2019 Annual Performance Report

Aberthaw Ash Disposal Site

Permit Number: DP3432SW

March 2020

RWE
The energy to lead

Summary

This document gives details on the performance of RWE Generation UK plc's Aberthaw Ash Disposal Site throughout 2019, as required by condition 4.2.1 of the site's Environmental Permit (EP), DP3432SW.

CONTENTS

1. Operational Update

Aberthaw Ash Disposal Site has reached its maximum height and the only area used for depositing Pulverised Fuel Ash (PFA) is the temporary storage area on the western side. The site has been restored as per plans approved by the Local Authorities. In 2019 there were no changes to the operational activities and no Environmental Permit variations.

2. Review of Results for Emission Monitoring

2.1. Hydrogeological Risk Assessment Review

In accordance with Environmental Permit DP3432SW there is the requirement to undertake a 6 yearly review of the HRA. This was completed in early 2018 by an external specialist consultant and concluded that whilst there was a discernible effect from the ash on groundwater & surface water, this effect has stabilised over time with little change in quality over the review period.

2.2. Groundwater Quality Review

Monitoring Objective

To carry out routine monitoring of groundwater to monitor the performance of the ash disposal site by measurement of absolute levels and concentrations and trends relative to relevant criteria including background levels and concentrations, control levels and compliance limits.

Number and Location of Monitoring Points

A summary of the monitoring boreholes is provided in Table 1 below and the locations are shown in Appendix A. There are 7 boreholes in natural ground, of which 5 are completed in the Porthkerry Member limestone and 2 in the Alluvium (clay). There are 2 shallow boreholes in fill material, BH7A with a response zone partly in clay fill and BH11A with a response zone partly in fill containing coal ash.

Groundwater flow beneath the ash disposal site is directed towards the River Thaw to the west and the sea to the south. Due to the ash disposal site's contact with the sea, the southern boundary of the site is a downgradient boundary. There are 4 boreholes on this boundary, BH10B, BH11B, BH7B and BH9B, with an average spacing of approximately 250m. The two shallow boreholes, BH7A and BH11A are situated close to boreholes BH7B and BH11B respectively. There is also 1 borehole, BH3B on the western downgradient boundary. Borehole BH8B was found damaged in Q2 2017 and it was not been possible to obtained a representative sample for the remainder of 2017. Following the outcome of the HRA review in 2018, sampling of BH8B was suspended.

BH6 and BH5 are located on the eastern boundary with an average spacing of approximately 750m and as both response zones are overlain by PFA they cannot be considered truly upgradient. Upgradient monitoring boreholes at the nearby Aberthaw Quarry Ash Disposal Site (Environmental Permit BP3339BH) are used as an indication of upgradient groundwater quality data for the limestone aquifer (Details of these boreholes are in italic in Table 1).

Table 1: Summary of Monitoring Boreholes

Monitoring Borehole	Formation Sampled	Lithology Type – Natural (N) Imported Fill (F)	Response Zone Depth (m b GL)	Geological Barrier Thickness above Response Zone (m)	Other Lithology above Response Zone
BH3B	Limestone	N	13.5-23.0	6	PFA: 6m
BH5	Limestone	N	2.5-11.5	0	PFA: 1.5m
BH6	Limestone	N	13.0-20.5	0	PFA: 12.2m
BH7A	Clay fill and Gravelly clay	F/N	2.0-9.5	8	PFA: 1.5m
BH7B	Limestone	N	17.0-26.0	3.9	Fill: 7.4m Sand & gravel: 5.7
BH9B	Limestone	N	6.0-13.0	0	PFA: 3m
BH10B	Clay	N	23.0-30.0	6.6	Fill: 2.8m Sand: 13m
BH11A	Fill – ash and clay	F	1.5-5.0	0	N/A
BH11B	Clay	N	9.5–19.0	4.5	Fill: 4.9m
E09-01A	*Limestone*	*N*	*18-24*		
E09-01B	*Limestone*	*N*	*24-30*		
E09-02A	*Limestone*	*N*	*21-27*		
E09-02B	*Limestone*	*N*	*27-33*		

Note: mb GL – metres below ground level

Monitoring Measurements

The groundwater monitoring analytical suite contains a range of parameters which are monitored on a quarterly basis along with the groundwater level and standard field measurements in accordance with the Environmental Permit. RWE employ the services of an independent external contractor for the sampling of groundwater boreholes and an independent external laboratory is used for the analysis of those samples.

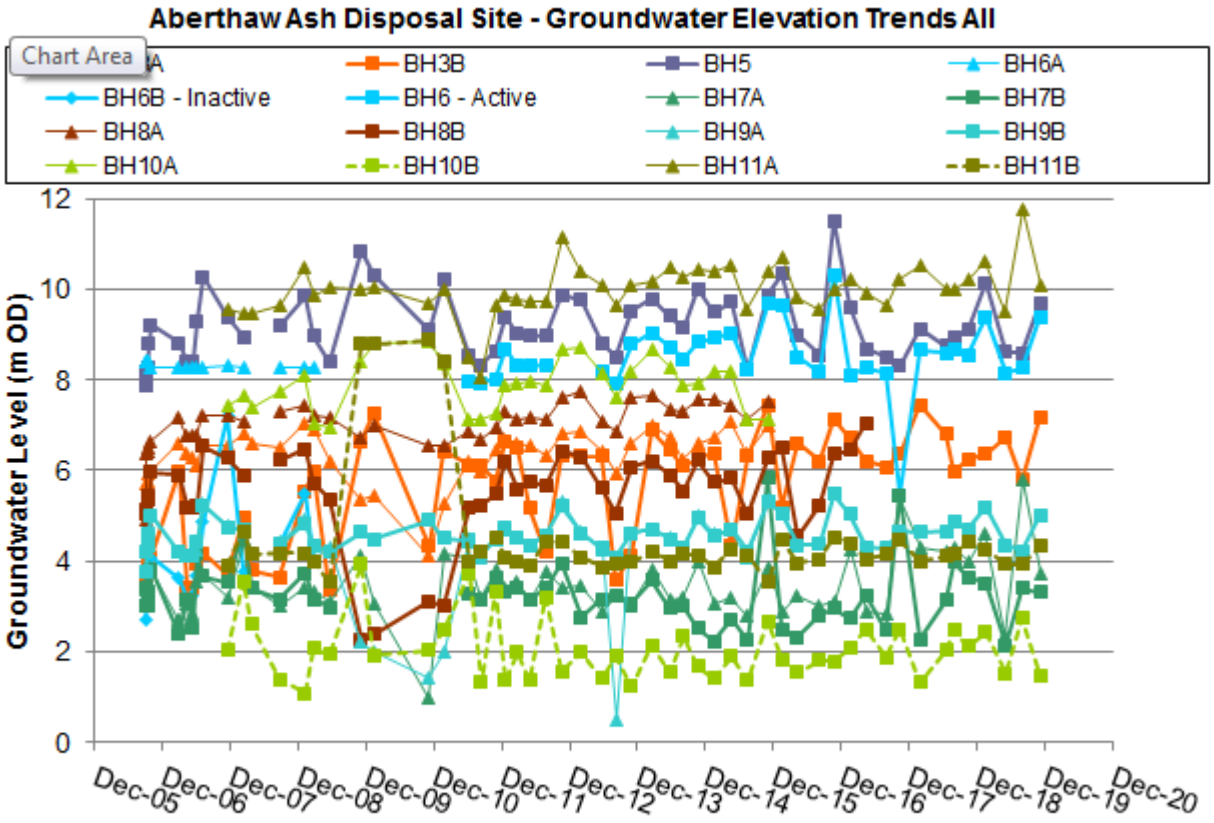
Table 2 summarises changes to the groundwater sampling methodology to improve sample quality.

Table 2: Summary of Groundwater Sampling Methods

Monitoring Borehole	Purge Strategy	Purge Equipment	Date From	Date To
BH3B	1 x Well volume	Bailer	Quarter 3 2006	Quarter 1 2011
	1 x Well volume	Inertial pump	Quarter 2 2011	Quarter 2 2013
	Low flow steady state	Submersible pump	Quarter 3 2013	—
BH7A	1 x Well volume	Bailer	Quarter 3 2006	Quarter 1 2011
	1 x Well volume	Inertial pump	Quarter 2 2011	Quarter 2 2013
	3 x Well volume	Inertial pump	Quarter 3 2013	—
BH7B, BH10B	1 x Well volume	Bailer	Quarter 3 2006	Quarter 2 2013
	Low flow steady state	Submersible pump	Quarter 3 2013	—
BH5, BH6, BH9B	1 x Well volume	Bailer	Quarter 3 2006	Quarter 2 2013
	3 x Well volume	Inertial pump	Quarter 3 2013	—
BH11A	2 x Well volume	Bailer	Quarter 3 2006	Quarter 2 2013
	3 x Well volume	Bailer	Quarter 3 2013	—
BH11B	3 x Well volume	Bailer	Quarter 3 2006	Quarter 2 2013
	Low flow steady state	Submersible pump	Quarter 3 2013	—

Figure 1 shows recorded groundwater elevations for the previous 12 years. These vary between +1 (BH10B/BH7A) to +12m OD (BH5) with groundwater elevations in limestone boreholes being characterised by seasonal cyclic water level fluctuations associated with annual winter influxes of rainfall recharge.

Figure 1: Groundwater Hydrograph



Note: Limestone monitor wells as solid lines, Alluvial as dashed lines and Fill as dotted.

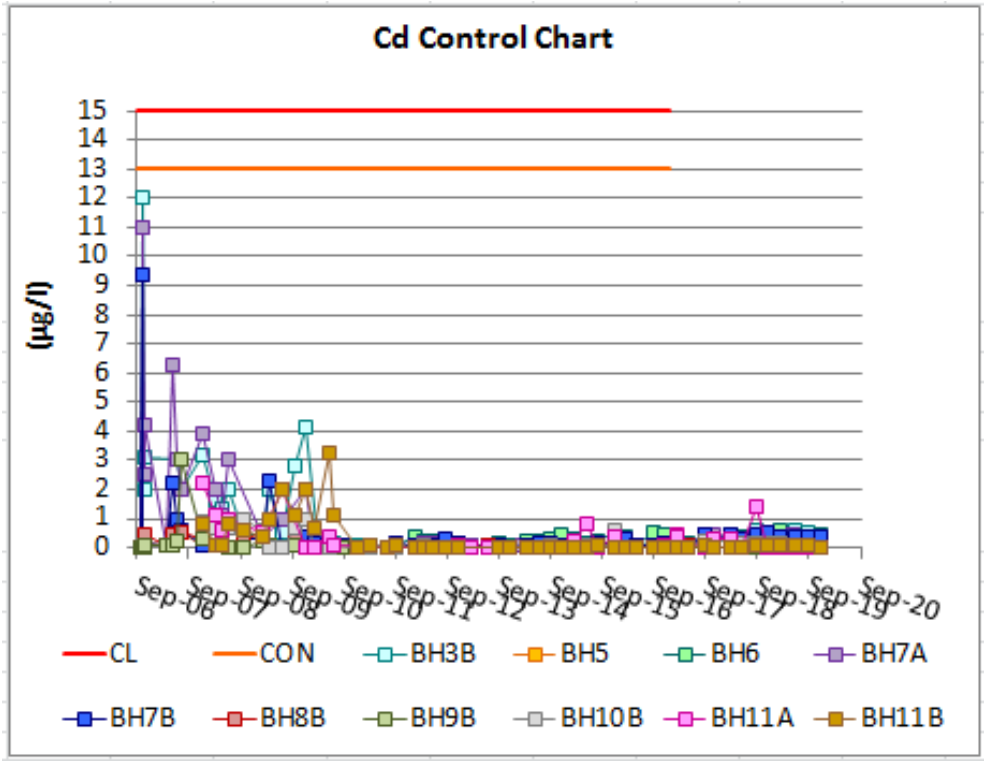
Figure 2 shows the groundwater control charts with concentrations of all boreholes plotted. It should be noted that the compliance limits and control levels (where defined) apply to boreholes BH3B and BH7B. An exceedance is defined as a result above the compliance limit or control level for 3 consecutive sampling events.

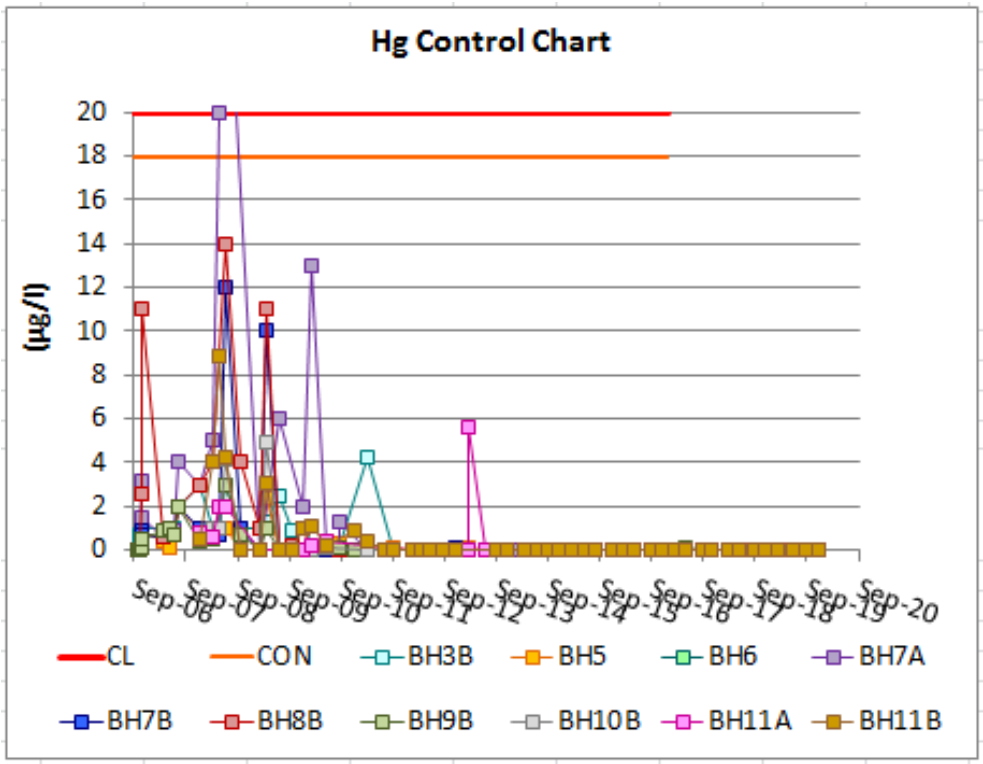
In 2019, there were no exceedances of the compliance limit or control level for any critical parameter. As in 2018, elevated concentrations in BH3B of arsenic, boron, molybdenum, sulphate and vanadium were observed. In BH7B elevated concentrations of boron, molybdenum, sulphate and ammoniacal-nitrogen were observed.

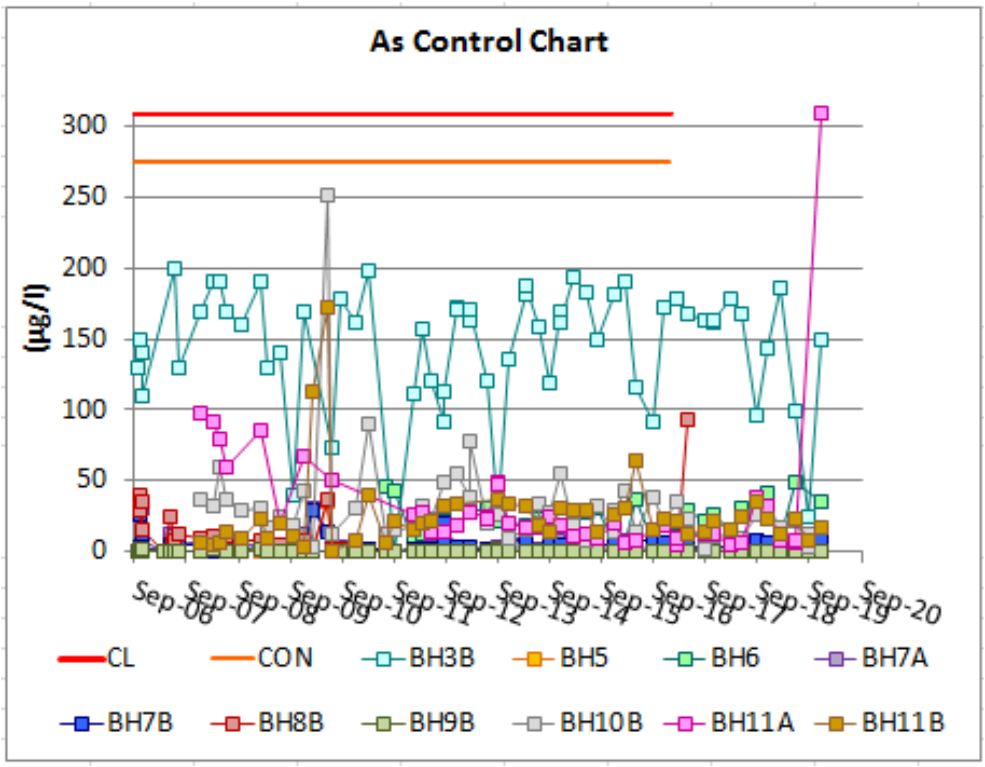
The control charts show there are no increasing trends in critical parameter concentrations. Other key points to note are:

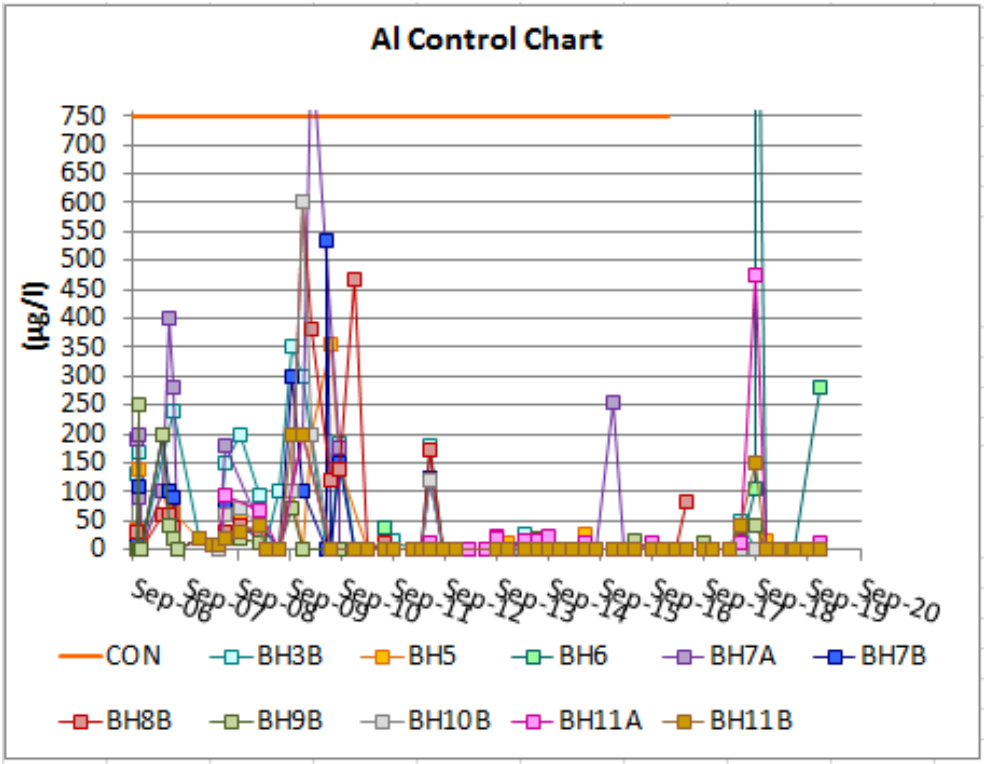
- Decreasing and generally stable trends for cadmium, mercury, aluminium, chromium and selenium since sampling began;
- Highly variable ammoniacal nitrogen concentrations in BH10B and;
- Elevated sulphate, boron and molybdenum in most boreholes and a single occurrence of elevated arsenic in BH11A for Q4 2019. These will continue to be monitored during 2020.

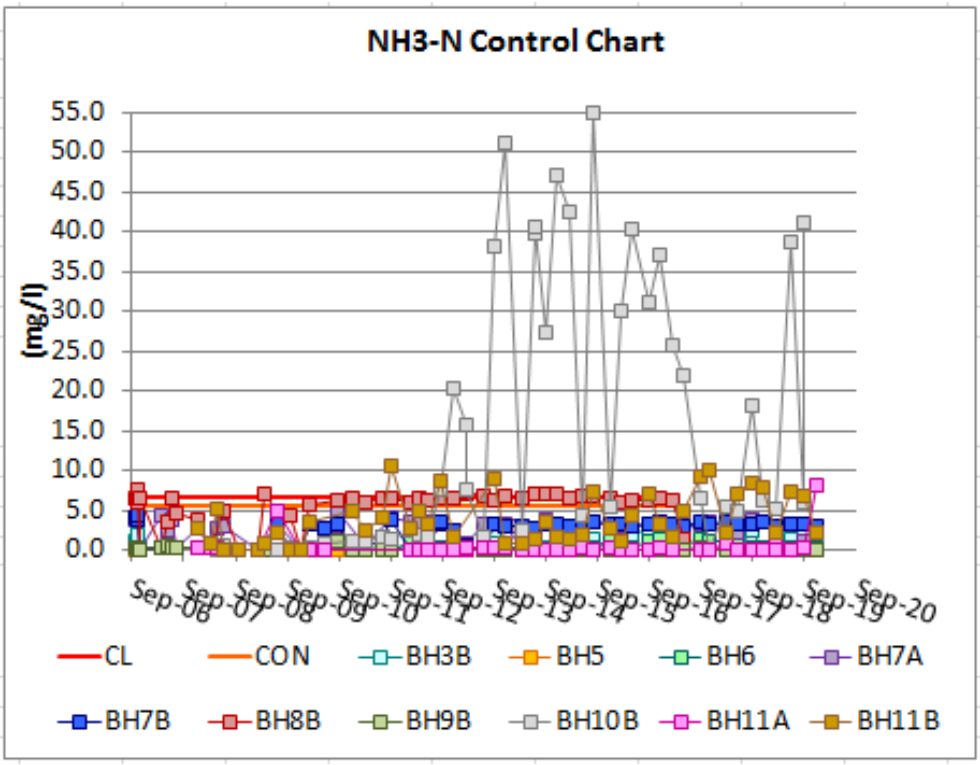
Figure 2: Control charts for groundwater boreholes
(CL – Compliance Limit, CON – Control Level, 0 – result at Method Detection Limit)

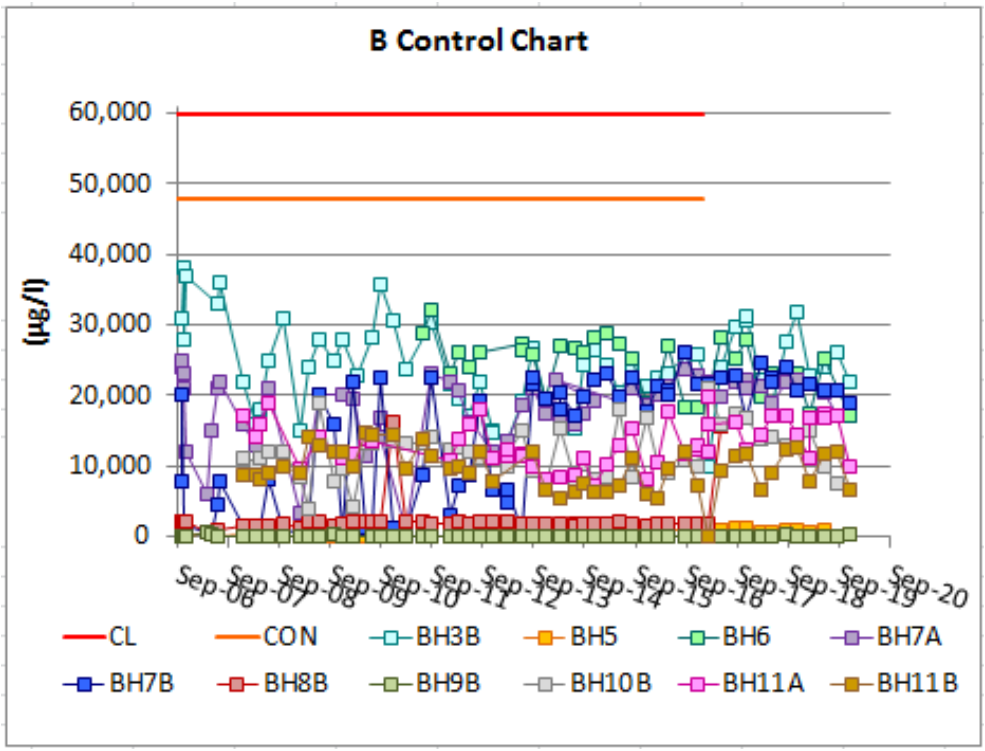


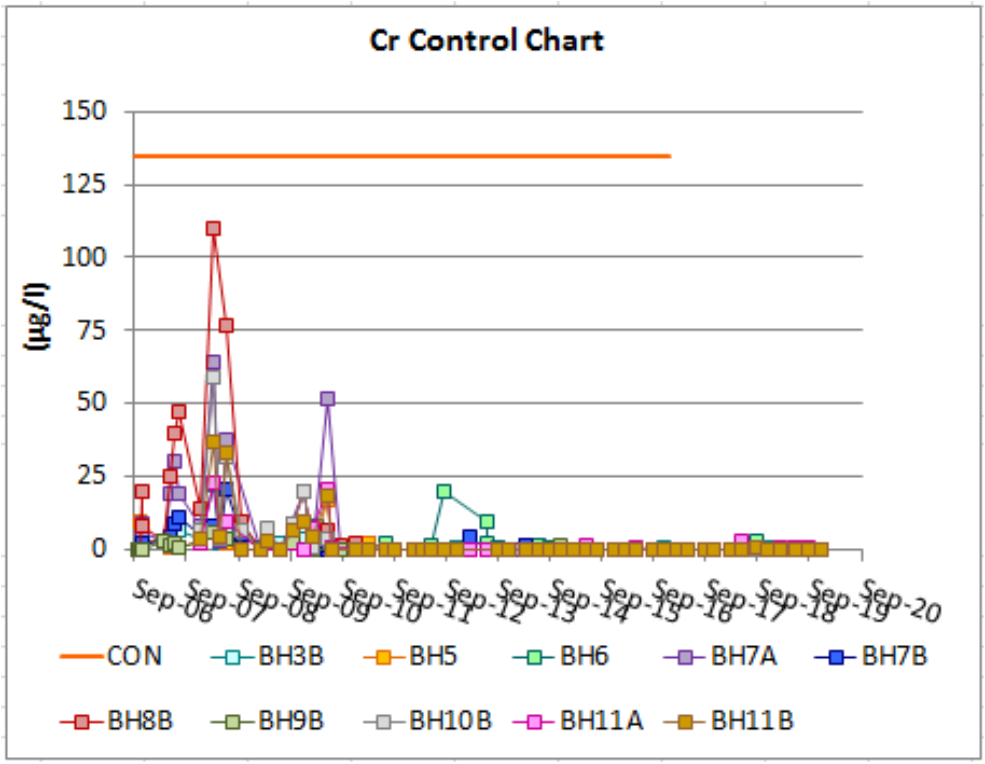

Hg Control Chart
(µg/l)
20
18
16
14
12
10
8
6
4
2
0
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
CL
CON
BH3B
BH5
BH6
BH7A
BH7B
BH8B
BH9B
BH10B
BH11A
BH11B

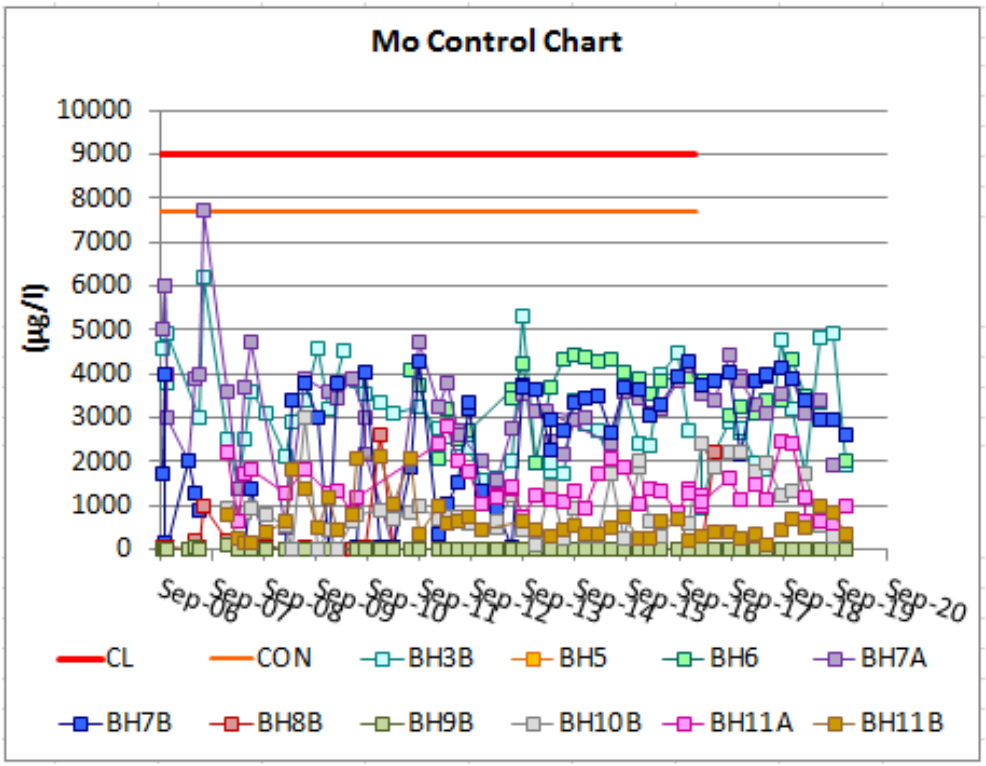

As Control Chart
(µg/l)
300
250
200
150
100
50
0
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
CL
CON
BH3B
BH5
BH6
BH7A
BH7B
BH8B
BH9B
BH10B
BH11A
BH11B

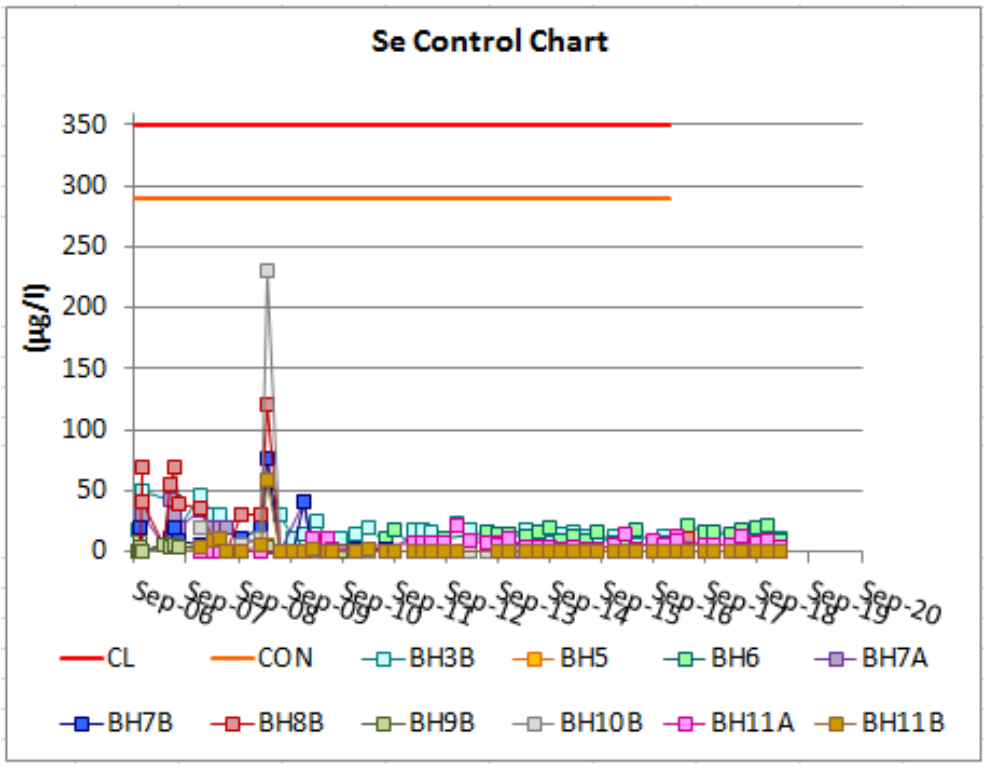

Al Control Chart
(µg/l)
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16 Sep-17 Sep-18 Sep-19 Sep-20
CON
BH3B
BH5
BH6
BH7A
BH7B
BH8B
BH9B
BH10B
BH11A
BH11B

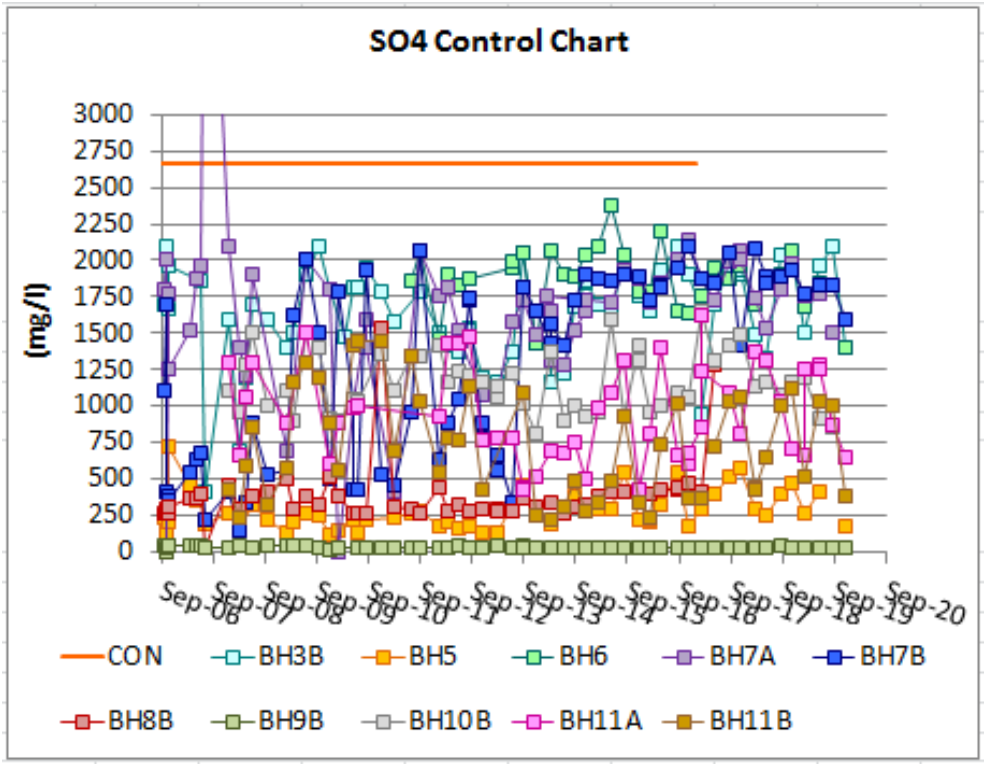

NH3-N Control Chart
(mg/l)
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16 Sep-17 Sep-18 Sep-19 Sep-20
CL
CON
BH3B
BH5
BH6
BH7A
BH7B
BH8B
BH9B
BH10B
BH11A
BH11B

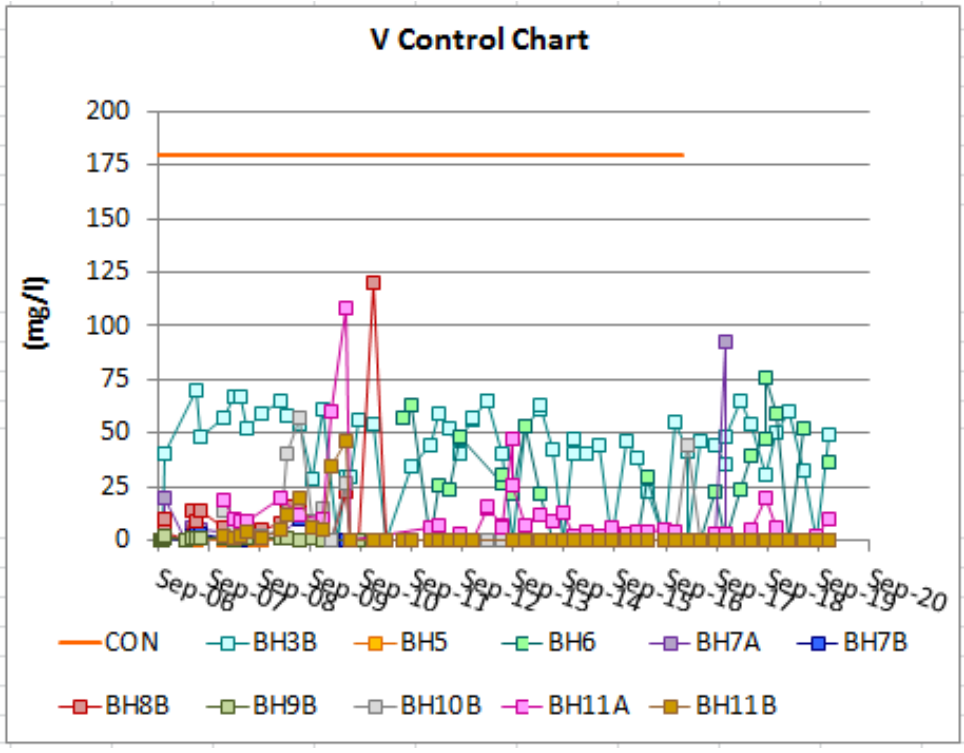

B Control Chart
60,000
50,000
40,000
30,000
20,000
10,000
0
(µg/l)
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
CL
CON
BH3B
BH5
BH6
BH7A
BH7B
BH8B
BH9B
BH10B
BH11A
BH11B


Cr Control Chart
150
125
100
75
50
25
0
(µg/l)
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
CON
BH3B
BH5
BH6
BH7A
BH7B
BH8B
BH9B
BH10B
BH11A
BH11B


Mo Control Chart
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
(µg/l)
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
CL
CON
BH3B
BH5
BH6
BH7A
BH7B
BH8B
BH9B
BH10B
BH11A
BH11B


Se Control Chart
350
300
250
200
150
100
50
0
(µg/l)
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
CL
CON
BH3B
BH5
BH6
BH7A
BH7B
BH8B
BH9B
BH10B
BH11A
BH11B


SO4 Control Chart
(mg/l)
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
CON
BH3B
BH5
BH6
BH7A
BH7B
BH8B
BH9B
BH10B
BH11A
BH11B


V Control Chart
(mg/l)
200
175
150
125
100
75
50
25
0
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
CON
BH3B
BH5
BH6
BH7A
BH7B
BH8B
BH9B
BH10B
BH11A
BH11B

2.3. Surface Water Quality Review

Monitoring Objective

To carry out routine monitoring of surface water to;

- monitor the performance of the ash disposal site by measurement of absolute levels and concentrations and trends relative to relevant criteria including background concentrations and control levels; and;
- identify and quantify effects on surface water receptors.

Number and Location of Monitoring Points

A summary of the surface water monitoring points is provided in Table 3 below and the locations are shown in Appendix A.

Table 3: Summary of Surface water monitoring points

Monitoring Point	Description	Direction from site	Remarks
Eastern Perimeter Drain (EPD)	Western bank of drainage ditch	East	
Brackish Lagoon (BL)	Saline lagoon	South-east	Surface water Receptor
River Thaw (S3)	Eastern bank, tidal mudflats below rail bridge	North upgradient	Surface water Receptor
Group 5 Spring (S1)	Wetland area adjacent to spring within ash disposal site	West	
Mouth of River Thaw	At the mouth of the river as it meets the sea	South West	Surface water receptor (added after suggestion by HRA review 2018)

Monitoring Measurements

The surface water monitoring analytical suite contains a range of parameters which are monitored on a quarterly basis in accordance with the Environmental Permit. A trained RWE operative is responsible for the sampling of the groundwater boreholes and an independent external laboratory is used for the analysis of the samples.

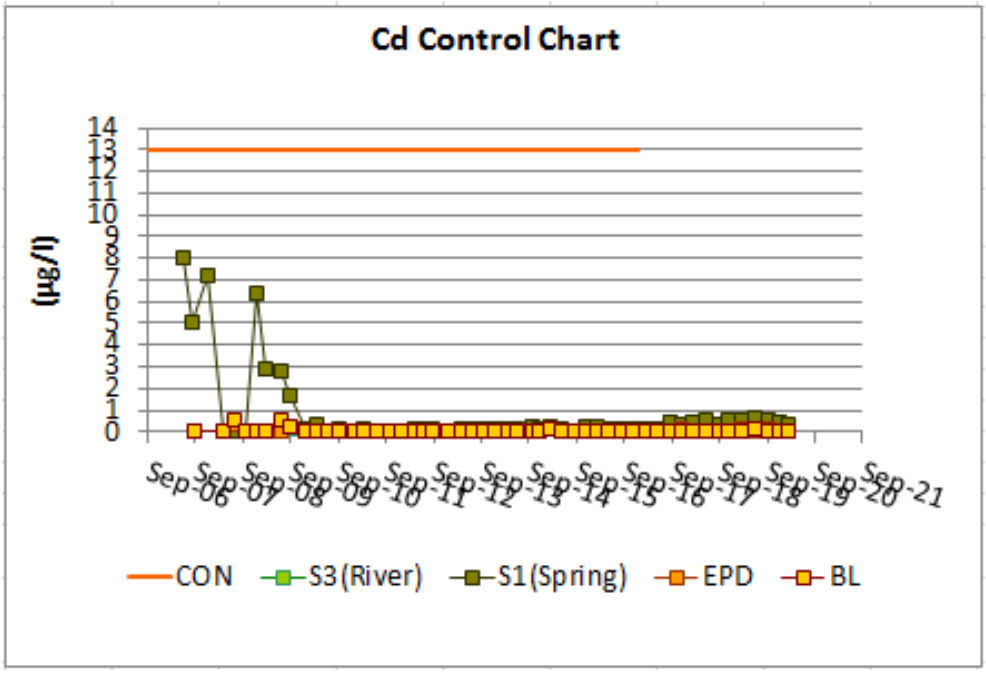
Figure 3 shows the surface water control charts for the associated monitoring points. It should be noted that the control levels apply to all surface water monitoring points and are identical to the respective groundwater control levels. An exceedance is defined as a result above the control level for 3 consecutive sampling events.

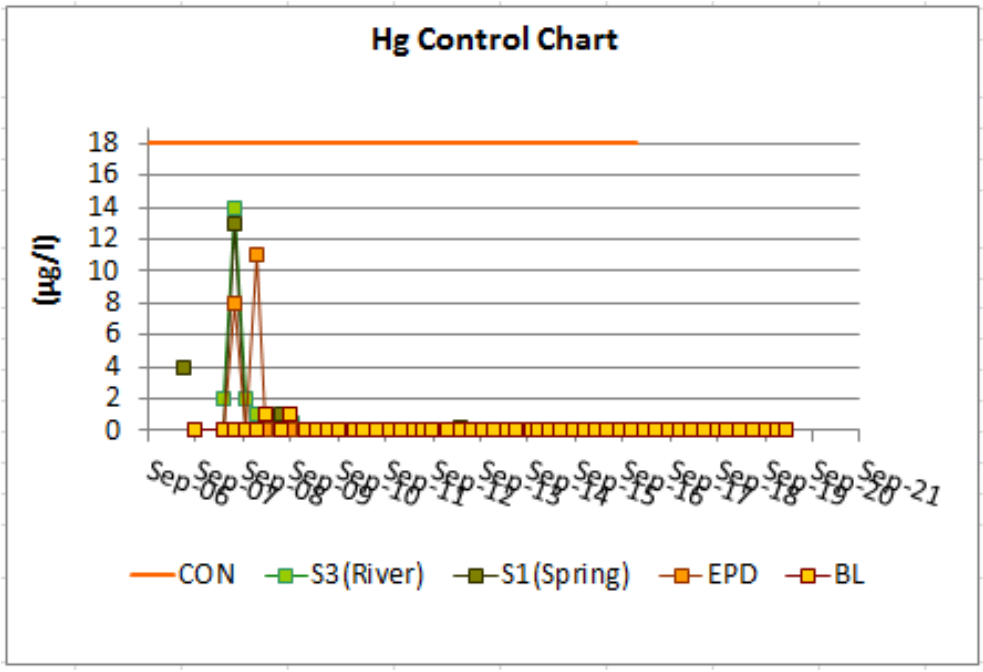
In 2019, there were no exceedances of the control level for any critical parameter and the control charts show there are no increasing trends in critical parameter concentrations.

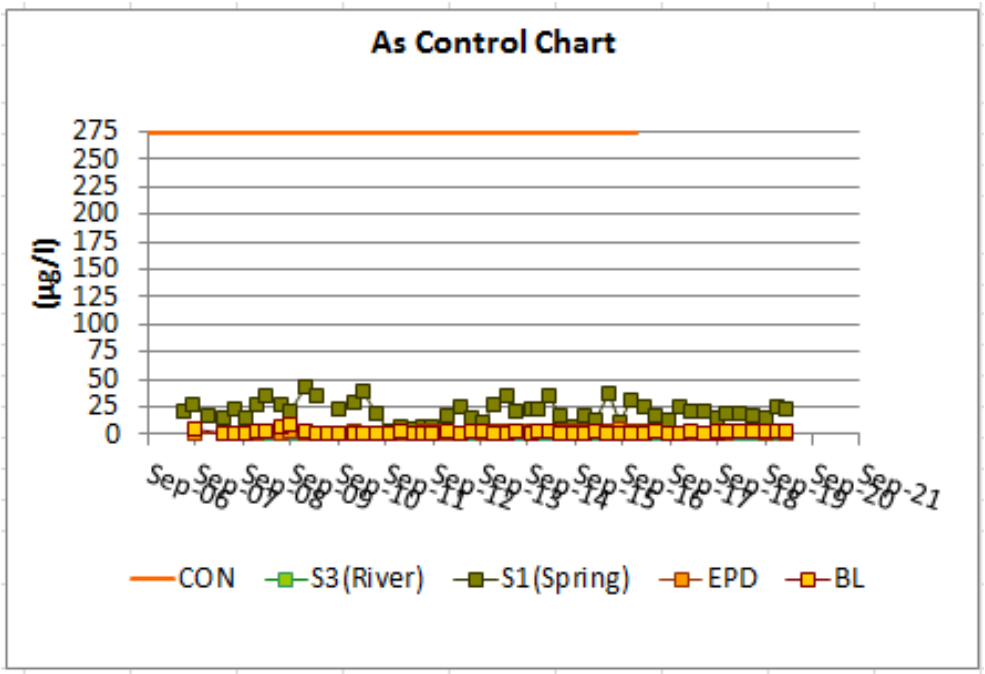
Ammoniacal-nitrogen levels remain highly variable in Group 5 Spring (S1) with 2 consecutive elevated results recorded for Q3 and Q4 2019. This will continue to be monitored during 2020.

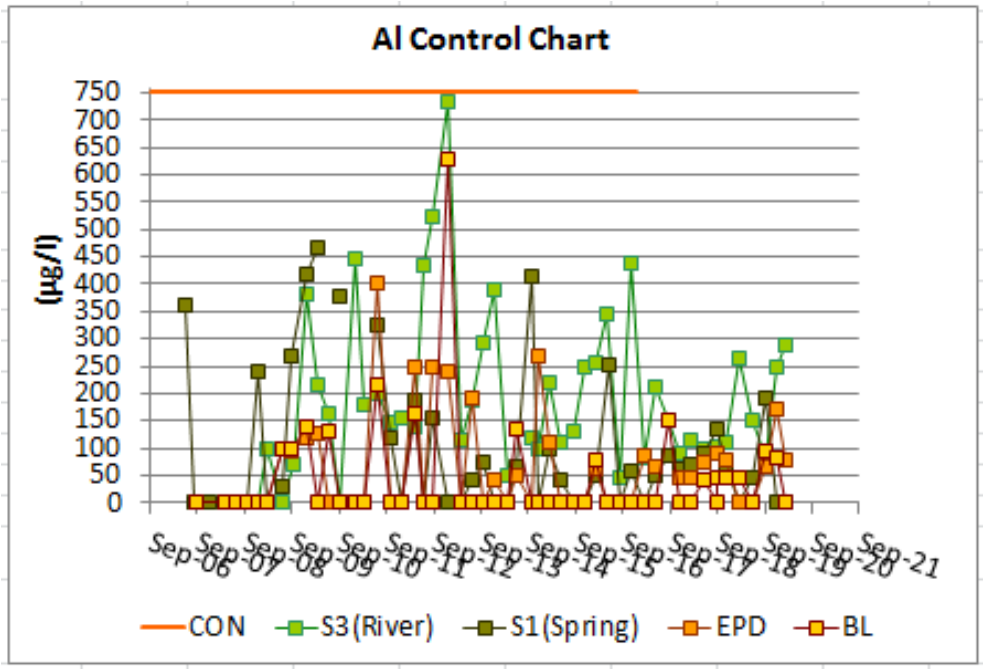
Group 5 Spring (S1) also displays the highest concentrations of other critical parameters, in particular boron, molybdenum and sulphate, which does suggests it is affected by PFA leachate. However, it should be noted the spring discharges into a stagnant pond surrounded by wetland with water only lost by evapotranspiration or seepage. Therefore the samples may not be representative of the spring discharge from the ash mound nor considered as a discharge from the ash disposal site.

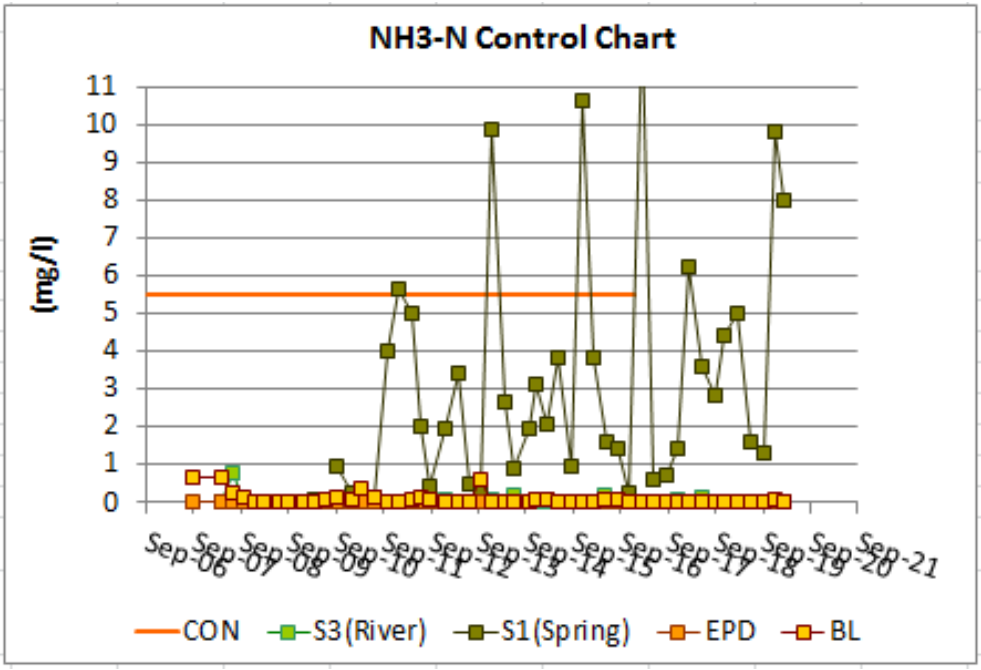
Figure 3: Control charts for surface water monitoring points
(CON – Control Level, 0 – result at Method Detection Limit)

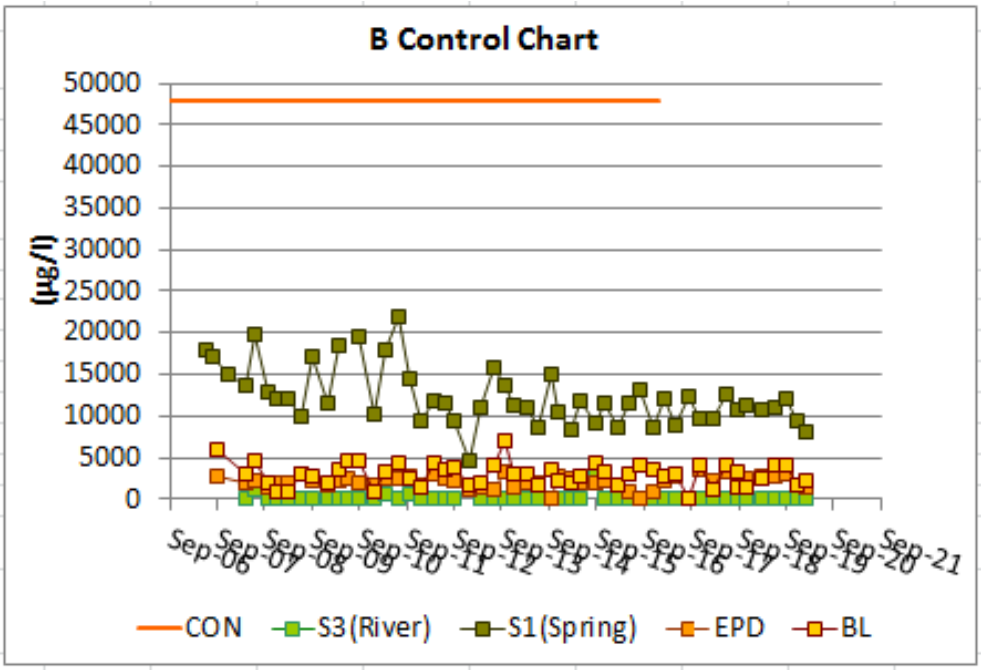


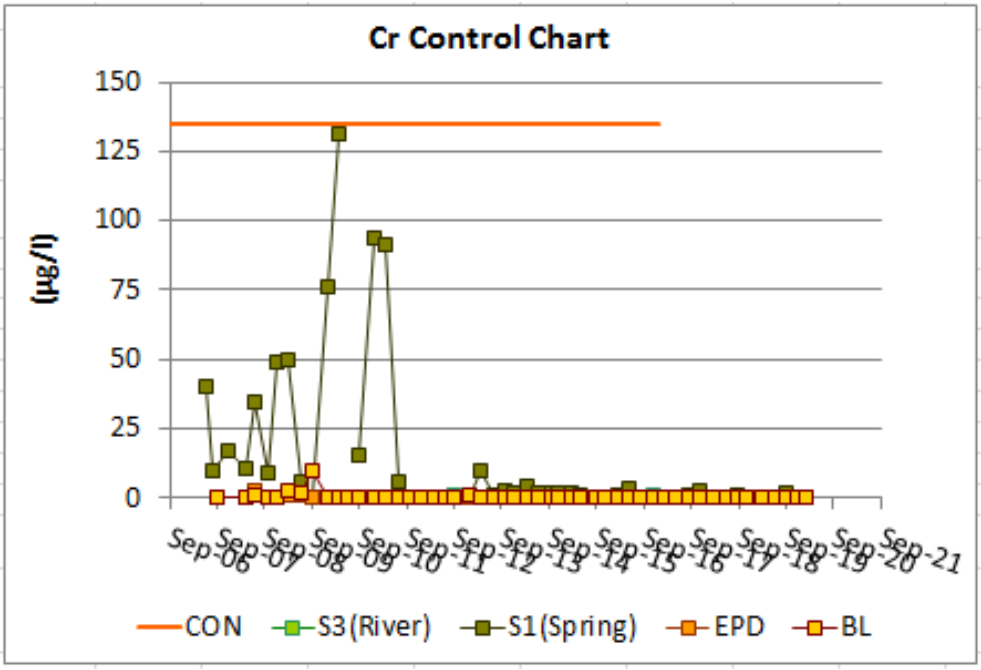


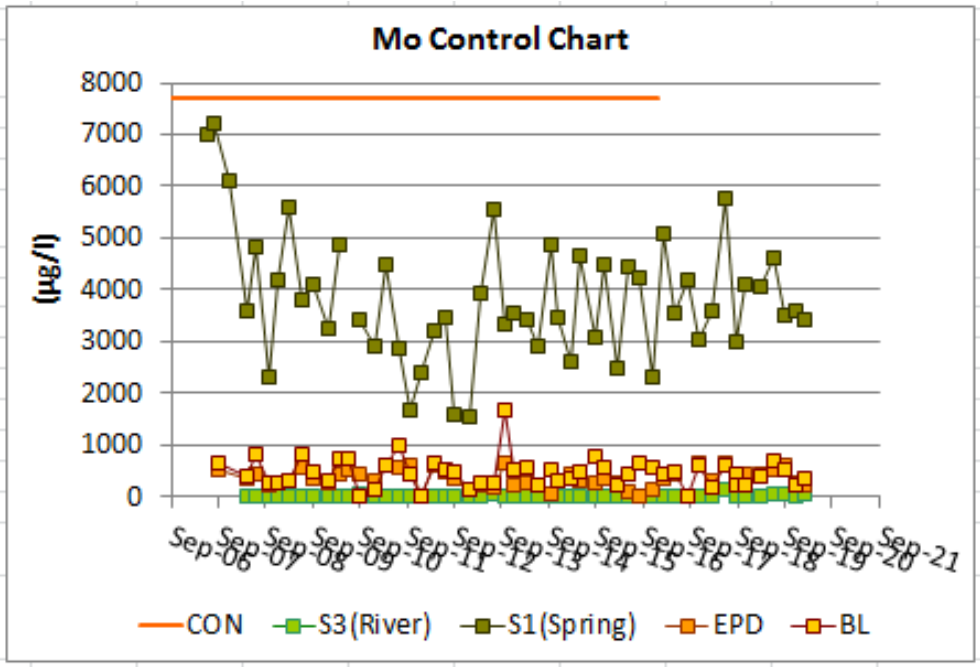

As Control Chart
(µg/l)
275
250
225
200
175
150
125
100
75
50
25
0
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
Sep-21
CON
S3 (River)
S1 (Spring)
EPD
BL

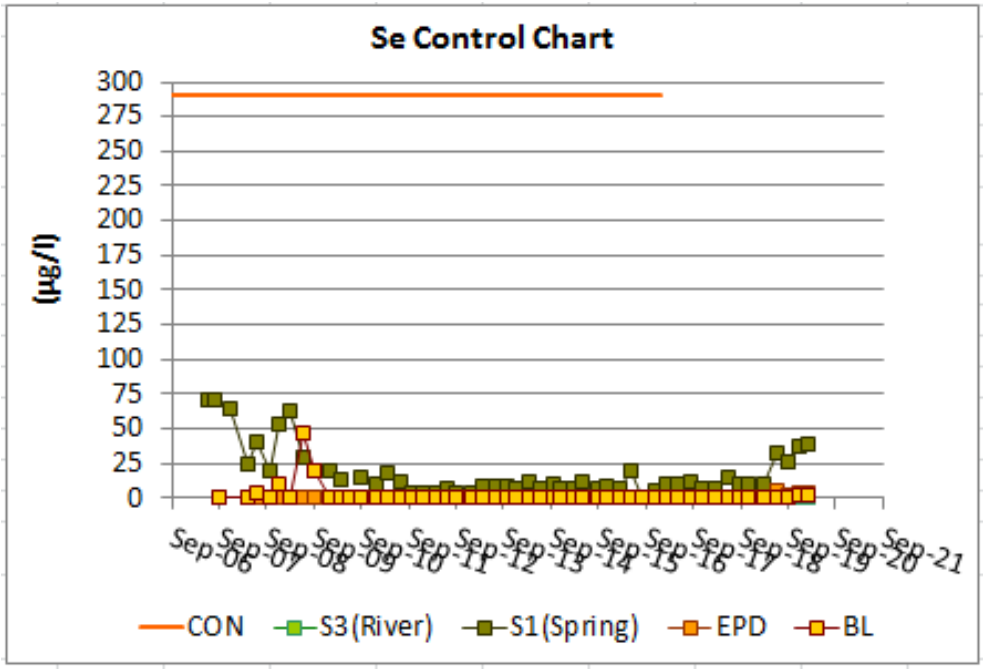

Al Control Chart
(µg/l)
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
Sep-21
CON
S3 (River)
S1 (Spring)
EPD
BL

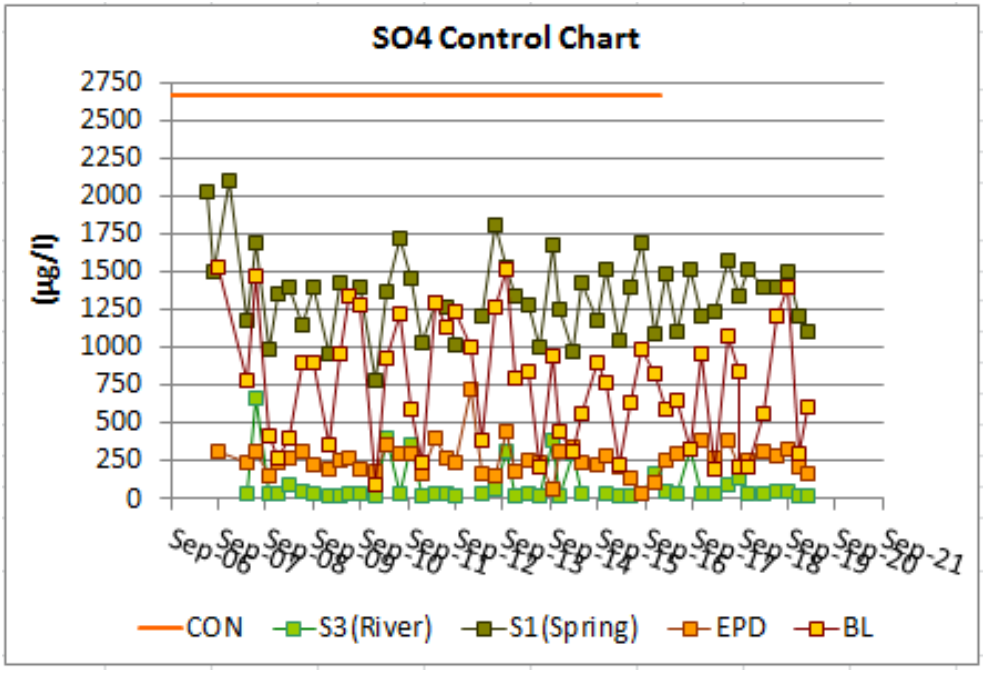

NH3-N Control Chart
(mg/l)
11
10
9
8
7
6
5
4
3
2
1
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16 Sep-17 Sep-18 Sep-19 Sep-20 Sep-21
CON
S3(River)
S1(Spring)
EPD
BL

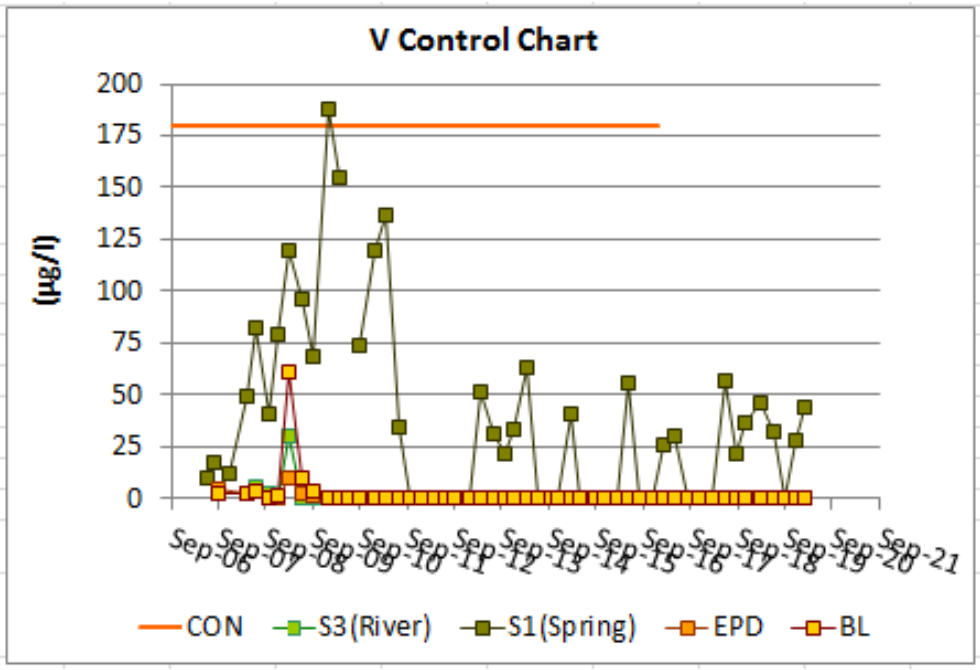

B Control Chart
(µg/l)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16 Sep-17 Sep-18 Sep-19 Sep-20 Sep-21
CON
S3(River)
S1(Spring)
EPD
BL


Cr Control Chart
150
125
100
75
50
25
0
(µg/l)
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
Sep-21
CON
S3(River)
S1(Spring)
EPD
BL


Mo Control Chart
8000
7000
6000
5000
4000
3000
2000
1000
0
(µg/l)
Sep-06
Sep-07
Sep-08
Sep-09
Sep-10
Sep-11
Sep-12
Sep-13
Sep-14
Sep-15
Sep-16
Sep-17
Sep-18
Sep-19
Sep-20
Sep-21
CON
S3(River)
S1(Spring)
EPD
BL


Se Control Chart
(µg/l)
300
275
250
225
200
175
150
125
100
75
50
25
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16 Sep-17 Sep-18 Sep-19 Sep-20 Sep-21
CON
S3(River)
S1(Spring)
EPD
BL


SO4 Control Chart
(µg/l)
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16 Sep-17 Sep-18 Sep-19 Sep-20 Sep-21
CON
S3(River)
S1(Spring)
EPD
BL



3. Annual Production/Treatment Data 2019

Table 5: Annual Production/Treatment Data(Table S5.2 EP)

Parameter	Value	Unit
Surface water disposed off site	0	m^3/yr
Groundwater disposed off site	0	m^3/yr

4. Contamination/Decontamination of Site

There have been no incidents or emissions which may have caused any site contamination during 2019, and, therefore, no requirement to decontaminate the site during 2019.

5. Topographical Surveys

The last topographical survey to ordnance datum was carried out in May 2009 following closure of the ash disposal site.

6. Landfill Capacity

Aberthaw Ash Disposal Site has reached its maximum height and the only area used for depositing Pulverised Fuel Ash (PFA) is the temporary storage area on the western side. Hence, there was no PFA permanently deposited at the ash disposal site during 2019 as recorded Table 6 below and reported to Natural Resources Wales via the Waste Return Form. It is estimated that around 133,588m^3 of void capacity remains within the temporary storage area on the western side of the ash mound.

Table 6: PFA Deposited

Reporting Period	PFA Deposited (tonnes)
1st January – 31st December 2019	0

7. Waste Acceptance Compliance Testing

Aberthaw Ash Disposal Site is a mono-landfill site under the direct operational control of Aberthaw Power Station. All ash was transported directly from the Power Station to the Ash Disposal Site.

The exact composition of PFA is dependent upon the composition of the fuel utilised by the Power Station. RWE has well established procedures which control the quality of fuel supplied to its stations. Table 7 summarises the analytical data obtained for leachate tests performed on composite samples of conditioned PFA from Aberthaw Power Station between 2012 and 2017. The CEN two-stage method for leachate analysis was used (BS EN 12457-3:2002 Characterisation of waste – Leaching – Compliance test for leaching of granular waste materials and sludges of which Part 3).

Table 7: Summary of 10:1 Leachate Calculated Results (mg/kg)

Period	Jan-17	Apr-12 to Jan-17			
Analyte:	Latest Result	Minimum	Mean	Maximum	Number of results
Aluminium as Al (Dissolved)	8.1	2.4	21.9	75.4	15
Ammoniacal Nitrogen as N	156.6	4.2	83.5	158.1	15
Antimony as Sb (Dissolved)	0.192	0.020	0.163	0.256	15
Arsenic as As (Dissolved)	2.449	0.077	1.907	3.313	15
Barium as Ba (Dissolved)	1.4	0.1	2.5	5.9	15
Boron as B (Dissolved)	12.1	0.7	12.8	17.7	15
Bromide as Br	36.3	0.6	71.5	293.5	15
Cadmium as Cd (Dissolved)	0.0010	0.0004	0.002	0.0056	15
Chromium as Cr (Dissolved)	0.19	0.01	0.3	1.03	15
Copper as Cu (Dissolved)	0.010	0.004	0.015	0.028	15
Cyanide (Total) as CN	0.5	0.2	0.3	0.5	15
Dissolved Organic Carbon	25.5	2.2	22.6	43.3	15
Fluoride as F	21.7	2.3	23.5	45.1	15
Iron as Fe (Dissolved)	1.16	0.52	1.03	1.52	15
Lead as Pb (Dissolved)	0.043	0.013	0.034	0.083	15
Manganese as Mn (Dissolved)	0.025	0.006	0.066	0.174	15
Mercury as Hg (Dissolved)	0.0019	0.0004	0.0057	0.0132	15
Molybdenum as Mo (Dissolved)	8.1	0.7	9.4	17.8	15
Nickel as Ni (Dissolved)	0.040	0.003	0.028	0.062	15
Nitrate as N	4.6	2.3	3.1	4.6	15
Selenium as Se (Dissolved)	2.8	0.2	2.1	3.5	15
Sodium as Na (Dissolved)	327	9	821	2696	15
Total Dissolved Solids	6787	350	8888	21800	15
Total Nitrogen as N	162.7	5.0	92.1	166.0	15
Total Sulphur as SO4 (Dissolved)	3745	170	3422	4271	15
Vanadium as V (Dissolved)	3.59	0.40	2.39	3.59	15
Zinc as Zn (Dissolved)	0.17	0.01	0.14	0.57	15

Appendix A. Groundwater and Surface Water Monitoring Locations