

2016 Annual Performance Report

Aberthaw Quarry Ash Disposal Site

Permit Number: BP3339BH

March 2017

Summary

This document gives details on the performance of Aberthaw Quarry Ash Disposal Site over 2016, as required by condition 4.2.1 of the site's Environmental Permit (EP), BP3339BH.

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1. Operational Update

Aberthaw Quarry Ash Disposal Site (AQADS) is being constructed and filled with Pulverised Fuel Ash (PFA) in four distinct phases (see Appendix A). Phase 1 was constructed in 2008, filled between Quarter 4 2008 to Quarter 4 2010 and then capped and hydroseeded in Spring 2011. Phase 2 was constructed in 2009/10 with filling commencing from Quarter 4 2010. Phase 2 East was filled until Quarter 3 2013 before being capped and hydroseeded whilst Phase 2 West was filled until Quarter 4 2014 before being capped and hydroseeded. Phase 3A (east) was constructed in 2012/13 with filling commencing in Quarter 3 2013 and remained the working phase throughout 2014 and 2015. The construction of Phase 3B (west) was completed in 2014 with filling commencing in Quarter 2 2015. In 2016, Phase 3A and Phase 3B remained as the working phases.

2. Review of Results for Emission Monitoring

2.1. 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. In January 2015, borehole improvement works were completed to improve water sampling. E05-03 and E06-01 were re-drilled (new details provided in Table 1) and the top hat cover was replaced on E06-05. In addition, a new borehole was installed above Phase 3B, E15/1 to improve the understanding of groundwater quality potentially flowing into the site from the south-east. In total, there are 12 boreholes in natural ground, all completed in the Porthkerry Member limestone.

Groundwater flow beneath the ash disposal site is directed towards the cement work lagoons and the River Thaw to the west. Hence, monitoring boreholes, E09-01A, E09-01B, E09-02A and E09-02B on the north-eastern site boundary (approximately 200m apart) are upgradient. Borehole E15/1 on the south site boundary is also upgradient.

Monitoring boreholes along the western site boundary (E05-03, E05-04 and E06-01) with an average spacing of 100m are downgradient of the current active Pulverised Fuel Ash (PFA) disposal area (Phase 1 and 2). Along the south-western site boundary, two of the monitoring boreholes with an average spacing of 100m (E06-02 and E06-03) are downgradient of the current active PFA disposal area (Phase 3A & 3B) and a future filling phase (Phase 4). Whilst the two remaining boreholes (E06-04 and E06-05) with an average spacing of 100m may be downgradient of a future filling phase (Phase 4).

Table 1: Summary of Monitoring Boreholes

Monitoring Borehole	Formation Sampled	Lithology Type – Natural (N)	Response Zone Depth (m b GL)	Designation
E09-01A	Limestone	N	18-24	Upgradient
E09-01B	Limestone	N	24-30	Upgradient
E09-02A	Limestone	N	21-27	Upgradient
E09-02B	Limestone	N	27-33	Upgradient
E15-1	Limestone	N	17-29	Upgradient
E05-03	Limestone	N	3 - 15	Downgradient Phase 1&2 Active Area
E05-04	Limestone	N	2.5 - 20	Downgradient Phase 1&2 Active Area

Monitoring Borehole	Formation Sampled	Lithology Type – Natural (N)	Response Zone Depth (m b GL)	Designation
E06-01	Limestone	N	3 - 15	Downgradient Phase 1&2 Active Area
E06-02	Limestone	N	2 - 10	Downgradient Phase 3A & 3B Active Area
E06-03	Limestone	N	2 - 10	Downgradient Phase 3A & 3B Active Area
E06-04	Limestone	N	2 - 10	Downgradient Future Filling Phases
E06-05	Limestone	N	2 – 8	Downgradient Future Filling Phases

m b 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. An independent external contractor is responsible for the sampling of the groundwater boreholes and an independent external laboratory is responsible for the analysis of the samples. There have been no changes to the contractor for the groundwater sampling and one change to the analytical laboratory from Q2 2010. Table 2 summarises the changes to the groundwater sampling method since monitoring began to improve the sample quality.

Table 2: Summary of Groundwater Sampling Methods

Monitoring Borehole	Purge Strategy	Purge Equipment	Date From	Date To
E09-01A, E09-01B, E09-02A, E09-02B, E05-04	1 x Well volume	Bailer	Quarter 1 2006	Quarter 2 2013
	Low flow steady state	Submersible pump	Quarter 3 2013	—
E05-03	1 x Well volume	Bailer	Quarter 1 2006	Quarter 3 2012
	1 x Well volume	Inertial pump	Quarter 4 2012	Quarter 2 2013
	Low flow steady state	Submersible pump	Quarter 3 2013	—
E06-01	1 x Well volume	Bailer	Quarter 1 2006	Quarter 2 2012
	1 x Well volume	Inertial pump	Quarter 3 2012	Quarter 2 2013
	3 x Well volume	Inertial pump	Quarter 3 2013	Quarter 4 2014
	Low flow steady state	Submersible pump	Quarter 3 2013	Quarter 1 2015
E06-02, E06-03	1 x Well volume	Bailer	Quarter 1 2006	Quarter 2 2012
	1 x Well volume	Inertial pump	Quarter 3 2012	Quarter 2 2013
	3 x Well volume	Inertial pump	Quarter 3 2013	Quarter 3 2014
	Low flow steady state	Submersible pump	Quarter 4 2014	—
E06-04, E06-05	1 x Well volume	Bailer	Quarter 1 2006	Quarter 2 2013
	3 x Well volume	Inertial pump	Quarter 3 2013	—

Figure 1 shows the recorded groundwater elevations for the previous 10 years which vary between +17 (E05-03) to +35m OD (E05-02B). Upgradient groundwater elevations are characterised by larger amplitude seasonal water level fluctuations with annual winter influxes of rainfall recharge. Downgradient groundwater elevations fluctuate only slightly due to effect of dewatering from the Quarry which maintains groundwater at near-constant elevations.

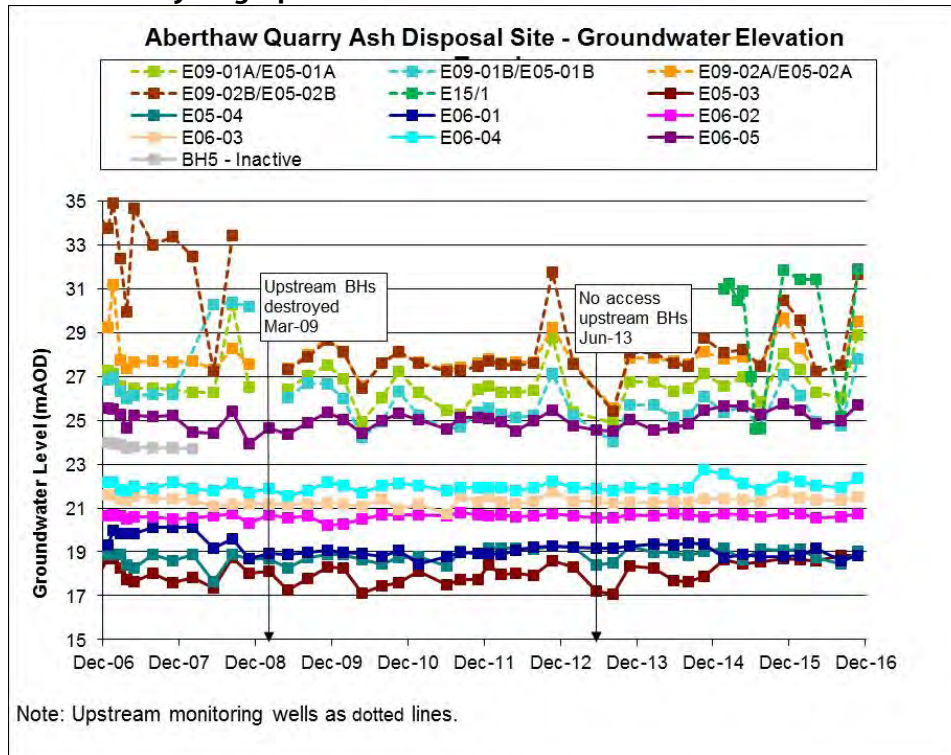
Figure 1: Groundwater Hydrograph

Figure 2 shows the general groundwater quality for the major ions in each of the groundwater boreholes. Natural groundwater quality varies between upgradient and downgradient groundwater. Calcium is depleted in downgradient boreholes, E05-03, E05-04, E06-01 and E06-02 and correlated with elevated sodium, suggesting ion exchange reactions are occurring along the groundwater flow path. Whilst in downgradient boreholes, E06-03, E06-04 and E06-05, major ion chemistry is distinctly different with elevation of calcium, magnesium and sulphate, suggesting a natural geological or quarry-related source in or upgradient of this area.

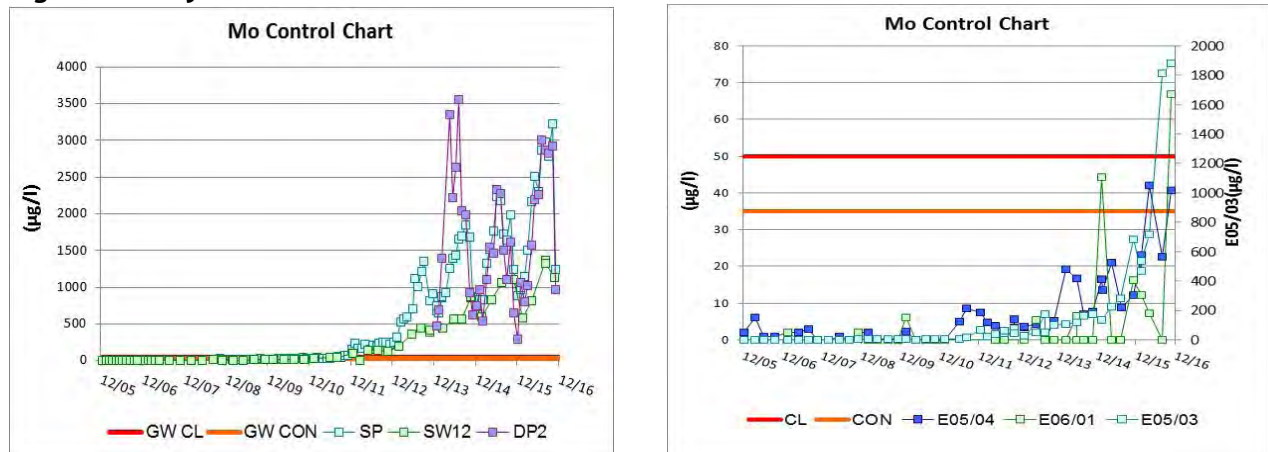
Figure 3 shows the groundwater control charts with concentrations of all downgradient boreholes plotted as well as the average upgradient concentration (representing concentrations in boreholes E09-01A, E09-01B, E09-02A and E09-02B i.e. background groundwater quality). It should be noted that the compliance limits apply to boreholes E05-03, E05-04 and E06-01 whilst the control levels (where defined) apply to all downgradient boreholes. An exceedance is defined as a result above the compliance limit or control level for 3 consecutive sampling events.

In 2016, there were no exceedances of the compliance limit or control level for any critical parameter except the continued exceedance of Molybdenum in E05-03, which has been on an upward trend since January 2012. The elevated cadmium result in E05-03 in Q3 2016 is considered an anomaly as the Q4 result was below the method detection limit of 0.1 µg/l. The elevated Molybdenum result in E06-01 in Q4 2016 is currently considered an anomaly but needs to be closely monitored in 2017 to confirm concentrations are not increasing in this borehole. Other key points to note are:

- a decrease in arsenic concentrations in E05-04 from 7 µg/l to 2 µg/l;
- naturally elevated sulphate concentrations in E06-03, E06-04 and E06-05 above 400 mg/l; and;
- variable vanadium concentrations in E06-02 between 1 µg/l and 12 µg/l.

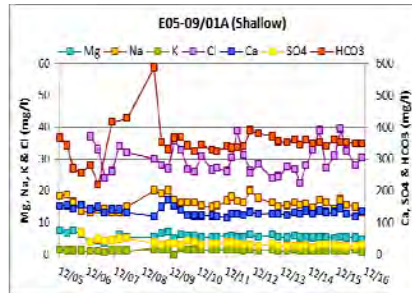
Figure 4 shows the control chart for molybdenum for E05-03 and the two other boreholes closest to it, E05-04 and E06-01 as well as the surface water monitoring points (note there are no surface water compliance limits or control levels for molybdenum). The boreholes are located to the west of and adjacent to Phase 1 and are downgradient of active filling operations. Natural background concentrations of molybdenum in the Porthkerry Formation are $<3\mu\text{g/l}$ and the average pre-filling concentration for the cement works lagoon (SW12) is $3\mu\text{g/l}$.

Figure 4: Molybdenum concentrations

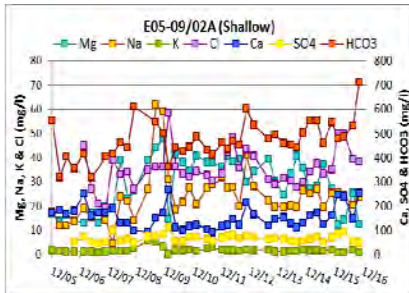


Molybdenum concentrations in E05-03 have been increasing since January 2012, around a year after Phase 1 was completed, which suggests the source is unlikely to be from the deposited PFA. After reviewing the 2016 data it appears there is a co-association of increasing concentrations in other indicative PFA leachate parameters; boron, sulphate and ammoniacal-nitrogen, suggesting PFA is the source of contamination. During site investigations in 2014, three possible sources were identified; discharges from the wheel wash pipe into an unlined ditch close to the borehole; surface water discharges of eroded PFA areas around the wheel wash pipe into the unlined ditch; and/or; leakage from adjacent cement works lagoon. In 2015, the wheel wash discharge pipe was re-routed into Settlement Pond 1, the unlined ditch cleaned out and the eroded areas smoothed. Since the improvements, molybdenum concentrations have continued to increase for over 14 months/5 sampling rounds) and further investigation will be undertaken as part of the hydrogeological risk assessment review in 2017.

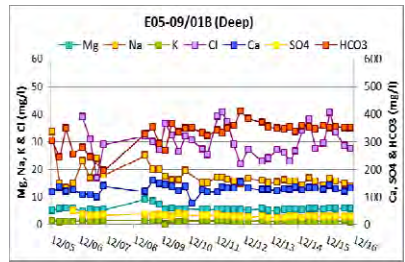
In borehole E05-04, molybdenum concentrations were approximately double the natural background concentrations until March 2014. Since then concentrations have increased moderately up to $42\mu\text{g/l}$ and there appears to be an increasing trend suggesting the source of contamination may be spreading. Prior to 2015, the molybdenum concentrations in E06-01 have consistently reflected the natural background concentrations. Since February 2015, results have been sporadically above the natural background concentrations up to $67\mu\text{g/l}$, however, there is no definitive increasing trend. Thus suggesting the source of contamination has not impacted this borehole. There is no co-association of increasing concentrations in other indicative PFA leachate parameters in either E05-04 or E06-01. Like in E05-03, molybdenum concentrations in the settlement ponds (SP) have been increasing since January 2012, however, since 2013, concentrations are characterised by large amplitude seasonal fluctuations, with the highest concentrations in the summer and the lowest in the winter. This seasonal fluctuation is reflected in DP2 which collects surface water and groundwater from the site, suggesting the source of contamination is intermittent. The water from the settlement ponds is discharged periodically into the cement works lagoon (SW12) and molybdenum concentrations have been rising steadily since January 2012 to levels similar to those in E05-03.

Figure 2: General Groundwater Quality Charts**Upgradient Boreholes**

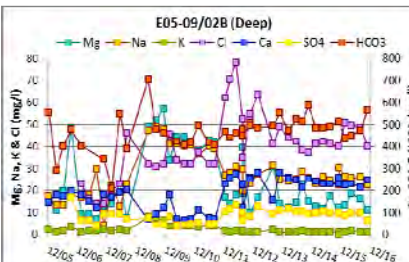
All analytes low and concentrations steady.



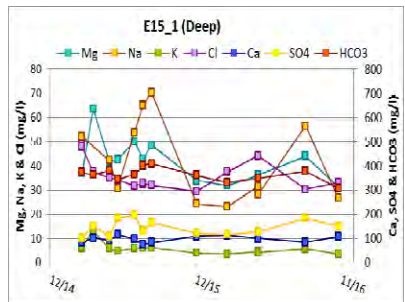
All analytes low but fluctuating.



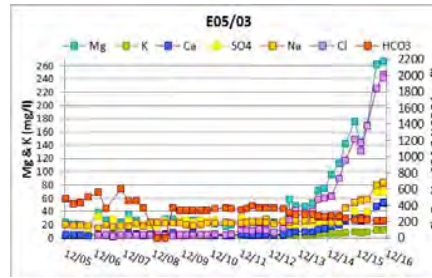
All analytes low and concentrations steady.



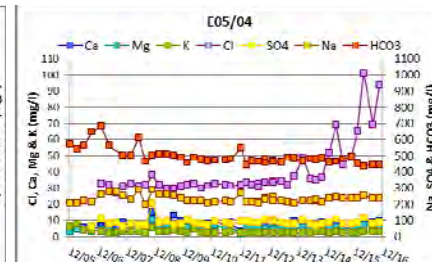
All analytes low but fluctuating, spike Mg 09-11.



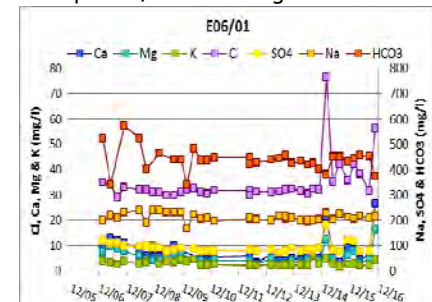
All analytes low, Mg & Na higher than other upgradient boreholes.

Downgradient Boreholes Phase 1/2

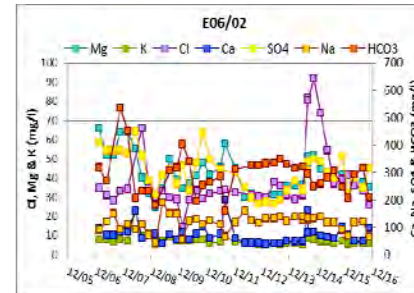
All analytes low but increasing except HCO3; Cl from Jan-12; Mg/K/Ca from Sep-14; and; SO4/Na from Aug 2015.



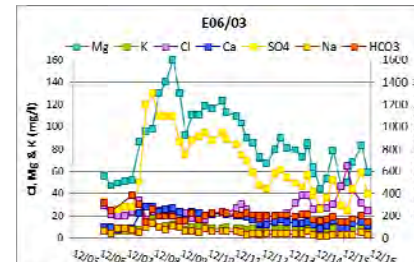
All analytes low, concentrations steady, Ca depleted, Cl increasing from Feb-15.



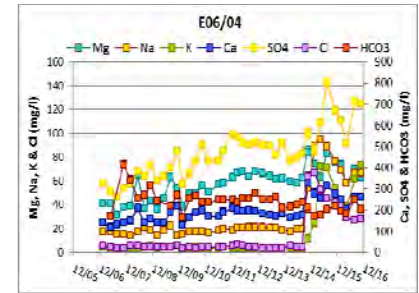
All analytes low, concentrations steady, Ca depleted.

Downgradient Boreholes Phase 3/4

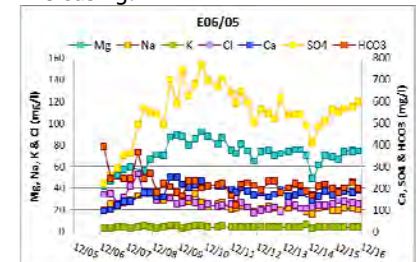
All analytes low but fluctuating, Mg/SO4 decreasing then increasing since Sept-14.



All analytes low except Mg and SO4 elevated.

Downgradient Boreholes Future Phase

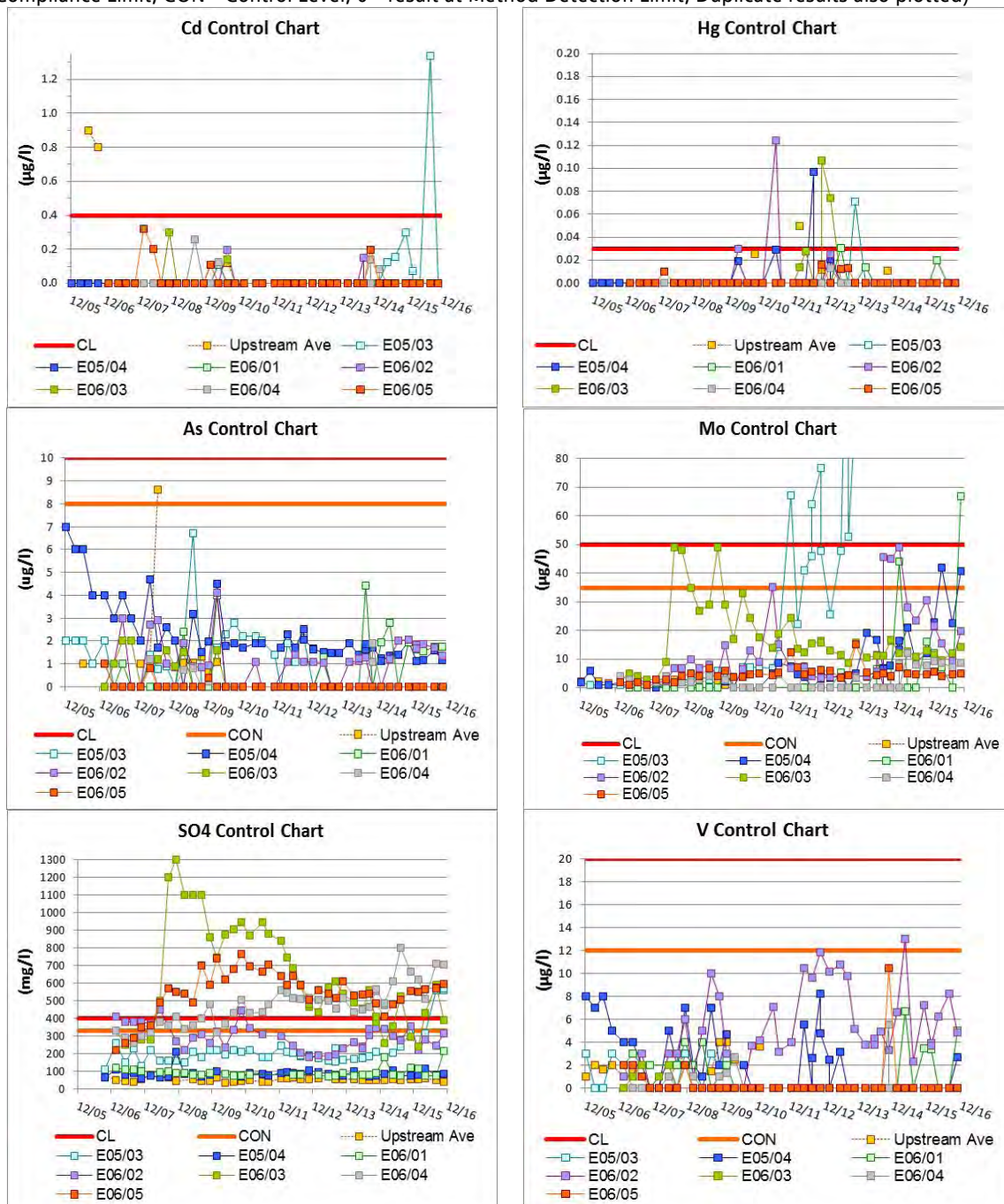
All analytes low except SO4 increasing and from Nov-14 Cl, Mg, Na and K increasing.

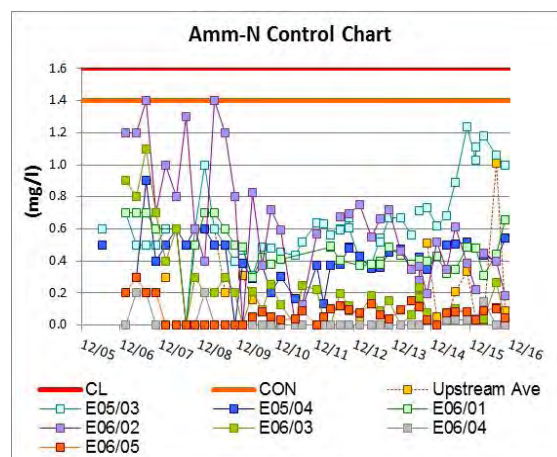
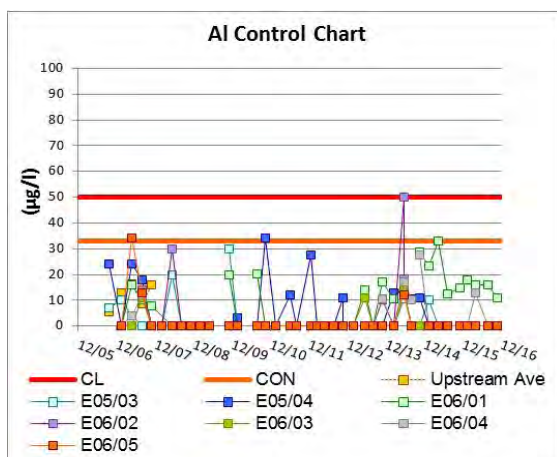
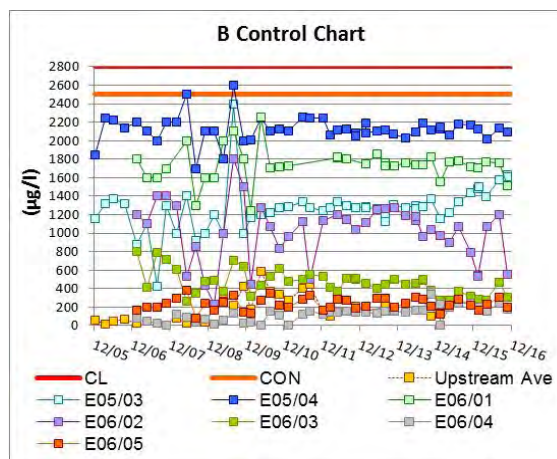
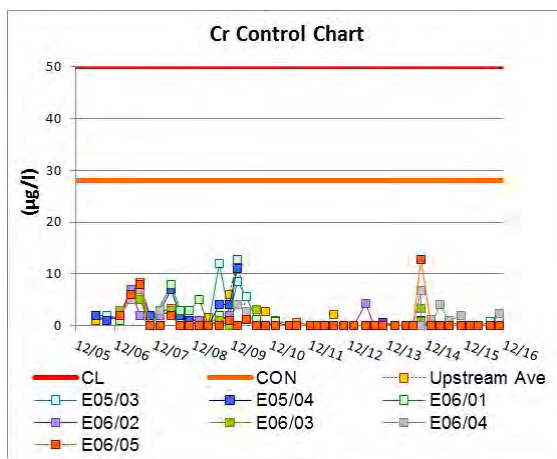


All analytes low except SO4 elevated.

Figure 3: Control charts for groundwater boreholes

(CL – Compliance Limit, CON – Control Level, 0 – result at Method Detection Limit, Duplicate results also plotted)





A summary of the average groundwater quality for all monitoring parameters between 2006 and 2016 is provided in Appendix B with a comparison of pre- and post-fill concentrations. The key trends in the data have been discussed above, however, it can be summarised that there may be some low level contamination from fugitive emissions of PFA, which is considered to have not significantly impacted the groundwater receptors.

The difference in pH between field and laboratory measurements in 2016 was less than 0.5 pH units which indicates stable sample conditions. For Electrical Conductivity the difference was between 0-25% with field measurements consistently higher. A change greater than 10% may indicate a change in sample conditions and therefore for some samples precipitation of solids between sampling and analysis may be occurring. Yet Major ion balances were all within +/- 5% suggesting precipitation of solids is minimal. Duplicate samples collected during 2016 showed good repeatability and were within the expected laboratory error of +/- 20%.

2.2. 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. As detailed in a letter to NRW dated 13th June 2014 a new surface water monitoring point has been added, DP2, to monitor the composition of water from the under-drainage. Routine monitoring at DP2 began in May 2014.

Table 3: Summary of Surface water monitoring points

Monitoring Point	Description	Direction from site	Designation
SW12	East shore of cement works lagoon in NW area	West	Surface water Receptor
Settlement Ponds (SP)	Two concrete ponds collecting groundwater and surface water	South-west	
DP2	Surface water and groundwater drainage channel at base of Phase 1 and 2	West within site	

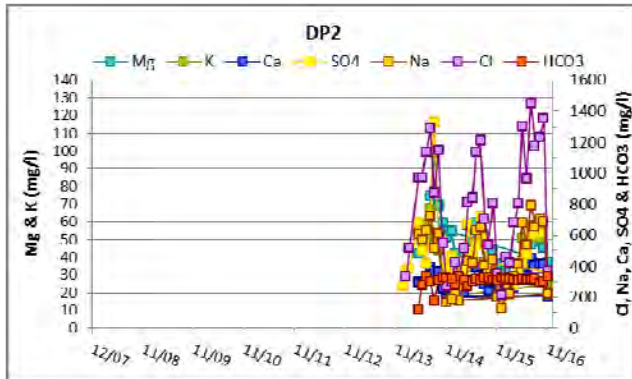
A proportion of the upstream and underlying groundwater will be collected in the groundwater drainage layer and directed towards the two settlement ponds along with any water that has infiltrated through the PFA and the barrier/attenuation layer. Surface water from runoff is also directed into the two settlement ponds via a series of perimeter ditches and toe drains. The settlement ponds are constructed on the quarry floor, contained by concrete and butyl lined 3m high bunds and are designed to allow suspended solids to settle out before the water is discharged through penstocks into the nearby cement works lagoon (SW12).

Monitoring Measurements

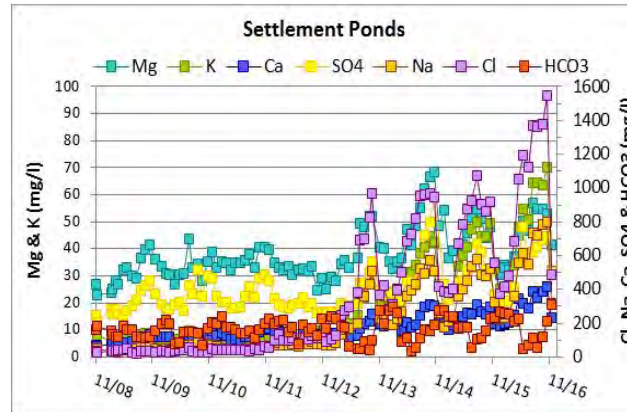
The surface water monitoring analytical suite contains a range of parameters which are monitored on a quarterly basis for SW12 and a monthly basis for the SP and DP2, in accordance with the Environmental Permit. Trained in-house operatives are responsible for the sampling of the SP and DP2 and an independent external contractor is responsible for the sampling of SW12. An independent external laboratory is responsible for the analysis of the samples. There was a change to the analytical laboratory from September 2009 for the SP surface water analysis and from Q2 2010 for the SW12 surface water analysis.

Figure 5 shows the general surface water quality for the major ions. Calcium, magnesium and sulphate concentrations appear naturally elevated in the cement works lagoon and the settlement ponds i.e. prior to any PFA deposition, and are at similar concentrations to those in the downgradient boreholes, E06-03, E06-04 and E06-05, suggesting a natural geological or quarry-related source upgradient of this area. Concentrations appear to be seasonably variable in the settlement ponds and the cement works lagoon with highs in July to December and lows in February to June except for HCO₃ with lows in July to December and highs in February to June. When routine monitoring began in DP2 in May 2014 this seasonal pattern in concentrations was also evident. The seasonal pattern is much more marked in 2013-2016 with much higher chloride concentrations than seen previously. It is not clear where the source of chloride is coming from and this will be investigated during the hydrogeological risk assessment review in 2017.

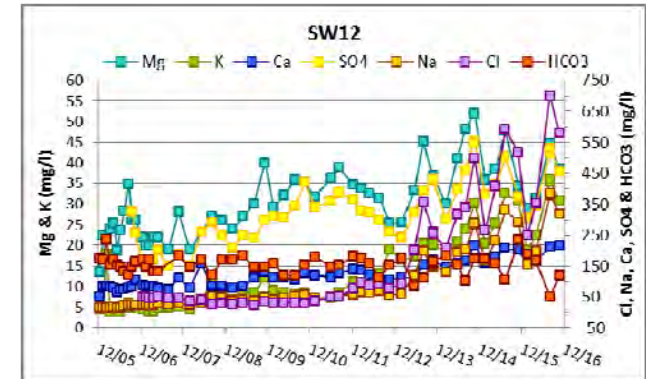
Figure 5: General Surface Water Quality Charts



Fluctuations in SO₄, Na & Cl with high concentrations in summer and low concentrations in winter.



From 2013 fluctuations in Mg, K, Ca, SO₄, Na & Cl with high concentrations in summer and low concentrations in winter and HCO₃ with low concentrations in summer and high concentrations in winter.



From 2013 fluctuations in Mg, K, SO₄, Na & Cl with high concentrations in summer and low concentrations in winter.

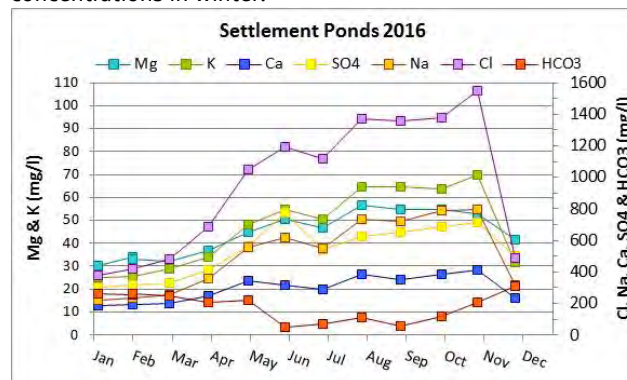
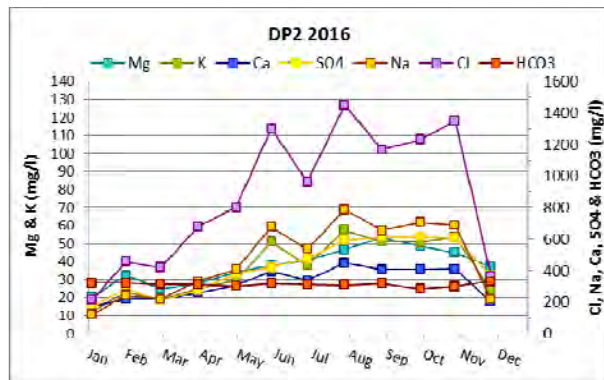


Figure 6 shows the surface water control charts. It should be noted that the compliance limits apply to the discharge from the settlement ponds whilst the control levels (where defined) apply to both the discharge from the settlement ponds and SW12. An exceedance is defined as a result above the compliance limit or control level for 3 consecutive sampling events.

In 2016, there were no exceedances of the compliance limit or control level for any critical parameter, except for sulphate and ammoniacal nitrogen. SP sulphate concentrations exceeded the compliance limit of 400mg/l between April 2016 and December 2016, which appears to be linked to previous exceedance periods; April-November 2015 and May 2014 - January 2015. A temporary approval of the elevated discharge is in place with NRW on the basis of no environmental impact and the understanding that the elevated concentrations are being caused by drainage into the site from the south-east. This will be reviewed as part of the hydrogeological risk assessment review in 2017. Ammoniacal nitrogen concentrations exceeded the compliance limit of 0.6mg/l following December 2016 sampling although sufficient oxidation or stripping appears to take place by the time the discharge passes to the cement works lagoon as concentrations are low and not increasing. Ammonia levels will be reviewed as part of the hydrogeological risk assessment review in 2017.

In general, Figure 6 shows that there are no increasing trends in critical parameter concentrations except for sulphate as discussed above and that although concentrations of critical parameters have been variable over time there appears to be no impact on the water quality within the cement works lagoon, SW12 into which the settlement ponds discharge. Other key points to note are:

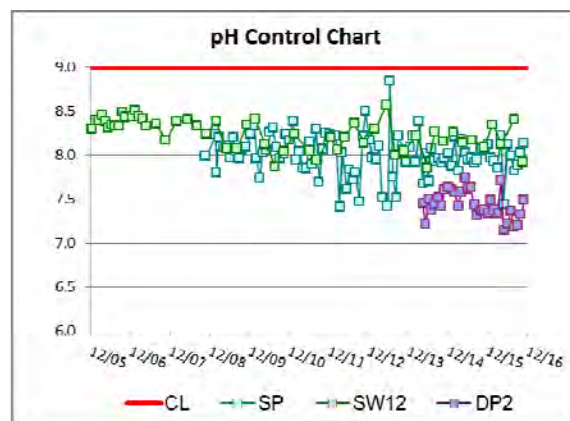
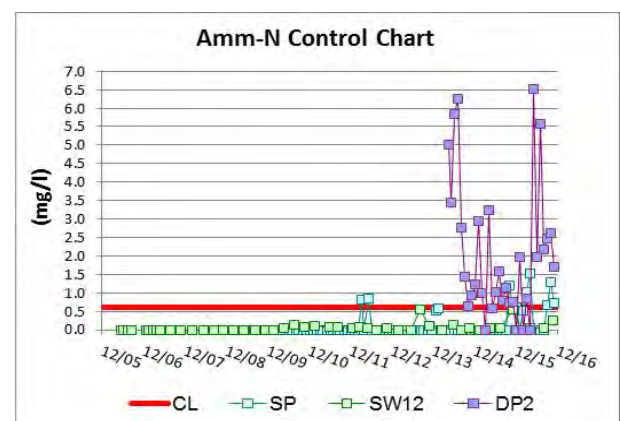
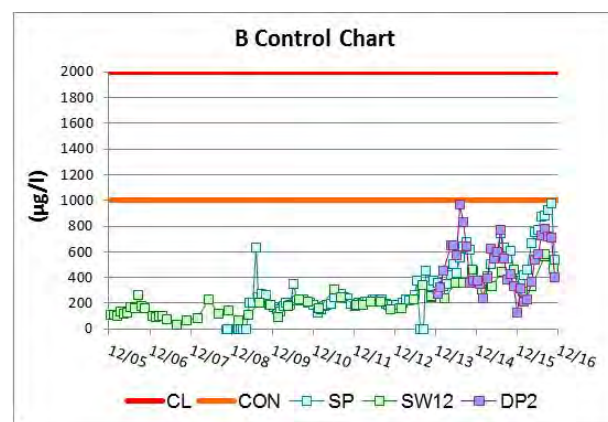
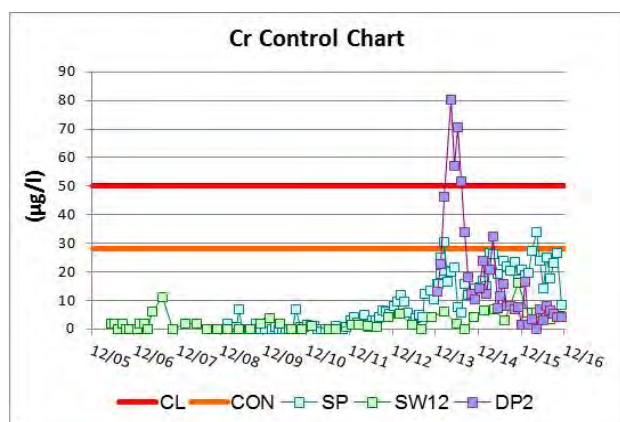
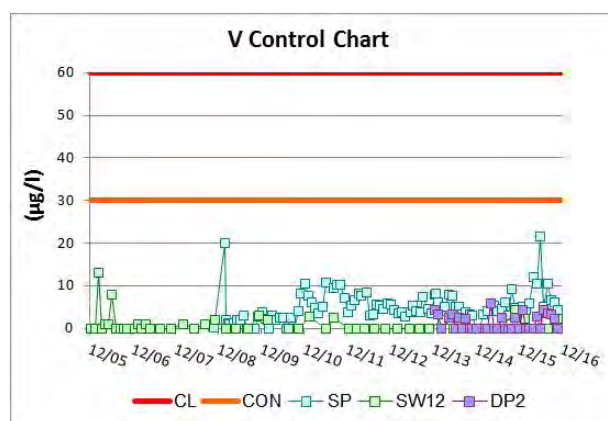
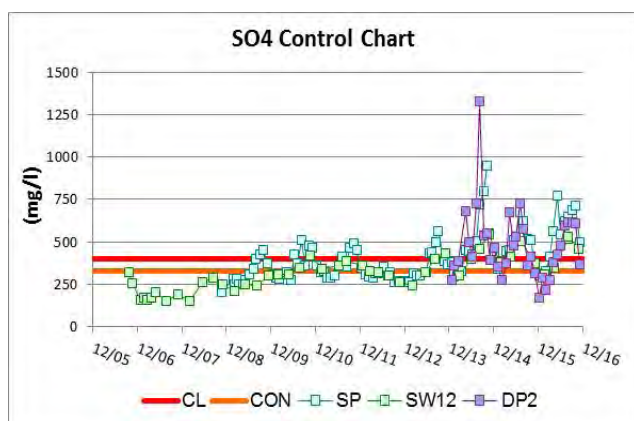
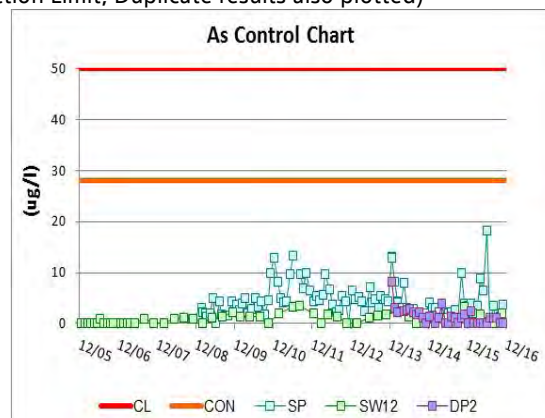
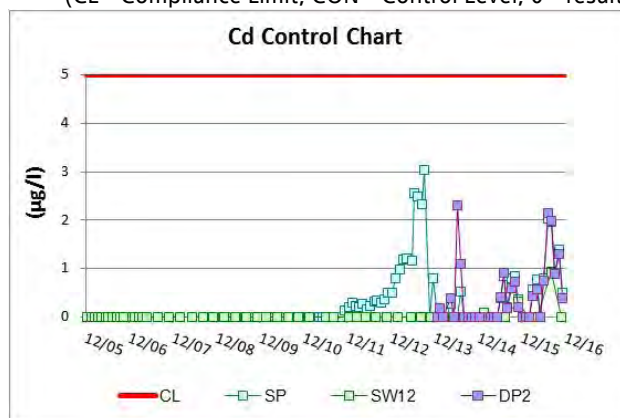
- variable chromium concentrations in SP (between 1µg/l and 30µg/l) and DP2 (between 10µg/l and 80µg/l), although concentrations in DP2 are decreasing to around 5µg/l.
- variable boron concentrations in SP (between 129µg/l and 975µg/l) and DP2 (between 241µg/l and 970µg/l).
- variable ammoniacal nitrogen concentrations in SP (between 0.5mg/l and 1.52mg/l) and DP2 (between 0.5mg/l and 6.2mg/l).

During 2015, works to improve surface water management included the re-profiling of drainage ditches, concrete lining of some of the key surface water ditches and removal of small PFA slippages.

A summary of the average surface water quality between 2006 and 2016 is provided in Appendix B with a comparison of pre- and post-fill concentrations. The key trends in the data have been discussed above, however, it can be summarised that there may be some low level contamination from fugitive emissions of PFA, which is considered to have not significantly impacted the surface water receptors.

Figure 6: Surface Water Control Charts

(CL – Compliance Limit, CON – Control Level, 0 – result at Method Detection Limit, Duplicate results also plotted)



3. Annual Improvement Targets Summary

Aberthaw Power Station continues to maintain its ISO 14001 Certification for the “Generation of electricity, by the combustion of fossil fuel and biomasses, together with the associated sale or disposal of ash”. The station had 2 surveillance visits by Lloyds Register Quality Assurance during 2016 and no non-conformities were identified. Table 4 provides details of the improvement targets for 2016 and the performance against those targets.

Table 4: Environmental Improvement Plan

Objective	Target	Target Date	Responsible Person	Final Status
Maintain a High Level of Environmental Compliance	No more than 2 environmental incidents resulting in justified complaints.	End 2016	All employees	Target not met. 4 Justified Complaints (1 Dust complaint related to AQADS Operations)
	No more than zero exceedances of permit conditions which result or have potential to cause significant environmental harm. (Natural Resources Wales CCS Category 1 and 2).	End 2016	All employees	Target met - 0
	Minimise exceedances of permit conditions which result or have potential to cause minor environmental harm. (Natural Resources Wales CCS Category 3). Fully investigate all exceedances of this type and implement improvements to minimise the likelihood of environmental harm.	End 2016	All employees	Target not met. 4 CCS Cat 3 (2 Dust management related to AQADS Operations)
	No more than zero non-compliance with emissions limits or conditions as set out in Environmental Permits (Natural Resources Wales CCS Category 4). Submit all NRW reporting on time.	End 2016	Environmental Compliance Engineer	Target not met. 3 CCS Cat 4 (2 Elevated Mo in E05/03 & SO4 in SP related to AQADS Operations)
	Complete response to Environmental Permit Pre-Operational Condition 14 - Unit 9 Low NOx Boiler Commissioning Plan.	12/02/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 6 - Third update to Plan of how Aberthaw will contribute to minimising total SO2 emissions from existing coal fired stations in England and Wales and not exceeding 70kt/yr by 2020.	01/04/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 36 - Review of Accident Management Plan for Unit 9 Low NOx Boiler Modifications.	25/04/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 40 - Normal Volatile Coal Trial Report.	31/08/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 37 - Unit 9 Low NOx Boiler Post-Commissioning Report.	25/07/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 21 - Impact of Flue Gas Desulphurisation on Marine Environment Report.	01/08/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 38 - Impact of pH Trial on Marine Environment Report.	30/09/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental	30/09/2016	Environmental	Target met.

	Permit Improvement Condition 39 - pH Trial Report.		Compliance Engineer	
	Complete response to Environmental Permit Improvement Condition 7 - 2015 Annual monitoring report on acidifying and eutrophying deposition and ecological parameters at protected nature sites.	31/12/2016	Environmental Compliance Engineer	Target met.
Ensure Efficient Uses of Resources	Waste < 15 segregation non-compliances. Non-compliance definition: - >10% wrong material in the skip. - Waste causing a safety or environmental hazard.	End 2016	All employees	Target met - 2
	Monitor and regularly report waste disposal and recycling statistics to identify minimisation opportunities.	Ongoing	Environmental Compliance Engineer	Target met.
	Water 5% reduction on 2013 target <110 m3/GWh process water (Ely Wells and St Lythans supplement).	End 2016	All employees	Target not met - 208m3/hr
	Monitor and regularly report process and potable water use to identify minimisation opportunities.	Ongoing	Section Head Performance & Commercial Section Head Regulation	Target met.
Be Responsive to Concerns and Complaints regarding our Operations	Provide response to public enquiries and complaints within 48hrs of normal office hours.	Ongoing	Section Head Regulation Environmental Compliance Engineer	Target met.
Be Accountable by Publicly Reporting our Environmental Performance	Hold a Local Liaison Committee.	Jul-16	Station Manager Section Head Regulation	Target met.
Reduce the Carbon Intensity of Electricity Generated	To meet the business plan targets for biomass burn and thermal efficiency.	End 2016	Section Head Materials Handling Section Head Performance & Commercial	Target not met.
Drive Continuous Improvements in Standards of Environmental Management	Ensure the Environmental Management System (EMS) is maintained to ISO 14001, plan and implement the transition process for updating the EMS to the revised 2015 Standard.	End 2016	Section Head Regulation Environmental Compliance Engineer	Target met.
	Ensure all staff and residential contractors (managers and first line supervisors) new to site in 2016 have completed the environmental training program.	End 2016	Section Heads & Line Managers Technical Officers	Target partially met.
	Finalise and roll-out the new environmental training program.	Q2 2016	Environmental Compliance Engineer	Target met.
	Finalise the Biodiversity Management Plan for 2016-2020.	Q1 2016	Environmental Compliance Engineer	Target met.
	Improve the bund planting around the northern laydown area and review landscaping opportunities for biodiversity/visual improvement.	Q4 2016	Environmental Compliance Engineer	Target not met.
	Complete installation of water meters on the process water system.	Q2 2016	Station Chemist	Target partially met.
	Install oil in water monitor in the site drainage system at P2.	Q2 2016	Station Chemist	Target partially met.
	Install a weather station at Aberthaw Centre for Energy and the Environment.	Q2 2016	Environmental Compliance Engineer	Target partially met.

4. Annual Production/Treatment Data

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

5. Contamination/Decontamination of Site

There have been no incidents or emissions which may have caused any site contamination during 2016, and, therefore, no requirement to decontaminate the site during 2016.

6. Topographical Survey

The last topographical survey to ordnance datum was carried out in September 2016 for Phase 3A and 3B which is shown in Appendix C.

7. Landfill Capacity

Table 6 below details the amount of PFA deposited at Aberthaw Quarry Ash Disposal Site during 2016 as reported to Natural Resources Wales via the Waste Return Form. The total amount deposited is well below the permitted annual waste input limit of 650,000 tonnes. It is estimated that around 2,493,912m³ of void capacity remains (Phases 1–4).

Table 6: PFA Deposited

Reporting Period	PFA Deposited (tonnes)
1 st January – 31 st December 2016	240,795

8. Waste Acceptance Compliance Testing

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

The exact composition of PFA is dependent upon the composition of the fuel utilised by Aberthaw Power Station. RWE has well established procedures which control the quality of fuel supplied to its stations. The coal purchased by RWEST for Aberthaw is only from an approved 'matrix' for the site (i.e. a list of named coals specifically approved for use at Aberthaw). Any new fuels undergo a rigorous fuel assessment process before trial/use on site to ensure they meet the mandatory fuel specifications and safety requirements of the station.

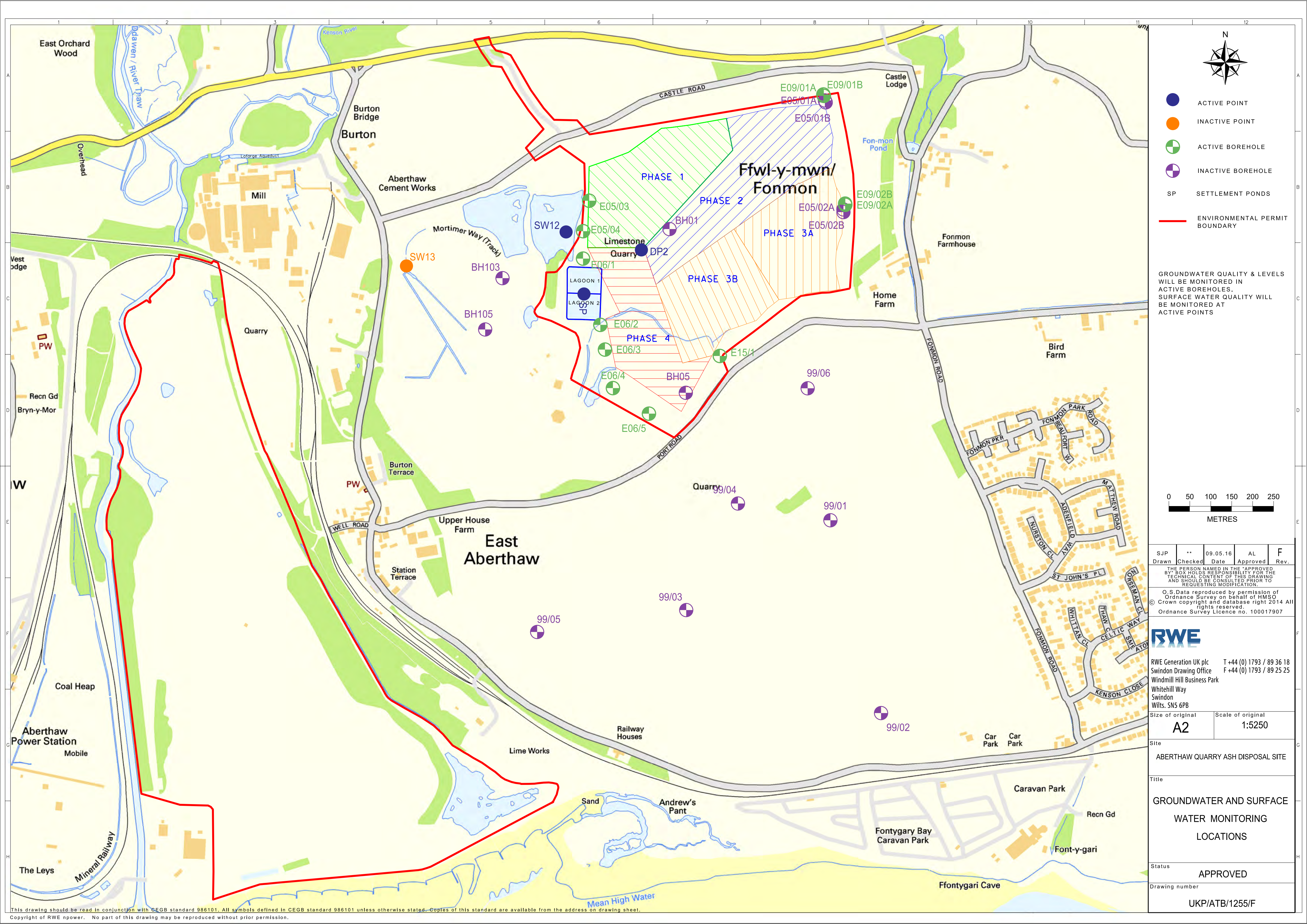
Table 7 summarises the analytical data obtained for leachate tests performed on composite samples of conditioned PFA from Aberthaw Power Station between 2012 and 2016. The CEN two-stage method for leachate analysis was used (BS EN 12457-3:2002 Characterisation of waste – Leaching – Compliance test for 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 SO ₄ (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

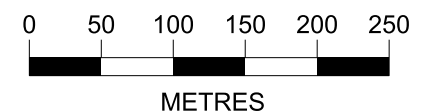
Appendix A. Groundwater and Surface Water Monitoring Locations

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- ACTIVE POINT
- INACTIVE POINT
- ACTIVE BOREHOLE
- INACTIVE BOREHOLE
- SP SETTLEMENT PONDS
- ENVIRONMENTAL PERMIT BOUNDARY

GROUNDWATER QUALITY & LEVELS WILL BE MONITORED IN ACTIVE BOREHOLES. SURFACE WATER QUALITY WILL BE MONITORED AT ACTIVE POINTS



SJP	**	09.05.16	AL	F
Drawn	Checked	Date	Approved	Rev.

THE PERSON NAMED IN THE 'APPROVED BY' BOX HOLDS RESPONSIBILITY FOR THE TECHNICAL CONTENT OF THIS DRAWING AND SHOULD BE CONSULTED PRIOR TO REQUESTING MODIFICATION.

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RWE Generation UK plc
Swindon Drawing Office
Windmill Hill Business Park
Whitehill Way
Swindon
Wilts. SN5 6PB

T +44 (0) 1793 / 89 36 18
F +44 (0) 1793 / 89 25 25

Size of original	Scale of original
A2	1:5250

Site
ABERTHAW QUARRY ASH DISPOSAL SITE

Title
GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

Status
APPROVED

Drawing number
UKP/ATB/1255/F

Appendix B. Groundwater and Surface Water Quality

(Dark orange exceeds compliance limits, light orange exceeds EQS/DWS, blue exceeds background >25%)

	Aquifer	Response Zone Interval	Al		Sb		As		B		Cd		Ca		Cr		Cu		Fe	
		m b GL	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	µg/l	µg/l	µg/l	µg/l							
Background - Limestone			11		3		2		201		0.6		150		3		2		81	
Background - Seawater			256		<10		2		4166		0.1				1		12		<100	
GW EQS/DWL			200		5		10		2000		5.0		250		50		2000		200	
GW MRV							1				1.0									
GW CL			50				10		2800		0.4				50					
SW CL							50		2000		5.0				50					
Upstream Groundwater			Average		Average		Average		Average		Average		Average		Average		Average		Average	
E05-09_01A	Limestone	18-24	14		3		1		43		<0.1		133		3		3		106	
E05-09_01B		24-30	14		1		1		42		<0.1		128		3		2		75	
E05-09_02A		21-27	12		3		1		121		0.1		155		3		2		395	
E05-09_02B		27-33	9		2		2		339		0.6		191		4		2		86	
E15_1		17-29	21		<1		<1		259		<0.1		95		3		2		64	
Downstream Active Filling Operations			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
E05_03	Limestone	3-15	15	11	4	1	1	1	1109	1318	<0.1	0.1	37	105	3	1	7	1	38	50
E05_04		2.5-20	21	11	6	2	4	2	2123	2126	<0.1	<0.1	6	8	4	1	5	1	39	31
E06_01		3-15	16	15	6	1	1	1	1667	1755	<0.1	<0.1	10	7	4	1	1	1	47	31
E06_02		2-10	21	12	6	1	2	1	1113	992	<0.1	0.1	89	70	3	1	5	1	86	30
Downstream Future Filling Operations			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
E06_03	Limestone	2-10	19	10	5	2	1	1	561	442	<0.1	0.1	131	165	3	1	2	2	71	<30
E06_04		2-10	17	11	4	1	1	1	58	153	<0.1	0.1	147	210	3	1	5	3	55	39
E06_05		2-8	21	10	5	1	1	1	224	236	0.4	0.1	129	188	3	1	2	2	33	<30
Downstream Surface Water			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
DP2 Phase 2 West				12		1		2		497		0.5		296		18		3		<30
Settlement Ponds				90		1		5		296		0.3		155		8		2		55
SW12 Lafarge Lagoon			21	11	5	1	1	2	122	277	<0.1	0.2	86	146	2	3	2	1	32	31

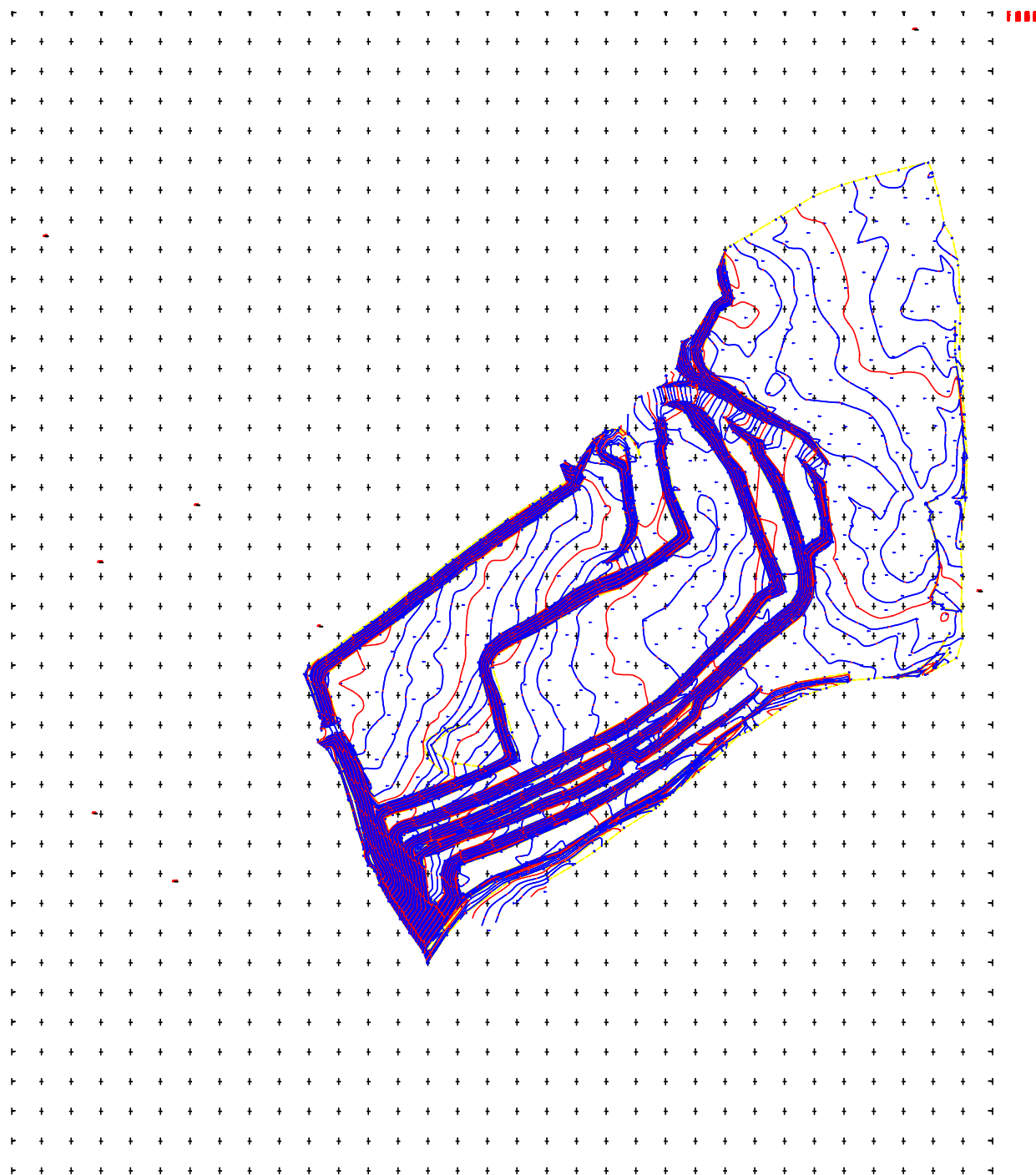
	Aquifer	Response Zone Interval	Mg		Mn		Hg		Mo		Ni		K		Se		Na		Vn	
		m b GL	mg/l		µg/l		µg/l		µg/l		µg/l		mg/l		µg/l		mg/l		µg/l	
Background - Limestone			16		51		0.02		3		4		2		3		21		2	
Background - Seawater					<20		0.02		<30		9		380		<1				<20	
GW EQS/DWL			50		50		1.00		70		20		12		10		200		60	
GW MRV							0.10													
GW CL							0.03		50										20	
SW CL																			60	
Upstream Groundwater			Average		Average		Average		Average		Average		Average		Average		Average		Average	
E05-09_01A	Limestone	18-24	6		12		0.01		1		4		1		2		16		2	
E05-09_01B		24-30	6		8		0.02		3		3		1		3		17		2	
E05-09_02A		21-27	29		74		0.01		3		4		2		3		24		2	
E05-09_02B		27-33	22			49		0.01		2		5		2		2		27		2
E15/1		17-29	41			20		<0.01		9		2		6		<1		44		<2
Downstream Active Filling Operations			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
E05_03	Limestone	3-15	24	69	11	39	<0.01	0.01	1	254	2	2	4	5	1	1	149	263	2	2
E05_04		2.5-20	4	5	6	9	<0.01	0.01	2	9	2	1	4	3	2	1	241	231	4	3
E06_01		3-15	7	5		12	<0.01	0.01	1	7	1	1	3	3	1	1	215	211	2	2
E06_02		2-10	56	39	18	10	<0.01	0.01	3	14	4	2	10	7	2	1	109	116	2	6
Downstream Future Filling Operations			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
E06_03	Limestone	2-10	62	89	10	13	<0.01	0.02	11	18	5	3	7	9	5	2	70	49	1	2
E06_04		2-10	42	62	5	26	<0.01	0.01	3	4	4	3	4	17	2	1	17	36	1	2
E06_05		2-8	52	74	6	10	0.04	0.01	2	6	4	2	4	5	2	1	27	24	1	2
Downstream Surface Water			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
DP2 Phase 2 West				47		27		0.01		1645		17		37		1		440		3
Settlement Ponds				37		10		0.03		577		9		17		2		179		5
SW12 Lafarge Lagoon			23	36	2	15	0.05	<0.01	3	408	2	4	6	18	2	2	23	142	2	2

	Aquifer	Response Zone Interval m b GL	pH		EC µS/cm		Bicarbonate mg/l		Sulphate mg/l		Ammoniacal Nitrogen as N mg/l		Total Oxidised Nitrogen as N mg/l		Nitrate mg/l		Chloride mg/l		Fluoride mg/l		Total Organic Carbon mg/l	
Background - Limestone			7.41		812		408		55		0.3		10.62		22		34		0.2		#DIV/0!	
Background - Seawater			7.88				97		2396						16300		1.3					
GW EQS/DWL			8.50		2500		250		400		0.3				50		250		1.5			
GW MRV																						
GW CL									400		1.6											
SW CL			9.00						400		0.6											
Upstream Groundwater			Average		Average		Average		Average		Average		Average		Average		Average		Average		Average	
E05-09_01A	Limestone	18-24	7.43		679		351		34		0.03		5.70		52		30		0.1		5	
E05-09_01B		24-30	7.45		668		332		32		0.03		5.15		28		30		0.1		4	
E05-09_02A		21-27	7.36		876		472		66		0.74		8.63		8		35		0.3		4	
E05-09_02B		27-33	7.29		1031		467		86		0.13		23.34		22		40		0.3		7	
E15/1		17-29	7.54		830		367		139		0.35		2.87		3		36		0.2		2	
Downstream Active Filling Operations			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
E05_03	Limestone	3-15	8.50	7.81	977	2040	462	293	178	231	0.53	0.67	0.14	0.65	0.42	2.09	33	426	1.4	1.6	16	3
E05_04		2.5-20	8.79	8.54	1010	940	564	475	79	90	0.53	0.39	0.30	0.07	0.84	<0.2	31	41	6.4	5.2	19	5
E06_01		3-15	8.66	8.58	923	874	473	433	106	92	0.58	0.45	0.45	0.09	<0.2	1	33	35	2.1	2.7	19	3
E06_02		2-10	8.39	7.84	1214	1006	336	286	390	276	1.09	0.51	0.72	0.60	0.60	0.55	38	39	0.6	0.5	5	5
Downstream Future Filling Operations			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
E06_03	Limestone	2-10	8.20	7.71	1224	1346	276	191	443	655	0.67	0.13	2.28	0.99	1.60	0.18	23	26	0.5	0.4	4	6
E06_04		2-10	7.99	7.57	930	1353	290	232	320	505	0.20	0.04	0.10	0.55	0.50	1.95	26	94	<0.5	0.3	12	20
E06_05		2-8	8.08	7.59	1063	1239	289	204	363	580	0.21	0.07	0.30	0.20	3.30	<0.2	37	25	<0.5	0.4	9	1
Downstream Surface Water			Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill	Prefill	Postfill
DP2 Phase 2 West				7.44		3558		300		477		2.10		20.96		18.79		777		0.2		1
Settlement Ponds				8.01		1701		165		380		0.10		6.55		11.63		300		0.3		2
SW12 Lafarge Lagoon				8.38	8.17	713	1439	159	151	207	366	<0.2	0.09	1.16	2.75	5.09	3.20	44	207	<0.5	0.2	8

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Appendix C. Topographical Survey

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[illegible]

	Notas

Sheet Layout

North Point.

All items related to:
Customer Registry Design Defined by CPM

Title	NORTH QUARRY, ABERTHAW.
Client	RWE NPOWER

Section: 1-1000 @ A6	Date: October 2018
Drawn by: CHAMPB	Checked by: A J D
Design Number:	2018

DAVIES
SURVEYS LIMITED
Chris Hoare, Telford WAU, CPE/FRD
Tel: 01925 28 611 696
Email: info@davies-surveys.co.uk
Web: www.davies-surveys.co.uk