CCR Energy Limited

2024 ANNUAL PERFORMANCE REPORT

Aberthaw Ash Disposal Site

70112185-2024PFA
JANUARY 2025

PUBLIC

CCR Energy Limited

2024 ANNUAL PERFORMANCE REPORT

Aberthaw Ash Disposal Site

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70112185

OUR REF. NO. 70112185-2024PFA

DATE: JANUARY 2025

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QUALITY CONTROL

Issue/revision	First issue
Remarks	
Date	January 2025
Prepared by	[redacted]
Signature	[redacted]
Checked by	[redacted]
Signature	[redacted]
Authorised by	[redacted]
Signature	[redacted]
Project number	70112185
Report number	70112185-2024PFA

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1 INTRODUCTION

1.1 AUTHORISATION

WSP UK Ltd (WSP) has been instructed by CCR Energy Limited (CCRE) to complete quarterly groundwater and surface water monitoring on their Ash Disposal Site, which is located at Aberthaw Power Station, The Leys, Aberthaw, Barry, CF62 4ZW (Hereafter referred to as 'the Site'). A Site location map is presented in **Appendix A**.

1.2 PROJECT BACKGROUND

WSP has been commissioned to produce an Annual Performance Report of CCRE's Ash Disposal Site throughout 2024, as required by condition 4.2.1 of the Site's Environmental Permit, **DP3432SW**. This report will summarise the geo-environmental performance of the Site using data gathered during four quarters of monitoring by WSP site engineers.

The Site's Environmental Permit Section 4.2.1 outlines a number of minimum requirements for an Annual Performance Review which are as follows:

" 4.2.1 A report or reports on the performance of the activities over the previous year shall be submitted to the Agency by 31 January (or other date agreed in writing by the Agency) each year. The report(s) shall include as a minimum:

(a) A review of the results of monitoring and assessment carried out in accordance with this permit against the relevant assumptions, parameters and results in the risk assessments submitted with the application;

(b) Where the operator's management system encompasses annual improvement targets, a summary report of the previous year's progress against such targets;

(c) The annual production/treatment set out in schedule 5 table S5.2.

(d) Details of any contamination or decontamination of the site which has occurred;

(e) The topographical surveys required by condition 3.6.3 other than those submitted as part of a CQA validation report;

(f) The volumetric difference (reported in cubic metres) between the most recent topographical survey and the previous annual topographical survey i.e. the additional volume of the landfill void that is occupied by waste;

(g) A calculation of the remaining capacity (reported in cubic metres) derived from the pre-settlement contours and the most recent topographical survey;

(h) A summary of the waste acceptance compliance testing undertaken in the period"

Aberthaw Ash Disposal Site historically reached its maximum permissible height and the wider Aberthaw Power Station site is in the process of decommissioning and demolition. As a result, a number of requirements for annual reporting are now redundant under its current state, and these points are summarised under **Section 3**.

1.3 OPERATIONAL UPDATE

Aberthaw Ash Disposal Site is no longer operational and has been restored as per plans approved by the Local Authorities.

No changes were made to operational activities and no Environmental Permit variations associated with the Ash Mound were made during 2024. The Ash Mound, as part of the wider Aberthaw Power Station site was sold by RWE Generation UK plc to CCR Energy Limited, with the associated permit transfer taking place on 14th March 2023. The permit transfer notice is included as **Appendix B**.

2 REVIEW OF RESULTS OF EMISSION MONITORING

2.1 SUMMARY OF MONITORING

Four groundwater monitoring visits were undertaken during 2024 by WSP site engineers. These visits are summarised in **Table 2-1** below.

Table 2-1 – Summary of Groundwater Monitoring Site Visits

Quarter	Dates of Visit
Q1	26th – 28th March 2024
Q2	24th – 28th June 2024
Q3	10th – 12th September 2024
Q4	25th – 29th November 2024

The annual review of laboratory results also include results reported during the three rounds completed by WSP in 2023 for comparison.

It is noted that Eastern Perimeter Drain surface water sampling location was not sampled during Q2 and Q3 due to being dry. Sampling was completed as expected in Q1 and Q4.

2.2 HYDROGEOLOGICAL RISK ASSESSMENT REVIEW

In accordance with Environmental Permit DP3432SW there is a requirement to undertake a 4-yearly review of the Hydrogeological Risk Assessment (HRA). It has been agreed with Natural Resources Wales (NRW) that the HRA review should be carried out every six years as per Environment Agency Landfill Operators Guidance. WSP completed the HRA for Aberthaw Ash Disposal Site in 2024 (*WSP ref.: 70112185-601*).

2.3 GROUNDWATER QUALITY REVIEW

MONITORING OBJECTIVES

The objective of groundwater monitoring is to monitor the performance of the Ash Disposal Site by measurement of absolute levels, concentrations and trends relative to relevant criteria including background level and concentrations, control levels and compliance limits. Background levels for both Limestone and Seawater are as determined by RWE in the PFA Mound 10 Year Summary prior to WSP taking over monitoring responsibilities, included in **Appendix D**. Background results for Limestone are based upon upstream boreholes not present on the Site (1A, 1B, 2A and 2B). Seawater background results are based upon Controlled Water Inlet data collected in 2011-12. For consistency, these background values have been maintained.

LOCATIONS OF MONITORING POINTS

A summary of the monitoring boreholes is provided in **Table 2-2** below, with locations presented in **Appendix A** . Seven boreholes are in natural ground, five of which are completed in the Porthkerry Member limestone, and two in the Alluvium (clay). There are two shallow boreholes in fill material

(BH07A with a response partially in clay fill, and BH11A with a response partially in fill containing coal ash).

Groundwater flow direction beneath the Ash Disposal Site is towards the River Thaw to the west and Severn estuary 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 four boreholes situated on this boundary (BH10B, BH11A, BH11B, BH07A, BH07B and BH09B), spaced approximately 250m apart. Replacements for BH08A and BH08B were installed in February 2021.

Table 2-2 – Summary of Monitoring Boreholes

Monitoring Point	Formation sampled	Lithology type – Natural (N); Imported Fill (F)	Response Zone Depth (m bgl)	Geological Barrier Thickness above Response Zone (m)	Other Lithology Above Response Zone
BH03B	Limestone	N	13.5 – 23.0	6	PFA – 6m
BH05	Limestone	N	2.5 – 11 5	0	PFA – 1.5m
BH06	Limestone	N	13.0 – 20.5	0	PFA – 12.2m
BH07A	Clay fill and gravelly clay	F/N	2.0 – 9.5	8	PFA – 1.5m
BH07B	Limestone	N	17.0 – 26.0	3.9	Fill – 7.4m Sand and gravel – 5.7m
BH08A	Limestone	N	5.3 – 7.0	0	PFA – 5.3m
BH08B	Limestone	N	30.0 – 38.0	0	PFA – 5.3m
BH09B	Limestone	N	6.0 – 13 0	0	PFA – 3m
BH10B	Clay	N	23.0 – 30.0	6.6	Fill – 2.8m Sand – 13.0m
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

MONITORING MEASUREMENTS

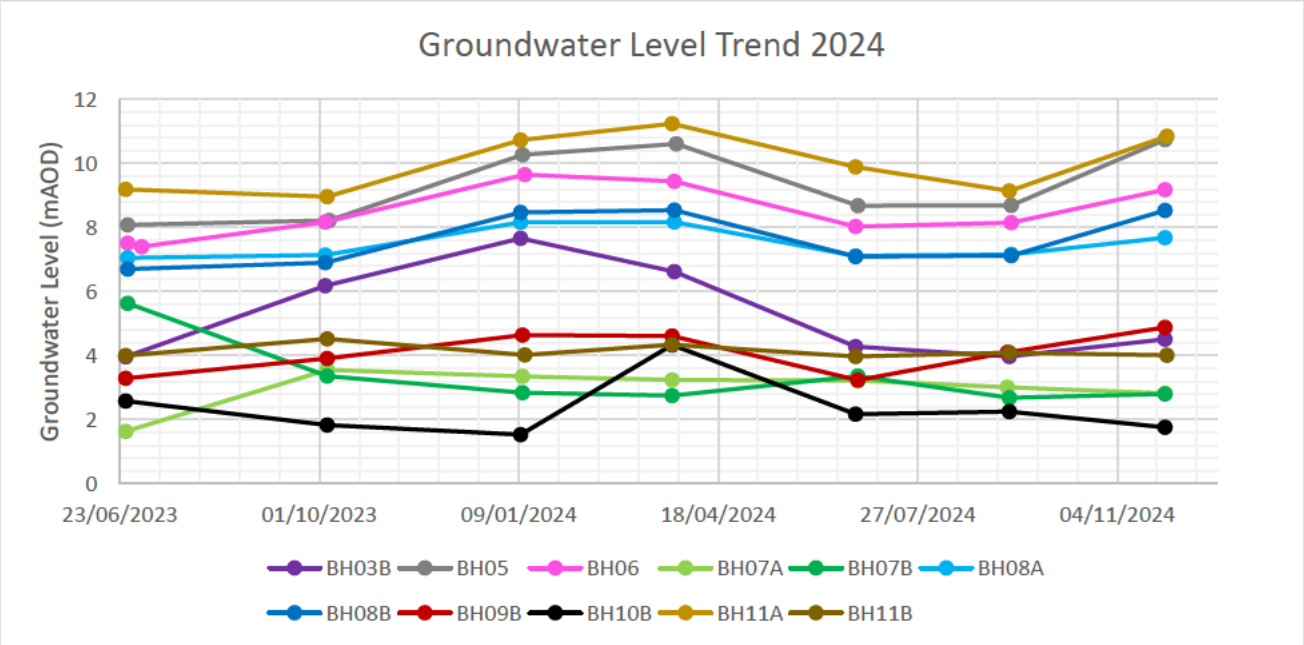
Groundwater Level

The groundwater monitoring analytical suite contains a range of parameters which are monitored on the quarterly basis along with groundwater levels and standard field measurements (including pH,

temperature, dissolved oxygen, redox potential (ORP) and electrical conductivity) in accordance with the Environmental Permit. A summary of field measurements for each location is presented in **Appendix E**. Laboratory analysis is completed through MCERTS and UKAS accredited laboratory ALS Hawarden.

Figure 2-1 shows recorded groundwater elevations for the entire period of WSP monitoring including 2023 and 2024. Results in 2024 vary between 1.76m above ordnance datum (AOD) (BH10B) and 11.24m AOD (BH11A) with groundwater elevations in limestone boreholes being characterised by seasonal cyclic water level fluctuations associated with annual winter influxes of rainfall recharge.

Figure 2-1 - Groundwater Hydrograph



Contaminant Concentrations

Figure 2-2 shows the groundwater control charts with concentrations of contaminants within boreholes plotted. It should be noted that compliance limits and control levels (where defined) apply to boreholes BH03B and BH07B. An exceedance is defined as a result above the compliance limit or control level for three consecutive sampling events. Compliance limits and control levels were defined and agreed between NRW and the previous permit holder RWE; These limits have been maintained for use in this report, for consistency in continued annual reporting of the Aberthaw Ash Disposal Site.

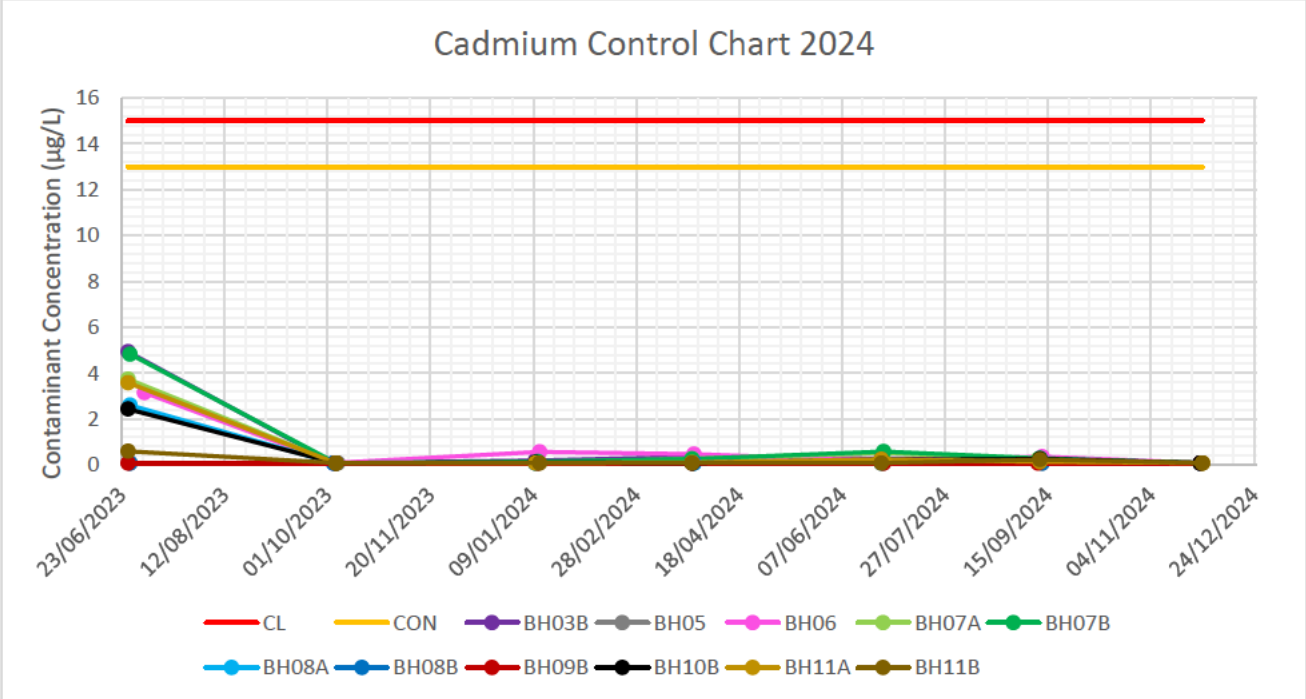
In 2024, there were no exceedances of the Control Level for any critical parameters for either of the compliance boreholes. Some individual readings are reported above the Control Level for Selenium and Vanadium, however, these results are not within compliance boreholes. The control charts show that there are no increasing trends in critical parameter concentrations. Elevated concentrations of Arsenic are observed in BH03B across the full monitoring period, and this is in line with historical trends for this location.

For additional information, trends for the other monitored parameters (i.e. those without an applied Control Level or Compliance Limit) have been attached within **Appendix C**. Hexavalent chromium is noted to have been detected in BH11A during Round 1 of 2024. This is the only instance of a detection of hexavalent chromium during WSP routine monitoring; hexavalent chromium concentration in BH11A reverted to the laboratory LOD during each following round. A general summary of groundwater and surface water quality over the 10 years prior to WSP's monitoring (circa 2013 to 2023) has also been included within **Appendix D.** Control Levels and Compliance Limits are sourced from this summary of monitoring.

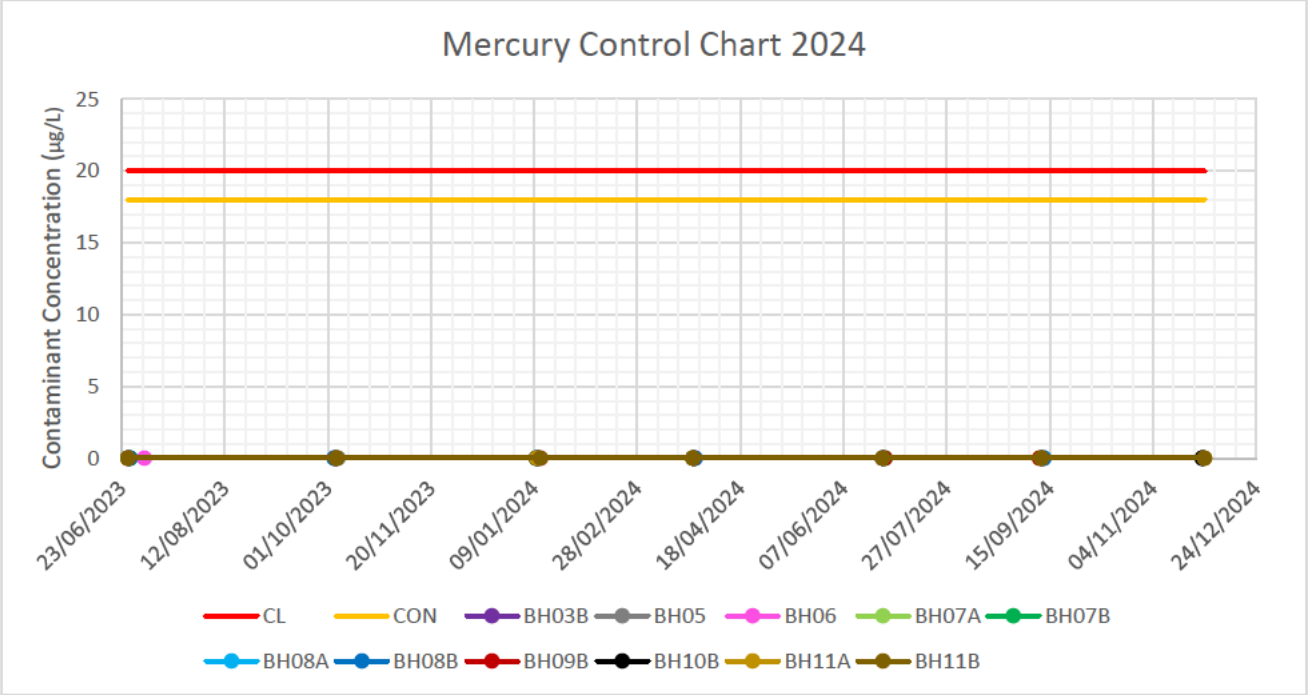
Please note that contaminant concentration results have been adapted for the purposes of assessment and trend plotting. For many of the parameters a significant proportion of the results are routinely reported by ALS Hawarden as being below the Laboratory limit of detection (LOD), the value of which varies across contaminants and generally decreases as individual test methods have been developed and improved over time. Consideration has been given to how results below LOD should be presented. WSP has concluded that the most appropriate way of representing results below LOD is to report them in the time series graphs as the value of the LOD itself as a conservative scenario.

Figure 2-2 - Control Charts for Groundwater Boreholes

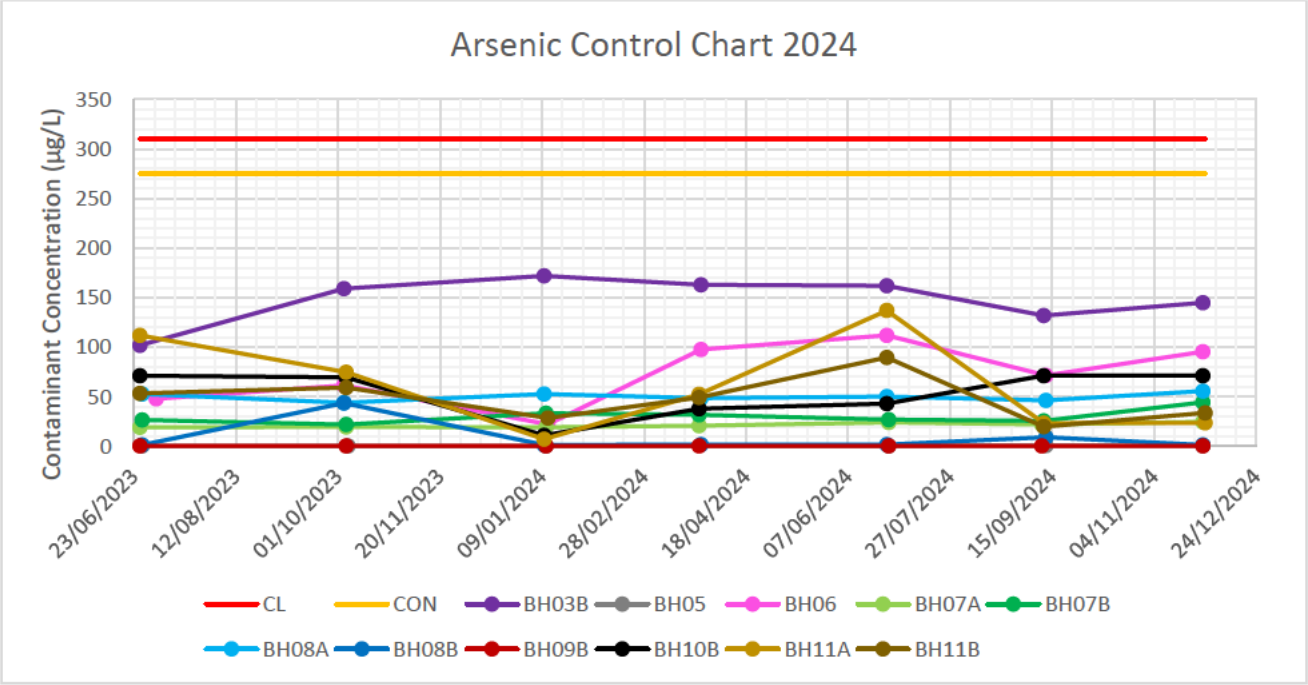
(CL – Compliance Limit, CON – Control Level)



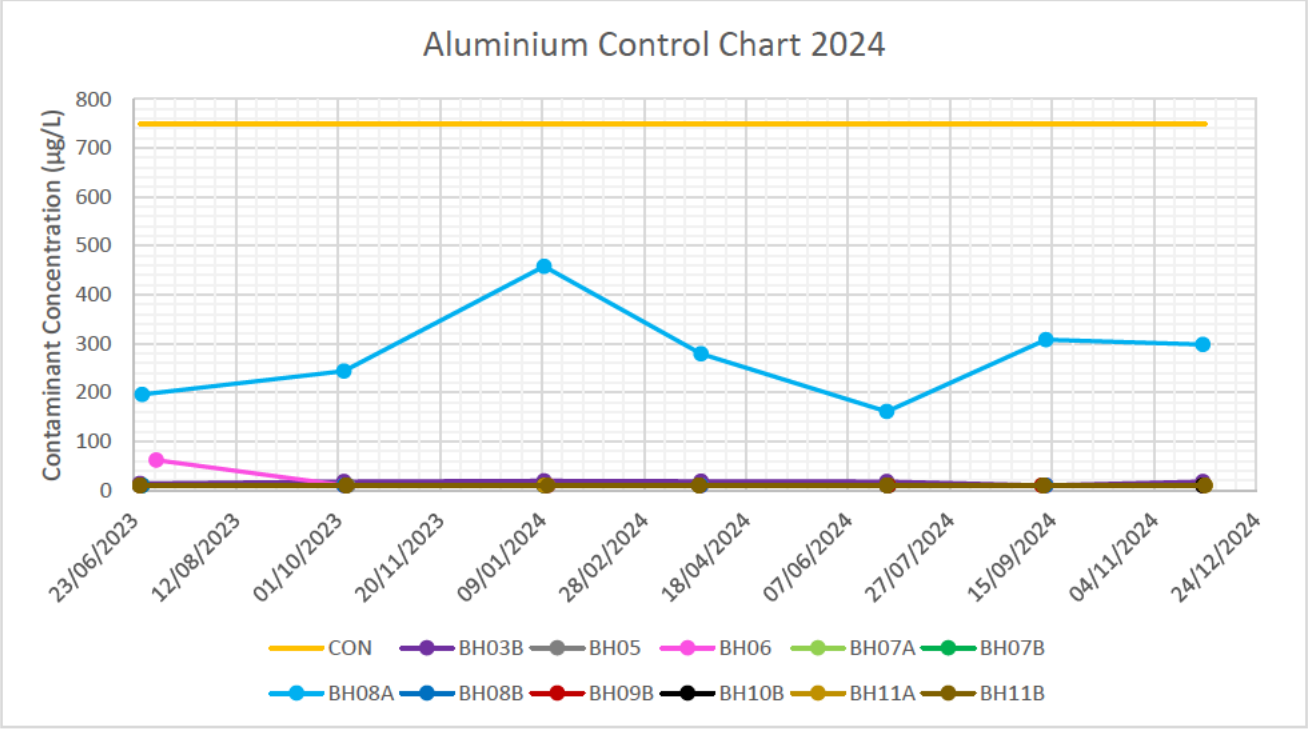
Results are below Control Level and Compliance Limit in 2024.



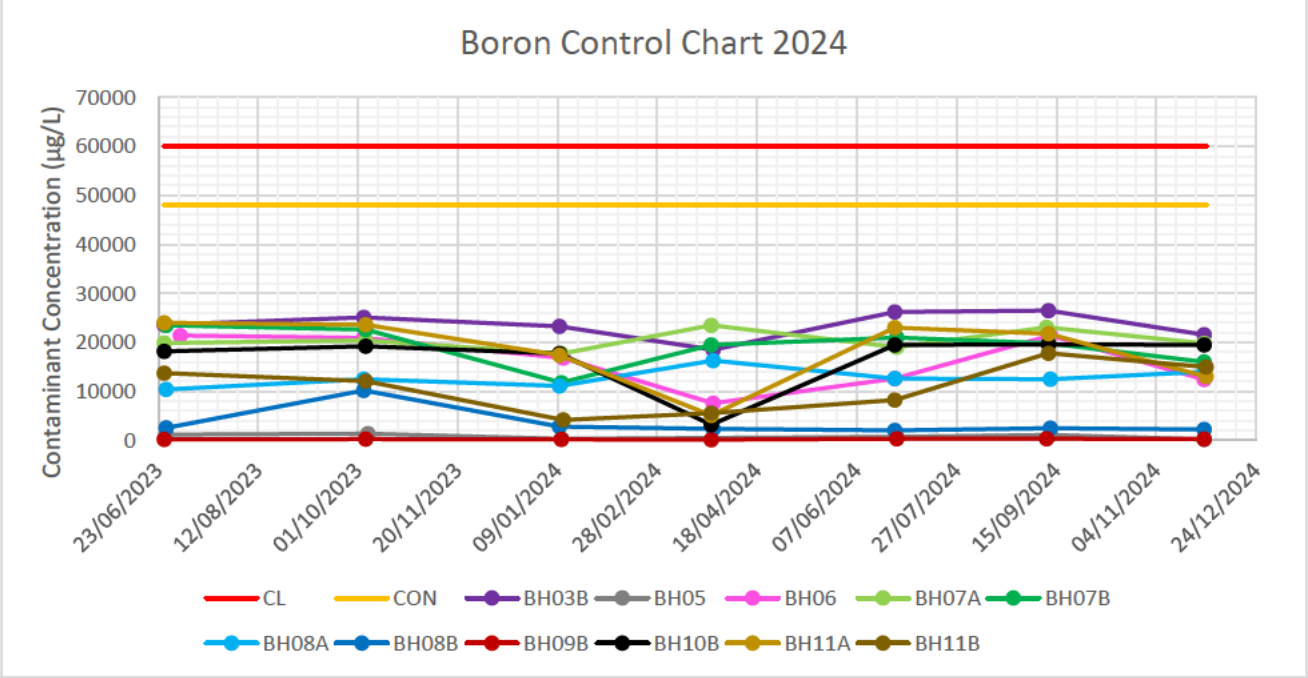
All results are below LOD in 2024.



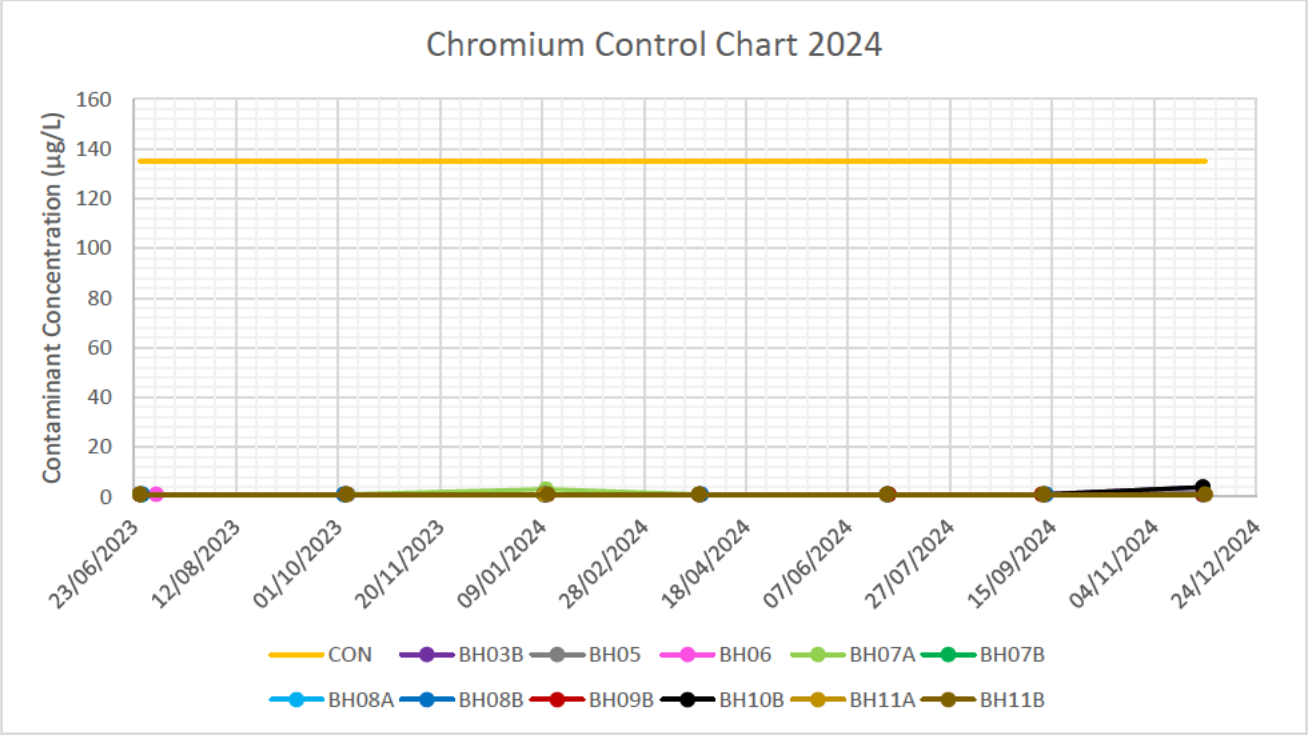
All results are below Control Level and Compliance Limit in 2024.



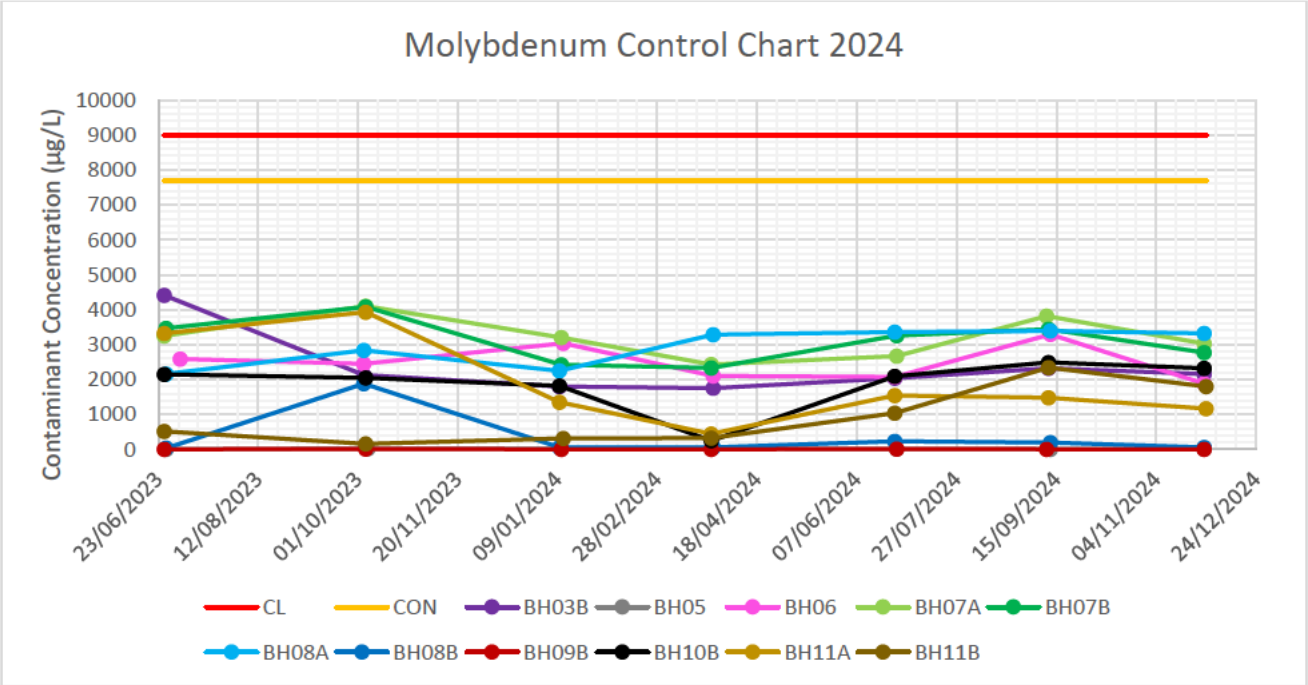
All results are below Control Level in 2024.



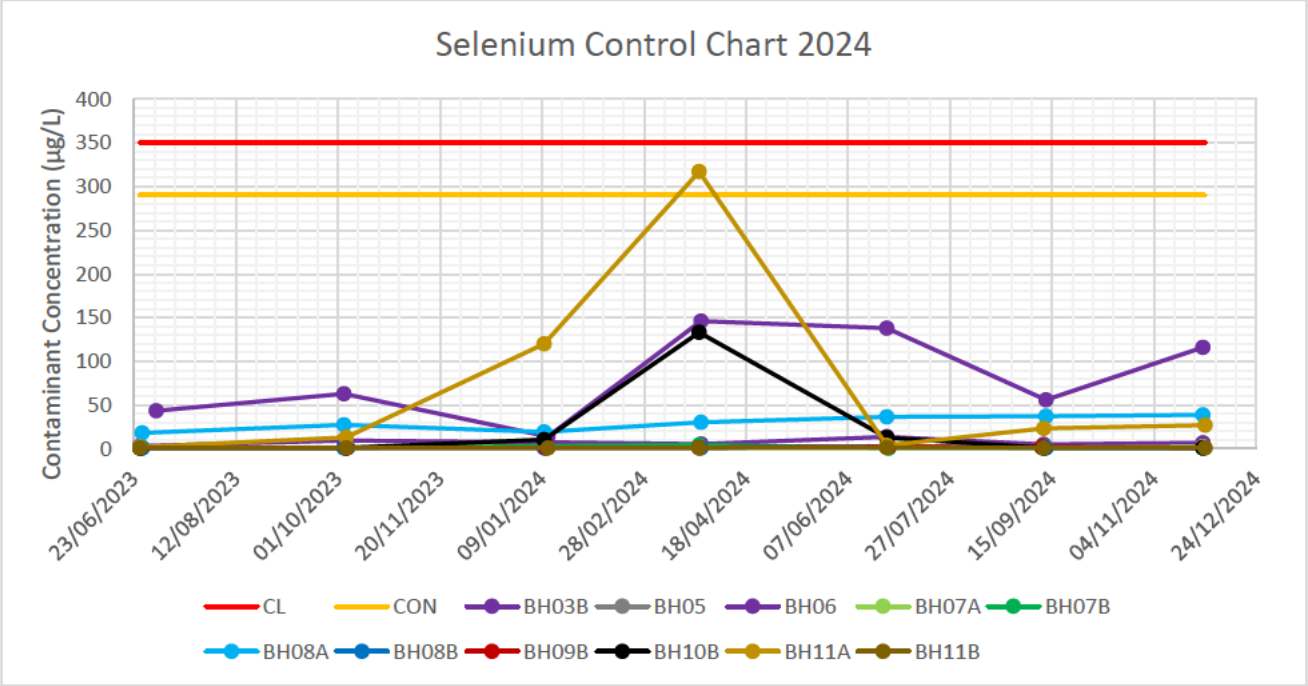
All results are below Control Level and Compliance Limit in 2024.



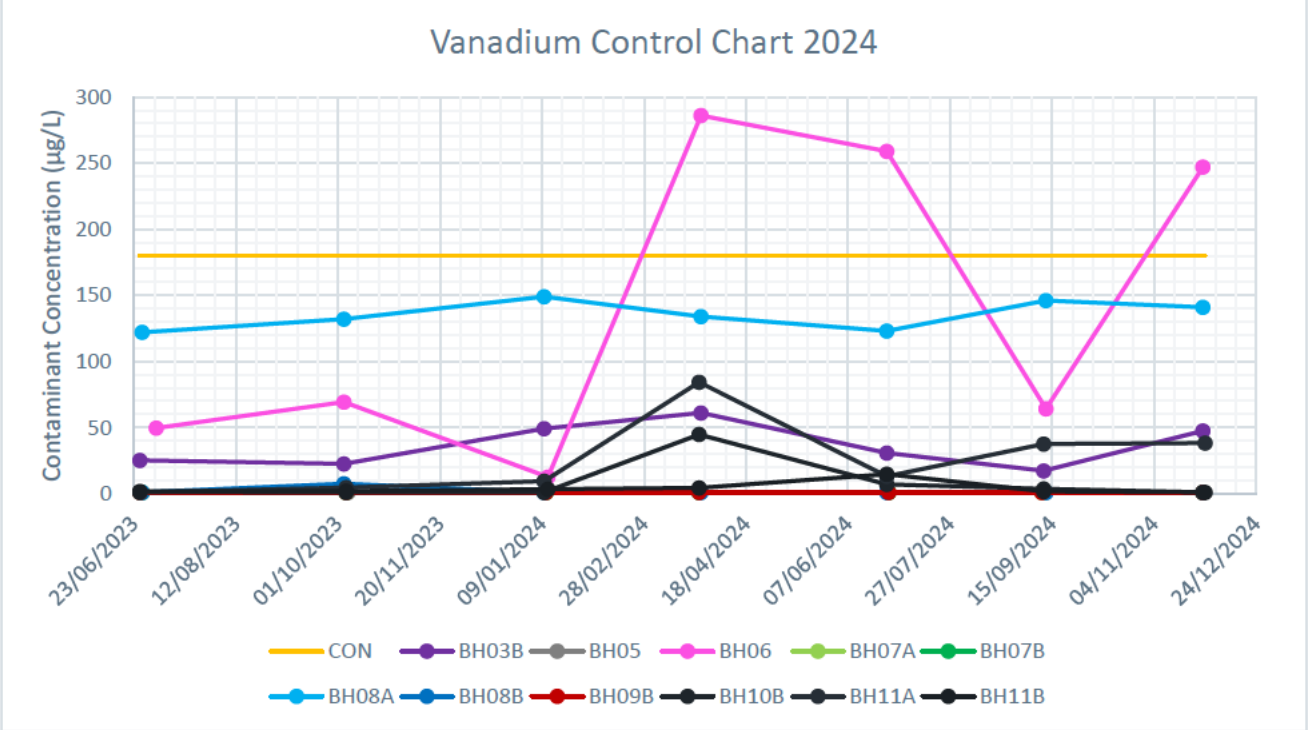
All results are below Control Level in 2024. Contaminant concentration was measure below LOD (1 µg/L) for all results with the exception Round 4 where BH03B, BH05 and BH10B reported detections within one order of magnitude of the LOD.



All results are within Control Level and Compliance Limit in 2024.



BH11A is noted to have reported an elevated concentration of Selenium during Round 1 of 2024 above the Control Level, however, this location is not a compliance borehole and did not persist for three consecutive sampling events – therefore this is not considered an exceedance. All other results are below the Compliance Limit and Control Level in 2024.



Three results for Vanadium were reported in 2024 within BH06 which were above the Control Level. BH06 is not one of the compliance boreholes and the results were not three consecutive sampling events, therefore this is not considered an exceedance. Other than BH06 all results are below the Control Level in 2024.

2.4 SURFACE WATER QUALITY REVIEW

MONITORING OBJECTIVES

The objectives of monitoring of surface waters are:

- 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,
- To identify and quantify impacts to surface water receptors.

LOCATIONS OF MONITORING POINTS

A summary of the surface water monitoring points is provided in **Table 2-3** with locations presented in **Appendix A**.

Table 2-3 – Summary of Surface Water Monitoring Points

Monitoring point	Description	Direction from Site	Comments
Eastern Perimeter Drain (EPD)	Western bank of drainage ditch	East	Prone to drying up during summer months
Brackish Lagoon (BL)	Saline lagoon	Southeast	Surface water receptor
River Thaw (S3)	Eastern bank, tidal mud flats below rail bridge	North, upgradient	Immediate surface water receptor based on groundwater flow direction.
Group Five Spring (S1)	Wetland area adjacent to spring within Ash Disposal Site	West	Surface water within PFA mound Site area

The surface water monitoring analytical suite contains a range of parameters which are monitored on a quarterly basis in accordance with the Environmental Permit. Surface waters are sampled by trained WSP site engineers working as a pair to ensure additional safety, with field measurements taken in line with parameters monitored for groundwater monitoring locations.

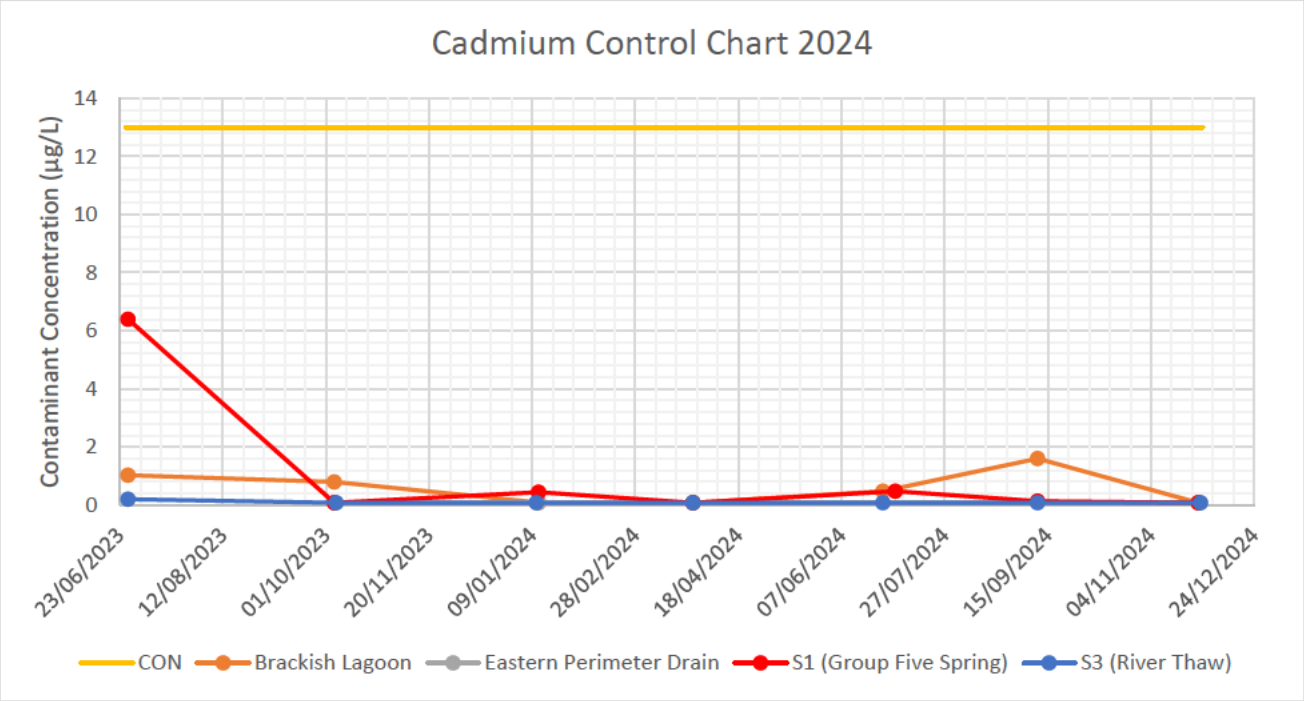
MONITORING RESULTS

Figure 2-3 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 three consecutive sampling events.

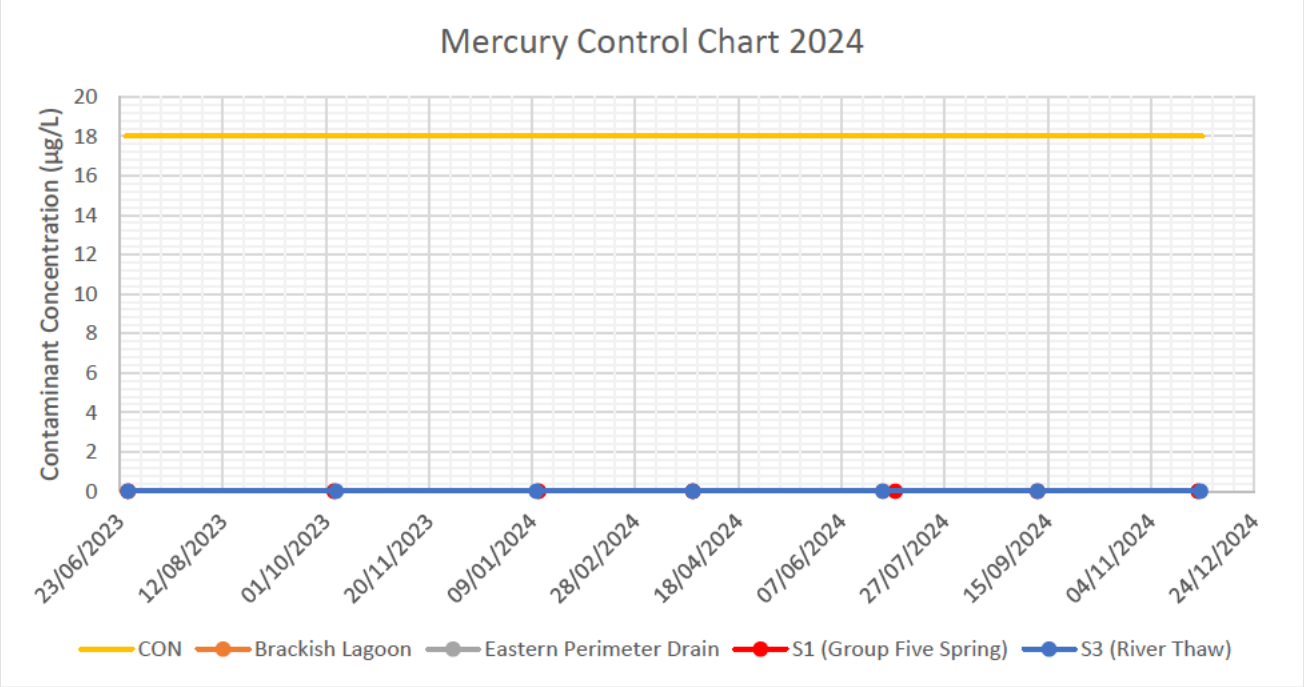
In 2024, there were no exceedances of the control level for any critical parameters. There is one instance during Q3 2024 where aluminium was detected in Brackish Lagoon above the control level, however concentrations returned to typical values in the following monitoring round. The control charts show that there are no increasing trends in critical parameter concentrations. S1 (Group Five Spring) displays higher concentrations of critical parameters. In particular, these include arsenic,

boron, molybdenum, selenium and vanadium. It should be noted that the spring discharges into a stagnant pond surrounded by wetland with water only lost by evapotranspiration or seepage. Therefore, the samples taken from the pond may not be representative of the spring discharge from the ash mound nor considered as a discharge from the Ash Disposal Site.

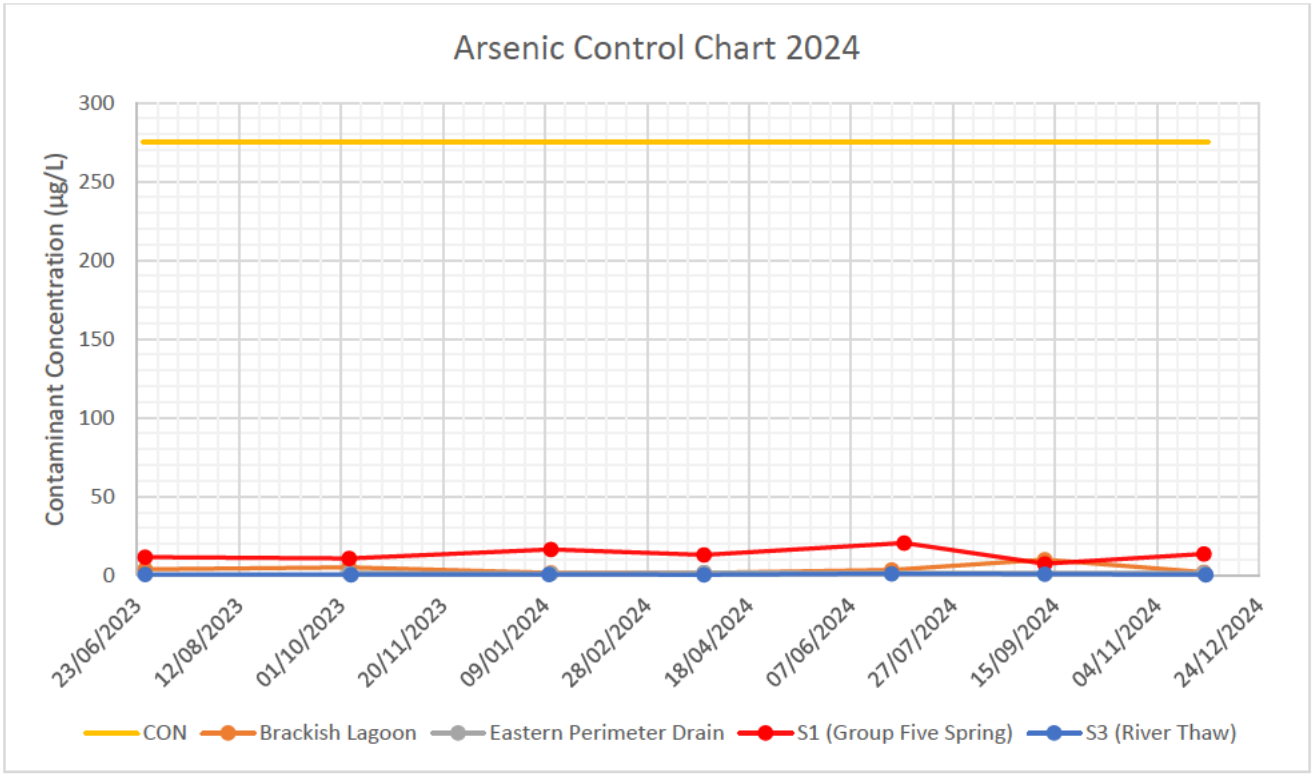
Figure 2-3 - Control Charts for Surface Water Monitoring Points



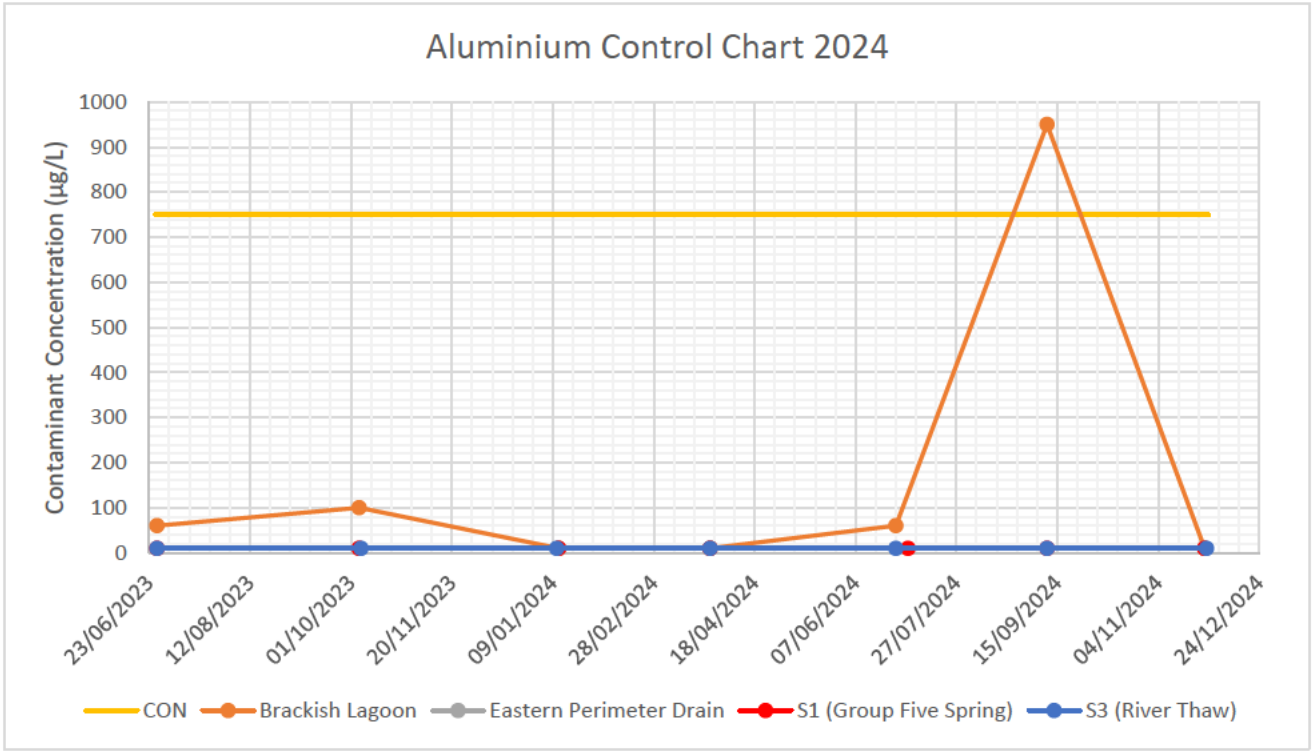
All results are below the Control Level in 2024.



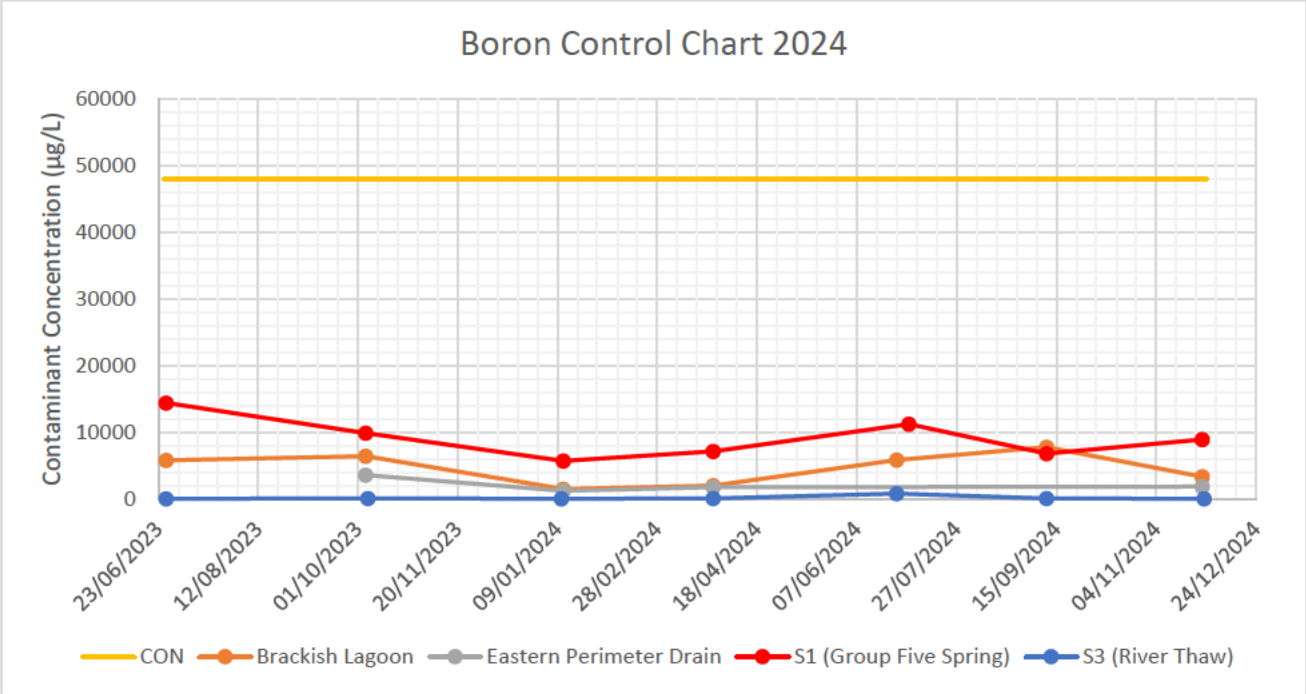
All results are below the Control Level in 2024. Furthermore, all results are recorded as below the laboratory LOD (0.01 µg/L).



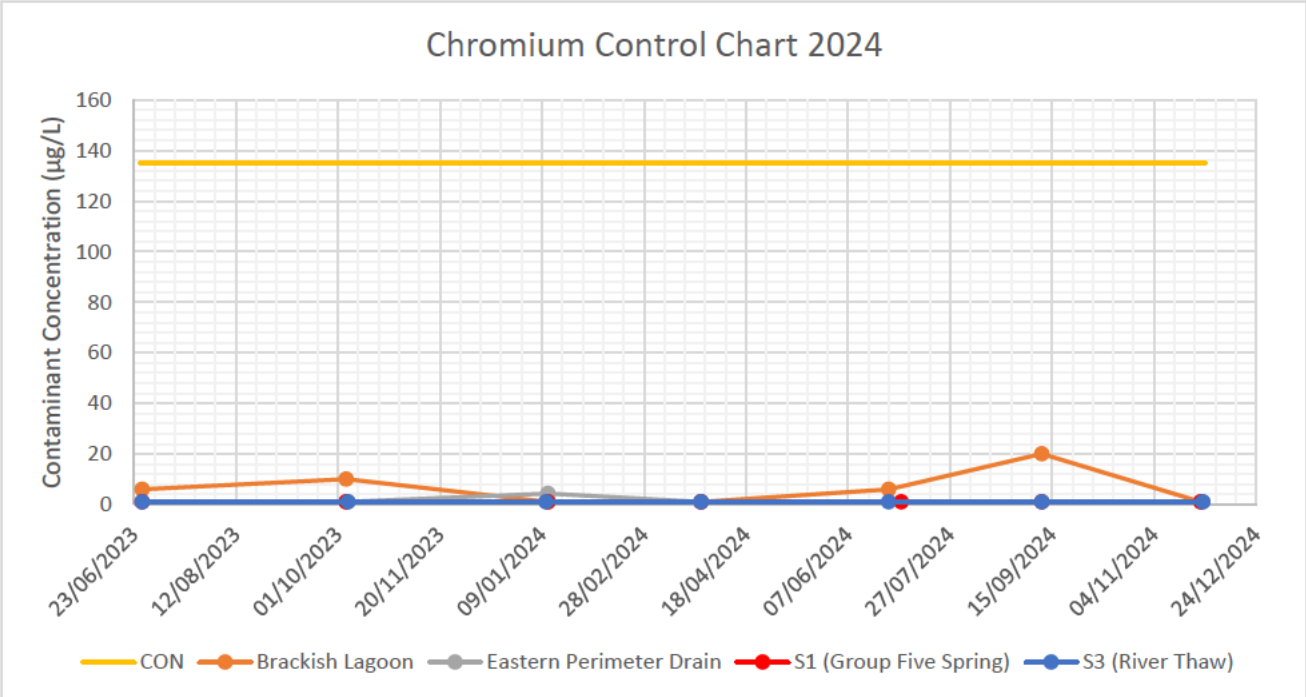
All results are below the Control Level in 2024. It is noted that slightly elevated concentrations are reported in S1 (Group Five Spring) when compared to other surface water locations.



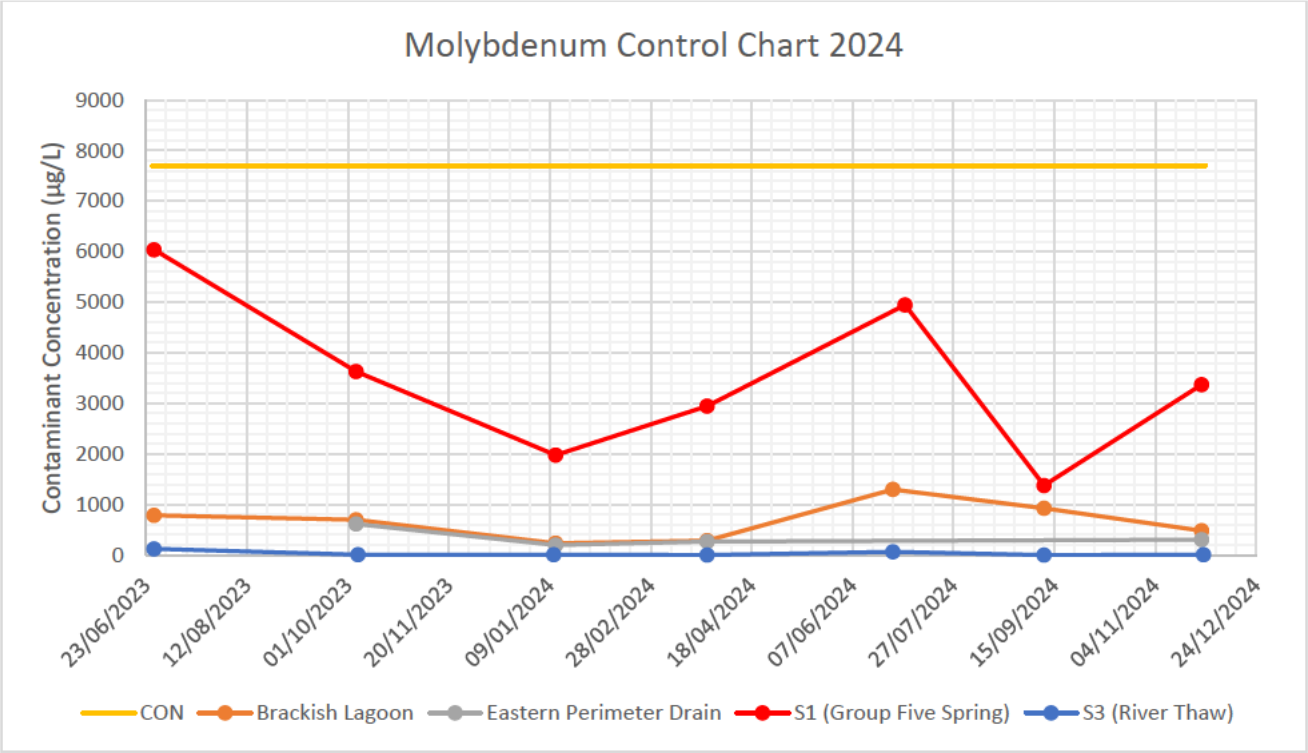
All results are below the Control Level in 2024 with the exception of Brackish Lagoon during Q3. As the reported concentration returned to typical values in the following round this is not considered an exceedance.



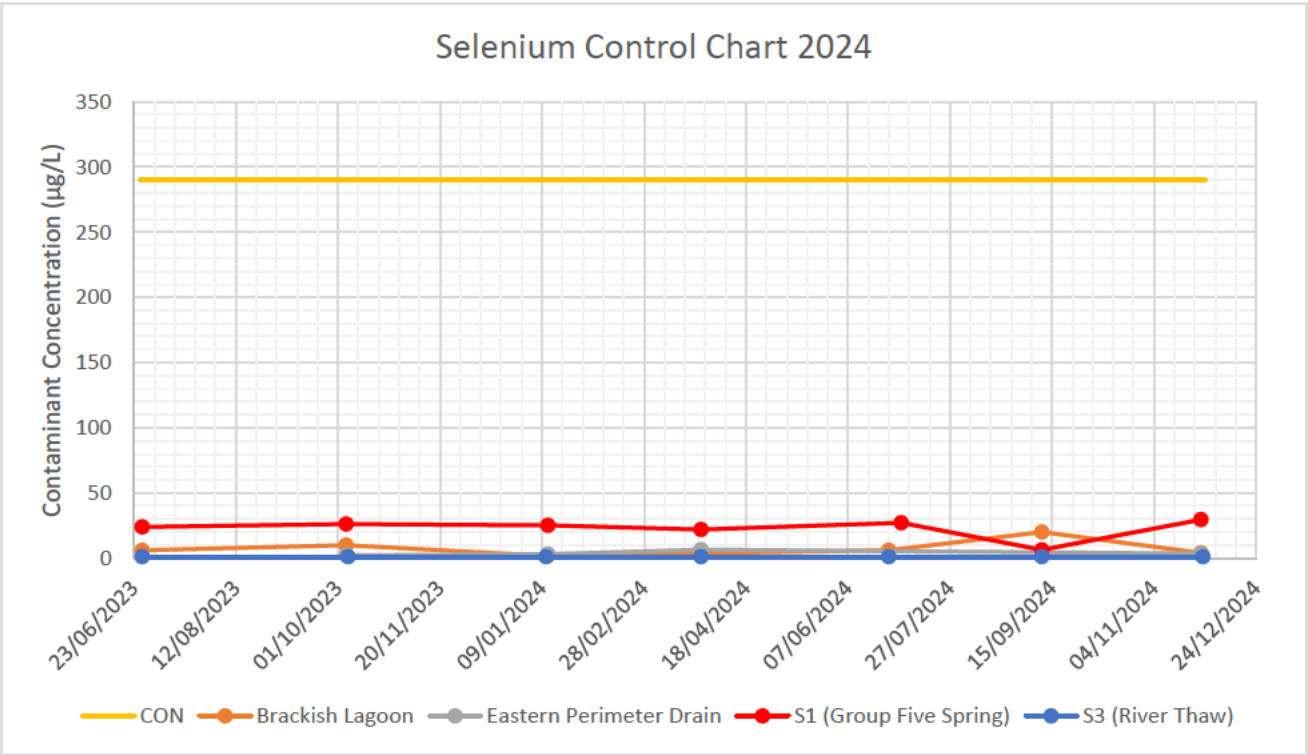
All results are below the Control Level in 2024.



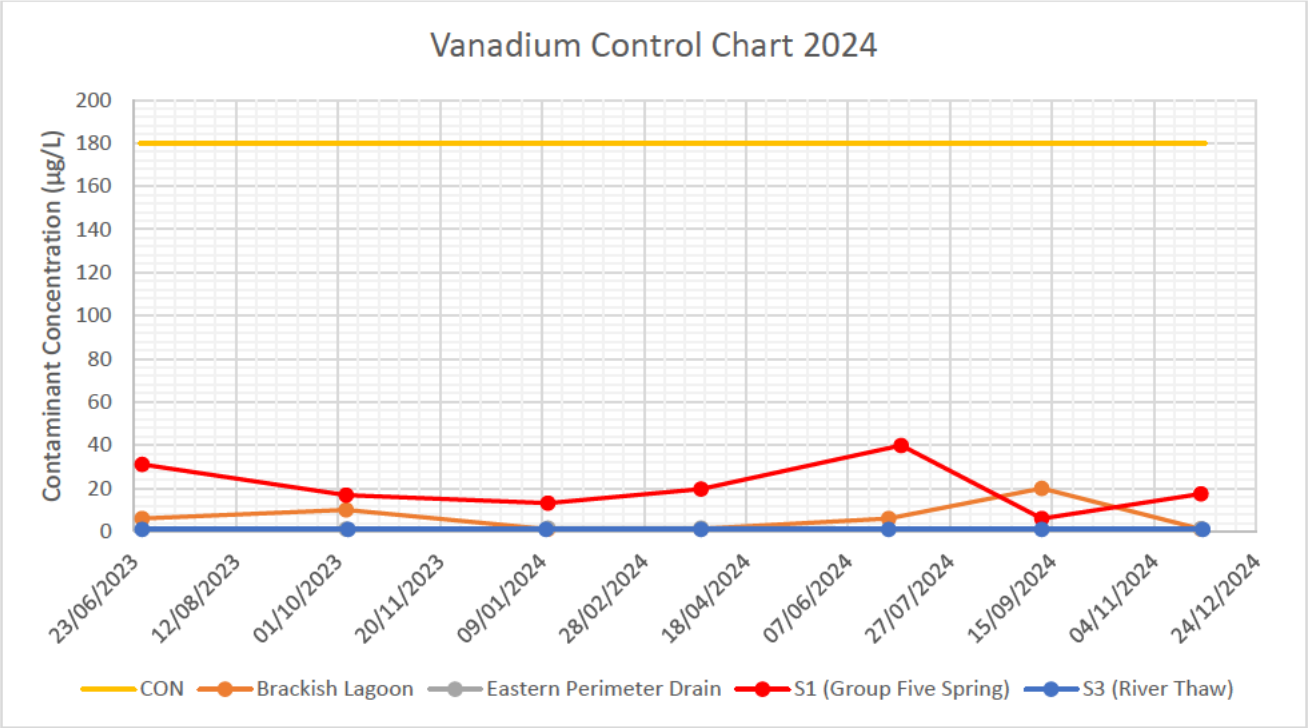
All results are below the Control Level in 2024. Some elevated concentrations are noted in Brackish Lagoon when compared to other locations where results are typically reported below the laboratory LOD (1 µg/L).



All results are below the Control Level in 2024. It is noted that reported results for S1 (Group Five Spring) are elevated compared to other surface water locations, however, concentrations appear to be trending downwards.



All results are below the Control Level in 2024.



All results are below the Control Level in 2024.

3 ADDITIONAL PERMIT REQUIREMENTS

Aberthaw Ash Disposal Site is no longer operational and material reuse options are being actively discussed. Under its current state the Site no longer accepts new waste material, and the additional requirements of the Environmental Permit which are included in **Section 1.2** are summarised below.

3.1 ANNUAL PRODUCTION / TREATMENT DATA 2024

No surface water or groundwater was treated or disposed of off-Site.

3.2 CONTAMINATION / DECONTAMINATION OF SITE

No incidents or emissions have been recorded which may have caused any Site contamination during 2024 and, therefore, there was no requirement to decontaminate the Site during 2024.

3.3 TOPOGRAPHICAL SURVEYS

The last topographical survey to ordnance datum was carried out in March 2021 as part of the wider Aberthaw Power Station sale preparatory works. The drawings from this survey were attached to the 2021 Annual Report produced by RWE.

3.4 LANDFILL CAPACITY

Aberthaw Ash Disposal Site historically reached its maximum permissible height and the only area used for depositing Pulverised Fuel Ash (PFA) over the final operational years was in a temporary ‘short tip’ storage area on the western side of the Site (utilised for fuel ash). This was reprofiled as part of the main Aberthaw Power Station closure and decommissioning process during 2020.

Given the larger Aberthaw Power Station site’s operational status as being in the process of demolition, Waste Returns forms have not been reported to Natural Resources Wales as PFA is no longer being deposited at the Site.

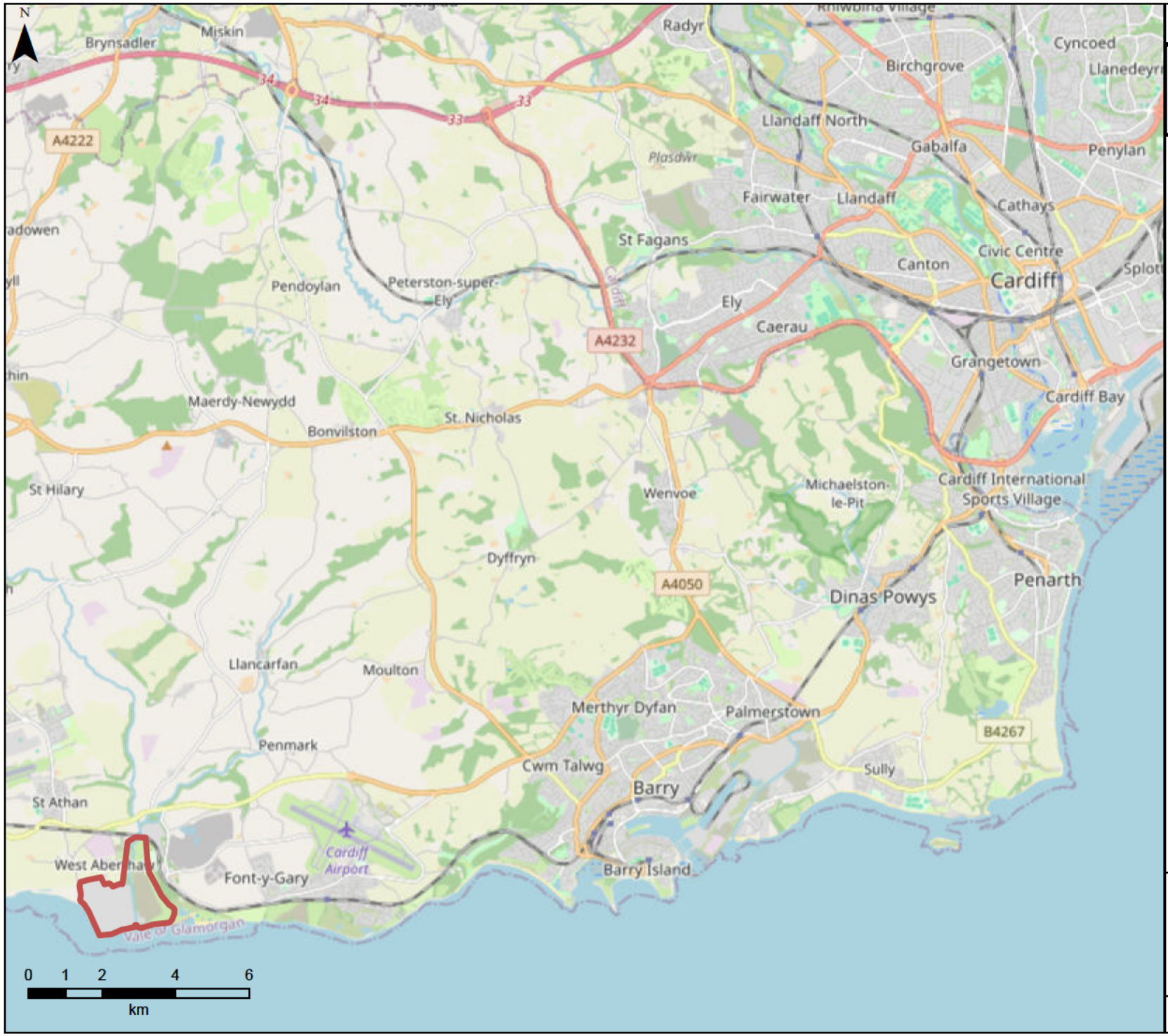
3.5 WASTE ACCEPTANCE COMPLIANCE TESTING

Aberthaw Ash Disposal Site is classified as a mono-landfill site, and was under the direct operational control of Aberthaw Power Station. Two asbestos tips and a general waste tip are known to be present within the mound as well. All ash was transported directly from the Power Station to the Ash Disposal Site.

The exact composition of PFA was dependent upon the composition of the fuel used by the Power Station.

Appendix A

SITE MAPS



DO NOT SCALE

Information Classification:

INTERNAL

Information that is only intended for internal distribution among WSP employees, independent consultants, contractors, sub-contractors, clients and authorised third parties.

Legend :

Aberthaw Power Station Site Boundary

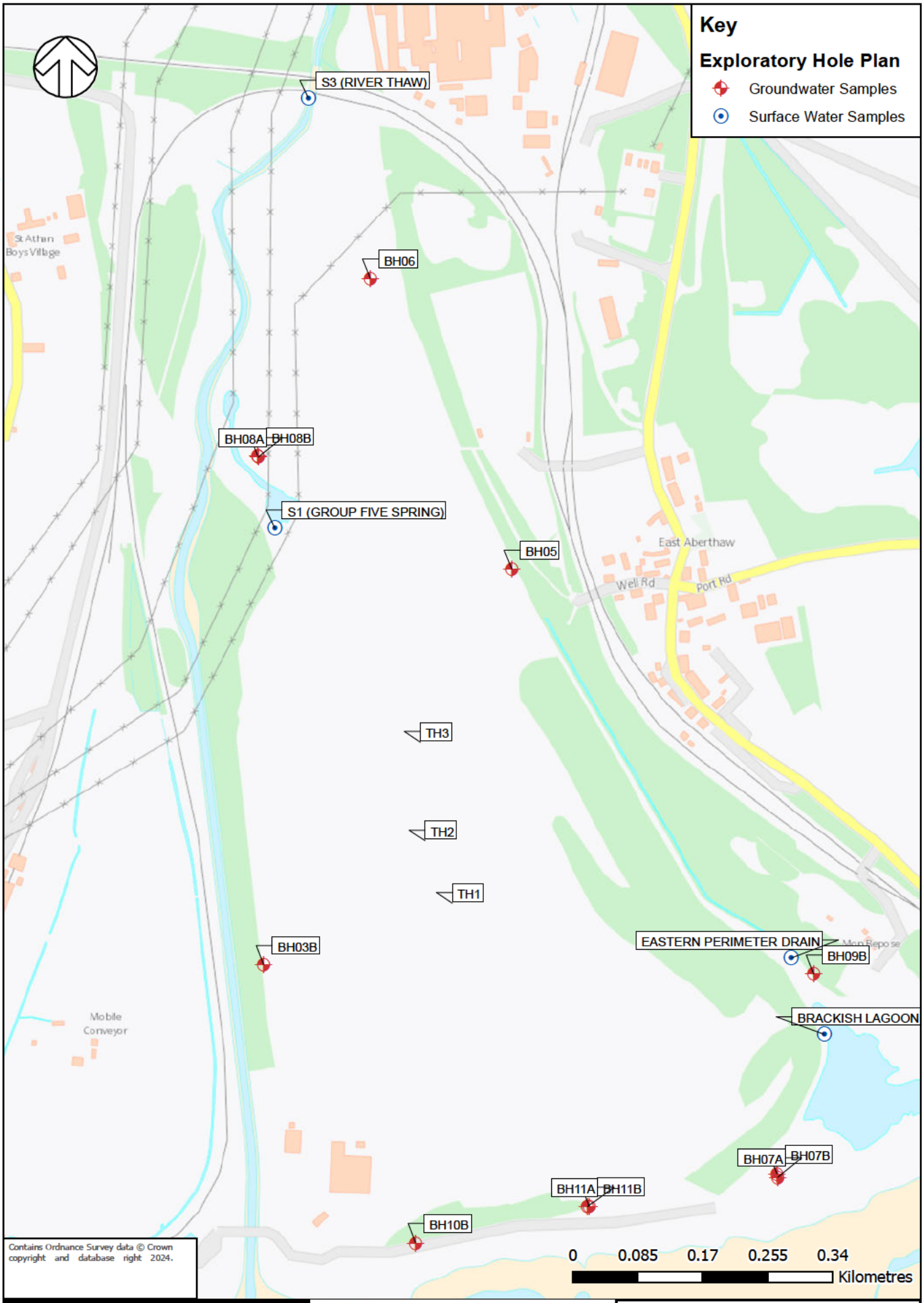
Title : Figure 1 - Site Location

Author : [redacted]

Scale : 1:144,448

Layout : WSP A4 Landscape

Current Time : 13/03/2024 09:56



Date Modified:

Drawn By:

File:

wsp

TITLE:

ABERTHAW
ASH DISPOSAL SITE
ANNUAL PERFORMANCE REPORT

FIGURE No:

FIGURE 2 - SITE PLAN

Appendix B

PERMIT TRANSFER NOTICE

Notice of transfer with introductory note

The Environmental Permitting (England & Wales) Regulations 2016

CCR Energy Limited

Aberthaw Ash Disposal Site
Aberthaw Power Station
The Leys
Aberthaw
Barry
Vale of Glamorgan
CF62 4ZW

Transfer application number

EPR/DP3432SW/T015

Permit number

EPR/DP3432SW

Aberthaw Ash Disposal Site
Permit number EPR/DP3432SW

Introductory note

This introductory note does not form a part of the notice

The following notice gives notice of the transfer of an environmental permit to a new operator (the transferee).

The permit is transferred in full from RWE Generation UK plc to CCR Energy Limited.

The status log of a permit sets out the permitting history, including any changes to the permit reference number.

Status log of the permit		
Description	**Date**	**Comments**
Application DP3432SW	09/05/05	
Request to reduce installation boundary size	04/08/05	
Request to extend determination	15/09/05	
Response to request for information	14/11/05	
Request to extend determination	07/12/05	
Response to request for information	06/02/05	
Schedule 4 notice	10/06/06	
Request to extend determination	07/04/06	
Request to extend determination	12/05/06	
Request to extend determination	30/06/06	
Request to extend height of ash mound	30/08/06	
Request to remove height extension proposal from application	14/12/06	
Request to extend determination	19/12/06	
Permit determined	30/03/07	
Application EPR/DP3432SW/T002		Request for full transfer from RWE Energy UK plc to CCR Energy Limited
Further information requested	09/06/2022	
Further information received	10/08/2022	Application duly made
Schedule 5 notice	14/11/2022	Further details provided for the new proposed financial provision
Transfer determined EPR/DP3432SW/T002	14/03/2023	Permit transferred in full to CCR Energy Limited

Superseded or partially superseded licences / authorisations / contents relating to this application			
Holder	Reference Number	Date of Issue	Fully or Partially Superseded
RWE Npower	EA/WML/42	22/08/1991	Partially

Other existing licences/authorisations/registrations relating to this site		
Holder	Reference Number	Date of Issue
RWE Npower plc	EA/WM/L42	22/08/1991

End of introductory note

Notice of transfer

The Environmental Permitting (England and Wales) Regulations 2016

The Natural Resources Body for Wales ("Natural Resources Wales") in exercise of its powers under regulation 21 of the Environmental Permitting (England and Wales) Regulations 2016 transfers

Permit number

EPR/DP3432SW

to

CCR Energy Limited ("the operator")

whose registered office is

County Hall
Atlantic Wharf
Cardff
Wales
CF10 4UW

company registration number 13951868

to operate a regulated facility at

Aberthaw Ash Disposal Site
Aberthaw Power Station
The Leys
Aberthaw
Barry
Vale of Glamorgan
CF62 4ZW

from RWE Generation UK plc

This notice shall take effect from 14/03/2023.

Signed	Date
Holly Noble	**14/03/2023**

Authorised on behalf of Natural Resources Wales

Schedule 1 – conditions to be deleted

None.

Schedule 2 – conditions to be amended

The following conditions are amended as detailed, as a result of the application made by the operator:

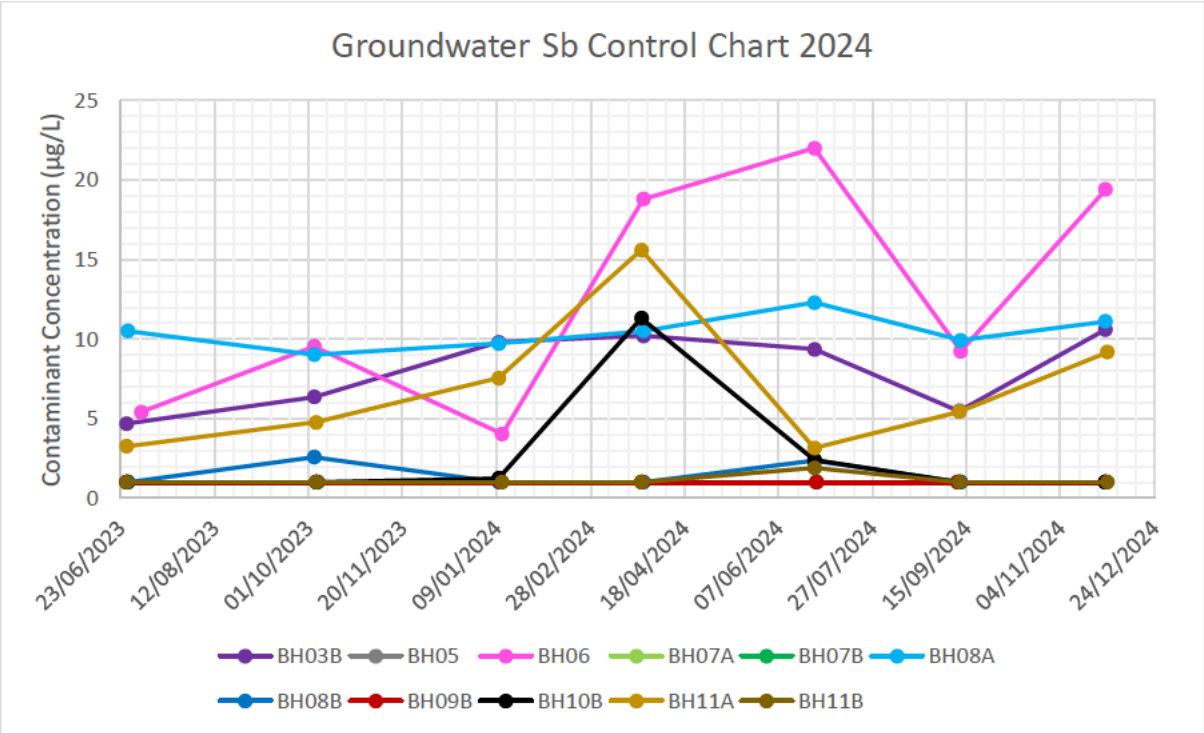
1.3.1 The financial provision for meeting the obligations under this permit set out in the agreement made between the operator and Natural Resources Wales dated 10/03/2023 or other financial provision as subsequently agreed in writing with Natural Resources Wales, shall be maintained by the operator throughout the subsistence of this permit and the operator shall produce evidence of such provision whenever required by Natural Resources Wales.

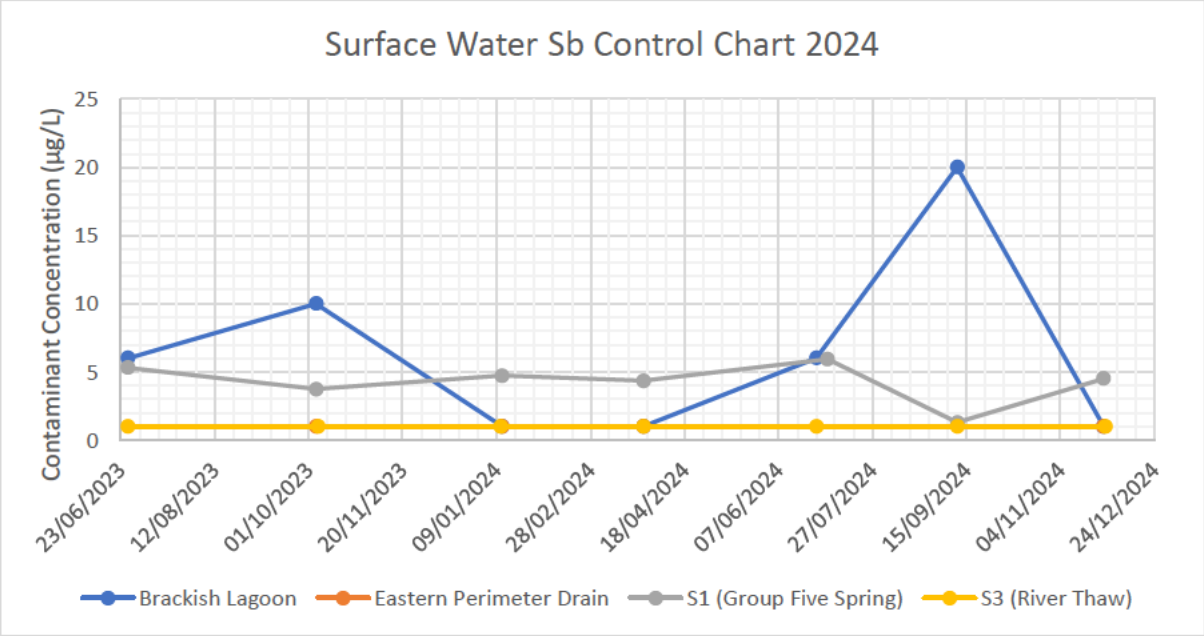
Schedule 3 – conditions to be added

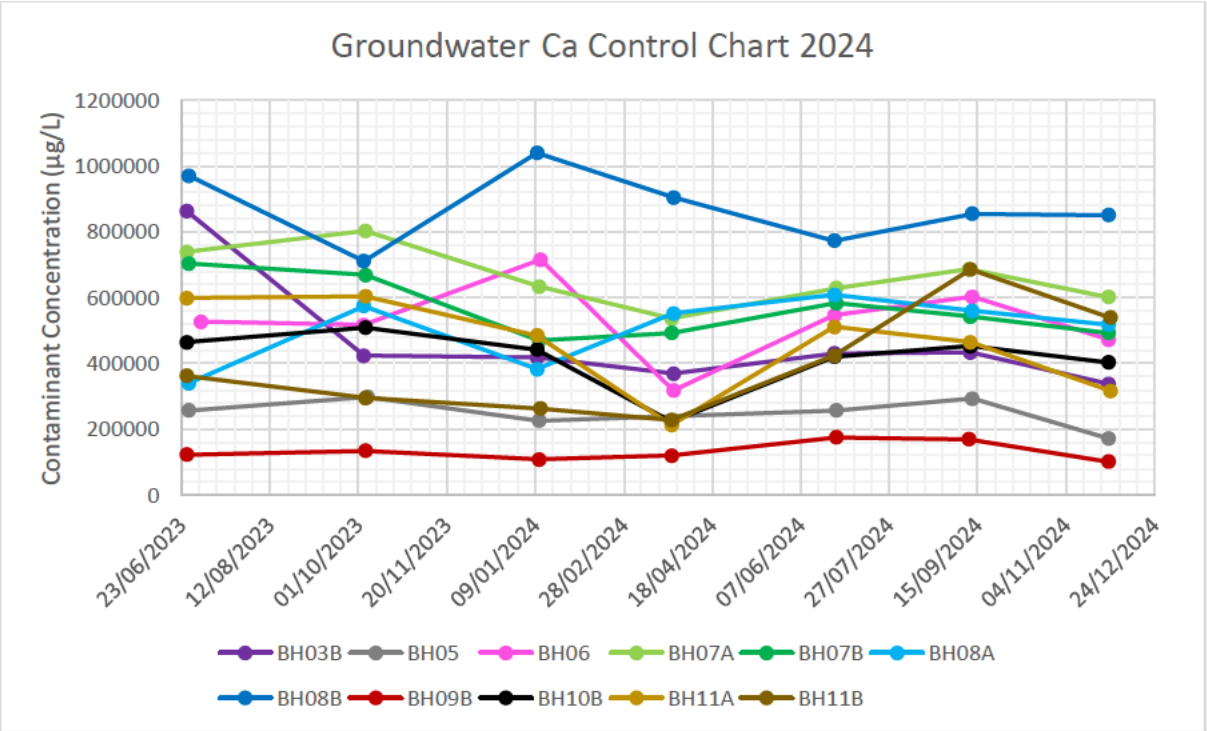
None.

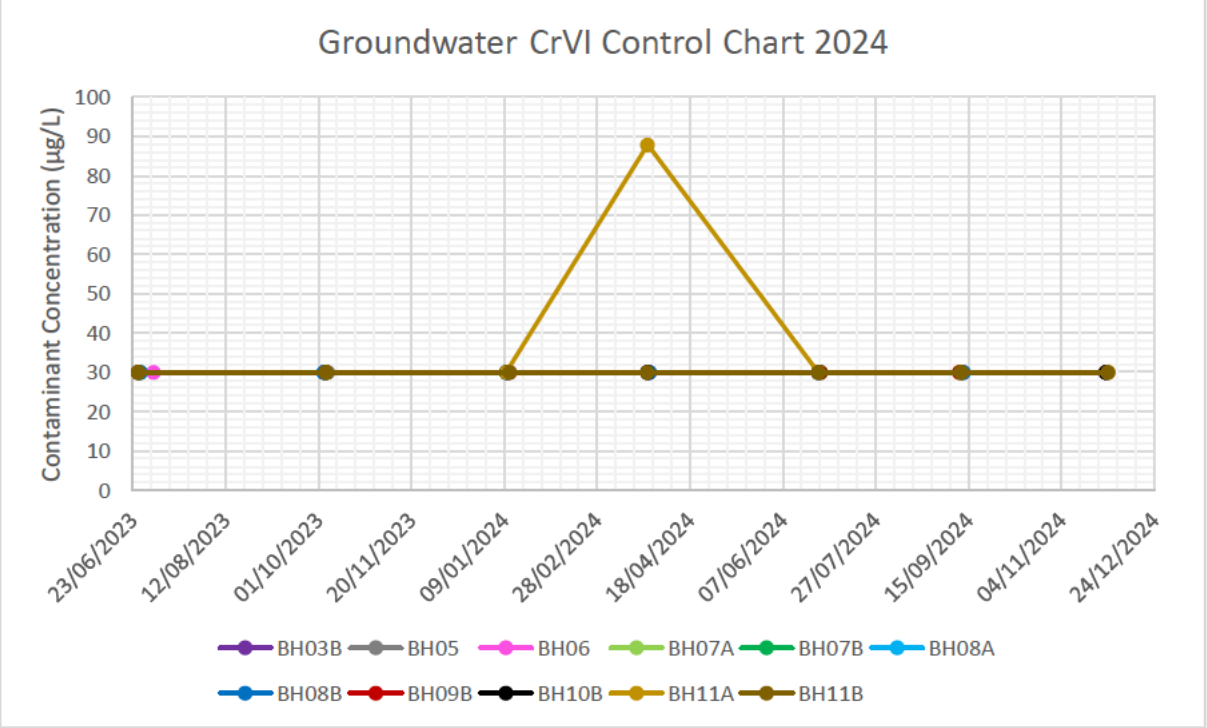
Appendix C

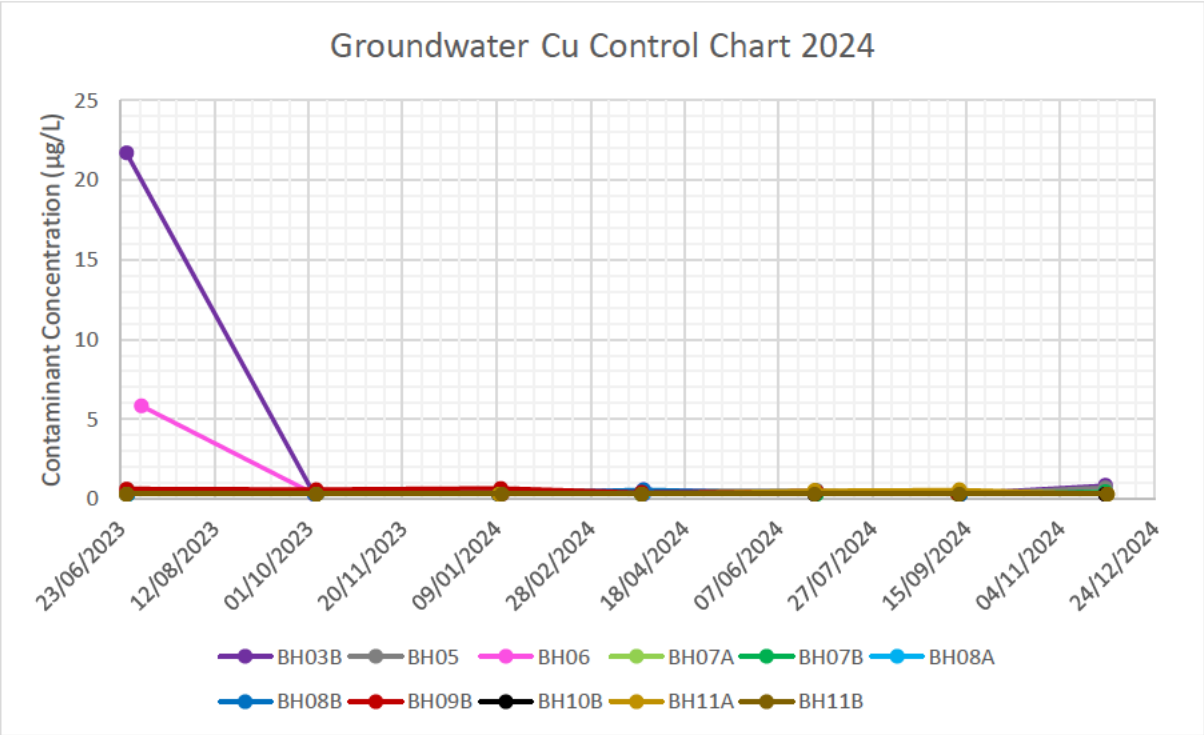
NON CL CONTAMINANTS TIME SERIES

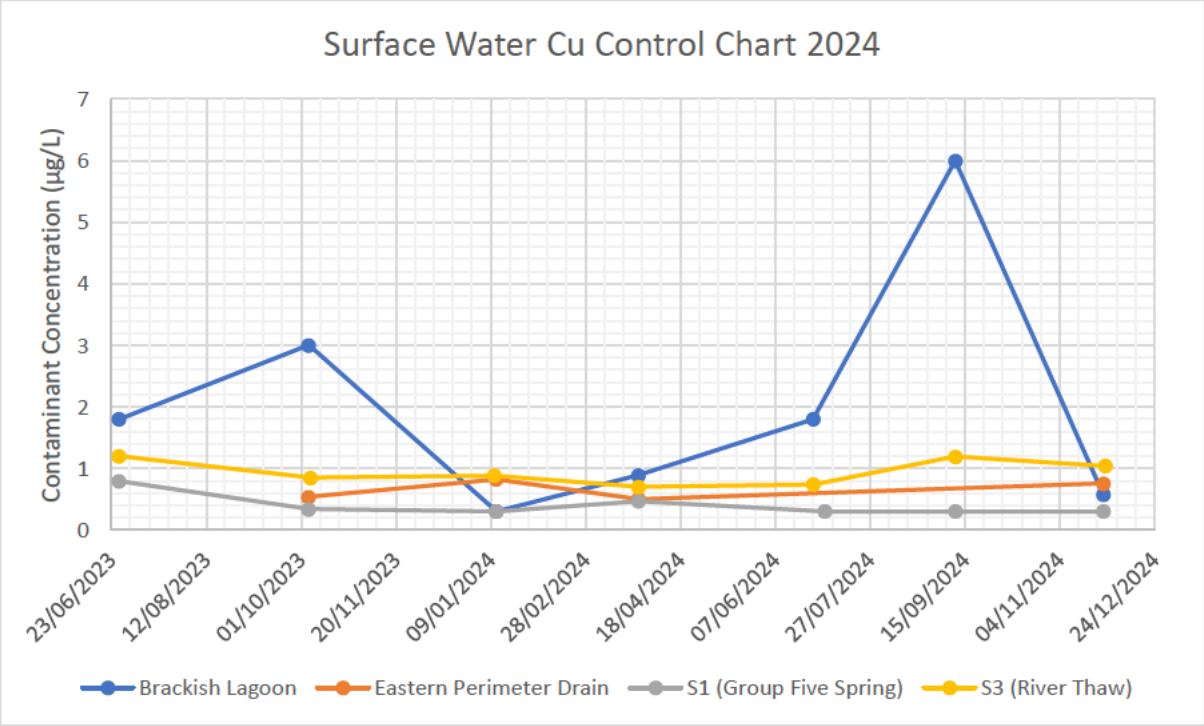

Groundwater Sb Control Chart 2024
Contaminant Concentration (µg/L)
25
20
15
10
5
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B

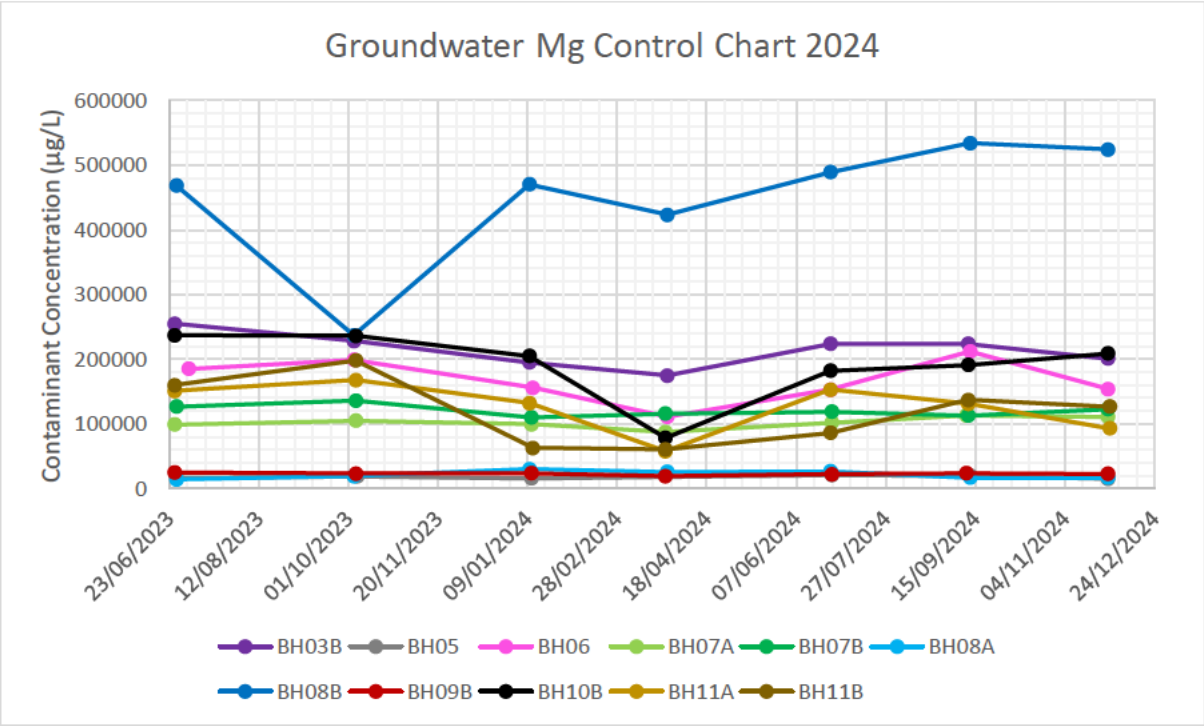

Surface Water Sb Control Chart 2024
Contaminant Concentration (µg/L)
25
20
15
10
5
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
Brackish Lagoon
Eastern Perimeter Drain
S1 (Group Five Spring)
S3 (River Thaw)

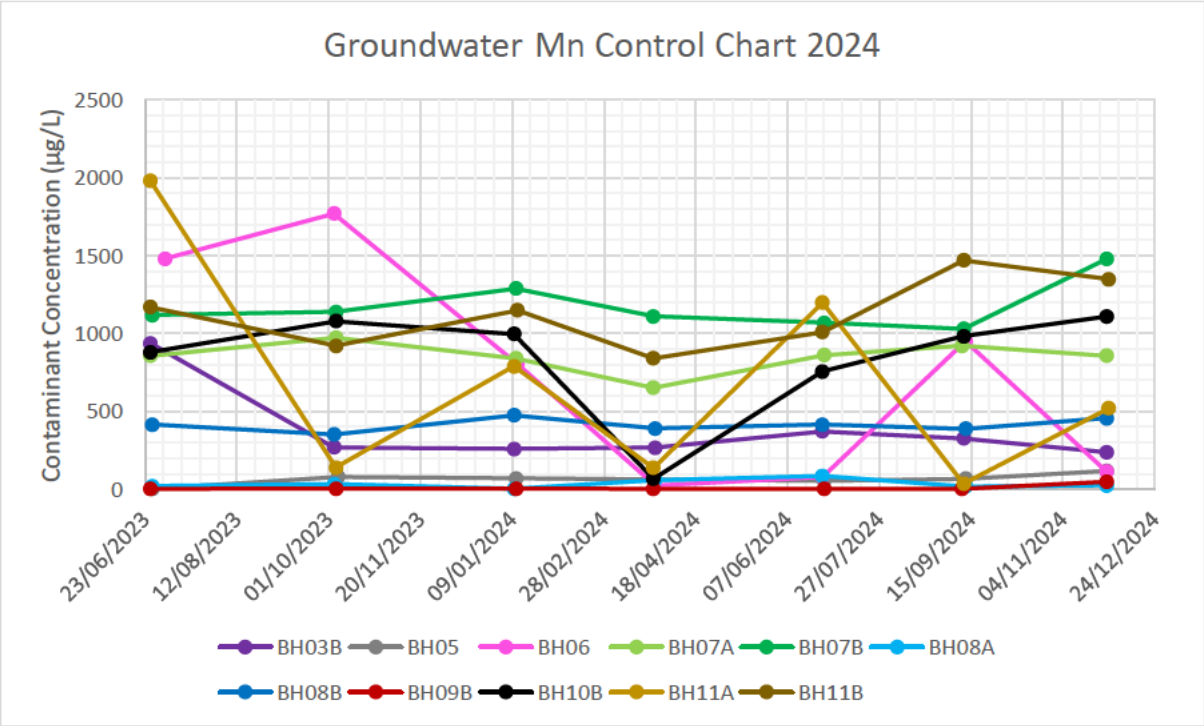

Groundwater Ca Control Chart 2024
Contaminant Concentration (µg/L)
1200000
1000000
800000
600000
400000
200000
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B

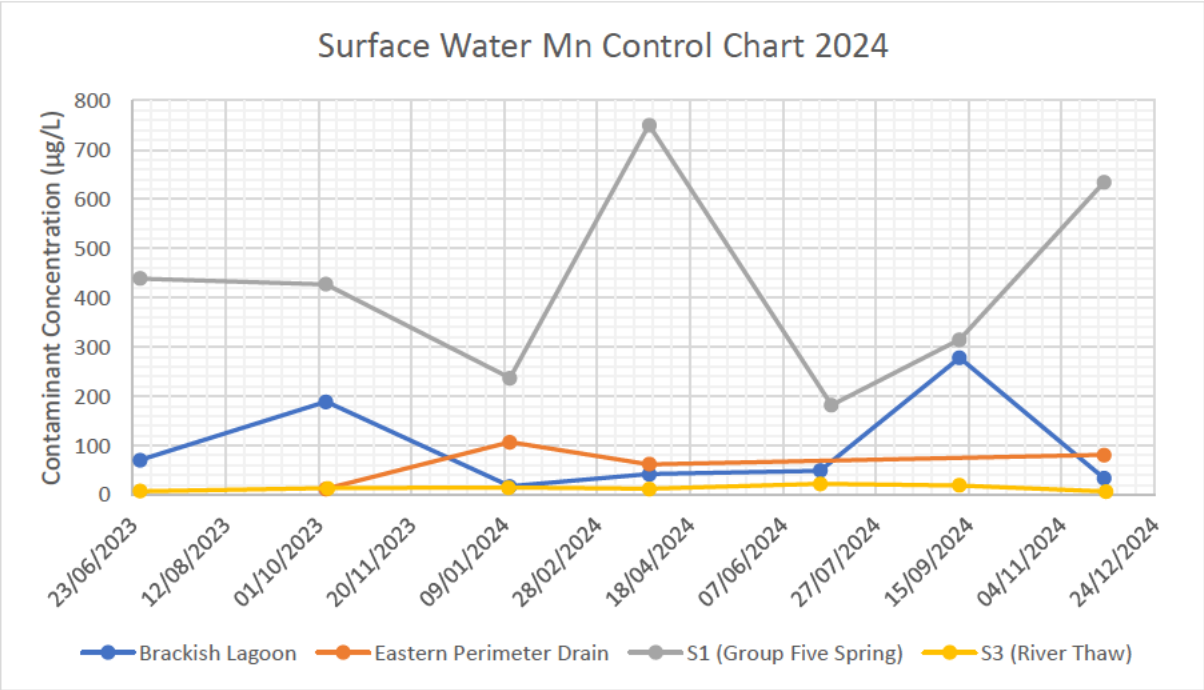

Groundwater CrVI Control Chart 2024
Contaminant Concentration (µg/L)
100
90
80
70
60
50
40
30
20
10
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B

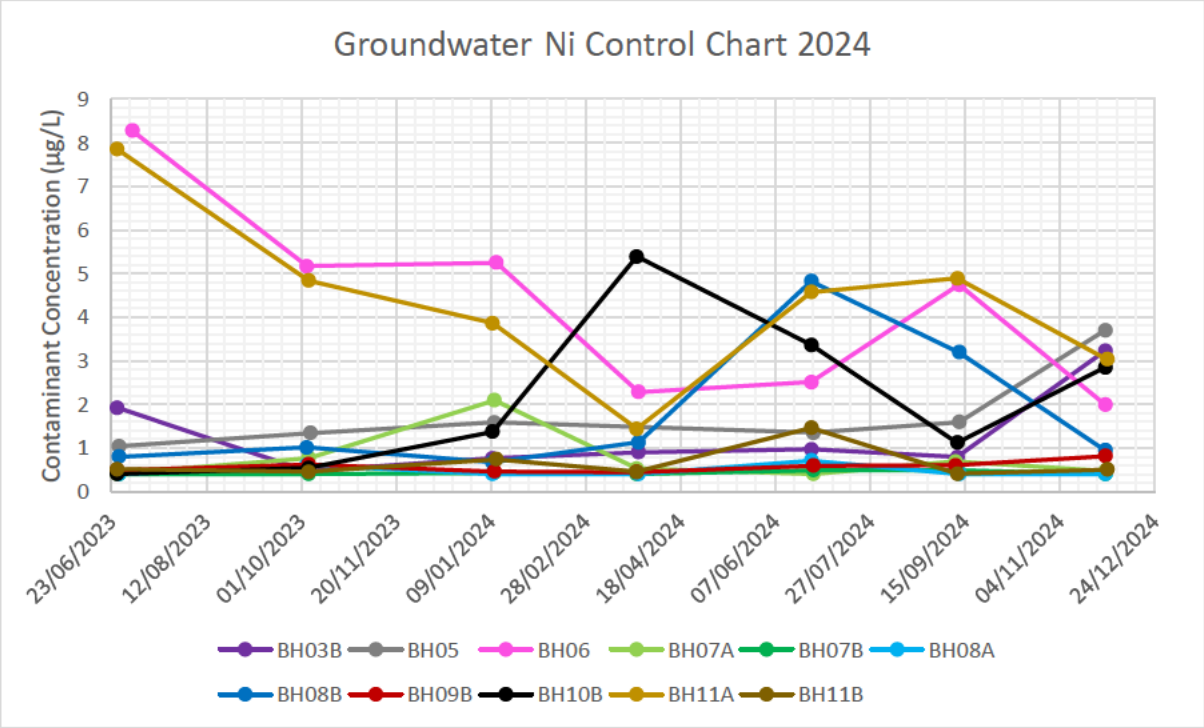

Groundwater Cu Control Chart 2024
Contaminant Concentration (µg/L)
25
20
15
10
5
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B

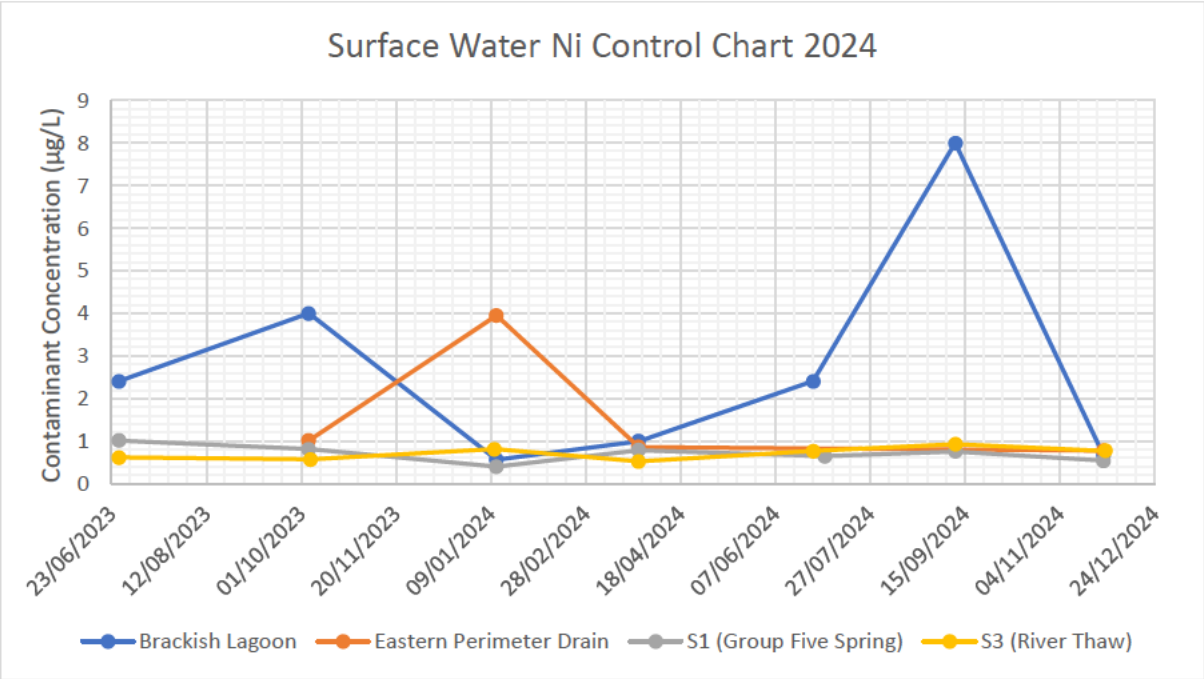

Surface Water Cu Control Chart 2024
Contaminant Concentration (µg/L)
7
6
5
4
3
2
1
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
Brackish Lagoon
Eastern Perimeter Drain
S1 (Group Five Spring)
S3 (River Thaw)

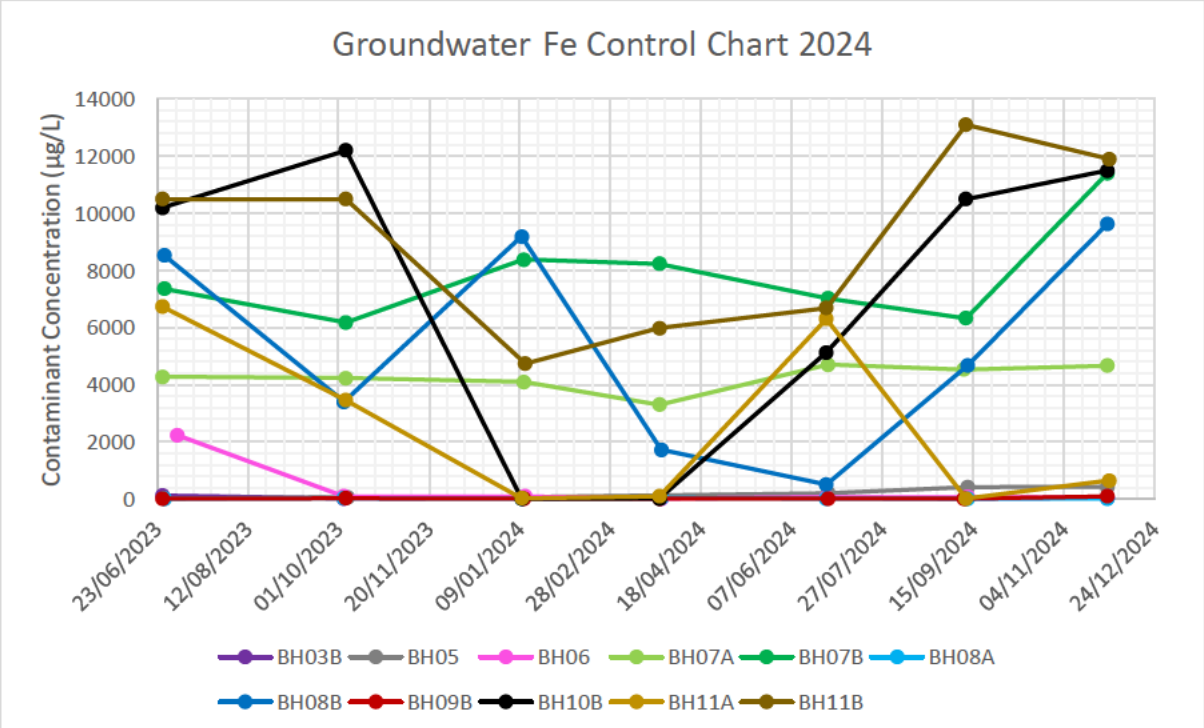

Groundwater Mg Control Chart 2024
Contaminant Concentration (µg/L)
600000
500000
400000
300000
200000
100000
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B

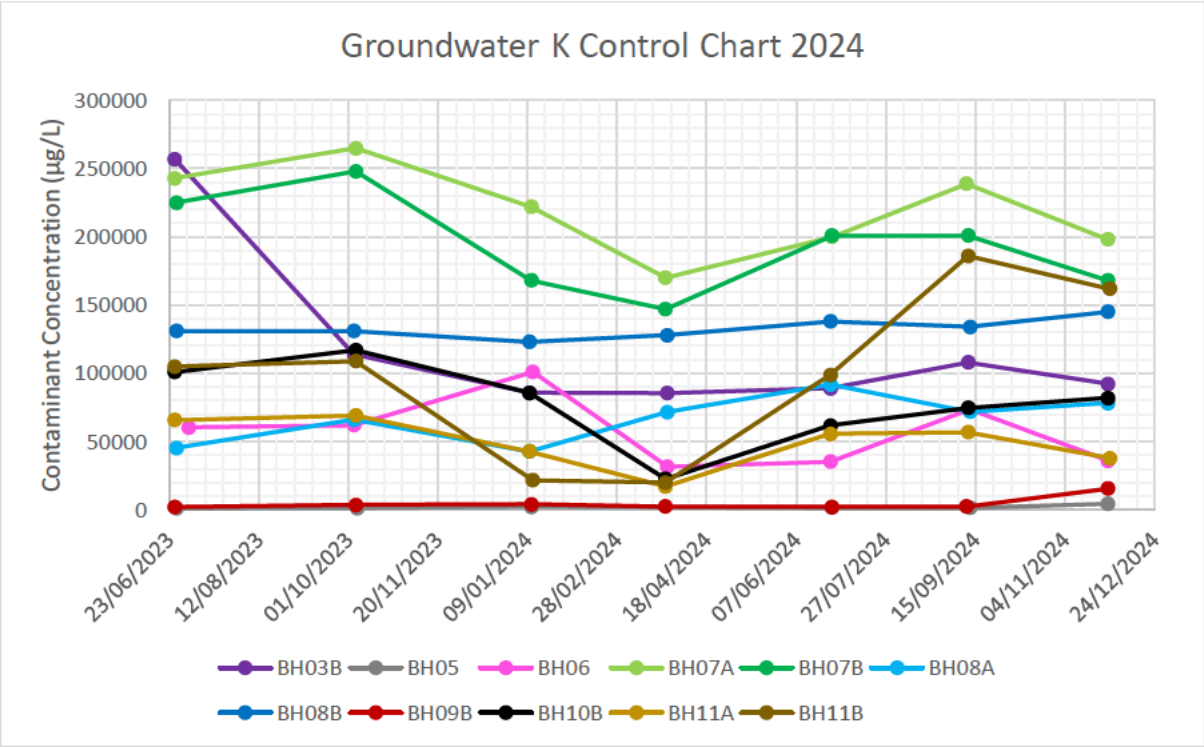

Groundwater Mn Control Chart 2024
Contaminant Concentration (µg/L)
2500
2000
1500
1000
500
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B

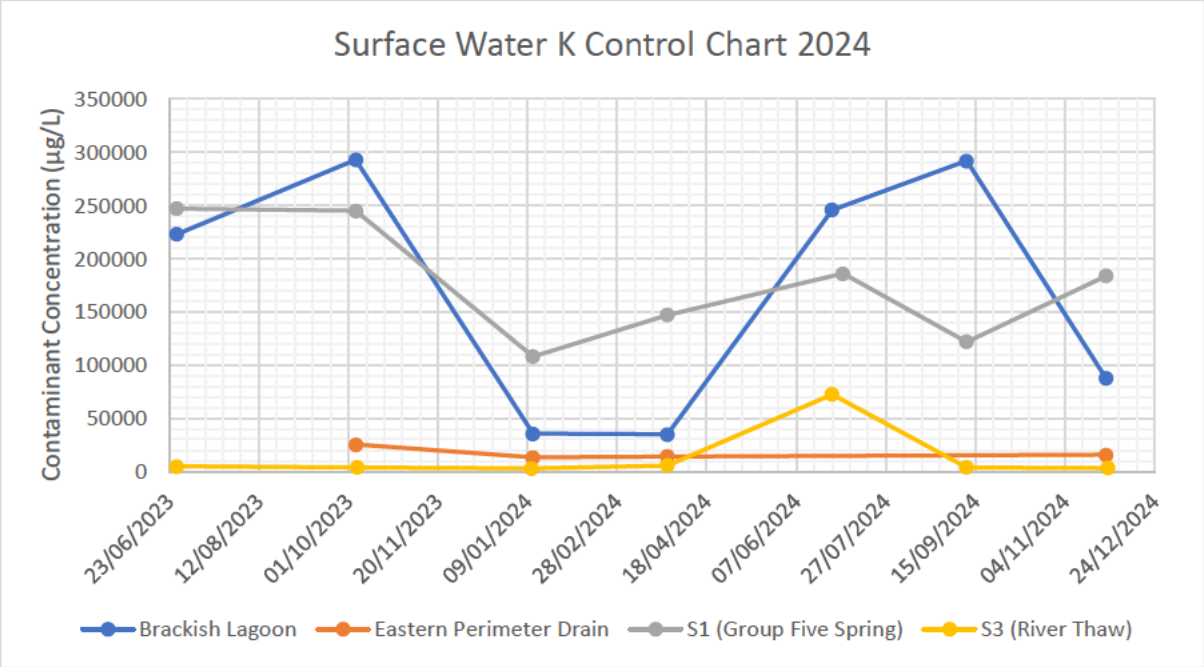

Surface Water Mn Control Chart 2024
Contaminant Concentration (µg/L)
800
700
600
500
400
300
200
100
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
Brackish Lagoon
Eastern Perimeter Drain
S1 (Group Five Spring)
S3 (River Thaw)

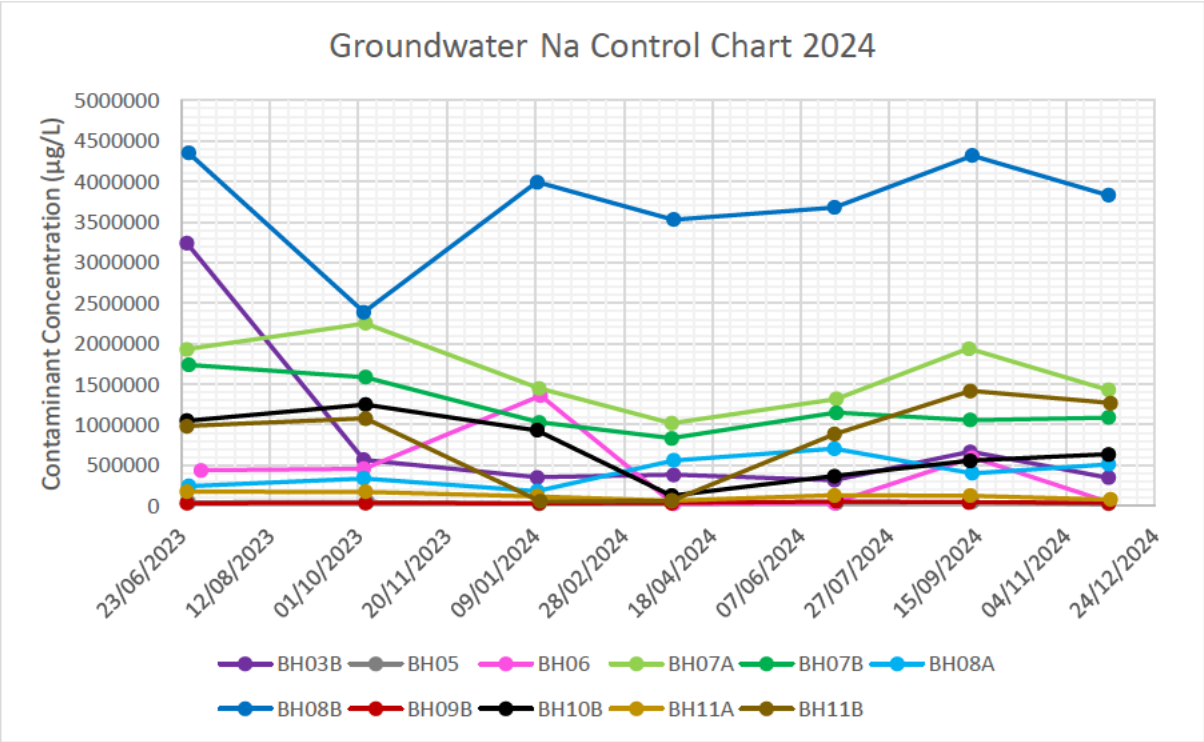

Groundwater Ni Control Chart 2024
Contaminant Concentration (µg/L)
9
8
7
6
5
4
3
2
1
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B

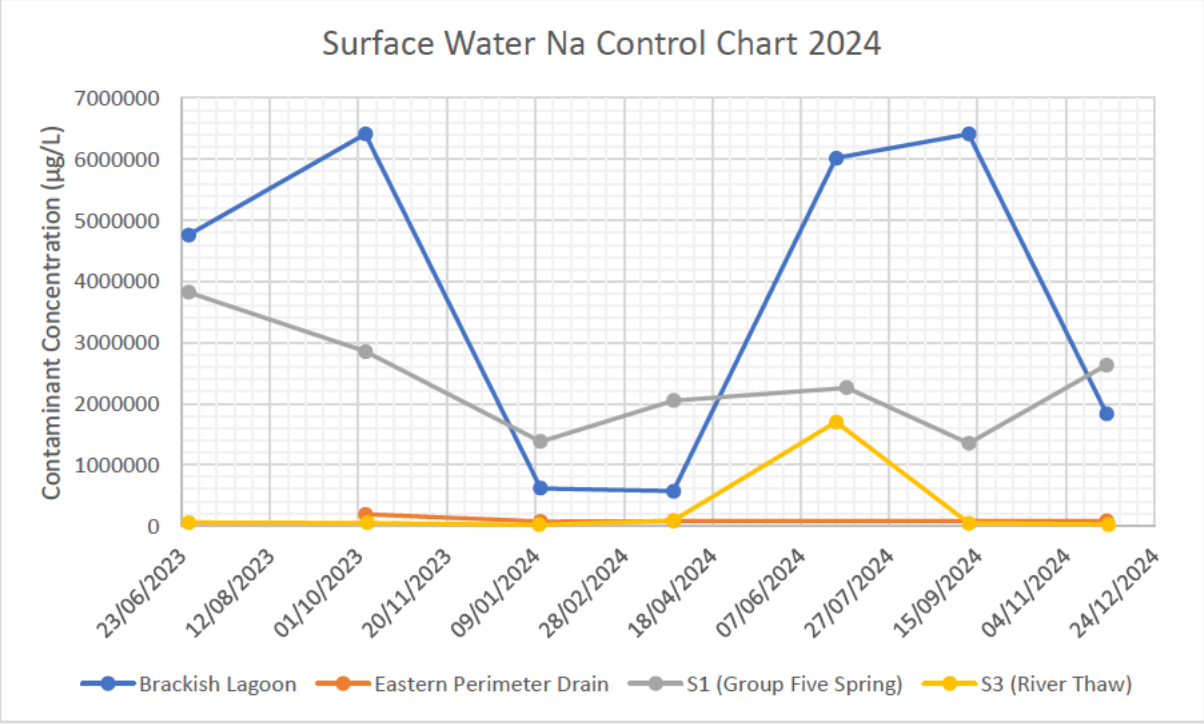

Surface Water Ni Control Chart 2024
Contaminant Concentration (µg/L)
0
1
2
3
4
5
6
7
8
9
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
Brackish Lagoon
Eastern Perimeter Drain
S1 (Group Five Spring)
S3 (River Thaw)

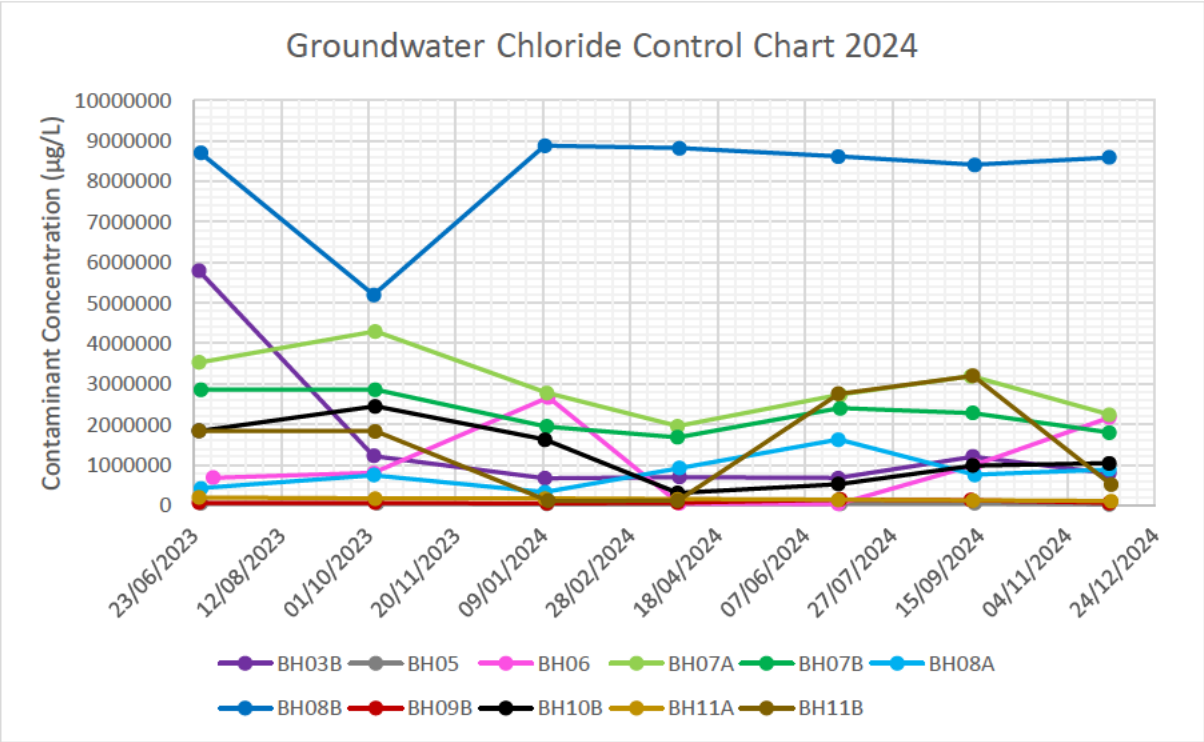

Groundwater Fe Control Chart 2024
Contaminant Concentration (µg/L)
0
2000
4000
6000
8000
10000
12000
14000
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B

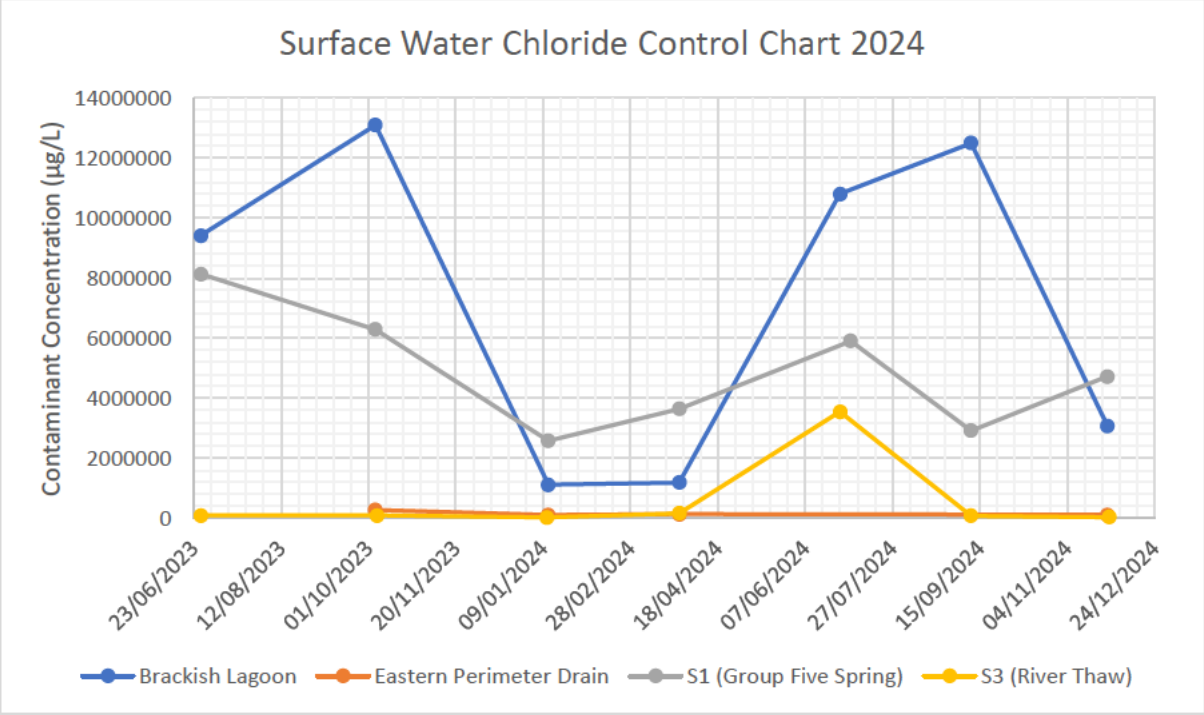

Groundwater K Control Chart 2024
Contaminant Concentration (µg/L)
300000
250000
200000
150000
100000
50000
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B

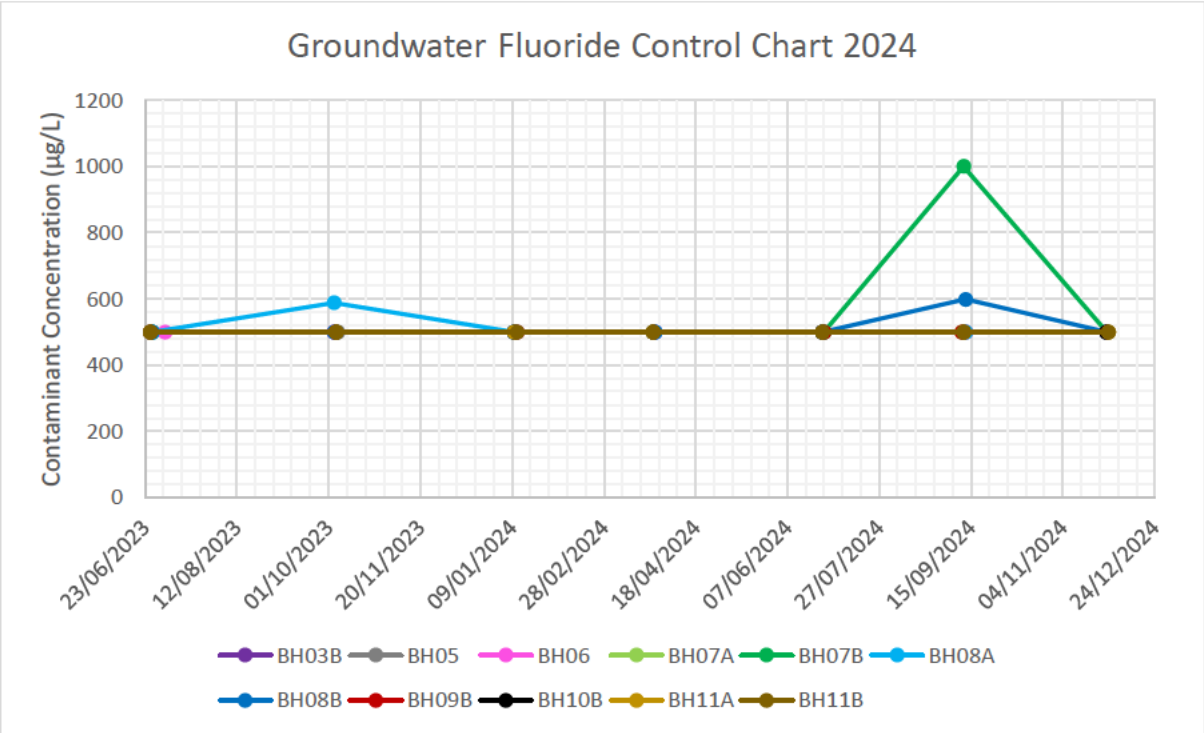

Surface Water K Control Chart 2024
Contaminant Concentration (µg/L)
350000
300000
250000
200000
150000
100000
50000
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
Brackish Lagoon
Eastern Perimeter Drain
S1 (Group Five Spring)
S3 (River Thaw)

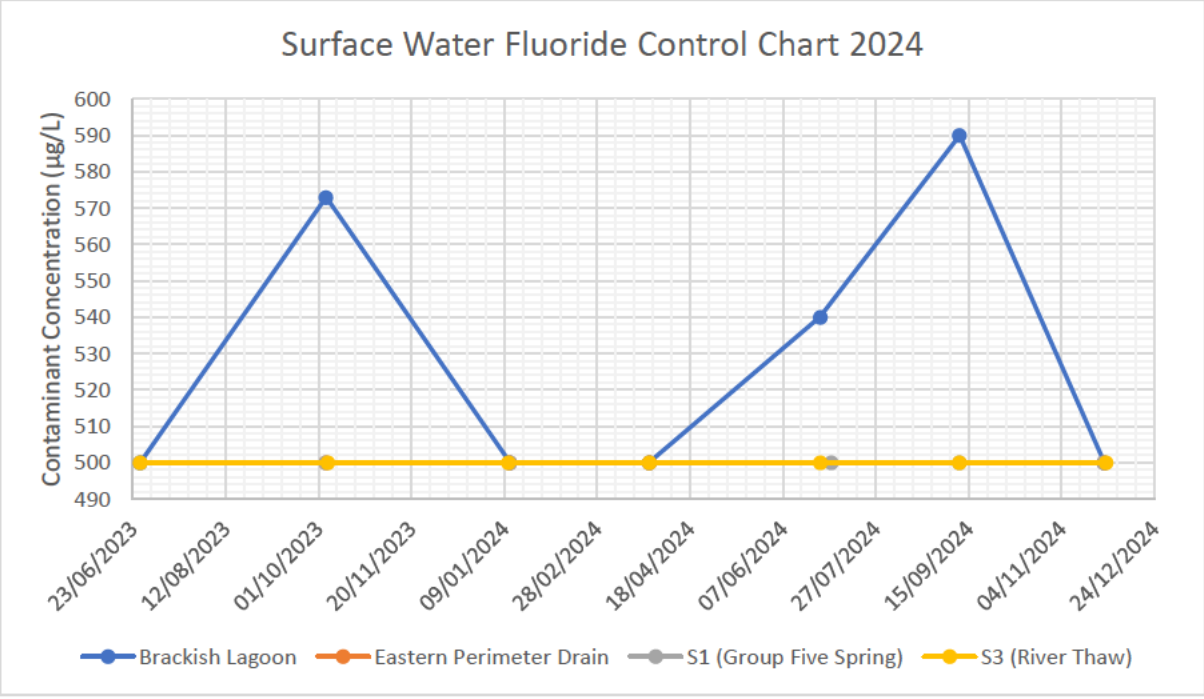

Groundwater Na Control Chart 2024
Contaminant Concentration (µg/L)
5000000
4500000
4000000
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B

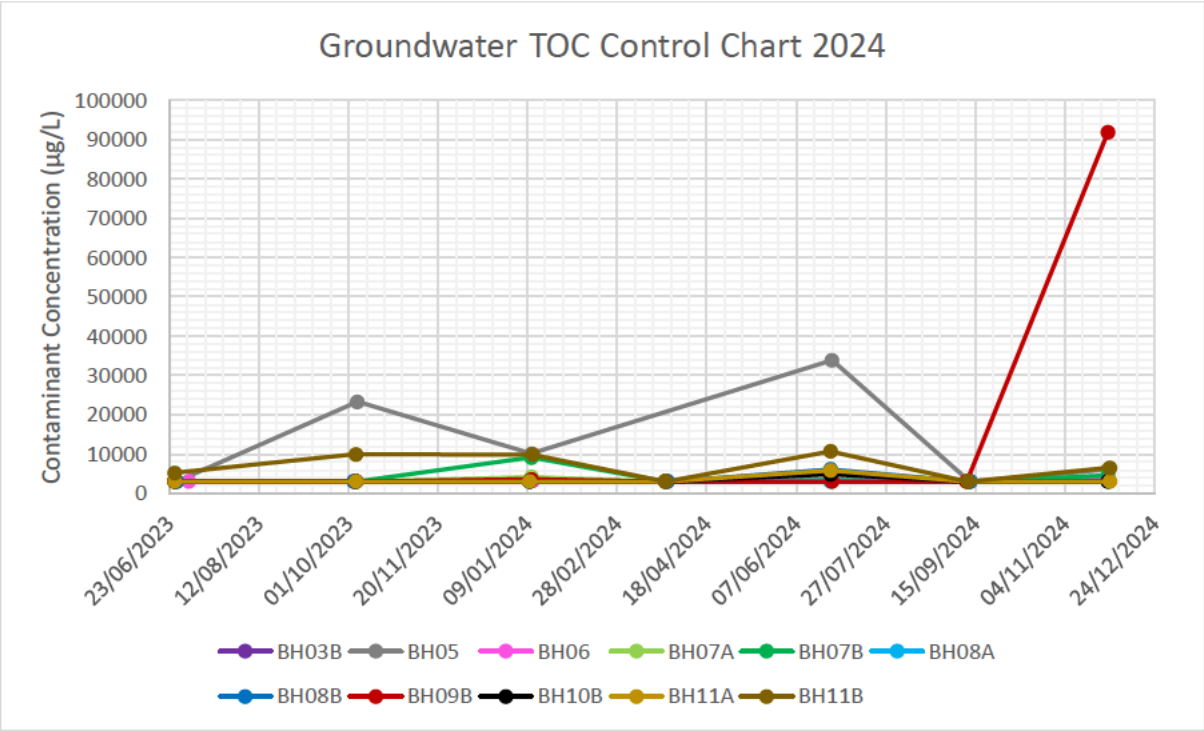

Surface Water Na Control Chart 2024
Contaminant Concentration (µg/L)
7000000
6000000
5000000
4000000
3000000
2000000
1000000
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
Brackish Lagoon
Eastern Perimeter Drain
S1 (Group Five Spring)
S3 (River Thaw)

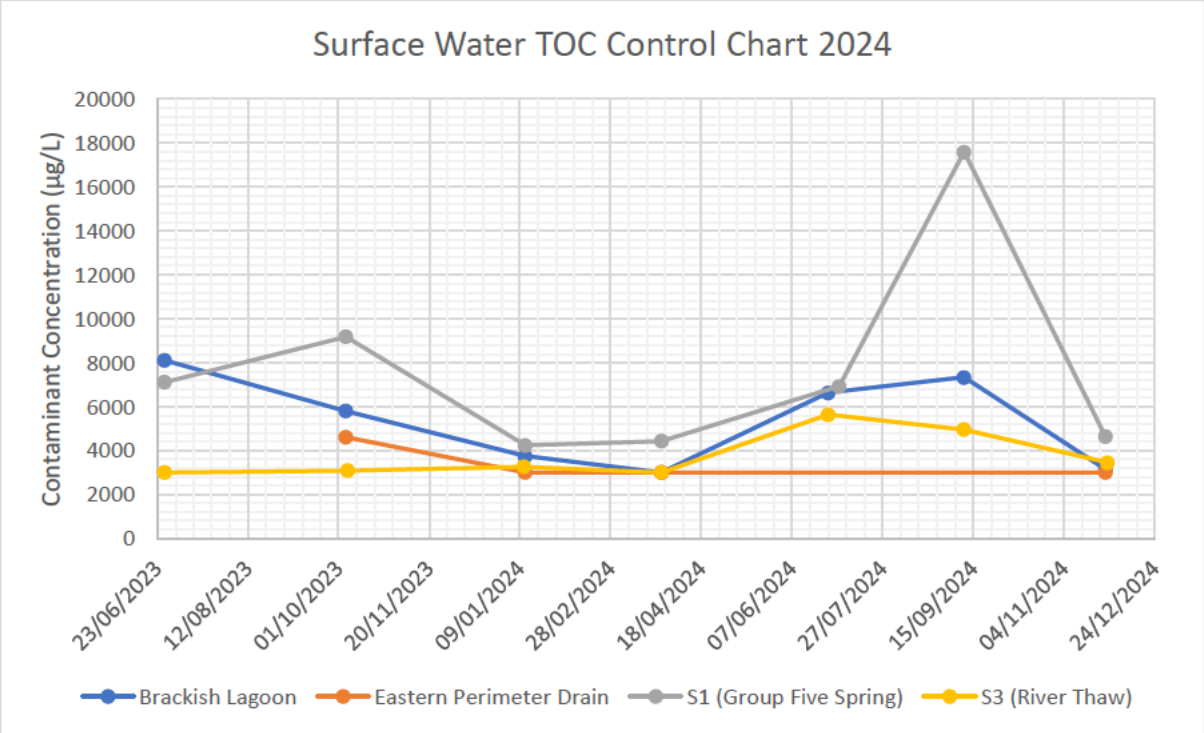

Groundwater Chloride Control Chart 2024
Contaminant Concentration (µg/L)
10000000
9000000
8000000
7000000
6000000
5000000
4000000
3000000
2000000
1000000
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B


Surface Water Chloride Control Chart 2024
Contaminant Concentration (µg/L)
14000000
12000000
10000000
8000000
6000000
4000000
2000000
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
Brackish Lagoon
Eastern Perimeter Drain
S1 (Group Five Spring)
S3 (River Thaw)


Groundwater Fluoride Control Chart 2024
Contaminant Concentration (µg/L)
1200
1000
800
600
400
200
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B


Surface Water Fluoride Control Chart 2024
Contaminant Concentration (µg/L)
600
590
580
570
560
550
540
530
520
510
500
490
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
Brackish Lagoon
Eastern Perimeter Drain
S1 (Group Five Spring)
S3 (River Thaw)


Groundwater TOC Control Chart 2024
Contaminant Concentration (µg/L)
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
BH03B
BH05
BH06
BH07A
BH07B
BH08A
BH08B
BH09B
BH10B
BH11A
BH11B


Surface Water TOC Control Chart 2024
Contaminant Concentration (µg/L)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
23/06/2023
12/08/2023
01/10/2023
20/11/2023
09/01/2024
28/02/2024
18/04/2024
07/06/2024
27/07/2024
15/09/2024
04/11/2024
24/12/2024
Brackish Lagoon
Eastern Perimeter Drain
S1 (Group Five Spring)
S3 (River Thaw)

Appendix D

10 YEAR SUMMARY OF CONTAMINANTS

Summary of Groundwater and Surface Water Quality (over the last 10 Years)

	Aquifer	Response Zone Interval [1] m b GL	Al µg/l	Sb µg/l	As µg/l	B µg/l	Cd µg/l	Ca mg/l	Cr µg/l	Cu µg/l	Mg mg/l
Background - Limestone [2]			6	1	1	88	0.1	151	1	3	17
Background - Seawater [3]			256	10	1.3	3700	2.3		0.36	12	
GW DWS/EQS Comparison			200	5	10	1000	5.0	250	50	2000	50
GW Compliance Limit					310	60000	15.0				
SW & GW Control Level			750		275	48000	13		135		
Upstream Groundwater			**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**
BH5	Limestone	2.5 - 11.5m	6.1	0.7	0.4	747.9	0.04	261.6	0.23	2.5	18.3
Downstream Groundwater											
BH3A - Last sampled 2015	PFA	2 - 6m	50.3	57.7	136.3	12,537.5	0.09	370.5	0.39	0.6	171.3
BH3B - COMPLIANCE LOCATION	Limestone	13.5 - 23m	17.9	10.2	137.5	23,702.6	0.16	535.3	0.30	2.6	214.7
BH6	Limestone	13 - 20.5m	25.7	6.8	29.7	23,378.4	0.28	784.1	0.64	1.8	222.0
BH7A	Gravelly CLAY	2 - 9.5m	23.7	4.8	3.0	20,744.7	0.16	776.4	0.34	4.8	115.3
BH7B - COMPLIANCE LOCATION	Limestone	18 - 26m	17.3	4.8	5.3	20,463.6	0.18	764.9	0.35	3.4	121.6
BH8A	Silty Sand	5.3 - 7m	224.4	19.3	89.4	8,924.1	0.15	263.9	0.89	8.8	45.0
BH8B	Limestone	30 - 38m	19.2	5.2	4.1	2,502.7	0.04	294.9	0.36	53.5	428.2
BH9A - Last sampled 2015	Fill	2.2 - 6m	8.7	0.5	0.5	75.5	0.05	77.2	0.25	2.1	8.3
BH9B	Limestone	6 - 13m	7.0	0.8	0.5	180.9	0.05	100.9	0.30	1.9	21.1
BH10A - Last sampled 2015	Fill	1 - 3m	15.6	12.1	71.3	7,330.0	0.09	165.8	0.25	1.2	85.8
BH10B	Clay	23 - 30m	16.9	5.0	20.5	12,033.7	0.07	410.3	0.35	3.2	400.7
BH11A	Fill - ash and clay	1.5 - 5m	19.8	7.3	45.5	13,992.4	0.16	380.5	0.43	2.2	103.7
BH11B	Clay	9.5 - 19m	21.0	4.6	28.7	9,285.8	0.04	311.7	0.37	6.3	136.9
Upstream Surface water											
River Thaw			166.4	3.9	0.6	374.1	0.05	123.7	0.50	1.8	64.1
Downstream Surface Water											
S1 Group 5 Spring			66.5	5.8	20.3	10,854.6	0.26	902.6	1.41	12.1	74.4
EPD Eastern Perimeter Drain			94.8	4.4	2.0	2,278.6	0.05	186.2	0.30	1.4	19.3
BL Brackish Lagoon			44.0	6.8	1.8	3,766.2	0.15	260.9	0.47	2.0	312.9
River Thaw (mouth) - Commenced Nov-18			159.1	2.6	0.7	312.5	0.04	118.1	0.68	1.7	40.5

1 Response zone interval for latest well where time series data are compiled from the original and replacement monitor well

2 Background - Limestone is mean of upstream boreholes (E05-09/1A,E05-09/1B, E05-09/2A, E05-09/2B)

3 Background - Seawater is mean of CW Inlet data collected 2011-12

Over Compliance Limit (GW)
Over Control Level (SW & GW)
Above DWS / EQS
Above Background by >25% (GW) (not pH)

Summary of Groundwater and Surface Water Quality

	Aquifer	Response Zone Interval [1] m b GL	Mn µg/l	Hg µg/l	Mo µg/l	Ni µg/l	K mg/l	Se µg/l	Na mg/l	V µg/l	pH
Background - Limestone [2]			23	0.01	2	3	2	1	23	1	7.4
Background - Seawater [3]			20	0.02	30	9	380	1.7		10	7.9
GW DWS/EQS Comparison			50	1.0	70	20	12	10	200	60	
GW Compliance Limit				20	9000			350		N/A	
SW & GW Control Level				18	7700			290		180	
Upstream Groundwater			**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**
BH5	Limestone	2.5 - 11.5m	24.7	0.007	6.5	1.6	2.2	0.5	51.3	0.8	7.1
Downstream Groundwater											
BH3A - Last sampled 2015	PFA	2 - 6m	641.0	0.005	1,830.0	1.7	79.5	18.1	782.3	128.5	7.9
BH3B - COMPLIANCE LOCATION	Limestone	13.5 - 23m	502.0	0.007	2,970.8	1.0	156.7	10.0	1,407.0	38.5	7.7
BH6	Limestone	13 - 20.5m	1,447.8	0.006	3,652.2	5.7	105.3	13.7	1,242.4	32.8	7.5
BH7A	Gravelly CLAY	2 - 9.5m	1,345.0	0.005	3,266.1	0.9	257.3	0.5	2,094.2	12.0	7.3
BH7B - COMPLIANCE LOCATION	Limestone	18 - 26m	1,174.2	0.007	3,258.6	0.9	253.8	0.5	2,095.4	9.9	7.3
BH8A	Silty Sand	5.3 - 7m	22.5	0.005	2,640.6	1.1	34.8	18.2	150.3	141.1	8.4
BH8B	Limestone	30 - 38m	161.2	0.006	103.9	1.2	118.9	1.1	3,866.5	7.2	7.3
BH9A - Last sampled 2015	Fill	2.2 - 6m	5.0	0.005	5.0	0.8	7.0	0.5	24.2	1.0	7.7
BH9B	Limestone	6 - 13m	14.6	0.007	4.0	1.0	2.3	0.5	26.2	0.8	7.5
BH10A - Last sampled 2015	Fill	1 - 3m	30.0	0.005	653.2	1.6	29.1	1.3	88.3	70.3	7.9
BH10B	Clay	23 - 30m	655.0	0.006	969.3	0.8	152.9	0.5	3,053.7	8.8	7.5
BH11A	Fill - ash and clay	1.5 - 5m	522.0	0.005	1,292.7	2.0	50.4	6.4	158.5	6.4	7.5
BH11B	Clay	9.5 - 19m	920.3	0.006	530.6	1.0	88.0	0.5	817.6	8.0	7.4
Upstream Surface water											
River Thaw			28.3	0.006	24.8	0.9	19.3	0.5	447.1	7.6	8.1
Downstream Surface Water											
S1 Group 5 Spring			755.6	0.011	3,638.5	1.2	194.4	13.9	2,569.7	23.9	7.3
EPD Eastern Perimeter Drain			207.2	0.008	401.7	0.9	18.6	1.7	155.7	8.1	8.1
BL Brackish Lagoon			115.7	0.008	564.8	0.9	128.9	3.4	2,752.5	8.0	8.3
River Thaw (mouth) - Commenced Nov-18			29.5	0.007	30.6	0.9	12.9	0.5	277.2	4.3	8.2

1 Response zone interval for latest well where time series data are compiled from the original and replacement monitor well

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3 Background - Seawater is mean of CW Inlet data collected 2011-12

Over Compliance Limit (GW)
Over Control Level (SW & GW)
Above DWS / EQS
Above Background by >25% (GW) (not pH)

Summary of Groundwater and Surface Water Quality

	Aquifer	Response Zone Interval [1]	Electrical Conductivity	Bicarbonate	Sulphate	Ammoniacal Nitrogen as N	Total Oxidised Nitrogen as N	Chloride	Fluoride	Total Organic Carbon	Cr VI (from May 2019)
		m b GL	µS/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	
Background - Limestone [2]			830	409.00	62	0.2	10	35	0.2	4	0.29
Background - Seawater [3]				97.00	2345	0.03		16300	1.3		
GW DWS/EQS Comparison					250	0.50		250	1.5		3.4
GW Compliance Limit						6.6					
SW & GW Control Level					2660	5.5					
Upstream Groundwater			**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	
BH5	Limestone	2.5 - 11.5m	1,315	397.3	376.6	0.0	0.9	73.9	0.1	5.0	0.128
Downstream Groundwater											
BH3A - Last sampled 2015	PFA	2 - 6m	5,693	349.8	1,233.3	0.2	0.5	1,257.5	0.1	18.9	
BH3B - COMPLIANCE LOCATION	Limestone	13.5 - 23m	8,990	254.4	1,721.3	0.8	0.7	2,491.5	0.1	2.6	0.039
BH6	Limestone	13 - 20.5m	8,943	409.7	1,875.1	0.6	15.8	2,230.8	0.6	6.0	0.015
BH7A	Gravelly CLAY	2 - 9.5m	12,292	370.2	1,736.3	2.8	0.4	3,573.9	0.4	5.4	0.015
BH7B - COMPLIANCE LOCATION	Limestone	18 - 26m	12,443	368.4	1,729.0	3.0	0.2	3,616.2	0.4	5.0	0.015
BH8A	Silty Sand	5.3 - 7m	2,030	246.9	641.9	0.4	2.0	248.7	0.1	14.6	0.002
BH8B	Limestone	30 - 38m	19,357	802.2	483.5	6.5	0.2	6,802.5	0.5	14.3	0.002
BH9A - Last sampled 2015	Fill	2.2 - 6m	482	306.8	14.3	0.0	0.3	18.5	0.2	1.8	
BH9B	Limestone	6 - 13m	666	334.4	44.1	0.0	2.6	46.5	0.2	5.5	0.258
BH10A - Last sampled 2015	Fill	1 - 3m	1,522	544.1	312.1	0.1	0.2	136.8	0.3	101.6	
BH10B	Clay	23 - 30m	15,981	990.4	1,098.0	25.0	0.2	5,110.0	0.2	6.8	0.015
BH11A	Fill - ash and clay	1.5 - 5m	2,599	580.6	971.5	0.5	0.7	187.9	0.0	10.0	0.128
BH11B	Clay	9.5 - 19m	5,408	836.4	675.2	4.7	0.2	1,333.2	0.3	5.5	0.015
Upstream Surface water											
River Thaw			2,718	330.6	81.8	0.0	3.5	770.4	0.2	3.0	
Downstream Surface Water											
S1 Group 5 Spring			14,185	159.9	1,354.3	3.5	9.5	4,614.1	0.1	6.0	
EPD Eastern Perimeter Drain			1,580	316.4	274.1	0.0	2.2	246.2	0.1	2.0	
BL Brackish Lagoon			13,925	221.9	879.7	0.1	1.1	4,693.0	0.4	4.0	
River Thaw (mouth) - Commenced Nov-18			1,834	323.6	93.9	0.0	3.3	451.2	0.1	2.9	

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Over Compliance Limit (GW)
Over Control Level (SW & GW)
Above DWS / EQS
Above Background by >25% (GW) (not pH)

Appendix E

IN SITU RESULTS

Analyte	BH03B	BH05	BH06	BH07A	BH07B	BH08A	BH08B	BH09B	BH10B	BH11A	BH11B	BRACKISH LAGOON	EASTERN PERIMETER DRAIN	S1 (GROUP FIVE SPRING)	S3 (RIVER THAW)
Q2 2023															
Conductivity (µS/cm)	18565	1466	Grab sample taken	13026	11544	3148	24869	921	8551	3873	7657	28206	Location dry	24505	947
Dissolved Oxygen (mg/L)	0.34	0.69		0.61	0.54	0.34	0.34	0.72	0.52	0.02	0.03	3.52		6.58	1.52
pH	7.2	6.8		7.1	7.1	8.36	6.84	7.07	7.16	6.65	7.21	8.15		7.66	8.31
ORP (mV)	29	-2		-121	-128	-99	-178	57	-142	39	-212	-147		17	-6
Temperature (°C)	13.3	12.6		14.3	14.6	14.3	14.6	12.5	15.4	14.1	13.6	25		24.3	18.8
Q3 2023															
Conductivity (µS/cm)	6366	1555	5106	15042	11549	4834	14761	993	9995	4000	7953	35540	2019	27620	916
Dissolved Oxygen (mg/L)	5.19	2.62	1.16	0.52	0.47	0.5	0.51	1.39	1.43	2.09	1.92	2.62	7.36	4.29	8.1
pH	7.36	6.73	7.17	7.15	7.13	8.39	7.15	6.99	7.13	6.79	7.32	7.62	8.1	6.25	7.93
ORP (mV)	35	-52	-80	-111	-109	-150	-135	23	-124	-66	-172	-73	24	88	56
Temperature (°C)	13.7	12.5	13.1	14	14.1	13.4	13.4	13.8	14	13.7	14	17.5	15.2	15.4	13.5
Q4 2023															
Conductivity (µS/cm)	4603	1217	5106	11067	8280	2903	25426	842	7565	3236	Location dry	19194	1168	26060	664.9
Dissolved Oxygen (mg/L)	1.6	0.83	1.16	0.27	1.55	0.33	0.42	2.13	0.75	0.9		3.81	10.26	1.73	0.42
pH	7.46	6.68	7.17	7.11	7.01	8.73	6.77	7.06	7.13	6.92		7.49	7.82	6.42	7.84
ORP (mV)	-16	-94	-80	-118	-79	12	-129	56	-86	-59		-122	36	-57	89
Temperature (°C)	10.9	10.5	13.1	11.8	11.8	9.6	10.1	9.6	12.1	11		11.4	8.3	10.3	7.5
Q1 2024															
Conductivity (µS/cm)	4368	843	2104	8425	6995	5279	25966	926	2302	1816	1304	28411	1241	10218	1100
Dissolved Oxygen (mg/L)	1.76	0.51	4.46	0.64	0.5	0.3	0.31	2.99	5.04	2.5	0.29	11.47	10.62	9.83	9.11
pH	7.58	7.04	7.12	7.13	7.12	7.87	6.85	7.09	6.95	6.97	7.18	8.37	7.93	6.33	8.07
ORP (mV)	-44	-95	72	-79	-94	-65	-21	92	85	42	-107	67	86	102	108
Temperature (°C)	9.7	8.4	13	12.6	12.2	10.9	11.2	9.9	12.5	11	12.8	13.6	9.5	11.6	9
Q2 2024															
Conductivity (µS/cm)	4755	1423	3495	10629	9800	5977	24269	1296	4515	3534	8936	30763	Location dry	Grab sample taken due to access constraints	10609
Dissolved Oxygen (mg/L)	4.95	1.81	4.97	0.3	1.39	0.41	0.95	2.58	3.37	1.98	4.19	5.74			10.49
pH	7.46	6.66	7.02	7.03	7.07	8.13	6.87	6.94	6.95	6.83	6.99	8.93			7.96
ORP (mV)	38	-57	95	-113	-109	57	31	73	-56	-88	-103	-34			62
Temperature (°C)	14.9	12.3	19.6	15.5	14.3	14.2	15.2	12.5	16.3	16.5	22.3	23.3			17.5
Q3 2024															
Conductivity (µS/cm)	6250	1560	3287	12585	9728	4987	24244	1233	5734	3232	10609	35648	Location dry	23018	793
Dissolved Oxygen (mg/L)	3.5	3.26	6.1	1.55	1.67	2.15	1.31	3.51	1.72	1.11	1.07	4.86		5.76	9.25
pH	6.98	6.72	7.4	7.18	7.15	8.64	6.93	7.03	7.1	6.74	7.22	7.61		6.45	7.93
ORP (mV)	116	-82	-66	-112	-93	-35	18	-33	-88	-4	-104	24		-248	71
Temperature (°C)	13	11.8	14.3	14	14.2	13.1	12.4	13.4	14	13.9	18	19.7		16.2	14
Q4 2024															
Conductivity (µS/cm)	5043	1015	8680	9362	8418	5623	25680	1120	6205	2480	4246	27333	1285	26182	720
Dissolved Oxygen (mg/L)	2.15	7.63	2.58	1.13	0.35	0.33	0.89	0.61	0.67	1.89	2.96	1.4	6.44	4.28	10.82
pH	7.46	6.86	7.17	7.09	7.06	8.66	6.86	6.81	7.12	7.03	7.27	7.52	7.65	6.34	7.86
ORP (mV)	15	-96	103	-75	-109	47	-115	-251	-100	8	-64	-92	156	167	47
Temperature (°C)	12.3	9.2	11.7	11.6	12.5	11.8	11.3	10.4	11.9	12.1	10.6	12.1	9.4	11.6	8.3

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