# Project: Kerosene Vale Ash Dam and Dry Ash Repository

KVAR Stage 2 Water Quality Assessment
February, 2012 to March, 2013

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# Summary


Aurecon was engaged by EnergyAustralia NSW to assess:

- The changes, if any, in surface and groundwater quality due to the seepage collection and diversion systems at:
    - the Sawyers Swamp Creek Ash Dam (SSCAD) v-notch pump-back system
    - sub-surface drains in the Kerosene Vale Ash Dam (KVAD) under the dry ash Kerosene Vale Ash Repository (KVAR)
    - diversion of the KVAD groundwater to Lidsdale Cut via the unblocked KVAD toe drains
    - diversion of the Lidsdale Cut discharge from Sawyers Swamp Creek (SSC) to the Sawyers Swamp Creek Ash Dam (SSCAD)
- The effects of the Stage 1 and Stage 2A dry ash placements on surface and groundwater receiving waters with the effects of the local coal mining and the Springvale Mine water discharge taken into account.

The assessment of surface and groundwater quality found that the seepage collection and diversion systems have reduced the salinity (conductivity), sulphate and trace metals in the local groundwater bores at the KVAD/R such that, other than the local mineral effects, the water quality and trace metals met the local/ANZECC (2000) guidelines. The resulting conditions in Lidsdale Cut were greatly improved so that all the elements met the local/ANZECC (2000) guidelines. These reductions provided evidence that the Stage 1 and Stage 2 dry ash placements are not measurably affecting the groundwater quality.

This, together with the local KVAD/R seepage and more detailed measurements in Sawyers Swamp Creek, indicated no significant effects on the creek receiving waters. In addition, although the seepage from the SSCAD was found to influence the salinity (conductivity) in Sawyers Swamp Creek, the creek salinity was decreasing and there was no significant effect on the trace metals.

In contrast with the improved water quality and trace metals in the groundwater and Lidsdale Cut, the water quality at the Sawyers Swamp Creek receiving water site was elevated in trace metals. This appeared to be associated with mine spoil groundwater seepage into the creek after a heavy rainfall event.

Since mid- to late 2012, the Springvale Mine water inflows have altered the water quality and trace metal concentrations in Sawyers Swamp Creek, thereby compromising future assessments of the SSCAD and KVAD/R effects on the creek. It is recommended that the SSCAD and KVAD/R seepages, Sawyers Swamp Creek and the mine water continue to be monitored so that the effects of the mine water and local background conditions are not assigned by others to the ash placement activities.

# 1. Introduction

Wet slurry ash placement from Wallerawang Power Station was originally deposited in the Kerosene Vale Ash Dam (KVAD). When the KVAD was full of ash, wet ash placement was directed to the Sawyers Swamp Creek Ash Dam (SSCAD) and ultimately the KVAD was capped with clay. Ash placement in the SSCAD was ultimately ceased[1] and dry ash was placed on top of the clay capping of the KVAD.

In 2002, Delta Electricity (now EnergyAustralia NSW) obtained approval for conversion of the wet slurry ash 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 is ongoing.

During the Stage 2 dry ash placement, EnergyAustralia NSW installed seepage collection and diversion systems underneath the KVAR and reinstated the KVAD toe drains to minimise effects on the local groundwater and Sawyers Swamp Creek. These works are described in the next Section.

Aurecon has been engaged by EnergyAustralia NSW to assess the combined effects of the Stage 1 and Stage 2 dry ash placements on surface and groundwater quality in receiving waters, including the current reporting period from February, 2012 to March, 2013. The study is to take into account the potential benefits of the seepage collection and diversion works described in the next Section, as well as any influences of Springvale Mine water inflows and other, non-ash related, catchment inputs to SSC, as well as the local background conditions.

## 1.1 Background

With placement of dry ash on top of the KVAD, seepage from the KVAD to Sawyers Swamp Creek (SSC) increased. As a result, it became necessary to install a new sub-surface drain in the area under the KVAR placement to collect and divert seepage to Lidsdale Cut by connection to the existing KVAD toe drains that feed onto Lidsdale Cut. Installation was completed in October, 2010. The works undertaken involved unblocking of the KVAD toe drains, which had been identified in a previous report as affecting the local groundwater quality.

The seepage collection and diversion system was designed to lower the groundwater table in the KVAD to at least 1 metre below the clay capping, which forms the base of the KVAR's dry ash placement. The groundwater level decrease was to minimise seepage from the KVAD to Sawyers Swamp Creek. A schematic of the seepage diversion system is shown in Figure 1.

The subsurface drains are underneath the eastern section of the stage 2 area of the KVAR. Subsurface drains were not required in the north-western section of Stage 2 because seepage from the KVAD drains to the toe drains at the base of the dam wall. The toe drains on the western side of Stage 2 extend along the area near the internal bores GW10 and GW11. On the north side, the

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

seepage flows into the toe drains that extend along the areas sampled by the piezometers AP09 and AP17 shown in Figure 1.

Subsequent to these works, the discharge from Lidsdale Cut to Sawyers Swamp Creek stopped in April, 2012 and has been diverted to the power station ash dam return canal since July, 2012 to prevent the water level increasing in the void and seeping into the local mine spoil and creeks. The water from the canal is directed to the SSCAD for retention and evaporation while some is used for dust suppression on the dry ash placement, as shown in Figure 1. The Lidsdale Cut water level has been controlled since these works were undertaken.

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.

During 2012, the Springvale Mine water pipeline (that delivers mine water for use in the Wallerawang Power Station cooling towers) was leaking into Sawyers Swamp Creek. EnergyAustralia NSW advised Aurecon that, subsequently, the emergency 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.

The new mine water discharge site is located at the Sawyers Swamp Creek Ash Dam Spillway and has been continually discharged (other than due to pump or pipeline issues) to Sawyers Swamp Creek. This discharge enters just downstream of the spillway, and flows into the Coxs River above Lake Wallace, which provides cooling water for Wallerawang Power Station.

Since October, 2012, EnergyAustralia NSW greatly reduced the amount of mine water coming to the power station via the pipeline and since 1 July 2013 they have received virtually no mine water through the pipeline.


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**Source:** Aurecon, EnergyAustralia

**Projection:** GDA 1994 MGA Zone 56

EnergyAustralia **Wallerawang Power Station**

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

## 1.2 Aims and Objectives

EnergyAustralia NSW has advised Aurecon that they have completed their annual review of the Development Consent conditions of approval for KVAR Stage 2 and require an understanding of any changes in the water quality in Sawyers Swamp Creek following the implementation of the KVAR and SSCAD seepage collection and diversion works and diversion of the Lidsdale Cut discharge to the SSCAD, and confirmation that the KVAR is not interfering with local surface and groundwater quality.

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

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

## 1.3 Previous Report

The previous report (Aurecon, 2012) found that the initial 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 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
- benefits of unblocking KVAD toe drains
- attenuation of selenium in ash leachate due to uptake by local soils or mine spoil
- effects of Springvale Mine water leaking from the pipeline into Sawyers Swamp Creek
- the highly mineralised nature of the catchment.

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

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

A detailed investigation of the pathway that ash leachates from the KVAR, KVAD and the SSCAD may take in reaching the local groundwater and Sawyers Swamp Creek was undertaken in a previous investigation (Aurecon, 2010). Assessment of the surface and groundwater quality data since then showed that the pathways essentially explained the observations and revealed some improvements in knowledge of how the system operates, particularly the role of Lidsdale Cut in acting as a sink for the local groundwater flows. These understandings have been incorporated into the present report.

As noted in previous reports, 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 receiving waters was continued to be used in this report.

## 1.4 Scope

Aurecon has been engaged by EnergyAustralia NSW to review all ground and surface water monitoring data at the KVAR, KVAD and in Sawyers Swamp Creek to identify effects, including potential benefits, of the seepage collection and return systems or otherwise on water quality in Sawyers Swamp Creek and the upper Coxs River as a result of the various seepage collection and diversion works describe above. EnergyAustralia NSW has requested Aurecon to undertake a follow-up study from that of the 2012 report now that the KVAD/R seepage collection and diversion works have been finalised.

As in the previous report, the water quality at the Sawyers Swamp Creek receiving water site, WX7 (Figure 2), which is just upstream of the junction with the upper Coxs River, has been assessed in this report.

## 1.5 Information provided by EnergyAustralia NSW

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

- Relevant Lend Lease Infrastructure (LLI) KVAR management reports
- Water quality data in the dry ash runoff collection ponds and a schematic of its diversion to the SSCAD via the return canal (Figure 1)
- Plan of the KVAD final seepage diversion works
- Location of any new water quality sampling sites in the upper Coxs River
- Surface and groundwater quality data from 2010 to the present, including:
    - Sawyers Swamp Creek receiving water site, WX7
    - Water quality in the SSCAD and KVAD seepage detection bores
    - Lidsdale Cut water quality
    - Background surface and groundwater data
- Springvale mine water quality data
- SSCAD seepage flows via the v-notch weir to the collection and pump-back system
- Any additional water quality sampling by NALCO relevant to the study
- Copy of recent, relevant correspondence with EPA on the water quality expectations in Sawyers Swamp Creek.

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.

## 1.6 Data Quality

The data contained in this report was provided by EnergyAustralia NSW and LLI. Examination of the data provided for the SSCAD showed that a data transfer error had occurred in the previous report. Accordingly, the data in Attachment 2 includes the previously provided data for the SSCAD from April, 2010 to January, 2012, as well as the current data from February, 2012 to March, 2013.

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 the 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.


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**Projection:** GDA 1994 MGA Zone 56

EnergyAustralia **Wallerawang Power Station**

**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 and surface water quality monitoring at the KVAD and KVAR used for assessment of effects, if any, of leachates on the local surface and groundwater quality. Due to the local inputs from coal mining activities in the area, 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.

## 2.1 Monitoring Design for Differentiation of Water Quality Sources

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.

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 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 KVAD/R, as well as for the SSCAD.

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

### 2.1.1 Groundwater Monitoring

The up-gradient bores (WGM4/D1 and D2) allow for the effects of various local sources of groundwater flowing into the KVAD/R and SSCAD areas. The down-gradient bores (WGM4/D3 and D4) are located for detection of the SSCAD seepage and bores WGM4/D5 and D6 are the seepage detection bores for the KVAD/R. These down-gradient bores also sample the combined effects of the local 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).

In addition, 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.

### 2.1.2 Surface Water Monitoring

The surface water monitoring sites comprise:

- Lidsdale Cut (WX5), which discharged to Sawyers Swamp Creek until April, 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 WX7 is the receiving waters where the local/ANZECC (2000) freshwater guideline trigger values apply for assessment of seepage effects from KVAD, KVAR, Lidsdale Cut and SSCAD.

Site WX5, samples local coal mine groundwater seepage, 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 been unable to monitor the water quality in the Lidsdale Cut void since July, 2012 due to drawdown of the void water level by the pumps that direct the water to the SSCAD.

### 2.1.3 Sampling in Upper Sawyers Swamp Creek

As recommended in the previous report, monitoring at selected sites in the creek (Figure 2) has been undertaken by EnergyAustralia NSW and the ash dam 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.

To put the creek sampling sites into context of the location of the SSCAD v-notch, it should be noted that site SSC@600m is about 165 m upstream, and there are two sites downstream at Site 93 (165 m downstream) and at Site SSC@800m (about 300m downstream), see Figure 2. The water quality data for the two downstream sites was combined to assess the effects, if any, of the SSCAD seepage on the creek. Conductivity was the only characteristic consistently monitored and it was used to indicate changes in water quality due to the pump-back system. A change in alkalinity at Site 93 was used as a tracer for effects of the mine water discharge.

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.

The EnergyAustralia NSW monitoring is more detailed than that of LLI, including conductivity, alkalinity and trace metals. Sampling began in June, 2012. The ash dam contractor has continued to monitor at their four sites shown in Figure 2, but only limited water quality data, such as pH, conductivity and sulphate, is collected.

The following sites are sampled in Sawyers Swamp Creek and used in this report. This includes sites sampled by EnergyAustralia NSW and LLI:

- Site 92, in Sawyers Swamp Creek, upstream of the SSCAD
- SSC upstream @ 0m, located immediately downstream of the Sawyers Swamp Creek Ash Dam Spillway, where the Sawyers Swamp Creek bypass water re-enters the creek. Since August, 2012 it also includes the Springvale Mine water discharge that enters the creek at the same location. It is labelled as SSC at SSCAD Spillway in the water quality graphs in Section 3.

- SSC@600m upstream of the SSCAD V-notch (not sampled by EnergyAustralia NSW)
- Site 79, the main SSCAD seepage point v-notch.
- SSC@800m downstream of the V-notch and upstream of the KVAR north wall seepage pond,the EnergyAustralia NSW site 93 is located downstream of the V-notch.
- SSC@1250m downstream of the KVAD seepage pond.

The following notes and assumptions apply to these monitoring sites:

- The v-notch upstream site, SSC@600m, is about 165 m upstream
- Monitoring at the v-notch, site 79, began in February, 2010 to define the concentrations of water quality and trace metals seeping from the SSCAD to Sawyers Swamp Creek. It is assumed that concentrations in the v-notch are representative of the concentrations in all the seepage from under the dam wall into the creek as shown in Section 4, Figure 6. It is also likely that the seepage under the dam wall is at a slower rate than that in the v-notch
- The two sites downstream of the v-notch are Site 93 (165 m downstream of the v-notch) and at Site SSC@800m (about 300m downstream of the v-notch), see Figure 2. These sites are also used as the upstream sites for the KVAD north wall seepage pond. SSC@800m is about 100m upstream of the seepage pond
- The water quality and trace metal concentrations in the KVAD north wall seepage pond are assumed to be representative of all the seepage from under the KVAR placement into Sawyers Swamp Creek that was not possible to collect by the KVAD toe drains
- KVAD/R downstream site, SSC @1250m, is downstream of the northern section of the original KVAD dam wall.

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.

#### 2.1.4 Other data considerations

In addition to the many changes in seepage collections and diversions, the Springvale Mine water discharge has further complicated the assessment of effects of the KVAR. Accordingly, this report has taken into account the effects of these changes on the water quality in Sawyers Swamp Creek, as well as the local groundwater. In addition, a series of high rainfall events occurred during summer, or late summer, in 2010/11, 2011/12 and 2012/13 and the effects of these events on the local water quality have been taken into account.

The potential for water quality changes due to the seepage collection and diversion systems are assessed in Section 3 using changes in conductivity at the various sampling sites in the upper Sawyers Swamp Creek and at the WX7 receiving water site. These changes then allowed assessment of the cause of changes in trace metal concentrations. Effects of the KVAR Stage 2 placement on surface water quality and trace metal changes are assessed against the environmental goals, and according to the ANZECC guidelines, and discussed in Section 5.

### 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 and water quality (bores GW6, 10 and 11 and AP9 and AP17, shown in Figure 2). This data, together with the water quality monitoring in Sawyers Swamp Creek from the SSCAD spillway to near the north-west side of the KVAR, was used for assessment of the potential improvements in water quality due to the seepage collection and diversion works.

## 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 is not used as a tracer for the dry ash placement.

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

Long-term trends in surface and groundwater quality generally use conductivity to trace salinity effects, which in the mineralised area, tends to follow that of sulphate. Sulphate and boron trends are used to show changes due to coal mining activities and 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 confirm that the groundwater level in the KVAD is not reaching the dry ash placement above it.

Bores WWGM1/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, 2013 increased from that during the previous reporting period to 797 mm/year (Attachment 1), which is 92% of the long-term average annual rainfall of 863 mm/year. During the period February, 2012 to March, 2013, the monthly average rainfall of 79 mm/month, was above the long-term average of 72 mm/month due to above average rainfall events in February/March, 2012 and 2013.

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) and a similarly high rainfall event in February/March, 2013 with a total of 297 mm (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 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).

## 2.7 Guidelines

As used in previous reports, the principle of the ANZECC (1995) guidelines for protection of groundwater, where the potential future use of the water resource is considered, 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 KVAD/R 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 used in previous reports, as the 90$^{th}$ percentile of the pre-placement concentrations, or the ANZECC guideline default trigger values, whichever is higher. Use of the background 90$^{th}$ 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 90$^{th}$ percentile for naturally mineralised, highly disturbed groundwater. Hence, the background 90$^{th}$ 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).

**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 mentioned in previous reports, 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. As mentioned in previous reports, 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), previous reports identified the following receiving water sites for assessment of ash leachate effects from the KVAR dry ash placement:

- Groundwater bore WGM1/D5

- Lidsdale Cut (sampling site WX5)
- Sawyers Swamp Creek at site WX7.

The following provides clarification of how the receiving water sites are used to assess effects fo the SSCAD and KVAR.

With the various collection systems in place, the Sawyers Swamp Creek site is the final receiving water site for the residual SSCAD, KVAD and KVAR seepages, and the now Lidsdale Cut seepage. Site WX7 also receives inflows from the local background catchment of Dump Creek and groundwater inflows to the creek from areas where it flows through the coal measures upstream of the KVAD/R.

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 water quality in Lidsdale Cut, in addition to that at bore D5, has continued to be used for early warning of potential effects of groundwater in the water quality at WX7. Hence, WX7 is the final receiving water site for the ash placement areas. This approach was used in previous reports and has been used here for the current assessment.

As EnergyAustralia NSW has begun routinely monitoring of the water quality in the upper Sawyers Swamp Creek where it flows through the coal measures upstream of the KVAD/R, 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 50$^{th}$ percentile (median) in receiving waters with the 90$^{th}$ 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 50$^{th}$ percentile exceeds the pre-placement 90$^{th}$ 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 90$^{th}$ percentile pre-KVAR conditions.

These procedures are applied to each down-gradient groundwater bore, the Lidsdale Cut and Sawyers Swamp Creek at WX7 to assess long-term changes that are approaching the local/ANZECC trigger values.

## 2.8 Control Charts

Long-term plots are used to allow the identification of trends against the baseline and environmental goals. The trends are tracked using Control Charts (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. As the ANZECC guidelines apply to the receiving waters of Sawyers Swamp Creek, Lidsdale Cut and the KVAD and Stages I and II seepage detection bore D5, the trends over time are graphed against these environmental goals.

Investigations are indicated when the control chart shows that the post-placement median has exceeded the pre-placement 90$^{th}$ percentile. The medians are updated with data for each reporting period. If the investigation of the increase shows that it is likely to be due to the ash placement, early intervention may be warranted to minimise the potential for further increases. If the trend for increase continues, and approaches the local environmental goals, further management action would be indicated.

To keep the number of charts manageable, only those parameters of relevance to the Stage 2 dry ash placement, such as conductivity, sulphate, boron and selenium, or those showing significant unexplained increases above the levels expected from the Stage 2 Environmental Assessment (PB, 2008) are graphed.

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

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

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

This Section presents assessment further to that in the previous report on the likely effects of the KVAR Stage 2 seepage, the KVAD/R subsurface drains and SSCAD seepage collection and return systems on receiving water quality and trace metals in Sawyers Swamp Creek. As the subsurface drains and the KVAD toe drains send the collected seepage to Lidsdale Cut, the effects of the Lidsdale Cut v-notch discharge on the creek, prior to its cessation in April-June, 2012, are also examined.

As the Springvale Mine water discharge has altered the water quality in Sawyers Swamp Creek, its characteristics are discussed first.

## 3.1 Springvale Mine Water Quality

As noted above, the Springvale Mine water pipeline has been licenced to discharge to the creek since August, 2012 but has been leaking into the creek since July, 2011 (Aurecon, 2012), so the effects of mine water discharge has been examined first. The mine discharge rate, at 20 ML/day, is expected to be greater than the sum of the ash related seepage rates, particularly as much of the ash related seepage has been collected and diverted from entering the creek since 2010.

EnergyAustralia NSW has provided a copy of the typical Springvale Mine water quality, which is shown in Table 2. More accurate trace metal data is shown in Table 3.

The mine water is characterised by relatively low dissolved salts, including sulphate and chloride, but the conductivity is relatively high at 745 to 1098 uS/cm due to a high concentration of bicarbonate alkalinity. This is possibly derived from the limestone dust which is applied to the floor and walls of the mine as an explosion inhibitor. The discharge is also characterised by relatively low concentrations of trace metals, including selenium. As the alkalinity is higher than the various ash placement seepage waters, alkalinity has been used as a tracer for the mine water discharge to Sawyers Swamp Creek.

**Table 2: Typical Springvale Coal Mine Water Quality**

| Parameter | Mine Water | | | |
|---|---|---|---|---|
| (mg/L) | Range | | | Average |
| pH | 7.2 | to | 7.7 | 7.5 |
| EC (uS/cm) | 704 | to | 786 | 745 |
| TSS | 0 | to | 8 | 3 |
| TDS | 413 | to | 502 | 458 |
| Turbidity (NTU) | - | to | - | - |
| Calcium | 22 | to | 32 | 27 |
| Magnesium | 10 | to | 16 | 13 |
| Potassium | 31 | to | 40 | 36 |
| Sodium | 88 | to | 119 | 104 |
| Alkalinity (HCO3) | 323 | to | 359 | 341 |
| Sulphate | 26 | to | 45 | 35 |
| Chloride | 4 | to | 13 | 8 |
| | | | | |
| Ammonia | 0.0 | to | 1.2 | 0.4 |
| Nitrate + Nitrite | 0.0 | to | 2.8 | 1.3 |
| | | | | |
| Arsenic | 0.00 | to | 0.02 | 0.01 |
| Barium | 0.0 | to | 0.3 | 0.2 |
| Boron | 0.0 | to | 0.2 | 0.1 |
| Cadmium | 0.00 | to | 0.00 | 0.00 |
| Chromium (VI) | 0.00 | to | 0.01 | 0.00 |
| Copper | 0.0 | to | 0.1 | 0.0 |
| Fluoride | 0.0 | to | 0.6 | 0.3 |
| Lead | 0.00 | to | 0.06 | 0.03 |
| Mercury | 0.000 | to | 0.000 | 0.000 |
| Selenium | 0.00 | to | 0.00 | 0.00 |
| Silver | 0.00 | to | 0.01 | 0.00 |
| Zinc | 0.0 | to | 0.2 | 0.1 |
| Fe (filt) | 0.0 | to | 0.1 | 0.0 |
| Mn (filt) | 0.00 | to | 0.22 | 0.10 |
| Note: results less than detection limit reported as nil | | | | |

## 3.2 Sawyers Swamp Creek Ash Dam Pump-back System Water Quality

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 (Table 3) is compared with the water quality in the creek, upstream and downstream of the v-notch. Changes in conductivity and alkalinity in the creek are assessed in relation to the ash dam seepage collection and pump-back system in March, 2010. Water quality changes in the creek are also examined to provide an indication of effects of the Springvale Mine discharge since August, 2012.

**Table 3: Summary of Average Water Quality in SSCAD for Pre-placement and Post-Stage 2 Periods and the V-notch Seepage Compared to Sawyers Swamp Creek Up- and Downstream of the V-notch, Dump Creek Background and Surface Water Guidelines or Goals**

| Element (mg/L) | Pre-Placement (1996-2003) | Stage 2A Post-placement (April, 2010-January, 2012) | Ongoing Stage 2 Post-placement February, 2012 to March, 2013 | V-Notch Seepage February, 2012 to March, 2013 | SSC Upstream V-Notch Seepage February, 2012 to March, 2013 | SSC Downstream V-Notch Seepage February, 2012 to March, 2013 | Mine Discharge Indicative Water Quality Data ** 50th Percentile | Back-ground Dump Creek,WX11 (February, 2012-March, 2013) | ANZECC (2000) Guide-lines & Goals for SSC |
|---|---|---|---|---|---|---|---|---|---|
| | SSCAD | SSCAD | SSCAD | SSCAD | SSC | SSC | Springvale Mine Water** | WX11 | |
| pH | 5.4 | 4.8 | 4.8 | 7.2 | 8.4 | 8.1 | 8.4 | 3.5 | 6.5-8.0 |
| Cond (µS/cm) | 1219 | 1912 | 1457 | 1629 | 640 | 714 | 1098 | 1519 | 2200 |
| TDS | 858 | 1418 | 1066 | 1195 | 374 | 450 | 845 | 1059 | 1500 |
| SO4 | 553 | 910 | 674 | 712 | 21 | 61 | 44 | 701 | 1000 |
| Cl | 18 | 30 | 20 | 44 | 8 | 11 | - | 33 | 350 |
| Alk | 18 | 19 | 25 | 84 | - | 366 | 341 | 21.4 | - |
| As | 0.016 | 0.0013 | 0.002 | <0.001 | - | 0.009 | 0.008 | 0.001 | 0.024 |
| Cd | 0.012 | 0.0021 | 0.0042 | 0.0003 | - | <0.0002 | - | 0.0004 | 0.0015 |
| Cr | 0.005 | 0.0014 | 0.0028 | 0.002 | - | <0.001 | - | 0.0012 | 0.005 |
| Cu | 0.007 | 0.0115 | 0.0203 | 0.003 | - | 0.007 | <0.01 | 0.0054 | 0.005 |
| Fe | 0.17 | 0.21 | 0.08 | 0.05 | - | 0.18 | 0.19 | 6.68 | 0.3 |
| Mn | 1.2 | 1.34 | 1.17 | 0.02 | - | 0.03 | 0.015 | 6.29 | 1.9 |
| B | 4.7 | 2.01 | 1.82 | 2.2 | - | 0.18 | 0.055 | 2.68 | **1.25** |
| F | 9.3 | 2.15 | 2.21 | 1.21 | - | 0.87 | 1.28 | 1.36 | 1.5 |
| Mo | 0.152 | 0.033 | 0.013 | <0.01 | - | 0.02 | - | 0.010 | 0.01 |
| Ni | 0.129 | 0.041 | 0.071 | <0.01 | - | 0.003 | <0.01 | 0.428 | 0.05 |
| Pb | 0.002 | 0.001 | 0.003 | <0.001 | - | 0.002 | - | 0.002 | 0.005 |
| Se | 0.151 | 0.006 | 0.009 | 0.002 | - | <0.002 | <0.002 | 0.002 | 0.005 |
| Zn | 0.426 | 0.136 | 0.263 | 0.04 | - | 0.035 | 0.04 | 1.096 | **0.153** |

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

Table 3 shows the following characteristics:

- A moderate increase in conductivity from upstream to downstream of the v-notch in SSC
- Conductivity in the creek is much lower than in the SSCAD or the v-notch discharge and is similar to that of the Springvale mine water
- Alkalinity in the creek (downstream of the v-notch) is much higher than in the SSCAD or the v-notch discharge and is similar to that of the Springvale mine water
- Arsenic and molybdenum in the creek (downstream of the v-notch) are higher than in the SSCAD or the v-notch discharge and the arsenic is similar to that in the mine water.
- Copper in the creek is higher than in the v-notch and in bore D4 (Table 5). Contribution to these metals by the Springvale mine water, if any, cannot be determined due to lack of data or the high detection limits used but the copper concentration at the downstream site increased to 0.022 mg/L in August, 2012 at the time the continuous mine water discharge began. This may explain the high average copper concentration. See also comments on these metals in Section 3.3 and Table 4.

It is noted that the concentration of all these trace metals has increased since the initial detailed sampling from February to October, 2010 by LLI at the downstream site (SSC@800m) – see Attachment 2.8. During February to October, 2010, arsenic averaged 0.002 mg/L (now 0.009 mg/L), copper 0.002 (now 0.007 mg/L) and molybdenum <0.01 (now 0.02 mg/L). As a result of these changes, copper and molybdenum are now higher than their respective local guidelines and higher than in the background site in Dump Creek (Table 3).

The sampling site at the SSCAD spillway (SSC@0m, Figure 2) where the SSCAD freshwater inflow diversion, as well as the Springvale Mine Water discharges since August, 2012, enters Sawyers Swamp Creek, has been sampled for water quality and trace metals since November, 2012. In addition, the water quality and trace metals at site 92, SSC upstream of the ash dam (Figure 2) have been sampled since June, 2012. The results are shown in Attachment 2.8. These data show that the combined discharge was elevated in arsenic and molybdenum but not copper, while the upstream SSC has low concentrations of these trace metals. Hence, it is suggested that EnergyAustralia NSW sample the mine water for trace metals to assist in confirmation of the cause of the increases in the creek.

To assist in clarification of the changes in Sawyers Swamp Creek, upstream and downstream of the v-notch, due to the mine water, changes over time in conductivity and alkalinity from February 2010 to March, 2013 are shown in Figure 3. The LLI dataset had missing data, which are shown as dotted lines in Figure 3.

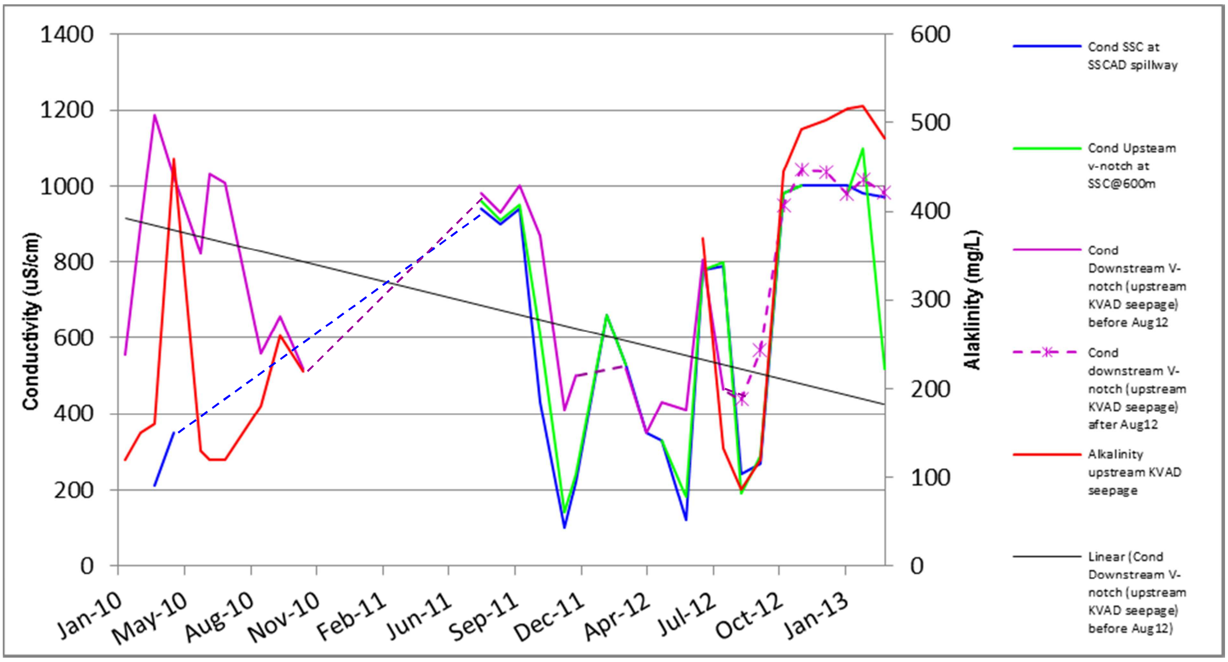



**Figure 3: Sawyers Swamp Creek Conductivity and Alkalinity Variations from February, 2010 to March, 2013 at sites upstream and downstream of the v-notch (downstream site is upstream of KVAD seepage). Conductivity data is shown from before and after August, 2012 (Missing data in 2010/11 shown as dotted lines)**

Figure 3 shows the following changes:

- From 2010 to August, 2012 there was a long-term trend for decrease in conductivity at the SSC downstream site (even with an intermediate effect of the pipeline leak). These changes are considered to be due to improvements resulting from the v-notch pump-back system. The changes are not likely to be due to the seepage collection improvements at the KVAD/R ash placement area because the downstream sampling site is located upstream of the KVAD seepage
- Conductivity at the SSCAD spillway site increased from October to December, 2011 due to a leak in the Springvale Coal Mine pipeline. The conductivity subsequently decreased until September, 2012
- Between September and October, 2012, the conductivity at the SSCAD spillway, as well as at the sites upstream and downstream of the v-notch all sharply increased to the same levels of about 1000 uS/cm
- As the same time as the recent conductivity increase, the alkalinity at the downstream site increased from mostly less than 250 mg/L in 2010 to about 500 mg/L from October, 2012.

EnergyAustralia NSW has advised that the licenced discharge of the Springvale Mine water pipeline into Sawyers Swamp Creek, from just below the ash dam spillway crest, was the cause of the high conductivity and alkalinity at the spillway sampling site and in the creek. This means that the discharge now dominates the water quality conditions in the upper Sawyers Swamp Creek and has eliminated the observed conductivity improvements before the discharge began, which were thought to have resulted from the v-notch pump-back system.

It should be noted that the diversion of the Lidsdale Cut water to the ash dam may significantly change the water quality in the SSCAD over time. This could be confirmed by ongoing monitoring.

## 3.3 KVAD/R Seepage and Subsurface Seepage Collection and Diversion Effects

The main KVAD/R seepage point from the north wall into Sawyers Swamp Creek is located near the ash placement internal groundwater bore GW6 (Figure 2). The water quality in the seepage, as well as in Sawyers Swamp Creek, and upstream and downstream of the seepage point, is shown in Table 4, as is the water quality at the receiving water site, WX7. Unfortunately, the KVAD/R seepage to the creek is only tested for general water quality, such as conductivity, and trace metals are not measured, so it is suggested that EnergyAustralia NSW test the north wall seepage water for trace metals as well as general water quality.

Changes in conductivity in the creek have also been assessed in relation to the KVAD/R subsurface drains for seepage collection and diversion to Lidsdale Cut since October, 2010. Water quality changes in the creek are also examined in relation to effects of the Springvale Mine discharge since August, 2012. Cessation of discharges from Lidsdale Cut to the creek, which was stopped in April, 2012, has also been taken into account.

**Table 4: Summary of Average and Median Water Quality in Sawyers Swamp Creek at the Receiving Water Site, WX7, compared to KVAD/R North Wall Seepage to the creek, Up- and Downstream of the Seepage, Lidsdale Cut, Springvale Mine Water and Surface Water Guidelines or Goals**

| Element (mg/L) | Sawyers Swamp Creek (WX7) | | | North Wall KVAD/R Seepage to SSC | Upper Sawyers Swamp Creek | | Springvale Mine Water** | Lidsdale Cut (WX5) | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre-placement (1991-2003) 90th Percentile | Stage 2A Post-placement (April, 2010-January, 2012) Median | Ongoing Stage 2 Post-placement (February, 2012-March, 2013) | Ongoing Stage 2 Post-placement (February, 2012-March, 2013) | SSC upstream KVAD/R Seepage & below V-notch (February, 2012 to March, 2013) | SSC down-stream KVAD/R Seepage near D5 (February, 2012 to March, 2013) | Indicative Water Quality Data ** Median | Ongoing Stage 2 Post-placement (February, 2012- July, 2012) Median | Surface Water Guidelines# or Goals^ |
| pH | 7.6 | 7.3 | 7.5 | 4.2 | 8.1 | 8.0 | 8.4 | 7.3 | 6.5 – 8.0 |
| Cond (µS/cm) | 760 | 1100 | 828 | 1462 | 714 | 688 | 1098 | 590 | 2200 |
| TDS | 584 | 690 | 553 | 1244 | 450 | 435 | 845 | 360 | 1500^ |
| SO4 | 323 | 300 | 156 | 769 | 61 | 67 | 44 | 160 | 1000 ++ |
| Cl | 27 | 16 | 11 | 19 | 11 | 11 | - | 13 | 350 + |
| Alkalinity | 20 | 162* | 257* | - | 366 | 278 | 341 | 100 | - |
| As | <0.001 | 0.004 | 0.007 | - | 0.009 | 0.008 | 0.008 | 0.001 | 0.024 |
| B | 2.33 | 1.4 | 0.634 | - | 0.18 | 0.22 | 0.055 | 0.55 | **1.25** |
| Cd | <0.001 | 0.0007 | 0.0011 | - | <0.0002 | <0.0002 | - | 0.0007 | 0.0015 |
| Cr | <0.001 | 0.0025 | 0.0128 | - | <0.001 | <0.001 | - | 0.001 | 0.005 |
| Cu | <0.007 | 0.003 | 0.0099 | - | 0.007 | 0.001 | <0.01 | 0.0025 | 0.005 |
| F | 1.1 | 1.7 | 1.7 | - | 0.87 | 0.786 | 1.28 | 0.80 | 1.5+++ |
| Fe | 0.507 | 0.02 | 0.26 | - | 0.18 | 0.28 | 0.19 | 0.12 | 0.3+++ |
| Mn | 0.829 | 1.7 | 0.72 | - | 0.03 | 0.25 | 0.015 | 0.74 | 1.9 |
| Mo | - | 0.02 | 0.014 | - | 0.02 | 0.02 | - | 0.010 | 0.01 + |
| Ni | - | 0.16 | 0.059 | - | 0.003 | <0.01 | <0.01 | 0.03 | 0.05 |
| Pb | 0.003 | 0.002 | 0.003 | - | 0.002 | 0.001 | - | 0.001 | 0.005 |
| Se | 0.003 | <0.002 | <0.001 | - | <0.002 | <0.002 | <0.002 | 0.002 | 0.005 |
| Zn | 0.153 | 0.45 | 0.035 | - | 0.035 | 0.03 | 0.04 | 0.070 | **0.153** |

*averages used to allow for effects of periods of mine water pipeline leakage or the recent discharge
** Mine emergency discharge data from Aurecon (2010) for 17th Feb to 7th Aug09

Table 4 shows the following characteristics:

- The KVAD/R Seepage appears not to have an effect on the conductivity or total dissolved solids (TDS) in upper Sawyers Swamp Creek as they were both lower downstream of the north wall KVAD/R seepage point than upstream.
- The KVAD/R seepage sulphate at 769 mg/L was the highest source of sulphate, including the mine water, Lidsdale Cut and the SSCAD v-notch seepage (Table 3). Note that the north wall KVAD/R sulphate was even higher than in Dump Creek (see Table 3) which enters SSC upstream of WX7 but downstream of the creek site near D5. This suggests that the KVAD/R

seepage was the cause of the small sulphate increase from upstream to downstream of the KVAD/R seepage point. However, the sulphate still met the local/ANZECC (2000) guideline goals. The average sulphate in Table 4 includes the period from October, 2012 when the mine water ceased to be used directly by the power station and was diverted to Sawyers swamp Creek. With this data not included, the increase in sulphate from February to September, 2012 was from 75 mg/L upstream to 91 mg/L downstream of the KVAD/R seepage point. Hence, the effects of the seepage were not significant in terms of the local/ANZECC (2000) guidelines.

- The moderate boron increase from up- to downstream of the north wall seepage is consistent with the sulphate increase in the creek, which indicates that the KVAD/R seepage has a higher boron than in the Springvale mine water
- Alkalinity in the creek downstream of the KVAD/R seepage (near bore D5 and at WX7) is moderately lower than the upstream site, which is similar to that of the Springvale mine water. The moderate decrease is likely to be due to the low pH in the seepage water (for which there is no alkalinity data).
- The moderate level of alkalinity in Lidsdale Cut, before it stopped discharging, is higher than the typical 20 mg/L in bore D5 (see Table 6, Section 4.4) due to the recent increase in pH in the void from 4.8 to the current 7.3. The alkalinity and pH increase is suggested to be due to mine water flowing down Sawyers Swamp Creek and seeping into the Lidsdale Cut void (see Section 4.5)
- Arsenic and molybdenum at the downstream sites in the creek, as well as at WX7, are higher than the current concentrations in Lidsdale Cut. Cadmium, copper, chromium, fluoride and nickel are also higher at WX7 than in Lidsdale Cut.
- The concentrations of arsenic, cadmium, copper and chromium have increased at WX7 since the previous reporting period. As a result of these changes, copper and chromium are now higher than their respective local guidelines and higher than in the background site in Dump Creek (Table 3).
- The Springvale mine water discharge has lowered the conductivity, total dissolved solids and sulphate, as well as the concentrations of boron, manganese, nickel and zinc at WX7 such that, of these, only nickel is now higher than the local guidelines.

The source of the elevated copper and chromium concentrations at WX7 was investigated and was found to be due to a large increase in trace metal concentrations, including copper and chromium, at WX7 in May, 2012 (see Attachment 2.1). EnergyAustralia NSW advised that the high groundwater inflows to Lidsdale Cut following the February/March flood caused the void water level to rise and seep into the local mine spoil. The acidic pH and high conductivity, sulphate and trace metals, including aluminium, boron and nickel, are characteristic of the local mine spoil groundwater. As the trace metal increases did not occur in Sawyers Swamp Creek near D5, in Lidsdale Cut or in Dump Creek, the coal related groundwater seepage must have entered the creek upstream of WX7 and downstream of Lidsdale Cut. Hence, it is unlikely that the increase was related to the KVAD/R Stage 1 and Stage 2 ash placements and it appears that the discolouring of Sawyers Swamp Creek in April, 2012 was inappropriately assigned to the Lidsdale Cut discharge.

It is unlikely that the Springvale mine water added to the chromium levels at WX7 at this time because Table 4 shows that the creek sites above and below the KVAD/R seepage, and both upstream of Lidsdale Cut, had low chromium concentrations. In addition, although the KVAD/R upstream site had elevated copper, the high copper occurred later in August (see Attachment 2.8) and the downstream site, near D5, had low copper levels. However, to clarify the effects of the mine water, if any, on cadmium, copper, chromium, molybdenum and lead in the creek, measurements of the mine water discharge are suggested to be undertaken at detection limits lower than the ANZECC (2000) guidelines.

To further assess the effects of the KVAD/R seepage collection and diversion systems on the water quality and trace metals in Sawyers Swamp Creek, as well as changes due to the mine water, the trends over time are examined in Figure 4.

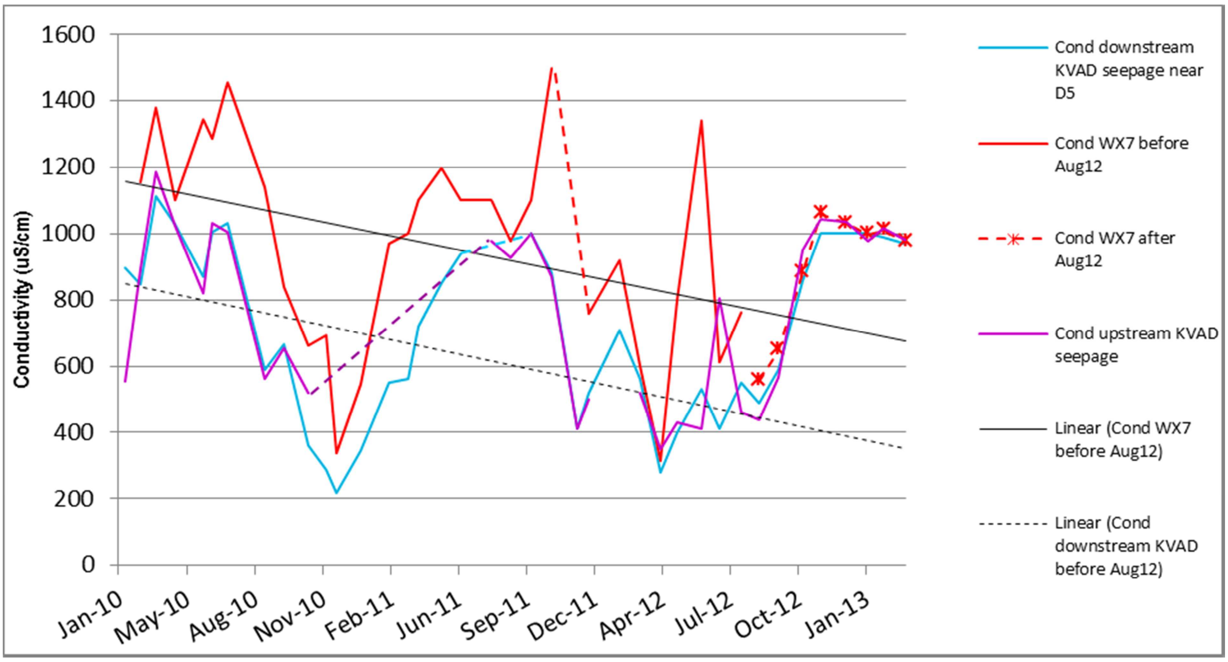



**Figure 4: Sawyers Swamp Creek Conductivity Variations from February, 2010 to February, 2012 at sites upstream and downstream of KVAD/R North Wall seepage as well as at Receiving Water Site WX7 (downstream site taken as the LLI site near the groundwater bore D5)**

Figure 4 shows the following changes:

- Prior to the mine water discharge in August, 2012, there was a trend for decrease in conductivity in Sawyers Swamp Creek at both the KVAD/R downstream site and at the receiving water site WX7, which is located downstream of the Dump Creek inflow. This trend was evident even with the intermediate effect of the pipeline leak in 2011. These changes are considered to be due to improvements resulting from the KVAD/R seepage collection and diversion system since 2010. As shown in Figure 3, the conductivity also decreased at the creek site upstream of the KVAD/R, apparently due to the SSCAD seepage collection system
- After the Springvale mine water began to be discharged to the creek, the conductivity at the KVAD/R upstream and downstream sites, as well as at WX7 sharply increased to all be at the same levels of about 1000 uS/cm between September and October, 2012.

At the same time as the recent conductivity increase, the alkalinity at the downstream site increased from an average of 119 mg/L before October, 2012 to 490 mg/L from October, 2012. A similar increase was observed at WX7, confirming the dominant effects of the mine water discharge on the water quality in the creek.

## 3.4 Lidsdale Cut

This Section assess the effects of the Lidsdale Cut discharge on the water quality in Sawyers Swamp Creek. The assessment of effects of KVAD/R seepage and local groundwater on the water quality in Lidsdale Cut itself and its ongoing changes is provided in Section 4.5.

The KVAD/R seepage collection and diversion system to Lidsdale Cut was previously shown to improve the water quality in Lidsdale Cut (WX5). This section examines the ongoing changes to June, 2012 which are shown in Figure 5.

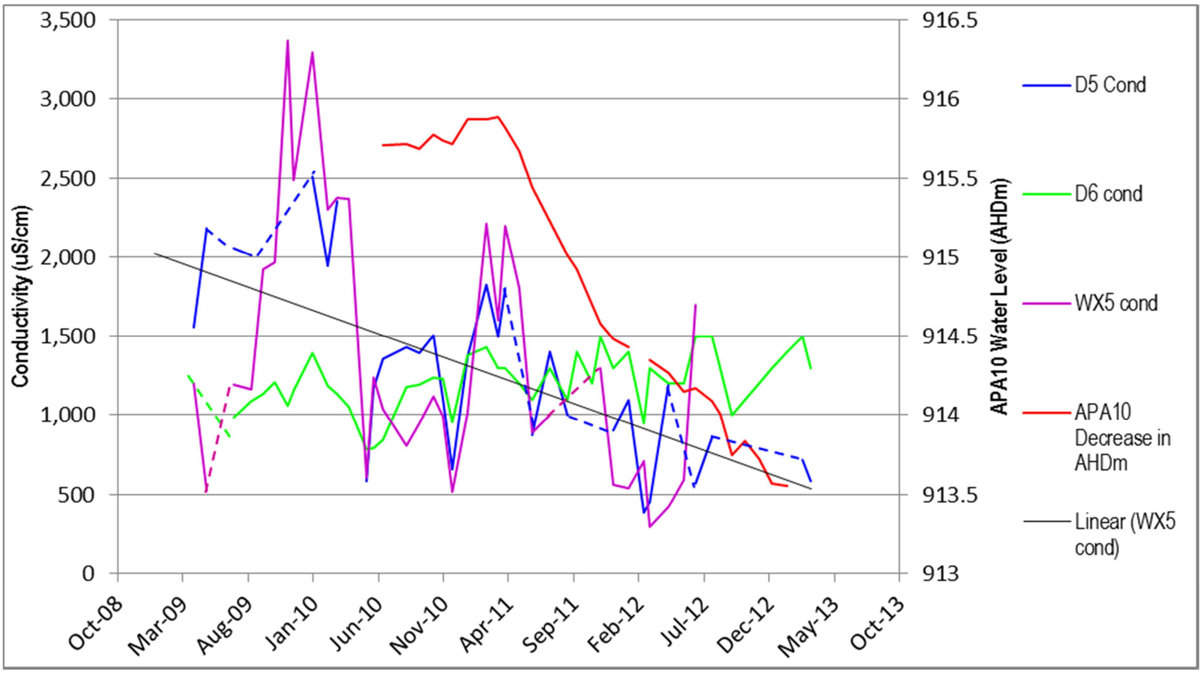



**Figure 5: Lidsdale Cut (WX5) Conductivity compared to KVAD Seepage Detection Bores D5 and D6 Conductivity and the KVAD Groundwater Level decrease at Piezometer APA10 from October, 2010 to March, 2013**

Figure 5 shows that the KVAD/R seepage collection and diversion system to Lidsdale Cut has lowered the conductivity in the void from over 2500 to about 1000 uS/cm since the initial installation in 2010. The conductivity in the void has decreased to be lower than the average of the KVAD/R north wall seepage of 1462 uS/cm (Table 4), indicating that the seepage collection system is collecting lower salinity water from other areas under the ash placement. This is confirmed by the similar trend in conductivity for the WWGM4/D5 groundwater bore, which is down-gradient of the KVAD/R placement but near, and up-gradient of the Lidsdale Cut void. In addition, soon after installation of the seepage collection system in 2010, the conductivity in Lidsdale Cut and D5 became similar to each other.

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

From the flow paths shown in Figure 6, it appears that the subsurface drains are collecting KVAD seepage water that has been diluted by low salinity water entering the area from upstream of the KVAD/R placements. Prior to installation of the subsurface drains in 2010, both bore D5 and Lidsdale Cut had a higher conductivity than in bore D6 because the flow paths also indicate that bore D6 has its conductivity limited by the low salinity up-gradient inflows. The moderate increase in conductivity at D6 since 2010 indicates that the drawdown in the groundwater table by the toe drains and the subsurface drains (shown by the APA10 piezometer, Figure 5) has limited some of the low salinity groundwater from reaching bore D6.

In addition to the changes due to installation of the subsurface drains, EnergyAustralia NSW has advised that in May 2012, the diversion of KVAD/R groundwater to the Lidsdale Cut void appeared to cause the void discharge to discolour Sawyers Swamp Creek with an aluminium deposit. Accordingly, EnergyAustralia NSW was requested by the NSW EPA to seal the discharge pipes in April, 2012 to prevent the void water from entering the creek. By the end of June, 2012 seepage water from the blocked Lidsdale Cut was found to have surfaced in Dump Creek, so pumping of the water from the void to the SSCAD, via the return canal, (Figure 2) began in July, 2012. The Lidsdale Cut water level has been controlled ever since.

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

This Section assesses the likely effects, if any, of the capped Stage 1 KVAR and the current KVAR Stage 2 dry ash placement on the local groundwater quality. Effects identified in Section 3 on the local surface water and groundwater by the subsurface drains, the SSCAD seepage collection and return system and diversion of the Lidsdale Cut discharge to the SSCAD are taken into account. In addition, the effects on local groundwater, if any, of the Springvale mine water discharge to Sawyers Swamp Creek are also considered.

The aim of the seepage collection and diversion system management measures is for the receiving water quality at the groundwater bore WWGM1/D5 and in Sawyers Swamp Creek (WX7) to meet the local/ANZECC (2000) guideline trigger values for the characteristics defined in Table 1 during the post-dry ash placement periods. This presupposes any exceedances of the trigger values in the receiving waters by non-ash related changes in the area, such as increased background concentrations or the influence of the Springvale mine water discharge, can be taken into account.

Long-term trends in water quality and trace metals are examined for changes from pre- to post-dry ash placement in the following groundwater bores:

- SSCAD seepage detection bores, WGM1/D3 and D4
- KVAD/R groundwater seepage detection bores WGM1/D5 and D6.

Groundwater quality changes at all the bores are compared to changes in the background bores, D1 and D2 and Lidsdale Cut. The overall effects on the final receiving water site in Sawyers Swamp Creek at WX7 are also included.

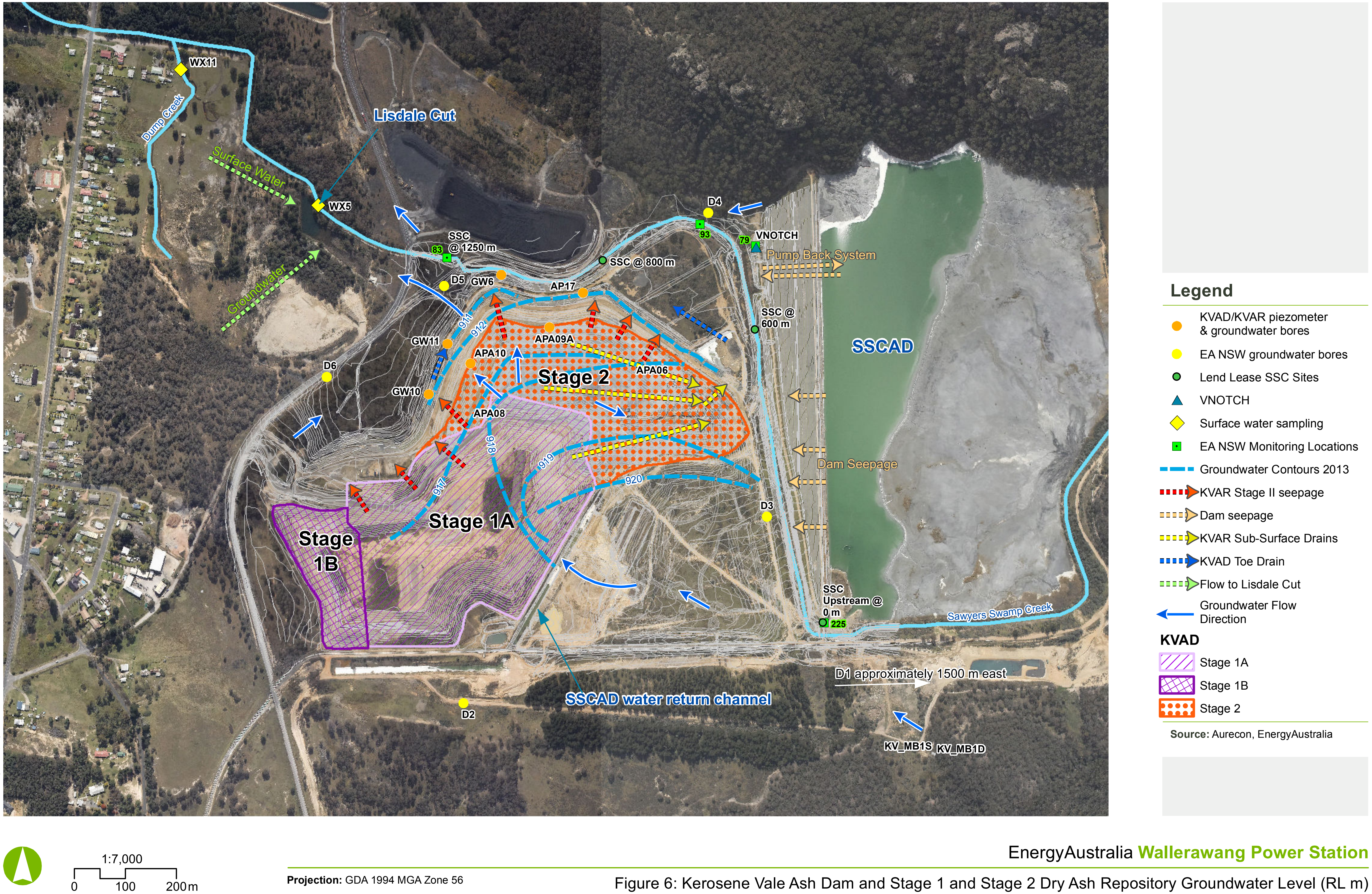
As discussed in Section 1.1, a seepage collection and pump-back system was installed on the SSCAD v-notch seepage to minimise effects of the ash dam on Sawyers Swamp Creek and the local groundwater quality. However, residual effects of seepage from the ash dam pond under the dam wall on bores D3 and D4 have to be taken into account as they are up-gradient of the Stage 2 placement and may affect the groundwater flowing into the placement area.

## 4.1 Groundwater Flow Directions

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 groundwater level contours and overall, indicative, groundwater flow paths in the ash placement areas. The level contours have changed from those of the previous report due to the ongoing drawdown of the water table under the KVAR by the toe drains and subsurface drains.
The indicative KVAD/R seepage flow paths to the KVAD toe drains and toward the low point of the Lidsdale Cut are shown. 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 in Figure 6. 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 in Figure 6.

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**Projection:** GDA 1994 MGA Zone 56

EnergyAustralia **Wallerawang Power Station**

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

The piezometer water level changes and the groundwater contours provided by LLI show that the unblocked toe drains have drawn the ash placement groundwater level to below the assumed KVAD clay capping level of RL918m[2] along the western and northern wall (Figure 6). This drawdown is consistent with the decrease in water level in the KVAD, under the dry ash placement, by over 2m (as measured at the piezometer APA10, see Figures 5 and 6). However, in the south-eastern area, groundwater mounding has increased from a maximum height of RL917m in 2012 to RL918 to RL919m in 2013.

These changes in the water level contours indicate that some rainwater infiltration is being retained above the clay capping. From these observations, it appears that the subsurface drains installed under the south-eastern section of the Stage 2 area (Figure 1) are taking groundwater from under the clay capping and sending it to the low point of the eastern drainage system (as indicated by the yellow arrows in Figure 6). The reversed groundwater flow direction in this area (the blue arrow) also indicates that some of the water above the clay capping is flowing to the eastern low point. Groundwater from the low point is directed into the KVAD toe drains and Lidsdale Cut.

Since unblocking of the toe drains and installation of the subsurface drains, the groundwater flow directions, the likely sources of groundwater and effects on the water quality in bores D5 and D6, as well as in the Lidsdale Cut have become clearer, based on the following observations:

- Groundwater in the KVAD, under Stages 1 and 2, is flowing toward Sawyers Swamp Creek
- Although seepage water from the SSCAD (the main flow now collected at the v-notch and pumped back into the dam pond) most likely affects the groundwater at D4 on the right abutment of the ash dam wall, the lower groundwater level of RL906m means it is unlikely to significantly affect the KVAD/R groundwater. The flow paths shown in Figure 6 indicate that the groundwater at bore D4 mainly flows to Sawyers Swamp Creek
- Groundwater sampled by bore D3 on the left abutment is less affected by the SSCAD seepage water (Section 4.3) and the groundwater is diluted by inflows of near pristine groundwater (but low pH water) from up-gradient of the borehole site
- Background groundwater for the KVAD/R is measured at bores D2 and D3, which are up-gradient of the KVAD. The D2 and D3 up-gradient sources appear to flow into the KVAD, under the KVAR, where it dilutes the KVAD water as it is collected by the toe drains and subsurface drains and sent to Lidsdale Cut. Bore D1 is up-gradient of the SSCAD and its flow appears to dilute the D3 groundwater which samples seepage from the SSCAD into the D3 area
- Some of the up-gradient water appears to flow around the southern edge of the KVAD where it dilutes KVAD seepage flowing toward bore D6
- Effects of residual seepage from the SSCAD and KVAD/R on water quality in Sawyers Swamp Creek, if any, appear to be dominated by the effects of the discharge flows from the Springvale coal mine.

## 4.2 Sawyers Swamp Creek Ash Dam Water Quality

The changes in water quality in the SSCAD, 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.

[2] The KVAR is placed on the clay capping of the KVAD.

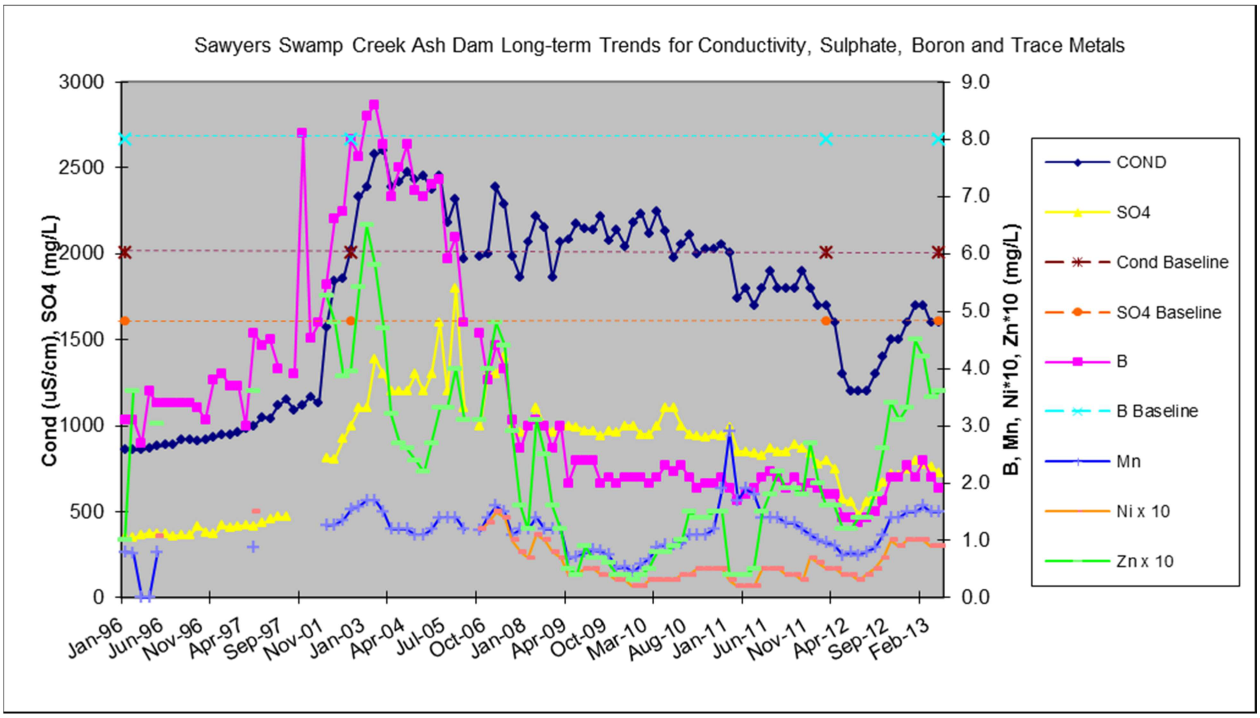


**Figure 7: Sawyers Swamp Creek Ash Dam Long-term Trends in Conductivity, Sulphate, Boron and Trace Metals**

Figure 7 shows the following changes since 2003:

- The conductivity and sulphate and boron concentrations have all decreased since 2003
- Concentrations of manganese, nickel and zinc decreased to 2010
- Manganese and zinc concentrations increased following the summer 2010/11 flood, but not as much as first thought in the previous report, and further increases occurred for zinc after the subsequent February/March, 2012 flood, together with an increase in nickel and continued increased levels of manganese
- The conductivity recovered after the February/March, 2012 decrease as did sulphate and boron, with a continued increase in zinc.
- The trace metal increases suggest that the large inflows of freshwater infiltrated the ash deposit and leached the trace metals and selenium from the ash into the water in the dam. Although the reason for the nickel and zinc to remain elevated into 2012/13 is not known, their concentrations in the v-notch discharge were not elevated (see Table 3). Ongoing monitoring may provide some insight into the processes taking part in the ash dam.

The water quality and trace metal data collected from the v-notch seepage is expected to represent the residual seepage from the base of the dam wall. The average concentrations in Table 3 show that all the elements, except boron, were lower than the local surface water or groundwater goals (Table 1) and that a significant increase in concentrations in Sawyers Swamp Creek or bores D3 or D4 near the base of the dam wall is unlikely to be caused.

## 4.3 SSCAD Groundwater Quality

The SSCAD seepage detection bores, WGM1/D3 and D4, are located down-gradient of the SSCAD and up-gradient of the KVAD and KVAR Stage 1 and Stage 2 dry placement areas (Figure 1). Bore D3 samples groundwater affected by ash dam seepage from near the left abutment of the ash dam wall and bore D4 samples the right abutment. The conductivity and salinity at D3 has always been lower than at D4 (Table 5) as it is diluted by inflows of low salinity groundwater from up-gradient of the SSCAD (see flow paths in Figure 6).

Changes in the SSCAD seepage detection bores have been assessed using data from pre-placement 90$^{th}$ percentile baselines (before May, 2003 at bore D4) and the background bore, D2. This data has been compared to the post-placement medians for periods of Stage 1, including capping since April, 2009 (May, 2003 to March, 2010) and during the Stage 2A dry ash placement (April, 2010 to January, 2012) and the current Stage 2 placement (February, 2012 to March, 2013), as shown in Table 5.

As bore D4 is located near the lower section of Sawyers Swamp Creek, where it passes the dam wall and the V-notch seepage, the water quality and trace metals at this bore are expected to show any effects of residual seepage from the dam wall since the v-notch pump back system was installed. To assess changes in bore D4 during the current period, the medians have been compared to those during previous periods together with its 90$^{th}$ percentile baseline in Table 5.

**Table 5: Median Water Quality for SSCAD V-notch Seepage and Seepage affected Groundwater bores during Post-Stage 1 and Post-Stage 2 Compared to the Groundwater Background, Seepage Bore WGM1/D4 Baseline and Groundwater Guidelines or Goals**

| Element (mg/L) | SSCAD Seepage Affected Bores | | | | | | V-Notch Seepage February, 2012 to March, 2013 | Back-ground (February, 2012 to March, 2013) | D4 Baseline (Pre-Stage I 90$^{th}$ Percentile) | ANZECC Guideline Goals for Groundwater |
|---|---|---|---|---|---|---|---|---|---|---|
| | Stage 1 & Cap May, 2003 to March, 2010 | | Stage 2A Post-placement (April, 2010 to January, 2012) | | Stage 2 Post-placement (February, 2012 to March, 2013) | | | | | |
| | D3 | D4 | D3 | D4 | D3 | D4 | SSCAD | D2 | D4 | |
| pH | 6.2 | 5.9-8 | 5.9 | 5.8 | 6.1 | 5.7 | 7.2 | 4.9 | 6.8 | 6.5-8.0 |
| Cond (µS/cm) | 693 | 1276 | 746 | 1500 | 540 | 1500 | 1629 | 320 | 728 | 2600 |
| TDS | 430 | 1120 | 450 | 1200 | 330 | 1200 | 1195 | 215 | 510 | 2000 |
| SO4 | 110 | 720 | 115 | 770 | 68 | 770 | 712 | 100 | 201 | 1000 |
| Cl | 82 | 27 | 105 | 33 | 66 | 35 | 44 | 22 | 45 | 350 |
| Cu | 0.005 | 0.0008 | 0.002 | 0.001 | 0.004 | 0.003 | 0.003 | 0.003 | 0.010 | **0.005** |
| Fe | 0.10 | 46.50 | 0.03 | 43.0 | 4.2 | 39.0 | 0.05 | 0.01 | 86 | **1.7** |
| Mn | 0.63 | 17.0 | 0.73 | 18.0 | 0.80 | 16.5 | 0.02 | 0.49 | 6.5 | 1.9 |
| B | 0.03 | 1.20 | 0.03 | 1.50 | 0.02 | 1.55 | 2.2 | 0.01 | 0.49 | **1.7** |
| F | 0.05 | 0.05 | 0.05 | 0.10 | 0.10 | 0.10 | 1.21 | 0.10 | 0.24 | 1.5 |
| Ni | 0.130 | 0.040 | 0.130 | 0.050 | 0.12 | 0.040 | <0.01 | 0.050 | 0.023 | **0.137** |
| Se | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.005 |
| Zn | 0.065 | 0.080 | 0.140 | 0.080 | 0.070 | 0.065 | 0.04 | 0.075 | 0.060 | **0.505** |

The summary data in Table 5 shows:

- The bore D3 conductivity and salinity is now lower than during the Stage 1 period and the trace metals have shown no significant changes other than an increase in iron
- The bore D4 conductivity and salinity have increased slightly since Stage 1 and are similar to that measured in the V-notch seepage.
- The trace metals at D4 have shown no notable changes since Stage 1 and are mostly higher than measured at the V-notch. The higher concentrations of boron and fluoride at the V-notch appear not to have affected the D4 concentrations, as evidenced by the low fluoride at both groundwater bores. If the SSCAD seepage was the cause of the elevated boron at D4 (1.2 to 1.55 mg/L), the effects of the seepage should have appeared at bore D3 as an increase above that in the KVAD/R up-gradient bore D2. However, there was no such increase.

Long-term changes in conductivity, sulphate and boron at bore D4 are shown in Figure 8. Comparison with the changes in the SSCAD in Figure 7 shows the effect of the early SSCAD increases before dry ash placement began in 2003. Although the SSCAD levels began to decrease from 2005 (Figure 7), the conductivity, sulphate and boron concentrations in the D4 bore (Figure 8) continued to increase to have similar levels as those in the SSCAD and consistently exceeded their baselines, except during rainfall events. The lack of a trend for decrease in conductivity, sulphate and boron at D4 since 2010 indicates that installation of the v-notch pump-back system has not provided an improvement in groundwater quality. This is not unexpected, as most of the v-notch discharge flowed down the creek, and did not infiltrate into the surrounding area. The concentrations in D4 are almost exclusively influenced by seepage from the wider area of the ash dam pond into the local groundwater. The main improvement from the installation of the v-notch pump-back system could be expected to occur on the surface water quality in Sawyers Swamp Creek (See Section 4.6).

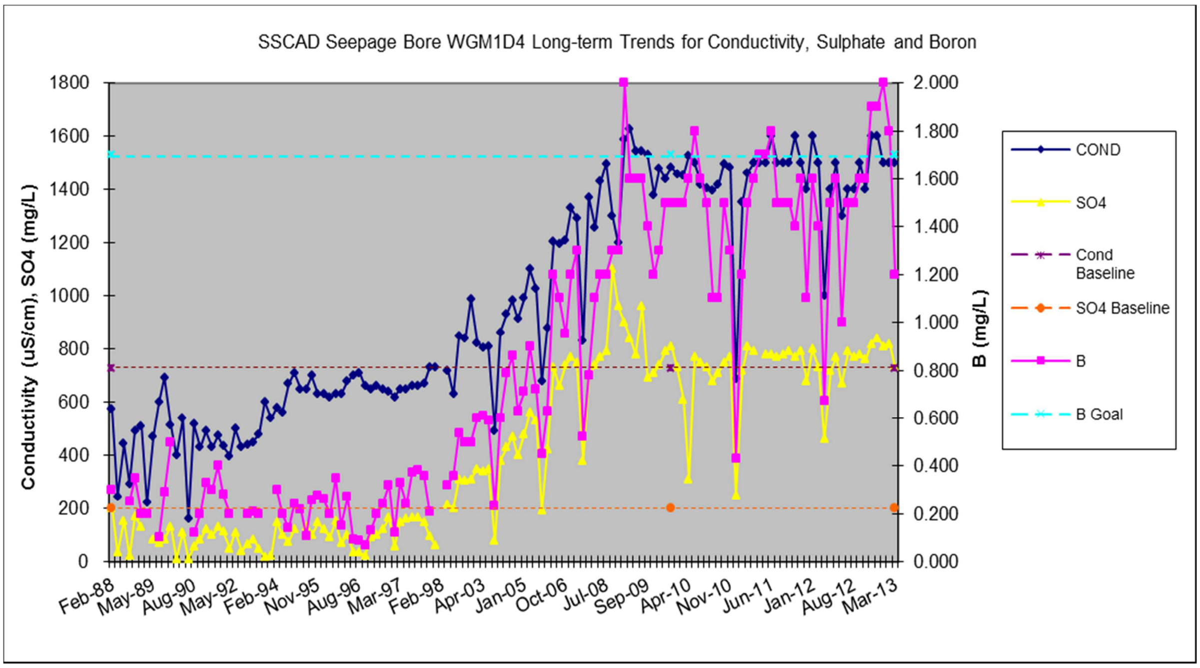


**Figure 8 - Sawyers Swamp Creek Ash Dam Seepage Detection Bore WGM1/D4 Long-term Trends in Conductivity, Sulphate and Boron**

In summary, Figure 8 shows that the conductivity, sulphate and boron in the SSCAD seepage detection bore D4 showed a steady increase from 2003 to 2008/09, followed by stabilisation at elevated levels. However, Table 3 in Section 3.2 and examination of Sawyers Swamp Creek data in

Attachment 2.8 shows that, prior to the Springvale mine water discharge, there was no evidence of effects of groundwater seepage from the area sampled by bore D4. This is considered to be due to the slow rate of groundwater seepage into Sawyers Swamp Creek relative to the normal catchment inflows.

## 4.4 KVAD and KVAR Groundwater Quality

The changes in salinity at the groundwater bores WGM1/D5 and D6 were examined in relation to the KVAD/R subsurface drains and the effects on the water quality in the Lidsdale Cut in Section 3.3.1. This Section examines the groundwater quality in these bores in relation to potential effects of the KVAR Stage 2. Changes from pre-placement, during the Stage 1 placement and capping and during the initial Stage 2 dry ash placement are examined.

The understanding of the groundwater flow directions shown in Figure 6 explains how the inflowing up-gradient, low salinity groundwater dilutes the KVAD water that is collected by the toe drains and subsurface drains from under the KVAR. In turn, this is directed to Lidsdale Cut via the unblocked toe drains. Figure 5 shows that the conductivity in both the Lidsdale Cut and bore D5 were reduced to be similar to that at bore D6, shortly after the sub-surface drains were initially connected to the KVAD toe drains. Since then, their salinities have continued to decrease to be less than in bore D6. The continuing decrease indicates that the groundwater level drawdown is depleting the amount of high salinity water present in the KVAD.

The elements that had higher concentrations than the local guidelines during the Stage 2 period are highlighted in blue in Table 4. Table 6 shows that, as a result of the seepage collection and diversion works, the local groundwater quality has changed. During 2010 to 2012, bore D6 had a lower median conductivity and sulphate than in bore D5, but during 2012 to 2013, bore D5 has the lower conductivity and sulphate. In addition, the concentrations of iron, nickel and zinc in bore D5 have decreased and boron, cadmium and copper and now lower than the local guidelines. There were no significant changes in concentrations of the other trace metals, including selenium, which remained low.

In regard to the changes in trace metals in the area, it should be noted that the low pH in bores D5 and D6 indicates pyrite oxidation (Deutsch, 2005) of the residual coal and chitter in the Kerosene Vale mine void underneath the KVAR. Pyrite oxidation and its associated acidification are known to release trace metals into groundwater.

In addition to the changes observed in the local groundwater, the flow directions indicate that bore D5 samples the groundwater seepage from under the KVAR on its way to Sawyers Swamp Creek, which is nearby. Hence, the KVAR subsurface drains, together with the KVAD toe drains, could be expected to improve the salinity in the creek by decreasing the salinity in the local groundwater.

**Table 6: Median Water Quality for Dry Ash KVAD/KVAR Groundwater Seepage Bores during Post-Stage 1, Initial Stage 2 and Stage 2A Compared to Current Groundwater Background Bore WGM1/D2 and Bore WGM1/D5 Baseline and Groundwater Guidelines or Goals**

| Element (mg/L) | KVAD & KVAR Dry Ash Placement Monitoring Bores | | | | | | Back-ground February, 2012 to March, 2013 | D5 Baseline (Pre-Stage I 90th Percentile) | ANZECC Guideline Goals for Ground-water |
|---|---|---|---|---|---|---|---|---|---|
| | Stage I& Cap May, 2003 to March, 2010 | | Stage 2A April, 2010 to January, 2012 | | Ongoing Stage 2 February, 2012 to March, 2013 | | | | |
| | D5 | D6 | D5 | D6 | D5 | D6 | D2 | D5 | |
| pH | 3.6 | 3.2 | 3.6 | 3.2 | 3.7 | 3.4 | 4.9 | 4.5 | 6.5-8.0 |
| Cond (µS/cm) | 1917 | 1110 | 1356 | 1216 | 580 | 1300 | 320 | 810 | 2600 |
| TDS | 1600 | 600 | 1000 | 730 | 430 | 885 | 215 | 550 | 2000 |
| SO4 | 1100 | 350 | 680 | 485 | 240 | 530 | 100 | 328 | 1000 |
| Cl | 18 | 56 | 15 | 48 | 13 | 47 | 22 | 24 | 350 |
| As | 0.001 | 0.005 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 | 0.008 | **0.024** |
| B | 4.8 | 0.80 | 2.2 | 0.74 | 0.80 | 0.63 | 0.01 | 1.7 | **1.7** |
| Cd | 0.0024 | 0.0004 | 0.002 | 0.001 | 0.001 | 0.0002 | 0.0002 | 0.004 | 0.001 |
| Cr | 0.003 | 0.0026 | 0.001 | 0.002 | 0.002 | 0.0015 | 0.001 | 0.041 | 0.004 |
| Cu | 0.013 | 0.003 | 0.008 | 0.005 | 0.003 | 0.005 | 0.003 | 0.058 | 0.005 |
| Fe | 4.85 | 38.0 | 1.7 | 14.5 | 0.35 | 54.5 | 0.01 | 14.7 | **1.7** |
| Mn | 8.55 | 3.6 | 7.5 | 3.5 | 3.5 | 4.45 | 0.49 | 2.5 | 1.9 |
| Mo | 0.005 | 0.008 | 0.010 | 0.010 | 0.01 | 0.010 | 0.010 | - | 0.01 |
| F | 1.10 | 0.20 | 0.80 | 0.40 | 0.60 | 0.30 | 0.10 | 0.65 | 1.5 |
| Ni | 0.830 | 0.335 | 0.540 | 0.350 | 0.230 | 0.345 | 0.050 | 0.137 | **0.137** |
| Pb | 0.016 | 0.005 | 0.007 | 0.012 | 0.002 | 0.002 | 0.001 | 0.021 | **0.010** |
| Se | 0.001 | <0.001 | 0.002 | 0.002 | <0.002 | 0.002 | 0.002 | 0.002 | 0.005 |
| Zn | 1.50 | 0.335 | 1.10 | 0.895 | 0.560 | 0.920 | 0.075 | 0.505 | **0.505** |

To clarify the role of KVAR seepage, if any, on the local groundwater and surface water quality, long-term changes for conductivity, sulphate and boron in bore D5, from before dry ash placement, during Stage 1 and to the current Stage 2 placement, are examined in Figure 9. Bore D5 is used as the indicator of potential effects on Sawyers Swamp Creek because it has been shown to sample the groundwater seepage from under the KVAR on its way to the creek.

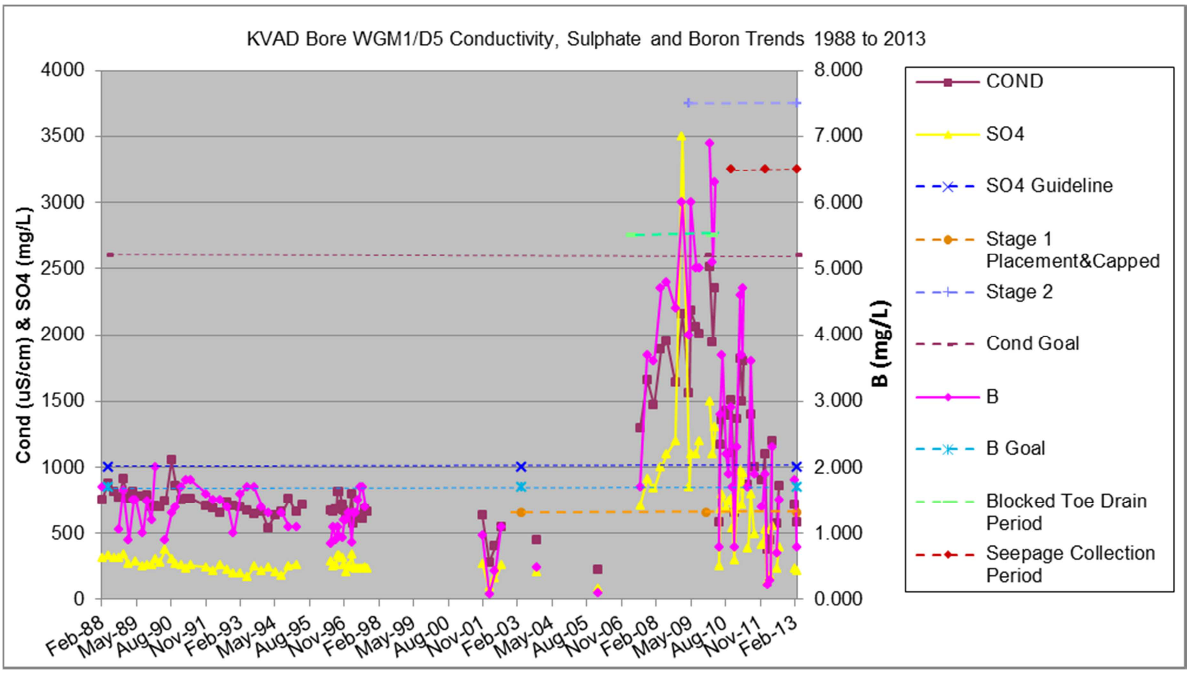


**Figure 9: Kerosene Vale Ash Dam Seepage Detection Bore WGM1/D5 Long-term Trends in Conductivity, Sulphate and Boron (Periods for Stage 1 placement and capped since 2003, Stage 2A, including initial Stage 2 since April 2009, Blocked toe drains and Subsurface drain seepage Periods are shown)**

Figure 9 shows that the conductivity, sulphate and boron at bore D5 have all decreased since installation of the KVAD/R seepage collection system to be similar to the Stage 1 pre-placement background levels. Other than boron, they have also had concentrations consistently below their respective environmental goals.

As discussed above in Section 3.3.1, the lower concentrations in bore D5 during the Stage 2 period appear to be due to the increased ability of the low conductivity background water to enter the KVAD under the KVAR since installation of the sub-surface drains and unblocking of the KVAD toe drains.

If the KVAR was significantly adding to the groundwater concentrations, they would not have decreased to their background levels. This is supported by the apparent lack of effects of the high rainfall events during summers 2010/11, 2011/12 and 2012/13 (see the rainfall in Section 2.4) on bore D5 concentrations, relative to the large changes seen at bore D4 (Figure 8). Hence, the lower variability at D5 may be due to effective sealing of the KVAD by the combined effects of the dry ash placement on the clay capping, which is on top of the KVAD.

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

## 4.5 Lidsdale Cut

This Section assesses the effects of KVAD/R and local groundwater seepage, as well as the diversion systems, on the water quality in Lidsdale Cut. Section 3.3.1 showed that the KVAD/R Stage 2 seepage collection and diversion system was related to a decrease in conductivity in Lidsdale Cut (WX5) as well as at the KVAD seepage detection bore, D5, but not at D6. The relationships of observed water quality and trace metal changes in the Lidsdale Cut are further investigated in this Section.

Table 7 shows water quality changes at Lidsdale Cut from pre-dry ash placement to Stage 1 (capped) and the various Stage 2 periods, including the current ongoing Stage 2 reporting period. These changes are compared to the current period for bore D5 and the groundwater quality changes at bore D5 over the same periods, which are shown in Table 6. This information can be used to confirm the findings from the previous Section on potential inputs from the KVAR to the local groundwater by identifying any links between the KVAD/R groundwater quality and that in the Lidsdale Cut.

Table 7 shows the following changes in the Lidsdale Cut water quality:

- All the water quality parameters and trace metals, including selenium, have lower concentrations than the local/ANZECC (2000) guidelines
- Conductivity and sulphate, as well as the trace metals boron, fluoride, iron, manganese, lead and zinc have decreased to be lower than the pre-placement 90$^{th}$ percentile baselines and nickel is now lower than during the Stage 1 period
- There were no significant changes in concentrations of the other trace metals, including selenium which remained low
- Alkalinity and pH increased, causing the pH to be alkaline for the first time, and even higher than the pre-placement baseline of 6.9.

The alkalinity and pH increases suggest that water from Sawyers Swamp Creek, containing alkaline Springvale Mine water, may have seeped into the Lidsdale Cut void. The increases occurred as early as November, 2011 and may have been due to the water level in the creek being increased by high flows caused by the mine water pipeline leak, which began in July, 2011, aided by a period of high rainfall from November, 2011, and particularly the flooding due to the high rainfall in February and March, 2012. EnergyAustralia NSW confirmed that it is possible that the creek water may have seeped into the void through the surrounding mine spoil.

**Table 7: Median Lidsdale Cut Water Quality during Stage 1 and Capping and Stage 2 Dry Ash Placement periods compared to the current Groundwater Quality at Bore WGM1/D5 and relative to the Pre-placement Baseline 90th Percentile and Groundwater Guidelines or Goals**

| Element (mg/L) | KVAD & KVAR Groundwater (WGM1/D5) | Lidsdale Cut (WX5) | | | | | |
|---|---|---|---|---|---|---|---|
| | Ongoing Stage 2 Post-placement (February, 2012-March, 2013) | Pre-Placement (1992-2003) 90th Percentile | Stage 1 &Cap Post-placement (May, 2003-March, 2010) | Initial Stage 2 Post-placement (April, 2009-March, 2010) | Stage 2A Post-placement (April, 2010-January, 2012) | Ongoing Stage 2 February, 2012 to June, 2012* | Groundwater Guidelines# or Goals |
| pH | 3.7 | 6.9 | 4.3 | 3.4 | 4.8 | 7.3 | 6.5 – 8.0 |
| Cond/ (µS/cm) | 580 | 952 | 1178 | 1965 | 1011 | 590 | 2600^ |
| TDS | 430 | 650 | 870 | 1500 | 740 | 360 | 2000 |
| SO4 | 240 | 359 | 580 | 970 | 460 | 160 | 1000 |
| Cl | 13 | 34 | 18 | 19 | 21 | 13 | 350 |
| Alk | 20 | 38 | 30 | 85 | 84.5 | 100 | - |
| As | 0.001 | <0.001 | 0.002 | 0.002 | 0.002 | 0.001 | 0.024 |
| B | 0.80 | 2.16 | 2.50 | 5.20 | 2.4 | 0.55 | **1.7** |
| Cd | 0.001 | <0.001 | 0.0008 | 0.0008 | 0.0013 | 0.0007 | 0.001 |
| Cr | 0.002 | <0.006 | 0.001 | 0.0013 | 0.001 | 0.001 | 0.004 |
| Cu | 0.003 | <0.005 | 0.003 | 0.003 | 0.004 | 0.0025 | 0.005 |
| F | 0.60 | 1.99 | 3.10 | 6.70 | 2.60 | 0.80 | 1.5 |
| Fe | 0.35 | 0.7 | 0.54 | 3.05 | 0.04 | 0.12 | **1.7** |
| Mn | 3.5 | 2.12 | 3.70 | 6.30 | 4.10 | 0.74 | 1.9 |
| Mo | 0.01 | - | 0.005 | 0.010 | <0.010 | 0.010 | 0.010 |
| Ni | 0.230 | - | 0.375 | 0.540 | 0.280 | 0.030 | **0.137** |
| Pb | 0.002 | 0.004 | 0.003 | 0.003 | 0.002 | 0.001 | **0.01** |
| Se | <0.002 | 0.001 | <0.001 | 0.001 | 0.002 | 0.002 | 0.005 |
| Zn | 0.560 | 0.304 | 0.360 | 1.20 | 0.520 | 0.070 | **0.505** |

* EnergyAustralia NSW was unable to monitor the water quality in the Lidsdale Cut void from July, 2012 due to drawdown of the void water level by the pumps that direct the water to the SSCAD.

The above mentioned Lidsdale Cut decreases in water quality parameters during the current Stage 2 period corresponded with similar decreases in the conductivity and sulphate in bore D5. Most of the trace metals decreased in both the Lidsdale Cut void and in bore D5, with the exception of manganese, nickel and zinc, which remained higher in the D5 groundwater.

These observations are consistent with dilution of the poor water quality in the KVAD, underneath the KVAR, as well as at bore D5, with inflows of low salinity and trace metals from the up-gradient background areas (Figure 6). The diluted groundwater is collected by the KVAD/R toe drains and sub-surface drains and directed to Lidsdale Cut, thereby causing the decreases in concentrations noted above. In addition, some mine water would continue to seep into the void, but under the conditions during the reporting period, the Lidsdale Cut trace metals remained low. As a result, the Lidsdale Cut trace metal concentrations, including selenium, now all meet the local/ANZECC (2000) guideline trigger values.

Figure 10 shows the long-term trends for conductivity, sulphate and boron in Lidsdale Cut. As mentioned in previous reports, the water quality improved as a result of the unblocking of the toe drains in February, 2010 and subsequent installation of the sub-surface drains.

A comparison of Figures 9 and 10 shows similar changes in conductivity, sulphate and boron in the Lidsdale Cut as in bore D5 since 2001. However, in June, 2012, following the prevention of discharge from Lidsdale Cut to Sawyers Swamp Creek in April, 2012, the concentrations of these parameters increased to be above those in bore D5. The sharp increase in concentrations was associated with a decrease in alkalinity and pH to acidic conditions, which suggests that local mine water was entering the void in increased amounts, possibly due to the initial drawdown of the Lidsdale Cut void water level. These water quality changes were also associated with a period of dry weather, after the summer flood, and suggest that the inflows from the KVAD/R drains, as well as mine water seepage from the creek, into the void are determined by rainfall runoff conditions.

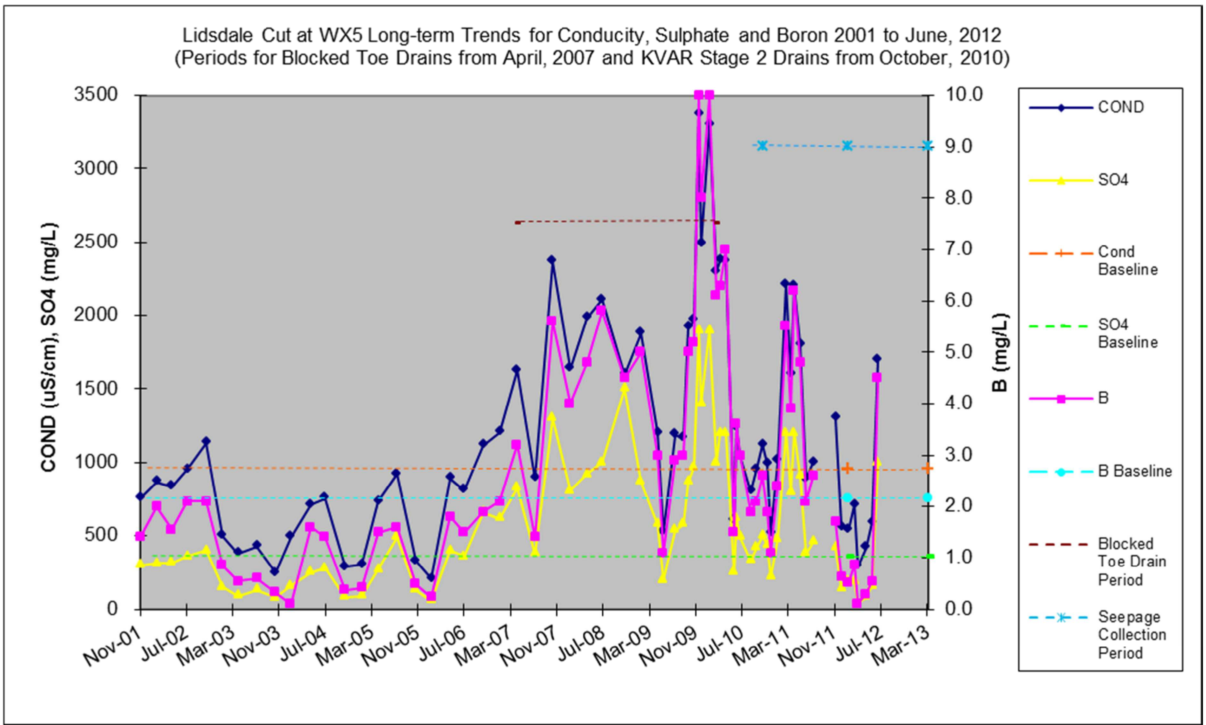


**Figure 10: Lidsdale Cut Long-term Trends in Conductivity, Sulphate and Boron from 2001 to June, 2012 Compared to the Pre-Stage I Baselines (Periods for Blocked toe drains from April, 2007 and KVAR Stage 2 Sub-surface drains from October, 2010 are shown)**

Lidsdale Cut was stopped from discharging to Sawyers Swamp Creek and the water has been pumped out to the SSCAD via the ash slurry return pipeline since July, 2012. Although the void is the low point for collection of groundwater flows in the area and it also receives the sub-surface water from the KVAD/R drains, EnergyAustralia NSW has advised that the water level is now kept lower than the level of Sawyers Swamp Creek. Under these conditions, it is possible that the creek water could seep into the void, particularly during high rainfall events, and be pumped out together with the groundwater flows and the sub-surface drain water to the SSCAD. It is also possible that there will be additional seepage into Lidsdale Cut from the overburden deposits at the back of the void. This means that Lidsdale Cut has ceased to provide an early warning of groundwater changes or potential effects on the Sawyers Swamp Creek receiving waters. Hence, it is suggested that water quality in the void no longer needs to be sampled as part of the routine sampling program.

## 4.6 Sawyers Swamp Creek

Changes in the water quality and trace metals at the Sawyers Swamp Creek receiving water site (WX7) were assessed in Section 3 in relation to the inputs of seepage water from under the SSCAD wall and seepage from the current Stage 2 dry ash KVAD/R ash placements, as well as the Lidsdale Cut discharge until mid-2012. The effects of the Springvale mine water pipeline leak since July, 2011, and its licenced discharge since August, 2012 were also assessed. As WX7 is the final receiving water site for the ash placement areas, this Section examines the overall effects of surface and groundwater seepage on the WX7 receiving waters.

Figure 11 shows the trends for conductivity, sulphate and boron at WX7 from before conversion from wet to dry ash to the current Stage 2 placement period. The trends are compared to the conductivity in the SSCAD (reduced by half to allow direct comparison with the WX7 conductivity on the same scale), as well as the various ash placement management periods that may have affected the water quality at WX7. These include:

- The period when the KVAD toe drains were found to be blocked and subsequently unblocked to allow the KVAD seepage water to drain to Lidsdale Cut
- Springvale Mine water pipeline leak and constant discharge periods
- SSCAD v-notch seepage pump-back, and
- KVAD/R subsurface drain seepage collection and diversion to Lidsdale Cut.

The concentrations of conductivity, sulphate and boron all decreased from their peaks after the toe drains were unblocked, which showed the potential effects of the KVAD/R seepage on the creek without a seepage collection system. The SSCAD pump-back system was installed about the same time the toe drains were unblocked and this was followed soon after by the KVAD/R subsurface drains.

The more recent water quality data has clarified the role of the SSCAD seepage on the water quality at the Sawyers Swamp Creek receiving water site, WX7. Prior to installation of the seepage works in mid-2010 and early 2011, the WX7 creek site conductivity tended to follow that of the SSCAD conductivity. After installation of these systems, the WX7 conductivity decreased in August, 2012 to its lowest level since the late 1990s. However, the SSCAD conductivity also decreased during this period, and the WX7 conductivity continued to follow that of the SSCAD trend. The main differences between WX7 and the SSCAD trends during this period was a large decrease, followed by an increase at WX7, relative to the SSCAD. These changes at WX7 were mostly due to heavy rainfall followed by the mine water pipeline leaks. Since the mine water pipeline discharge became continuous in August, 2012, the WX7 conductivity increased and, as a consequence, there is no current link between the SSCAD conductivity trend and that at WX7.

Since the mine water discharge to the creek became continuous, the concentrations of sulphate and boron at WX7 have decreased to below their respective goals or pre-KVAR baselines, but the conductivity has increased again to about 1,000 µS/cm. The conductivity is now similar to that of the mine water (Table 4). As noted in Section 3, the conductivity increase was due to the relatively high conductivity in the mine water, which is mostly due to the high concentration of alkaline salts, rather than sulphate (Table 3).

Table 3 also shows that, although WX7 is downstream of Dump Creek (WX11), the elevated concentrations of sulphate (701 mg/L) and boron at (2.68 mg/L) at WX11 did not prevent the mine water from diluting the WX7 concentrations to low levels. This supports the view that the mine water flow rate is much higher that the local catchment runoff or the combined seepage rates from the SSCAD and the KVAD/R ash placement areas. This is further supported by the WX11 conductivity of 1519 µS/cm, which was diluted at WX7 to about 1,000 µS/cm by the mine water.

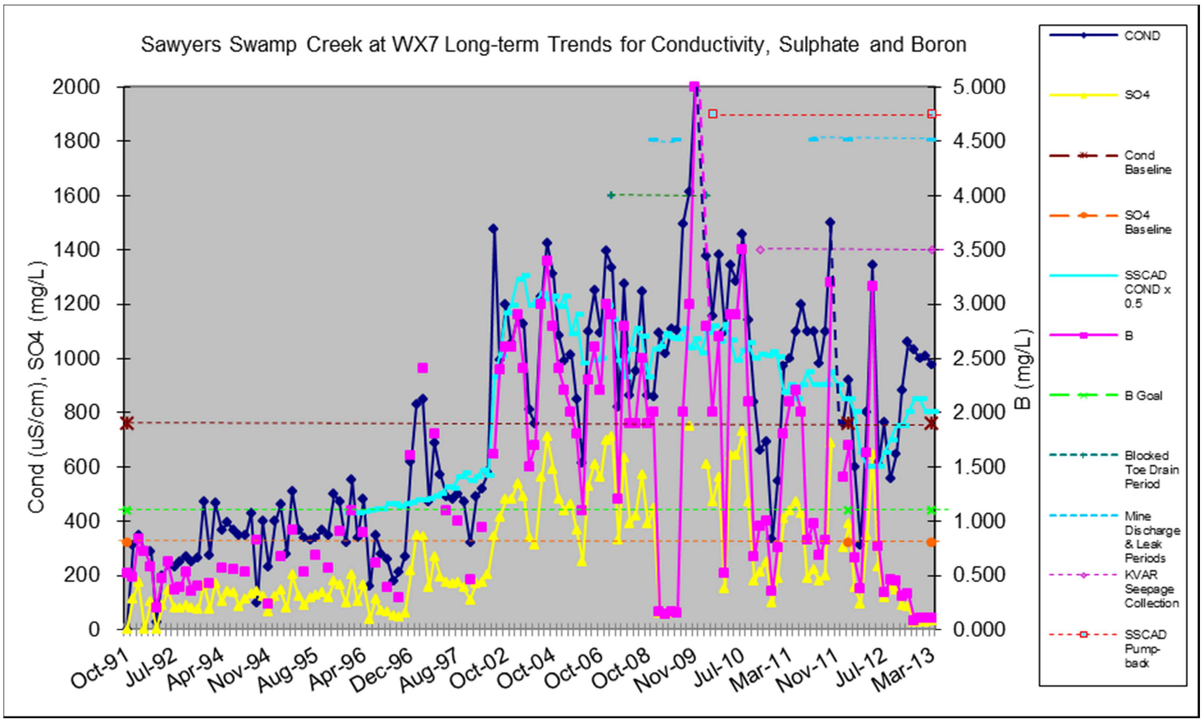


**Figure 11: Sawyers Swamp Creek Long-term trends in Conductivity, Sulphate and Boron in relation to baseline and goals and the SSCAD Conductivity (halved) and Periods shown for the blocked KVAD toe drains, Springvale Mine water discharge and pipeline leak, SSCAD pump-back and KVAD/R seepage collection and diversion to Lidsdale Cut**

## 4.7 Overall Effects of Groundwater Seepage from Ash Placements on Sawyers Swamp Creek Receiving Waters

From the above considerations, the following overall effects of groundwater seepage from the KVAD/R and SSCAD on the WX7 receiving waters, qualified by the local background conditions and the Springvale Mine water, are:

- Prior to August, 2012, the SSCAD seepage dominated the conductivity conditions in Sawyers Swamp Creek other than during high rainfall events and the previous Springvale Mine water pipeline leak and the recent continuous discharge to the creek. Water quality, including conductivity, continued to meet the local/ANZECC (2000) guideline goals and there was no evidence of effects of the seepage on trace metals at WX7.

- After unblocking of the toe drains and installation of the KVAD/R subsurface drains, there were no detectable effects of the Stage 1 and Stage 2 dry ash placements on water quality and trace metals in the creek
- Although the KVAD/R north wall seepage caused a small increase in the sulphate, and possibly boron, in the creek, the sulphate continued to meet the local/ANZECC (2000) guideline goal. The naturally elevated boron levels in the creek were diluted by the Springvale Mine water discharge to below its local goal concentration
- Lidsdale Cut water quality and trace metals met all the local/ANZECC (2000) guideline goals. Accordingly, it is unlikely to have affected the creek receiving waters
- Copper and chromium (as well as aluminium) temporarily increased at WX7 due to local mine spoil seepage after the February/March, 2012 flood
- Springvale Mine water discharge now dominates most of the water quality conditions in the upper (above KVAD/R) and lower (below KVAD/R and Lidsdale Cut) Sawyers Swamp Creek. The discharge lowered the concentrations of boron and zinc at WX7 to below the local goals. An increase in copper and molybdenum occurred at the time of the continuous mine water discharge in the upper creek and the increases were also evident at WX7.

# 5. Discussion

The Sawyers Swamp Creek Ash Dam seepage, and possibly some input from the associated groundwater bore D4, was confirmed as the main determinant of the conductivity in Sawyers Swamp Creek prior to the Springvale mine water discharge, but always met the local/ANZECC guidelines and had no significant effects on trace metals. These conditions have since been surpassed by the Springvale Mine water discharge.

The mine water has completely altered the water quality and trace metals in the creek, but other than increases in copper and molybdenum, the creek water quality downstream of the SSCAD v-notch has continued to meet the local/ANZECC guidelines. As the mine water discharge is expected to continue indefinitely, monitoring of the SSCAD v-notch water quality will be the only means of defining the potential effects of the ash dam seepage on the creek. In addition, the water quality in the SSCAD itself may change, or may already be in the process of changing, as a result of the diversion of the KVAD/R groundwater and Lidsdale Cut water to the ash dam.

As the Springvale Mine water quality is poorly understood, it is suggested that EnergyAustralia NSW test the mine water for trace metals at detection limits lower than the ANZECC (2000) guidelines to confirm effects, if any, on the creek. This is particularly important in regard to understanding the effects of the KVAD/R seepage into the creek.

Notwithstanding the Springvale Mine water discharge, it was apparent that the KVAD/R Seepage has not significantly affected the conductivity or salinity in Sawyers Swamp Creek. Although the trace metal concentrations in the KVAD/R north wall seepage are unknown, the creek data indicates that the seepage was unlikely to significantly affect the concentrations in the creek. To confirm this view, it is suggested that EnergyAustralia NSW test the north wall seepage water for trace metals as well as water quality. As the Springvale Mine water now dominates the water quality and trace metals in the creek, definition of the KVAD/R seepage water quality and trace metal concentrations is needed to allow an effective understanding of potential effects on Sawyers Swamp Creek.

Repair of the KVAD toe drains and installation of sub-surface drains under the KVAR has drawn down the groundwater and in the process appears to have depleted the poor water quality in the KVAD. As a result, the water quality and trace metals in bore D5 and Lidsdale Cut (the receptacle of the drains) has continued to improve. Consequently, the KVAR Stage 1 and Stage 2 dry ash placements did not significantly increase the salinity and trace metal concentrations in the local groundwater, and as a consequence, was not expected to affect the conditions in Sawyers Swamp Creek. Hence, other than the effects of the local background conditions and the mine water, the water quality and trace metal concentrations were lower than the Local/ANZECC (2000) guidelines in the creek’s receiving waters.

The February/March, 2012 flood caused groundwater from the local coal mine spoil to seep into Sawyers Swamp Creek in May, 2012, which made the water acidic and increased the concentrations of conductivity, sulphate and trace metals at the WX7 receiving water site. The trace metal increases did not occur in Sawyers Swamp Creek upstream of Lidsdale Cut, in Lidsdale Cut itself or in Dump Creek, so it is considered unlikely that the increases were related to the KVAD/R Stage 1 and Stage 2 ash placements or Lidsdale Cut. As a result of this event, the Lidsdale Cut discharge was stopped and pumped to Sawyers Swamp Creek Ash Dam but it appears that the effects on Sawyers Swamp Creek were inappropriately assigned to the Lidsdale Cut discharge rather than local mine spoil groundwater seepage.

As the Lidsdale Cut discharge has been stopped and the water is pumped out of the void, Lidsdale Cut could cease to be the early warning site for potential effects of groundwater seepage on Sawyers Swamp Creek. Hence, it is suggested that water quality monitoring in the void may no longer be needed.

The dominant effect of the Springvale Mine water discharge on the Sawyers Swamp Creek receiving water site means that WX7 ceases to be useful as the final receiving water site for the KVAR. This would leave only bore D5 as the site for indication of potential effects on the Sawyers Swamp Creek receiving waters for the KVAR. However, it would be prudent to retain the existing water quality monitoring in Sawyers Swamp Creek so that EnergyAustralia NSW is not incorrectly assigned effects of the local coal mine conditions and the Springvale Mine water discharge.

In summary, the key points from the assessment are:

- SSCAD – confirmed as contributing conductivity and salinity to Sawyers Swamp Creek, but does not exceed the local/ANZECC guidelines for water quality and trace metals
- KVAD – unblocking of the toe drains and installation of the subsurface drains have reduced effects on the local groundwater quality to an acceptable level, when the background conditions are taken into account.
- KVAR – on evidence of significant effects on surface or groundwater quality.
- Springvale Mine water discharge – the water quality conditions in Sawyers Swamp Creek now overridden by the mine water discharge but, other than copper and molybdenum, the creek continued to meet the local/ANZECC guidelines for water quality and trace metals.

The finding for effects on Sawyers Swamp Creek at the receiving water site had to take into account the increase in trace metals due to local coal mine spoil seepage into the creek after the heavy rainfall event of February/March, 2012.

# 6. Conclusions

The findings of this assessment of effects of the Stage 1 and Stage 2 dry ash KVAR placements and the Sawyers Swamp Creek Ash Dam seepage on the surface and groundwater, taking into account the number of management changes (toe drains, subsurface drains, SSCAD v-notch pump-back and Lidsdale Cut stopped discharge) and the beginning of the continuous Springvale Mine water discharge, lead to the following conclusions:

- The SSCAD seepage was associated with a decrease in conductivity in Sawyers Swamp Creek in line with that in the SSCAD until the Springvale Mine water discharge began, after which the conductivity increased and the water quality and trace metals also changed. All the water quality and trace metal concentrations in the creek, downstream of the ash dam v-notch, met the local/ANZECC guideline concentrations, with the exception of copper and molybdenum, which became elevated at the time of the mine water discharge
- KVAD/R North Wall seepage had no observable effects on the conductivity in Sawyers Swamp Creek, and like that upstream at the SSCAD, was also decreasing until the beginning of the Springvale Mine water discharge.
- All the water quality and trace metal concentrations in the creek downstream of the KVAD/R seepage met the local/ANZECC guideline concentrations, with the exception of molybdenum. Both the upstream and downstream molybdenum concentrations were similar and the increases both occurred in October, 2012, shortly after the mine discharge began in August, 2012. However, it is noted that there was no trace metal data for the KVAD/R seepage, so it was recommended that the seepage be tested for trace metals
- The conductivity in Lidsdale Cut and in the groundwater at bore D5 decreased together following reinstatement of the toe drains and installation of the subsurface drains. The improvement in conductivity has continued as the groundwater level in the KAVD/R has decreased.
- Unblocking of the KVAD toe drains, installation of the KVAR sub-surface drains and diversion of the groundwater to Lidsdale Cut provided conditions that reduced the salinity (conductivity), sulphate and trace metals in:
  - The local groundwater at bore D5
  - Lidsdale Cut
  - Sawyers Swamp Creek receiving water site, which had the water quality and trace metal concentrations lower than the Local/ANZECC (2000) guidelines other than effects of the local background conditions and the Springvale Mine water.
- High rainfall during the Stage 2 period introduced high concentrations of trace metals from the local mine spoil into Sawyers Swamp Creek downstream of Lidsdale Cut, causing the receiving waters to exceed some of the local environmental goals.
- Although the water quality data indicates that the KVAR ash placement management effectively controls dry ash leachates from affecting the local groundwater and surface water quality, the advent of the continuous Springvale Mine water discharge has compromised future assessment of potential effects on the Sawyers Swamp Creek receiving water site. As a consequence, appropriate changes to the monitoring program are advisable.

# 7. Recommendations

From the study findings 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 groundwater monitoring sites and make the following changes to the surface water monitoring:
  - Water quality monitoring in the Lidsdale Cut void to cease as part of the routine sampling program
  - Retain the existing water quality monitoring in Sawyers Swamp Creek to avoid assignment of the local coal mines and Springvale Mine water discharge to KVAD/R and/or SSCAD
  - Monitor the Springvale mine water for trace metals at detection limits lower than the ANZECC (2000) guidelines to confirm effects, if any, on the creek
  - Continue to monitor the SSCAD water quality and the v-notch discharge to define the potential effects on Sawyers Swamp Creek
  - Monitor the KVAD/R north wall seepage water for trace metals as well as water quality
  - Silver be removed from the sampling program.

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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 | | | | | | | | | | |

# Attachment 2

## Wallerawang Power Station Ash Dam Surface Water and Groundwater Quality Stage 2 from Feburary, 2012 to March, 2013

Attachment also contains:

- Pre-Dry Ash Placement Summary data before April, 2003 and;
- LLI Sawyers Swap Creek Data from Feburary, 2010 to March, 2013

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, 2013:

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, 2013, 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** |
| 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 |
| 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 |
| 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 |
| 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 |

| | **Mg** |
|---|---|
| Average | 15 |
| Maximum | 39 |
| Minimum | 4 |
| 90th Percentile | 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, 2013. | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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, 2013. | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 2 Dry Ash Placement February, 2012 to March, 2013 (mg/L) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ag | Al | ALK | As | B | Ba | Be | Ca | Cd | Cl | COND | Cr | Cu | F | Fe | Hg | K | Mg |
| Average | <0.001 | 23.8 | 257.4 | 0.007 | 0.634 | 0.031 | | 20 | 0.0011 | 11 | 828 | 0.0128 | 0.0099 | 1.70 | 0.26 | 0.00005 | 15 | 11 |
| Maximum | <0.001 | 272.0 | 515.0 | 0.013 | 3.161 | 0.056 | | 69 | 0.0075 | 19 | 1342 | 0.0550 | 0.0780 | 8.93 | 3.04 | 0.00005 | 54.4 | 30.7 |
| Minimum | <0.001 | 0.16 | 3.8 | 0.001 | 0.087 | 0.014 | | 6 | 0.0002 | 5 | 313 | 0.0020 | 0.0010 | 0.50 | 0.01 | 0.00005 | 8.83 | 2.73 |
| 50th Percentile | 0.001 | 2.03 | 210.0 | 0.006 | 0.359 | 0.030 | | 14 | 0.0002 | 11 | 841.5 | 0.0020 | 0.0025 | 1.16 | 0.04 | 0.00005 | 11 | 9.425 |

| Continued………… Sawyers Swamp Creek WX7 Post-Stage 2A Dry Ash Placement February, 2012 to March, 2013 (mg/L) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mn | Mo | NO2+NO3 | Na | NFR | Ni | Ortho P | Pb | pH | Se | SiO2 | SO4 | TDS | TOT P | Zn |
| Average | 0.72 | 0.015 | 0 | 155 | 107 | 0.059 | | 0.003 | 7.5 | 0.001 | | 156 | 553 | 0.045 | 0.208 |
| Maximum | 3.67 | 0.042 | 0.55 | 284 | 1088 | 0.281 | | 0.015 | 8.6 | 0.002 | | 648 | 1046 | 0.100 | 0.924 |
| Minimum | 0.00 | 0.001 | 0.25 | 31 | 3 | 0.004 | | 0.001 | 4.6 | 0.001 | | 27 | 156 | 0.020 | 0.022 |
| 50th Percentile | 0.40 | 0.010 | 0.275 | 137 | 25 | 0.033 | | 0.002 | 7.9 | 0.001 | | 106 | 580 | 0.045 | 0.093 |

## 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) February, 2012 to March, 2013 | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **Al** | **ALK** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| 22-Feb-12 | 0.001 | 0.5 | 20 | <0.001 | 2 | 0.02 | | 55 | 0.0002 | 21 | 1100 | 0.001 | 0.002 | 0.5 | 0.27 | 0.00005 | 24 | 48 |
| 8-Mar-12 | 0.001 | 0.21 | 20 | <0.001 | 0.89 | 0.016 | | 38 | 0.0002 | 18 | 670 | 0.001 | 0.002 | 0.4 | 0.33 | 0.00005 | 15 | 25 |
| 19-Apr-12 | 0.001 | 1.6 | 20 | <0.001 | 2.6 | 0.025 | | 62 | 0.0002 | 24 | 1400 | 0.001 | 0.003 | 1.4 | 3.3 | 0.00005 | 28 | 59 |
| 23-May-12 | 0.001 | 1.5 | 20 | <0.001 | 2.8 | 0.025 | | 68 | 0.0003 | 24 | 1600 | 0.001 | 0.005 | 1.3 | 6.4 | 0.00005 | 31 | 67 |
| 21-Jun-12 | 0.001 | 1.1 | 20 | <0.001 | 2.5 | 0.027 | | 73 | 0.0003 | 26 | 1400 | 0.001 | 0.003 | 1.1 | 3.8 | 0.00005 | 27 | 65 |
| 27-Jul-12 | 0.001 | 0.89 | 20 | <0.001 | 2.2 | 0.026 | | 73 | 0.0002 | 26 | 1400 | 0.001 | 0.002 | 0.9 | 1.2 | 0.00005 | 24 | 64 |
| 15-Aug-12 | 0.001 | 2.2 | 20 | <0.001 | 2.8 | 0.026 | | 81 | 0.0003 | 28 | 1600 | 0.001 | 0.005 | 1.7 | 4.5 | 0.00005 | 30 | 72 |
| 13-Sep-12 | 0.001 | 0.49 | 20 | 0.001 | 1.6 | 0.023 | | 57 | 0.0002 | 55 | 1300 | 0.001 | 0.009 | 0.5 | 0.89 | 0.00005 | 28 | 50 |
| 11-Oct-12 | 0.001 | 2 | 20 | <0.001 | 3 | 0.024 | | 69 | 0.0004 | 24 | 1500 | 0.001 | 0.007 | 1.6 | 21 | 0.00005 | 30 | 66 |
| 14-Nov-12 | 0.001 | 2.3 | 20 | <0.001 | 3.7 | 0.039 | | 84 | 0.0004 | 25 | 1900 | 0.001 | 0.004 | 3 | 11 | 0.00005 | 38 | 76 |
| 12-Dec-12 | 0.001 | 2.5 | 25 | <0.001 | 3.5 | 0.022 | | 82 | 0.0005 | 23 | 1900 | 0.001 | 0.005 | 2 | 10 | 0.00005 | 41 | 75 |
| 17-Jan-13 | 0.001 | 4 | 25 | <0.001 | 3.4 | 0.038 | | 79 | 0.0007 | 29 | 1800 | 0.001 | 0.013 | 1.8 | 11 | 0.00005 | 38 | 75 |
| 21-Feb-13 | 0.001 | 3.3 | 25 | 0.001 | 3.4 | 0.02 | | 90 | 0.0006 | 23 | 1800 | 0.001 | 0.008 | 2.5 | 11 | 0.00005 | 39 | 79 |
| 13-Mar-13 | 0.001 | 2.8 | 25 | <0.001 | 3.1 | 0.022 | | 89 | 0.0006 | 110 | 1900 | 0.004 | 0.007 | 0.3 | 8.8 | 0.00005 | 40 | 79 |

| Continued……………………..Dump Creek WX11 Post-Dry Ash Placement Data (mg/l) February, 2012 to March, 2013 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Mn | Mo | Na | NFR | Ni | Pb | pH | Se | SO4 | TDS | Zn |
| 22-Feb-12 | 4.3 | 0.01 | 90 | | 0.27 | 0.001 | 3.9 | 0.002 | 490 | 740 | 0.57 |
| 8-Mar-12 | 1.3 | 0.01 | 51 | | 0.1 | 0.001 | 6.5 | 0.002 | 270 | 440 | 0.21 |
| 19-Apr-12 | 5 | 0.01 | 110 | | 0.34 | 0.001 | 3.4 | 0.002 | 620 | 980 | 0.85 |
| 23-May-12 | 6.5 | 0.01 | 110 | | 0.46 | 0.001 | 3.3 | 0.002 | 730 | 1100 | 1.1 |
| 21-Jun-12 | 6.2 | 0.01 | 100 | | 0.39 | 0.001 | 3.4 | 0.002 | 690 | 1100 | 0.9 |
| 27-Jul-12 | 6.3 | 0.01 | 94 | | 0.33 | 0.001 | 3.5 | 0.002 | 670 | 1000 | 0.71 |
| 15-Aug-12 | 7.2 | 0.01 | 120 | | 0.48 | 0.001 | 3.4 | 0.002 | 780 | 1200 | 1.2 |
| 13-Sep-12 | 4.1 | 0.01 | 120 | | 0.16 | 0.001 | 3.5 | 0.002 | 540 | 860 | 0.4 |
| 11-Oct-12 | 6.9 | 0.01 | 110 | | 0.49 | 0.003 | 3.2 | 0.002 | 710 | 1100 | 1.3 |
| 14-Nov-12 | 8.5 | 0.01 | 130 | | 0.59 | 0.003 | 3 | 0.002 | 860 | 1200 | 1.5 |
| 12-Dec-12 | 8.1 | 0.01 | 120 | | 0.6 | 0.004 | 3.2 | 0.002 | 900 | 1300 | 1.6 |
| 17-Jan-13 | 7.6 | 0.01 | 110 | | 0.57 | 0.008 | 3.1 | 0.002 | 820 | 1200 | 1.7 |
| 21-Feb-13 | 7.9 | 0.01 | 150 | | 0.59 | 0.004 | 3.1 | 0.002 | 880 | 1300 | 1.6 |
| 13-Mar-13 | 8.1 | 0.01 | 130 | | 0.62 | 0.004 | 3.1 | 0.002 | 850 | 1300 | 1.7 |

| Dump Creek WX11 Post-Stage 2 Dry Ash Placement February, 2012 to March, 2013 (mg/L) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ag | Al | ALK | As | B | Ba | Be | Ca | Cd | Cl | COND | Cr | Cu | F | Fe | Hg | K | Mg |
| Average | <0.001 | 1.8 | 21.4 | 0.001 | 2.678 | 0.025 | | 71 | 0.0004 | 33 | 1519 | 0.0012 | 0.0054 | 1.36 | 6.68 | 0.00005 | 31 | 64 |
| Maximum | <0.001 | 4.0 | 25.0 | 0.001 | 3.700 | 0.039 | | 90 | 0.0007 | 110 | 1900 | 0.0040 | 0.0130 | 3.00 | 21.00 | 0.00005 | 41 | 79 |
| Minimum | <0.001 | 0.21 | <20 | 0.001 | 0.890 | 0.016 | | 38 | 0.0002 | 18 | 670 | 0.0010 | 0.0020 | 0.30 | 0.27 | 0.00005 | 15 | 25 |
| 50th Percentile | <0.001 | 1.80 | 20.0 | 0.001 | 2.800 | 0.025 | | 73 | 0.0003 | 24.5 | 1550 | 0.0010 | 0.0050 | 1.35 | 5.45 | 0.00005 | 30 | 66.5 |

| Continued…………….Dump Creek WX11 Post-Stage 2 Dry Ash Placement February, 2012 to March, 2013 (mg/L) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mn | Mo | Na | NFR | Ni | Pb | pH | Se | SO4 | TDS | Zn |
| Average | 6.29 | 0.010 | 110 | | 0.428 | 0.002 | 3.5 | 0.002 | 701 | 1059 | 1.096 |
| Maximum | 8.50 | 0.010 | 150 | | 0.620 | 0.008 | 6.5 | 0.002 | 900 | 1300 | 1.700 |
| Minimum | 1.30 | 0.010 | 51 | | 0.100 | 0.001 | 3 | 0.002 | 270 | 440 | 0.210 |
| 50th Percentile | 6.70 | 0.010 | 110 | | 0.470 | 0.001 | 3.35 | 0.002 | 720 | 1100 | 1.150 |

## 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) February, 2012 to March, 2013 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **Al** | **ALK** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| 22-Feb-12 | 0.001 | 9.2 | 130 | 0.002 | 0.87 | 0.029 | | 24 | 0.0015 | 13 | 710 | 0.001 | 0.003 | 1.2 | <0.01 | 0.00005 | 18 | 11 |
| 8-Mar-12 | 0.001 | 0.28 | 85 | 0.001 | 0.11 | 0.032 | | 5.8 | 0.0002 | 11 | 290 | <0.001 | <0.001 | 0.2 | 0.23 | 0.00005 | 4 | 4 |
| 19-Apr-12 | 0.001 | 1.4 | 110 | 0.001 | 0.29 | 0.032 | | 11 | 0.0002 | 13 | 420 | <0.001 | 0.002 | 0.5 | 0.02 | 0.00005 | 7 | 7 |
| 23-May-12 | 0.001 | 3.5 | 100 | 0.001 | 0.55 | 0.037 | | 19 | 0.0007 | 15 | 590 | 0.001 | 0.002 | 0.8 | 0.02 | 0.00005 | 10 | 10 |
| 21-Jun-12 | <0.001 | 65 | 20 | <0.001 | 4.5 | 0.032 | | 93 | 0.016 | 21 | 1700 | 0.011 | 0.02 | 13 | 0.22 | <0.00005 | 72 | 36 |
| 27-Jul-12 | | | | | | | | | | | | | | | | | | |
| 15-Aug-12 | | | | | | | | | | | | | | | | | | |
| 13-Sep-12 | | | | | | | | | | | | | | | | | | |
| 11-Oct-12 | | | | | | | | | | | | | | | | | | |
| 14-Nov-12 | | | | | | | | | | | | | | | | | | |
| 12-Dec-12 | | | | | | | | | | | | | | | | | | |
| 17-Jan-13 | | | | | | | | | | | | | | | | | | |
| 21-Feb-13 | | | | | | | | | | | | | | | | | | |
| 13-Mar-13 | | | | | | | | | | | | | | | | | | |

| Continued…….Lidsdale Cut WX5 Post-Dry Ash Placement Data (mg/l) February, 2012 to March, 2013 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **NFR** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| 22-Feb-12 | 1 | 0.01 | 110 | | 0.08 | 0.001 | 7.3 | 0.002 | 190 | 420 | 0.2 |
| 8-Mar-12 | 0.045 | 0.01 | 54 | | 0.01 | 0.001 | 8 | 0.002 | 38 | 150 | 0.03 |
| 19-Apr-12 | 0.26 | 0.01 | 76 | | 0.01 | 0.001 | 7.6 | 0.002 | 83 | 280 | 0.03 |
| 23-May-12 | 0.74 | 0.01 | 84 | | 0.03 | 0.001 | 7.2 | 0.002 | 160 | 360 | 0.07 |
| 21-Jun-12 | 5.4 | <0.01 | 100 | | 0.44 | 0.002 | 4.2 | 0.003 | 1000 | 1600 | 1.2 |
| 27-Jul-12 | | | | | | | | | | | |
| 15-Aug-12 | | | | | | | | | | | |
| 13-Sep-12 | | | | | | | | | | | |
| 11-Oct-12 | | | | | | | | | | | |
| 14-Nov-12 | | | | | | | | | | | |
| 12-Dec-12 | | | | | | | | | | | |
| 17-Jan-13 | | | | | | | | | | | |
| 21-Feb-13 | | | | | | | | | | | |
| 13-Mar-13 | | | | | | | | | | | |

| Lidsdale Cut WX5 Post-Stage 2 Dry Ash Placement February, 2012 to March, 2013 (mg/L) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ag | Al | ALK | As | B | Ba | Be | Ca | Cd | Cl | COND | Cr | Cu | F | Fe | Hg | K | Mg |
| Average | <0.001 | 15.9 | 89.0 | 0.001 | 1.264 | 0.032 | | 31 | 0.0037 | 15 | 742 | 0.0043 | 0.0068 | 3.14 | 0.12 | 0.00005 | 22 | 14 |
| Maximum | <0.001 | 65.0 | 130.0 | 0.002 | 4.500 | 0.037 | | 93 | 0.0160 | 21 | 1700 | 0.0110 | 0.0200 | 13.00 | 0.23 | 0.00005 | 72 | 36 |
| Minimum | <0.001 | 0.28 | 20 | 0.001 | 0.110 | 0.029 | | 6 | 0.0002 | 11 | 290 | 0.0010 | 0.0020 | 0.20 | 0.02 | 0.00005 | 4 | 4 |
| 50th Percentile | <0.001 | 3.50 | 100.0 | 0.001 | 0.550 | 0.032 | | 19 | 0.0007 | 13 | 590 | 0.0010 | 0.0025 | 0.80 | 0.12 | 0.00005 | 10 | 10 |

| Continued………..Lidsdale Cut WX5 Post-Stage 2 Dry Ash Placement February, 2012 to March, 2013 (mg/L) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mn | Mo | Na | NFR | Ni | Pb | pH | Se | SO4 | TDS | Zn |
| Average | 1.49 | 0.010 | 85 | | 0.114 | 0.001 | 6.9 | 0.002 | 294 | 303 | 0.306 |
| Maximum | 5.40 | 0.010 | 110 | | 0.440 | 0.002 | 8 | 0.003 | 1000 | 420 | 1.200 |
| Minimum | 0.05 | 0.010 | 54 | | 0.010 | 0.001 | 4.2 | 0.002 | 38 | 150 | 0.030 |
| 50th Percentile | 0.74 | 0.010 | 84 | | 0.030 | 0.001 | 7.3 | 0.002 | 160 | 320 | 0.070 |

## 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, 2013 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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, 2013 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **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) February, 2012 to March, 2013 | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **Al** | **ALK** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| 30-Mar-12 | <0.001 | 0.5 | 31 | <0.001 | 0.05 | 0.02 | | 2.5 | <0.0001 | 11 | 140 | <0.001 | 0.002 | <0.1 | 0.77 | <0.00005 | 3 | <1 |
| 20-Apr-12 | <0.001 | 0.39 | 36 | <0.001 | 0.04 | 0.022 | | 2.9 | <0.0002 | 10 | 130 | <0.001 | 0.002 | <0.1 | 0.72 | 0.00006 | 3 | <1 |
| 09-May-12 | | | | | | | | | | | | | | | | | | |
| 27-Jun-12 | <0.001 | 0.67 | 28 | <0.001 | 0.03 | 0.023 | | 3.6 | <0.0002 | 9 | 120 | <0.001 | 0.003 | <0.1 | 0.3 | <0.00005 | 3 | 2 |
| 26-Jul-12 | <0.001 | 0.34 | 28 | <0.001 | 0.03 | 0.014 | | 2.9 | <0.0002 | 8 | 130 | <0.001 | 0.001 | <0.1 | 0.31 | <0.00005 | 2 | 1 |
| 15-Aug-12 | <0.001 | 0.2 | 31 | <0.001 | 0.03 | 0.011 | | 2.9 | <0.0002 | 9 | 140 | <0.001 | 0.002 | <0.1 | 0.38 | <0.00005 | 2 | 1 |
| 14-Sep-12 | <0.001 | 1.3 | 35 | <0.001 | 0.03 | 0.079 | | 5.7 | <0.0002 | 9 | 150 | <0.001 | 0.005 | <0.1 | 0.5 | <0.00005 | 6 | 1 |
| 11-Oct-12 | <0.001 | 0.6 | 35 | <0.001 | 0.02 | 0.027 | | 2.5 | <0.0002 | 8 | 130 | <0.001 | 0.002 | <0.1 | 3.9 | <0.00005 | 2 | <1 |
| 14-Nov-12 | <0.001 | 0.2 | 40 | <0.001 | 0.03 | 0.014 | | 2.6 | <0.0002 | 8 | 150 | <0.001 | 0.002 | <0.1 | 1.2 | <0.00005 | 2 | <1 |
| 12-Dec-12 | <0.001 | 0.75 | 46 | <0.001 | 0.02 | 0.035 | | 3.1 | <0.0002 | 9 | 160 | 0.004 | 0.002 | <0.1 | 3.1 | <0.00005 | 3 | 1 |
| 21-Feb-13 | <0.001 | 1.8 | <25 | <0.001 | 0.05 | 0.051 | | 4.5 | <0.0002 | 9 | 190 | <0.001 | 0.003 | <0.1 | 0.09 | <0.00005 | 4 | 2 |
| 13-Mar-13 | <0.001 | 0.51 | <25 | <0.001 | 0.05 | 0.014 | | 1.4 | <0.0002 | 10 | 140 | <0.001 | 0.002 | <0.1 | 0.62 | <0.00005 | 2 | <1 |

| Continued……. Sawyers Swamp Creek Upstream of SSCAD WX1 Post-Dry Ash Placement Data (mg/l) February, 2012 to March, 2013 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **NFR** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| 30-Mar-12 | 0.002 | <0.01 | 27 | 14 | <0.01 | <0.001 | 6.3 | <0.002 | 16 | 99 | <0.01 |
| 20-Apr-12 | 0.066 | <0.01 | 26 | 11 | <0.01 | <0.001 | 6.6 | <0.002 | 13 | 92 | 0.02 |
| 09-May-12 | | | | | | | | | | | |
| 27-Jun-12 | 0.005 | <0.01 | 20 | 34 | <0.01 | <0.001 | 6.8 | <0.002 | 16 | 99 | 0.04 |
| 26-Jul-12 | <0.001 | <0.01 | 21 | 13 | <0.01 | <0.001 | 6.7 | <0.002 | 20 | 85 | <0.01 |
| 15-Aug-12 | 0.004 | <0.01 | 25 | 6.8 | <0.01 | <0.001 | 6.8 | <0.002 | 26 | 81 | 0.02 |
| 14-Sep-12 | 0.55 | <0.01 | 27 | 100 | <0.01 | 0.002 | 6.5 | <0.002 | 22 | 89 | 0.05 |
| 11-Oct-12 | 0.35 | <0.01 | 26 | 19 | <0.01 | <0.001 | 6.4 | <0.002 | 20 | 100 | 0.01 |
| 14-Nov-12 | 0.04 | <0.01 | 27 | 6.6 | <0.01 | <0.001 | 6.6 | <0.002 | 18 | 90 | 0.03 |
| 12-Dec-12 | 1 | <0.01 | 26 | 45 | <0.01 | 0.001 | 7 | <0.002 | 17 | 110 | 0.04 |
| 21-Feb-13 | 0.29 | <0.01 | 30 | 110 | <0.01 | 0.002 | 6.4 | <0.002 | 52 | 120 | 0.03 |
| 13-Mar-13 | 0.036 | <0.01 | 27 | 12 | <0.01 | <0.001 | 6.3 | <0.002 | 31 | 100 | 0.03 |

| Sawyers Swamp Creek Upstream of SSCAD WX1 Post-Dry Ash Placement Data (mg/l) February, 2012 to March, 2013 | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Ag** | **Al** | **ALK** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| Average | <0.001 | 0.66 | 34 | <0.001 | 0.035 | 0.028 | | 3.1 | <0.0002 | 9 | 144 | 0.004 | 0.002 | <0.1 | 1.08 | 0.00006 | 3 | 1 |
| Maximum | <0.001 | 1.8 | 46 | <0.001 | 0.05 | 0.079 | | 5.7 | <0.0002 | 11 | 190 | 0.004 | 0.005 | <0.1 | 3.9 | 0.00006 | 6 | 2 |
| Minimum | <0.001 | 0.2 | 28 | <0.001 | 0.02 | 0.011 | | 1.4 | <0.0002 | 8 | 120 | 0.004 | 0.001 | <0.1 | 0.09 | 0.00006 | 2 | 1 |
| 50th Percentile | <0.001 | 0.51 | 35 | <0.001 | 0.03 | 0.022 | | 2.9 | <0.0002 | 9 | 140 | 0.004 | 0.002 | <0.1 | 0.62 | 0.00006 | 3 | 1 |

| Continued……….. Sawyers Swamp Creek Upstream of SSCAD WX1 Post-Dry Ash Placement Data (mg/l) February, 2012 to March, 2013 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Mn** | **Mo** | **Na** | **NFR** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| Average | 0.23 | <0.01 | 26 | 33.8 | <0.01 | 0.002 | 6.6 | <0.002 | 23 | 97 | 0.03 |
| Maximum | 1 | <0.01 | 30 | 110 | <0.01 | 0.002 | 7 | <0.002 | 52 | 120 | 0.05 |
| Minimum | 0.002 | <0.01 | 20 | 6.6 | <0.01 | 0.001 | 6.3 | <0.002 | 13 | 81 | 0.01 |
| 50th Percentile | 0.053 | <0.01 | 26 | 14 | <0.01 | 0.002 | 6.6 | <0.002 | 20 | 99 | 0.03 |

## 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) February, 2012 to March 2013 | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 23-Feb-12 | 0.001 | 65 | 1.5 | 0.006 | 0.04 | 0.056 | | 9.3 | 0.0002 | 38 | | 370 | 0.004 | 0.009 | 0.1 | 3.2 | 0.00005 | 5 | | 14 |
| 30-Mar-12 | 0.001 | 92 | 1.2 | 0.011 | 0.03 | 0.069 | | 12 | 0.0002 | 59 | | 490 | 0.002 | 0.002 | 0.1 | 6.7 | 0.00005 | 6 | | 19 |
| 20-Apr-12 | 0.001 | 100 | 0.2 | 0.01 | 0.02 | 0.069 | | 14 | 0.0002 | 66 | | 540 | 0.002 | 0.002 | 0.1 | 9.3 | 0.00005 | 6 | | 22 |
| 9-May-12 | 0.001 | 110 | 0.1 | 0.005 | 0.02 | 0.08 | | 16 | 0.0002 | 77 | | 620 | 0.002 | 0.003 | 0.1 | 7.2 | 0.00005 | 6 | | 25 |
| 27-Jun-12 | | | | | | | | | | | | | | | | | | | | |
| 26-Jul-12 | 0.001 | 84 | 0.67 | 0.003 | 0.02 | 0.071 | | 13 | 0.0002 | 65 | | 500 | 0.003 | 0.003 | 0.1 | 0.41 | 0.00005 | 6 | | 19 |
| 15-Aug-12 | 0.001 | 110 | 0.22 | 0.004 | 0.02 | 0.076 | | 14 | 0.0002 | 74 | | 570 | <0.001 | 0.003 | 0.1 | 4.2 | 0.00005 | 6 | | 21 |
| 14-Sep-12 | 0.001 | 110 | 0.08 | 0.006 | 0.02 | 0.078 | | 17 | 0.0002 | 75 | | 600 | <0.001 | 0.002 | 0.1 | 0.04 | 0.00005 | 7 | | 23 |
| 11-Oct-12 | 0.001 | 91 | 0.73 | 0.008 | 0.02 | 0.072 | | 14 | 0.0002 | 65 | | 500 | <0.001 | 0.005 | 0.1 | 5.1 | 0.00005 | 6 | | 20 |
| 14-Nov-12 | 0.001 | 110 | 0.12 | 0.004 | <0.01 | 0.081 | | 16 | 0.0002 | 77 | | 620 | <0.001 | 0.015 | 0.1 | 1.6 | 0.00005 | 7 | | 23 |
| 12-Dec-12 | 0.001 | 120 | 0.06 | 0.002 | <0.01 | 0.087 | | 18 | 0.0002 | 81 | | 660 | <0.001 | 0.025 | 0.1 | 2.5 | 0.00005 | 8 | | 24 |
| 16-Jan-13 | 0.001 | 110 | 0.15 | 0.002 | 0.04 | 0.084 | | 16 | 0.0002 | 74 | | 590 | <0.001 | 0.088 | 0.1 | 5 | 0.00005 | 7 | | 23 |
| 20-Feb-13 | 0.001 | 87 | 0.25 | 0.004 | 0.07 | 0.069 | | 15 | 0.0002 | 56 | | 480 | 0.001 | 0.004 | 0.1 | 8.2 | 0.00005 | 6 | | 20 |
| 13-Mar-13 | 0.001 | 55 | 0.4 | 0.003 | 0.12 | 0.07 | | 14 | 0.0002 | 47 | | 420 | 0.001 | 0.021 | 0.1 | 3.2 | 0.00005 | 5 | | 17 |

| Continued…….WGM1/D3 Post-Dry Ash Placement Data (mg/L) February, 2012 to March 2013 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **WL1** | **WL AHD** | **Zn** |
| 23-Feb-12 | 1 | 0.01 | 49 | 0.14 | 0.005 | 5.8 | 0.002 | 45 | 310 | 9.5 | 920.70 | 0.09 |
| 30-Mar-12 | 1.2 | 0.01 | 62 | 0.15 | 0.002 | 6.1 | 0.002 | 55 | 350 | 9.6 | 920.60 | 0.07 |
| 20-Apr-12 | 1.1 | 0.01 | 69 | 0.14 | 0.001 | 7.4 | 0.002 | 60 | 340 | 9.8 | 920.40 | 0.05 |
| 9-May-12 | 0.8 | 0.01 | 65 | 0.13 | 0.001 | 6.3 | 0.002 | 66 | 350 | | | 0.07 |
| 27-Jun-12 | | | | | | | | | | | | |
| 26-Jul-12 | 0.58 | 0.01 | 60 | 0.1 | 0.002 | 6 | 0.002 | 58 | 310 | 9.9 | 920.30 | 0.09 |
| 15-Aug-12 | 0.64 | 0.01 | 66 | 0.11 | 0.001 | 6 | 0.002 | 68 | 370 | 9.9 | 920.30 | 0.1 |
| 14-Sep-12 | 0.63 | 0.01 | 72 | 0.11 | 0.002 | 6.4 | 0.002 | 73 | 340 | 10 | 920.20 | 0.22 |
| 11-Oct-12 | 0.57 | 0.01 | 66 | 0.1 | 0.002 | 6 | 0.002 | 68 | 300 | 10 | 920.20 | 0.32 |
| 14-Nov-12 | 0.66 | 0.01 | 71 | 0.12 | 0.001 | 6.2 | 0.002 | 78 | 330 | 10.2 | 920.00 | 0.04 |
| 12-Dec-12 | 0.71 | 0.01 | 76 | 0.13 | 0.001 | 6.1 | 0.002 | 81 | 410 | 10.3 | 919.90 | 0.07 |
| 16-Jan-13 | 0.82 | 0.01 | 66 | 0.14 | 0.001 | 6.1 | 0.002 | 73 | 330 | 10.1 | 920.10 | 0.06 |
| 20-Feb-13 | 1 | 0.01 | 62 | 0.11 | 0.001 | 6.1 | 0.002 | 62 | 300 | 9.7 | 920.50 | 0.03 |
| 13-Mar-13 | 0.95 | 0.01 | 46 | 0.09 | 0.001 | 5.7 | 0.002 | 71 | 280 | 9.4 | 920.80 | 0.05 |

| WGM1/D3 Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ag | ALK | Al | As | B | Ba | Be | Ca | Cd | Cl | COND | Cr | Cu | F | Fe | Hg | K | Mg |
| Average | <0.001 | 96 | 0.44 | 0.0052 | 0.04 | 0.074 | | 14 | 0.0002 | 66 | 535 | 0.0021 | 0.0140 | 0.10 | 4.4 | 0.00005 | 6 | 21 |
| Maximum | <0.001 | 120 | 1.50 | 0.0110 | 0.12 | 0.087 | | 18 | 0.0002 | 81 | 660 | 0.0040 | 0.0880 | 0.10 | 9.3 | 0.00005 | 8 | 25 |
| Minimum | <0.001 | 55 | 0.06 | 0.0020 | 0.02 | 0.056 | | 9 | 0.0002 | 38 | 370 | 0.0010 | 0.0020 | 0.10 | 0.0 | 0.00005 | 5 | 14 |
| 50th Percentile | <0.001 | 100 | 0.22 | 0.0040 | 0.02 | 0.072 | | 14 | 0.0002 | 66 | 540 | 0.0020 | 0.0040 | 0.10 | 4.2 | 0.00005 | 6 | 21 |

| Continued……….. WGM1/D3 Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mn | Mo | Na | Ni | Pb | pH | Se | SO4 | TDS | WL1 | WL AHD | Zn |
| Average | 0.82 | 0.010 | 64 | 0.121 | 0.002 | 6.2 | 0.002 | 66 | 332 | 9.9 | 920.3 | 0.097 |
| Maximum | 1.20 | 0.010 | 76 | 0.150 | 0.005 | 7.4 | 0.002 | 81 | 410 | 10.3 | 920.8 | 0.320 |
| Minimum | 0.57 | 0.010 | 46 | 0.090 | 0.001 | 5.7 | 0.002 | 45 | 280 | 9.4 | 919.9 | 0.030 |
| 50th Percentile | 0.80 | 0.010 | 66 | 0.120 | 0.001 | 6.1 | 0.002 | 68 | 330 | 9.9 | 920.3 | 0.070 |

*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 February, 2012 to March 2013 (mg/l) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 23-Feb-12 | 0.001 | 20 | 0.02 | 0.002 | 1.4 | 0.016 | | 98 | 0.0002 | 35 | 1500 | 0.001 | 0.001 | 0.1 | 39 | 0.00005 | 10 | | 67 |
| 30-Mar-12 | 0.001 | 34 | 0.16 | 0.002 | 0.67 | 0.034 | | 88 | 0.0002 | 33 | 1000 | 0.001 | 0.001 | 0.1 | 19 | 0.00005 | 9 | | 41 |
| 20-Apr-12 | 0.001 | 20 | 0.02 | 0.002 | 1.5 | 0.026 | | 100 | 0.0002 | 34 | 1400 | 0.001 | 0.002 | 0.1 | 45 | 0.00005 | 10 | | 66 |
| 9-May-12 | 0.001 | 23 | 0.02 | 0.002 | 1.6 | 0.027 | | 100 | 0.0002 | 36 | 1500 | 0.001 | 0.003 | 0.1 | 49 | 0.00005 | 9 | | 72 |
| 27-Jun-12 | 0.001 | 37 | 0.03 | 0.002 | 1.0 | 0.021 | | 93 | 0.0002 | 38 | 1300 | 0.001 | 0.003 | 0.1 | 49 | 0.00005 | 10 | | 59 |
| 26-Jul-12 | 0.001 | 20 | 0.01 | 0.002 | 1.5 | 0.021 | | 100 | 0.0002 | 35 | 1400 | 0.001 | 0.003 | 0.1 | 39 | 0.00005 | 12 | | 69 |
| 15-Aug-12 | 0.001 | 21 | 0.02 | 0.002 | 1.5 | 0.021 | | 95 | 0.0002 | 38 | 1400 | 0.001 | 0.001 | 0.1 | 53 | 0.00005 | 9 | | 68 |
| 14-Sep-12 | 0.001 | 20 | 0.01 | 0.002 | 1.6 | 0.021 | | 100 | 0.0002 | 35 | 1500 | 0.001 | 0.002 | 0.1 | 43 | 0.00005 | 12 | | 69 |
| 11-Oct-12 | 0.001 | 20 | <0.01 | 0.002 | 1.6 | 0.018 | | 100 | 0.0002 | 34 | 1400 | 0.001 | 0.003 | 0.1 | 89 | 0.00005 | 9 | | 70 |
| 14-Nov-12 | 0.001 | 20 | 0.01 | 0.002 | 1.9 | 0.021 | | 110 | 0.0002 | 33 | 1600 | 0.001 | 0.003 | 0.1 | 36 | 0.00005 | 10 | | 74 |
| 12-Dec-12 | 0.001 | 33 | 0.02 | 0.002 | 1.9 | 0.019 | | 110 | 0.0002 | 33 | 1600 | 0.001 | 0.002 | 0.1 | 29 | 0.00005 | 11 | | 75 |
| 16-Jan-13 | 0.001 | 32 | 0.01 | 0.002 | 2.0 | 0.018 | | 110 | 0.0002 | 31 | 1500 | 0.001 | 0.004 | 0.1 | 28 | 0.00005 | 11 | | 74 |
| 20-Feb-13 | 0.001 | 38 | 0.02 | 0.002 | 1.8 | 0.015 | | 120 | 0.0002 | 32 | 1500 | 0.001 | 0.004 | 0.1 | 27 | 0.00005 | 10 | | 79 |
| 13-Mar-13 | 0.001 | 35 | 0.45 | 0.002 | 1.2 | 0.023 | | 110 | 0.0002 | 38 | 1500 | 0.001 | 0.007 | 0.1 | 32 | 0.00005 | 10 | | 62 |

| Continued…………………WGM1/D4 Post-Dry Ash Placement Data February, 2012 to March 2013 (mg/l) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **WL1** | **WL AHD** | **Zn** |
| 23-Feb-12 | 16 | 0.01 | 120 | 0.04 | 0.001 | 5.5 | 0.002 | 730 | 1200 | 1.1 | 906.02 | 0.07 |
| 30-Mar-12 | 7.1 | 0.01 | 75 | 0.03 | 0.001 | 5.9 | 0.002 | 460 | 770 | 1.2 | 905.92 | 0.05 |
| 20-Apr-12 | 15 | 0.01 | 120 | 0.04 | 0.001 | 5.6 | 0.002 | 720 | 1100 | 1.1 | 906.02 | 0.05 |
| 9-May-12 | 17 | 0.01 | 110 | 0.04 | 0.001 | 5.7 | 0.002 | 770 | 1200 | | | 0.09 |
| 27-Jun-12 | 12 | 0.01 | 110 | 0.03 | 0.001 | 5.9 | 0.002 | 670 | 1100 | 16 | 891.12 | 0.07 |
| 26-Jul-12 | 16 | 0.01 | 150 | 0.04 | 0.001 | 5 | 0.002 | 790 | 1300 | 1.1 | 906.02 | 0.06 |
| 15-Aug-12 | 16 | 0.01 | 110 | 0.04 | 0.001 | 5.4 | 0.002 | 770 | 1200 | 1.1 | 906.02 | 0.07 |
| 14-Sep-12 | 18 | 0.01 | 160 | 0.04 | 0.001 | 5.5 | 0.002 | 780 | 1200 | 1.1 | 906.02 | 0.07 |
| 11-Oct-12 | 17 | 0.01 | 120 | 0.04 | 0.001 | 5.5 | 0.002 | 760 | 1300 | 1.1 | 906.02 | 0.06 |
| 14-Nov-12 | 19 | 0.01 | 130 | 0.04 | 0.001 | 5.6 | 0.002 | 820 | 1300 | 1.2 | 905.92 | 0.06 |
| 12-Dec-12 | 19 | 0.01 | 130 | 0.04 | 0.001 | 5.8 | 0.002 | 840 | 1400 | 1.1 | 906.02 | 0.07 |
| 16-Jan-13 | 19 | 0.01 | 130 | 0.04 | 0.001 | 5.8 | 0.002 | 810 | 1300 | 1.1 | 906.02 | 0.08 |
| 20-Feb-13 | 18 | 0.01 | 150 | 0.04 | 0.001 | 5.9 | 0.002 | 820 | 1300 | 1 | 906.12 | 0.05 |
| 13-Mar-13 | 14 | 0.01 | 120 | 0.03 | 0.001 | 5.7 | 0.002 | 730 | 1100 | 1 | 906.12 | 0.06 |

| WGM1/D4 Post-Stage 2A Dry Ash Placement April, February, 2012 to March 2013 (mg/L) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| Average | <0.001 | 27 | 0.06 | 0.0020 | 1.51 | 0.022 | | 102 | 0.0002 | 35 | 1436 | 0.0010 | 0.0028 | 0.10 | 41.2 | 0.00005 | 10 | 68 |
| Maximum | <0.001 | 38 | 0.45 | 0.0020 | 2.00 | 0.034 | | 120 | 0.0002 | 38 | 1600 | 0.0010 | 0.0070 | 0.10 | 89.0 | 0.00005 | 12 | 79 |
| Minimum | <0.001 | 20 | 0.01 | 0.0020 | 0.67 | 0.015 | | 88 | 0.0002 | 31 | 1000 | 0.0010 | 0.0010 | 0.10 | 19.0 | 0.00005 | 9 | 41 |
| 50th Percentile | <0.001 | 22 | 0.02 | 0.0020 | 1.55 | 0.021 | | 100 | 0.0002 | 35 | 1500 | 0.0010 | 0.0030 | 0.10 | 39.0 | 0.00005 | 10 | 69 |

| Continued……………WGM1/D4 Post-Stage 2A Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **WL1** | **WL AHD** | **Zn** |
| Average | 15.94 | 0.010 | 124 | 0.038 | 0.001 | 5.6 | 0.002 | 748 | 1198 | 2.2 | 904.9 | 0.065 |
| Maximum | 19.00 | 0.010 | 160 | 0.040 | 0.001 | 5.9 | 0.002 | 840 | 1400 | 16.0 | 906.1 | 0.090 |
| Minimum | 7.10 | 0.010 | 75 | 0.030 | 0.001 | 5.0 | 0.002 | 460 | 770 | 1.0 | 891.1 | 0.050 |
| 50th Percentile | 16.50 | 0.010 | 120 | 0.040 | 0.001 | 5.7 | 0.002 | 770 | 1200 | 1.1 | 906.0 | 0.065 |

## 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 February, 2012 to March 2013 | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 23-Feb-12 | 0.001 | 20 | 0.42 | 0.001 | 0.06 | 0.048 | | 1.4 | 0.0002 | 12 | | 120 | 0.006 | 0.004 | 0.1 | 0.03 | 0.00005 | 4 | | 3 |
| 30-Mar-12 | 0.001 | 20 | 0.57 | 0.001 | 0.07 | 0.058 | | 1.7 | 0.0001 | 19 | | 120 | 0.005 | 0.004 | 0.1 | 0.03 | 0.00005 | 5 | | 4 |
| 20-Apr-12 | 0.001 | 20 | 0.48 | 0.001 | 0.07 | 0.057 | | 2 | 0.0002 | 16 | | 120 | 0.003 | 0.003 | 0.1 | 0.04 | 0.00005 | 4 | | 4 |
| 9-May-12 | 0.001 | 21 | 0.29 | 0.001 | 0.06 | 0.052 | | 2.3 | 0.0002 | 12 | | 120 | 0.001 | 0.002 | 0.1 | 0.02 | 0.00005 | 3 | | 4 |
| 27-Jun-12 | 0.001 | 20 | 0.75 | 0.001 | 0.04 | 0.05 | | 1.4 | 0.0002 | 14 | | 110 | 0.001 | 0.004 | 0.1 | 0.01 | 0.00005 | 4 | | 4 |
| 26-Jul-12 | 0.001 | 20 | 0.47 | 0.001 | 0.04 | 0.046 | | 1.3 | 0.0002 | 14 | | 120 | 0.001 | 0.002 | 0.1 | 0.01 | 0.00005 | 3 | | 4 |
| 15-Aug-12 | 0.001 | 20 | 0.2 | 0.001 | 0.03 | 0.033 | | 0.88 | 0.0002 | 10 | | 100 | 0.001 | 0.001 | 0.1 | 0.01 | 0.00005 | 2 | | 2 |
| 14-Sep-12 | 0.001 | 20 | 6.9 | 0.001 | 0.02 | 0.08 | | 1.1 | 0.0002 | 15 | | 110 | 0.005 | 0.02 | 0.1 | 0.06 | 0.00005 | 3 | | 2 |
| 11-Oct-12 | 0.001 | 20 | 1.8 | 0.001 | 0.01 | 0.037 | | 1.2 | 0.0002 | 17 | | 120 | 0.001 | 0.004 | 0.1 | 0.43 | 0.00005 | 2 | | 2 |
| 14-Nov-12 | 0.001 | 20 | 0.76 | 0.001 | <0.01 | 0.034 | | 1.2 | 0.0002 | 20 | | 120 | 0.001 | 0.005 | 0.1 | 0.05 | 0.00005 | 2 | | 2 |
| 12-Dec-12 | 0.001 | 25 | 0.95 | 0.001 | <0.01 | 0.036 | | 1.6 | 0.0002 | 22 | | 130 | 0.001 | 0.027 | 0.1 | 0.03 | 0.00005 | 2 | | 2 |
| 16-Jan-13 | 0.001 | 25 | 0.15 | 0.001 | 0.56 | 0.029 | | 31 | 0.0002 | 22 | | 140 | 0.001 | 0.015 | 0.1 | 0.01 | 0.00005 | 5 | | 23 |
| 20-Feb-13 | 0.001 | 25 | 0.33 | 0.001 | 0.03 | 0.039 | | 2.1 | 0.0002 | 20 | | 130 | 0.001 | 0.014 | 0.1 | 0.06 | 0.00005 | 4 | | 2 |
| 13-Mar-13 | 0.001 | 25 | 0.12 | 0.001 | 0.07 | 0.085 | | 2 | 0.0002 | 21 | | 180 | 0.001 | 0.006 | 0.1 | 0.01 | 0.00005 | 5 | | 6 |

| Continued……..WGM1/D1 Post-Dry Ash Placement Data February, 2012 to March 2013 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **WL1** | **WL AHD** | **Zn** |
| 23-Feb-12 | 0.11 | 0.01 | 15 | 0.001 | 0.001 | 5.9 | 0.002 | 17.0 | 99 | 1.7 | 946.42 | 0.04 |
| 30-Mar-12 | 0.31 | 0.01 | 14 | 0.001 | 0.001 | 5.6 | 0.002 | 13.0 | 89 | 1.7 | 946.42 | 0.04 |
| 20-Apr-12 | 0.44 | 0.01 | 13 | 0.001 | 0.001 | 7.2 | 0.002 | 13.0 | 60 | 1.7 | 946.42 | 0.04 |
| 9-May-12 | 0.65 | 0.01 | 12 | 0.001 | 0.001 | 6 | 0.002 | 13.0 | 60 | | | 0.05 |
| 27-Jun-12 | 0.31 | 0.01 | 13 | 0.001 | 0.001 | 6 | 0.002 | 12.0 | 50 | 1.7 | 946.42 | 0.05 |
| 26-Jul-12 | 0.32 | 0.01 | 14 | 0.001 | 0.001 | 6.5 | 0.002 | 13.0 | 91 | 1.7 | 946.42 | 0.03 |
| 15-Aug-12 | 0.15 | 0.01 | 13 | 0.001 | 0.001 | 5.8 | 0.002 | 13.0 | 75 | 2.4 | 945.72 | 0.03 |
| 14-Sep-12 | 0.04 | 0.01 | 17 | 0.001 | 0.014 | 5.7 | 0.002 | 11.0 | 80 | 2.9 | 945.22 | 0.11 |
| 11-Oct-12 | 0.2 | 0.01 | 17 | 0.001 | 0.001 | 5.8 | 0.002 | 10.0 | 84 | 3.2 | 944.92 | 0.07 |
| 14-Nov-12 | 0.38 | 0.01 | 18 | 0.001 | 0.001 | 5.9 | 0.002 | 10.0 | 81 | 3.7 | 944.42 | 0.07 |
| 12-Dec-12 | 0.68 | 0.01 | 19 | 0.001 | 0.001 | 5.7 | 0.002 | 11.0 | 110 | 3.9 | 944.22 | 0.14 |
| 16-Jan-13 | 0.99 | 0.01 | 46 | 0.02 | 0.001 | 5.9 | 0.002 | 11.0 | 69 | 4.3 | 943.82 | 0.1 |
| 20-Feb-13 | 1.1 | 0.01 | 18 | 0.001 | 0.001 | 5.9 | 0.002 | 6.0 | 76 | 3.7 | 944.42 | 0.18 |
| 13-Mar-13 | 0.069 | 0.01 | 22 | 0.001 | 0.001 | 5.5 | 0.002 | 12.0 | 140 | 1.7 | 946.42 | 0.06 |

| WGM1/D1 Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| Average | <0.001 | 22 | 1.01 | 0.0010 | 0.09 | 0.049 | | 4 | 0.0002 | 17 | | 124 | 0.0021 | 0.0079 | 0.10 | 0.1 | 0.00005 | 3 | 5 |
| Maximum | <0.001 | 25 | 6.90 | 0.0010 | 0.56 | 0.085 | | 31 | 0.0002 | 22 | | 180 | 0.0060 | 0.0270 | 0.10 | 0.4 | 0.00005 | 5 | 23 |
| Minimum | <0.001 | 20 | 0.12 | 0.0010 | 0.01 | 0.029 | | 1 | 0.0001 | 10 | | 100 | 0.0010 | 0.0010 | 0.10 | 0.0 | 0.00005 | 2 | 2 |
| 50th Percentile | <0.001 | 20 | 0.48 | 0.0010 | 0.05 | 0.047 | | 2 | 0.0002 | 17 | | 120 | 0.0010 | 0.0040 | 0.10 | 0.0 | 0.00005 | 4 | 4 |

| Continued…………………WGM1/D1 Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **WL1** | **WL AHD** | **Zn** |
| Average | 0.41 | 0.010 | 18 | 0.002 | 0.002 | 6.0 | 0.002 | 12 | 83 | 2.6 | 945.5 | 0.072 |
| Maximum | 1.10 | 0.010 | 46 | 0.020 | 0.014 | 7.2 | 0.002 | 17 | 140 | 4.3 | 946.4 | 0.180 |
| Minimum | 0.04 | 0.010 | 12 | 0.001 | 0.001 | 5.5 | 0.002 | 6 | 50 | 1.7 | 943.8 | 0.030 |
| 50th Percentile | 0.32 | 0.010 | 16 | 0.001 | 0.001 | 5.9 | 0.002 | 12 | 81 | 2.4 | 945.7 | 0.055 |

| 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 February, 2012 to March 2013 | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 23-Feb-12 | 0.001 | 20 | 0.29 | 0.001 | 0.01 | 0.039 | | 1.2 | 0.0002 | 17 | | 290 | 0.001 | 0.002 | 0.1 | 0.01 | 0.00005 | 4 | | 20 |
| 30-Mar-12 | 0.001 | 20 | 0.39 | 0.001 | 0.01 | 0.039 | | 1.2 | 0.0002 | 16 | | 280 | 0.001 | 0.002 | 0.1 | 0.01 | 0.00005 | 5 | | 20 |
| 20-Apr-12 | 0.001 | 20 | 0.35 | 0.001 | 0.02 | 0.039 | | 1.1 | 0.0002 | 17 | | 280 | 0.002 | 0.002 | 0.1 | 0.01 | 0.00009 | 4 | | 20 |
| 9-May-12 | 0.001 | 20 | 0.32 | 0.001 | 0.02 | 0.044 | | 1.2 | 0.0002 | 21 | | 300 | 0.001 | 0.003 | 0.1 | 0.02 | 0.000089 | 4 | | 23 |
| 27-Jun-12 | 0.001 | 20 | 0.27 | 0.001 | 0.01 | 0.041 | | 1.4 | 0.0002 | 20 | | 310 | 0.001 | 0.003 | 0.1 | <0.01 | 0.00016 | 4 | | 23 |
| 26-Jul-12 | 0.001 | 20 | 0.27 | 0.001 | 0.01 | 0.04 | | 1.4 | 0.0002 | 22 | | 320 | 0.001 | 0.003 | 0.1 | 0.01 | 0.00008 | 4 | | 24 |
| 15-Aug-12 | 0.001 | 20 | 0.37 | 0.001 | 0.01 | 0.041 | | 1.5 | 0.0002 | 23 | | 330 | 0.001 | 0.003 | 0.1 | 0.01 | 0.00005 | 4 | | 23 |
| 14-Sep-12 | 0.001 | 20 | 0.24 | 0.001 | 0.01 | 0.04 | | 1.5 | 0.0002 | 26 | | 320 | 0.001 | 0.002 | 0.1 | 0.02 | 0.00007 | 4 | | 21 |
| 11-Oct-12 | 0.001 | 20 | 0.21 | 0.001 | 0.01 | 0.041 | | 1.5 | 0.0002 | 26 | | 320 | 0.001 | 0.007 | 0.1 | 0.09 | 0.00008 | 4 | | 21 |
| 14-Nov-12 | 0.001 | 20 | 0.27 | 0.001 | 0.05 | 0.043 | | 2.3 | 0.0002 | 30 | | 430 | 0.001 | 0.006 | 0.1 | 0.06 | 0.00006 | 4 | | 24 |
| 12-Dec-12 | 0.001 | 25 | 0.45 | 0.001 | 0.01 | 0.045 | | 1.3 | 0.0002 | 22 | | 330 | 0.001 | 0.005 | 0.1 | 0.01 | 0.00005 | 5 | | 21 |
| 16-Jan-13 | 0.001 | 25 | 0.29 | 0.001 | 0.07 | 0.041 | | 2.1 | 0.0002 | 33 | | 430 | 0.001 | 0.007 | 0.1 | 1.2 | 0.00005 | 4 | | 21 |
| 20-Feb-13 | 0.001 | 25 | 0.38 | 0.001 | 0.02 | 0.041 | | 1.2 | 0.0002 | 25 | | 320 | 0.002 | 0.006 | 0.1 | 0.03 | 0.00005 | 4 | | 20 |
| 13-Mar-13 | 0.001 | 25 | 0.28 | 0.001 | 0.03 | 0.042 | | 1.4 | 0.0002 | 21 | | 340 | 0.001 | 0.002 | 0.1 | 0.01 | 0.00005 | 5 | | 21 |

| Continued……..WGM1/D2 Post-Dry Ash Placement Data February, 2012 to March 2013 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **WL1** | **WL AHD** | **Zn** |
| 23-Feb-12 | 0.42 | <0.01 | 17.00 | 0.04 | 0.001 | 5 | 0.002 | 89 | 230 | 3.1 | 917.10 | 0.07 |
| 30-Mar-12 | 0.41 | <0.01 | 18.00 | 0.05 | 0.001 | 5.1 | 0.002 | 88 | 190 | 3.2 | 917.00 | 0.06 |
| 20-Apr-12 | 0.41 | 0.01 | 18.00 | 0.04 | 0.001 | 5.8 | 0.002 | 88 | 170 | 4.4 | 915.80 | 0.05 |
| 9-May-12 | 0.43 | 0.01 | 19.00 | 0.04 | 0.001 | 4.9 | 0.002 | 91 | 180 | | | 0.08 |
| 27-Jun-12 | 0.5 | <0.01 | 19.00 | 0.05 | 0.001 | 5 | 0.002 | 100 | 190 | 4 | 916.20 | 0.08 |
| 26-Jul-12 | 0.52 | <0.01 | 21.00 | 0.05 | 0.001 | 5 | 0.002 | 110 | 220 | 4.3 | 915.90 | 0.07 |
| 15-Aug-12 | 0.54 | <0.01 | 20.00 | 0.05 | 0.001 | 4.8 | 0.002 | 110 | 220 | 4.8 | 915.40 | 0.08 |
| 14-Sep-12 | 0.5 | <0.01 | 25.00 | 0.05 | 0.001 | 4.9 | 0.002 | 95 | 190 | 7.3 | 912.90 | 0.07 |
| 11-Oct-12 | 0.52 | <0.01 | 26.00 | 0.05 | 0.001 | 4.7 | 0.002 | 100 | 190 | 7.4 | 912.80 | 0.07 |
| 14-Nov-12 | 0.73 | <0.01 | 38.00 | 0.08 | 0.001 | 4.3 | 0.002 | 140 | 250 | 7.8 | 912.40 | 0.1 |
| 12-Dec-12 | 0.47 | <0.01 | 23.00 | 0.05 | 0.001 | 4.9 | 0.002 | 100 | 220 | 4.2 | 916.00 | 0.08 |
| 16-Jan-13 | 0.65 | <0.01 | 39.00 | 0.07 | 0.001 | 4.2 | 0.002 | 130 | 240 | 7.8 | 912.40 | 0.11 |
| 20-Feb-13 | 0.41 | <0.01 | 30.00 | 0.05 | 0.001 | 4.9 | 0.002 | 94 | 210 | 6.6 | 913.60 | 0.06 |
| 13-Mar-13 | 0.45 | <0.01 | 28.00 | 0.05 | 0.001 | 4.7 | 0.002 | 100 | 240 | 3.1 | 917.10 | 0.08 |

| WGM1/D2 Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| Average | <0.001 | 21 | 0.31 | 0.0010 | 0.02 | 0.041 | | 1 | 0.0002 | 23 | | 329 | 0.0011 | 0.0038 | 0.10 | 0.11 | 0.00007 | 4 | 22 |
| Maximum | <0.001 | 25 | 0.45 | 0.0010 | 0.07 | 0.045 | | 2 | 0.0002 | 33 | | 430 | 0.0020 | 0.0070 | 0.10 | 1.20 | 0.00016 | 5 | 24 |
| Minimum | <0.001 | 20 | 0.21 | 0.0010 | 0.01 | 0.039 | | 1 | 0.0002 | 16 | | 280 | 0.0010 | 0.0020 | 0.10 | 0.01 | 0.00005 | 4 | 20 |
| 50th Percentile | <0.001 | 20 | 0.29 | 0.0010 | 0.01 | 0.041 | | 1 | 0.0002 | 22 | | 320 | 0.0010 | 0.0030 | 0.10 | 0.01 | 0.00006 | 4 | 21 |

| Continued…………………WGM1/D2 Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **WL1** | **WL AHD** | **Zn** |
| Average | 0.50 | 0.010 | 24 | 0.051 | 0.001 | 4.9 | 0.002 | 103 | 210 | 5.2 | 915.0 | 0.076 |
| Maximum | 0.73 | 0.010 | 39 | 0.080 | 0.001 | 5.8 | 0.002 | 140 | 250 | 7.8 | 917.1 | 0.110 |
| Minimum | 0.41 | 0.010 | 17 | 0.040 | 0.001 | 4.2 | 0.002 | 88 | 170 | 3.1 | 912.4 | 0.050 |
| 50th Percentile | 0.49 | 0.010 | 22 | 0.050 | 0.001 | 4.9 | 0.002 | 100 | 215 | 4.4 | 915.8 | 0.075 |

## 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 Data February, 2012 to March 2013 | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 23-Feb-12 | 0.001 | 20 | 5.7 | 0.001 | 0.23 | 0.023 | | 18 | 0.0006 | 5 | | 380 | 0.002 | 0.002 | 0.3 | 0.26 | 0.00005 | 6 | | 9 |
| 30-Mar-12 | 0.001 | 20 | 7.5 | 0.001 | 0.3 | 0.034 | | 19 | 0.001 | 6 | | 450 | 0.003 | 0.003 | 0.4 | 0.27 | 0.00005 | 7 | | 15 |
| 20-Apr-12 | 0.001 | 20 | 16 | 0.001 | 2.3 | 0.025 | | 35 | 0.002 | 39 | | 1200 | 0.004 | 0.003 | 0.5 | 20 | 0.00005 | 28 | | 52 |
| 9-May-12 | | | | | | | | | | | | | | | | | | | | |
| 27-Jun-12 | 0.001 | 20 | 7.5 | 0.001 | 0.71 | 0.025 | | 22 | 0.00096 | 12 | | 570 | 0.001 | 0.003 | 0.9 | 1 | 0.00005 | 13 | | 23 |
| 26-Jul-12 | 0.001 | 20 | 14 | 0.001 | 1.5 | 0.026 | | 30 | 0.001 | 29 | | 860 | 0.002 | 0.007 | 0.6 | 0.47 | 0.00005 | 17 | | 38 |
| 15-Aug-12 | | | | | | | | | | | | | | | | | | | | |
| 14-Sep-12 | | | | | | | | | | | | | | | | | | | | |
| 11-Oct-12 | | | | | | | | | | | | | | | | | | | | |
| 14-Nov-12 | | | | | | | | | | | | | | | | | | | | |
| 12-Dec-12 | | | | | | | | | | | | | | | | | | | | |
| 16-Jan-13 | | | | | | | | | | | | | | | | | | | | |
| 20-Feb-13 | 0.001 | 82 | 0.26 | 0.038 | 1.8 | 0.028 | | 31 | 0.0005 | 19 | | 720 | 0.001 | 0.003 | 0.9 | 0.02 | 0.00005 | 43 | | 23 |
| 13-Mar-13 | 0.001 | 25 | 7.8 | 0.001 | 0.8 | 0.047 | | 24 | 0.001 | 13 | | 580 | 0.002 | 0.003 | 0.8 | 0.35 | 0.00005 | 12 | | 21 |

**Continued………WGM1/D5 Post-Dry Ash Placement Data February, 2012 to March 2013**

| Date | Mn | Mo | Na | Ni | Pb | pH | Se | SO4 | TDS | WL1 | WL AHD | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23-Feb-12 | 2 | 0.01 | 10 | 0.13 | 0.001 | 3.7 | 0.002 | 140 | 290 | 2.6 | 901.59 | 0.35 |
| 30-Mar-12 | 2.8 | 0.01 | 20 | 0.23 | 0.002 | 3.7 | 0.002 | 180 | 300 | 2.6 | 901.59 | 0.56 |
| 20-Apr-12 | 6.8 | 0.01 | 86 | 0.45 | 0.003 | 3.8 | 0.002 | 560 | 860 | 6.2 | 897.99 | 0.81 |
| 9-May-12 | | | | | | | | | | | | |
| 27-Jun-12 | 3.5 | 0.01 | 24 | 0.25 | 0.002 | 3.8 | 0.002 | 240 | 410 | 2.3 | 901.89 | 0.64 |
| 26-Jul-12 | 5.2 | 0.01 | 47 | 0.29 | 0.003 | 3.7 | 0.002 | 400 | 630 | 5.6 | 898.59 | 0.62 |
| 15-Aug-12 | | | | | | | | | | | | |
| 14-Sep-12 | | | | | | | | | | | | |
| 11-Oct-12 | | | | | | | | | | | | |
| 14-Nov-12 | | | | | | | | | | | | |
| 12-Dec-12 | | | | | | | | | | | | |
| 16-Jan-13 | | | | | | | | | | | | |
| 20-Feb-13 | 4.3 | 0.19 | 70 | 0.03 | <0.001 | 6.4 | 0.002 | 240 | 510 | 7.7 | 896.49 | 0.06 |
| 13-Mar-13 | 3.2 | 0.01 | 25 | 0.22 | 0.002 | 3.7 | 0.002 | 220 | 430 | 3.1 | 901.09 | 0.56 |

| WGM1/D5 Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| Average | 0.0010 | 30 | 8.4 | 0.0063 | 1.09 | 0.030 | | 26 | 0.0010 | 18 | | 680 | 0.0021 | 0.0034 | 0.63 | 3.20 | 0.000050 | 18 | 25.86 |
| Maximum | 0.0010 | 82 | 16.0 | 0.0380 | 2.30 | 0.047 | | 35 | 0.0020 | 39 | | 1200 | 0.0040 | 0.0070 | 0.90 | 20.00 | 0.000050 | 43 | 52.00 |
| Minimum | 0.0010 | 20 | 0.3 | 0.0010 | 0.23 | 0.023 | | 18 | 0.0005 | 5 | | 380 | 0.0010 | 0.0020 | 0.30 | 0.02 | 0.000050 | 6 | 9.00 |
| 50th Percentile | 0.0010 | 20 | 7.5 | 0.0010 | 0.80 | 0.026 | | 24 | 0.0010 | 13 | | 580 | 0.0020 | 0.0030 | 0.60 | 0.35 | 0.000050 | 13 | 23.00 |

| Continued………….WGM1/D5 Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **WL1** | **WL AHD** | **Zn** |
| Average | 3.97 | 0.036 | 40 | 0.229 | 0.002 | 4.1 | <0.002 | 283 | 490 | 4.3 | 899.9 | 0.514 |
| Maximum | 6.80 | 0.190 | 86 | 0.450 | 0.003 | 6.4 | <0.002 | 560 | 860 | 7.7 | 901.9 | 0.810 |
| Minimum | 2.00 | 0.010 | 10 | 0.030 | 0.001 | 3.7 | <0.002 | 140 | 290 | 2.3 | 896.5 | 0.060 |
| 50th Percentile | 3.50 | 0.010 | 25 | 0.230 | 0.002 | 3.7 | <0.002 | 240 | 430 | 3.1 | 901.1 | 0.560 |

*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 February, 2012 to March 2013 | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 23-Feb-12 | 0.001 | 20 | 4.2 | 0.001 | 0.49 | 0.017 | | 7.3 | 0.0003 | 23 | | 950 | 0.002 | 0.002 | 0.400 | 1.3 | 0.00005 | 7 | | 49 |
| 30-Mar-12 | 0.001 | 20 | 2.4 | 0.001 | 0.81 | 0.02 | | 22 | 0.0002 | 52 | | 1,300 | 0.001 | 0.001 | 0.300 | 67 | 0.00005 | 9 | | 58 |
| 20-Apr-12 | 0.001 | 20 | 1.6 | 0.002 | 0.98 | 0.017 | | 28 | 0.0002 | 47 | | 1,200 | 0.002 | 0.002 | 0.300 | 110 | 0.00005 | 8 | | 57 |
| 9-May-12 | 0.001 | 20 | 1.1 | 0.002 | 0.97 | 0.018 | | 30 | 0.0002 | 45 | | 1,200 | 0.002 | 0.007 | 0.200 | 86 | 0.00005 | 8 | | 54 |
| 27-Jun-12 | 0.001 | 20 | 1.6 | 0.001 | 1.1 | 0.021 | | 34 | 0.0002 | 48 | | 1,500 | 0.002 | 0.002 | 0.200 | 140 | 0.00005 | 11 | | 55 |
| 26-Jul-12 | 0.001 | 20 | 1.3 | 0.001 | 1.1 | 0.019 | | 35 | 0.0002 | 50 | | 1,500 | 0.001 | 0.004 | 0.100 | 110 | 0.00005 | 13 | | 53 |
| 15-Aug-12 | 0.001 | 20 | 0.61 | 0.001 | 1.1 | 0.017 | | 34 | 0.0002 | 51 | | 1,300 | 0.001 | 0.002 | 0.100 | 150 | 0.00005 | 7 | | 48 |
| 14-Sep-12 | 0.001 | 20 | 1.9 | 0.002 | 0.45 | 0.015 | | 21 | 0.0006 | 40 | | 1,000 | 0.001 | 0.003 | 0.300 | 16 | 0.00005 | 7 | | 44 |
| 11-Oct-12 | 0.001 | 20 | 2.9 | 0.004 | 0.45 | 0.016 | | 17 | 0.0017 | 37 | | 1,100 | 0.001 | 0.006 | 0.300 | 59 | 0.00005 | 7 | | 46 |
| 14-Nov-12 | 0.001 | 20 | 2 | 0.002 | 0.44 | 0.017 | | 15 | 0.001 | 42 | | 1,200 | 0.001 | 0.009 | 0.300 | 9.6 | 0.00005 | 7 | | 44 |
| 12-Dec-12 | 0.001 | 25 | 1.8 | 0.002 | 0.48 | 0.017 | | 17 | 0.0005 | 47 | | 1,300 | 0.001 | 0.009 | 0.300 | 17 | 0.00005 | 7 | | 45 |
| 16-Jan-13 | 0.001 | 25 | 1.8 | 0.002 | 0.67 | 0.018 | | 25 | 0.0002 | 57 | | 1,400 | 0.002 | 0.01 | 0.400 | 50 | 0.00005 | 8 | | 53 |
| 20-Feb-13 | 0.001 | 25 | 4.7 | 0.002 | 0.55 | 0.018 | | 27 | 0.001 | 81 | | 1,500 | 0.002 | 0.008 | 0.200 | 24 | 0.00005 | 8 | | 81 |
| 13-Mar-13 | 0.001 | 25 | 3.3 | 0.002 | 0.58 | 0.019 | | 16 | 0.0002 | 42 | | 1,300 | 0.002 | 0.016 | 0.700 | 24 | 0.00005 | 8 | | 64 |

| Continued………………..WGM1/D6 Post-Dry Ash Placement Data February, 2012 to March 2013 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **WL1** | **WL AHD** | **Zn** |
| 23-Feb-12 | 1.1 | 0.01 | 77 | 0.35 | 0.002 | 3.40 | 0.002 | 380 | 560 | 10.3 | 896.65 | 0.74 |
| 30-Mar-12 | 4 | 0.01 | 98 | 0.34 | 0.001 | 3.50 | 0.002 | 540 | 900 | 10.1 | 896.85 | 0.59 |
| 20-Apr-12 | 5.2 | 0.01 | 91 | 0.25 | 0.001 | 4.20 | 0.002 | 560 | 960 | 10.4 | 896.55 | 0.39 |
| 9-May-12 | 5.9 | 0.01 | 78 | 0.19 | 0.002 | 4.70 | 0.002 | 590 | 890 | | 906.95 | 0.31 |
| 27-Jun-12 | 6.9 | 0.01 | 110 | 0.23 | 0.001 | 4.80 | 0.002 | 650 | 1100 | 15.0 | 891.95 | 0.35 |
| 26-Jul-12 | 7 | 0.01 | 140 | 0.16 | 0.001 | 3.10 | 0.002 | 660 | 1100 | 10.0 | 896.95 | 0.2 |
| 15-Aug-12 | 7.4 | 0.01 | 75 | 0.12 | 0.001 | 4.10 | 0.002 | 670 | 1200 | 10.8 | 896.15 | 0.12 |
| 14-Sep-12 | 4 | 0.01 | 74 | 0.3 | 0.002 | 3.90 | 0.002 | 460 | 660 | 11.0 | 895.95 | 1.1 |
| 11-Oct-12 | 3.2 | 0.01 | 75 | 0.43 | 0.005 | 3.10 | 0.002 | 420 | 710 | 10.8 | 896.15 | 1.6 |
| 14-Nov-12 | 2.9 | 0.01 | 71 | 0.4 | 0.003 | 3.00 | 0.002 | 400 | 590 | 10.7 | 896.25 | 1.4 |
| 12-Dec-12 | 3.6 | 0.01 | 77 | 0.39 | 0.002 | 3.10 | 0.002 | 430 | 650 | 10.8 | 896.15 | 1.3 |
| 16-Jan-13 | 5.1 | 0.01 | 82 | 0.37 | <0.001 | 3.00 | 0.002 | 520 | 800 | 11.0 | 895.95 | 1.1 |
| 20-Feb-13 | 4.9 | 0.01 | 140 | 0.64 | 0.003 | 3.20 | 0.002 | 640 | 1100 | 10.7 | 896.25 | 2.1 |
| 13-Mar-13 | 3 | 0.01 | 110 | 0.53 | 0.002 | 3.30 | 0.002 | 520 | 880 | 10.4 | 896.55 | 1.3 |

| WGM1/D6 Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ag | ALK | Al | As | B | Ba | Be | Ca | Cd | Cl | Co | COND | Cr | Cu | F | Fe | Hg | K | Li | Mg |
| Average | <0.001 | 21 | 2.23 | 0.0018 | 0.73 | 0.018 | | 23 | 0.0005 | 47 | | 1268 | 0.0015 | 0.0058 | 0.29 | 61.7 | 0.00005 | 8 | | 54 |
| Maximum | <0.001 | 25 | 4.70 | 0.0040 | 1.10 | 0.021 | | 35 | 0.0017 | 81 | | 1500 | 0.0020 | 0.0160 | 0.70 | 150.0 | 0.00005 | 13 | | 81 |
| Minimum | <0.001 | 20 | 0.61 | 0.0010 | 0.44 | 0.015 | | 7 | 0.0002 | 23 | | 950 | 0.0010 | 0.0010 | 0.10 | 1.3 | 0.00005 | 7 | | 44 |
| 50th Percentile | <0.001 | 20 | 1.85 | 0.0020 | 0.63 | 0.018 | | 24 | 0.0002 | 47 | | 1300 | 0.0015 | 0.0050 | 0.30 | 54.5 | 0.00005 | 8 | | 53 |

| Continued…………….WGM1/D6 Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mn | Mo | Na | Ni | Pb | pH | Se | SO4 | TDS | WL1 | WL AHD | Zn |
| Average | 4.59 | 0.010 | 93 | 0.336 | 0.002 | 3.6 | 0.002 | 531 | 864 | 10.9 | 896.8 | 0.900 |
| Maximum | 7.40 | 0.010 | 140 | 0.640 | 0.005 | 4.8 | 0.002 | 670 | 1200 | 15.0 | 907.0 | 2.100 |
| Minimum | 1.10 | 0.010 | 71 | 0.120 | 0.001 | 3.0 | 0.002 | 380 | 560 | 10.0 | 892.0 | 0.120 |
| 50th Percentile | 4.45 | 0.010 | 80 | 0.345 | 0.002 | 3.4 | 0.002 | 530 | 885 | 10.7 | 896.3 | 0.920 |

## 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 February, 2012 to March 2013 | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 22-Feb-12 | 0.001 | 20 | 2 | 0.002 | 1.8 | 0.075 | | 66 | 0.0028 | 23 | | 1600 | 0.001 | | 0.013 | 2 | 0.010 | 0.00005 | 38 | | 14 |
| 14-Mar-12 | 0.001 | 20 | 1.3 | 0.001 | 1.4 | 0.061 | | 52 | 0.002 | 20 | | 1300 | 0.001 | | 0.008 | 1.5 | 0.02 | 0.00005 | 32 | | 11 |
| 19-Apr-12 | 0.001 | 20 | 1.8 | 0.002 | 1.4 | 0.061 | | 50 | 0.002 | 20 | | 1200 | 0.001 | | 0.009 | 0.4 | 0.31 | 0.00006 | 28 | | 11 |
| 9-May-12 | 0.001 | 74 | 1.5 | 0.003 | 1.3 | 0.064 | | 45 | 0.0019 | 18 | | 1200 | 0.002 | | 0.01 | 1.7 | 0.03 | 0.00005 | 24 | | 10 |
| 27-Jun-12 | 0.001 | 20 | 2.2 | 0.003 | 1.4 | 0.076 | | 46 | 0.003 | 19 | | 1200 | 0.005 | | 0.017 | 1.7 | 0.06 | 0.00005 | 28 | | 10 |
| 26-Jul-12 | 0.001 | 20 | 5.4 | 0.004 | 1.5 | 0.079 | | 51 | 0.003 | 19 | | 1300 | 0.008 | | 0.023 | 2.4 | 0.1 | 0.00005 | 30 | | 11 |
| 15-Aug-12 | 0.001 | 20 | 7.6 | 0.002 | 1.7 | 0.078 | | 50 | 0.004 | 20 | | 1400 | 0.007 | | 0.027 | 2.2 | 0.11 | 0.00005 | 33 | | 12 |
| 13-Sep-12 | 0.001 | 20 | 11 | 0.002 | 2.1 | 0.08 | | 61 | 0.006 | 20 | | 1500 | 0.006 | | 0.028 | 3.3 | 0.06 | 0.00005 | 40 | | 15 |
| 11-Oct-12 | 0.001 | 20 | 8.2 | 0.003 | 2.1 | 0.075 | | 60 | 0.006 | 20 | | 1500 | 0.001 | | 0.026 | 2.8 | 0.11 | 0.00005 | 37 | | 14 |
| 14-Nov-12 | 0.001 | 20 | 6.5 | 0.004 | 2.3 | 0.061 | | 64 | 0.006 | 20 | | 1600 | 0.003 | | 0.022 | 2.9 | 0.06 | 0.00005 | 41 | | 15 |
| 12-Dec-12 | 0.001 | 25 | 5.7 | 0.002 | 2.1 | 0.073 | | 60 | 0.006 | 20 | | 1700 | 0.001 | | 0.022 | 2.8 | 0.08 | 0.00005 | 43 | | 14 |
| 16-Jan-13 | 0.001 | 25 | 3.6 | 0.002 | 2.4 | 0.076 | | 65 | 0.006 | 22 | | 1700 | 0.001 | | 0.018 | 2.4 | 0.03 | 0.00005 | 45 | | 16 |
| 20-Feb-13 | 0.001 | 25 | 2.4 | 0.001 | 2.1 | 0.07 | | 70 | 0.005 | 21 | | 1600 | 0.001 | | 0.022 | 2.3 | 0.010 | 0.00005 | 40 | | 17 |
| 13-Mar-13 | 0.001 | 25 | 4.2 | <0.001 | 1.9 | 0.067 | | 60 | 0.005 | 20 | | 1600 | 0.001 | | 0.039 | 2.6 | 0.07 | 0.00005 | 41 | | 15 |

| Continued……..SSCAD Post-Dry Ash Placement February, 2012 to March 2013 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| 22-Feb-12 | 0.91 | 0.02 | 280 | 0.05 | <0.001 | 5 | 0.012 | 750 | 1100 | 0.16 |
| 14-Mar-12 | 0.74 | 0.02 | 220 | 0.04 | <0.001 | 5.1 | 0.008 | 570 | 890 | 0.12 |
| 19-Apr-12 | 0.79 | 0.01 | 190 | 0.04 | 0.001 | 4.6 | 0.008 | 560 | 940 | 0.12 |
| 9-May-12 | 0.74 | 0.01 | 190 | 0.03 | 0.001 | 7.4 | 0.006 | 480 | 810 | 0.14 |
| 27-Jun-12 | 0.8 | 0.02 | 180 | 0.04 | 0.001 | 4.5 | 0.009 | 560 | 940 | 0.14 |
| 26-Jul-12 | 0.88 | 0.01 | 190 | 0.05 | 0.003 | 4.2 | 0.01 | 600 | 940 | 0.18 |
| 15-Aug-12 | 1.1 | 0.01 | 190 | 0.07 | 0.002 | 4.4 | 0.01 | 670 | 1100 | 0.26 |
| 13-Sep-12 | 1.4 | 0.01 | 220 | 0.1 | 0.002 | 4.5 | 0.009 | 720 | 1100 | 0.34 |
| 11-Oct-12 | 1.4 | 0.01 | 220 | 0.09 | 0.002 | 4.6 | 0.01 | 710 | 1100 | 0.31 |
| 14-Nov-12 | 1.5 | 0.02 | 240 | 0.1 | 0.002 | 4.7 | 0.012 | 750 | 1200 | 0.33 |
| 12-Dec-12 | 1.5 | 0.01 | 240 | 0.1 | 0.003 | 4.6 | 0.008 | 800 | 1200 | 0.45 |
| 16-Jan-13 | 1.6 | 0.01 | 240 | 0.1 | 0.002 | 4.8 | 0.008 | 780 | 1200 | 0.42 |
| 20-Feb-13 | 1.5 | 0.01 | 280 | 0.09 | <0.001 | 4.8 | 0.006 | 760 | 1200 | 0.35 |
| 13-Mar-13 | 1.5 | 0.01 | 230 | 0.09 | 0.015 | 4.6 | 0.005 | 730 | 1200 | 0.36 |

| SSCAD Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (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 | 25 | 4.5 | 0.002 | 1.82 | 0.071 | | 57 | 0.0042 | 20 | 1457 | 0.0028 | | 0.0203 | 2.21 | 0.08 | 0.00005 | 36 | 13 |
| Maximum | 0.001 | 74 | 11.0 | 0.004 | 2.40 | 0.080 | | 70 | 0.0060 | 23 | 1700 | 0.0080 | | 0.0390 | 3.30 | 0.31 | 0.00006 | 45 | 17 |
| Minimum | 0.001 | 20 | 1.3 | 0.001 | 1.30 | 0.061 | | 45 | 0.0019 | 18 | 1200 | 0.0010 | | 0.0080 | 0.40 | 0.01 | 0.00005 | 24 | 10 |
| 50th Percentile | 0.001 | 20 | 3.9 | 0.002 | 1.85 | 0.074 | | 60 | 0.0045 | 20 | 1500 | 0.0010 | | 0.0220 | 2.35 | 0.06 | 0.00005 | 38 | 14 |

| Continued………………..SSCAD Post-Stage 2 Dry Ash Placement February, 2012 to March 2013 (mg/L) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| Average | 1.17 | 0.013 | 222 | 0.071 | 0.003 | 4.8 | 0.009 | 674 | 1066 | 0.263 |
| Maximum | 1.60 | 0.020 | 280 | 0.100 | 0.015 | 7.4 | 0.012 | 800 | 1200 | 0.450 |
| Minimum | 0.74 | 0.010 | 180 | 0.030 | 0.001 | 4.2 | 0.005 | 480 | 810 | 0.120 |
| 50th Percentile | 1.25 | 0.010 | 220 | 0.080 | 0.002 | 4.6 | 0.009 | 715 | 1100 | 0.285 |

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

| SSC upstream @0 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** |
| 23-Mar-10 | | | | | | | | | | 14 | | 210 | | | | | | | | | |
| 28-Apr-10 | | | | | | | | | | 12 | | 349 | | | | | | | | | |
| 25/07/2011 | | | | | | | | | | 5 | | 940 | | | | | | | | | |
| 23/08/2011 | | | | | | | | | | 6 | | 900 | | | | | | | | | |
| 21/09/2011 | | | | | | | | | | 5 | | 940 | | | | | | | | | |
| 21/10/2011 | | | | | | | | | | 9 | | 430 | | | | | | | | | |
| 28/11/2011 | | | | | | | | | | 9 | | 100 | | | | | | | | | |
| 16/12/2011 | | | | | | | | | | 9 | | 220 | | | | | | | | | |
| 30/01/2012 | | | | | | | | | | 7 | | 660 | | | | | | | | | |
| 28/02/2012 | | | | | | | | | | 7 | | 530 | | | | | | | | | |
| 30/03/2012 | | | | | | | | | | 9 | | 350 | | | | | | | | | |
| 24/04/2012 | | | | | | | | | | 9 | | 330 | | | | | | | | | |
| 30/05/2012 | | | | | | | | | | 10 | | 120 | | | | | | | | | |
| 25/06/2012 | | | | | | | | | | 6 | | 780 | | | | | | | | | |
| 26/07/2012 | | | | | | | | | | 6 | | 790 | | | | | | | | | |
| 22/08/2012 | | | | | | | | | | 10 | | 240 | | | | | | | | | |
| 19/09/2012 | | | | | | | | | | 10 | | 270 | | | | | | | | | |
| 25/10/2012 | | | | | | | | | | 6 | | 980 | | | | | | | | | |

| SSC upstream @0 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** |
| 21/11/2012 | <0.001 | 520 | 0.10 | 0.012 | 0.06 | 0.019 | | 5.6 | 0.0002 | 5 | | 1000 | 0.001 | | 0.001 | 1.2 | 0.04 | 0.00005 | 11 | | 0.015 |
| 28/12/2012 | <0.001 | 510 | 0.34 | 0.019 | 0.07 | 0.022 | | 4.4 | 0.0002 | 6 | | 1000 | 0.001 | | 0.002 | 1.3 | 0.03 | 0.00005 | 12 | | 0.027 |
| 29/01/2013 | <0.001 | 530 | 0.18 | 0.014 | 0.09 | 0.017 | | 4.5 | 0.0002 | 5 | | 1000 | 0.001 | | 0.001 | 1.3 | 0.01 | 0.00005 | 11 | | 0.001 |
| 22/02/2013 | <0.001 | 520 | 0.19 | 0.014 | 0.10 | 0.018 | | 5.2 | 0.0002 | 5 | | 980 | 0.001 | | 0.001 | 1.2 | 0.01 | 0.00005 | 11 | | 0.003 |
| 26/03/2013 | <0.001 | 490 | 0.14 | 0.013 | 0.07 | 0.021 | | 4.4 | 0.0002 | 5 | | 970 | 0.001 | | 0.004 | 1.2 | 0.02 | 0.00005 | 11 | | 0.015 |

| 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** |
| 23-Mar-10 | | | | | | 8.22 | | 22 | 560 | |
| 28-Apr-10 | | | | | | 9.19 | | 22 | 600 | |
| 25/07/2011 | | | | | | 8.7 | | 21 | | |
| 23/08/2011 | | | | | | 8.7 | | 20 | 260 | |
| 21/09/2011 | | | | | | 8.6 | | 20 | 89 | |
| 21/10/2011 | | | | | | 8.7 | | 19 | 140 | |
| 28/11/2011 | | | | | | 6.9 | | 17 | | |
| 16/12/2011 | | | | | | 8.2 | | 17 | 340 | |
| 30/01/2012 | | | | | | 8.5 | | 17 | 200 | |
| 28/02/2012 | | | | | | 8.7 | | 16 | 230 | |
| 30/03/2012 | | | | | | 7.9 | | 16 | 130 | |
| 24/04/2012 | | | | | | 8.1 | | 22 | 530 | |
| 30/05/2012 | | | | | | 7 | | 22 | 500 | |
| 25/06/2012 | | | | | | 8.4 | | 19 | 140 | |
| 26/07/2012 | | | | | | 8.3 | | 19 | 190 | |
| 22/08/2012 | | | | | | 7.4 | | 19 | 620 | |
| 19/09/2012 | | | | | | 7.5 | | 21 | 660 | |
| 25/10/2012 | | | | | | 8.5 | | 21 | 630 | |
| 21/11/2012 | 0.015 | 0.02 | 240 | 0.01 | 0.001 | 8.1 | 0.002 | 22 | 700 | 0.03 |
| 28/12/2012 | 0.027 | 0.02 | 220 | 0.01 | 0.001 | 8.5 | 0.002 | 20 | 590 | 0.04 |
| 29/01/2013 | 0.001 | 0.02 | 220 | 0.01 | 0.002 | 8.3 | 0.002 | 21 | 600 | 0.03 |
| 22/02/2013 | 0.003 | 0.03 | 270 | 0.01 | 0.001 | 8.3 | 0.002 | 22 | 560 | 0.02 |
| 26/03/2013 | 0.015 | 0.02 | 250 | 0.01 | 0.001 | 8.3 | 0.002 | 22 | 600 | 0.03 |

| Sawyers Swamp Creek upstream @0 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 | <0.001 | 0.19 | 514 | 0.014 | 0.08 | 0.019 | | 4.8 | 0.0002 | 7 | 667 | 0.001 | | 0.002 | 1.2 | 0.02 | 0.00005 | 11.2 | 2.0 |
| Maximum | <0.001 | 0.34 | 530 | 0.019 | 0.10 | 0.022 | | 5.6 | 0.0002 | 10 | 1000 | 0.001 | | 0.004 | 1.3 | 0.04 | 0.00005 | 12.0 | 2.0 |
| Minimum | <0.001 | 0.10 | 490 | 0.012 | 0.06 | 0.017 | | 4.4 | 0.0002 | 5 | 120 | 0.001 | | 0.001 | 1.2 | 0.01 | 0.00005 | 11.0 | 2.0 |
| 50th Percentile | <0.001 | 0.18 | 520 | 0.014 | 0.07 | 0.019 | | 4.5 | 0.0002 | 6 | 785 | 0.001 | | 0.001 | 1.2 | 0.02 | 0.00005 | 11.0 | 2.0 |

| Continued……………….. Sawyers Swamp Creek upstream @0 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 | 0.012 | 0.02 | 240 | 0.010 | 0.001 | 8.1 | 0.002 | 19 | 433 | 0.030 |
| Maximum | 0.027 | 0.03 | 270 | 0.010 | 0.002 | 8.7 | 0.002 | 22 | 700 | 0.040 |
| Minimum | 0.001 | 0.02 | 220 | 0.010 | 0.001 | 7.0 | 0.002 | 16 | 130 | 0.020 |
| 50th Percentile | 0.015 | 0.02 | 240 | 0.010 | 0.001 | 8.3 | 0.002 | 20 | 515 | 0.030 |

| 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 | | | | | | | | | |

| 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** |
| 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 | |

| SSCAD Seepage from V-notch (water collected and recycling back into dam) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 1/02/2010 | <0.001 | 90 | 0.2 | <0.002 | 2.9 | 0.024 | 0.001 | 150 | 0.0004 | 49 | | 2013 | <0.001 | | <0.001 | 0.6 | <0.01 | <0.00005 | 34 | | 67 |
| 24/02/2010 | <0.001 | 80 | 0.1 | <0.001 | 2.8 | 0.022 | 0.001 | 130 | 0.00018 | 51 | | 2139 | <0.001 | | 0.0029 | 1.6 | <0.01 | <0.00005 | 35 | | 61 |
| 18/03/2010 | <0.001 | 80 | <0.1 | <0.001 | 3 | 0.021 | 0.001 | 140 | 0.0002 | 46 | | 2016 | <0.001 | | 0.0032 | 1.5 | <0.01 | <0.00005 | 35 | | 64 |
| 15/04/2010 | <0.001 | 110 | <0.1 | <0.001 | 2.4 | 0.021 | <0.001 | 120 | 0.0002 | 48 | | 2000 | <0.001 | | 0.004 | 1.2 | 0.01 | <0.00005 | 33 | | 57 |
| 26/05/2010 | <0.001 | 60 | 0.5 | <0.001 | 2 | 0.021 | <0.001 | 99 | <0.0002 | 40 | | 1555 | 0.001 | | 0.002 | 1.2 | 0.02 | <0.00005 | 28 | | 47 |
| 9/06/2010 | <0.001 | 80 | 0.09 | <0.001 | 2.7 | 0.021 | | 140 | 0.0002 | 48 | | 1831 | <0.001 | | 0.002 | 1.3 | <0.01 | <0.00005 | 35 | | 65 |
| 1/07/2010 | <0.001 | 90 | 0.36 | <0.001 | 2 | 0.03 | | 110 | <0.0002 | 50 | | 1681 | <0.001 | | 0.004 | 1.2 | <0.01 | <0.00005 | 26 | | 52 |
| 25/08/2010 | <0.001 | 80 | 1.1 | <0.001 | 0.75 | 0.03 | | 52 | <0.0002 | 46 | | 860 | 0.001 | | 0.003 | 0.8 | 0.01 | <0.00005 | 12 | | 25 |
| 23/09/2010 | <0.001 | 240 | 1.1 | 0.001 | 0.58 | 0.033 | | 41 | <0.0002 | 45 | | 979 | <0.001 | | 0.004 | 1.2 | 0.01 | <0.00005 | 12 | | 21 |
| 27/10/2010 | <0.001 | 80 | 1.1 | <0.001 | 0.79 | 0.035 | | 48 | <0.0002 | 38 | | 818 | <0.001 | | 0.002 | 0.7 | 0.01 | <0.00005 | 12 | | 24 |
| 19/11/2010 | <0.001 | 110 | 1.7 | 0.001 | 1 | 0.056 | | 62 | <0.0002 | 48 | | 1004 | 0.002 | | 0.005 | 0.9 | 0.01 | <0.00005 | 17 | | 31 |
| 9/12/2010 | <0.001 | 50 | 0.88 | 0.0015 | 1.7 | 0.058 | | 78 | 0.001 | 44 | | 1488 | <0.001 | | 0.0042 | 1.1 | <0.01 | <0.00005 | 29 | | 33 |
| 12/01/2011 | <0.001 | 90 | 0.09 | <0.001 | 2.1 | 0.029 | | 120 | <0.0002 | 58 | | 1840 | <0.001 | | 0.001 | 1.3 | 0.01 | <0.00005 | 32 | | 58 |
| 24/02/2011 | <0.001 | 90 | 0.06 | <0.001 | 2.5 | 0.023 | | 130 | 0.0002 | 51 | | 1900 | <0.001 | | <0.001 | 1.4 | <0.01 | <0.00005 | 34 | | 60 |
| 24/03/2011 | <0.001 | 86 | 0.05 | <0.001 | 2.5 | 0.023 | | 130 | <0.0002 | 51 | | 1900 | <0.001 | | 0.002 | 1.3 | <0.01 | <0.00005 | 34 | | 61 |
| 8/04/2011 | <0.001 | 85 | 0.06 | <0.001 | 2.6 | 0.021 | | 120 | 0.0002 | 50 | | 1900 | <0.001 | | 0.002 | 1.3 | 0.02 | <0.00005 | 37 | | 57 |
| 12/05/2011 | <0.001 | 81 | 0.05 | <0.001 | 2.5 | 0.022 | | 120 | 0.0002 | 48 | | 1900 | <0.001 | | 0.002 | 1.3 | 0.02 | <0.00005 | 33 | | 60 |
| 10/06/2011 | <0.001 | 82 | 0.08 | <0.001 | 2.6 | 0.022 | | 130 | <0.0002 | 48 | | 2000 | <0.001 | | 0.003 | 1.3 | <0.01 | <0.00005 | 33 | | 59 |
| 26/07/2011 | <0.001 | 82 | 0.04 | <0.001 | 2.6 | 0.02 | | 120 | <0.0002 | 45 | | 1800 | 0.001 | | 0.002 | 1.3 | <0.01 | <0.00005 | 35 | | 57 |
| 30/08/2011 | <0.001 | 85 | 0.06 | <0.001 | 2.3 | 0.021 | | 120 | <0.0002 | 46 | | 1800 | <0.001 | | 0.002 | 1.3 | <0.01 | <0.00005 | 33 | | 53 |
| 21/09/2011 | <0.001 | 84 | 0.05 | <0.001 | 2.4 | 0.021 | | 120 | <0.0002 | 49 | | 1900 | 0.002 | | 0.004 | 1.4 | 0.02 | <0.00005 | 34 | | 56 |
| 26/10/2011 | <0.001 | 89 | 0.05 | <0.001 | 2.1 | 0.022 | | 110 | <0.0002 | 47 | | 1900 | 0.001 | | <0.001 | 1.3 | 0.03 | <0.00005 | 33 | | 55 |

| SSCAD Seepage from V-notch (water collected and recycling back into dam) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 15/11/2011 | <0.001 | 87 | 0.1 | <0.001 | 2.4 | 0.18 | | 120 | <0.0002 | 53 | | 1900 | <0.001 | | 0.003 | 1.4 | 0.03 | <0.00005 | 33 | | 56 |
| 18/01/2012 | <0.001 | 89 | 0.12 | <0.001 | 2.4 | 0.024 | | 120 | <0.0002 | 52 | | 1900 | <0.001 | | 0.003 | 1.3 | 0.03 | <0.00005 | 34 | | 54 |
| 23/02/2012 | <0.001 | 90 | 0.37 | <0.001 | 1.9 | 0.027 | | 92 | <0.0002 | 43 | | 1600 | <0.001 | | 0.002 | 0.9 | 0.03 | <0.00005 | 28 | | 44 |
| 14/03/2012 | <0.001 | 100 | 0.09 | <0.001 | 2 | 0.03 | | 97 | <0.0002 | 53 | | 1700 | <0.001 | | 0.002 | 0.9 | 0.01 | <0.00005 | 30 | | 47 |
| 20/04/2012 | <0.001 | 88 | 0.31 | <0.001 | 2.3 | 0.024 | | 100 | 0.0002 | 49 | | 1700 | <0.001 | | 0.004 | 1.7 | 0.02 | 0.00006 | 30 | | 48 |
| 23/05/2012 | <0.001 | 85 | 0.19 | <0.001 | 2.4 | 0.023 | | 110 | <0.0002 | 47 | | 1700 | <0.001 | | 0.003 | 1.3 | 0.01 | <0.00005 | 28 | | 53 |
| 21/06/2012 | <0.001 | 89 | 0.11 | <0.001 | 2 | 0.021 | | 88 | <0.0002 | 45 | | 1500 | <0.001 | | 0.002 | 1.3 | <0.01 | <0.00005 | 26 | | 43 |
| 26/07/2012 | <0.001 | 68 | 1.1 | <0.001 | 1.4 | 0.026 | | 62 | <0.0002 | 38 | | 1200 | <0.001 | | 0.002 | 0.8 | 0.03 | <0.00005 | 19 | | 31 |
| 15/08/2012 | <0.001 | 86 | 0.17 | <0.001 | 2.1 | 0.023 | | 93 | <0.0002 | 48 | | 1600 | <0.001 | | 0.002 | 1.5 | 0.02 | <0.00005 | 28 | | 44 |
| 14/09/2012 | <0.001 | 86 | 0.19 | <0.001 | 2.3 | 0.022 | | 98 | <0.0002 | 46 | | 1600 | <0.001 | | 0.003 | 1.2 | <0.01 | <0.00005 | 31 | | 46 |
| 11/10/2012 | <0.001 | 82 | 0.31 | <0.001 | 2.3 | 0.024 | | 94 | 0.0002 | 42 | | 1600 | <0.001 | | 0.004 | 1.2 | 0.22 | <0.00005 | 30 | | 44 |
| 14/11/2012 | <0.001 | 82 | 0.07 | <0.001 | 2.5 | 0.022 | | 98 | <0.0002 | 41 | | 1700 | <0.001 | | 0.002 | 1.3 | <0.01 | <0.00005 | 31 | | 45 |
| 12/12/2012 | <0.001 | 79 | 0.36 | <0.001 | 2.4 | 0.044 | | 96 | 0.0003 | 44 | | 1700 | <0.001 | | 0.004 | 1.5 | <0.01 | <0.00005 | 38 | | 45 |
| 16/01/2013 | <0.001 | 80 | 0.69 | <0.001 | 2.6 | 0.039 | | 110 | 0.0006 | 42 | | 1700 | 0.002 | | 0.008 | 1.8 | 0.04 | <0.00005 | 37 | | 47 |
| 20/02/2013 | <0.001 | 77 | 0.17 | <0.001 | 2.4 | 0.021 | | 110 | <0.0002 | 37 | | 1700 | <0.001 | | 0.004 | 0.2 | <0.01 | <0.00005 | 33 | | 50 |
| 13/03/2013 | <0.001 | 84 | 0.08 | <0.001 | 2.2 | 0.027 | | 110 | 0.0002 | 40 | | 1800 | <0.001 | | 0.005 | 1.4 | <0.01 | <0.00005 | 36 | | 51 |

| Continued…….. SSCAD Seepage from V-notch (water collected and recycling back into dam) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| 1/02/2010 | 0.03 | <0.01 | 250 | 0.01 | <0.001 | 7.4 | 0.002 | 1000 | 1600 | 0.06 |
| 24/02/2010 | 0.05 | <0.01 | 230 | <0.01 | <0.001 | 7.4 | <0.002 | 980 | 1500 | 0.03 |
| 18/03/2010 | 0.06 | <0.01 | 240 | 0.01 | <0.001 | 7.5 | <0.002 | 900 | 1600 | 0.04 |
| 15/04/2010 | 0.02 | <0.01 | 250 | <0.01 | <0.001 | 7.8 | 0.002 | 890 | 1500 | 0.04 |
| 26/05/2010 | 0.05 | <0.01 | 190 | <0.01 | <0.001 | | <0.002 | 720 | 1100 | 0.03 |
| 9/06/2010 | 0.05 | <0.01 | 240 | 0.01 | <0.001 | 7.4 | 0.002 | 930 | 1500 | 0.04 |
| 1/07/2010 | 0.22 | <0.01 | 190 | <0.01 | <0.001 | 8 | <0.002 | 700 | 1200 | 0.03 |
| 25/08/2010 | 0.15 | <0.01 | 96 | <0.01 | 0.001 | 7.7 | <0.002 | 250 | 530 | 0.04 |
| 23/09/2010 | <0.01 | 0.01 | 150 | <0.01 | 0.001 | 8.2 | 0.002 | 190 | 610 | 0.01 |
| 27/10/2010 | 0.24 | <0.01 | 83 | <0.01 | 0.001 | 7.7 | <0.002 | 250 | 560 | 0.02 |
| 19/11/2010 | 0.11 | <0.01 | 120 | <0.01 | 0.002 | 7.7 | <0.002 | 330 | 700 | 0.02 |
| 9/12/2010 | 0.41 | 0.01 | 210 | 0.02 | <0.001 | 7.4 | 0.002 | 640 | 1100 | 0.07 |
| 12/01/2011 | <0.01 | <0.01 | 240 | <0.01 | <0.001 | 7.5 | <0.002 | 850 | 1500 | 0.03 |
| 24/02/2011 | 0.07 | <0.01 | 250 | 0.01 | <0.001 | 7.5 | <0.002 | 910 | 1500 | 0.03 |
| 24/03/2011 | 0.046 | <0.01 | 250 | <0.01 | <0.001 | 7.4 | <0.002 | 890 | 1400 | 0.03 |
| 8/04/2011 | 0.046 | <0.01 | 250 | <0.01 | <0.001 | 7.5 | <0.002 | 900 | 1500 | 0.03 |
| 12/05/2011 | 0.049 | <0.01 | 240 | <0.01 | <0.001 | 7.4 | <0.002 | 880 | 1500 | 0.03 |
| 10/06/2011 | 0.055 | <0.01 | 260 | 0.01 | <0.001 | 7.4 | <0.002 | 890 | 1400 | 0.04 |
| 26/07/2011 | 0.05 | <0.01 | 240 | <0.01 | <0.001 | 7.3 | 0.002 | 880 | 1400 | 0.04 |
| 30/08/2011 | 0.047 | <0.01 | 240 | <0.01 | <0.001 | 7.5 | 0.002 | 820 | 1300 | 0.04 |
| 21/09/2011 | 0.039 | <0.01 | 250 | <0.01 | <0.001 | 7.7 | 0.002 | 850 | 1500 | 0.03 |
| 26/10/2011 | 0.05 | <0.01 | 230 | <0.01 | <0.001 | 7.4 | 0.002 | 820 | 1400 | 0.03 |
| 15/11/2011 | 0.019 | <0.01 | 230 | <0.01 | <0.001 | 7.7 | 0.002 | 830 | 1500 | 0.51 |
| 18/01/2012 | 0.076 | <0.01 | 250 | <0.01 | <0.001 | 7.6 | <0.002 | 820 | 1400 | 0.04 |
| 23/02/2012 | 0.001 | <0.01 | 210 | <0.01 | <0.001 | 7.6 | <0.002 | 630 | 1100 | 0.03 |
| 14/03/2012 | 0.032 | <0.01 | 220 | <0.01 | <0.001 | 7.7 | 0.002 | 700 | 1100 | 0.03 |
| 20/04/2012 | 0.019 | <0.01 | 220 | <0.01 | <0.001 | 7.4 | 0.002 | 750 | 1300 | 0.03 |
| 23/05/2012 | 0.026 | <0.01 | 210 | <0.01 | <0.001 | 7.2 | 0.002 | 740 | 1300 | 0.06 |
| 21/06/2012 | 0.03 | <0.01 | 190 | <0.01 | <0.001 | 7.5 | 0.002 | 660 | 1200 | 0.03 |
| 26/07/2012 | <0.001 | <0.01 | 140 | <0.01 | <0.001 | 7 | 0.002 | 480 | 860 | 0.03 |
| 15/08/2012 | 0.014 | <0.01 | 210 | <0.01 | <0.001 | 7.1 | 0.002 | 720 | 1300 | 0.07 |
| 14/09/2012 | 0.007 | <0.01 | 210 | <0.01 | <0.001 | 7.4 | <0.002 | 730 | 1200 | 0.04 |

| Continued…….. SSCAD Seepage from V-notch (water collected and recycling back into dam) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| 11/10/2012 | 0.087 | <0.01 | 210 | <0.01 | <0.001 | 7.1 | 0.002 | 710 | 1200 | 0.03 |
| 14/11/2012 | 0.027 | <0.01 | 220 | <0.01 | <0.001 | 6.9 | 0.002 | 730 | 870 | 0.04 |
| 12/12/2012 | 0.017 | <0.01 | 210 | <0.01 | <0.001 | 7.2 | 0.002 | 820 | 1300 | 0.05 |
| 16/01/2013 | 0.031 | <0.01 | 220 | 0.02 | 0.001 | 6.8 | 0.002 | 780 | 1300 | 0.08 |
| 20/02/2013 | 0.024 | <0.01 | 250 | <0.01 | <0.001 | 7.1 | <0.002 | 770 | 1400 | 0.03 |
| 13/03/2013 | 0.007 | <0.01 | 230 | 0.01 | <0.001 | 7 | 0.002 | 750 | 1300 | 0.04 |

| SSCAD Seepage from V-notch (water collected and recycling back into dam) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| Average | <0.001 | 84 | 0.3 | <0.001 | 2.20 | 0.027 | | 97 | 0.0003 | 44 | 1629 | 0.0020 | 0.003 | 1.214 | 0.05 | <0.00005 | 30 | 46 | 0.003 |
| Maximum | <0.001 | 100 | 1.1 | <0.001 | 2.60 | 0.044 | | 110 | 0.0006 | 53 | 1800 | 0.0020 | 0.008 | 1.800 | 0.22 | <0.00005 | 38 | 53 | 0.008 |
| Minimum | <0.001 | 68 | 0.1 | <0.001 | 1.40 | 0.021 | | 62 | 0.0002 | 37 | 1200 | 0.0020 | 0.002 | 0.200 | 0.01 | 0.00006 | 19 | 31 | 0.002 |
| 50th Percentile | <0.001 | 85 | 0.2 | <0.001 | 2.30 | 0.024 | | 98 | 0.0002 | 44 | 1700 | 0.0020 | 0.003 | 1.300 | 0.03 | <0.00005 | 30 | 46 | 0.003 |

| SSCAD Seepage from V-notch (water collected and recycling back into dam) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| Average | 0.02 | <0.01 | 211 | <0.01 | <0.001 | 7.2 | 0.002 | 712 | 1195 | 0.04 |
| Maximum | 0.09 | <0.01 | 250 | 0.020 | <0.001 | 7.7 | 0.002 | 820 | 1400 | 0.08 |
| Minimum | 0.00 | <0.01 | 140 | 0.010 | 0.001 | 6.8 | 0.002 | 480 | 860 | 0.03 |
| 50th Percentile | 0.02 | <0.01 | 210 | <0.01 | <0.001 | 7.2 | 0.002 | 730 | 1250 | 0.04 |

| Sawyers Creek @850m – upstream seepage from KVAD wall and Below v-notch Seepage Point. EANSW Site 93 from June, 2012 | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 1-Feb-10 | <0.001 | 120 | 0.3 | 0.002 | 0.43 | 0.043 | <0.001 | 20 | <0.0002 | 15 | | 554 | <0.001 | | 0.001 | 0.6 | 0.32 | <0.00005 | 8 | | 9.4 |
| 24-Feb-10 | <0.001 | 150 | <0.1 | 0.001 | 0.82 | 0.085 | <0.001 | 44 | <0.0001 | 22 | | 895 | <0.001 | | 0.0012 | 0.6 | 0.02 | <0.00005 | 12 | | 21 |
| 17-Mar-10 | <0.001 | 160 | <0.1 | 0.001 | 1.1 | 0.14 | 0.001 | 66 | <0.0002 | 29 | | 1188 | <0.001 | | 0.002 | 0.6 | <0.01 | <0.00005 | 16 | | 33 |
| 15-Apr-10 | <0.001 | 460 | 0.8 | 0.003 | 0.19 | 0.027 | <0.001 | 12 | <0.0002 | 9 | | 1024 | <0.001 | | 0.002 | 1 | 0.33 | <0.00005 | 11 | | 6 |
| 26-May-10 | <0.001 | 130 | 5 | 0.004 | 0.63 | 0.089 | 0.001 | 34 | <0.0002 | 32 | | 822 | 0.005 | | 0.009 | 0.5 | 0.02 | <0.00005 | 13 | | 19 |
| 9-Jun-10 | <0.001 | 120 | 0.03 | 0.001 | 0.98 | 0.07 | | 52 | <0.0002 | 33 | | 1031 | <0.001 | | 0.001 | 0.6 | 0.02 | <0.00005 | 15 | | 26 |
| 1-Jul-10 | <0.001 | 120 | 0.04 | 0.001 | 0.85 | 0.08 | | 48 | <0.0002 | 32 | | 1007 | <0.001 | | 0.003 | 0.4 | <0.01 | <0.00005 | 14 | | 25 |
| 25-Aug-10 | <0.001 | 180 | 0.51 | 0.001 | 0.2 | 0.032 | | 14 | <0.0002 | 20 | | 560 | <0.001 | | 0.001 | 0.5 | 0.62 | <0.00005 | 6 | | 7.7 |
| 23-Sep-10 | <0.001 | 260 | 0.4 | 0.003 | 1.1 | 0.024 | | 8.8 | <0.0002 | 10 | | 656 | <0.001 | | 0.002 | 0.6 | 0.95 | <0.00005 | 7 | | 4.5 |
| 28-Oct-10 | <0.001 | 220 | 1 | 0.002 | 0.07 | 0.026 | | 7.2 | <0.0002 | 8 | | 519 | <0.001 | | 0.002 | 0.5 | 0.46 | <0.00005 | 5 | | 4.3 |
| 23-Nov-10 | | | | | | | | | | | | | | | | | | | | | |
| 9-Dec-10 | | | | | | | | | | | | | | | | | | | | | |
| 13-Jan-11 | | | | | | | | | | | | | | | | | | | | | |
| 24-Feb-11 | | | | | | | | | | | | | | | | | | | | | |
| 24-Mar-11 | | | | | | | | | | | | | | | | | | | | | |
| 8-Apr-11 | | | | | | | | | | | | | | | | | | | | | |
| 12-May-11 | | | | | | | | | | | | | | | | | | | | | |
| 10-Jun-11 | | | | | | | | | | | | | | | | | | | | | |
| 25/07/2011 | | | | | | | | | | 8 | | 980 | | | | | | | | | |
| 23/08/2011 | | | | | | | | | | 9 | | 930 | | | | | | | | | |

**Sawyers Creek @850m – upstream seepage from KVAD wall and Below v-notch Seepage Point. EANSW Site 93 from June, 2012**

| Date | Ag | ALK | Al | As | B | Ba | Be | Ca | Cd | Cl | Co | COND | Cr | CrIV | Cu | F | Fe | Hg | K | Li | Mg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21/09/2011 | | | | | | | | | | 8 | | 1000 | | | | | | | | | |
| 21/10/2011 | | | | | | | | | | 19 | | 870 | | | | | | | | | |
| 28/11/2011 | | | | | | | | | | 13 | | 410 | | | | | | | | | |
| 16/12/2011 | | | | | | | | | | 12 | | 500 | | | | | | | | | |
| 30/01/2012 | | | | | | | | | | | | | | | | | | | | | |
| 28/02/2012 | | | | | | | | | | 10 | | 520 | | | | | | | | | |
| 30/03/2012 | | | | | | | | | | 11 | | 350 | | | | | | | | | |
| 24/04/2012 | | | | | | | | | | 12 | | 430 | | | | | | | | | |
| 30/05/2012 | | | | | | | | | | 16 | | 410 | | | | | | | | | |
| 29/06/2012 | <0.001 | 370 | 0.23 | 0.004 | 0.15 | 0.03 | | 9.0 | <0.0002 | 10 | | 804 | <0.001 | | <0.001 | 0.84 | 0.05 | <0.00005 | 8.5 | | 4.9 |
| 26/07/2012 | <0.001 | 133 | 1.27 | 0.002 | 0.19 | 0.03 | | 10.9 | <0.0002 | 17 | | 463 | <0.001 | | 0.002 | 0.35 | 0.14 | <0.00005 | 5.8 | | 6.2 |
| 22/08/2012 | <0.001 | 86 | 0.70 | 0.005 | 0.29 | 0.04 | | 14.0 | <0.0002 | 16 | | 438 | <0.001 | | 0.022 | 0.29 | 0.07 | <0.00005 | 5.9 | | 8.1 |
| 19/09/2012 | <0.001 | 119 | 1.15 | 0.009 | 0.41 | 0.07 | | 20.4 | <0.0002 | 18 | | 567 | <0.001 | | 0.004 | 0.45 | 0.09 | <0.00005 | 8.1 | | 11.4 |
| 25/10/2012 | <0.001 | 444 | 0.41 | 0.007 | 0.18 | 0.03 | | 10.5 | <0.0002 | 10 | | 950 | <0.001 | | 0.002 | 0.86 | 1.32 | <0.00005 | 10.0 | | 5.9 |
| 21/11/2012 | <0.001 | 492 | 0.11 | 0.008 | 0.21 | 0.03 | | 10.9 | <0.0002 | 8 | | 1043 | <0.001 | | 0.001 | 1.17 | 0.04 | <0.00005 | 11.6 | | 5.9 |
| 12/12/2012 | <0.001 | 502 | 0.26 | 0.016 | 0.10 | 0.03 | | 6.9 | <0.0002 | 7 | | 1037 | <0.001 | | 0.001 | 1.28 | 0.02 | <0.00005 | 13.2 | | 3.3 |
| 29/01/2013 | <0.001 | 516 | 0.13 | 0.013 | 0.11 | 0.02 | | 5.9 | <0.0002 | 6 | | 979 | <0.001 | | 0.001 | 1.23 | 0.05 | <0.00005 | 11.3 | | 2.7 |
| 22/02/2013 | <0.001 | 519 | 0.09 | 0.014 | 0.11 | 0.02 | | 7.4 | <0.0002 | 6 | | 1017 | <0.001 | | <0.001 | 1.25 | 0.02 | <0.00005 | 11.4 | | 3.1 |
| 26/03/2013 | <0.001 | 483 | 0.09 | 0.012 | 0.10 | 0.02 | | 6.2 | <0.0002 | 6 | | 981 | <0.001 | | 0.025 | 0.96 | 0.03 | <0.00005 | 11.3 | | 3.2 |

| Continued…….. SSCAD Seepage from V-notch (water collected and recycling back into dam) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| 1-Feb-10 | 0.08 | <0.01 | 84 | <0.01 | <0.001 | 7.9 | <0.002 | 130 | 340 | <0.01 |
| 24-Feb-10 | 1.1 | <0.01 | 110 | <0.01 | <0.001 | 7.6 | <0.002 | 250 | 550 | 0.01 |
| 17-Mar-10 | 1.6 | <0.01 | 150 | <0.01 | <0.001 | 7.5 | <0.002 | 390 | 860 | 0.02 |
| 15-Apr-10 | <0.01 | 0.01 | 230 | <0.01 | <0.001 | 8.5 | <0.002 | 71 | 590 | 0.04 |
| 26-May-10 | 0.11 | <0.01 | 120 | <0.01 | 0.011 | 7.7 | <0.002 | 230 | 480 | 0.06 |
| 9-Jun-10 | 0.55 | <0.01 | 130 | <0.01 | <0.001 | 7.7 | <0.002 | 380 | 720 | 0.01 |
| 1-Jul-10 | 0.91 | <0.01 | 120 | <0.01 | <0.001 | 8.2 | <0.002 | 320 | 600 | 0.02 |
| 25-Aug-10 | 0.2 | <0.01 | 95 | <0.01 | <0.001 | 8.1 | <0.002 | 79 | 310 | 0.02 |
| 23-Sep-10 | 0.04 | <0.01 | 140 | <0.01 | 0.001 | 8.3 | <0.002 | 68 | 390 | 0.01 |
| 28-Oct-10 | 0.02 | 0.01 | 110 | <0.01 | 0.001 | 8.1 | <0.002 | 38 | 360 | 0.02 |
| 23-Nov-10 | | | | | | | | | | |
| 9-Dec-10 | | | | | | | | | | |
| 13-Jan-11 | | | | | | | | | | |
| 24-Feb-11 | | | | | | | | | | |
| 24-Mar-11 | | | | | | | | | | |
| 8-Apr-11 | | | | | | | | | | |
| 12-May-11 | | | | | | | | | | |
| 10-Jun-11 | | | | | | | | | | |
| 25/07/2011 | | | | | | 8.4 | | 58 | 630 | |
| 23/08/2011 | | | | | | 8.6 | | 57 | 610 | |
| 21/09/2011 | | | | | | 8.4 | | 59 | | |
| 21/10/2011 | | | | | | 7.8 | | 200 | 560 | |
| 28/11/2011 | | | | | | 7.6 | | 79 | 280 | |
| 16/12/2011 | | | | | | 8.0 | | 120 | 330 | |
| 30/01/2012 | | | | | | | | | | |
| 28/02/2012 | | | | | | 8.1 | | 39 | 340 | |
| 30/03/2012 | | | | | | 8.0 | | 36 | 240 | |
| 24/04/2012 | | | | | | 7.9 | | 56 | 260 | |
| 30/05/2012 | | | | | | 7.6 | | 99 | 220 | |
| 29/06/2012 | 0.050 | 0.01 | 176 | 0.002 | <0.001 | 8.5 | <0.002 | 57 | 536 | 0.029 |
| 26/07/2012 | 0.001 | 0.01 | 81 | 0.002 | 0.002 | 7.7 | <0.002 | 72 | 310 | 0.014 |

| Continued........ SSCAD Seepage from V-notch (water collected and recycling back into dam) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| 22/08/2012 | 0.005 | 0.01 | 69 | 0.003 | 0.002 | 7.3 | <0.002 | 106 | 273 | 0.06 |
| 19/09/2012 | 0.052 | 0.01 | 89 | 0.006 | 0.003 | 7.6 | <0.002 | 136 | 350 | 0.061 |
| 25/10/2012 | 0.145 | 0.02 | 212 | 0.003 | 0.001 | 8.3 | <0.002 | 60 | 564 | 0.016 |
| 21/11/2012 | 0.015 | 0.02 | 241 | 0.003 | <0.001 | 8.0 | <0.002 | 62 | 672 | 0.028 |
| 12/12/2012 | 0.037 | 0.03 | 233 | 0.003 | 0.001 | 8.7 | <0.002 | 34 | 643 | 0.071 |
| 29/01/2013 | 0.001 | 0.02 | 227 | 0.002 | 0.002 | 8.5 | <0.002 | 31 | 688 | 0.029 |
| 22/02/2013 | 0.001 | 0.02 | 280 | 0.003 | <0.001 | 8.5 | <0.002 | 35 | 600 | 0.016 |
| 26/03/2013 | 0.001 | 0.02 | 245 | 0.005 | 0.002 | 8.4 | <0.002 | 34 | 610 | 0.029 |

| Sawyers Creek @850m – upstream seepage from KVAD wall and Below v-notch Seepage Point. EANSW Site 93 | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| Average | <0.001 | 366 | 0.44 | 0.009 | 0.18 | 0.03 | | 10.2 | <0.0002 | 11 | 714 | <0.001 | | 0.007 | 0.87 | 0.18 | <0.00005 | 9.7 | 5.5 |
| Maximum | <0.001 | 519 | 1.27 | 0.016 | 0.41 | 0.07 | | 20.4 | <0.0002 | 18 | 1043 | <0.001 | | 0.025 | 1.28 | 1.32 | <0.00005 | 13.2 | 11.4 |
| Minimum | <0.001 | 86 | 0.09 | 0.002 | 0.10 | 0.02 | | 5.9 | <0.0002 | 6 | 350 | <0.001 | | 0.001 | 0.29 | 0.02 | <0.00005 | 5.8 | 2.7 |
| 50th Percentile | <0.001 | 464 | 0.24 | 0.009 | 0.17 | 0.03 | | 9.8 | <0.0002 | 10 | 686 | <0.001 | | 0.002 | 0.91 | 0.05 | <0.00005 | 10.6 | 5.4 |

| Sawyers Creek @850m – upstream seepage from KVAD wall and Below v-notch Seepage Point. EANSW Site 93 from June, 2012 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| Average | 0.03 | 0.02 | 185 | 0.003 | 0.002 | 8.1 | <0.002 | 61 | 450 | 0.035 |
| Maximum | 0.15 | 0.03 | 280 | 0.006 | 0.003 | 8.7 | <0.002 | 136 | 688 | 0.071 |
| Minimum | 0.00 | 0.01 | 69 | 0.002 | 0.001 | 7.3 | <0.002 | 31 | 220 | 0.014 |
| 50th Percentile | 0.01 | 0.02 | 220 | 0.003 | 0.002 | 8.1 | <0.002 | 56 | 443 | 0.029 |

| Sawyers Swamp Creek @ 1250m near GW Bore D5, EANSW Site 83 | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 1-Feb-10 | <0.001 | 90 | 1.9 | <0.002 | 1.7 | 0.041 | 0.002 | 37 | <0.0002 | 17 | | 897 | <0.001 | | 0.001 | 1.2 | 0.02 | <0.00005 | 23 | | 26 |
| 24-Feb-10 | <0.001 | 140 | <0.1 | <0.001 | 0.85 | 0.083 | <0.001 | 39 | <0.0001 | 21 | | 846 | <0.001 | | 0.0013 | 0.7 | 0.06 | <0.00005 | 13 | | 20 |
| 17-Mar-10 | <0.001 | 170 | <0.1 | <0.001 | 0.96 | 0.13 | <0.001 | 55 | <0.0002 | 26 | | 1113 | <0.001 | | 0.002 | 0.7 | 0.02 | <0.00005 | 14 | | 30 |
| 15-Apr-10 | <0.001 | 460 | 0.9 | 0.003 | 0.23 | 0.026 | <0.001 | 12 | <0.0002 | 10 | | 1029 | <0.001 | | 0.002 | 0.8 | 0.25 | <0.00005 | 11 | | 6.4 |
| 26-May-10 | <0.001 | 130 | 3.7 | 0.003 | 0.71 | 0.081 | 0.001 | 36 | <0.0002 | 33 | | 870 | 0.003 | | 0.006 | 0.5 | 0.01 | <0.00005 | 14 | | 20 |
| 9-Jun-10 | <0.001 | 120 | 0.01 | <0.001 | 0.93 | 0.073 | | 49 | <0.0002 | 33 | | 1007 | <0.001 | | 0.001 | 0.5 | 0.02 | <0.00005 | 14 | | 25 |
| 1-Jul-10 | <0.001 | 120 | 0.02 | <0.001 | 0.88 | 0.086 | | 47 | <0.0002 | 33 | | 1031 | <0.001 | | 0.002 | 0.5 | 0.03 | <0.00005 | 13 | | 25 |
| 25-Aug-10 | <0.001 | 180 | 0.85 | 0.001 | 0.21 | 0.034 | | 14 | <0.0002 | 19 | | 589 | <0.001 | | 0.001 | 0.6 | 0.23 | <0.00005 | 7 | | 8.2 |
| 23-Sep-10 | <0.001 | 270 | 0.36 | 0.003 | 1.3 | 0.023 | | 9.1 | <0.0002 | 10 | | 667 | <0.001 | | 0.002 | 0.7 | 0.96 | <0.00005 | 7 | | 4.7 |
| 27-Oct-10 | <0.001 | 120 | 0.28 | 0.001 | 0.1 | 0.023 | | 8 | <0.0002 | 10 | | 360 | <0.001 | | 0.001 | 0.4 | 0.63 | <0.00005 | 4 | | 4.8 |
| 18-Nov-10 | <0.001 | 90 | 0.42 | 0.001 | 0.09 | 0.021 | | 6.1 | <0.0002 | 9 | | 287 | <0.001 | | 0.002 | 0.3 | 0.57 | <0.00005 | 3 | | 3.8 |
| 9-Dec-10 | <0.001 | 30 | 0.53 | <0.001 | 0.14 | 0.051 | | 6.5 | <0.0002 | 13 | | 220 | <0.001 | | 0.0015 | 0.2 | 0.09 | <0.00005 | 4 | | 4.5 |
| 13-Jan-11 | <0.001 | 80 | 0.27 | <0.001 | 0.22 | 0.042 | | 12 | <0.0002 | 14 | | 347 | <0.001 | | <0.001 | 0.4 | 0.43 | <0.00005 | 4 | | 7 |
| 24-Feb-11 | <0.001 | 110 | 0.03 | <0.001 | 0.39 | 0.058 | | 21 | <0.0002 | 20 | | 549 | <0.001 | | <0.001 | 0.5 | 0.14 | <0.00005 | 7 | | 13 |
| 24-Mar-11 | <0.001 | 120 | 0.07 | <0.001 | 0.42 | 0.053 | | 22 | <0.0002 | 21 | | 560 | <0.001 | | 0.001 | 0.4 | 0.17 | <0.00005 | 8 | | 13 |
| 8-Apr-11 | <0.001 | 170 | 0.03 | <0.001 | 0.47 | 0.05 | | 24 | <0.0002 | 20 | | 720 | <0.001 | | 0.002 | 0.5 | 0.06 | <0.00005 | 9 | | 14 |
| 12-May-11 | <0.001 | 330 | 0.1 | 0.002 | 0.3 | 0.035 | | 16 | <0.0002 | 20 | | 850 | <0.001 | | 0.001 | 0.8 | 0.19 | <0.00005 | 11 | | 10 |
| 10-Jun-11 | <0.001 | 430 | 0.36 | 0.005 | 0.19 | 0.022 | | 11 | <0.0002 | 9 | | 940 | <0.001 | | <0.001 | 1 | 0.05 | <0.00005 | 9 | | 5 |
| 21/09/2011 | | | | | | | | | | 8 | | 1000 | | | | | | | | | |
| 21/10/2011 | | | | | | | | | | 19 | | 880 | | | | | | | | | |
| 28/11/2011 | | | | | | | | | | 13 | | 410 | | | | | | | | | |

| Sawyers Swamp Creek @ 1250m near GW Bore D5, EANSW Site 83 | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 16/12/2011 | | | | | | | | | | 13 | | 520 | | | | | | | | | |
| 30/01/2012 | | | | | | | | | | 13 | | 710 | | | | | | | | | |
| 28/02/2012 | <0.001 | 180 | 0.47 | 0.002 | 0.18 | 0.025 | | 9.4 | <0.0002 | 10 | | 560 | <0.001 | | 0.002 | 0.4 | 0.47 | <0.00005 | 6 | | 5 |
| 14/03/2012 | <0.001 | 84 | 0.19 | <0.001 | 0.13 | 0.034 | | 5.7 | <0.0002 | 11 | | 280 | <0.001 | | <0.001 | 0.2 | 0.29 | <0.00005 | 4 | | 4 |
| 20/04/2012 | <0.001 | 120 | 0.19 | <0.001 | 0.21 | 0.032 | | 9.4 | <0.0002 | 12 | | 400 | <0.001 | | 0.001 | 0.3 | 0.44 | 0.00005 | 5 | | 6 |
| 23/05/2012 | <0.001 | 120 | 0.2 | <0.001 | 0.36 | 0.037 | | 16 | <0.0001 | 15 | | 530 | <0.001 | | 0.001 | 0.6 | 0.1 | <0.00005 | 7 | | 9 |
| 21/06/2012 | <0.001 | 63 | 0.25 | <0.001 | 0.31 | 0.034 | | 15 | <0.0002 | 17 | | 410 | <0.001 | | <0.001 | 0.3 | 0.08 | <0.00005 | 6 | | 8 |
| 26/07/2012 | <0.001 | 180 | 0.66 | 0.002 | 0.21 | 0.027 | | 11 | <0.0002 | 16 | | 550 | <0.001 | | 0.001 | 0.5 | 0.33 | <0.00005 | 7 | | 6 |
| 15/08/2012 | <0.001 | 93 | 0.21 | <0.001 | 0.36 | 0.032 | | 15 | <0.0002 | 16 | | 490 | <0.001 | | <0.001 | 0.5 | 0.09 | <0.00005 | 7 | | 8 |
| 14/09/2012 | <0.001 | 110 | 0.27 | <0.001 | 0.5 | 0.041 | | 21 | <0.0002 | 17 | | 590 | <0.001 | | 0.001 | 0.6 | 0.04 | <0.00005 | 10 | | 12 |
| 11/10/2012 | <0.001 | 420 | 0.45 | 0.004 | 0.21 | 0.023 | | 10 | <0.0002 | 9 | | 860 | <0.001 | | 0.002 | 1 | 1.7 | <0.00005 | 11 | | 6 |
| 14/11/2012 | <0.001 | 500 | 0.13 | 0.007 | 0.18 | 0.022 | | 9.6 | <0.0002 | 7 | | 1000 | <0.001 | | 0.0012 | 1.2 | 0.11 | <0.00005 | 12 | | 5 |
| 12/12/2012 | <0.001 | 510 | 0.29 | 0.015 | 0.09 | 0.024 | | 5.9 | <0.0002 | 6 | | 1000 | <0.001 | | 0.002 | 1.4 | 0.01 | <0.00005 | 13 | | 3 |
| 16/01/2013 | <0.001 | 520 | 0.12 | 0.013 | 0.1 | 0.018 | | 5.4 | <0.0002 | 5 | | 1000 | <0.001 | | 0.001 | 1.3 | 0.08 | <0.00005 | 11 | | 2 |
| 20/02/2013 | <0.001 | 520 | 0.1 | 0.012 | 0.1 | 0.015 | | 6 | <0.0002 | 5 | | 990 | <0.001 | | <0.001 | 1.3 | 0.08 | <0.00005 | 11 | | 3 |
| 13/03/2013 | <0.001 | 470 | 0.1 | 0.012 | 0.09 | 0.019 | | 5 | <0.0002 | 5 | | 970 | <0.001 | | <0.001 | 1.4 | 0.07 | <0.00005 | 12 | | 3 |

| Continued…….. Sawyers Swamp Creek @ 1250m near GW Bore D5, EANSW Site 83 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| 1-Feb-10 | 3.2 | <0.01 | 110 | 0.2 | 0.001 | 7.3 | <0.002 | 350 | 600 | 0.21 |
| 24-Feb-10 | 1.1 | <0.01 | 110 | <0.01 | <0.001 | 7.7 | <0.002 | 230 | 520 | 0.02 |
| 17-Mar-10 | 1.6 | <0.01 | 130 | <0.01 | <0.001 | 7.8 | <0.002 | 330 | 790 | 0.02 |
| 15-Apr-10 | <0.01 | 0.02 | 220 | <0.01 | <0.001 | 8.5 | <0.002 | 76 | 580 | 0.04 |
| 26-May-10 | 0.14 | <0.01 | 130 | <0.01 | 0.008 | 7.9 | <0.002 | 250 | 560 | 0.04 |
| 9-Jun-10 | 0.69 | <0.01 | 120 | <0.01 | <0.001 | 7.8 | <0.002 | 360 | 700 | 0.01 |
| 1-Jul-10 | 1.1 | <0.01 | 120 | <0.01 | <0.001 | 8.2 | <0.002 | 330 | 640 | 0.02 |
| 25-Aug-10 | 0.15 | <0.01 | 110 | <0.01 | <0.001 | 8.2 | <0.002 | 79 | 330 | 0.02 |
| 23-Sep-10 | 0.03 | <0.01 | 150 | <0.01 | 0.001 | 8.4 | <0.002 | 68 | 400 | 0.02 |
| 27-Oct-10 | 0.04 | <0.01 | 66 | <0.01 | <0.001 | 8 | <0.002 | 46 | 230 | 0.01 |
| 18-Nov-10 | 0.05 | <0.01 | 54 | <0.01 | <0.001 | 7.9 | <0.002 | 35 | 210 | 0.02 |
| 9-Dec-10 | 0.007 | <0.01 | 31 | <0.01 | <0.001 | 7.3 | <0.002 | 46 | 170 | 0.02 |
| 13-Jan-11 | 0.04 | <0.01 | 56 | <0.01 | <0.001 | 7.8 | <0.002 | 68 | 260 | 0.02 |
| 24-Feb-11 | 0.53 | <0.01 | 77 | <0.01 | <0.001 | 7.5 | <0.002 | 130 | 350 | 0.01 |
| 24-Mar-11 | 0.42 | <0.01 | 81 | <0.01 | <0.001 | 7.7 | <0.002 | 130 | 340 | 0.01 |
| 8-Apr-11 | 0.5 | <0.01 | 120 | <0.01 | <0.001 | 8.1 | <0.002 | 160 | 500 | 0.02 |
| 12-May-11 | 0.22 | 0.01 | 170 | <0.01 | <0.001 | 8.3 | <0.002 | 100 | 560 | 0.01 |
| 10-Jun-11 | 0.041 | 0.02 | 220 | <0.01 | 0.001 | 8.5 | <0.002 | 61 | 570 | 0.02 |
| 21/09/2011 | | | | | | 8.5 | | 59 | | |
| 21/10/2011 | | | | | | 8.1 | | 210 | 560 | |
| 28/11/2011 | | | | | | 7.9 | | 74 | 270 | |
| 16/12/2011 | | | | | | 8.2 | | 120 | 320 | |
| 30/01/2012 | | | | | | 8.3 | | 63 | | |
| 28/02/2012 | 0.057 | 0.01 | 100 | <0.01 | <0.001 | 8.3 | <0.002 | 50 | 360 | 0.02 |
| 14/03/2012 | 0.016 | <0.01 | 53 | <0.01 | <0.001 | 7.9 | <0.002 | 36 | 150 | 0.03 |
| 20/04/2012 | 0.21 | <0.01 | 73 | <0.01 | <0.001 | 7.8 | <0.002 | 61 | 200 | 0.02 |
| 23/05/2012 | 0.57 | <0.01 | 84 | <0.01 | <0.001 | 7.6 | <0.002 | 120 | 330 | 0.03 |
| 21/06/2012 | 0.5 | <0.01 | 54 | <0.01 | <0.001 | 7.7 | <0.002 | 110 | 270 | 0.01 |
| 26/07/2012 | 0.098 | <0.01 | 110 | <0.01 | <0.001 | 8 | <0.002 | 77 | 370 | 0.02 |
| 15/08/2012 | 0.4 | <0.01 | 71 | <0.01 | <0.001 | 7.4 | <0.002 | 120 | 320 | 0.04 |
| 14/09/2012 | 0.61 | <0.01 | 93 | <0.01 | <0.001 | 7.5 | <0.002 | 150 | 370 | 0.03 |
| 11/10/2012 | 0.17 | 0.02 | 210 | 0.01 | 0.001 | 8.2 | <0.002 | 59 | 570 | 0.03 |

| Continued…….. Sawyers Swamp Creek @ 1250m near GW Bore D5, EANSW Site 83 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| 14/11/2012 | 0.043 | 0.03 | 250 | <0.01 | <0.001 | 8.2 | <0.002 | 47 | 640 | 0.03 |
| 12/12/2012 | 0.026 | 0.02 | 240 | <0.01 | 0.001 | 8.6 | <0.002 | 27 | 640 | 0.06 |
| 16/01/2013 | <0.001 | 0.03 | 220 | <0.01 | 0.002 | 8.5 | <0.002 | 27 | 690 | 0.03 |
| 20/02/2013 | <0.001 | 0.03 | 270 | <0.01 | <0.001 | 8.5 | <0.002 | 24 | 620 | 0.02 |
| 13/03/2013 | <0.001 | 0.02 | 250 | <0.01 | <0.001 | 8.4 | <0.002 | 26 | 560 | 0.03 |

| Sawyers Creek @1250m – upstream seepage from KVAD wall and Below v-notch Seepage Point. EANSW Site 93 | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| Average | <0.001 | 278 | 0.26 | 0.008 | 0.22 | 0.027 | | 10 | <0.0002 | 11 | 688 | 0.001 | | 0.786 | 0.28 | <0.00005 | 9 | 6 | 0.001 |
| Maximum | <0.001 | 520 | 0.66 | 0.015 | 0.50 | 0.041 | | 21 | <0.0002 | 17 | 1000 | 0.002 | | 1.400 | 1.70 | <0.00005 | 13 | 12 | 0.002 |
| Minimum | <0.001 | 63 | 0.10 | 0.002 | 0.09 | 0.015 | | 5 | <0.0002 | 5 | 280 | 0.001 | | 0.200 | 0.01 | <0.00005 | 4 | 2 | 0.001 |
| 50th Percentile | <0.001 | 180 | 0.21 | 0.010 | 0.20 | 0.026 | | 10 | <0.0002 | 11 | 575 | 0.001 | | 0.600 | 0.10 | <0.00005 | 9 | 6 | 0.001 |

| Sawyers Creek @1250m – upstream seepage from KVAD wall and Below v-notch Seepage Point. EANSW Site 93 from June, 2012 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| Average | 0.25 | 0.02 | 148 | <0.01 | 0.001 | 8.0 | <0.002 | 67 | 435 | 0.03 |
| Maximum | 0.61 | 0.03 | 270 | 0.010 | 0.002 | 8.6 | <0.002 | 150 | 690 | 0.06 |
| Minimum | 0.02 | 0.01 | 53 | <0.01 | 0.001 | 7.4 | <0.002 | 24 | 150 | 0.01 |
| 50th Percentile | 0.17 | 0.02 | 105 | <0.01 | 0.001 | 8.1 | <0.002 | 55 | 370 | 0.03 |

*Seepage Water Northern wall collection pit near GW6*

| Seepage water Northern wall collection pit near GW6 Groundwater from the KVAD on the northside drains. All water reports to the pipe out to the Lisdale Cut. | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 21-Feb-11 | | | | | | | | | | 19 | | 1055 | | | | | | | | | |
| 04-Mar-10 | | | | | | | | | | | | 808 | | | | | | | | | |
| 23-Mar-10 | | | | | | | | | | 24 | | 803 | | | | | | | | | |
| 15-Apr-10 | | | | | | | | | | | | | | | | | | | | | |
| 26-May-10 | | | | | | | | | | | | | | | | | | | | | |
| 15-Jun-10 | | | | | | | | | | 25 | | 817 | | | | | | | | | |
| 20-Jul-10 | | | | | | | | | | 20 | | 812 | | | | | | | | | |
| 18-Aug-10 | | | | | | | | | | 20 | | 833 | | | | | | | | | |
| 14-Sep-10 | | | | | | | | | | 20 | | 814 | | | | | | | | | |
| 12-Oct-10 | | | | | | | | | | 19 | | 854 | | | | | | | | | |
| 10-Nov-10 | | | | | | | | | | 20 | | 887 | | | | | | | | | |
| 10-Dec-10 | | | | | | | | | | 19 | | 932 | | | | | | | | | |
| 10-Jan-11 | | | | | | | | | | 21 | | 985 | | | | | | | | | |
| 21-Feb-11 | | | | | | | | | | 19 | | 1055 | | | | | | | | | |
| 15-Mar-11 | | | | | | | | | | 19 | | 1200 | | | | | | | | | |
| 17-Apr-11 | | | | | | | | | | 20 | | 1300 | | | | | | | | | |
| 20-May-11 | | | | | | | | | | 20 | | 1200 | | | | | | | | | |
| 22-Jun-11 | | | | | | | | | | 19 | | 1500 | | | | | | | | | |
| 25-Jul-11 | | | | | | | | | | 19 | | 1500 | | | | | | | | | |
| 23-Aug-11 | | | | | | | | | | 20 | | 1500 | | | | | | | | | |

| Seepage water Northern wall collection pit near GW6 Groundwater from the KVAD on the northside drains. All water reports to the pipe out to the Lisdale Cut. | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **Co** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Li** | **Mg** |
| 21-Sep-11 | | | | | | | | | | 20 | | 1400 | | | | | | | | | |
| 21-Oct-11 | | | | | | | | | | 18 | | 1600 | | | | | | | | | |
| 28-Nov-11 | | | | | | | | | | 19 | | 1600 | | | | | | | | | |
| 16-Dec-11 | | | | | | | | | | 19 | | 1700 | | | | | | | | | |
| 30-Jan-12 | | | | | | | | | | 18 | | 1500 | | | | | | | | | |
| 28-Feb-12 | | | | | | | | | | 18 | | 1500 | | | | | | | | | |
| 30-Mar-12 | | | | | | | | | | 18 | | 1700 | | | | | | | | | |
| 24-Apr-12 | | | | | | | | | | 16 | | 1700 | | | | | | | | | |
| 30-May-12 | | | | | | | | | | 17 | | 1700 | | | | | | | | | |
| 29-Jun-13 | | | | | | | | | | 17 | | 2000 | | | | | | | | | |
| 26-Jul-13 | | | | | | | | | | 18 | | 2100 | | | | | | | | | |
| 22-Aug-12 | | | | | | | | | | 18 | | 1800 | | | | | | | | | |
| 19-Sep-12 | | | | | | | | | | 18 | | 2100 | | | | | | | | | |
| 25-Oct-12 | | | | | | | | | | 17 | | 2200 | | | | | | | | | |
| 14-Nov-12 | | | | | | | | | | | | | | | | | | | | | |
| 28-Dec-12 | | | | | | | | | | 17 | | 2400 | | | | | | | | | |
| 29-Jan-13 | | | | | | | | | | 17 | | 2400 | | | | | | | | | |
| 20-Feb-13 | | | | | | | | | | | | | | | | | | | | | |
| 26-Mar-13 | | | | | | | | | | 18 | | 2900 | | | | | | | | | |

| Continued…….. Seepage water Northern wall collection pit near GW6 Groundwater from the KVAD on the northside drains. All water reports to the pipe out to the Lisdale Cut. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | Mn | Mo | Na | Ni | Pb | pH | Se | SO4 | TDS | Zn |
| 1-Feb-10 | | | | | | 4.2 | | 490 | | |
| 24-Feb-10 | | | | | | 6.08 | | | | |
| 17-Mar-10 | | | | | | 5.58 | | | | |
| 15-Apr-10 | | | | | | | | | | |
| 26-May-10 | | | | | | | | | | |
| 9-Jun-10 | | | | | | 5.81 | | | | |
| 1-Jul-10 | | | | | | 5.7 | | | | |
| 25-Aug-10 | | | | | | 5.7 | | | | |
| 23-Sep-10 | | | | | | 6 | | 350 | | |
| 28-Oct-10 | | | | | | 4.2 | | | | |
| 23-Nov-10 | | | | | | 4.2 | | 370 | | |
| 9-Dec-10 | | | | | | 4 | | 380 | | |
| 13-Jan-11 | | | | | | 3.9 | | 430 | 720 | |
| 24-Feb-11 | | | | | | 4.2 | | 490 | | |
| 24-Mar-11 | | | | | | 3.5 | | 510 | 760 | |
| 8-Apr-11 | | | | | | 3.4 | | 550 | 870 | |
| 12-May-11 | | | | | | 4.6 | | 600 | 950 | |
| 10-Jun-11 | | | | | | 3.3 | | 620 | 980 | |
| 25/07/2011 | | | | | | 3.4 | | 670 | 1000 | |
| 23/08/2011 | | | | | | 3.3 | | 690 | 1100 | |
| 21/09/2011 | | | | | | 5.2 | | 700 | | |
| 21/10/2011 | | | | | | 3.3 | | 730 | 1200 | |
| 28/11/2011 | | | | | | 3.3 | | 690 | 1100 | |
| 16/12/2011 | | | | | | 3.7 | | 800 | | |
| 30/01/2012 | | | | | | 5.6 | | 750 | | |
| 28/02/2012 | | | | | | 3.2 | | 650 | 1100 | |
| 30/03/2012 | | | | | | 3.1 | | 730 | 1100 | |
| 24/04/2012 | | | | | | 3.3 | | 750 | 1200 | |
| 30/05/2012 | | | | | | 3.4 | | 890 | 1400 | |
| 29/06/2012 | | | | | | 3.1 | | 960 | 1600 | |
| 26/07/2012 | | | | | | 3.1 | | 1100 | 1300 | |
| 22/08/2012 | | | | | | 5.6 | | 1200 | 1700 | |

| Continued…….. Seepage water Northern wall collection pit near GW6 Groundwater from the KVAD on the northside drains. All water reports to the pipe out to the Lisdale Cut. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| 19/09/2012 | | | | | | 4.1 | | 1200 | 1800 | |
| 25/10/2012 | | | | | | 5.7 | | 1200 | 1500 | |
| 21/11/2012 | | | | | | | | | | |
| 12/12/2012 | | | | | | 3 | | 1200 | 1700 | |
| 29/01/2013 | | | | | | 2.9 | | 1200 | 1800 | |
| 22/02/2013 | | | | | | | | | | |
| 26/03/2013 | | | | | | 2.9 | | 1400 | | |

| Seepage water Northern wall collection pit near GW6 Groundwater from the KVAD on the northside drains. All water reports to the pipe out to the Lisdale Cut. | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Ag** | **ALK** | **Al** | **As** | **B** | **Ba** | **Be** | **Ca** | **Cd** | **Cl** | **COND** | **Cr** | **CrIV** | **Cu** | **F** | **Fe** | **Hg** | **K** | **Mg** |
| Average | | | | | | | | | | 19 | 1462 | | | | | | | | |
| Maximum | | | | | | | | | | 25 | 2900 | | | | | | | | |
| Minimum | | | | | | | | | | 16 | 803 | | | | | | | | |
| 50th Percentile | | | | | | | | | | 19 | 1500 | | | | | | | | |

| Seepage water Northern wall collection pit near GW6 Groundwater from the KVAD on the northside drains. All water reports to the pipe out to the Lisdale Cut. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Mn** | **Mo** | **Na** | **Ni** | **Pb** | **pH** | **Se** | **SO4** | **TDS** | **Zn** |
| Average | | | | | | 4.2 | | 769 | 1244 | |
| Maximum | | | | | | 6.1 | | 1400 | 1800 | |
| Minimum | | | | | | 2.9 | | 350 | 720 | |
| 50th Percentile | | | | | | 3.9 | | 700 | 1150 | |

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