to be appropriate because the background conductivity at WX11 increased to about 1400 uS/cm in the 2010/12 reporting period, apparently due to diffuse effects of coal mining activities in the area (Aurecon, 2012).

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 Sawyers Swamp Creek would be slow, use of the creek trigger value was not considered appropriate for groundwater. Hence, 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.

2.7.1 Receiving Waters

As discussed in Section 2.1 and Aurecon (2012), the following receiving water sites for assessment of ash leachate effects from the KVAR dry ash placement were identified:

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

However, as explained in Section 1.1, WX5 and WX7 have ceased to be receiving water sites in this report due to blocking of the Lidsdale Cut discharge (WX5) and its pumping to the SSCAD and the dominant effects of the Springvale coal mine discharge on Sawyers Swamp Creek water quality (WX7). This only leaves bore D5 as the receiving water site, so the following provides clarification of how the receiving water site is used to assess effects of the SSCAD and KVAR.

With the various collection systems in place, 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 Lidsdale Cut via the KVAD toe drains. Consequently, the groundwater quality at bore D5, has continued to be used for early warning of potential effects of groundwater on the water quality in Sawyers Swamp Creek, if the Springvale mine water flow was to cease in the future.

However, due to the large changes that have taken place, the current assessment of effect of the KVAR on surface and groundwater has been undertaken by a direct method by estimating the rainfall infiltration through the dry ash and the effects of the resulting seepage on Sawyers Swamp Creek with no Springvale mine water flow (see Section 3). Section 3 also assesses the effects of the KVAR leachates on the groundwater at bore D5. A similar approach has been used to assess the effects of the KVAD seepage on bore D5, as well as its effects on Sawyers Swamp Creek with no Springvale mine water flow in Section 4.

As EnergyAustralia NSW has begun routine monitoring of the water quality in the upper Sawyers Swamp Creek where it flows through the coal measures upstream of the KVAR, changes in surface water quality at WX7 were assessed by comparison with these upstream sites, as well as the catchment background water quality in Dump Creek at WX11.

2.7.2 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 developing triggers for investigations of the cause of changes, and possible management actions. This approach involves comparing 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 relative 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 (until July, 2012) and Sawyers Swamp Creek at WX7 to assess long-term changes that are approaching the local/ANZECC trigger values.

2.8 Control Charts

In previous reports, the long-term plots of the water quality data were used to allow the identification of trends against the baseline and environmental goals. The trends are tracked using Control Charts (APHA Standard Methods, 1995 and ANZECC guidelines for Monitoring and Reporting, 2000) and the significance of any changes is determined by comparison with the criteria of pre-placement 90^{th} percentiles, post-placement medians, ANZECC (2000) guidelines or local guidelines. Due to Springvale mine water discharge, the ANZECC guidelines cease to apply to the receiving waters of Sawyers Swamp Creek. In addition, pumping of the water from Lidsdale Cut has been found to affect the water quality in the seepage detection bore D5, so the recent changes are shown in relevant tables in the report rather than by control charts.

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

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

This Section assesses the effects, if any, of the completed and capped Stage 1 KVAR and the now decommissioned (but as yet not capped) KVAR Stage 2 dry ash placement on the local surface and groundwater quality. Previous reports have concluded there was no observable effects of the KVAR on surface water or groundwater due to the local mineralised conditions that dominated the water quality and trace metal concentrations. In previous reports, a direct assessment of the effects of the KVAR on surface and groundwater was not undertaken because rainfall infiltration effects were not evident and any assessment was complicated by groundwater from the KVAD rising up into the dry ash placement.

However, with unblocking of the toe drains and installation of subsurface drains, groundwater does not reach the dry ash. The subsurface drains were installed under the KVAR to reduce groundwater levels in the wet ash KVAD, under the KVAR, and prevent groundwater from coming in contact with the dry ash. This reduced the KVAD groundwater level to below its clay capping level of RL918m and seepage of KVAD water from the dry ash area[5] ceased in 2014. It is understood that none was observed in 2014/15.

Although no effects of the KVAD on the dry ash occurs, some rainfall infiltration through the KVAR was noted in the previous 2013/14 report. Accordingly, a direct assessment of the potential effects of the KVAR on surface and groundwater has been undertaken and documented in this Section.

3.1 Direct Assessment of KVAR Rainfall Infiltration and effects on Surface and Groundwater

Due to the many changes in seepage collections and diversions, including the blocking of the Lidsdale Cut and pumping inflows to SSCAD, as well as the Springvale Mine water discharge to Sawyers Swamp Creek, assessment of effects of the KVAR, the KVAD and SSCAD on the receiving water site at WX7 has essentially been prevented. Hence, the rationale for doing the assessment of effects on Sawyers Swamp Creek is to test whether, in the event that the Springvale discharge were to stop, the KVAR effects are likely to be significant. Accordingly, the KVAR assessment has been undertaken by estimating the natural stream flow in the creek before the Springvale mine water discharge began.

As reported in previous reports, rainfall onto the KVAR is retained on the ash area by a perimeter bund wall to minimise inflows to Sawyers Swamp Creek or the local groundwater[6]. The accumulated rainfall is expected to result in some infiltration through the dry ash, but from previous studies for the Mt Piper dry ash placement, the amount of rainfall infiltration was estimated to be low at only 5% of the annual rainfall (Forster, 1999). However, it was noted in the previous annual report that some rainfall infiltration through the dry ash placement was found to collect on top of the clay capping between the KVAD and the KVAR in 2012. The piezometer groundwater level data shows that some levels have continued to be above RL918m (the height of the clay layer) in 2015.

[5] Seepage water from the dry ash was in fact KVAD water that had risen into the dry ash placement when the toe drains were blocked.

[6] Surface water runoff from the capped ash areas is directed into ponds that feed into the return canal, and from there the water is pumped into the SSCAD as shown in Figure 1.

EnergyAustralia NSW advised Aurecon that the narrow piezometers installed in the KVAR ash placement cannot be sampled for water quality. Hence, as the water quality of the KVAR ash leachates could not be sampled, the Wallerawang Power Station ash leachate results by the University of NSW and CSIRO (Ward, et al., 2009) have been used to estimate the effects of rainfall infiltration on the local surface and groundwater. This approach is considered reasonable and the procedure is set out below.

Rainfall infiltration through the KVAR dry ash placement was estimated to be about 0.05 ML/day[7] by using a similar approach to that for the groundwater modelling at the Mt Piper ash area by Merrick (2007). If it is assumed that the rainfall infiltration could flow through the dry ash embankment into Sawyers Swamp Creek, it would be diluted by the nearly 100-fold higher natural flow estimated for the creek of about 4.45 ML/day[8].

The CSIRO (2009) ash leachates results for Wallerawang were applied to the KVAR and the estimated increase in salinity and trace metals in Sawyers Swamp Creek are compared with the surface water quality Guidelines or Goals in Table 2. The estimated increases are also compared with the Springvale coal mine water quality, the water quality in the KVAD and in the creek at the receiving water site WX7. As the Springvale coal mine water discharge began in 2009, at about the same time as the start of the KVAR Stage 2 placement, the increase due to the leachates are also compared to the WX7 concentrations during the Stage 1 placement, before the mine water discharge.

It should be noted that, other than elevated molybdenum and a minor increase for pH, the Springvale coal mine water quality concentrations are lower than the ANZECC surface water guideline values or local goals.

[7] KVAR area about 0.395 Km^2 (comprising 0.332 km^2 capped and 0.63km^2 uncapped) x annual average rainfall 860 mm plus sprinkler irrigation of 114 mm/year on the uncapped area and 4.8% infiltration applied to capped and uncapped areas
[8] Sawyers Swamp Creek catchment about 9.5 km^2 of which 1.95 km^2 flows into SSCAD and is retained other than seepage. About 7.53km^2 of the catchment is diverted around the dam x annual average rainfall 863 mm and 0.25 catchment runoff coefficient.

Table 2. Wallerawang Power Station flyash leachates and potential increase in Sawyers Swamp Creek and local groundwater compared to KVAD groundwater seepage, WX7 concentrations with and without Springvale coal mine discharges, the coal mine water quality and surface and groundwater quality ANZECC (2000) Guidelines or Local Goals

Element (mg/L)	KVAD Ground-water Seepage North Wall in 2014/15	UNSW/ CSIRO Leachate	SSC Increase from KVAR Leachate	Surface Water Guidelines or Goals*	WX7 Pre-Springvale Mine Water Discharge#	WX7 with Springvale Discharge during 2014/15	Springvale Coal Mine Water Quality ***	Local Ground-water Increase from KVAR Leachates	Ground-water Guidelines or Goals*
pH	2.9	4.5	0.1	6.5-8.0	6.3	8.8	8.1	0.3	6.5-8.0
Cond (µS/cm)	3336	1505	15.2	2200	1070	1128	1092	92	2600
TDS	2736	1267	12.8	1500	774	714	654	77	2000
SO4	1918	709	7.2	1000	496	37.3	31.7	43	1000
Cl	18.7	-	-	350	26.5	5.4	8.2	-	350
Al	2.0	37.7	0.38	5.25**	0.274	0.289	0.199	2.3	5.10**
As	0.001	0.082	<0.001	0.024	0.015	0.024	0.018	0.005	0.024
B	5.8	4.76	0.048	1.25	2.26	0.086	0.064	0.3	1.7
Cd	<0.0002	0.025	0.0003	0.0015	0.0006	<0.0001	<0.0002	0.0015	0.001
Cr	0.0008	0.011	<0.0001	0.005	0.0003	0.0006	-	0.0007	0.004
Cu	0.001	0.103	<0.001	0.005	0.0004	0.0007	0.005	0.006	0.005
F	0.5	-	-	1.5	0.89	1.18	1.25	-	1.5
Fe	-	-	-	0.3	0.065	-	0.169	-	1.7
Mn	0.68	-	-	1.9	1.12	-	0.009	-	1.9
Mo	<0.01	0.011	<0.0001	0.01	0.005	0.05	0.060	0.0007	0.01
Ni	0.43	0.194	0.002	0.05	0.142	0.006	0.004	0.012	0.137
Pb	0.0006	-	-	0.005	0.004	0.0008	<0.001	-	0.010
Se	0.001	0.58	0.006	0.005	0.002	0.001	0.002	0.035(0.007)!	0.005
Zn	0.26	1.055	0.011	0.153	0.144	0.023	0.021	0.064	0.505

* From Table 1

** Dump Creek 90th Percentile and bore D6 90th percentile (data for both from April, 2012 to March, 2015). These sites used as background for period since Lidsdale Cut discharge to SSC stopped (see Sections 4.2 and 4.3 for explanation).

***Mine water discharge data from April, 2012 to May, 2015, except for TDS which is from April, 2012 to February, 2014; Cu detection limit of <0.010 is greater than local goal, so assumed concentration was half the detection limit

#Averages for KVAR Stage I period May, 2003 to July, 2007 from Connell Wagner (2008) before Springvale discharge into Sawyers Swamp Creek from 17th February, 2009

! Selenium concentration in brackets due to leachate reduced by 80% by absorption as pass through dry ash capping material before enter groundwater (PPI, 1999).

3.2 KVAR Effects on Sawyers Swamp Creek

In previous reports, it was assumed that the KVAD groundwater seepage at the north wall contained both KVAD groundwater and some KVAR infiltration, so the KVAD/R north wall groundwater seepage was used to assess effects on Sawyers Swamp Creek. This approach gave a conservatively high assessment because the north wall seepage was assumed to contain small amounts of KVAR leachates due to limited rainfall infiltration.

The estimated rainfall infiltration used in column three of Table 2 shows that the estimated increased water quality concentrations in Sawyers Swamp Creek due to leachates are lower than the ANZECC

(2000) Guidelines or local goals at WX7 before the Springvale mine discharge. The exception is selenium, which is marginally higher (Table 2).

However, the estimated increases in water quality are conservatively high because Figure 1 shows that most of the KVAR perimeter bund walls are located well away from Sawyers Swamp Creek and only the short northern wall (about 10% of the perimeter wall length) could potentially seep rainfall infiltration leachates from the KVAR into the creek. Hence, no significant effects on the water quality in the creek is expected, which is consistent with previous conclusions. On the other hand, seepage through the remaining 90% of the perimeter wall length are expected to enter the local groundwater and the effects on groundwater quality are assessed in the next Section.

3.3 KVAR Effects on Groundwater

From the above, it is apparent that most of the KVAR rainfall infiltration enters the local groundwater, rather than surface waters, either by seepage through the perimeter walls and into the ground between the walls and the creek, or directly through cracks in the clay capping into the long-held wet ash in the KVAD.

An indication of the KVAR contribution to the KVAD groundwater by seepage through the clay capping can be gained by comparing the much higher concentration of metals such as aluminium, arsenic, copper, selenium and zinc in ash leachates (Table 2) than in the KVAD underneath. The lower concentrations indicate about 95% dilution, or conversely, only about 5% of the leachates enter the KVAD by rainfall infiltration from the dry ash. Hence the KVAR is not expected to have a significant effect on the groundwater under the dry ash placement.

As the remaining infiltration from the KVAR could be expected to flow over the surface of the clay capping, the path to enter the groundwater is at the base of the 1.8km long perimeter walls. In this regard, EnergyAustralia NSW advised that some seepage is evident from the eastern side of the Stage 2 area.

The following approach was used to assess the effects of the KVAR on the local groundwater. As shown in previous reports, the KVAR seepage is diluted by groundwater inflows of low salinity and trace metal groundwater from up-gradient background areas (bores D1 and D2, Figure 6). To estimate the amount of dilution by these inflows, the groundwater inflows to Sawyers Swamp Creek were estimated using the Department of the Environment (2012) criteria for groundwater inflows to rivers. They found that, depending on the rainfall in the catchment, groundwater inflows are 15 to 60% of river flows, with an average of 37.5%. When applied to the average flow of 4.5ML/day in Sawyers Swamp Creek, the average groundwater flow into the creek from its catchment was estimated to be 1.7ML/day (range 0.67 to 2.67ML/day).

The source area of groundwater flows through the KVAD (under the KVAR) towards the creek, as shown by the groundwater flow directions in Figure 6, was estimated to be about 1.26 km^2, so the average groundwater flow was estimated to be 0.74 ML/day[9]. This is similar to the minimum

[9] The groundwater flow area was estimated to be bounded by Sawyers Swamp Creek from 300m upstream of the SSCAD spillway (to allow for some up-gradient background inflows) to near bore D5 (not including the Lidsdale Cut void area) and about 400m south of the SSCAD return water canal (background inflows through bore D2). The groundwater flow through this area of 0.74ML/day was estimated from the average inflow to the creek of 4.5 ML/day in proportion to the total catchment area of 7.53km^2 (not including the catchment intercepted by the SSCAD) and the groundwater inflow area of 1.257km^2 (4.45 X 1.257 / 7.53 = 0.74 ML/day).

groundwater flow of 0.67ML/day from the catchment into the creek and is considered acceptable to assess the effects of the KVAR leachates on the local groundwater.

Table 2 shows that, with the exception of selenium and minor increases for cadmium and copper, all the predicted water quality and trace metal increases in the local groundwater due to KVAR leachates have lower concentrations than the ANZECC/local groundwater guidelines. The predicted increase for selenium is not expected to enter the groundwater because of adsorption by the mine spoil/clay capping material used to form the berm surrounding the dry ash placement. The minor increased concentrations are not expected to affect the receiving water bore D5, which is down-gradient of the KVAD/R. Evidence for this is the low concentrations of copper, cadmium and selenium in the KVAD groundwater seepage (Table 3, Section 4), which represents the KVAD groundwater that flows toward bore D5. Hence, no significant effects on the KVAR on local groundwater quality is considered likely, which is consistent with previous conclusions.

Hence, the overall outcome of the direct assessment of effects of the KVAR on surface and groundwater is for no significant effects, which is in agreement with the predictions in the Stage 2 Environmental Assessment (Parsons Brinkerhoff, 2008).

The KVAD assessment is undertaken in the next Section, taking into account that the Lidsdale Cut pond does not discharge any more to the creek. The assessment for the Sawyers Swamp Creek Ash Dam surface and groundwater effects is presented in Section 5.

4. KVAD effects on Surface and Groundwater Quality

As for the KVAR assessment, the rationale for assessing the KVAD effects on Sawyers Swamp Creek is to see whether there are significant effects without the Springvale mine discharge.

The previous report mentioned that the subsurface seepage collection and diversion system was installed to prevent the KVAD groundwater reaching the dry ash placement above it, and this was subsequently shown to be successful. Accordingly, this Section examines the changes in water quality in the KVAD since installation of the subsurface drains and its effects, if any, on the receiving water quality at the groundwater bore WWGM1/D5.

In previous reports, the effects of the KVAD groundwater seepage on the local D5 groundwater quality was assessed on the basis that most of the seepage was diverted to the Lidsdale Cut pond by the toe drains. It was also assumed that any seepage not collected by the drains had potential to affect the water quality at bore D5. However, no significant effects were evident, except for some trace metals released from the pre-existing coal and chitter in the Kerosene Vale mine void underneath the KVAR due to the reducing conditions and low pH of the groundwater.

Table 3 shows the groundwater quality inside the KVAD measured at the two piezometers A17 (eastern side of the north wall) and A9 on the western side of the north wall, as well as in a groundwater bore GW11, which is located on the western wall of the KVAD (see Figure 2).

There is a large difference in salinity throughout the KVAD with essentially fresh water on the western side (GW11) and high salinity on the eastern north wall (A17), while A9 has a salinity similar to the average of the three. The high salinity, including sulphate, in A17 is associated with low pH, high concentrations of aluminium, boron, iron, manganese, nickel and zinc, which indicates the source is the coal and chitter in the bottom of the KVAD mine void where the wet ash was placed before operation of the SSCAD. The release of these types of metals is typically associated with oxidation of pyrites under acidic conditions.

Bore A9 was distinguished by having a slightly acidic pH, the highest arsenic concentration and a high iron concentration. Ward et al. (2009) observed elevated arsenic concentrations in the KVAD groundwater pore water, and noted that arsenic tends to be released into solution from being bound with iron in low pH and reducing conditions. This suggests that the groundwater flow through the north-west area of the KVAD mine void is too slow to bring in sufficient dissolved oxygen to prevent reducing conditions. This does not appear to be the case in the north east (A17) or the western areas (GW11).

Furthermore, groundwater inflows into the western area has caused fresh water in GW11, which has alkaline pH, but is associated with high concentrations of chromium and moderately high copper. The groundwater flow directions shown in Figure 6 indicated inflows of low salinity groundwater from the south-east of the SSCAD and the groundwater at bore D1 has elevated concentrations of copper (0.025 mg/L) but chromium is low at 0.002 mg/L. Although there may be other sources of fresh water, such as the decommissioned ash return canal, the area is known as being mineralised with metals such as copper, lead and zinc.

The lack of significant selenium concentrations in the KVAD groundwater, at all three sites, shows that leachates from the long-held ash in the mine void have been depleted, and that most of the trace metals are now from mineralised groundwater inflows from coal or chitter, or the background conditions in the area.

4.1 KVAD Effects on Sawyers Swamp Creek

Although the rate of groundwater seepage from the KVAD to Sawyers Swamp Creek is unknown, an indication of effects can be obtained by comparing the change in water quality in Sawyers Swamp Creek from upstream of the KVAD to downstream. However, the Springvale coal mine discharge of 18 ML/day now determines the water quality in the creek, so the relatively small KVAD seepage is not expected to affect the water quality in the creek (see Section 4.2). Hence, to determine the effects, if any, of the KVAD seepage on the creek water quality, with no Springvale Mine water discharge, the data for 2011/12 has been used to provide an indication of seepage effects.

The upstream and downstream data is shown in Table 3. All the salinity characteristics in the creek had concentrations lower than the ANZECC/local guideline trigger values at the KVAD downstream site. The salinity (Total Dissolved Solids, TDS) increase in the creek from upstream to downstream was small at about 8.5%, indicating that most of the KVAD groundwater seepage is collected by the ash dam toe drains and does not enter the creek.

Although no trace metal concentrations were measured in the creek, if it is assumed that metal increases, due to the KVAD seepage, are proportional to the salinity increase, the estimated increases, assuming no Springvale mine water, were calculated and are shown in italics for the KVAD downstream site in Table 3. Other than iron, all the estimated increases were lower than the surface water ANZECC/local guideline values shown in Table 3. In this regard, it should be noted that most, if not all the metal increases, could be due to the local mineralised conditions in the area, rather than any residual effects of ash storage in the KVAD coal mine void.

Table 3. KVAD groundwater quality compared to Sawyers Swamp Creek with no Springvale Mine water discharge in 2011/12, estimated increase in trace metals in the creek and the receiving water bore D5 groundwater quality

Element (mg/L)	Bore D5 groundwater Quality in 2014/15	KVAD Groundwater Quality 2014/15				SSC Downstream of KVAD* with no Mine Water & estimated metal increase	SSC upstream of KVAD & downstream of SSCAD no Mine Water	SSC upstream of SSCAD at spillway no Mine Water
		A17	A9	GW11	Average			
pH	3.9	3.6	6.2	7.3	5.7	8.0	7.8	7.9
Cond (µS/cm)	717	4400	1536	235	2057	547	497	325
TDS	533	4445	1185	195	1942	344	317	191
SO4	330	2991	715	22	1243	104	94	18
Cl	19.2	16.3	28.9	14.0	19.7	14	14	8.9
Al	16.7	38.73	0.15	2.50	13.79	*1.17* #		
As	0.007	0.003	0.062	0.002	0.022	*0.002*		
B	1.06	10.5	2.1	0.043	4.2	*0.36*		
Cd	0.0334	0.0006	0.0001	0.0001	0.0003	*<0.0001*		
Cr	0.005	0.002	0.001	0.142	0.048	*0.004*		
Cu	0.034	0.006	0.001	0.013	0.007	*<0.001*		
F	0.79	-	-	-	-	-		
Fe	1.28	237	25	0.26	87.5	*7.4*		
Mn	4.13	17.09	5.48	0.03	7.53	*0.64*		
Mo	0.007	0.026	0.160	0.003	0.063	*0.005*		
Ni	0.316	1.555	0.145	0.018	0.572	*0.049*		
Pb	0.0625	0.002	0.001	0.006	0.003	*<0.001*		
Se	0.003	0.002	0.001	0.001	0.001	*<0.001*		
Zn	1.62	3.73	0.07	0.03	1.28	*0.109*		

*Downstream KVAD site located at SSC1250m, upstream KVAD at SSC 850m and up-steam of SSCAD at SSC 0m (see Figure 2).

#Trace metal concentration increases in italics estimated assuming 8.5% of the average KVAD groundwater concentrations enter Sawyers Swamp Creek at the downstream site SSC@1250m.

Note that the 8.5% increase is for the estimated natural SSC flow of 4.45 ML/day (no Springvale mine water); if the 8.5% is applied during the 18ML/day of Springvale mine water flows, the trace metal increases are reduced by 4-fold and the increase in SSC for iron of 7.4 mg/L is reduced to 1.82 mg/L.

4.2 KVAD Effects on Groundwater

Figure 6 shows that KVAD groundwater seepage, which is not collected by the toe drains, could flow toward bore D5, so the groundwater quality in D5 is compared with that in the KVAD in Table 3. Table 3 shows that, the salinity (TDS) in bore D5 is nearly 4-fold lower than in the average KVAD groundwater and 8-fold lower than in the A17 piezometer. The small increase in salinity at D5 indicates that only a small amount of the groundwater flow through the KVAD is not collected by the toe drains.

In addition, the low, acidic pH in the D5 bore is similar to that in the A17 piezometer and it indicates coal/chitter flows into the groundwater sampled by bore D5. This view is supported by the high concentrations of copper, lead and zinc, which were also associated with high concentrations of cadmium and nickel. Although elevated concentrations of nickel in the area is known by the high local background guideline (Table 1), Förstner and Wittmann (2012) reported that cadmium and other metals can be released by oxidation of pyrites under acidic oxidizing conditions in acid mine drainage.

Figure 4 shows that since February, 2014, cadmium has increased consistently (up to 0.11 mg/L) with drawdown of the groundwater table at bore D5. The groundwater elevation changes at bore D5 (Figure 5) show that the level has frequently been drawn down to its minimum and recharged by rainfall between the drawn down periods.

These increases during periods of low groundwater levels suggest that pyrites in the soils are being oxidised by air. The lack of significant concentrations of selenium in bore D5 is similar to that in the KVAD groundwater and indicates that the source of the increased metals is pyrites in coal waste/chitter and not due to ash leachates.

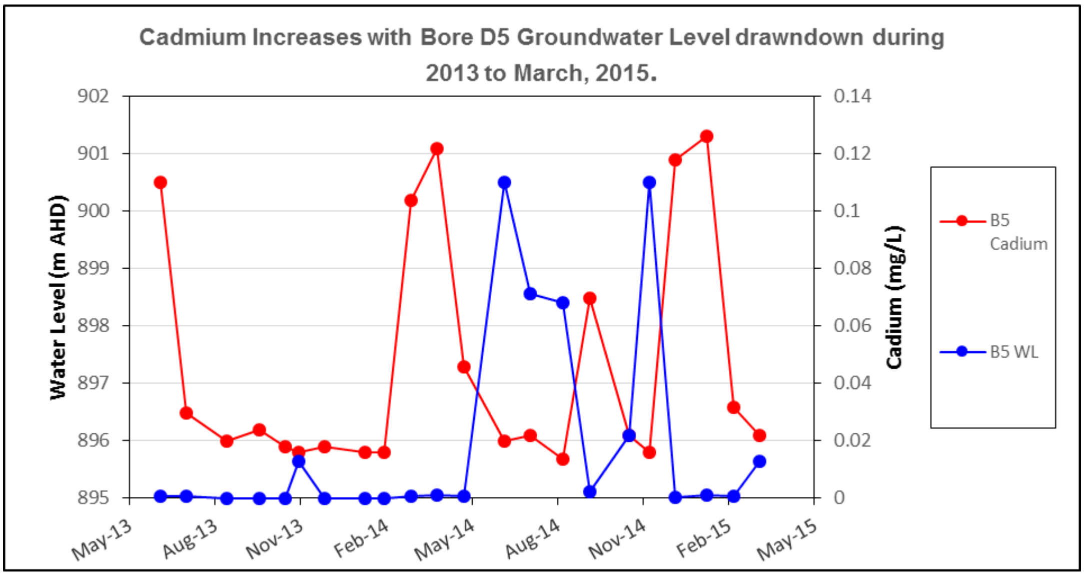

Figure 4. Recent increases in Cadmium at Bore D5 with Groundwater Level drawn down during April, 2013 to March, 2015

Table 4 shows the changes in groundwater quality in bores D5 and D6 since the early ash placement in the Stage 2 area. There has been a halving of the salinity at the D5 bore since installation of the subsurface drains, indicating that saline groundwater flows from the KVAD have been diverted to Lidsdale Cut. On the other hand, the salinity at bore D6 has increased, suggesting that some of the low salinity groundwater flowing into the southern KVAD area was diverted from its path toward bore D6 into the SSCAD by the southern subsurface drain (shown in Figure 1).

4.3 Lidsdale Cut water quality changes since pumping began

The increases in the metals copper etc. in bore D5 are compared with the current concentrations in the Lidsdale Cut pond in Table 4. The salinity and all the metals, except molybdenum and lead have greatly increased in Lidsdale Cut since pumping of the water from its pond began. These increases indicate that the drawdown of water in the pond has increased the flow of highly saline groundwater from the chitter filled mine void, and the increased metal concentrations could be due to oxidation of the pyrites in the chitter.

The largest increases were for aluminium, cadmium and selenium. The release of selenium in acid mine drainage is known to occur and its release from the Lidsdale Cut chitter suggests that the selenium was accumulated as the insoluble sulphide (see Förstner and Wittmann, 2012) over the long-term from the KVAD flyash, when it was an active ash dam. Its release as the soluble selenium may have occurred due to the change from reducing to oxidation of the pyrites, as was the cadmium and also the aluminium.

Table 4: Groundwater Quality changes for KVAD groundwater seepage bores WGM1/D5 and D6 from Initial to current Stage 2 placement compared to background Bore D2, Bore D5 90th Percentile Baseline, current KVAD and Lidsdale Cut groundwater quality and Groundwater Guidelines or Goals

Element (mg/L)	KVAD Ground-water 2014/15	KVAD & KVAR Dry Ash Placement Monitoring Bores						Back-ground April, 2013 to March, 2015	D5 Baseline (Pre-Stage I 90th Percent-ile)	Lids-dale Cut in 2014/15	ANZECC Guideline Goals for Ground-water
		Stage 2A April, 2010 to January, 2012		Stage 2 February, 2012 to March, 2013		Stage 2 April, 2014 to March, 2015					
		D5	D6	D5	D6	D5	D6	D2	D5		
pH	2.9	3.6	3.2	3.7	3.4	3.9	3.3	4.0	4.5	3.5	6.5-8.0
Cond (µS/cm)	3336	1356	1216	580	1300	717	1475	503	810	4146	2600
TDS	2736	1000	730	430	885	533	1007	290	550	4633	2000
SO4	1918	680	485	240	530	330	658	159	328	3148	1000
Cl	18.7	15	48	13	47	19.2	40	30	24	33	350
Al	2.0	21.0	3.6	7.5	1.85	16.7	3.55	0.27	-	198	5.1
As	0.001	0.001	0.001	0.001	0.002	0.007	0.005	0.001	0.008	0.030	0.024
B	5.8	2.2	0.74	0.80	0.63	1.06	0.85	0.1	1.7	14.8	1.7
Cd	<0.0002	0.002	0.001	0.001	0.0002	0.0334	0.002	0.0001	0.004	0.059	0.001
Cr	0.0008	0.001	0.002	0.002	0.0015	0.005	0.002	0.0014	0.041	0.0337	0.004
Cu	0.001	0.008	0.005	0.003	0.005	0.034	0.005	0.0036	0.058	0.068	0.005
Fe		1.7	14.5	0.35	54.5	0.79	80.7	1.2	14.7	-	1.7
Mn	0.68	7.5	3.5	3.5	4.45	4.13	4.75	0.63	2.5	2.53	1.9
Mo	<0.01	0.010	0.010	0.01	0.010	0.007	0.001	0.001	-	0.004	0.010
F	0.5	0.80	0.40	0.60	0.30	1.28	0.51	0.09	0.65	30.0	1.5
Ni	0.43	0.540	0.350	0.230	0.345	0.316	0.496	0.068	0.137	1.129	0.137
Pb	0.0006	0.007	0.012	0.002	0.002	0.0625	0.012	0.002	0.021	0.006	0.010
Se	0.001	0.002	0.002	<0.002	0.002	0.003	0.001	0.001	0.002	0.072	0.005
Zn	0.26	1.10	0.895	0.560	0.920	1.62	1.30	0.094	0.505	2.815	0.505

4.4 Groundwater Level Changes and Flow Directions

Figure 5 shows an overall long-term trend for groundwater elevation changes at the receiving water bores D5 and D6 down-gradient of the KVAD ash placement, compared to the background bores and those up-gradient of the KVAD.

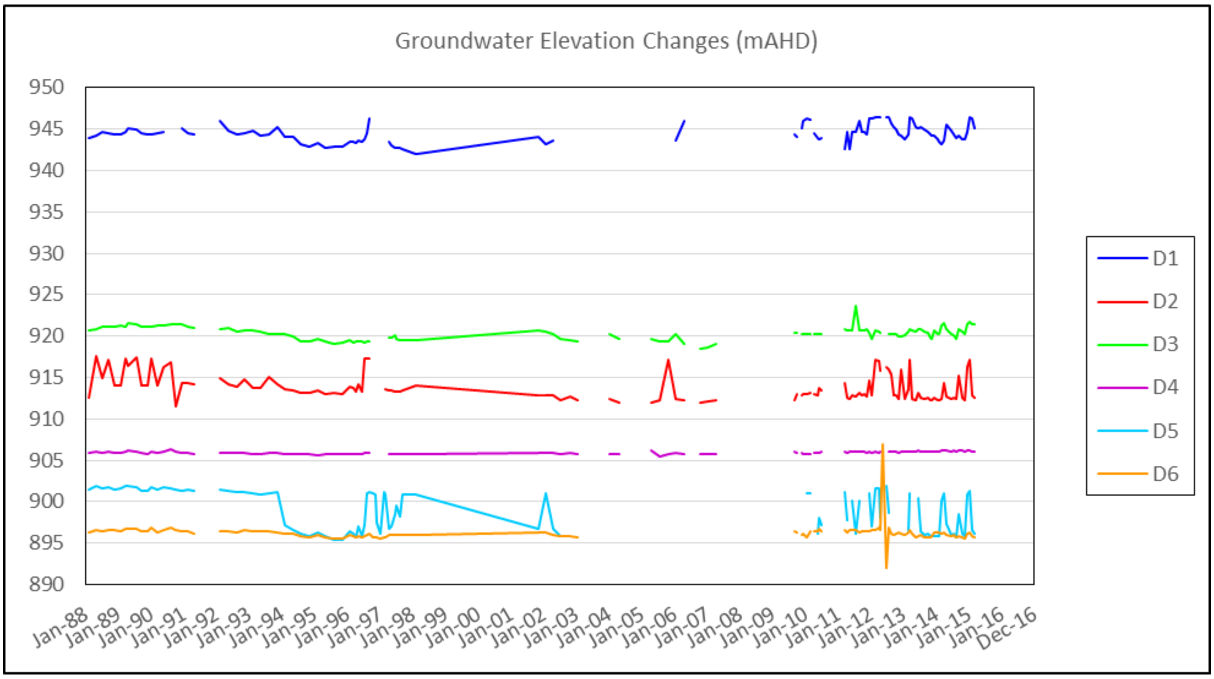

Figure 5. Long-term Groundwater Elevation changes at background bores WGM1/D1 and D2 and SSCAD seepage detection bores D3 and D4 compared to receiving water bores D5 and D6 down-gradient of the KVAD/R ash placement area

Figure 5 shows that changes in groundwater levels have been relatively small since before dry ash placement began in 2003, but with increased variability in recent years, even at the background bores D1 and D2 up-gradient of the SSCAD. The greatest variability has been for bore D5 in recent years with the level decreasing to be the same as at bore D6 during dry weather, and often having no groundwater in the bore. The increased variability appears to be due to the prolonged period of below average rainfall since 2012 with intermittent high rainfall events (Attachment 1).

The groundwater flow directions are used to help explain why groundwater quality changes occur in the groundwater under and around the KVAD/R, as well as potential effects of seepage into Sawyers Swamp Creek. The flow directions were examined in previous reports because it was shown that the conductivity in the Lidsdale Cut was reduced to be similar to that at bore D5 when the sub-surface drains under the Stage 2 Area were first 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 2).

Figure 6 shows the indicative KVAD seepage flow paths to the KVAD toe drains and toward the low point of the Lidsdale Cut. Seepage from the KVAD, under the KVAR that is intercepted by the toe drains, is also shown. Any seepage that is not collected by the subsurface drains or the toe drains is shown as flowing to the local groundwater.

The groundwater level contours and overall, indicative, groundwater flow paths in the ash placement areas, as modified by the ongoing drawdown of the water table under the KVAR by the toe drains and subsurface drains are also shown in Figure 6. Following installation of the subsurface drains, the groundwater at bore GW10, in the south-west of the KVAD, is now dry. In addition to the subsurface drain effects, the changes in water quality and trace metal concentrations in the Lidsdale Cut pond, as well as at bore D5, indicate that pumping of the groundwater out of the Lidsdale Cut pond is drawing down the groundwater levels around the open-cut area that forms the Lidsdale Cut. This drawdown effect appears to have been increased by the prolonged dry weather conditions.

The effects of the Sawyers Swamp Creek Ash Dam on the water quality in Sawyers Swamp Creek, taking into consideration the now dominant effects of the Springvale mine water discharge, as well as effects of seepage from the ash dam on the local groundwater, upstream of the KVAD/R, are assessed in the next Section.

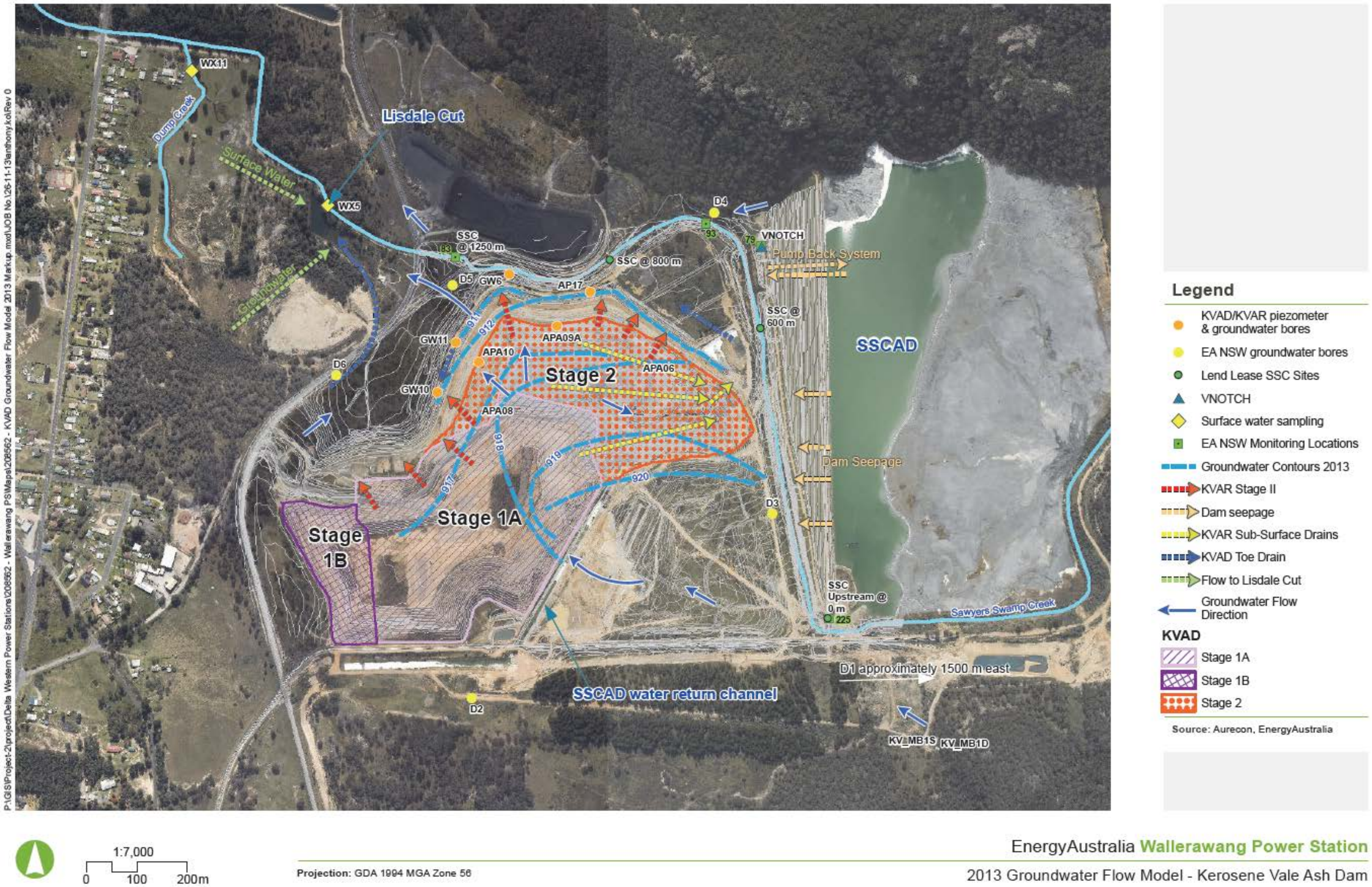

Figure 6: Kerosene Vale Ash Dam and Stage 1 and Stage 2 Dry Ash Repository Groundwater Level (RL m) Contours with Inferred Flow Directions (from sketch provided by Lend Lease Infrastructure to EnergyAustralia NSW)

5. Sawyers Swamp Creek Ash Dam effects on Surface and Groundwater Quality

The previous report found that since mid- to late 2012, the Springvale Mine water inflows had altered the water quality and trace metal concentrations in Sawyers Swamp Creek, so during 2014/15, it was not possible to assess the effects of seepage from the dam wall on the water quality in the creek. However, previous assessments, with no mine water inflows, showed that the seepage increased the salinity in the creek. The increase for such data in 2011/12 is shown in Table 5. The TDS increase from 191 mg/L, at the ash dam spillway, to 317 mg/L at the site downstream of the dam wall seepage, is shown in Table 5. Although the seepage from the SSCAD was found to influence the salinity, previous reports showed that there was no significant effect on trace metals.

However, EnergyAustralia NSW has continued to monitor the water quality in the ash dam pond, which is now receiving the acidic pH, high salinity and trace metal concentrations in the water from Lidsdale Cut. Nevertheless, flow of water pumped from Lidsdale Cut is expected to be small in comparison with the volume of water held in the SSCAD pond. The water quality in the v-notch seepage, at the base of the dam wall, has also continued to be monitored. Accordingly, the changes in water quality within the ash dam pond and in the seepage water is discussed in this Section.

Table 3 shows the changes in water quality in the SSCAD pond and in the v-notch seepage, compared to the changes in the creek from upstream to downstream of the dam wall. The creek data is dominated by the Springvale mine water inflows in 2014/15 from the time wet ash slurry ash placement was stopped in 2003, to the current Stage 2 periods is shown in Table 3. The Selenium concentration decreased by an order of magnitude from 0.15 mg/L to 0.009 mg/L and is less than the ANZECC (2000) guideline in the v-notch seepage water. Long-term trends in conductivity and sulphate, as well as the trace metals boron, manganese, nickel and zinc are shown in Figure 7.

Table 3 shows the water quality in the SSCAD and in the main seepage point from the ash dam (the v-notch, see Figure 2) into Sawyers Swamp Creek. The alkalinity in the SSCAD and in the seepage increased to about 400 to 500 mg/L from September, 2013 to August, 2014 and the pH increased to over 8, but the reason is unknown. Although the concentrations are compared with the water quality in the creek, upstream and downstream of the v-notch, the water in the creek was mostly that of the Springvale mine water, containing high concentrations of molybdenum, so no significant changes in water quality were observed other than a decrease in arsenic from upstream to downstream.

Although the Lidsdale Cut water has been pumped into the SSCAD for some time, there were no outstanding changes in trace metals in the SSCAD in 2014/15 from that measured in previous periods. Surprisingly, the water quality and trace metals in the seepage water was improved for all the characteristics measured, but the cadmium concentration increased to 0.0048mg/L (3-fold higher than the local guideline) in February and March, 2015 (Attachment 1). It is suggested that EnergyAustralia NSW continue to monitor the water quality and trace metals in the ash dam pond and in the seepage to confirm that the Lidsdale Cut water is not affecting the surface water in Sawyers Swamp Creek even with the Springvale flow.

Table 5: Water Quality in SSCAD for Pre-placement and Stage 2 Periods to 2014/15 and the V-notch Seepage Compared to Sawyers Swamp Creek Up- and Downstream of the V-notch and Surface Water Guidelines or Goals

Element (mg/L)	Pre-Placement (1996-2003)	Stage 2A (April, 2010-January, 2012)	Stage 2 February, 2012 to March, 2013	Stage 2 during 2014/15	V-Notch Seepage 2014/15	SSC Upstream V-Notch Seepage April,2014 to March, 2015	SSC Downstream V-Notch Seepage April, 2014 to March, 2015	Springvale Mine water discharge	ANZECC (2000) Guide-lines & Goals for SSC
	SSCAD	SSCAD	SSCAD	SSCAD	SSCAD v-notch	SSC	SSC	Springvale Mine Water**	
pH	5.4	4.8	4.8	6.1	7.8	8.5	8.7	8.1	6.5-8.0
Cond (µS/cm)	1219	1912	1457	1496	1453	1142	1142	1092	2200
TDS	858	1418	1066	1083	1093	714	723	854	1500
SO4	553	910	674	710	542	35	39	31.7	1000
Cl	18	30	20	19	26	5.3	5.5	8.2	350
Alk	18	19	25	28	213	557	550	341	-
Al				2.16	0.63	0.21	0.23	0.199	5.25
As	0.016	0.0013	0.002	0.002	0.004	0.023	0.009	0.018	0.024
Cd	0.012	0.0021	0.0042	0.0038	0.0012	<0.0002	<0.0002	<0.002	0.0015
Cr	0.005	0.0014	0.0028	0.001	0.001	<0.001	<0.001	-	0.005
Cu	0.007	0.0115	0.0203	0.0055	0.002	<0.001	<0.001	0.005	0.005
Fe	0.17	0.21	0.08	0.10	-	-	-	0.169	0.3
Mn	1.2	1.34	1.17	1.23	0.50	<0.5	<0.5	0.009	1.9
B	4.7	2.01	1.82	2.07	1.31	0.074	0.08	0.064	1.25
F	9.3	2.15	2.21	2.19	1.30	1.2	1.15	1.25	1.5
Mo	0.152	0.033	0.013	0.024	0.013	0.047	0.044	0.060	0.01
Ni	0.129	0.041	0.071	0.076	0.053	0.004	0.005	0.004	0.05
Pb	0.002	0.001	0.003	0.001	<0.001	<0.001	<0.001	<0.002	0.005
Se	0.151	0.006	0.009	0.004	0.001	<0.002	<0.002	0.002	0.005
Zn	0.426	0.136	0.263	0.196	0.085	0.019	0.019	0.021	0.153

*Springvale mine water **from Table 2

5.1 SSCAD Groundwater Quality

The SSCAD dam wall seepage to Sawyers Swamp Creek that is not collected by the v-notch pump-back system is shown as flowing to the local groundwater sampled by bore D3 in Figure 6. These inflows are from the ash dam pond flowing under the ash dam wall due to hydrostatic pressure of the water height stored in the pond. Table 6 shows that all the water quality and trace metals at D3, except for iron (which is decreasing in concentration) had concentrations lower than the ANZECC/Local groundwater trigger values.

The groundwater inflows from the northern end of the dam wall to bore D4 were originally thought to be from the ash dam, but since 2014 the salinity in the ash dam pond has decreased to be lower than in D4. Hence, it appears likely that some groundwater from outside the wider area of the ash dam pond, possibly from under the nearby escarpment, is influencing the salinity at bore D4. Other than the historically high iron and manganese concentrations at D4, the only metal showing a significant increase in 2014/15 was boron, while all the other characteristics were lower than the ANZECC/Local groundwater trigger values.

From these observations, it is clear that the seepage from the SSCAD to the groundwater at the bores up-gradient of the KVAD/R areas are not the source of the elevated concentrations of cadmium, copper, lead, nickel and zinc at bore D5.

Table 6: Water Quality for SSCAD Seepage detection Groundwater bores WGM1/D3 and D4 during Stage 2 to 2014/15 Compared to the Groundwater Background bore D2, Bore D4 90th Percentile Baseline and Groundwater Guidelines or Goals

Element (mg/L)	SSCAD Seepage Affected Bores						Back-ground (February, 2012 to March, 2013)	D4 Baseline (Pre-Stage I 90th Percentile)	ANZECC Guideline Goals for Groundwater
	Stage 2A Post-placement (April, 2010 to January, 2012)		Stage 2 Post-placement (February, 2012 to March, 2013)		Stage 2 Post-placement (April, 2014 to March, 2015)				
	D3	D4	D3	D4	D3	D4	D2	D4	
pH	5.9	5.8	6.1	5.7	5.8	5.9	4.2	6.8	6.5-8.0
Cond (µS/cm)	746	1500	540	1500	668	1658	479	728	2600
TDS	450	1200	330	1200	403	1358	278	510	2000
SO4	115	770	68	770	153	849	155	201	1000
Cl	105	33	66	35	74	45	25	45	350
Al					0.12	0.05	0.29		5.25
As					0.001	0.002	<0.001		0.024
Cd					0.0002	<0.0002	<0.0002		0.001
Cr					0.001	<0.001	0.001		0.004
Cu	0.002	0.001	0.004	0.003	0.0019	0.0013	0.0014	0.010	0.005
Fe	0.03	43.0	4.2	39.0	2.37	47.7	0.86	86	1.7
Mn	0.73	18.0	0.80	16.5	0.73	15.8	0.59	6.5	1.9
B	0.03	1.50	0.02	1.55	0.04	1.75	0.09	0.49	1.7
F	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.24	1.5
Mo					0.001	<0.001	<0.001		0.01
Ni	0.130	0.050	0.12	0.040	0.108	0.032	0.061	0.023	0.137
Pb					0.0015	0.001	0.0023		0.005
Se	0.002	0.002	0.002	0.002	0.001	<0.002	<0.002	0.002	0.005
Zn	0.140	0.080	0.070	0.065	0.140	0.049	0.084	0.060	0.505

5.2 Sawyers Swamp Creek

The receiving water site (WX7) has ceased to function as the overall receiving water site for the ash placement area because of the effects of the Springvale mine water discharge on the water quality and trace metals at the site. Hence, any changes in the water quality and trace metals at WX7 during 2014/15 have not been assessed in relation to the inputs of seepage water from under the SSCAD wall and seepage from the KVAD. However, the effects of the mine water on the water quality are examined here and Table 2 in Section 3 shows the changes in water quality from without (2003 to 2007) and with the mine water flows in 2014/15. The comparisons show a significant decrease in sulphate, chloride, boron, nickel, lead and zinc but increases for molybdenum, as well as for arsenic up to its surface water guideline value. The decreases in sulphate, boron, nickel, lead and zinc at WX7 corresponded with the water quality characteristics typical of the coal/chitter leachates present in Lidsdale Cut (Table 4). Hence, those decreases were most likely due to stopping of the discharge from the Lidsdale Cut pond to the Sawyers Swamp Creek, upstream of WX7, since mid-2012.

6. Discussion

This assessment of the effects of the KVAR has found:

- No significant effects of rainfall infiltration on the water quality in Sawyers Swamp Creek is expected, even without the Springvale mine water discharge
- As the rainfall infiltration seepage rate is small and it has to pass through the mine spoil bund walls before entering the groundwater, trace metals such as selenium are reduced in concentration due to adsorption by the bund wall soil, so no significant effects of the KVAR on local groundwater quality is considered likely.

These findings are consistent with the project's Environmental Assessment of no likely effects on surface and groundwater quality (see Parsons Brinkerhoff, 2008). As the dry ash placement has been decommissioned and is proposed to be capped, the potential for future impacts will be further reduced.

However, due to the current large water quality changes observed in the local groundwater and in Lidsdale Cut, as well as the potential effects of pumping water into the SSCAD, it is suggested that EnergyAustralia NSW continue to undertake all the current surface and groundwater monitoring.

The large increases in salinity and trace metals in the Lidsdale Cut pond, and similar increases at bore D5 for trace metals such as cadmium, appears to be due to drawdown, due to pumping, of the water table in the chitter filled Lidsdale Cut mine void, as well as in the nearby bore D5. Recent increases in aluminium in Dump Creek indicate that it is also possibly being affected by the chemical changes taking place in the void pond and surrounding groundwater. Hence, it is suggested that EnergyAustralia NSW investigate maintaining a higher water level in the pond to return to the reducing conditions of pyrites in the coal waste/chitter that most likely existed prior to pumping. It is suggested that this be raised in future discussions between EnergyAustralia NSW and the NSW EPA.

Last year's 2013/14 report suggested that the precipitation of aluminium in Sawyers Swamp Creek in mid-2012 after a significant rainfall event appeared to be due to an upstream source, such as the coal/chitter in the area, rather than due to the Lidsdale Cut discharge, or inflows via the toe drains from the KVAD, both of which had low concentrations of aluminium at the time. This conclusion is supported by the high aluminium concentration of about 200 mg/L in the Lidsdale Cut pond. The release into solution of such a high concentrations is indicated by the literature as being due to mobilisation from the coal waste/chitter. It is suggested that a similar release occurred in mid-2012 from some part of the wider area of coal/chitter placements in the Sawyers Swamp Creek catchment, downstream of the SSCAD, as shown in Figure 3.

Although the water quality and trace metals in the Sawyers Swamp Creek Ash Dam pond and the dam wall seepage have improved, it may be prudent for EnergyAustralia NSW to maintain monthly monitoring of the pond and the seepage for metals such as cadmium. The monitoring would also assist in confirming the benefits of any management actions taken to the limit mobilisation of metals from the Lidsdale Cut coal waste/chitter fill.

Due to the stabilised salinity and relatively low concentrations of trace metals in SSCAD, no significant effects have been seen at the seepage detection bore D3. In addition, although there has been a steady increase in salinity at bore D4, no effects on trace metals have been seen, other than an increase in boron, which may indicate a source other than the ash dam.

7. Conclusions

The overall conclusions of this assessment for the 2014/15 study is that:

- The KVAR is not having a significant effect on the local surface and groundwater quality
- Leachates from the long-held ash in the KVAD have been largely depleted (as indicated by the very low selenium concentrations in the KVAD groundwater) and the remaining metal leachates are from pre-existing coal waste/chitter in the void that form the KVAD.
- Diversion of the KVAD groundwater to Lidsdale Cut by the toe drains minimised effects of the KVAD seepage on the local surface and groundwater quality
- Salinity and metal leachates from coal waste/chitter in the Lidsdale Cut void are currently being released, apparently due to draw down of the water table in the void and surrounding area
- The SSCAD seepage is not having a significant effect on the local groundwater up-gradient of the KVAD. Seepage at the northern part of the dam wall has increased salinity and boron above background levels, but the increases are not all due to the ash dam
- The rare events of aluminium precipitation in Sawyers Swamp Creek appear to be due to leachates from the local coal waste/chitter in the catchment following high rainfall runoff events that cause oxidation of the coal waste/chitter under the prevailing acidic conditions.

8. Recommendations

Based on the findings of this study, including the effects of pumping from Lidsdale Cut and the domination of the water quality in Sawyers Swamp Creek by the discharge of water from the Springvale Mine, the following recommendations are made:

- Continue monthly water quality monitoring at the EnergyAustralia NSW routine surface water and groundwater monitoring sites until the relevant Authorities advise on the decommissioning conditions for the site
- EnergyAustralia NSW investigate maintaining a higher water level in the Lidsdale Cut pond to minimise trace metal release from pyrites in the coal waste/chitter.

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Attachment 1

Lithgow Rainfall Data

Lithgow Rainfall Data from January, 2000 to March, 2013 (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	152.6	189.8	44.4	30.6	81.8	49.8	21.2	48.6	20.8	30.9	64.1	791.7
2013	64.1	113.2	184.2	66.2	28.1	29	24.4	23.2	36.8	21.8	95.2	34.2	720.4
2014	13.6	74	143.8	63	14	43.2	24.2	24.2	27.9	60.7	21.8	174.3	684.7
2015	124.8	31	35										

Attachment 2

Wallerawang Power Station Ash Dam Surface Water and Groundwater Quality Stage 2 from February, 2012 to March, 2015

Attachment also contains:

- Pre-Dry Ash Placement Summary data before April, 2003 and;
- LLI Sawyers Swap Creek Data from February, 2010 to March, 2015

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)
- Stage 2A Water Quality Assessment from April, 2010 to January, 2012 in Aurecon (2012)

Post Dry Ash Placement Stage 2 Raw Data and Summary Statistics from February, 2012 to March, 2015:

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 Sawyers Swamp Creek at WX1, upstream of SSCAD. EANSW site 92
4. Water Quality Data and Summary for SSCAD Groundwater Seepage Detection Bores WGM1/D3 and 1/D4
5. Water Quality Data and Summary for Background Groundwater Bore WGM1/D2
6. 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
7. Water Quality Data and Summary for SSCAD (includes data from April, 2010 to January, 2012)
8. Water Quality Data and Summary for Sawyers Swamp Creek Monitoring from SSCAD Spillway to near WGM4/D5

Sawyers Swamp Creek EANSW & LLI WQ monitoring February, 2010 to March, 2015, including:

- Sawyer Swamp Creek at WX1, upstream SSCAD. EANSW Site 92
- Sawyers Swamp creek upstream @0 m where SSCAD diversion and Springvale Mine Water from August, 2012 enters SSC at spillway

- Sawyers Crk upstream @600 m downstream of Spillway but upstream of Ash Dam seepage from V-notch
- Sawyers Swamp Creek Ash Dam Seepage from V-notch (water collected and recycling back into dam)
- Sawyers Swamp Creek at @850m - upstream seepage from KVAD wall and Below SSCAD v-notch Seepage Point. EANSW Site 93 from June, 2012
- Sawyers Swamp Creek at 1250 m near GW Bore D5. EANSW Site 83
- KVAD/R Seepage water Northern wall collection pit near GW6 Groundwater from the KVAD on the northside drains

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) February, 2012 to March, 2015.																	
Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
22-Feb-12	0.001	20.5	114	0.004	0.66	0.043		24	0.0019	12	601	0.003	0.006	1.5	0.005	0.00005	14.5	13.1
8-Mar-12	0.001	3.4	24	<0.001	0.38	0.036		13.7	0.00055	11	313	<0.001	0.002	0.5	0.01	0.00005	8.96	7.19
19-Apr-12	0.001	18.2	4	0.001	1.63	0.034		37.2	0.0029	16	800	0.002	0.005	2.9	0.08	0.00005	29	17.5
23-May-12	0.001	272	12	0.01	3.16	0.056		68.5	0.0075	19	1342	0.055	0.026	8.9	0.034	0.00005	54.4	30.7
21-Jun-12	0.001	2.7	38	<0.001	0.77	0.034		26.8	0.0003	18	612	<0.001	0.002	0.6	0.015	0.00005	11.2	20.8
27-Jul-12	0.001	1.2	272	0.002	0.34	0.025		14.3	0.0002	12	763	<0.001	0.002	0.7	0.049	0.00005	8.87	10.6
15-Aug-12	0.001	6.3	97	0.006	0.46	0.046		18.6	0.0002	16	555	0.002	0.004	0.7	0.031	0.00005	8.83	12
13-Sep-12	0.001	5.8	148	0.003	0.45	0.046		20.2	0.0002	16	647	0.002	0.004	0.9	0.025	0.00005	10.4	11.2
11-Oct-12	0.001	1.3	395	0.003	0.31	0.023		13.5	0.0002	10	883	<0.001	0.003	1.0	3.04	0.00005	11.1	8.19
14-Nov-12	0.001	0.4	479	0.006	0.33	0.019		12.3	0.0002	7	1061	<0.001	0.002	1.4	0.073	0.00005	12.8	8.25
12-Dec-12	0.001	0.3	513	0.013	0.09	0.018		5.97	0.0002	6	1032	<0.001	0.001	1.2	0.009	0.00005	11.8	2.98
17-Jan-13	0.001	0.3	515	0.011	0.10	0.017		5.8	0.0002	5	998	<0.001	0.002	1.1	0.087	0.00005	11.3	2.73
21-Feb-13	0.001	0.2	512	0.012	0.11	0.014		6.35	0.0002	5	1011	<0.001	0.001	1.3	0.085	0.00005	10.5	2.91
13-Mar-13	0.001	0.2	481	0.011	0.10	0.017		5.86	0.0002	5	977	<0.001	0.078	1.3	0.084	0.00005	11.9	3.32

Continued……….Sawyers Swamp Creek WX7 Post-Stage 2A Ash Placement Data (mg/l) February, 2012 to March, 2015.

Date	Mn	Mo	NO2+NO3	Na	NFR	Ni	Ortho P	Pb	pH	Se	SiO2	SO4	TDS	TOT P	Zn
22-Feb-12	0.604	0.003	0.25	85.2	102	0.076		0.004	7.61	<0.002		157	354	0.06	0.344
8-Mar-12	0.468	0.005	0.3	30.8	26.5	0.037		<0.001	7.11	<0.002		95	156.25	0.03	0.098
19-Apr-12	1.88	0.003	0.25	91.2	51.2	0.143		0.001	5.24	0.001		351	562	<0.01	0.361
23-May-12	3.67	0.01	0.25	132	1088	0.281		0.015	4.6	0.002		648	1046	0.1	0.924
21-Jun-12	1.6	0.003	0.25	63.4	20.9	0.084		0.001	7.08	<0.002		229	442	0.02	0.226
27-Jul-12	0.648	0.009	0.3	142	34	0.034		<0.001	8.14	<0.002		118	508	0.02	0.088
15-Aug-12	0.602	<0.001	0.25	79.7	67.1	0.059		0.002	7.34	0.001		158	382	0.06	0.346
13-Sep-12	0.001	0.001	0.25	115	45.2	0.032		0.003	7.63	<0.002		148	408	0.06	0.183
11-Oct-12	0.341	0.018	0.3	211	23.8	0.021		0.001	8.16	0.001		88	598	0.02	0.086
14-Nov-12	0.158	0.022	0.3	239	7.1	0.026		0.001	8.2	<0.002		83	654	<0.01	0.071
12-Dec-12	0.014	0.025	0.55	238	12.6	0.007		<0.001	8.63	0.001		29	650	0.02	0.085
17-Jan-13	0.001	0.042	0.45	222	6.79	0.004		0.002	8.16	0.001		27	696	0.06	0.035
21-Feb-13	0.016	0.031	0.4	284	3	0.007		<0.001	8.47	0.001		29	656	<0.01	0.022
13-Mar-13	0.033	0.024	0.25	240	3.73	0.009		0.004	8.47	0.001		31	636	<0.01	0.037

Sawyers Swamp Creek WX7 Post-Stage 2A Ash Placement Data (mg/l) April, 2013 to March, 2015																																						
Date	Ag	Al	Al_Filt	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	Cu_Filt	F	Fe	Hg	K	Mg	Mn	Mo	NO2+NO3	Na	NFR	Ni	Ortho P	Pb	pH	Se	SiO2	SO4	TDS	TKN	TN	TOT P	Zn	Zn_filt
10-Apr-13	0.0005	0.15	0.04	510	0.012	0.1	0.019		5.5	0.0001	5	1000	0.0005	0.0005	0.0005	1.4		0.00003	12.00	3.00		0.033		230		0.005		0.001	8.6	0.001		28	550		0.4		0.028	0.009
17-May-13	0.0005	0.24	0.03	510	0.014	0.08	0.02		5.7	0.0001	5	1000	0.0005	0.029	0.0005	1.3		0.00003	11.00	2.90		0.034		230		0.005		0.003	8.5	0.001		27	640		0.55		0.037	0.008
13-Jun-13	0.0005	0.22	0.06	550	0.017	0.09	0.019		6.5	0.0001	6	1000	0.0005	0.003	0.0005	1.2		0.00003	10.00	3.00		0.034		240		0.005		0.001	8.6	0.001		32	680		0.55		0.03	0.011
11-Jul-13	0.0005	0.08	0.03	560	0.014	0.11	0.018		5.8	0.0001	5	1100	0.0005	0.0005	0.0005	1.2		0.00003	12.00	4.00		0.034		260		0.004		0.0005	8.7	0.001		30	650		0.55		0.025	0.007
23-Aug-13	0.0005	0.2	0.02	600	0.013	0.09	0.022		5.2	0.0001	5	1100	0.001	0.0005	0.0005	0.05		0.00003	11.00	3.00		0.034		260		0.004		0.0005	8.7	0.001		27	670		0.6		0.02	0.007
26-Sep-13	0.0005	0.33	0.16	550	0.016	0.08	0.027		6.1	0.0001	5	1100	0.002	0.001	0.0005	0.1		0.00003	11.00	4.00		0.035		250		0.005		0.001	8.6	0.001		38	740		0.65		0.03	0.025
23-Oct-13	0.0005	0.12	0.02	590	0.018	0.11	0.021		4.9	0.0001	6	1200	0.002	0.0005	0.0005	1.2		0.00003	11.00	3.00		0.037		270		0.005		0.0005	8.7	0.001		40	800		0.5		0.023	0.007
6-Nov-13	0.0005	0.12	0.06	580	0.025	0.1	0.022		4.5	0.0001	5	1200	0.002	0.0005	0.0005	1.1		0.00003	11.00	3.00		0.037		260		0.005		0.0005	8.7	0.001		37	710		0.6		0.025	0.009
5-Dec-13	0.0005	0.14	0.08	540	0.024	0.11	0.022		5.1	0.0001	5	1200	0.002	0.0005	0.0005	1.5		0.00003	10.00	3.00		0.036		250		0.007		0.0005	8.7	0.001		45	680		0.6		0.029	0.006
15-Jan-14	0.0005	0.17	0.05	560	0.024	0.1	0.026		5	0.0001	5	1200	0.002	0.001	0.0005	1.2		0.00003	11.00	3.00		0.04		260		0.007		0.0005	8.7	0.001		39	660		0.65		0.021	0.0025
5-Feb-14	0.0005	0.13	0.04	560	0.025	0.09	0.025		4.5	0.0001	5	1200	0.002	0.0005	0.0005	1.1		0.00003	10.00	3.00		0.045		230		0.008		0.0005	8.7	0.001		41	660		0.6		0.024	0.007
5-Mar-14	0.0005	0.2	0.05	530	0.025	0.1	0.027		5	0.0001	5	1100	0.002	0.001	0.0005	1		0.00003	12.00	3.00		0.042		250		0.008		0.0005	8.7	0.001		42	700		0.6		0.031	0.008
3-Apr-14	0.0005	0.46	0.04	520	0.02	0.1	0.029		5.7	0.0001	6	1100	0.002	0.0005	0.0005	1.2		0.00003	12.00	3.00		0.04		260		0.008		0.001	8.7	0.001		42	730		0.35		0.028	0.008
1-May-14	0.0005	0.15	0.03	570	0.021	0.09	0.024		5.1	0.0001	5	1100	0.0005	0.0005	0.0005	1		0.00003	10.00	3.00		0.04		240		0.006		0.0005	8.7	0.001		39	720		0.4		0.032	0.01
12-Jun-14	0.0005	0.26	0.17	580	0.022	0.08	0.028		5.1	0.0001	5	1200	0.0005	0.0005	0.0005	1		0.00003	11.00	3.00		0.04		260		0.007		0.001	8.8	0.001		36	700		0.6		0.04	0.019
10-Jul-14	0.0005	0.16	0.04	530	0.021	0.1	0.024		6	0.0001	5	1200	0.0005	0.0005	0.0005	1.1		0.00003	11.00	3.00		0.04		260		0.007		0.001	8.7	0.001		39	740		0.55		0.031	0.009
14-Aug-14	0.0005	0.16	0.03	560	0.025	0.08	0.019		3.8	0.0001	5	1100	0.0005	0.0005	0.0005	1.3		0.00003	7.00	1.00		0.11		250		0.005		0.0005	8.7	0.001		31	680		0.5		0.03	0.0025
11-Sep-14	0.0005	0.23	0.07	560	0.029	0.08	0.027		4.8	0.0001	5	1100	0.0005	0.0005	0.0005	1.2		0.00003	10.00	3.00		0.04		240		0.005		0.0005	8.8	0.001		35	670		0.5		0.01	0.0025
23-Oct-14	0.0005	0.2	0.11	580	0.024	0.09	0.027		5	0.0001	5	1200	0.0005	0.0005	0.0005	1.2		0.00003	11.00	3.00		0.049		270		0.005		0.0005	8.8	0.001		38	700		0.6		0.03	0.006
13-Nov-14	0.0005	0.11	0.05	600	0.026	0.08	0.026		5.1	0.0001	6	1200	0.0005	0.0005	0.0005	1.3		0.00003	12.00	3.00		0.053		290		0.003		0.0005	8.8	0.001		38	720		0.35		0.024	0.0025
11-Dec-14	0.0005	0.2	0.06	580	0.028	0.08	0.029		5.4	0.0001	6	1100	0.0005	0.0005	0.0005	1.2		0.00003	12.00	3.00		0.06		280		0.006		0.0005	8.7	0.001		41	740		0.6		0.012	0.006
15-Jan-15	0.0005	0.17	0.06	580	0.029	0.09	0.028		5.6	0.0001	5	1100	0.0005	0.0005	0.0005	1.2		0.00003	12.00	4.00		0.045		280		0.005		0.0005	8.7	0.001		39	730		0.6		0.011	0.0025
12-Feb-15	0.0005	0.94	0.03	540	0.032	0.09	0.039		4.9	0.0001	6	1200	0.0005	0.001	0.0005	1.2		0.00003	12.00	3.00		0.058		270		0.005		0.002	8.8	0.001		39	730		0.75		0.011	0.0025
11-Mar-15	0.0005	0.43	0.06	520	0.012	0.07	0.021		4.5	0.0001	6	1100	0.0005	0.002	0.0005	1.2		0.00003	8.00	2.00		0.027		260		0.004		0.0005	8.8	0.001		31	710		0.5		0.015	0.009

Sawyers Swamp Creek WX7 Post-Stage 2A Ash Placement Data (mg/l) April, 2013 to March, 2015																																						
Date	Ag	Al	Al_Filt	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	Cu_Filt	F	Fe	Hg	K	Mg	Mn	Mo	NO2+NO3	Na	NFR	Ni	Ortho P	Pb	pH	Se	SiO2	SO4	TDS	TKN	TN	TOT P	Zn	Zn_filt
ave	<0.001	0.2	0.058	556.7	0.022	0.091	0.025		5	0.0001	5.2917	1126	0.0010	0.0019	0.0005	1.10		0.00003	11	3		0.043		256		0.006		0.0008	8.7	0.001	#DIV/0!	36	696		0.55		0.025	0.0078
max	<0.001	0.9	0.170	600.0	0.032	0.110	0.039		7	0.0001	6.0000	1200	0.0020	0.0290	0.0005	1.50		0.00003	12	4		0.110		290		0.008		0.0030	8.8	0.001	0.0000	45	800		0.75		0.040	0.0250
Min	<0.001	0.08	0.020	510.0	0.012	0.070	0.018		4	0.0001	5.0000	180	0.0005	0.0005	0.0005	0.05		0.00003	7	1		0.027		230		0.003		0.0005	8.5	0.001	0.0000	27	550		0.35		0.010	0.0025
50th Percentile	0.001	0.17	0.050	560.0	0.024	0.090	0.026		5	0.0001	5.0000	1100	0.0005	0.0005	0.0005	1.20		0.00003	11	3		0.040		260		0.005		0.0005	8.7	0.001	#NUM!	39	710		0.60		0.025	0.0070

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, 2013 to March, 2015																													
Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	NFR	Ni	Pb	pH	Se	SO4	TDS	Zn
10-Apr-13	0.0005	3	12.5	0.0005	3.2	0.02		78	0.0005	24	1800	0.0005	0.006	2.3		0.000025	33	76		0.01	120		0.5	0.005	3.1	0.001	868	1200	1.6
17-May-13	0.0005	3.7	12.5	0.0005	1.8	0.02		59	0.0008	25	1500	0.0005	0.007	1.8		0.000025	25	61		0.01	90		0.42	0.005	3.2	0.001	640	960	1.1
13-Jun-13	0.0005	2.4	12.5	0.0005	1.2	0.012		39	0.0008	18	1000	0.0005	0.004	1		0.000025	15	39		0.00	58		0.29	0.003	3.3	0.001	420	590	1
11-Jul-13	0.0005	3.2	12.5	0.0005	2.8	0.017		69	0.0008	24	1500	0.0005	0.004	1.9		0.000025	28	69		0.00	110		0.47	0.004	3.3	0.001	720	1100	1.2
23-Aug-13	0.0005	3.6	12.5	0.0005	2.2	0.017		64	0.0007	26	1400	0.002	0.005	1.5		0.000025	23	67		0.00	98		0.36	0.005	3.2	0.001	660	970	1.1
26-Sep-13	0.0005	3.2	12.5	0.0005	2	0.022		59	0.0007	27	1400	0.002	0.013	1.5		0.000025	22	60		0.00	93		0.41	0.005	3.3	0.001	660	1000	1.2
23-Oct-13	0.0005	4	12.5	0.0005	2.7	0.025		70	0.0008	28	1700	0.002	0.009	2.1		0.000025	27	71		0.00	110		0.47	0.009	3.1	0.001	810	1200	1.4
6-Nov-13	0.0005	4.1	12.5	0.001	3	0.024		81	0.0009	27	1800	0.003	0.014	2.4		0.000025	33	80		0.00	130		0.62	0.009	3.2	0.001	950	1300	1.7
5-Dec-13	0.0005	4.1	12.5	0.0005	3.3	0.021		86	0.0009	26	1900	0.003	0.006	2.9		0.000025	35	84		0.00	130		0.65	0.007	3.1	0.001	980	1200	1.5
15-Jan-14	0.0005	3.6	12.5	0.0005	3.6	0.027		89	0.0007	25	2000	0.002	0.016	2.5		0.000025	39	86		0.00	130		0.67	0.008	3.1	0.001	1000	1400	1.6
5-Feb-14	0.0005	3.4	12.5	0.0005	3.6	0.025		93	0.0006	24	2000	0.002	0.008	2.4		0.000025	39	88		0.00	120		0.67	0.006	3	0.001	1000	1400	1.8
5-Mar-14	0.0005	3.6	12.5	0.0005	3.4	0.025		91	0.0009	24	2000	0.002	0.007	2.1		0.000025	36	82		0.00	120		0.66	0.006	3.1	0.001	980	1500	1.6
3-Apr-14	0.0005	3.7	12.5	0.0005	3.6	0.023		94	0.0008	24	2000	0.002	0.01	2.1		0.000025	40	88		0.00	120		0.65	0.007	3.1	0.001	1100	1500	1.5
1-May-14	0.0005	3.9	12.5	0.0005	3.3	0.017		90	0.0007	22	2000	0.001	0.003	2.5		0.000025	36	86		0.00	110		0.62	0.006	3.1	0.001	1000	1400	1.4
12-Jun-14	0.0005	4.1	12.5	0.0005	3	0.016		88	0.0008	21	2000	0.001	0.005	2.2		0.000025	34	83		0.00	120		0.63	0.006	3.1	0.001	840	1400	1.7
10-Jul-14	0.0005	4.5	12.5	0.0005	3.9	0.017		110	0.0006	20	2100	0.001	0.003	3.1		0.000025	38	98		0.00	130		0.72	0.006	3.1	0.001	1000	1100	1.8
14-Aug-14	0.0005	5.2	12.5	0.001	3.4	0.016		97	0.0008	24	2100	0.001	0.003	3.1		0.000025	34	93		0.00	120		0.7	0.007	3.1	0.001	1200	1500	2.1
11-Sep-14	0.0005	1.7	12.5	0.0005	0.73	0.017		28	0.0005	14	690	0.001	0.009	0.8		0.000025	10	24		0.00	38		0.17	0.003	3.6	0.001	280	380	0.6
23-Oct-14	0.0005	5.3	12.5	0.0005	3.3	0.017		89	0.0008	24	1900	0.001	0.006	2.7		0.000025	32	84		0.00	110		0.61	0.008	3.1	0.001	920	1300	1.6
13-Nov-14	0.0005	6.9	12.5	0.001	3.8	0.031		110	0.0009	34	2200	0.001	0.011	3.9		0.000025	38	100		0.00	140		0.64	0.009	3.1	0.004	1200	1600	1.8
11-Dec-14	0.0005	2.7	12.5	0.0005	1.7	0.019		51	0.0007	15	1200	0.0005	0.004	1.8		0.000025	22	47		0.00	68		0.38	0.004	3.3	0.001	510	740	0.96
15-Jan-15	0.0005	4.2	12.5	0.0005	3.3	0.024		86	0.0006	20	1800	0.0005	0.007	2.6		0.000025	35	78		0.00	110		0.56	0.006	3.2	0.001	880	1300	1.3
12-Feb-15	0.0005	5.7	12.5	0.001	3.4	0.028		88	0.0009	26	2000	0.001	0.009	3.1		0.000025	36	84		0.00	120		0.61	0.009	3.1	0.001	980	1500	1.5
11-Mar-15	0.0005	5.7	12.5	0.001	2.8	0.025		88	0.0009	27	2000	0.001	0.006	3.3		0.000025	37	85		0.00	120		0.59	0.009	3.1	0.002	1100	1400	1.5

Dump Creek WX11 Post-Stage 2 Dry Ash Placement Post-Stage 2 Dry Ash Placement April, 2013 to March, 2015 (mg/l)																													
Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	NFR	Ni	Pb	pH	Se	SO4	TDS	Zn
ave	0.0	4.0	12.5	0.0	2.9	0.0		79.0	0.0	23.7	1749.6	0.0	0.0	2.3		0.0	31.1	75.5		0.0	109.0		0.5	0.0	3.2	0.0	862.4	1205.8	1.4
max	0.0	6.9	12.5	0.0	3.9	0.0		110.0	0.0	34.0	2200.0	0.0	0.0	3.9		0.0	40.0	100.0		0.0	140.0		0.7	0.0	3.6	0.0	1200.0	1600.0	2.1
Min	0.00	1.70	12.50	0.00	0.73	0.01		28.00	0.00	14.00	690.00	0.00	0.00	0.80		0.00	10.00	24.00		0.00	38.00		0.17	0.00	3.00	0.00	280.00	380.00	0.60
50th Percentile	0.00	3.80	12.50	0.00	3.25	0.02		87.00	0.00	24.00	1900.00	0.00	0.01	2.35		0.00	34.00	82.50		0.00	120.00		0.61	0.01	3.10	0.00	935.00	1300.00	1.50

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, 2013 to March. 2015																													
Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	NFR	Ni	Pb	pH	Se	SO4	TDS	Zn
10-Apr-13																													
16-May-13																													
13-Jun-13																													
10-Jul-13																													
22-Aug-13																													
26-Sep-13																			2.5										
24-Oct-13	0.0005	220	12.5	0.031	19	0.025		340	0.084	32	4900	0.036	0.05	38		0.00005	270	120	2.5	0.0005	330		1.6	0.033	3.3	0.086	3700	5300	3.9
7-Nov-13	0.0005	220	12.5		17	0.018		340	0.065	34	4900	0.03	0.05	37		0.00005	290	120	2.5	0.0005	350		1.6	0.024	3.3	0.068	3900	5800	4.3
5-Dec-13	0.0005	180	12.5	0.026	14	0.048		280	0.044	31	4200	0.023	0.04	36		0.0001	230	91	2.5	0.0005	270		1.2	0.014	3.3	0.063	3300	4200	3.2
16-Jan-14	0.0005	120	12.5	0.015	12	0.032		220	0.036	27	3700	0.01	0.017	24		0.00005	200	72	2.5	0.0005	320		0.87	0.008	3.5	0.046	2500	3500	2.3
6-Feb-14	0.0005	140	12.5	0.017	13	0.026		260	0.034	32	4000	0.012	0.017	28		0.00005	220	85	2.5	0.0005	320		0.84	0.008	3.4	0.062	3000	4200	2.5
6-Mar-14	0.0005	52	12.5	0.009	4.9	0.075		97	0.017	16	1800	0.006	0.013	9		0.00005	73	28	2.5	0.0005	87		0.35	0.004	3.5	0.024	1000	1500	0.81
3-Apr-14	0.0005	18	12.5	0.004	2.1	0.062		49	0.0067	14	960	0.003	0.006	4.1		0.00005	37	19	2.5	0.0005	54		0.18	0.002	3.9	0.008	460	720	0.41
1-May-14	0.0005	66	12.5	0.012	6.6	0.042		140	0.016	19	2400	0.006	0.015	14		0.00005	100	52	2.5	0.0005	130		0.5	0.012	3.4	0.027	1400	2100	1.1
12-Jun-14	0.0005	150	12.5	0.017	12	0.025		260	0.039	25	3800	0.013	0.03	21		0.00005	180	85	2.5	0.0005	230		0.78	0.02	3.5	0.048	2400	3900	1.8
10-Jul-14	0.0005	180	12.5	0.037	13	0.021		290	0.042	29	4000	0.016	0.048	24		0.00005	190	92	2.5	0.0005	240		1.1	0.011	3.6	0.069	2600	4300	2.4
14-Aug-14	0.0005	120	12.5	0.02	10	0.029		240	0.035	28	3300	0.01	0.04	24		0.00005	150	86	2.5	0.0005	210		0.94	0.03	3.6	0.048	4900	3600	2.5
11-Sep-14	0.0005	33	12.5	0.004	3	0.11		68	0.009	13	1200	0.004	0.009	6.6		0.00005	47	24	2.5	0.0005	63		0.28	0.004	3.9	0.013	690	930	0.7
23-Oct-14	0.0005	40	12.5	0.005	4	0.021		90	0.01	13	1600	0.004	0.012	8.1		0.00005	63	31	2.5	0.0005	83		0.35	0.013	3.6	0.012	850	1200	0.78
13-Nov-14	0.0005	140	12.5	0.03	13	0.02		280	0.031	35	4000	0.013	0.032	29		0.00005	180	96	2.5	0.0005	240		1.1	0.028	3.3	0.046	3000	4100	2.8
11-Dec-14	0.0005	15	12.5	0.004	1.9	0.079		50	0.0047	10	890	0.001	0.006	3.8		0.00005	34	18	0.5	0.0005	49		0.19	0.003	3.8	0.006	420	600	0.37
15-Jan-15	0.0005	23	12.5	0.004	2.7	0.058		61	0.0055	11	1100	0.002	0.006	4.9		0.00005	43	25	2.5	0.0005	64		0.24	0.004	3.8	0.008	560	1000	0.48
12-Feb-15	0.0005	99	12.5	0.014	9.9	0.029		220	0.022	28	3400	0.008	0.02	19		0.00005	140	86	2.5	0.0005	200		0.9	0.036	3.2	0.04	2100	3200	2.5
11-Mar-15	0.0005	79	12.5	0.018	5.6	0.08		140	0.021	19	2200	0.009	0.023	15		0.00005	100	44	2.5	0.0005	130		0.52	0.008	3.5	0.041	1500	2000	1.3

Lidsdale Cut WX5 Post-Dry Ash Placement Data (mg/l) April, 2013 to March, 2015 (mg/l)																													
Date	Ag	al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Mn	Ni	Pb	pH	Se	SO4	TDS	Zn
ave	0.0005	105	12.5	0.016	9.1	0.044		190	0.0290	23	2908	0.011	0.024	19.2		5.3E-05	142	65	2.4	0.0005	187		0.75	0.015	3.5	0.040	2127	2897	1.9
max	0.0005	220	12.5	0.037	19.0	0.110		340	0.0840	35	4900	0.036	0.050	38.0		1.0E-04	290	120	2.5	0.0005	350		1.60	0.036	3.9	0.086	4900	5800	4.3
Min	0.0005	15	12.5	0.004	1.9	0.018		49	0.0047	10	890	0.001	0.006	3.8		5.0E-05	34	18	0.5	0.0005	49		0.18	0.002	3.2	0.006	420	600	0.4
50th Percentile	0.0005	110	12.5	0.015	10.0	0.031		220	0.0265	26	3350	0.010	0.019	20.0		5.0E-05	145	79	2.5	0.0005	205		0.81	0.012	3.5	0.044	2250	3350	2.1

3. Water Quality Data and Summary for Sawyers Swamp Creek at WX1, upstream of SSCAD. EANSW site 92

Sawyers Swamp Creek Upstream of SSCAD WX1 Post-Dry Ash Placement Data (mg/l) February, 2012 to March, 2015

Date	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg
10-Mar-92		0			0.042					8.0	3000				0.435			

Continued……. Sawyers Swamp Creek Upstream of SSCAD WX1 Post-Dry Ash Placement Data (mg/l) February, 2012 to March, 2015

Date	Mn	Mo	Na	NFR	Ni	Pb	pH	Se	SO4	TDS	Zn
10-Mar-92	0.068										0.040

Sawyers Swamp Creek Upstream of SSCAD WX1 Post-Dry Ash Placement Data (mg/l) April, 2013 to March, 2015

SAMPLE	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	NFR	Ni	NO2+NO3	Pb	pH	Se	SO4	TDS	TKN	TN	TP	Zn
10-Apr-13	0.0005	0.74	13	0.0005	0.025	0.014		1.2	0.0001	9	140	0.0005	0.009	0.05		0.000025	1.8	0.58		0.005	27		0.005		0.002	6.3	0.001	24	69				0.025
16-May-13	0.0005	0.45	13	0.0005	0.025	0.014		1.2	0.0001	10	140	0.0005	0.009	0.05		0.000025	2	0.61		0.0005	26		0.005		0.001	6.3	0.001	24	84				0.024
13-Jun-13	0.0005	0.96	13	0.0005	0.04	0.013		1.2	0.0001	10	130	0.0005	0.004	0.05		0.000025	2	0.5		0.0005	25		0.001		0.001	6.3	0.001	23	97				0.03
10-Jul-13	0.0005	0.57	13	0.0005	0.03	0.011		0.96	0.0001	10	130	0.0005	0.001	0.05		0.000025	2	0.5		0.0005	26		0.001		0.0005	6.3	0.001	24	74		0		0.022
22-Aug-13	0.0005	0.79	29	0.0005	0.025	0.013		1.7	0.0001	10	140	0.002	0.0005	0.1		0.000025	2	0.5		0.0005	28		0.002		0.0005	6.5	0.001	23	93		0.5		0.019
26-Sep-13	0.0005	0.75	28	0.0005	0.025	0.011		1.8	0.0001	10	140	0.002	0.002	0.1		0.000025	2	0.5		0.0005	26		0.002		0.0005	6.8	0.001	22	100		0		0.016
24-Oct-13	0.0005	1.3	38	0.001	0.025	0.033		3	0.0001	12	160	0.003	0.003	0.1		0.000025	3	1		0.0005	29		0.003		0.003	6.8	0.001	18	100		0.5		0.022
05-Dec-13	0.0005	5.1	13	0.002	0.07	0.07		4.5	0.0001	12	170	0.005	0.009	0.1		0.000025	4	2		0.0005	27		0.007		0.007	6.4	0.001	36	120		0.5		0.052
11-Sep-14	0.0005	3.9	13	0.0005	0.025	0.053		4.4	0.0001	10	110	0.003	0.004	0.1		0.000025	4	2		0.0005	10		0.003		0.005	6.2	0.001	10	170		8		0.05
11-Dec-14	0.0005	2.6	13	0.0005	0.06	0.065		4	0.0001	11	110	0.002	0.004	0.1		0.00006	5	2		0.0005	10		0.004		0.004	6.1	0.001	11	150		13		0.03
14-Jan-15	0.0005	1.2	13	0.0005	0.06	0.026		3.6	0.0001	10	150	0.0005	0.004	0.1		0.00006	4	2		0.0005	23		0.002		0.002	6.3	0.001	28	150		1		0.014
11-Feb-15	0.0005	0.6	28	0.0005	0.05	0.019		2	0.0001	11	150	0.0005	0.003	0.1		0.00008	2	0.5		0.0005	26		0.002		0.002	6.6	0.001	25	120		0.5		0.009
11-Mar-15	0.0005	1.5	30	0.0005	0.025	0.027		2.5	0.0001	11	150	0.001	0.005	0.1		0.00005	3	1		0.0005	27		0.002		0.002	6.5	0.001	21	130		1		0.011

WX1 (mg/L) SAWYERS SWAMP CREEK FRESH WATER UPSTREAM OF SCAD April, 2013 to March, 2015

	Ag	Al	ALK	As	B	Ba	Be	Ca	Cd	Cl	COND	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	NFR	Ni	NO2+NO3	Pb	pH	Se	SO4	TDS	TKN	TN	TP	Zn
Average	0.0005	1.574	19	0.0007	0.037	0.028		2.5	0.0001	10	140	0.0016	0.004	0.1		0.00004	2.8	1		0.0008	24		0.003		0.0023	6.4	0.001	22	112		2.5		0.025
Maximum	0.0005	5.1	38	0.0020	0.070	0.07		4.5	0.0001	12	170	0.0050	0.009	0.1		0.00008	5.0	2		0.0050	29		0.007		0.0070	6.8	0.001	36	170		13		0.052
Minimum	0.0005	0.45	13	0.0005	0.025	0.011		1.0	0.0001	9	110	0.0005	0.001	0.1		0.00003	1.8	1		0.0005	10		0.001		0.0005	6.1	0.001	10	69		0		0.009
50th Percentile	0.0005	0.96	13	0.0005	0.025	0.019		2.0	0.0001	10	140	0.0010	0.004	0.1		0.00003	2.0	1		0.0005	26		0.002		0.0020	6.3	0.001	23	100		0.5		0.022

4. 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, 2013 to March 2015																																
Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
10-Apr-13	0.001	90	0.09	0.004	0.025	0.08		14	0.0002	75		560	0.001	0.011	0.05	11	0.00005	6.2		17	0.92	0.005	56	0.099	0.0005	6.1	0.001	69	350	9.5	920.70	0.038
17-May-13	0.001	58	0.07	0.003	0.025	0.064		12	0.0002	78		520	0.001	0.012	0.05	0.005	0.00005	6		16	0.42	0.005	61	0.05	0.004	5.8	0.001	66	300	9.6	920.60	0.13
13-Jun-13	0.001	55	0.1	0.002	0.07	0.069		13	0.0002	55		460	0.003	0.005	0.05	0.34	0.00005	5		18	0.55	0.001	52	0.087	0.001	5.7	0.001	71	280	9.3	920.90	0.096
10-Jul-13	0.001	64	0.08	0.003	0.07	0.076		15	0.0003	54		480	0.001	0.007	0.05	1.9	0.00005	6		20	0.57	0.001	56	0.098	0.001	5.8	0.001	83	260	9.4	920.80	0.17
22-Aug-13	0.001	100	0.09	0.003	0.025	0.078		18	0.0002	75		580	0.002	0.002	0.05	5	0.0009	6		24	0.66	0.001	66	0.097	0.0005	6	0.001	74	340	9.7	920.50	0.049
26-Sep-13	0.001	100	0.51	0.004	0.025	0.084		16	0.0002	73		570	0.002	0.003	0.1	11	0.00005	6		21	0.62	0.001	66	0.099	0.003	6	0.001	75	380	9.8	920.40	0.044
24-Oct-13	0.001	100	0.06	0.006	0.025	0.09		19	0.0002	85		660	0.004	0.003	0.1	0.74	0.00005	8		25	0.58	0.003	81	0.1	0.0005	5.9	0.001	90	400	10.4	919.80	0.041
7-Nov-13	0.001	87	0.04	0.002	0.025	0.086		18	0.0002	89		660	0.003	0.002	0.1	0.02	0.00005	7		23	0.61	0.001	75	0.098	0.0005	6	0.001	98	380	10.6	919.60	0.039
5-Dec-13	0.001	84	0.12	0.004	0.025	0.097		21	0.0002	97		710	0.003	0.003	0.1	0.08	0.00005	7		27	0.79	0.001	79	0.11	0.0005	6.1	0.001	130	380	9.5	920.70	0.051
16-Jan-14	0.001	90	0.07	0.004	0.025	0.094		20	0.0002	85		680	0.002	0.011	0.1	0.51	0.00005	7		26	0.67	0.001	78	0.13	0.005	6	0.001	120	360	9.9	920.30	0.055
6-Feb-14	0.001	95	0.14	0.003	0.025	0.099		20	0.0002	85		680	0.002	0.006	0.1	1.5	0.00005	7		26	0.63	0.001	75	0.12	0.004	5.9	0.001	110	370	9.9	920.30	0.042
6-Mar-14	0.001	59	0.08	0.001	0.025	0.093		18	0.0002	80		660	0.002	0.002	0.1	0.03	0.00005	7		23	0.93	0.001	65	0.1	0.001	5.7	0.001	130	400	8.9	921.30	0.069
3-Apr-14	0.001	33	0.14	0.001	0.09	0.1		19	0.0002	84		750	0.001	0.003	0.1	0.07	0.00005	7		29	1.4	0.001	82	0.21	0.001	5.5	0.001	190	470	8.6	921.60	0.14
2-May-14	0.001	44	0.04	0.002	0.025	0.096		20	0.0002	80		700	0.001	0.001	0.1	0.01	0.00005	7		26	0.7	0.001	76	0.082	0.002	5.6	0.001	160	430	9.4	920.80	0.18
13-Jun-14	0.001	46	0.08	0.001	0.025	0.074		14	0.0002	67		610	0.001	0.0005	0.1	0.005	0.00005	7		18	0.48	0.001	69	0.061	0.001	5.7	0.001	100	360	9.9	920.30	0.18
11-Jul-14	0.001	46	0.06	0.001	0.025	0.073		15	0.0002	71		610	0.001	0.001	0.1	0.005	0.00005	7		20	0.47	0.001	69	0.066	0.002	5.7	0.001	100	360	10.1	920.10	0.23
15-Aug-14	0.001	58	0.07	0.001	0.025	0.088		17	0.0002	82		620	0.001	0.0005	0.1	0.005	0.00005	7		21	0.51	0.001	70	0.061	0.001	5.8	0.001	110	370	10.5	919.70	0.18
12-Sep-14	0.001	44	0.12	0.001	0.025	0.093		20	0.0002	78		670	0.001	0.001	0.1	2.9	0.00005	7		23	0.67	0.001	68	0.08	0.002	6	0.001	170	400	9.3	920.90	0.15
24-Oct-14	0.001	52	0.06	0.001	0.025	0.085		20	0.0002	73		680	0.001	0.002	0.1	2.3	0.00005	7		24	0.6	0.001	72	0.076	0.0005	6.1	0.001	150	370	9.7	920.50	0.11
14-Nov-14	0.001	74	0.09	0.001	0.025	0.094		22	0.0002	87		710	0.001	0.002	0.1	6.2	0.00005	7		27	0.73	0.001	80	0.11	0.001	6.1	0.001	160	410	10	920.20	0.15
12-Dec-14	0.001	12.5	0.16	0.001	0.1	0.08		16	0.0002	55		660	0.001	0.003	0.1	0.75	0.00005	7		26	0.76	0.001	66	0.21	0.004	5.6	0.001	180	380	8.7	921.50	0.15
15-Jan-15	0.001	50	0.13	0.002	0.025	0.11		24	0.0002	69		740	0.001	0.003	0.1	10	0.00005	8		30	0.9	0.001	78	0.14	0.002	5.8	0.001	190	470	8.4	921.80	0.076
12-Feb-15	0.001	29	0.09	0.001	0.025	0.096		21	0.0002	70		640	0.001	0.002	0.1	3.3	0.00005	8		25	0.76	0.001	66	0.11	0.001	5.5	0.001	170	450	8.8	921.40	0.076
12-Mar-15	0.001	32	0.4	0.001	0.025	0.089		20	0.0002	73		620	0.001	0.004	0.1	2.9	0.00005	7		24	0.74	0.001	66	0.095	0.001	5.6	0.001	150	370	8.8	921.40	0.057

WGM1/D3 Post-Dry Ash Placement Data (mg/L) April, 2013 to March 2015																																
Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
ave	<0.001	63	0.12	0.001	0.037	0.087		18	0.0002	74		668	0.001	0.002	0.1	2.37	0.00009	7		23	0.73	0.001	70	0.108	0.002	5.8	0.001	153	403	9.5	920.67	0.140
max	<0.001	100	0.51	0.006	0.100	0.110		24	0.0003	97		750	0.004	0.012	0.1	11.00	0.00090	8		30	1.40	0.005	82	0.210	0.005	6.1	0.001	190	470	10.6	921.80	0.230
Min	<0.001	13	0.04	0.001	0.025	0.064		12	0.0002	54		460	0.001	0.001	0.05	0.01	0.00005	5		16	0.42	0.001	52	0.050	0.001	5.5	0.001	66	260	8.4	919.60	0.038
50th Percentile	<0.001	58	0.09	0.002	0.025	0.089		19	0.0002	77		660	0.001	0.003	0.1	0.75	0.00005	7		24	0.67	0.001	69	0.099	0.001	5.8	0.001	115	375	9.6	920.65	0.086

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, 2013 to March 2015 (mg/l)																																
Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
10-Apr-13	0.0005	35	0.01	0.002	1.9	0.023		85	0.0002	32		1600	0.001	0.004	0.05	49	0.00005	10		75	19	0.01	130	0.035	0.001	6	0.002	846	1300	1	906.12	0.05
16-May-13	0.0005	38	0.005	0.003	1.7	0.023		110	0.0002	33		1500	0.001	0.026	0.05	33	0.00005	10		79	19	0.01	130	0.03	0.002	5.8	0.002	820	1200	1	906.12	0.066
13-Jun-13	0.0005	50	0.025	0.003	1.8	0.009		110	0.0002	33		1500	0.001	0.001	0.05	22	0.00005	10		77	18	0.001	130	0.037	0.001	5.9	0.002	830	1200	0.9	906.22	0.064
10-Jul-13	0.0005	12.5	0.025	0.003	1.8	0.022		110	0.0002	33		1400	0.001	0.002	0.05	38	0.00005	9		75	17	0.001	120	0.034	0.001	5.5	0.002	790	1200	1	906.12	0.053
22-Aug-13	0.0005	40	0.04	0.003	1.8	0.023		110	0.0002	33		1500	0.001	0.001	0.05	28	0.00005	9		78	18	0.001	130	0.03	0.001	5.7	0.002	820	1200	1	906.12	0.044
26-Sep-13	0.0005	30	0.03	0.005	1.8	0.021		110	0.0002	33		1500	0.002	0.001	0.1	79	0.00005	9		76	18	0.001	130	0.033	0.001	5.7	0.002	830	1300	1	906.12	0.053
24-Oct-13	0.0005	60	0.005	0.004	2	0.02		110	0.0002	34		1600	0.002	0.001	0.1	27	0.00005	10		81	18	0.001	140	0.035	0.001	6	0.002	910	1300	1	906.12	0.059
7-Nov-13	0.0005	38	0.005	0.002	1.8	0.02		110	0.0002	33		1500	0.002	0.001	0.1	21	0.00005	9		77	18	0.001	130	0.033	0.001	5.8	0.002	830	1300	1	906.12	0.055
5-Dec-13	0.0005	32	0.04	0.003	1.8	0.018		100	0.0002	34		1600	0.003	0.003	0.1	16	0.00005	9		74	18	0.001	130	0.032	0.001	5.9	0.002	880	1200	1	906.12	0.06
16-Jan-14	0.0005	33	0.01	0.003	1.8	0.019		100	0.0002	32		1600	0.002	0.002	0.1	15	0.00005	10		72	17	0.001	130	0.036	0.001	5.8	0.002	820	1200	1	906.12	0.064
6-Feb-14	0.0005	35	0.005	0.003	1.7	0.02		96	0.0002	32		1500	0.001	0.001	0.1	16	0.00005	9		68	16	0.001	120	0.035	0.001	5.8	0.002	800	1200	1	906.12	0.05
6-Mar-14	0.0005	40	0.005	0.003	1.9	0.021		95	0.0002	32		1400	0.001	0.001	0.1	17	0.00005	9		66	17	0.001	120	0.033	0.001	5.9	0.002	780	1300	0.9	906.22	0.049
3-Apr-14	0.0005	48	0.02	0.002	1.7	0.048		240	0.0002	120		2700	0.001	0.001	0.1	13	0.00005	12		110	13	0.001	270	0.029	0.001	6	0.002	1500	2400	0.9	906.22	0.051
1-May-14	0.0005	50	0.3	0.003	1.7	0.019		120	0.0002	39		1600	0.001	0.001	0.1	30	0.00005	10		73	15	0.001	130	0.029	0.002	5.9	0.002	840	1400	0.9	906.22	0.054
12-Jun-14	0.0005	53	0.06	0.002	1.6	0.018		95	0.0002	28		1600	0.001	0.001	0.1	32	0.00005	10		64	16	0.001	120	0.033	0.001	6	0.002	700	1200	1	906.12	0.059
11-Jul-14	0.0005	56	0.005	0.002	1.9	0.019		100	0.0002	29		1600	0.001	0.001	0.1	30	0.00005	10		68	17	0.001	120	0.032	0.001	6	0.002	720	1300	0.9	906.22	0.052
14-Aug-14	0.0005	68	0.03	0.002	1.7	0.02		98	0.0002	32		1500	0.001	0.001	0.1	35	0.00005	9		69	17	0.001	120	0.032	0.001	6.1	0.002	780	1200	1	906.12	0.054
11-Sep-14	0.0005	38	0.04	0.002	1.6	0.021		110	0.0002	44		1600	0.001	0.001	0.1	66	0.00005	9		69	16	0.001	130	0.03	0.001	6.1	0.002	910	1300	0.9	906.22	0.05
23-Oct-14	0.0005	12.5	0.03	0.002	1.8	0.017		100	0.0002	32		1500	0.001	0.001	0.1	67	0.00005	9		68	16	0.001	120	0.031	0.001	5.4	0.002	760	1200	0.9	906.22	0.043
13-Nov-14	0.0005	34	0.02	0.002	1.8	0.018		98	0.0002	33		1500	0.001	0.001	0.1	62	0.00005	9		67	17	0.001	130	0.032	0.001	6	0.002	880	1200	1	906.12	0.075
11-Dec-14	0.0005	45	0.01	0.002	1.7	0.018		97	0.0002	33		1500	0.001	0.001	0.1	61	0.00005	10		67	16	0.001	130	0.036	0.001	6	0.002	760	1200	0.9	906.22	0.04
14-Jan-15	0.0005	44	0.06	0.002	2	0.021		130	0.0002	89		1800	0.001	0.001	0.1	58	0.00005	10		80	15	0.001	180	0.029	0.001	6	0.002	880	1500	0.9	906.22	0.034
11-Feb-15	0.0005	33	0.02	0.002	1.8	0.019		96	0.0002	32		1500	0.001	0.001	0.1	60	0.00005	9		63	15	0.001	120	0.035	0.001	5.8	0.002	730	1200	1	906.12	0.035
11-Mar-15	0.0005	38	0.02	0.002	1.7	0.022		98	0.0002	31		1500	0.001	0.005	0.1	59	0.00005	10		68	16	0.001	130	0.033	0.001	5.8	0.002	730	1200	1	906.12	0.04

WGM1/D4 Post-Dry Ash Placement Data April, 2013 to March 2015 (mg/l)																																
Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
ave	<0.001	40	0.05	0.0021	1.75	0.021		110	0.0002	45		1658	0.0010	0.0013	0.10	47.8	0.00005	10		74	15.75	0.001	135	0.032	0.001	5.9	0.002	849	1358	1.0	906.2	0.049
max	<0.001	68	0.30	0.0050	2.00	0.048		240	0.0002	120		2700	0.0030	0.0260	0.10	79.0	0.0001	12		110	19.00	0.010	270	0.037	0.002	6.1	0.002	1500	2400	1.0	906.2	0.075
Min	<0.001	13	0.01	0.0020	1.60	0.009		85	0.0002	28		1400	0.0010	0.0010	0.05	13.0	0.00005	9		63	13.00	0.001	120	0.029	0.001	5.4	0.002	700	1200	0.9	906.1	0.034
50th Percentile	<0.001	38	0.02	0.0020	1.80	0.020		100	0.0002	33		1500	0.0010	0.0010	0.10	32.5	0.00005	10		73	17.00	0.001	130	0.033	0.001	5.9	0.002	820	1200	1.0	906.1	0.053

5. Water Quality Data and Summary for Background Groundwater Bore WGM1/D1 and WGM1/D2

WGM1/D1 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	16	0.002	0.05	0.156		2.4	0.001	48		210	0.016	0.016	0.19	2.3	0.0002	3	2.5
Maximum	0.001	32	0.006	0.35	2.000		19.0	0.003	92		394	0.045	0.170	0.66	15.7	0.0006	10	15.0
Minimum	0.001	1.50	0.001	0.01	0.030		0.0	0.001	15		99	0.001	0.001	0.001	0.0	0.0001	0	0.0
90th Percentile	0.001	24	0.004	0.10	0.090		5.1	0.002	78		305	0.041	0.035	0.41	5.6	0.0004	6	5.0

Continued…………………WGM1/D1 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	0.37		27		0.010	5.3	0.002	4	143	4.0	944.0	0.078
Maximum	1.00		65		0.035	6.8	0.003	31	302	6.1	946.3	0.230
Minimum	0.05		8		0.001	4.2	0.001	0	50	1.9	942.1	0.012
90th Percentile	0.66		44		0.018	5.9	0.002	9	215	5.3	945.0	0.122

WGM1/D1 Post-Dry Ash Placement Data April, 2013 to March 2015																																
SAMPLE	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
10-Apr-13	0.0005	12.5	0.23	0.0005	0.05	0.063		1.1	0.0001	21		140	0.001	0.002	0.05	0.01	0.000025	3.5		3.5	0.088	0.005	17	0.005	0.0005	5.8	0.001	20	48	1.9	946.22	0.029
16-May-13	0.0005	12.5	0.1	0.0005	0.05	0.044		1	0.0001	16		120	0.001	0.008	0.05	0.02	0.000025	3		3.5	0.03	0.005	15	0.005	0.0005	5.8	0.001	14	64	2.9	945.22	0.033
13-Jun-13	0.0005	12.5	0.13	0.0005	0.06	0.038		1.6	0.0001	19		130	0.001	0.003	0.05	0.04	0.000025	3		3	0.1	0.0005	16	0.002	0.0005	5.7	0.001	15	73	3	945.12	0.054
10-Jul-13	0.0005	12.5	0.59	0.0005	0.04	0.036		1.4	0.0001	21		130	0.001	0.004	0.05	0.24	0.000025	3		3	0.06	0.0005	18	0.002	0.0005	5.6	0.001	11	73	2.9	945.22	0.082
22-Aug-13	0.0005	12.5	1.3	0.0005	0.025	0.034		1.2	0.0001	24		130	0.002	0.004	0.05	0.09	0.000025	2		2	0.043	0.0005	20	0.002	0.002	5.7	0.001	9	96	3.1	945.02	0.05
26-Sep-13	0.0005	12.5	1.5	0.0005	0.025	0.031		1.3	0.0001	23		130	0.002	0.004	0.1	0.24	0.000025	2		2	0.079	0.0005	21	0.003	0.001	5.5	0.001	8	140	3.5	944.62	0.068
24-Oct-13	0.0005	12.5	0.74	0.0005	0.025	0.03		1.3	0.0001	26		140	0.003	0.003	0.1	0.02	0.000025	2		2	0.26	0.0005	21	0.003	0.001	5.5	0.001	8	100	3.8	944.32	0.075
7-Nov-13	0.0005	12.5	0.69	0.0005	0.025	0.027		1.3	0.0001	27		140	0.002	0.002	0.1	0.02	0.000025	2		2	0.34	0.0005	21	0.003	0.0005	5.6	0.001	8	110	3.9	944.22	0.078
5-Dec-13	0.0005	12.5	0.46	0.0005	0.025	0.032		1.3	0.0001	27		140	0.003	0.006	0.1	0.04	0.000025	2		2	0.48	0.0005	20	0.004	0.0005	5.7	0.001	8	78	3.9	944.22	0.1
16-Jan-14	0.0005	12.5	0.14	0.0005	0.28	0.029		15	0.0001	28		390	0.002	0.004	0.1	0.54	0.000025	3		12	2.9	0.0005	35	0.009	0.0005	5.6	0.001	120	200	4.4	943.72	0.085
6-Feb-14																														4.7	943.42	
6-Mar-14																														4.9	943.22	
3-Apr-14																														4.5	943.62	
2-May-14	0.0005	12.5	0.5	0.0005	0.025	0.03		1.6	0.0001	18		110	0.002	0.006	0.1	0.06	0.00015	2		2	0.52	0.0005	13	0.003	0.0005	5.5	0.001	5	69	2.6	945.52	0.099
13-Jun-14	0.0005	12.5	0.85	0.0005	0.025	0.028		0.99	0.0001	19		110	0.001	0.002	0.1	0.09	0.000025	2		1	0.095	0.0005	15	0.002	0.002	5.5	0.001	6	80	3.3	944.82	0.061
11-Jul-14	0.0005	12.5	0.89	0.0005	0.025	0.031		1	0.0001	22		120	0.001	0.002	0.1	0.07	0.000025	2		2	0.071	0.0005	17	0.002	0.001	5.4	0.001	6	98	3.8	944.32	0.061
15-Aug-14	0.0005	12.5	0.76	0.0005	0.025	0.032		0.9	0.0001	26		120	0.002	0.004	0.1	0.04	0.000025	2		1	0.068	0.0005	17	0.003	0.002	5.3	0.001	6	100	4.2	943.92	0.064
12-Sep-14	0.0005	12.5	1.6	0.0005	0.025	0.031		1.1	0.0001	29		120	0.001	0.002	0.1	0.04	0.000025	2		2	0.062	0.0005	18	0.002	0.001	5.7	0.001	6	72	3.9	944.22	0.07
24-Oct-14	0.0005	12.5	1.6	0.0005	0.025	0.039		0.99	0.0001	24		120	0.002	0.008	0.1	0.06	0.000025	2		2	0.21	0.0005	16	0.004	0.005	5.6	0.001	5	120	4.3	943.82	0.089
14-Nov-14	0.0005	12.5	0.52	0.0005	0.025	0.032		1.8	0.0001	28		140	0.001	0.004	0.1	0.31	0.000025	2		2	0.42	0.0005	19	0.004	0.001	5.6	0.001	10	74	4.3	943.82	0.11
12-Dec-14	0.0005	12.5	0.32	0.0005	0.025	0.031		1.7	0.0001	22		120	0.001	0.013	0.1	2.9	0.000025	4		2	0.31	0.0005	15	0.004	0.001	5.6	0.001	5	62	3.4	944.72	0.14
15-Jan-15	0.0005	12.5	0.08	0.0005	0.07	0.082		1.6	0.0001	24		180	0.001	0.001	0.1	0.02	0.000025	5		6	0.039	0.0005	21	0.001	0.0005	5.5	0.001	14	120	1.7	946.42	0.034
12-Feb-15	0.0005	12.5	0.27	0.0005	0.07	0.059		0.96	0.0001	11		120	0.001	0.001	0.1	0.02	0.000025	3		4	0.052	0.0005	13	0.001	0.0005	5.5	0.001	20	100	1.9	946.22	0.021
12-Mar-15	0.0005	12.5	0.42	0.0005	0.06	0.053		1.1	0.0001	10		110	0.002	0.44	0.1	0.03	0.000025	3		3	0.06	0.0005	13	0.002	0.0005	5.5	0.005	19	80	3	945.12	0.032

WGM1/D1 Post-Dry Ash Placement Data April, 2013 to March 2015																																
Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
ave	0.0005	13	0.65	0.0005	0.05	0.039		2	0.0001	22		141	0.0016	0.0249	0.09	0.2	0.00003	3		3	0.30	0.001	18	0.003	0.001	5.6	0.001	15	93	3.5	944.6	0.068
max	0.0005	13	1.60	0.0005	0.28	0.082		15	0.0001	29		390	0.0030	0.4400	0.10	2.9	0.00015	5		12	2.90	0.005	35	0.009	0.005	5.8	0.005	120	200	4.9	946.4	0.140
Min	0.0005	13	0.08	0.0005	0.03	0.027		1	0.0001	10		110	0.0010	0.0010	0.05	0.0	0.00003	2		1	0.03	0.001	13	0.001	0.001	5.3	0.001	5	48	1.7	943.2	0.021
50th Percentile	0.0005	13	0.52	0.0005	0.03	0.032		1	0.0001	23		130	0.0010	0.0040	0.10	0.0	0.00003	2		2	0.09	0.001	17	0.003	0.001	5.6	0.001	8	80	3.7	944.5	0.068

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, 2013 to March 2015

Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	D2 SO4	TDS	WL1	WL AHD	Zn
10-Apr-13	0.0005	12.5	0.22	0.001	0.025	0.045		1.1	0.0002	32		360	0.001	0.004	0.05	0.17	0.000025	4.2		16	0.4	0.01	35	0.049	0.001	4.8	0.002	113	260	7.8	912.4	0.06
17-May-13	0.0005	12.5	0.3	0.001	0.1	0.04		2.7	0.0002	29		480	0.001	0.008	0.05	2	0.000025	4		25	0.78	0.01	47	0.08	0.003	4.1	0.002	160	270	7.9	912.3	0.11
13-Jun-13	0.0005	12.5	0.28	0.001	0.05	0.047		1.8	0.0002	29		400	0.003	0.004	0.05	0.1	0.000025	4		20	0.49	0.001	39	0.058	0.002	4.2	0.002	130	300	7	913.2	0.092
10-Jul-13	0.0005	12.5	0.2	0.001	0.03	0.04		1.5	0.0002	25		380	0.001	0.009	0.05	0.04	0.000025	4		23	0.48	0.001	39	0.054	0.001	4.6	0.002	120	190	7.6	912.6	0.075
22-Aug-13	0.0005	12.5	0.27	0.001	0.1	0.038		2.3	0.0002	34		480	0.002	0.004	0.05	1.7	0.00005	3		24	0.71	0.001	49	0.068	0.002	3.9	0.002	160	290	7.8	912.4	0.087
26-Sep-13	0.0005	12.5	0.27	0.001	0.09	0.036		2.2	0.0002	36		510	0.002	0.007	0.1	4.7	0.000025	3		21	0.69	0.001	56	0.075	0.002	3.8	0.002	160	350	7.7	912.5	0.097
24-Oct-13	0.0005	12.5	0.24	0.001	0.14	0.035		2.5	0.0002	38		590	0.003	0.006	0.1	3.2	0.000025	3		22	0.78	0.001	55	0.086	0.003	3.7	0.002	190	350	7.9	912.3	0.12
7-Nov-13	0.0005	12.5	0.24	0.001	0.15	0.033		2.8	0.0002	39		650	0.003	0.005	0.1	0.69	0.000025	3		22	0.81	0.001	59	0.094	0.003	3.5	0.002	190	370	7.9	912.3	0.13
5-Dec-13	0.0005	12.5	0.28	0.001	0.13	0.033		2.5	0.0002	41		590	0.003	0.006	0.1	0.73	0.000025	3		20	0.75	0.001	57	0.086	0.003	3.5	0.002	180	300	7.7	912.5	0.12
16-Jan-14	0.0005	12.5	0.2	0.001	0.16	0.034		2.5	0.0002	42		630	0.002	0.004	0.1	0.63	0.000025	3		19	0.75	0.001	60	0.086	0.003	3.4	0.002	190	310	7.9	912.3	0.12
6-Feb-14	0.0005	12.5	0.18	0.001	0.15	0.035		2.6	0.0002	39		640	0.001	0.004	0.1	0.76	0.000025	3		19	0.75	0.001	58	0.08	0.002	3.4	0.002	190	330	8	912.2	0.1
6-Mar-14	0.0005	12.5	0.2	0.001	0.15	0.036		2.4	0.0002	40		610	0.002	0.009	0.1	3.8	0.000025	3		18	0.76	0.001	53	0.081	0.002	3.6	0.002	180	320	7.8	912.4	0.12
3-Apr-14	0.0005	12.5	0.63	0.001	0.025	0.044		1.1	0.0002	20		380	0.002	0.002	0.1	0.02	0.000025	4		17	0.4	0.001	36	0.044	0.001	4.5	0.002	130	240	5.8	914.4	0.059
2-May-14	0.0005	12.5	0.24	0.001	0.06	0.026		1.4	0.0002	22		390	0.001	0.002	0.1	0.06	0.000025	4		17	0.47	0.001	39	0.048	0.002	4.3	0.002	120	240	7.5	912.7	0.075
13-Jun-14	0.0005	12.5	0.32	0.001	0.14	0.032		2.5	0.0002	28		570	0.001	0.002	0.1	0.37	0.000025	4		20	0.77	0.001	54	0.077	0.002	3.7	0.002	160	320	7.8	912.4	0.12
11-Jul-14	0.0005	12.5	0.28	0.001	0.17	0.031		2.8	0.0002	31		620	0.001	0.001	0.1	1.1	0.000025	4		22	0.87	0.001	57	0.087	0.003	3.6	0.002	180	340	7.7	912.5	0.12
15-Aug-14	0.0005	12.5	0.28	0.001	0.18	0.032		2.8	0.0002	35		620	0.001	0.001	0.1	2.9	0.000025	3		23	0.85	0.001	59	0.084	0.003	3.6	0.002	200	350	7.8	912.4	0.12
12-Sep-14	0.0005	12.5	0.34	0.001	0.025	0.041		1.3	0.0002	21		410	0.001	0.001	0.1	0.1	0.000025	4		20	0.45	0.001	42	0.05	0.002	4.9	0.002	150	250	5	915.2	0.08
24-Oct-14	0.0005	12.5	0.25	0.001	0.12	0.034		2.3	0.0002	29		540	0.001	0.001	0.1	1.5	0.000025	3		20	0.69	0.001	52	0.071	0.003	3.7	0.002	170	270	7.6	912.6	0.096
14-Nov-14	0.0005	12.5	0.35	0.001	0.18	0.029		3	0.0002	38		640	0.001	0.001	0.1	3.9	0.000025	4		23	0.84	0.001	62	0.083	0.003	3.5	0.002	210	330	7.9	912.3	0.12
12-Dec-14	0.0005	12.5	0.19	0.001	0.025	0.029		1.1	0.0002	15		380	0.001	0.001	0.1	0.02	0.000025	5		17	0.39	0.001	40	0.046	0.002	5	0.002	130	210	3.9	916.3	0.054
15-Jan-15	0.0005	12.5	0.16	0.001	0.025	0.028		1.1	0.0002	15		370	0.001	0.001	0.1	0.01	0.000025	4		17	0.38	0.001	39	0.039	0.002	5	0.002	130	250	3.1	917.1	0.048
12-Feb-15	0.0005	12.5	0.17	0.001	0.025	0.031		1.1	0.0002	20		360	0.001	0.001	0.1	0.02	0.000025	4		15	0.36	0.001	40	0.043	0.002	4.5	0.002	120	240	7.3	912.9	0.05
12-Mar-15	0.0005	12.5	0.31	0.001	0.09	0.037		2	0.0002	29		470	0.001	0.003	0.1	0.37	0.000025	4		19	0.57	0.001	52	0.061	0.002	4	0.002	160	290	7.7	912.5	0.071

WGM1/D2 Post-Dry Ash Placement Data April, 2013 to March 2015

Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
ave	0.0005	13	0.29	0.0010	0.0888	0.035		2	0.0002	25.2500		479.1667	0.0011	0.0014	0.1000	0.8642	0.00003	4		20	0.5867	0.0010	49	0.0611	0.0023	4.1917	0.0020	155.0000	277.5000	7.2	913.0	0.0844
max	0.0005	13	0.63	0.0010	0.18	0.047		3	0.0002	42		650	0.0030	0.0090	0.10	4.7	0.00005	5		25	0.87	0.010	62	0.094	0.003	5.0	0.002	210	370	8.0	917.1	0.130
Min	0.0005	13	0.16	0.0010	0.03	0.026		1	0.0002	15		360	0.0010	0.0010	0.05	0.0	0.00003	3		15	0.36	0.001	35	0.039	0.001	3.4	0.002	113	190	3.1	912.2	0.048
50th Percentile	0.0005	13	0.26	0.0010	0.10	0.035		2	0.0002	30		495	0.0010	0.0035	0.10	0.7	0.00003	4		20	0.70	0.001	52	0.073	0.002	3.9	0.002	160	295	7.7	912.5	0.097

6. Water Quality Data and Summary for KVAD/R 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 Date April, 2013 to March 2015

Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL AHD	WL1	Zn
10-Apr-13																																
17-May-13																																
13-Jun-13	0.001	12.5	4	0.0005	0.2	0.02		17	0.0006	5		340	0.004	0.009	0.4	0.09	0.00005	7		10	1.7	0.0005	9	0.097	0.003	3.7	0.001	130	200	900.49	3.7	0.25
10-Jul-13	0.001	12.5	6.6	0.0005	0.7	0.027		24	0.0007	11		520	0.003	0.003	0.5	0.55	0.00005	10		21	2.9	0.0005	24	0.18	0.003	3.8	0.001	220	350	896.49	7.7	0.35
22-Aug-13																														895.99	8.2	
26-Sep-13																														896.19	8	
24-Oct-13																														895.89	8.3	
7-Nov-13	0.001	130	27	0.007	1.4	0.086		33	0.013	36		840	0.01	0.044	0.1	2.9	0.00018	20		39	4.8	0.003	59	0.3	0.042	6.1	0.01	280	540	895.79	8.4	2.2
5-Dec-13																														895.89	8.3	
16-Jan-14																														895.79	8.4	
6-Feb-14																														895.79	8.4	
6-Mar-14	0.001	12.5	3.9	0.0005	0.27	0.025		16	0.0007	6		400	0.002	0.006	0.4	0.12	0.00005	7		10	1.6	0.0005	10	0.1	0.003	3.7	0.001	140	240	900.19	4	0.23
3-Apr-14	0.001	12.5	5.8	0.0005	0.22	0.036		19	0.001	4		370	0.002	0.003	0.5	0.87	0.00005	6		10	2.1	0.0005	8	0.14	0.002	3.8	0.001	150	250	901.09	3.1	0.34
2-May-14	0.001	12.5	8.9	0.0005	0.88	0.031		26	0.0006	15		590	0.004	0.002	0.7	1.9	0.00005	11		23	3.7	0.0005	23	0.23	0.002	3.9	0.001	260	420	897.29	6.9	0.3
13-Jun-14	0.001	12.5	61	0.029	1.7	0.17		43	0.11	30		1000	0.021	0.12	1.3	0.78	0.00033	19		44	6.2	0.006	59	0.72	0.22	4	0.01	440	780	895.99	8.2	6.4
11-Jul-14	0.001	12.5	24	0.013	2	0.052		44	0.071	33		1100	0.005	0.034	1.1	0.28	0.00005	20		50	6.7	0.001	67	0.55	0.11	4	0.003	500	870	896.09	8.1	2
15-Aug-14	0.001	12.5	16	0.008	1.4	0.036		34	0.068	29		920	0.004	0.017	0.9	0.27	0.00005	19		41	5.5	0.0005	49	0.33	0.086	4.1	0.002	460	720	895.69	8.5	2.5
12-Sep-14	0.001	12.5	7	0.0005	0.65	0.017		23	0.0024	11		550	0.002	0.015	0.5	0.16	0.00005	12		21	2.8	0.0005	24	0.17	0.008	3.8	0.001	250	340	898.49	5.7	0.43
24-Oct-14	0.001	12.5	8.9	0.007	0.76	0.034		23	0.022	12		590	0.004	0.045	0.5	1.2	0.00008	14		24	3.1	0.001	27	0.24	0.061	4.1	0.001	250	370	896.09	8.1	1.3
14-Nov-14	0.001	12.5	25	0.015	1.8	0.05		45	0.11	37		1100	0.009	0.13	1.2	0.93	0.00016	20		50	6.4	0.003	69	0.43	0.21	4	0.006	590	860	895.79	8.4	3.8
12-Dec-14	0.001	12.5	2.1	0.0005	0.28	0.014		13	0.0005	4		330	0.0005	0.003	0.1	0.08	0.00005	9		10	1.5	0.0005	10	0.094	0.003	3.8	0.001	110	200	900.89	3.3	0.16
15-Jan-15	0.001	12.5	6.7	0.0005	0.27	0.035		18	0.001	4		330	0.0005	0.003	0.4	0.12	0.00005	6		11	1.9	0.0005	8	0.18	0.002	4.1	0.001	140	250	901.29	2.9	0.45
12-Feb-15	0.001	12.5	9.4	0.001	0.94	0.034		27	0.0009	17		620	0.002	0.005	0.8	3.8	0.00005	11		21	3.3	0.0005	24	0.29	0.004	3.7	0.001	260	470	896.59	7.6	0.61
12-Mar-15	0.001	12.5	26	0.004	1.8	0.06		45	0.013	34		1100	0.005	0.033	1.5	5	0.00011	22		48	6.4	0.008	65	0.42	0.042	3.9	0.004	550	860	896.09	8.1	1.2

WGM1/D5 Post-Dry Ash Placement Date April, 2013 to March 2015

Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
ave	0.0010	20	15.14	0.0055	0.95	0.045		28	0.0260	18		669	0.0049	0.0295	0.68	1.2	0.00009	13		27	3.79	0.002	33	0.279	0.050	4.0	0.003	296	483	897.3	6.9	1.408
max	0.0010	130	61.00	0.0290	2.00	0.170		45	0.1100	37		1100	0.0210	0.1300	1.50	5.0	0.00033	22		50	6.70	0.008	69	0.720	0.220	6.1	0.010	590	870	901.3	8.5	6.400
Min	0.0010	13	2.10	0.0005	0.20	0.014		13	0.0005	4		330	0.0005	0.0020	0.10	0.1	0.00005	6		10	1.50	0.001	8	0.094	0.002	3.7	0.001	110	200	895.7	2.9	0.160
50th Percentile	0.0010	13	8.90	0.0008	0.82	0.035		25	0.0017	14		590	0.0040	0.0120	0.50	0.7	0.00005	12		22	3.20	0.001	24	0.235	0.006	3.9	0.001	255	395	896.1	8.1	0.530

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
90^{th} 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 April, 2013 to March 2015																																
Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
10-Apr-13	0.001	12.5	1.1	0.002	0.4	0.017		9.3	0.0001	53		810	0.001	0.009	0.3	3.9	0.00005	5.6		34	1.9	0.005	69	0.23	0.001	4.4	0.001	281	580	10.8	896.15	0.24
17-May-13	0.001	12.5	1.5	0.005	0.32	0.02		13	0.0014	60		950	0.002	0.01	0.05	37	0.00005	6		37	2.5	0.005	72	0.27	0.01	3.3	0.001	300	540	11.2	895.75	0.7
13-Jun-13	0.001	12.5	4.1	0.002	0.45	0.019		8.7	0.0006	32		1000	0.004	0.005	0.6	1.5	0.00005	6		59	1.5	0.0005	82	0.5	0.003	3.4	0.001	560	660	11.1	895.85	1.6
10-Jul-13	0.001	12.5	4.8	0.002	0.51	0.022		5.2	0.0005	26		930	0.002	0.006	0.6	0.76	0.00005	6		65	0.76	0.0005	86	0.52	0.002	3.6	0.001	400	630	11	895.95	1.1
22-Aug-13	0.001	12.5	3.6	0.002	0.41	0.017		6.3	0.0001	26		880	0.002	0.001	0.5	0.74	0.00005	6		59	1	0.0005	77	0.39	0.0005	3.5	0.001	370	560	11.2	895.75	0.9
26-Sep-13	0.001	12.5	2.8	0.002	0.4	0.019		8.8	0.0001	31		1000	0.003	0.002	0.5	25	0.00005	6		55	1.6	0.0005	79	0.46	0.0005	3.3	0.001	410	680	11.2	895.75	1.1
24-Oct-13	0.001	12.5	2.4	0.002	0.44	0.022		10	0.0001	35		980	0.004	0.003	0.5	10	0.00005	6		53	1.9	0.0005	79	0.45	0.0005	3.6	0.001	440	660	11.2	895.75	0.99
7-Nov-13	0.001	12.5	2.5	0.003	0.87	0.022		29	0.0002	36		1400	0.007	0.01	0.5	15	0.00005	14		61	3.5	0.002	89	0.52	0.005	3.1	0.001	610	860	11.1	895.85	1.1
5-Dec-13	0.001	12.5	4	0.006	0.77	0.027		22	0.0028	45		1600	0.004	0.009	0.8	16	0.00005	8		72	4	0.0005	92	0.63	0.008	3	0.001	660	870	10.7	896.25	2
16-Jan-14	0.001	12.5	3.8	0.007	0.82	0.028		23	0.0009	44		1600	0.004	0.006	0.7	22	0.00005	8		74	4.2	0.0005	96	0.65	0.004	3	0.001	680	920	10.7	896.25	1.6
6-Feb-14	0.001	12.5	3.1	0.006	0.9	0.026		29	0.0006	44		1700	0.004	0.009	0.6	40	0.00005	8		75	5.3	0.0005	86	0.56	0.003	2.9	0.001	750	1000	10.7	896.25	1.2
6-Mar-14	0.001	12.5	3.9	0.008	1	0.027		29	0.0007	46		1800	0.004	0.005	0.5	57	0.00005	8		74	6	0.0005	83	0.61	0.004	3	0.001	770	1200	10.8	896.15	1.3
3-Apr-14	0.001	12.5	6.5	0.004	0.7	0.023		20	0.0009	56		1700	0.003	0.005	0.1	10	0.00005	8		88	3.7	0.0005	130	0.67	0.005	3	0.001	750	1100	10.7	896.25	1.8
2-May-14	0.001	12.5	3	0.007	0.87	0.019		27	0.0008	47		1500	0.003	0.004	0.4	80	0.00005	8		70	5.4	0.0005	96	0.45	0.009	3.3	0.001	690	1000	10.9	896.05	0.6
13-Jun-14	0.001	12.5	2.6	0.007	1.1	0.022		36	0.0007	42		1600	0.003	0.002	0.5	130	0.00005	8		70	7.1	0.0005	94	0.4	0.009	3.6	0.001	720	1200	11.1	895.85	0.69
11-Jul-14	0.001	12.5	3.3	0.006	1.1	0.025		36	0.0014	44		1600	0.003	0.004	0.4	120	0.00005	8		72	7.3	0.0005	89	0.43	0.015	3.5	0.001	720	1200	10.9	896.05	0.99
15-Aug-14	0.001	12.5	2.1	0.006	0.94	0.019		31	0.003	44		1400	0.002	0.008	0.4	110	0.00005	8		61	6.4	0.0005	89	0.35	0.011	3.7	0.001	710	1100	11.2	895.75	1.3
12-Sep-14	0.001	12.5	5.4	0.003	0.4	0.017		5	0.0015	26		900	0.002	0.003	0.7	5.5	0.00005	5		53	0.74	0.0005	74	0.47	0.01	3.7	0.001	410	590	11.1	895.85	1.4
24-Oct-14	0.001	12.5	4.2	0.005	0.92	0.023		26	0.0022	37		1700	0.003	0.005	0.6	90	0.00005	7		71	4.9	0.001	85	0.55	0.016	2.9	0.001	660	950	11.2	895.75	1.8
14-Nov-14	0.001	12.5	4.2	0.006	1.1	0.026		34	0.0041	45		1600	0.002	0.008	0.6	130	0.00005	8		76	6.5	0.0005	94	0.54	0.02	3.2	0.001	880	1200	11.4	895.55	2
12-Dec-14	0.001	12.5	5.5	0.004	0.75	0.023		21	0.004	35		1500	0.002	0.006	0.6	69	0.00005	8		72	3.8	0.0005	93	0.66	0.018	3.1	0.001	610	880	10.8	896.15	1.9
15-Jan-15	0.001	12.5	5.7	0.003	0.58	0.018		8.2	0.001	33		1200	0.001	0.002	0.8	15	0.00005	7		65	1.1	0.0005	110	0.54	0.007	3.4	0.001	460	780	10.7	896.25	1.2
12-Feb-15	0.001	12.5	2.6	0.004	0.73	0.021		20	0.0036	32		1400	0.002	0.007	0.4	69	0.00005	7		58	3.6	0.0005	92	0.45	0.017	3	0.001	540	880	11.1	895.85	0.99
12-Mar-15	0.001	12.5	2.4	0.004	0.95	0.028		35	0.0025	40		1600	0.002	0.008	0.6	140	0.00005	8		74	6.5	0.0005	98	0.44	0.011	3.4	0.001	750	1200	11.2	895.75	0.93

WGM1/D6 Post-Dry Ash Placement Data April, 2013 to March 2015																																
Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	WL1	WL AHD	Zn
ave	0.0010	13	3.55	0.0044	0.73	0.022		21	0.0014	40		1348	0.0029	0.0057	0.51	49.9	0.00005	7		65	3.80	0.001	89	0.489	0.008	3.3	0.001	589	885	11.0	896.0	1.226
max	0.0010	13	6.50	0.0080	1.10	0.028		36	0.0041	60		1800	0.0070	0.0100	0.80	140.0	0.00005	14		88	7.30	0.005	130	0.670	0.020	4.4	0.001	880	1200	11.4	896.3	2.000
Min	0.0010	13	1.10	0.0020	0.32	0.017		5	0.0001	26		810	0.0010	0.0010	0.05	0.7	0.00005	5		34	0.74	0.001	69	0.230	0.001	2.9	0.001	281	540	10.7	895.6	0.240
50th Percentile	0.0010	13	3.45	0.0040	0.76	0.022		22	0.0009	41		1450	0.0030	0.0055	0.50	31.0	0.00005	8		68	3.75	0.001	89	0.485	0.008	3.3	0.001	635	880	11.1	895.9	1.150

7. Water Quality Data and Summary for SSCAD

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 to January 2012
(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	<0.001	20		0.001	2.1	0.07	0.001	83	0.002	40		2247	0.001		0.01	2.5	0.03	0.00005	49		19
26-May-10	<0.001	20		0.001	2.3	0.071		88	0.0022	39		2130	0.001		0.005	2.3	0.05	0.00005	50		20
9-Jun-10	<0.001	20		0.001	2.2	0.069		85	0.0022	37		1978	0.001		0.004	2.2	0.01	0.00005	50		19
1-Jul-10	<0.001	20	1.5	0.001	2.3	0.071		81	0.0023	35		2055	0.001		0.008	2.2	0.14	0.00005	46		19
25-Aug-10	<0.001	20	4	0.001	2.1	0.071		78	0.0026	32		2109	0.001		0.01	2.4	0.57	0.00005	46		19
23-Sep-10	<0.001	20	3.6	0.001	1.9	0.067		81	0.0025	31		1996	0.001		0.012	2.7	1.4	0.00005	45		19
27-Oct-10	<0.001	20		0.002	2	0.075		78	0.0028	30		2026	0.001		0.01	2.3	0.39	0.00005	44		17
19-Nov-10	<0.001	20		0.002	2	0.083		79	0.0029	33		2023	0.001		0.011	2.5	0.15	0.00005	47		19
9-Dec-10	<0.001	20	1.5	0.0018	2.1	0.044		84	0.0014	32		2051	0.001		0.0057	1.7	0.07	0.00005	48		17
12-Jan-11	<0.001	20	0.32	0.002	1.9	0.029		90	0.0002	33		2007	0.001		0.001	1.3	1.3	0.00007	48		17
24-Feb-11	<0.001	20	0.14	0.001	1.7	0.027		76	0.0008	28		1745	0.001		<0.001	1.4	0.09	0.00005	41		14
24-Mar-11	<0.001	20	0.2	0.003	1.8	0.03		83	0.0005	27		1800	0.001		0.003	1.4	0.04	0.00005	42		15
8-Apr-11	<0.001	20	0.73	0.001	1.9	0.037		81	0.001	28		1700	0.001		0.006	1.6	0.01	0.00005	44		14
12-May-11	<0.001	20	2.8	0.001	2.1	0.052		82	0.003	26		1800	0.001		0.015	2.2	0.02	0.00005	45		16
10-Jun-11	<0.001	20	3	0.001	2.2	0.041		84	0.003	28		1900	0.001		0.014	2.4	0.01	0.00005	42		16
26-Jul-11	<0.001	20	2.7	0.001	2.1	0.031		91	0.002	26		1800	0.001		0.01	2.3	0.01	0.00005	45		15
30-Aug-11	<0.001	20	1.8	0.001	1.9	0.023		87	0.002	28		1800	0.001		0.007	1.9	0.01	0.00005	44		14
21-Sep-11	<0.001	20	1.6	0.001	2.1	0.024		96	0.002	29		1800	0.001		0.008	1.9	0.01	0.00005	48		15
12-Oct-11	<0.001	20	1.3	0.001	1.9	0.037		94	0.001	28		1900	0.001		0.004	1.7	0.01	0.00005	46		15
10-Nov-11	<0.001	20	7.2	0.002	2	0.098		75	0.0041	26		1800	0.010		0.046	2.3	0.09	0.00005	42		16
8-Dec-11	<0.001	20	4.5	0.001	1.9	0.083		70	0.0037	25		1700	0.001		0.031	4	0.04	0.00005	39		15
18-Jan-12	<0.001	2.6	20	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 to January, 2012 (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	0.001	4.5	0.003	1000	1600	0.08
26-May-10	0.92	0.01	380	0.03	0.001	5.5	0.002	1100	1600	0.08
9-Jun-10	0.93	0.02	370	0.03	0.001	5.9	0.003	1100	1600	0.09
1-Jul-10	0.94	0.02	350	0.04	0.001	4.9	0.003	1000	1600	0.1
25-Aug-10	1.1	0.01	330	0.04	0.001	4.6	0.003	950	1500	0.15
23-Sep-10	1.1	0.01	340	0.05	0.001	5.3	0.003	940	1500	0.14
27-Oct-10	1.1	0.01	320	0.05	0.001	5.2	0.004	930	1500	0.14
19-Nov-10	1.2	0.02	340	0.05	0.001	5	0.004	950	1400	0.15
9-Dec-10	1.9	0.01	350	0.05	0.001	4.2	0.004	940	1500	0.15
12-Jan-11	2.9	0.01	350	0.03	0.001	3.9	0.015	990	1400	0.04
24-Feb-11	1.7	0.25	280	0.02	0.001	5	0.006	850	1300	0.04
24-Mar-11	1.9	0.16	290	0.02	0.001	4.2	0.006	850	1200	0.04
8-Apr-11	1.8	0.04	280	0.02	0.001	5.1	0.005	840	1400	0.05
12-May-11	1.4	0.01	290	0.05	0.001	4.6	0.005	830	1400	0.15
10-Jun-11	1.4	0.01	290	0.05	0.001	4.5	0.005	870	1300	0.18
26-Jul-11	1.4	0.01	300	0.05	0.001	4.8	0.004	850	1400	0.22
30-Aug-11	1.3	0.01	290	0.04	0.001	4.9	0.004	850	1400	0.19
21-Sep-11	1.3	0.01	310	0.04	0.001	4.9	0.004	890	1300	0.19
12-Oct-11	1.2	0.03	290	0.03	0.001	5.2	0.006	870	1400	0.18
10-Nov-11	1.1	0.01	270	0.07	0.003	4.4	0.018	840	1300	0.27
8-Dec-11	1	0.01	260	0.06	0.002	4.8	0.014	780	1300	0.2
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 to January, 2012 (mg/L)																			
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**CrIV**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average	<0.001	19	3.3	0.0013	2.01	0.055		83	0.0021	30	1912	0.0014		0.0115	2.15	0.21	0.000051	45	17
Maximum	<0.001	20	20.0	0.0030	2.30	0.098		96	0.0041	40	2247	0.0100		0.0460	4.00	1.40	0.000070	50	20
Minimum	<0.001	3	0.1	0.0010	1.70	0.023		70	0.0002	25	1700	0.0010		0.0010	1.30	0.01	0.000050	39	14
50th Percentile	<0.001	20	1.8	0.0010	2.00	0.060		83	0.0022	29	1900	0.0010		0.0100	2.20	0.05	0.000050	45	16

Continued………………..SSCAD Post-Stage 2A Dry Ash Placement April, 2010 to January, 2012 (mg/L)										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average	1.34	0.033	315	0.041	0.001	4.8	0.006	910	1418	0.136
Maximum	2.90	0.250	380	0.070	0.003	5.9	0.018	1100	1600	0.270
Minimum	0.89	0.010	260	0.020	0.001	3.9	0.002	780	1200	0.040
50th Percentile	1.20	0.010	305	0.040	0.001	4.9	0.004	880	1400	0.150

SSCAD Post-Dry Ash Placement April, 2013 to March 2015																															
Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	CrIV	Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	Zn
10-Apr-13	0.001	12.5	2	0.002	2	0.073		58	0.005	21		1500	0.0005		0.018	2.4	0.050	0.00005	35		15	1.2	0.005	230	0.078	0.0005	5.5	0.006	691	940	0.24
16-May-13	0.001	12.5	2.5	0.002	1.7	0.071		59	0.0053	19		1500	0.0005		0.01	2.3	0.16	0.00005	38		16	1.5	0.005	220	0.09	0.0005	5.2	0.007	730	1100	0.25
13-Jun-13	0.001	12.5	1.7	0.002	2	0.065		61	0.0051	20		1500	0.0005		0.009	0.05	0.040	0.00005	37		16	1.5	0.014	210	0.083	0.0005	5.5	0.007	740	1100	0.29
10-Jul-13	0.001	12.5	1.6	0.002	2.2	0.066		60	0.005	20		1400	0.0005		0.009	2.1	0.03	0.00005	37		17	1.5	0.015	230	0.084	0.0005	5.4	0.006	710	1000	0.25
22-Aug-13	0.001	12.5	0.3	0.001	1.9	0.063		55	0.0038	19		1300	0.001		0.0005	1.7	0.005	0.00005	34		15	1.4	0.018	210	0.072	0.0005	6.8	0.003	650	990	0.19
26-Sep-13	0.001	12.5	1.2	0.002	2	0.066		59	0.0041	19		1400	0.002		0.003	1.9	0.1	0.00005	35		16	1.5	0.02	220	0.094	0.0005	5.6	0.004	720	1100	0.23
24-Oct-13	0.001	12.5	1.6	0.003	2.2	0.067		62	0.0044	20		1600	0.002		0.004	2.2	0.070	0.00005	36		16	1.5	0.016	230	0.087	0.0005	5.4	0.004	800	1100	0.25
7-Nov-13	0.001	12.5	1	0.002	1.9	0.078		61	0.0048	20		1500	0.002		0.003	2	0.02	0.00005	37		16	1.5	0.027	240	0.087	0.0005	5.8	0.006	820	1100	0.24
5-Dec-13	0.001	12.5	1.4	0.002	2	0.077		63	0.0043	22		1700	0.002		0.006	2.1	0.080	0.00005	38		17	1.5	0.03	240	0.084	0.0005	5.3	0.006	820	1200	0.24
16-Jan-14	0.001	99	0.08	0.004	1.7	0.061		52	0.0023	19		1600	0.002		0.002	1.8	0.005	0.00005	34		14	0.84	0.037	260	0.051	0.0005	8	0.003	690	1100	0.073
6-Feb-14	0.001	98	0.04	0.003	1.6	0.054		51	0.0014	19		1500	0.001		0.004	1.7	0.010	0.00005	32		14	0.43	0.043	240	0.029	0.0005	8.1	0.003	640	1100	0.025
6-Mar-14	0.001	81	0.15	0.002	1.7	0.05		54	0.0013	18		1500	0.002		0.002	1.8	0.01	0.00005	33		14	0.41	0.042	230	0.027	0.0005	7.9	0.003	650	1100	0.032
3-Apr-14	0.001	58	0.36	0.002	1.9	0.045		60	0.0014	19		1600	0.002		0.002	2.3	0.005	0.00005	38		16	0.41	0.04	240	0.028	0.0005	7.7	0.003	720	1100	0.035
1-May-14	0.001	61	0.24	0.001	1.8	0.045		57	0.0014	18		1500	0.001		0.002	1.9	0.03	0.00005	36		16	0.52	0.041	220	0.031	0.0005	7.8	0.002	660	1100	0.044
12-Jun-14	0.001	43	0.16	0.0005	1.9	0.045		63	0.0018	17		1600	0.001		0.002	1.7	0.050	0.00005	41		17	0.74	0.04	240	0.043	0.0005	7.6	0.002	620	1100	0.073
10-Jul-14	0.001	12.5	0.1	0.0005	2.1	0.043		64	0.0016	18		1500	0.001		0.002	1.8	0.005	0.00005	40		17	0.82	0.035	220	0.045	0.0005	7.3	0.002	640	1100	0.072
14-Aug-14	0.001	12.5	0.12	0.0005	1.8	0.034		58	0.0016	18		1300	0.001		0.002	2	0.040	0.00005	34		15	0.33	0.024	190	0.03	0.0005	7.3	0.002	650	1000	0.07
11-Sep-14	0.001	12.5	2.7	0.001	2.5	0.044		69	0.004	21		1600	0.001		0.003	2.6	0.04	0.00005	44		20	1.4	0.03	200	0.09	0.0005	5.4	0.004	800	1200	0.24
23-Oct-14	0.001	12.5	1.6	0.001	2.5	0.034		70	0.0046	19		1600	0.001		0.004	2.2	0.220	0.00005	43		19	1.4	0.013	210	0.11	0.0005	5.3	0.003	730	1100	0.25
13-Nov-14	0.001	12.5	2	0.002	2.6	0.038		73	0.0044	21		1600	0.001		0.004	2.7	0.09	0.00005	46		20	1.6	0.024	220	0.094	0.0005	5.4	0.003	860	1200	0.25
11-Dec-14	0.001	12.5	7.2	0.002	1.2	0.054		32	0.0046	9		710	0.001		0.01	2.2	0.070	0.00005	21		10	1.2	0.0005	61	0.095	0.002	4.6	0.004	310	460	0.28
14-Jan-15	0.001	12.5	6.5	0.002	2.9	0.045		79	0.0053	19		1600	0.001		0.007	3.3	0.09	0.00005	52		22	2	0.026	220	0.11	0.0005	4.8	0.006	760	1200	0.39
11-Feb-15	0.001	12.5	8	0.003	2.9	0.05		77	0.0063	20		1600	0.001		0.01	3.6	0.360	0.00005	49		21	2.1	0.022	200	0.13	0.001	4.6	0.005	780	1300	0.34
11-Mar-15	0.001	12.5	9.3	0.003	2.6	0.053		81	0.0067	20		1700	0.001		0.014	4.2	0.29	0.00005	53		23	2.3	0.005	210	0.14	0.001	4.4	0.008	840	1200	0.36

SSCAD Post-Stage 2 Dry Ash Placement April, 2013 to March, 2015 (mg/l)																															
Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr		Cu	F	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	pH	Se	SO4	TDS	Zn
ave	0.0010	28	2.16	0.0019	2.07	0.055		62	0.0038	19		1496	0.0012		0.0055	2.19	0.1	0.00005	38		17	1.23	0.024	216	0.076	0.001	6.1	0.004	710	1083	0.196
max	0.0010	99	9.30	0.0040	2.90	0.078		81	0.0067	22		1700	0.0020		0.0180	4.20	0.4	0.00005	53		23	2.30	0.043	260	0.140	0.002	8.1	0.008	860	1300	0.390
Min	0.0010	13	0.04	0.0005	1.20	0.034		32	0.0013	9		710	0.0005		0.0005	0.05	0.0	0.00005	21		10	0.33	0.001	61	0.027	0.001	4.4	0.002	310	460	0.025
50th Percentile	0.0010	13	1.50	0.0020	2.00	0.054		61	0.0044	19		1500	0.0010		0.0040	2.10	0.0	0.00005	37		16	1.40	0.024	220	0.084	0.001	5.5	0.004	720	1100	0.240

8. Water Quality Data and Summary for Sawyers Swamp Creek Monitoring from SSCAD Spillway to near WGM4/D5

Sawyers Crk upstream 0 m where SSCAD diversion and Springvale Mine Water from April, 2013 to March, 2015 enters SSC at spillway

Date	ag	Al	Alk	As	B	Ba	Be	Ca	Cd	Cl	Cond	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	NO2+NO3	Pb	pH	PO4	se	So4	TDS	TKN	TN	TP	TSS	Turbidity (NTU)	Zn
10/04/2013	0.0005	0.59	510	0.015	0.10	0.026		4.8	0.0001	4	1000	0.0005	0.0005	1.5		0.000025	10	2.3		0.036	250	0.005		0.002	8.3		0.001	25	580					3.4	0.022
16/05/2013	0.0005	1.3	520	0.019	0.09	0.035		4.5	0.0001	5	1000	0.0005	0.001	1.3		0.000025	11	2.4		0.038	230	0.005		0.003	8.2		0.001	23	700					40	0.022
13/06/2013	0.0005	0.13	560	0.018	0.07	0.021		5.2	0.0001	5	1000	0.0005	0.001	1.2		0.000025	10	3		0.033	230	0.005		0.001	8.4		0.001	25	650					5	0.024
10/07/2013	0.0005	0.34	570	0.019	0.08	0.03		5	0.0001	5	1000	0.0005	0.001	1.2		0.000025	11	3		0.04	260	0.005		0.002	8.4		0.001	25	600		0			17	0.025
22/08/2013	0.0005	0.2	580	0.014	0.07	0.025		4.7	0.0001	5	1000	0.002	0.0005	0.1		0.000025	11	3	0.5	0.032	250	0.004		0.0005	8.5		0.001	23	660		0			7.1	0.015
26/09/2013	0.0005	0.43	560	0.02	0.08	0.028		5.1	0.0001	5	1100	0.002	0.001	1.1		0.000025	11	3	0.5	0.037	260	0.004		0.001	8.5		0.001	30	770		0.5			14	0.023
24/10/2013	0.0005	0.09	600	0.024	0.08	0.022		3.9	0.0001	5	1200	0.002	0.0005	1.3		0.000025	11	2	0.5	0.037	280	0.005		0.0005	8.5		0.001	35	670		0.5			6.6	0.027
7/11/2013	0.0005	0.19	570	0.027	0.07	0.029		4	0.0001	5	1100	0.002	0.0005	1.2		0.000025	10	3	0.5	0.041	260	0.005		0.0005	8.5		0.001	33	650		0			9.7	0.025
5/12/2013	0.0005	0.07	530	0.026	0.08	0.024		4.5	0.0001	5	1100	0.003	0.0005	1.2		0.000025	10	3	0.5	0.039	260	0.006		0.0005	8.6		0.001	35	690		2			0.3	0.032
16/01/2014	0.0005	0.18	560	0.025	0.08	0.027		4.6	0.0001	5	1100	0.002	0.001	1.2		0.000025	11	3	0.5	0.044	240	0.006		0.0005	8.5		0.001	38	710		2			5	0.028
6/02/2014	0.0005	0.2	530	0.029	0.07	0.028		4.3	0.0001	5	1100	0.002	0.0005	1.2		0.000025	10	3	0.5	0.03	230	0.006		0.0005	8.6		0.001	40	700		2			4	0.022
6/03/2014	0.0005	0.14	540	0.026	0.08	0.026		3.9	0.0001	5	1100	0.002	0.0005	1.1		0.000025	11	3	0.5	0.043	240	0.005		0.0005	8.5		0.001	36	700		2			3.8	0.021
3/04/2014	0.0005	0.39	540	0.02	0.08	0.026		5.2	0.0001	5	1100	0.002	0.0005	1.3		0.000025	13	3	0.5	0.04	270	0.005		0.0005	8.4		0.001	43	760		2			5.6	0.026
1/05/2014	0.0005	0.18	570	0.02	0.07	0.024		4.7	0.0001	5	1100	0.0005	0.0005	1.3		0.000025	11	3	0.5	0.044	240	0.005		0.0005	8.5		0.001	36	690		2			7	0.034
12/06/2014	0.0005	0.14	530	0.019	0.08	0.025		5.2	0.0001	5	1100	0.0005	0.0005	1.1		0.000025	12	3	0.5	0.045	280	0.005		0.0005	8.5		0.001	38	690		1			3.4	0.029
10/07/2014	0.0005	0.17	530	0.029	0.08	0.026		5.2	0.0001	5	1200	0.001	0.002	1.2		0.000025	11	3	0.5	0.042	260	0.005		0.001	8.5		0.001	37	750		1			13	0.03
14/08/2014	0.0005	0.11	560	0.019	0.07	0.01		3.8	0.0001	5	1100	0.0005	0.0005	1.2		0.000025	7	0.5	0.5	0.039	250	0.003		0.001	8.6		0.001	28	680		1			3.6	0.028
11/09/2014	0.0005	0.14	560	0.029	0.07	0.03		4.4	0.0001	5	1100	0.0005	0.0005	1.1		0.000025	10	3	0.5	0.041	240	0.004		0.0005	8.5		0.001	31	660		1			6.9	0.01
23/10/2014	0.0005	0.21	580	0.025	0.08	0.026		4.7	0.0001	5	1200	0.0005	0.0005	1.3		0.000025	11	3	0.5	0.051	270	0.004		0.0005	8.6		0.001	36	760		1			6.8	0.012
13/11/2014	0.0005	0.1	600	0.028	0.07	0.027		5	0.0001	5	1200	0.0005	0.0005	1.1		0.000025	13	3	0.5	0.054	290	0.004		0.0005	8.5		0.001	35	730		0.5			2.9	0.024
11/12/2014	0.0005	0.28	580	0.026	0.07	0.03		5	0.0001	6	1200	0.0005	0.001	1.2		0.000025	12	3	0.5	0.067	280	0.004		0.0005	8.7		0.001	38	710		2			10	0.007
14/01/2015	0.0005	0.07	580	0.028	0.08	0.03		4.6	0.0001	5	1200	0.0005	0.0005	1.1		0.000025	12	3	0.5	0.05	270	0.004		0.0005	8.4		0.001	34	720		2			2.8	0.006
11/02/2015	0.0005	0.31	540	0.027	0.07	0.033		4.5	0.0001	6	1100	0.0005	0.001	1.1		0.000025	12	3	0.5	0.064	260	0.004		0.0005	8.5		0.001	37	730		2			11	0.008
11/03/2015	0.0005	0.38	510	0.009	0.07	0.013		4.2	0.0001	6	1100	0.0005	0.003	1.1		0.000025	8	1	0.5	0.028	260	0.002		0.0005	8.5		0.001	30	690		2			5.1	0.013

Sawyers Crk upstream 0 m where SSCAD diversion and Springvale Mine Water from April, 2013 to March, 2015 enters SSC at spillway

Date	ag	Al	Alk	As	B	Ba	Be	Ca	Cd	Cl	Cond	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	NO2+NO3	Pb	pH	PO4	se	So4	TDS	TKN	TN	TP	TSS	Turbidity (NTU)	Zn
Ave	<0.001	0.26	555	0.023	0.08	0.026		4.6	0.0001	5	1104	0.001	0.001	1.2		0.00003	10.8	2.7	0.500	0.04	257	0.005		0.001	8.5		0.001	33	694		1.26			8.1	0.021
Max	<0.001	1.30	600	0.029	0.10	0.035		5.2	0.0001	6	1200	0.003	0.003	1.5		0.00003	13.0	3.0	0.500	0.07	290	0.006		0.003	8.7		0.001	43	770		2.00			40.0	0.034
Min	<0.001	0.07	510	0.009	0.07	0.010		3.8	0.0001	4	1000	0.001	0.001	0.1		0.00003	7.0	0.5	0.500	0.03	230	0.002		0.001	8.2		0.001	23	580		0.00			0.3	0.006
50th Percentile	<0.001	0.19	560	0.025	0.08	0.026		4.7	0.0001	5	1100	0.001	0.001	1.2		0.00003	11.0	3.0	0.500	0.04	260	0.005		0.001	8.5		0.001	35	695		1.00			6.1	0.024

SSC upstream @600 m where SSCAD diversion and Springvale Mine Water from August, 2012 enters SSC at spillway																					
Date	Ag	ALK	Al	As	B	Ba	Be	Ca	Cd	Cl	Co	COND	Cr	CrIV	Cu	F	Fe	Hg	K	Li	Mg
25/07/2011										6		960									
23/08/2011										7		910									
21/09/2011										6		950									
21/10/2011										12		610									
28/11/2011										11		140									
16/12/2011										10		240									
30/01/2012										9		660									
28/02/2012										8		530									
30/03/2012																					
24/04/2012										10		330									
30/05/2012										12		180									
25/06/2012										7		780									
26/07/2012										6		800									
22/08/2012										12		190									
19/09/2012										13		290									
25/10/2012										6		980									
21/11/2012										6		1000									
28/12/2012																					
29/01/2013										5		980									
22/02/2013										5		1100									
26/03/2013										8		520									

Continued…….. SSC upstream @0 m where SSCAD diversion and Springvale Mine Water from August, 2012 enters SSC at spillway										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
25/07/2011						8.6		23	570	
23/08/2011						8.9		25	600	
21/09/2011						8.8		23		
21/10/2011						8.6		31	370	
28/11/2011						7.4		23	110	
16/12/2011						8.3		23	150	
30/01/2012						8.7		20		
28/02/2012						8.8		18	330	
30/03/2012										
24/04/2012						8.3		18	200	
30/05/2012						7.7		21	90	
25/06/2012						8.7		23	530	
26/07/2012						8.6		23	500	
22/08/2012						7.7		24	100	
19/09/2012						8		26	200	
25/10/2012						8.8		20	520	
21/11/2012						8.7		22	630	
28/12/2012										
29/01/2013						8.7		20	640	
22/02/2013						8.6		19		
26/03/2013						8.6		21		

Sawyers Swamp Creek upstream @600 m where SSCAD and Springvale Mine Water from August, 2012 enters SSC at spillway																		
Date	**Ag**	**ALK**	**Al**	**As**	**B**	**Ba**	**Be**	**Ca**	**Cd**	**Cl**	**COND**	**Cr**	**CrIV**	**Cu**	**F**	**Fe**	**Hg**	**K**	**Mg**
Average										8	640								
Maximum										13	1100								
Minimum										5	180								
50th Percentile										8	655								

Continued……………….. Sawyers Swamp Creek upstream @600 m where SSCAD and Springvale Mine Water from August, 2012 enters SSC at spillway										
Date	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**pH**	**Se**	**SO4**	**TDS**	**Zn**
Average						8.4		21	374	
Maximum						8.8		26	640	
Minimum						7.7		18	90	
50th Percentile						8.6		21	415	

Sawyers Creek Ash Dam Seepage from V-notch (water collected and recycling back into dam) from April, 2013 to March, 2015																																	
Date	ag	Al	Alk	As	B	Ba	Be	Ca	Cd	Cl	Cond	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	pH	PO4	se	So4	TDS	TKN	TN	TSS	Turbidity (NTU)	Zn
10/04/2013	0.0005	0.04	77	0.0005	2.3	0.021		91	0.0001	39	1700	0.0005	0.003	1.5		0.000025	29	45		0.005	220	0.005	0.0005	7.2		0.002	825	1200				0.25	0.025
16/05/2013	0.0005	0.06	77	0.0005	2	0.023		99	0.0002	40	1700	0.0005	0.011	1.3		0.000025	30	48		0.005	210	0.005	0.0005	6.8		0.001	740	1300				0.95	0.034
13/06/2013	0.0005	0.1	77	0.0005	2	0.021		95	0.0001	38	1600	0.0005	0.004	1.2		0.000025	29	46		0.0005	210	0.009	0.0005	7		0.001	730	1200				1.9	0.04
10/07/2013	0.0005	0.025	79	0.0005	2.5	0.02		100	0.0001	38	1600	0.0005	0.0005	1.3		0.000025	31	51		0.0005	230	0.01	0.0005	7		0.001	760	1100		0		1.1	0.034
22/08/2013	0.0005	0.21	86	0.0005	2.2	0.037		100	0.0001	40	1600	0.002	0.0005	1.2		0.000025	31	49	0.5	0.0005	230	0.01	0.0005	7.1		0.001	760	1200		0		3.7	0.034
26/09/2013	0.0005	0.14	530	0.016	0.15	0.028		8.6	0.0001	7	1100	0.002	0.0005	1.1		0.000025	12	5	0.5	0.038	260	0.006	0.001	8.6		0.001	58	790		0		3.2	0.027
24/10/2013	0.0005	0.07	470	0.016	0.68	0.022		30	0.0001	14	1300	0.002	0.0005	1.3		0.000025	16	15	0.5	0.027	260	0.005	0.0005	8.4		0.001	230	950		2		1	0.025
7/11/2013	0.0005	0.05	450	0.015	0.64	0.026		30	0.0001	14	1300	0.002	0.0005	1.2		0.000025	16	15	0.5	0.028	260	0.005	0.0005	8.4		0.001	250	650		2		1.8	0.026
5/12/2013	0.0005	0.13	360	0.013	0.91	0.025		40	0.0001	20	1400	0.003	0.0005	1.3		0.000025	17	20	0.5	0.023	240	0.007	0.0005	8.2		0.001	350	840		2		3.1	0.037
16/01/2014	0.0005	0.14	560	0.022	0.1	0.028		5.2	0.0001	5	1100	0.002	0.0005	1.2		0.000025	11	3	0.5	0.042	250	0.005	0.0005	8.5		0.001	42	670		3		2.5	0.025
6/02/2014	0.0005	0.22	560	0.018	0.09	0.027		5.4	0.0001	5	1100	0.002	0.0005	1.2		0.000025	10	3	0.5	0.041	240	0.005	0.0005	8.5		0.001	38	710		0.5		3.6	0.019
6/03/2014	0.0005	0.05	76	0.0005	2.1	0.023		96	0.0001	36	1600	0.002	0.0005	1.1		0.000025	30	43	0.5	0.0005	190	0.011	0.0005	7.3		0.001	810	1300		2		0.45	0.04
3/04/2014	0.0005	0.67	250	0.005	0.46	0.025		25	0.0001	16	830	0.002	0.002	0.9		0.000025	12	12	0.5	0.02	140	0.007	0.0005	8.1		0.001	140	570		0.5		18	0.022
1/05/2014	0.0005	0.41	520	0.007	0.19	0.019		11	0.0001	9	1100	0.0005	0.001	1.2		0.000025	10	6	0.5	0.034	230	0.007	0.0005	8.5		0.001	57	700		0.5		5.6	0.029
12/06/2014	0.0005	0.16	390	0.007	0.37	0.022		19	0.0001	14	1100	0.0005	0.001	1		0.000025	13	11	0.5	0.027	220	0.011	0.0005	8.7		0.001	180	690		0.5		3.3	0.043
10/07/2014	0.0005	0.15	420	0.013	0.52	0.023		25	0.0001	13	1300	0.0005	0.0005	1.1		0.000025	15	14	0.5	0.032	270	0.008	0.0005	8.6		0.001	190	840		1		3.4	0.031
14/08/2014	0.0005	0.21	480	0.011	0.33	0.024		18	0.0004	14	1100	0.0005	0.001	1.3		0.000025	13	9	0.5	0.04	240	0.006	0.0005	8.6		0.001	150	810		0.5		4.9	0.02
11/09/2014	0.0005	0.39	77	0.0005	1.9	0.025		110	0.0003	35	1600	0.002	0.0005	1.2		0.000025	29	48	0.5	0.0005	190	0.013	0.0005	7.4		0.001	760	1300		2		3.7	0.05
23/10/2014	0.0005	0.18	77	0.0005	2.2	0.022		120	0.0005	37	1800	0.001	0.0005	1.5		0.000025	32	52	0.5	0.0005	210	0.037	0.0005	7.6		0.001	870	1400		2		1.9	0.073
13/11/2014	0.0005	0.12	80	0.0005	2.3	0.024		130	0.0008	38	1800	0.0005	0.0005	1.4		0.000025	34	54	0.5	0.001	220	0.05	0.0005	7.2		0.001	930	1500		2		0.65	0.11
11/12/2014	0.0005	2.8	58	0.0005	1.6	0.038		87	0.0006	28	1300	0.002	0.004	1.1		0.000025	28	39	0.5	0.0005	160	0.039	0.003	7.3		0.001	610	1000		2		110	0.072
14/01/2015	0.0005	0.4	74	0.0005	1.9	0.033		110	0.0019	33	1600	0.0005	0.001	1.4		0.000025	30	47	0.5	0.0005	180	0.092	0.0005	7.4		0.001	720	1200		2		11	0.13
11/02/2015	0.0005	0.45	67	0.0005	2.3	0.032		150	0.0048	41	2000	0.0005	0.0005	1.7		0.000025	36	60	0.5	0.0005	220	0.19	0.0005	7.2		0.001	990	1600		2		1.6	0.24
11/03/2015	0.0005	1.6	67	0.001	1.7	0.059		140	0.0048	37	1900	0.0005	0.004	1.8		0.000025	32	55	0.5	0.001	200	0.18	0.001	7.1		0.001	910	1500		2		50	0.2

Sawyers Creek Ash Dam Seepage from V-notch (water collected and recycling back into dam) from April, 2013 to March, 2015																																	
Date	ag	Al	Alk	As	B	Ba	Be	Ca	Cd	Cl	Cond	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	pH	PO4	se	So4	TDS	TKN	TN	TSS	Turbidity (NTU)	Zn
Ave	<0.001	0.3	188	<0.001	1.64	0.027		79	0.0006	32	1509	0.0013	0.002	1.250	0.05	<0.00005	26	37	0.31	<0.01	217	0.028961538	<0.001	7.6		0.001	581	1099		1		9.9	0.05
Max	<0.001	2.8	560	<0.001	2.60	0.059		150	0.0048	53	2000	0.0030	0.011	1.800	0.22	<0.00005	38	60	0.50	<0.01	270	0.190	<0.001	8.7		0.002	990	1600		3		110.0	0.24
Min	<0.001	0.0	58	<0.001	0.09	0.019		5	0.0001	5	830	0.0005	0.001	0.200	0.01	0.00006	10	3	0.00	<0.01	140	0.005	0.001	6.8		0.001	38	570		0		0.3	0.02
50th Percentile	<0.001	0.2	85	<0.001	2.00	0.024		96	0.0001	38	1600	0.0010	0.002	1.250	0.03	<0.00005	29	45	0.50	<0.01	220	0.0095	<0.001	7.4		0.001	725	1200		2		3.2	0.03

Sawyer Creek @850m - upstream seepage from KVAD wall and Below v-notch Seepage Point. Detailed data from April, 2013 to March, 2015 is at Site 93

Date	ag	Al	Alk	As	B	Ba	Be	Ca	Cd	Cl	Cond	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	pH	PO4	se	So4	TDS	TKN	TN	TSS	Turbidity (NTU)	Zn
10/04/2013	0.0005	0.16	500		0.12	0.02		7.1	0.0001	5	1000	0.0005		1.40		0.000025	11.0	3.3		0.03	250	0.005	0.002	8.5		0.001	35	600				3	0.022
16/05/2013	0.0005	0.77	510	0.017	0.10	0.03		6.7	0.0001	6	1000	0.0005	0.001	1.30		0.000025	11.0	3.5		0.04	240	0.005	0.002	8.5		0.001	36	650				23	0.019
13/06/2013	0.0005	0.10	550	0.018	0.11	0.02		7.9	0.0001	6	1000	0.0005	0.0005	1.20		0.000025	10.0	4.0		0.04	240	0.005	0.001	8.6		0.001	42	650				3	0.024
10/07/2013	0.0005	0.07	550	0.015	0.13	0.02		7.1	0.0001	6	1000	0.0005	0.0005	1.10		0.000025	11.0	4.0		0.04	250	0.004	0.0005	8.5		0.001	41	640		0.0		3	0.017
22/08/2013	0.0005	0.19	570	0.013	0.11	0.02		6.4	0.0001	6	1100	0.001	0.0005	1.10		0.000025	11.0	4.0	0.5	0.03	250	0.003	0.0005	8.7		0.001	37	650		1.0		3	0.015
26/09/2013	0.0005	0.43	550	0.017	0.11	0.03		7.1	0.0001	6	1100	0.002	0.002	1.10		0.000025	11.0	4.0	0.5	0.04	260	0.004	0.001	8.6		0.001	47	790		0.0		8	0.023
24/10/2013	0.0005	0.14	580	0.022	0.12	0.02		6.1	0.0001	6	1200	0.002	0.0005	1.20		0.000025	11.0	4.0	0.5	0.04	280	0.004	0.0005	8.7		0.001	49	690		2.0		4	0.02
7/11/2013	0.0005	0.25	570	0.027	0.10	0.03		5.7	0.0001	5	1100	0.002	0.0005	1.20		0.000025	11.0	3.0	0.5	0.04	260	0.005	0.0005	8.6		0.001	46	640		0.0		11	0.025
5/12/2013	0.0005	0.22	520	0.025	0.12	0.03		6.4	0.0001	6	1100	0.003	0.0005	1.30		0.000025	10.0	4.0	0.5	0.04	260	0.007	0.001	8.7		0.001	54	700		3.0		24	0.032
16/01/2014	0.0005	0.17	570	0.026	0.08	0.03		4.6	0.0001	5	1100	0.002	0.0005	1.20		0.000025	11.0	3.0	0.5	0.04	250	0.006	0.0005	8.7		0.001	37	700		3.0		10	0.023
6/02/2014	0.0005	0.11	540	0.024	0.08	0.03		4.4	0.0001	5	1100	0.002	0.0005	1.10		0.000025	10.0	3.0	0.5	0.04	230	0.005	0.0005	8.7		0.001	40	700		3.0		3	0.019
6/03/2014	0.0005	0.24	530	0.028	0.11	0.03		5.7	0.0001	6	1100	0.002	0.0005	1.10		0.000025	11.0	4.0	0.5	0.04	230	0.005	0.001	8.7		0.001	53	700		3.0		10	0.021
3/04/2014	0.0005	0.25	530	0.020	0.09	0.03		5.6	0.0001	5	1100	0.001	0.0005	1.30		0.000025	13.0	3.0	0.5	0.03	280	0.005	0.0005	8.7		0.001	42	760		3.0		6	0.022
1/05/2014	0.0005	0.13	570	0.020	0.07	0.03		5.0	0.0001	5	1100	0.0005	0.0005	1.10		0.000025	11.0	3.0	0.5	0.04	250	0.004	0.0005	8.7		0.001	37	680		0.5		6	0.032
12/06/2014	0.0005	0.17	530	0.019	0.07	0.03		5.0	0.0001	5	1200	0.0005	0.0005	1.10		0.000025	11.0	3.0	0.5	0.04	260	0.004	0.0005	9.0		0.001	38	700		2.0		5	0.028
10/07/2014	0.0005	0.06	530	0.021	0.07	0.02		5.1	0.0001	5	1200	0.0005	0.0005	1.20		0.000025	11.0	3.0	0.5	0.04	260	0.003	0.0005	8.7		0.001	37	740		2.0		3	0.02
14/08/2014	0.0005	0.15	560	0.021	0.07	0.02		3.6	0.0001	5	1100	0.0005	0.0005	1.30		0.000025	7.0	1.0	0.5	0.03	260	0.003	0.001	8.8		0.001	29	700		2.0		7	0.028
11/09/2014	0.0005	0.24	540	0.024	0.12	0.03		7.2	0.0001	6	1100	0.001	0.0005	1.10		0.000025	11.0	4.0	0.5	0.04	250	0.004	0.0005	8.6		0.001	49	660		2.0		5	0.02
23/10/2014	0.0005	0.15	570	0.024	0.09	0.03		5.4	0.0001	5	1200	0.0005	0.0005	1.20		0.000025	11.0	3.0	0.5	0.05	260	0.004	0.0005	8.7		0.001	42	760		3.0		2	0.011
13/11/2014	0.0005	0.29	590	0.030	0.08	0.03		5.6	0.0001	5	1200	0.0005	0.001	1.10		0.000025	12.0	4.0	0.5	0.05	280	0.006	0.0005	8.7		0.001	39	760		0.5		22	0.032
11/12/2014	0.0005	0.37	560	0.024	0.09	0.03		6.6	0.0001	7	1100	0.0005	0.001	1.20		0.000025	13.0	4.0	0.5	0.06	270	0.005	0.0005	8.8		0.001	48	740		3.0		15	0.008
14/01/2015	0.0005	0.14	560	0.027	0.09	0.03		6.0	0.0001	6	1200	0.0005	0.0005	1.00		0.000025	12.0	4.0	0.5	0.05	280	0.003	0.0005	8.6		0.001	40	730		3.0		6	0.007
11/02/2015	0.0005	0.41	540	0.030	0.08	0.04		5.2	0.0001	6	1100	0.0005	0.001	1.10		0.000025	12.0	3.0	0.5	0.06	260	0.005	0.001	8.7		0.001	40	740		3.0		17	0.009
11/03/2015	0.0005	0.36	520	0.010	0.07	0.02		4.6	0.0001	6	1100	0.0005	0.002	1.10		0.000025	8.0	2.0	0.5	0.03	250	0.011	0.0005	8.7		0.001	32	700		2.0		9	0.012

Sawyer Creek @850m - upstream seepage from KVAD wall and Below v-notch Seepage Point. Detailed data from April, 2013 to March, 2015 is at Site 93

Date	ag	Al	Alk	As	B	Ba	Be	Ca	Cd	Cl	Cond	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	pH	PO4	se	So4	TDS	TKN	TN	TSS	Turbidity (NTU)	Zn
Ave	<0.001	0.23	548	0.022	0.10	0.03		5.8	0.0001	6	1108	0.001	0.001	1.17		0.000025	10.9	3.4	0.50	0.04	257	0.005	0.001	8.7		0.001	41	699		2.0		9	0.020
Max	<0.001	0.77	590	0.030	0.13	0.04		7.9	0.0001	7	1200	0.003	0.002	1.40		0.000025	13.0	4.0	0.50	0.06	280	0.011	0.002	9.0		0.001	54	790		3.0		24	0.032
Min	<0.001	0.06	500	0.010	0.07	0.02		3.6	0.0001	5	1000	0.0005	0.001	1.00		0.000025	7.0	1.0	0.50	0.03	230	0.003	0.001	8.5		0.001	29	600		0.0		2	0.007
50th Percentile	<0.001	0.18	550	0.022	0.09	0.03		5.7	0.0001	6	1100	0.0005	0.001	1.15		0.000025	11.0	3.4	0.50	0.04	260	0.005	0.001	8.7		0.001	40	700		2.0		6	0.021

Sawyers Creek at @1250 m near GWD5 (site 83) data from April, 2013 to March, 2015 is at Site 93

Date	ag	Al	Alk	As	B	Ba	Be	Ca	Cd	Cl	Cond	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni		Pb	pH	PO4	se	So4	TDS	TKN	TN	TSS	Turbidity (NTU)	Zn
10/04/2013	0.0005	0.14	510	0.014	0.1	0.021		5.3	0.0001	5	1000	0.0005	0.0005	1.5		0.000025	9.5	2.8		0.034	250	0.005		0.002	8.5		0.001	26	580				2	0.024
16/05/2013	0.0005	1.4	520	0.016	0.1	0.029		5.1	0.0001	5	1000	0.0005	0.0005	1.3		0.000025	11	2.8		0.036	250	0.005		0.002	8.4		0.001	27	670				22	0.016
13/06/2013	0.0005	0.15	550	0.018	0.1	0.02		6.4	0.0001	5	1000	0.0005	0.0005	1.2		0.000025	10	3		0.034	230	0.006		0.0005	8.6		0.001	31	660				3.4	0.029
10/07/2013	0.0005	0.13	570	0.014	0.11	0.022		5.5	0.0001	5	1000	0.0005	0.0005	1.2		0.000025	11	3		0.038	250	0.005		0.0005	8.5		0.001	30	580		0		2	0.024
22/08/2013	0.0005	0.24	580	0.014	0.09	0.024		5.2	0.0001	5	1100	0.002	0.0005	1.1		0.000025	11	3	0.5	0.031	250	0.005		0.0005	8.7		0.001	27	650		0		5.8	0.022
26/09/2013	0.0005	0.31	560	0.018	0.08	0.027		5.4	0.0001	5	1100	0.002	0.003	1.1		0.000025	11	3	0.5	0.035	250	0.006		0.001	8.7		0.001	33	790		0		8.4	0.024
24/10/2013	0.0005	0.14	590	0.021	0.1	0.022		4.5	0.0001	5	1200	0.002	0.0005	1.3		0.000025	11	3	0.5	0.036	280	0.005		0.0005	8.7		0.001	40	760		2		2.6	0.028
7/11/2013	0.0005	0.13	580	0.025	0.09	0.027		4.4	0.0001	5	1100	0.002	0.0005	1.2		0.000025	11	3	0.5	0.039	270	0.005		0.0005	8.6		0.001	35	660		3		4.1	0.025
5/12/2013	0.0005	0.16	540	0.024	0.1	0.024		4.9	0.0001	5	1100	0.002	0.0005	1.3		0.000025	10	3	0.5	0.039	260	0.005		0.0005	8.7		0.001	39	660		3		1.7	0.027
16/01/2014	0.0005	0.19	560	0.025	0.08	0.03		4.5	0.0001	5	1100	0.002	0.0005	1.2		0.000025	11	3	0.5	0.042	250	0.006		0.0005	8.7		0.001	37	660		4		3.7	0.022
6/02/2014	0.0005	0.14	530	0.026	0.08	0.025		4.5	0.0001	5	1100	0.002	0.0005	1.1		0.000025	10	3	0.5	0.03	240	0.006		0.0005	8.7		0.001	40	650		3		2	0.026
6/03/2014	0.0005	0.22	540	0.026	0.09	0.03		4.6	0.0001	5	1100	0.002	0.0005	1.1		0.000025	12	3	0.5	0.042	240	0.006		0.0005	8.7		0.001	39	720		3		6.9	0.021
3/04/2014	0.0005	0.28	540	0.023	0.09	0.03		5.3	0.0001	6	1100	0.017	0.001	1		0.000025	13	3	0.5	0.04	280	0.006		0.0005	8.6		0.001	41	760		0.5		5.9	0.022
1/05/2014	0.0005	0.12	570	0.021	0.08	0.025		4.8	0.0001	5	1100	0.0005	0.0005	1		0.000025	10	3	0.5	0.039	240	0.007		0.0005	8.7		0.001	37	710		0.5		5.4	0.03
12/06/2014	0.0005	0.24	570	0.02	0.08	0.027		5	0.0001	5	1100	0.0005	0.0005	1.2		0.000025	11	3	0.5	0.043	270	0.016		0.001	8.7		0.001	38	680		2		7.8	0.041
10/07/2014	0.0005	0.18	530	0.022	0.09	0.024		5.4	0.0001	6	1200	0.001	0.001	1.3		0.000025	11	3	0.5	0.04	280	0.005		0.001	8.7		0.001	40	730		2		4	0.032
14/08/2014	0.0005	0.13	570	0.021	0.08	0.019		3.6	0.0001	5	1100	0.0005	0.0005	1.4		0.000025	7	1	0.5	0.037	260	0.004		0.0005	8.8		0.001	31	700		2		7.2	0.02
11/09/2014	0.0005	0.22	560	0.029	0.09	0.029		4.9	0.0001	5	1100	0.0005	0.0005	1.2		0.000025	11	3	0.5	0.036	250	0.005		0.0005	8.7		0.001	34	660		2		6	0.01
23/10/2014	0.0005	0.18	580	0.025	0.09	0.026		4.9	0.0001	5	1200	0.0005	0.0005	1.3		0.000025	11	3	0.5	0.051	270	0.005		0.0005	8.7		0.001	37	710		3		2.8	0.028
13/11/2014	0.0005	0.1	590	0.027	0.08	0.027		5	0.0001	5	1100	0.0005	0.001	1.1		0.000025	12	3	0.5	0.053	290	0.006		0.0005	8.7		0.001	36	740		0.5		2.1	0.032
11/12/2014	0.0005	0.18	580	0.025	0.08	0.029		4.8	0.0001	6	1200	0.0005	0.0005	1.2		0.000025	12	3	0.5	0.05	270	0.004		0.0005	8.7		0.001	40	740		3		6.2	0.014
14/01/2015	0.0005	0.15	560	0.029	0.08	0.03		5	0.0001	5	1100	0.0005	0.0005	1		0.000025	12	3	0.5	0.047	270	0.003		0.0005	8.7		0.001	36	740		0.5		6.3	0.005
11/02/2015	0.0005	0.32	540	0.03	0.08	0.032		4.5	0.0001	6	1200	0.0005	0.0005	1.2		0.000025	12	3	0.5	0.06	250	0.005		0.0005	8.5		0.001	38	740		3		16	0.008
11/03/2015	0.0005	0.45	520	0.012	0.08	0.02		4.4	0.0001	6	1100	0.0005	0.001	1.1		0.000025	8	2	0.5	0.028	270	0.005		0.0005	8.7		0.001	31	700		2		10	0.016

Sawyers Creek at @1250 m near GWD5 (site 83) data from April, 2013 to March, 2015 is at Site 93

Date	ag	Al	Alk	As	B	Ba	Be	Ca	Cd	Cl	Cond	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni		Pb	pH	PO4	se	So4	TDS	TKN	TN	TSS	Turbidity (NTU)	Zn
Ave	<0.001	0.25	556	0.022	0.09	0.026		5	0.0001	5	1104	0.0017	0.001	1.192		0.000025	11	3	0.50	0.04	259	0.006		0.001	8.7		0.001	35	694		1.9		6.0	0.02
Max	<0.001	1.40	590	0.030	0.11	0.032		6	0.0001	6	1200	0.0170	0.003	1.500		0.000025	13	3	0.50	0.06	290	0.016		0.002	8.8		0.001	41	790		4.0		22.0	0.04
Min	<0.001	0.10	510	0.012	0.08	0.019		4	0.0001	5	1000	0.0005	0.001	1.000		0.000025	7	1	0.50	0.03	230	0.003		0.001	8.4		0.001	26	580		0.0		1.7	0.01
50th Percentile	<0.001	0.18	560	0.023	0.09	0.027		5	0.0001	5	1100	0.0005	0.001	1.200		0.000025	11	3	0.50	0.04	255	0.005		0.001	8.7		0.001	37	700		2.0		5.6	0.02

Seepage Water Northern wall collection pit near GW6

Seepage water Northern wall collection pit near GW6 Groundwater from the KVAD on the northside drains from April, 2013 to March, 2015. All water reports to the pipe out to the Lisdale Cut.

Date	ag	Al	Alk	As	B	Ba	Be	Ca	Cd	Cl	Cond	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni		Pb	pH	PO4	se	So4	TDS	TKN	TN	TSS	Turbidity (NTU)
10-Apr-13	0.0005	1.1	12.5	0.001	3.5	0.014		98	0.0001	11	2400	0.0005	0.033	0.6		0.000025	85	61		0.005	160	0.14		0.003	2.9		0.001	1280	1700			2.3	0.14
17-May-13	0.0005	1.2	12.5	0.001	3	0.013		140	0.0001	17	2400	0.0005	0.0005	0.5		0.000025	89	68		0.005	160	0.14		0.001	3		0.001	1300	1900			4.8	0.1
13-Jun-13	0.0005	1.4	12.5	0.001	3	0.002		130	0.0001	17	2300	0.0005	0.0005	0.05		0.000025	74	65		0.0005	140	0.14		0.001	3		0.001	1100	1100			11	0.15
10-Jul-13	0.0005	1.3	12.5	0.0005	3.7	0.009		150	0.0001	18	2400	0.0005	0.0005	0.05		0.000025	84	74		0.0005	170	0.15		0.0005	3		0.001	1400	1700		0	45	0.14
22-Aug-13	0.0005	1	12.5	0.0005	4	0.006		170	0.0001	18	2600	0.002	0.0005	0.05		0.000025	93	81	0.5	0.0005	190	0.14		0.0005	2.9		0.001	1400	2000		0	4.9	0.13
26-Sep-13	0.0005	1.4	12.5	0.001	4.1	0.005		160	0.0001	19	2700	0.002	0.001	0.4		0.000025	91	77	0.5	0.001	190	0.16		0.001	2.9		0.001	1500	2300		0	7.3	0.16
24-Oct-13	0.0005	1.6	12.5	0.002	5	0.006		200	0.0001	20	3100	0.002	0.0005	0.5		0.000025	110	88	0.5	0.002	220	0.18		0.001	2.9		0.001	2000	2300		0.5	3.3	0.2
7-Nov-13	0.0005	1.7	12.5	0.002	4.7	0.005		200	0.0001	20	3100	0.002	0.001	0.4		0.000025	110	88	0.5	0.002	230	0.2		0.001	2.9		0.001	2300	2500		0	3.3	0.21
5-Dec-13	0.0005	2.4	12.5	0.002	5	0.003		200	0.0001	21	3200	0.003	0.002	0.6		0.000025	110	93	0.5	0.004	220	0.2		0.001	2.9		0.001	1800	2400		0.5	5.9	0.21
16-Jan-14	0.0005	1.7	12.5	0.003	5.5	0.004		210	0.0001	21	3400	0.003	0.001	0.6		0.000025	120	92	0.5	0.002	230	0.26		0.0005	2.9		0.001	2000	3000		0.5	21	0.19
6-Feb-14	0.0005	1.2	12.5	0.002	5.3	0.003		210	0.0001	21	3300	0.002	0.0005	0.4		0.000025	130	90	0.5	0.002	250	0.25		0.0005	2.8		0.001	1900	2600		0.5	2.7	0.15
6-Mar-14	0.0005	2.3	12.5	0.002	4.7	0.002		180	0.0001	19	3100	0.002	0.002	0.5		0.000025	97	73	0.5	0.0005	180	0.22		0.0005	2.8		0.001	1600	2400		0.5	1.4	0.15
3-Apr-14	0.0005	2.1	12.5	0.001	4.7	0.002		180	0.0001	20	2900	0.002	0.004	0.3		0.000025	110	79	0.5	0.0005	190	0.23		0.0005	2.9		0.001	1600	2200		0.5	1.1	0.15
1-May-14	0.0005	1.4	12.5	0.001	5.3	0.002		210	0.0001	20	3100	0.0005	0.001	0.5		0.000025	110	92	0.5	0.0005	200	0.27		0.0005	2.9		0.001	1700	2600		2	4.6	0.15
12-Jun-14	0.0005	1.6	12.5	0.0005	4.9	0.001		220	0.0001	19	3300	0.001	0.0005	0.5		0.000025	110	92	0.5	0.0005	220	0.28		0.0005	2.9		0.001	1800	2600		0.5	7.3	0.15
10-Jul-14	0.0005	1.7	12.5	0.001	5.9	0.001		240	0.0001	19	3300	0.001	0.0005	0.5		0.000025	120	97	0.5	0.0005	230	0.33		0.0005	2.9		0.001	2000	2700		0.5	40	0.16
14-Aug-14	0.0005	1.4	12.5	0.001	5.5	0.001		230	0.0001	21	3200	0.001	0.0005	0.4		0.000025	110	98	0.5	0.0005	220	0.37		0.0005	3.1		0.001	2100	2900		2	19	0.19
11-Sep-14	0.0005	2	12.5	0.001	5.1	0.002		200	0.0001	16	3000	0.001	0.0005	0.4		0.000025	96	84	0.5	0.0005	200	0.34		0.0005	2.9		0.001	1600	2300		0.5	25	0.19
23-Oct-14	0.0005	2	12.5	0.001	6.4	0.001		250	0.0001	18	3500	0.001	0.001	0.6		0.000025	120	99	0.5	0.0005	240	0.46		0.0005	2.9		0.001	2000	2800		0.5	1.1	0.24
13-Nov-14	0.0005	1.8	12.5	0.002	7.1	0.001		280	0.0001	21	3700	0.0005	0.0005	0.4		0.000025	140	110	0.5	0.0005	280	0.53		0.0005	2.9		0.001	2300	3300		0.5	0.8	0.32
11-Dec-14	0.0005	2.7	12.5	0.002	5	0.002		210	0.0001	17	3000	0.0005	0.002	0.5		0.000025	110	82	2.5	0.0005	200	0.45		0.0005	2.9		0.001	1700	2400		14	3.6	0.28
14-Jan-15	0.0005	2.4	12.5	0.001	5.5	0.001		210	0.0001	16	3100	0.0005	0.001	0.6		0.000025	110	81	0.5	0.0005	210	0.41		0.0005	2.9		0.001	1700	2400		0.5	1.4	0.26
11-Feb-15	0.0005	1.9	12.5	0.002	7.1	0.001		270	0.0001	19	3700	0.0005	0.001	0.4		0.000025	140	100	0.5	0.0005	250	0.64		0.0005	2.9		0.001	2000	3000		0.5	0.55	0.4
11-Mar-15	0.0005	2.8	12.5	0.002	6.1	0.005		280	0.0001	20	3800	0.001	0.004	0.6		0.000025	150	110	0.5	0.0005	260	0.68		0.002	2.9		0.002	2200	3100		0.5	6.7	0.5

Seepage water Northern wall collection pit near GW6 Groundwater from the KVAD on the north side drains from April, 2013 to March, 2015. All water reports to the asbestos pipe out to the Lidsdale Cut (site 86)

Date	ag	Al	Alk	As	B	Ba	Be	Ca	Cd	Cl	Cond	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	pH	PO4	se	So4	TDS	TKN	TN	TSS	Turbidity (NTU)
Ave	0.0005	1.75	13	0.001	5.0	0.004		201	0.0001	19	3067	0.0013	0.002	0.43		0.00	109.1	86.4	0.60	0.00	210	0.299	0.001	2.9		0.001	1762	2425		1.2	9.3	0.21
Max	0.0005	2.80	13	0.003	7.1	0.014		280	0.0001	21	3800	0.003	0.033	0.60		0.00	150.0	110.0	2.50	0.01	280	0.680	0.003	3.1		0.002	2300	3300		14.0	45.0	0.50
Min	0.0005	1.00	13	0.001	3.0	0.001		98	0.0001	11	2300	0.0005	0.001	0.05		0.00	74.0	61.0	0.50	0.00	140	0.140	0.001	2.8		0.001	1100	1100		0.0	0.6	0.10
50th Percentile	0.0005	1.70	13	0.001	5.0	0.002		205	0.0001	19	3100	0.001	0.001	0.50		0.00	110.0	88.0	0.50	0.00	215	0.255	0.001	2.9		0.001	1750	2400		0.5	4.7	0.18

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