NANT Y CAWS
PHASE 1
CLOSED LANDFILL

ENVIRONMENTAL PERMIT 34183

Environmental Monitoring Review

Report Number 2396r1v1d1123

Commissioned by

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Table of Contents

List of Tables

List of Plates

List of Figures

List of Appendices

1 INTRODUCTION

Carmarthenshire County Council (CCC) maintains Nant y Caws (NYC) Phase I Landfill which is located east of Carmarthen and west of Cross Hands (see Figure 1). The landfill is in Aftercare and has not accepted waste since March 1997. The landfill has been partially restored, with a full FML (Flexible Membrane Liner) placed over the capped area. The site is regulated by Natural Resources Wales (NRW) through Permit No. EA WML 34183.

The Permit requires routine environmental monitoring to be undertaken. Geotechnology Ltd (Geotechnology) has been commissioned by CCC to undertake aspects of the monitoring since April 2013 and to report the results. This annual review of the monitoring data is based on the available data gathered up to Q4 2023.

2 OVERVIEW OF SITE ACTIVITY

Key dates relating to the operation, closure, capping and regulatory control of the landfill are provided in Table 2-1. A detailed site plan showing surface topography and monitoring infrastructure is provided in Figure 2.

Table 2-1 Summary of Key Dates

Date	Activity
1984	Phase 1 Landfill designed
12 Dec 1985	Waste Disposal Plan (WDP) issued by Carmarthen District Council
1 May 1994	WDP converted to a Waste Management Licence (WML)
1997	Cessation of landfilling operations
1998	Installation of gas and groundwater monitoring infrastructure
Dec 1999	Final FML capping completed
1 Jan 2002	Modification to WML by Environment Agency
2002/2003	Geotechnology undertakes hydrogeological risk assessment and prepares monitoring action plans based on limited data set
2009	Leachate Breakout on Southern Bund – Remedial measures implemented
6 April 2010	WML automatically became an Environmental Permit in accordance with the Environmental Permitting Regulations (England and Wales) 2010
2010	Leachate treatment system undergoing improvements
20 Jan 2015	Landfill formally taken into Aftercare by NRW
2016	Permit Variation issued to operator of leachate treatment system (EPR/PP3338CQ) CWM Environmental placed soils over central part of aimed at restoring surface drainage patterns
July 2020	Investigation of capping soil thickness for CWM Environmental

Key features of the site are highlighted on Figures 2 and 3. The latter figure is a conceptual site model previously developed for a Hydrogeological Risk Assessment by Geotechnology.

2.1 Landfilling

The landfill was designed in 1984 by W.S. Atkins and Partners and was based on a containment principle. However, there are no details available to demonstrate that any form of engineered containment was adopted. Instead, the design is considered to rely on the in-situ glacial till to provide an impermeable base. A series of leachate interceptor drains are shown on the original site plans. The design drawings also show that Phase 1 was divided into a series of working cells with a total of 25 shown on the plan.

This original plan also describes the working method, which involved vertical layering with working faces of 2 to 2.5m which are then capped with 300mm of inert fill. Subsequent working faces were pushed over each completed layer to form four layers, giving a total landfill thickness of between approximately 8 and 10m. This data was broadly confirmed in subsequent drilling for internal gas wells in 1998, though a maximum waste thickness of 14m was obtained. It is known that over-tipping and further waste layering was undertaken at the site in late 1994 and early 1995 which may account for the increased thickness observed. The original design also shows that at the site boundary a cut-off ditch was constructed which is further isolated from the refuse by a clay bund.

Landfilling ceased in March 1997 and the landfill has not received any wastes since then.

2.2 Capping

During the operational period, measures were undertaken to reduce the leachate yield from the site in the form of FML applications to the flanks. Initially, a 0.5mm polypropylene membrane was used on the southwestern flank though this has been replaced by a 2mm

double textured HDPE. All the flanks of the landfill now have a 2mm textured HDPE cover, which in turn is welded to a 1mm smooth HDPE liner on the plateau cap. Prior to the final capping work being completed in December 1999, an intermediate layer of 0.5m of clay soil cover was placed, though it is locally thicker in hollows.

The Phase 1 landfill has therefore been capped since December 1999.

At the request of the CWM Environmental, an inspection of the capping was undertaken during July 2020. The assessment was aimed at assessing the thickness of soil cover at the site as part of a feasibility study evaluating using part of the site as a solar farm.

2.3 Restoration

The agricultural restoration of the Phase 1 landfill continued from 1999 up until 2003, although there are no precise records. The restoration process involved the importation of sub-soils from many extraneous sources. Geotechnology undertook a soil audit of the areas completed up till November 2002. This is documented in Geotechnology report 237/0/1102 issued in November 2002. Geotechnology was not involved in the final stages of restoration at the landfill.

Agricultural post and wire fencing was placed and the surface was seeded to encourage surface soil stabilisation on the restored cap. The fields created by the fences are present today. The vegetation within the fields is, however, overgrown and does not appear to be being grazed or managed in accordance with the intention of the Post Closure Working Plan.

Following the removal of several stockpiles, CWM Environmental placed materials over the central part of the site during 2016. These works were aimed at reinstating the landfill landform and protection of the capping systems.

2.4 Leachate Management

The leachate at the site is collected by a gravity fed under waste drainage system comprising a 225mm diameter spine drain receiving inflows from 150mm diameter spur drains. The drainage system is accessed from the landfill surface by leachate inspection chambers, which rise through the waste. The chambers allow inspection of the leachate system and permit access for routine maintenance, leachate level measurement and cleaning. The position of each chamber has been re-surveyed by Geotechnology and is shown on Figure 2. Leachate inspection chambers 9 and 16 could not be found during the survey.

In addition to the under drainage works undertaken during the infilling, further leachate drains were installed at the toe of the flanks to intercept perched leachate which was historically observed to break out along the flanks. This work was completed during the capping period of the restoration in 1999. Both the toe drains and under drain system flow under gravity to the pumping sump from where the leachate is pumped, either to the nearby concrete lined leachate lagoon or the treatment plant. Following treatment, the leachate is discharged to the Afon Bantwen under discharge consent. An application to vary the Permit was prepared by Geotechnology, at the request of CCC in 2015, and this was accepted by NRW in 2016.

3 REGULATORY FRAMEWORK

The Aftercare Management Plan sets out the relevant regulatory framework against which the environmental protection measures should be evaluated. These criteria are summarised in the following sections.

3.1 Leachate Level Limit

The maximum level of leachate that should be observed from a leachate inspection chamber is 0.5m as measured from the base of the chamber.

3.2 Leachate Chemistry Control Levels

Control levels for assessing leachate chemistry are provided in Table 3-1.

Table 3-1 Leachate Control Levels

	Ammoniacal Nitrogen	**Chloride**	**Potassium**
	mg l-1	**mg l-1**	**mg l-1**
Current Discharge Consent from Effluent Treatment Plant	**4**		
Leachate Quarterly Control Level for L1	70	250	140
Daily Leachate Control Levels	4		

3.3 Groundwater Compliance Levels

Current groundwater trigger and control levels are summarised in Table 3-2.

Table 3-2 Trigger Levels for Emissions to Groundwater

	Ammoniacal Nitrogen	**Chloride**	**Potassium**
	mg l-1	**mg l-1**	**mg l-1**
Groundwater Trigger Level BH101, 103, 104, 105 and 117	10	250	40
Groundwater Control level BH101, 103, 104, 105 and 117	4	150	30

3.4 Surface Water Control Levels

Current surface water control levels are summarised in Table 3-3.

Table 3-3 Control Levels for Emissions to Surface Water

	Ammoniacal Nitrogen	**Chloride**	**Suspended Solids**
Location	**mg l-1**	**mg l-1**	**mg l-1**
SW1	0.6	150	
Cap run-off discharge			50 mg/l
French Drain Discharge	4		

3.5 Perimeter Gas Compliance Levels

Currently applicable emission limits for the perimeter gas wells are summarised in Table 3-4.

Table 3-4 Landfill Gas in External Monitoring Boreholes Emission Limits

Perimeter gas position	Carbon Dioxide Action Level (% v/v)	Methane Compliance Limit (% v/v)
All positions	3	1

Action levels are for internal use by CCC while methane compliance limits are a Permit requirement.

4 MONITORING NETWORK PERFORMANCE

To demonstrate that the site is functioning as designed, a monitoring programme is being implemented. The current programme is managed by CCC with the monitoring of leachate quality, downgradient groundwater, surface water and external landfill gas currently undertaken by Geotechnology. Upgradient groundwater wells are sampled by the current operators of the adjacent operational landfill, CWM Environmental. The available monitoring infrastructure is shown on Figure 2.

A summary of the current monitoring programme is provided in Table 4-1.

Table 4-1 Current Monitoring Programme

Item	Monitoring Point	Type of Monitoring	Monitoring Frequency	Relevant Working Plan	Party Responsible
A	Landfill leachate level	Level and Conditional Observations	Monthly for 12 months starting 2014 and then quarterly	See WP10	Needs to be clarified*
B	Landfill leachate – L1	Composition	Six monthly	See WP10	Geo (access required)
C	Leachate Breakout - Phase 1 flanks (including toe drain)	Visual	Quarterly	See WP10	Geo
D	Upgradient Groundwater – BH203, BH205	Composition		Data provided by CWM Environmental	CCC/CWM
E	Downgradient Groundwater – BH101, 103, 104, 105, 117	Level	Quarterly	See WP11	Geo
F	Downgradient Surface Water – SW1, SW4	Composition	Quarterly	See WP12	Geo
G	Internal landfill gas	Composition	Monthly	See WP13	Infinis
H	French Drain	On-site measurement of composition	When observed to be flowing during inspections by WEBS	See WP12	Needs to be clarified *
I	Run-off Discharge	Composition	Quarterly	See WP12	Geo
J	Leachate Discharge	Composition	Monthly	See WP10	Needs to be clarified *
K	Contingency Surface Water Sample Points	Composition		See WP12	Geo
L	Perimeter landfill gas - BH102, 106, 107, 109, 110, 111, 113, 114, 115, 118, 119, 120	Composition	Quarterly	See WP14	Geo
M	Monitoring infrastructure integrity	Observational	Inspect each point when sampling	See WP10 – WP14	Geo
N	Topographic Survey and Settlement Assessment	Topographic Survey	Every 5 years starting 2015	See WP15	Geo

Note: * Geotechnology understands that CCS has appointed a new contractor to manage the leachate treatment system. It is unknown if the new contractor has been requested to continue to undertake the monitoring identified – this monitoring was previously undertaken by WEBS

4.1 Monitoring Network

Each time Geotechnology undertakes the monitoring, an inspection of the monitoring infrastructure is also completed. Since 2013, clearance of vegetation along the northwestern edge of the landfill has taken place. Routine control of the vegetation significantly aids the safe collection of samples but this has unfortunately not been undertaken in recent months. As a consequence, SW1 is not easily or safely accessible.

Other minor repairs have been undertaken as required to headworks of several wells. Several headworks still, however, require improvement.

4.2 Sample Analysis & Laboratory Performance

Samples collected for laboratory testing were submitted to UKAS registered ALS laboratories in cooler boxes but in 2023 the testing was moved to Decus, based in Ammanford. The results from the laboratory analysis have been compiled as follows:

- Appendix 1: Laboratory Certificates
- Appendix 2: Leachate Chemistry
- Appendix 3: Groundwater Chemistry
- Appendix 4: Surface water Chemistry

In previous years, the operators of the leachate treatment plant undertook more frequent monitoring of the leachate prior to and following treatment and also monitored leachate levels. They also monitored the quality of a French drain along the southern perimeter of the site that was previously installed to collect leachate outbreaks. It is unclear if this data is still being gathered by the new contractor.

4.3 Site Observations

During the first round of sampling in April 2013, an oil sheen was noticed on the surface of the sample taken from BH104. This has not been observed since.

The restored landfill cap is largely covered by good vegetative cover and appears largely visibly stable. On the eastern flanks and most of the plateau, the landfill is parcelled into grassed fields. In some areas, drainage appears to be poor with reeds developing.

In recent years, the western and northern portions of the landfill have been reprofiled by CWM Environmental. Most of the flanks in the northern and western boundary of the landfill have self-seeded, resulting in the proliferation of many dwarf trees (mainly willow), gorse, broom and other flora. Whilst this is not in accordance with the species proposed in the Post Closure Working Plan, they have had the desired effect of stabilising the slopes, especially the near surface restoration soils. No evidence of instability, failure or leachate breakout has been observed during walkovers in recent years.

Leachate breakout has previously occurred on the southern bund of the landfill. Measures to collect and treat excess leachate have been implemented by CCC. In the same corner, the capping membrane HDPE is exposed and damaged over an area of approximately $1m^2$. Based on visible vehicle tracks, Geotechnology suspects that trafficking has primarily caused the damage rather than any failure of the soil cover. In the southeastern corner of the landfill,

Geotechnology suspects perching of leachate within the waste as the ground surface is soft and fully saturated.

The access road down to the leachate treatment plant is tarmacadam and is in good condition.

4.4 Topographic Survey

The landform at Phase 1 has been surveyed on many occasions, the most recent of which was in 2019 by Geotechnology, at the request of CWM Environmental. Given this recent survey, the next topographic survey should be scheduled for 2024. An isopachyte comparing the 2019 land surface with the 2015 land surface is provided in Appendix 5.

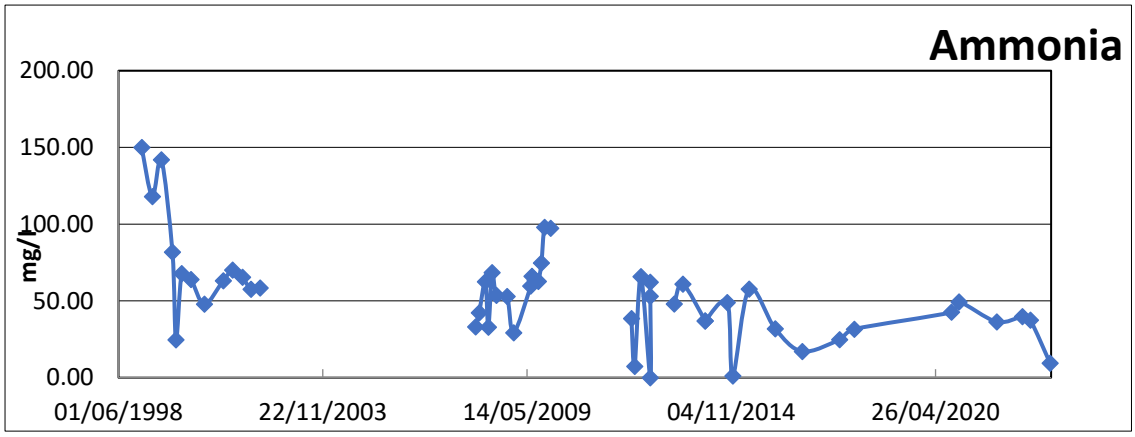
5 LEACHATE

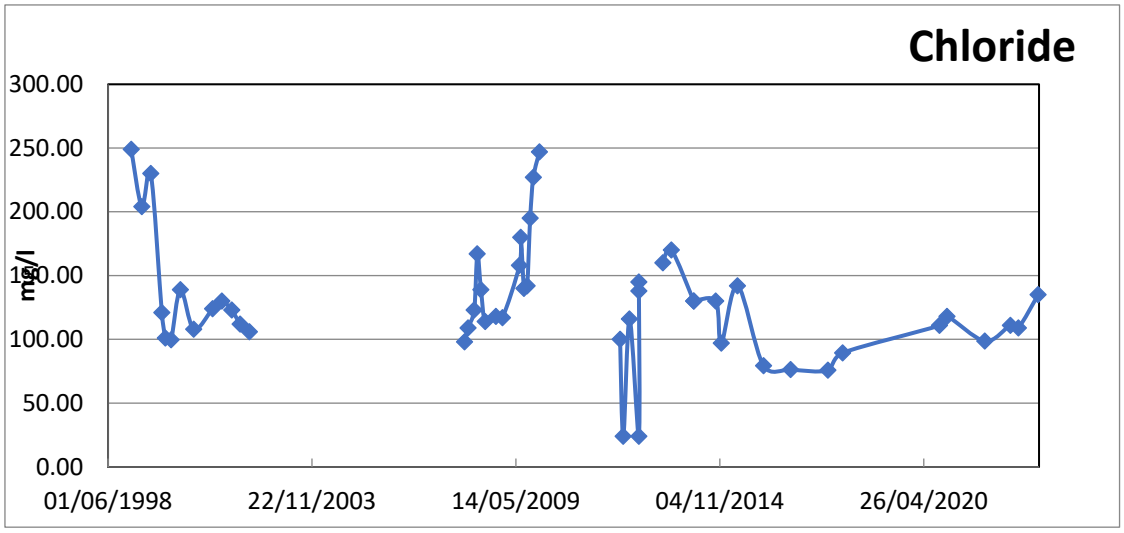
All the leachate results are presented in Appendix 2.

5.1 Leachate Quality

Leachate chemistry has been monitored between 1998 and 2002 and from December 2007 to 2023. The results are graphically illustrated in Appendix 2. More frequent monitoring of the leachate quality and discharge quality is undertaken by the contractor appointed by CCC to operate the leachate treatment plant. This is understood to be reported in a separate annual report.

Leachate continues to be moderately mineralised with electrical conductivity of approximately 1000-1400 microS/cm. The dominant contaminants within the leachate are ammonia and potassium. The concentration of these parameters and others is variable but appears to be declining with time, as shown in Plate 5-1.





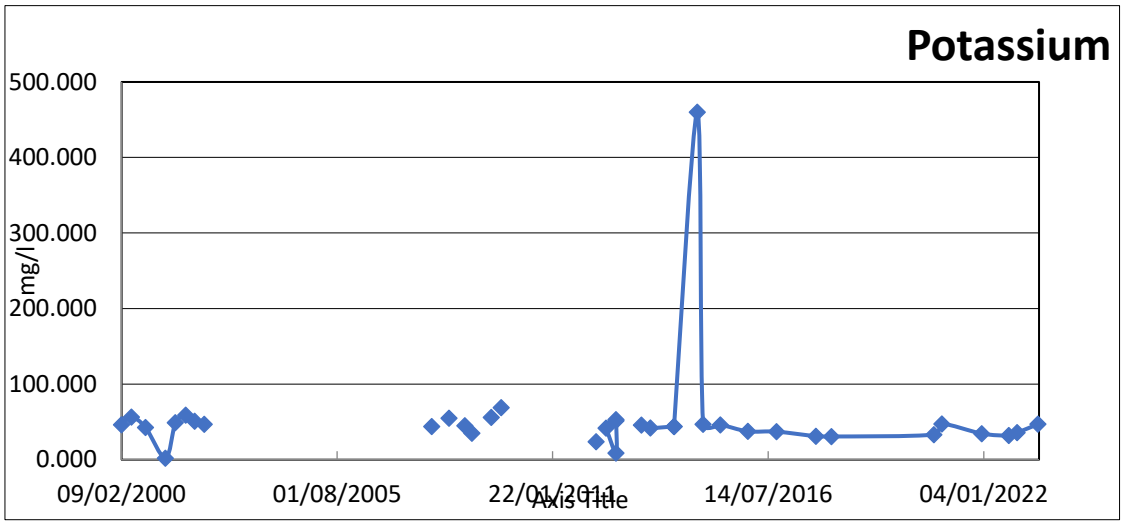


Plate 5-1 Temporal Variation of Key Parameters (mg/l)

Trace metals within the leachate have remained at very low concentrations in recent years, with several non-detectable and all below freshwater Environmental Quality Standards (EQS). Low level trace organics have also been detected. For instance, in 2017, <0.001 mg/l total PAH and 0.0012 mg/l mecoprop was detected and in 2018 0.00255 mg/l mecoprop. In 2020 and 2021, mecoprop was below the level of analytical detection and the only PAH detected was Benzo(a)pyrene at 0.00000302 mg/l.

Given the potentially declining source concentrations, Geotechnology suggests that CCC maintains scrutiny of the leachate treatment requirements to ensure resources are being effectively used. The treatment goals and operation of the leachate treatment plant and the potential for cost savings using alternate techniques should be regularly considered at least every 5 years.

5.2 Assessment against Control Levels

The spot samples collected by Geotechnology to date indicate that leachate quality falls below the control levels (see Table 5-1). The more detailed routine monitoring undertaken by the leachate treatment operator should also be scrutinised.

Table 5-1 Evaluation of Leachate Chemistry

	Ammoniacal Nitrogen	**Chloride**	**Potassium**
	mg l^{-1}	**mg l^{-1}**	**mg l^{-1}**
Leachate Quarterly Control Level for L1	**70**	**250**	**140**
2016 Maximum value from spot sampling at L1	31.9	79.4	37.6
2017 Maximum value from spot sampling at L1	24.8	75.8	31.1
2018 Maximum value from spot sampling at L1	31.6	89.4	30.7
2020 Maximum value from spot sampling at L1	49.4	118	47.4
2021 Maximum value from spot sampling at L1	36.4	98.7	34.5
2022 Maximum value from spot sampling at L1	39.8	111	35.9
2022 Maximum value from spot sampling at L1	9.4	135	47.1

6 GROUNDWATER

All the groundwater results are provided in Appendix 3.

To assist with describing the hydrochemistry of groundwater within the vicinity of Phase I, several borehole groupings have been created. The groupings are summarised below and are based on the position of each monitoring position relative to Phase I (see Figure 2).

- BH203 and BH205 – Up-gradient of Phase 1
- BH117 – across gradient from Phase 1 on Eastern side
- BH108 – across gradient from Phase 1 on Western side
- BH101, BH103, BH104 and BH105 – Down-gradient of Phase 1

Results for BH108 and BH117 are only available since 2008, whereas downgradient monitoring records are available since 1998.

6.1 Groundwater Quality

The persistent relatively low electrical conductivity (350-550 microS/cm) of the circumneutral downgradient groundwater indicates that groundwater is of relatively good quality despite the proximity of the monitoring positions to the unlined landfill. Groundwater is less mineralised than leachate but does become locally, slightly more mineralised in the wells along the southern edge of the landfill. In recent years, ammonia hasn't commonly been detected above 0.2mg/l in any groundwater wells downgradient of the site (apart from 0.676 mg/l at BH117 in September 2020 and 0.686 at BH117 in September 2022) and potassium has been below 1.0 mg/l. In 2023, the maximum found was 0.35mg/l on one occasion with all other readings <0.2mg/l.

Trace metals have been detected, at times, in groundwater downgradient of the landfill but at low concentrations. The concentration levels detected are low at either below or similar to freshwater EQS. Speciated PAHs were not detected in 2023.

Cadmium has previously been detected in groundwater upgradient and downgradient of the landfill but at a concentration lower than the freshwater EQS. Cadmium, mercury and lead were detected during the latest year of monitoring. However, all detected concentrations were below current freshwater EQS. Similarly, Nickel was detected on more than one occasion, but at concentrations below freshwater EQS.

Given the low TOC content of leachate, all groundwater samples have previously been found to contain <25 mg/l TOC, suggesting that the landfill is not a significant source of organic contaminants. In 2023 trace organics were not detected.

6.2 Assessment against Compliance Levels

The groundwater chemistry observed in 2023 is similar to that observed previously and no breaches of the control and trigger levels occurred, as shown by the summary in Table 6-1.

Table 6-1 Comparison of Groundwater Chemistry with Compliance Levels

	Potassium	Ammoniacal Nitrogen	Chloride
	mg/l	mg/l	mg/l
Trigger Levels (BH101, 103, 104, 105 and 117)	40	10	250
Control Levels (BH101, 103, 104, 105 and 117)	30	4	150
Maximum Value in Groundwater (2016)	4.39	0.631	26.8
Maximum Value in Groundwater (2017)	1.21	0.39	25.6
Maximum Value in Groundwater (2018)	0.966	0.261	25.3
Maximum Value in Groundwater (2019)	1.13	<0.2	25.3
Maximum Value in Groundwater (2020)	1.23	<0.2	24.5
Maximum Value in Groundwater (2021)	1.02	<0.2	20.4
Maximum Value in Groundwater (2022)	16.9	0.686	26.3
Maximum Value in Groundwater (2023)	1.2	0.322	29.3

7 SURFACE WATER

All the surface water results are presented in Appendix 4.

7.1 Contributions

Sample points SW1, SW2, SW3 and SW4 monitor the stream that runs west to east along the southern boundary of the landfill. The location of the surface water sample points is shown on Figure 2.

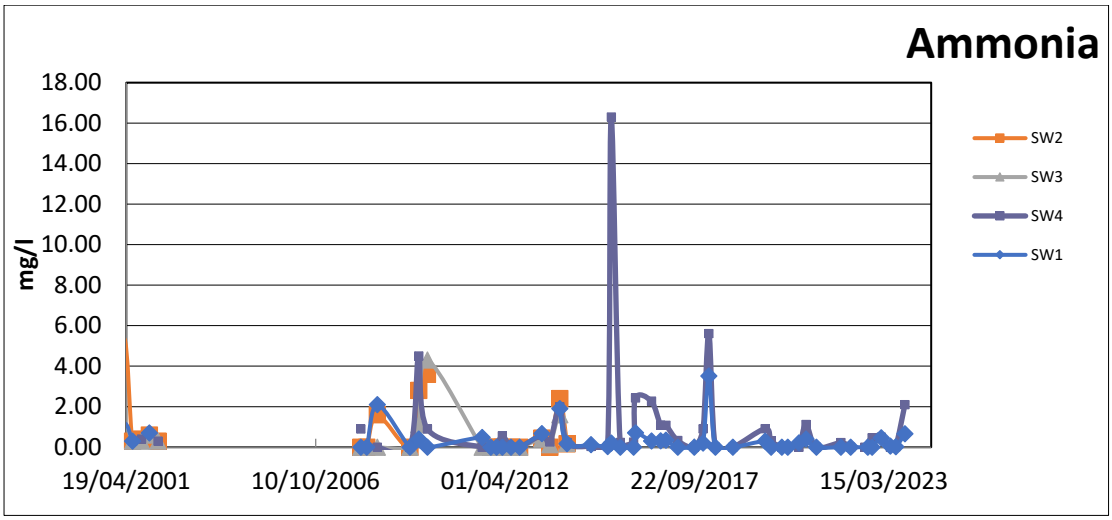
Surface water quality is primarily influenced by input from the CWM treatment lagoons west of the site, the level of leachate treatment achieved at the Phase I treatment plant and surface run-off containing elevated suspended solids from the landfill upgradient of Phase I.

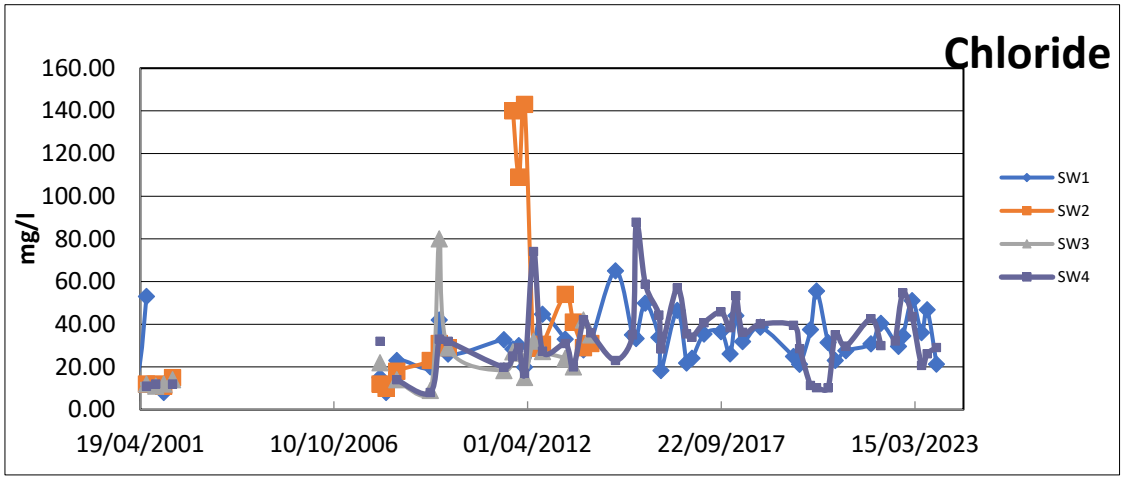
7.2 Quality

As shown in Plate 7-1, surface water quality observed during 2023 is similar to that observed previously.

The quality of surface water leaving the site at SW1 (the furthest point monitored downgradient of the site) is typically improved (more dilute) than the quality issuing into the stream just upstream of SW4 from the settlement lagoons to the west. As highlighted by the graphs reproduced below and further graphs in Appendix 4, this is best observed by comparing the higher concentration of several parameters observed at SW4 with the lower concentrations at SW1. This evaluation demonstrates that water quality at SW1 is dominated by the water quality at SW4 which in-turn is directly downgradient of the CWM settlement lagoons and not related to the Phase I closed landfill or leachate treatment.

Increased concentrations of suspended solids, potassium and chloride are sometimes observed at SW1. This is considered to be due to run-off from the upgradient phases of landfill that enters the stream just above the sample point. This run-off enters from the north and can be traced back to sources upgradient of the Phase I landfill – primarily mobilisation of sediment from access tracks / open areas. This input can be clearly seen in Plate 7-2.





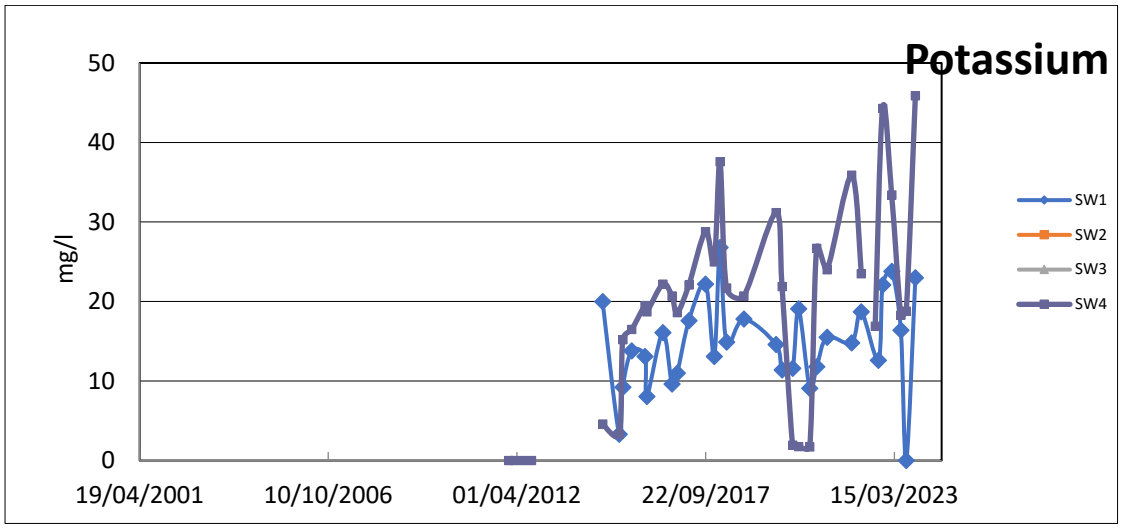


Plate 7-1 Surface Water quality

Plate 7-2 View north over confluence just above sample point SW1

7.3 Assessment against Control Levels

All recent surface water quality was below the emission limits, as summarised in Table 7-1, apart from occasional elevated ammonia. As can be seen by reviewing the graph above, the cause of the increased ammonia at SW1 is due to elevated ammonia upstream of the landfill at SW4. This is linked to the discharge from the lagoons to the west of the site.

Table 7-1 Comparison of Surface Water Data with Emission Levels

	Ammoniacal Nitrogen	Chloride	Suspended Solids
Location	**mg l^{-1}**	**mg l^{-1}**	**mg l^{-1}**
Control Levels			
SW1	**0.6**	**150**	
Cap run-off discharge			**50**
Max values in 2020			
SW1	0.399	55.6	
Cap run-off			<2
Max values in 2021			
SW1	<0.2	30.8	9.5
Cap run-off			<2
Max values in 2022			
SW1	<0.2	34.5	5.7
Cap run-off			<2
Max values in 2022			
SW1	0.66	51.1	
Cap run-off			<2

8 PERIMETER GROUND GAS

During the quarterly monitoring undertaken since April 2013, all methane concentrations have been below the Permit threshold. Methane has been below 0.3% at all monitoring positions since 2014 apart from during 2020 when 0.4% was reported by the instrument.

Carbon dioxide (CO_2) has been detected at several positions along the eastern boundary (BH114, BH115, BH116 & BH118). The latest monitoring is broadly similar to the previous results with all wells found to contain ground gas with less than 0.4% carbon dioxide apart from BH116. At this position, upto 6% has been detected in recent years. Gas flow is typically <0.1 l/h.

As each of the shallow gas wells contain groundwater, the data should be viewed with caution as monitoring gas in wells containing groundwater is not ideal.

9 SUMMARY AND RECOMMENDATIONS

9.1 Environmental Protection

The available data reveals a declining leachate source term. Consequently, the risk to the environment is reducing. With this in mind, CCC should regularly review the operation of the leachate treatment plant to ensure it is an efficient use of resources.

Groundwater and surface water monitoring completed in support of the Permit at Phase I has shown that the landfill is currently having limited impact. The available information shows that the quality of groundwater has not significantly deteriorated since the start of monitoring in 1998.

Potassium is a key contaminant within leachate and despite the mobility of this element it is not significantly elevated in downgradient groundwater. The reason that the landfill is not having a significant impact on groundwater is suspected to be because groundwater has a higher piezometric surface than the basal drainage system of the landfill. The basal drainage system, therefore, intercepts any leachate and groundwater. Consequently, the landfill is largely considered to be hydraulically isolated. The inward groundwater flow may not, however, prevent some outward diffusive transport, as contaminants move from an area of higher concentration to a lower one i.e. from the leachate to the aquifer. This process does not appear to be having a significant impact.

This model is further confirmed by the surrounding groundwater quality which shows little obvious impact from the landfill.

The quality of surface water within the vicinity of the landfill appears to be variable but generally good and is governed by inputs from the surface water treatment lagoons to the west and run-off from the north.

Along the southern flank of the landfill, leachate breakout is known to have previously occurred, but this situation is now being actively managed and controlled by CCC.

9.2 Decommissioning and Surrender

Ahead of the development of the site for the disposal of waste, CCC leased the land from a Mr D Davies as part of a 50-year lease, starting in 1983. Since this time, CWM has purchased the land and is now the landlord. Geotechnology understands that the long-term plan of CCC was to start the process of handing the land lease back to CWM once the materials being stored on the surface have been removed and any remedial works completed. Now that this work has been undertaken Geotechnology suggests that this next stage should be initiated.

During the next phase of site management, Geotechnology understands that CCC will continue to monitor the site and treat leachate and that CWM will continue to be responsible for landfill gas collection and management. Monitoring will continue to be coordinated by CCC until there is no risk to the environment. At that point, a Permit Surrender application will be submitted to NRW bringing together the lines of evidence that demonstrate the site no longer poses a risk to the environment and the infrastructure can be decommissioned. During this period, regular consideration should be given to the performance and suitability of the leachate treatment plant.

Figure 1 Site Location Plan

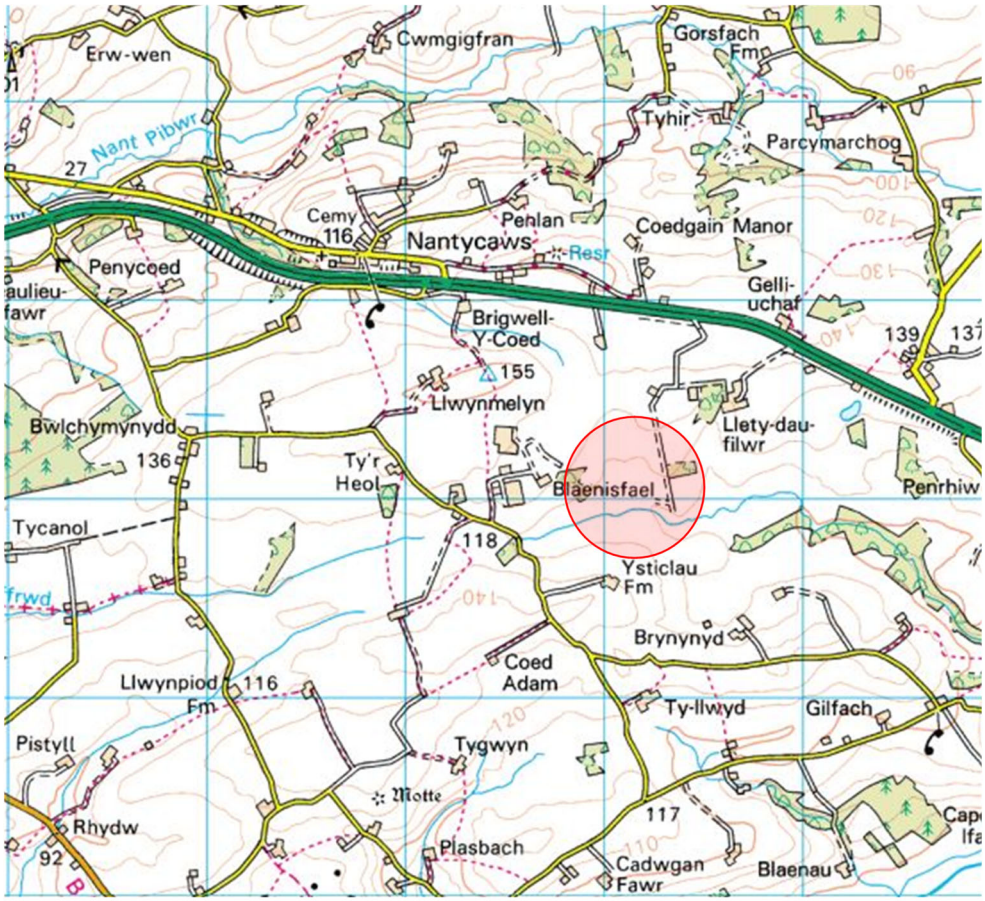


Figure 2 Available Monitoring Network

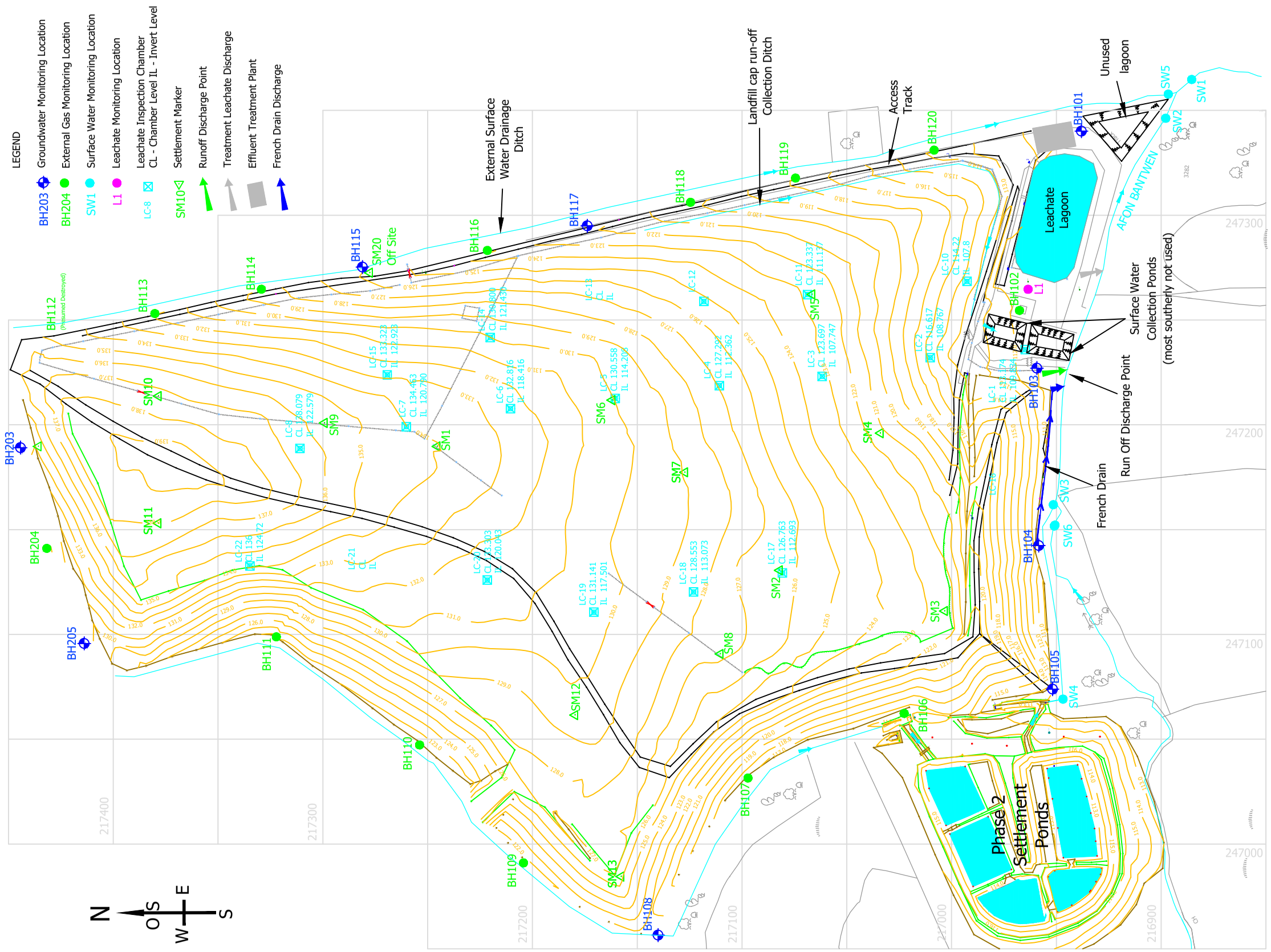
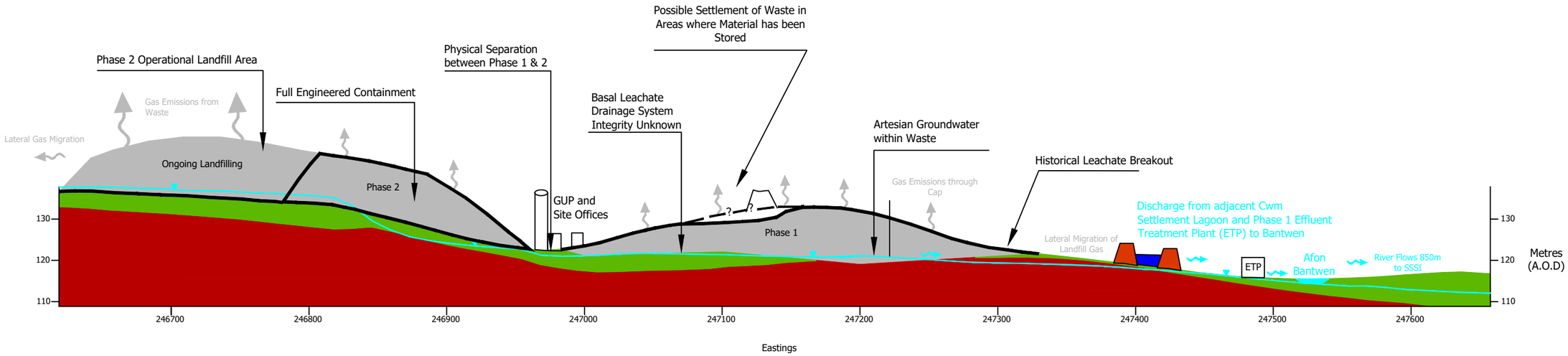


Figure 3 Conceptual Site Model



Legend

- Waste
- Glacial Drift
- Devonian Bedrock
- Potential Landfill Gas Emission
- Potential Seepage to Controlled Water

GUP Gas Utilisation Plant
ETP Effluent Treatment Plant

Note:
Landfill gas can give rise to odour and migrate laterally

NANT Y CAWS
PHASE 1
CLOSED LANDFILL

ENVIRONMENTAL
PERMIT 34183

Environmental
Monitoring Review

Appendix 1
Laboratory Certificates
Report Number 2396r1v1d1123

Unit 7-8 Hawarden Business Park
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CH5 3US
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email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Geotechnology
5 Cefn-yr-Allt
Aberdulais
Neath
West Glamorgan
SA10 8HE

Attention: Ben Rees

CERTIFICATE OF ANALYSIS

Date of report Generation:	22 February 2023
Customer:	Geotechnology
Sample Delivery Group (SDG):	230216-101
Your Reference:	
Location:	Carmarthen
Report No:	679571
Order Number:	

We received 13 samples on Thursday February 16, 2023 and 13 of these samples were scheduled for analysis which was completed on Wednesday February 22, 2023. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan

Operations Manager

1291

CERTIFICATE OF ANALYSIS

SDG: 230216-101 **Report Number:** 679571 **Superseded Report:**
Client Ref.: **Location:** Carmarthen

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
27563097	BH10			15/02/2023
27563081	BH101			14/02/2023
27563083	BH103			14/02/2023
27563084	BH104			14/02/2023
27563085	BH105			14/02/2023
27563087	BH117			14/02/2023
27563094	EFFLUENT			15/02/2023
27563093	INFLUENT			15/02/2023
27563088	NYC SW1			14/02/2023
27563089	NYC SW4			14/02/2023
27563090	RUNOFF			14/02/2023
27563091	WERN SW2			15/02/2023
27563092	WERN SW4			15/02/2023

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG: 230216-101 **Report Number:** 679571 **Superseded Report:**
Client Ref.: **Location:** Carmarthen

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

			Lab Sample No(s)	27563097	27563081	27563083	27563084	27563085	27563087	27563094	27563093
			Customer Sample Reference	BH10	BH101	BH103	BH104	BH105	BH117	EFFLUENT	INFLUENT
			AGS Reference								
			Depth (m)								
			Container	500ml Plastic (ALE208)	H2SO4 (ALE244)	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	500ml Plastic (ALE208)	H2SO4 (ALE244)	500ml Plastic (ALE208)	H2SO4 (ALE244)	500ml Plastic (ALE208)	H2SO4 (ALE244)	500ml Plastic (ALE208)	H2SO4 (ALE244)	HNO3 Filtered (ALE204)	500ml Plastic (ALE208)	H2SO4 (ALE244)
			Sample Type	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	SW	SW	SW	SW	SW
Alkalinity as CaCO3	All	NDPs: 0 Tests: 7			X		X		X		X			X								
Ammoniacal Nitrogen	All	NDPs: 0 Tests: 12		X		X			X		X		X			X		X				X
Anions by Kone (w)	All	NDPs: 0 Tests: 12	X		X			X		X		X				X		X			X	
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 12	X				X	X		X				X	X					X		
pH Value	All	NDPs: 0 Tests: 13	X		X			X		X		X				X		X			X	
Suspended Solids	All	NDPs: 0 Tests: 5																	X		X	

27563092	WERN SW4			HNO3 Filtered (ALE204)	SW									X					
				H2SO4 (ALE244)	SW					X									
				500ml Plastic (ALE208)	SW							X				X			
27563091	WERN SW2			HNO3 Filtered (ALE204)	SW									X					
				H2SO4 (ALE244)	SW					X									
				500ml Plastic (ALE208)	SW							X				X			
27563090	RUNOFF			500ml Plastic (ALE208)	SW											X		X	
27563089	NYC SW4			HNO3 Filtered (ALE204)	SW									X					
				H2SO4 (ALE244)	SW					X									
				500ml Plastic (ALE208)	SW		X				X					X		X	
27563088	NYC SW1			HNO3 Filtered (ALE204)	SW									X					
				H2SO4 (ALE244)	SW					X									
				500ml Plastic (ALE208)	SW		X				X					X		X	
27563093	INFLUENT			HNO3 Filtered (ALE204)	SW									X					

Validated

CERTIFICATE OF ANALYSIS

SDG: 230216-101 **Report Number:** 679571 **Superseded Report:**

Client Ref.: **Location:** Carmarthen

Results Legend	
#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH10	BH101	BH103	BH104	BH105	BH117
			Depth (m)	.	.	.	.	.	.
			Sample Type	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)	Ground Water (GW)
			Date Sampled	15/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023	14/02/2023
			Sample Time	.	.	.	.	.	.
			Date Received	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023
			SDG Ref	230216-101	230216-101	230216-101	230216-101	230216-101	230216-101
			Lab Sample No.(s)	27563097	27563081	27563083	27563084	27563085	27563087
			AGS Reference						
Alkalinity, Total as CaCO3	<2 mg/l	TM043			225 #	210 #	280 #	285 #	290 #
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099		165 #	<0.2 #	0.296 #	0.322 #	<0.2 #	0.228 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152		31.5 2 #	0.946 #	0.991 2 #	1.08 2 #	1.17 #	0.682 2 #
Chloride	<2 mg/l	TM184		243 #	14.3 #	15.3 #	14.1 #	11.4 #	24.2 #
pH	<1 pH Units	TM256		6.95 #	7.9 #	7.76 #	7.58 #	7.38 #	7.42 #
Conductivity @ 20 deg.C	<0.02 mS/cm	TM256		2.92 #	0.446 #	0.422 #	0.521 #	0.499 #	0.537 #

Validated

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Client Ref.: **Location:** Carmarthen

Results Legend	
#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	EFFLUENT	INFLUENT	NYC SW1	NYC SW4	RUNOFF	WERN SW2
			Depth (m)	.	.	.	.	.	.
			Sample Type	Surface Water (SW)	Surface Water (SW)	Surface Water (SW)	Surface Water (SW)	Surface Water (SW)	Surface Water (SW)
			Date Sampled	15/02/2023	15/02/2023	14/02/2023	14/02/2023	14/02/2023	15/02/2023
			Sample Time	.	.	.	.	.	.
			Date Received	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023	16/02/2023
			SDG Ref	230216-101	230216-101	230216-101	230216-101	230216-101	230216-101
			Lab Sample No.(s)	27563094	27563093	27563088	27563089	27563090	27563091
			AGS Reference						
Suspended solids, Total	<2 mg/l	TM022		8.25 #	19.6 #	<2 #	3 #	<2 #	
Alkalinity, Total as CaCO3	<2 mg/l	TM043				185 #	195 #		
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099		51.6 #	54 #	0.46 #	0.492 #		<0.2 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152		28.3 #	28.1 #	23.8 #	33.4 #		5.74 #
Chloride	<2 mg/l	TM184		148 #	151 #	51.1 #	43.4 #		17.5 #
pH	<1 pH Units	TM256				8.07 #	7.87 #	8.27 #	8.11 #
Conductivity @ 20 deg.C	<0.02 mS/cm	TM256		1.57 #	1.62 #	0.583 #	0.532 #	0.516 #	0.58 #

Validated

CERTIFICATE OF ANALYSIS

SDG: 230216-101 **Report Number:** 679571 **Superseded Report:**

Client Ref.: **Location:** Carmarthen

Results Legend	
#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	WERN SW4
Customer Sample Ref.			
Depth (m)			.
Sample Type			Surface Water (SW)
Date Sampled			15/02/2023
Sample Time			.
Date Received			16/02/2023
SDG Ref			230216-101
Lab Sample No.(s)			27563092
AGS Reference			
Ammoniacal Nitrogen as N	<0.2 mg/l	TM099	0.731 #
Potassium (Dis.Filt)	<0.2 mg/l	TM152	3.12 #
Chloride	<2 mg/l	TM184	43.1 #
pH	<1 pH Units	TM256	8.16 #
Conductivity @ 20 deg.C	<0.02 mS/cm	TM256	0.478 #

Table of Results - Appendix

Method No	Description
TM022	Determination of total suspended solids in waters
TM043	Determination of alkalinity in aqueous samples
TM099	Determination of Ammonium in Water Samples using the Kone Analyser
TM152	Analysis of Aqueous Samples by ICP-MS
TM184	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM256	Determination of pH, EC, TDS and Alkalinity in Aqueous samples

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).

CERTIFICATE OF ANALYSIS

SDG: 230216-101 **Report Number:** 679571 **Superseded Report:**
Client Ref.: **Location:** Carmarthen

Test Completion Dates

Lab Sample No(s)	27563097	27563081	27563083	27563084	27563085	27563087	27563094	27563093	27563088	27563089
Customer Sample Ref.	BH10	BH101	BH103	BH104	BH105	BH117	EFFLUENT	INFLUENT	NYC SW1	NYC SW4
AGS Ref.										
Depth										
Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water	Surface Water	Surface Water
Alkalinity as CaCO3		21-Feb-2023	21-Feb-2023	21-Feb-2023	21-Feb-2023	21-Feb-2023			21-Feb-2023	21-Feb-2023
Ammoniacal Nitrogen	22-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023	22-Feb-2023
Anions by Kone (w)	18-Feb-2023	18-Feb-2023	18-Feb-2023	18-Feb-2023	18-Feb-2023	18-Feb-2023	20-Feb-2023	20-Feb-2023	18-Feb-2023	18-Feb-2023
Dissolved Metals by ICP-MS	20-Feb-2023	20-Feb-2023	20-Feb-2023	20-Feb-2023	20-Feb-2023	20-Feb-2023	21-Feb-2023	21-Feb-2023	20-Feb-2023	20-Feb-2023
pH Value	21-Feb-2023	21-Feb-2023	21-Feb-2023	21-Feb-2023	21-Feb-2023	21-Feb-2023	21-Feb-2023	21-Feb-2023	21-Feb-2023	21-Feb-2023
Suspended Solids							20-Feb-2023	20-Feb-2023	20-Feb-2023	20-Feb-2023

Lab Sample No(s)	27563090	27563091	27563092
Customer Sample Ref.	RUNOFF	WERN SW2	WERN SW4
AGS Ref.			
Depth			
Type	Surface Water	Surface Water	Surface Water
Ammoniacal Nitrogen		22-Feb-2023	22-Feb-2023
Anions by Kone (w)		18-Feb-2023	18-Feb-2023
Dissolved Metals by ICP-MS		20-Feb-2023	20-Feb-2023
pH Value	21-Feb-2023	21-Feb-2023	21-Feb-2023
Suspended Solids	20-Feb-2023		

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as “mixed hydrocarbons”. Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials andd soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Ben Rees
Geotechnology Ltd
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Fax: 01269 841867
Email: info@decusuk.co.uk

Certificate of Analysis Number: 6721

Project/Site name:	Nant Y Caws
Quotation Number:	DS230430
Order Number:	1537 / 2280
Sample Matrix:	Groundwater, Surface Water, Leachate

Samples Taken:	22/05/2023
Samples Received:	22/05/2023
Date Instructed:	22/05/2023
Analysis Complete:	30/05/2023
Report Issued:	02/06/2023
Sampled By:	Jack Morgan

Amendment Records:
None

UKAS TESTING
4303

Approved by: Adam Whitehouse

Signature:

Title: Laboratory Manager

Client: Geotechnology Ltd
FAO: Ben Rees

Certificate of Analysis Number: 6721

Results of analysis of 8 samples recieved on the 22/05/2023

Report Date
02/06/2023

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**220523005**	**220523006**	**220523007**
Client Sample Reference:				BH101	BH103	BH104
Sample Date:				22/05/2023	22/05/2023	22/05/2023
Sample Matrix:				Groundwater	Groundwater	Groundwater
INORG-L01	pH	pH units	A	7.7	7.6	7.3
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	472	445	577
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	284	266	371
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	0.08	0.01	0.01
INORG-L13	Chloride	$mg.l^{-1}$	A	14.5	15.7	14.0
INORG-L21.1	Ortho-Phosphate	$mg.l^{-1}$	A	0.10	0.12	0.08
METALS-L	Total Hardness	$mg.l^{-1}$	A	239	225	316
METALS-L	Sulphate	$mg.l^{-1}$	A	7.6	6.6	12.1
METALS-L	Copper	$\mu g.l^{-1}$	A	<0.8	<0.8	<0.8
METALS-L	Chromium (Total)	$\mu g.l^{-1}$	A	5.8	5.6	5.9
METALS-L	Zinc	$\mu g.l^{-1}$	A	<1.1	2.9	1.4
METALS-L	Nickel	$\mu g.l^{-1}$	A	<1.5	<1.5	<1.5
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.11	<0.11	<0.11
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	<4.1	<4.1
1455	Arsenic	$\mu g.l^{-1}$	S-A	<0.20	0.36	0.33
METALS-L	Barium	$\mu g.l^{-1}$	A	125	60.0	16.9
METALS-L	Boron	$\mu g.l^{-1}$	A	<6.5	<6.5	<6.5
METALS-L	Barium	$\mu g.l^{-1}$	A	125	60.0	16.9
METALS-L	Beryllium	$\mu g.l^{-1}$	A	<0.5	<0.5	<0.5
METALS-L	Iron	$\mu g.l^{-1}$	A	2.7	2.2	2.8
METALS-L	Manganese	$\mu g.l^{-1}$	A	1.1	<1.0	2.8
METALS-L	Calcium	$mg.l^{-1}$	A	75.3	76.0	106
METALS-L	Magnesium	$mg.l^{-1}$	A	12.4	8.6	12.3
METALS-L	Sodium	$mg.l^{-1}$	A	16.4	15.2	14.8
METALS-L	Potassium	$mg.l^{-1}$	A	0.41	0.21	0.22
METALS-L	Phosphate total	$mg.l^{-1}$	A	<0.2	<0.2	<0.2
1455	Mercury	$\mu g.l^{-1}$	S-A	<0.05	<0.05	<0.05
ORG-L17	Mecoprop	$\mu g.l^{-1}$	N	<0.1	<0.1	<0.1
ORG-L02	Naphthalene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Acenapthylene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Acenaphthene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Fluorene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Phenanthrene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Anthracene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Fluoranthene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Pyrene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Benzo(a)anthracene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Chrysene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Benzo(b)Fluoranthene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Benzo(a)pyrene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Indeno(123-cd)pyrene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Benzo(ghi)perylene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Dibenza(ah)anthracene	µg.l-1	N	<0.05	<0.05	<0.05
ORG-L02	Total PAHs	µg.l-1	N	<1.0	<1.0	<1.0

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UKAS TESTING
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Client: Geotechnology Ltd
FAO: Ben Rees

Certificate of Analysis Number: 6721

Results of analysis of 8 samples recieved on the 22/05/2023

Report Date
02/06/2023

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**220523008**	**220523009**	-
Client Sample Reference:				BH105	BH117	-
Sample Date:				22/05/2023	22/05/2023	-
Sample Matrix:				Groundwater	Groundwater	-
INORG-L01	pH	pH units	A	7.3	7.3	-
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	535	577	-
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	350	356	-
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	0.03	0.09	-
INORG-L13	Chloride	$mg.l^{-1}$	A	14.9	29.3	-
INORG-L21.1	Ortho-Phosphate	$mg.l^{-1}$	A	0.20	0.46	-
METALS-L	Total Hardness	$mg.l^{-1}$	A	292	294	-
METALS-L	Sulphate	$mg.l^{-1}$	A	6.2	11.8	-
METALS-L	Copper	$\mu g.l^{-1}$	A	<0.8	<0.8	-
METALS-L	Chromium (Total)	$\mu g.l^{-1}$	A	5.5	<1.0	-
METALS-L	Zinc	$\mu g.l^{-1}$	A	<1.1	<1.1	-
METALS-L	Nickel	$\mu g.l^{-1}$	A	<1.5	<1.5	-
METALS-L	Cadmium	$\mu g.l^{-1}$	A	<0.11	<0.11	-
METALS-L	Lead	$\mu g.l^{-1}$	A	<4.1	<4.1	-
1455	Arsenic	$\mu g.l^{-1}$	S-A	<0.20	0.85	-
METALS-L	Barium	$\mu g.l^{-1}$	A	65.2	117	-
METALS-L	Boron	$\mu g.l^{-1}$	A	<6.5	<6.5	-
METALS-L	Barium	$\mu g.l^{-1}$	A	65.2	117	-
METALS-L	Beryllium	$\mu g.l^{-1}$	A	<0.5	<0.5	-
METALS-L	Iron	$\mu g.l^{-1}$	A	2.1	1.8	-
METALS-L	Manganese	$\mu g.l^{-1}$	A	14.2	280	-
METALS-L	Calcium	$mg.l^{-1}$	A	99.5	105	-
METALS-L	Magnesium	$mg.l^{-1}$	A	10.6	7.8	-
METALS-L	Sodium	$mg.l^{-1}$	A	12.9	14.0	-
METALS-L	Potassium	$mg.l^{-1}$	A	0.29	<0.2	-
METALS-L	Phosphate total	$mg.l^{-1}$	A	<0.2	<0.2	-
1455	Mercury	$\mu g.l^{-1}$	S-A	<0.05	<0.05	-
ORG-L17	Mecoprop	$\mu g.l^{-1}$	N	<0.1	<0.1	-
ORG-L02	Naphthalene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Acenapthylene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Acenaphthene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Fluorene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Phenanthrene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Anthracene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Fluoranthene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Pyrene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Benzo(a)anthracene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Chrysene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Benzo(b)Fluoranthene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Benzo(a)pyrene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Indeno(123-cd)pyrene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Benzo(ghi)perylene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Dibenza(ah)anthracene	µg.l-1	N	<0.05	<0.05	-
ORG-L02	Total PAHs	µg.l-1	N	<1.0	<1.0	-

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Client: Geotechnology Ltd
FAO: Ben Rees

Certificate of Analysis Number: 6721

Results of analysis of 8 samples recieved on the 22/05/2023

Report Date
02/06/2023

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**220523010**	**220523011**	**-**
Client Sample Reference:				SW1 NYC	SW4 NYC	-
Sample Date:				22/05/2023	22/05/2023	-
Sample Matrix:				Surface Water	Surface Water	-
INORG-L01	pH	pH units	A	8.0	8.1	-
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	516	432	-
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	236	224	-
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	0.05	0.02	-
INORG-L13	Chloride	$mg.l^{-1}$	A	36.1	20.7	-
INORG-L10	Total Suspended Solids	$mg.l^{-1}$	A	0.4	<1.5	-
METALS-L	Potassium	$mg.l^{-1}$	A	16.4	18.3	-

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Client: Geotechnology Ltd
FAO: Ben Rees

Certificate of Analysis Number: 6721

Results of analysis of 8 samples recieved on the 22/05/2023

Report Date
02/06/2023

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**220523012**	**-**	**-**
Client Sample Reference:				L1	-	-
Sample Date:				22/05/2023	-	-
Sample Matrix:				Leachate	-	-
INORG-L01	pH	pH units	N	7.7	-	-
INORG-L02	Conductivity	$\mu S.cm^{-1}$	N	1,203	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	N	346	-	-
INORG-L12	Ammonia	$mg.l^{-1}$ as N	N	9.4	-	-
INORG-L13	Chloride	$mg.l^{-1}$	N	135	-	-
INORG-L21.1	Ortho-Phosphate	$mg.l^{-1}$	N	0.19	-	-
METALS-L	Total Hardness	$mg.l^{-1}$	N	314	-	-
METALS-L	Sulphate	$mg.l^{-1}$	N	10.6	-	-
METALS-L	Copper	$\mu g.l^{-1}$	N	<0.8	-	-
METALS-L	Chromium (Total)	$\mu g.l^{-1}$	N	6.3	-	-
METALS-L	Zinc	$\mu g.l^{-1}$	N	5.0	-	-
METALS-L	Nickel	$\mu g.l^{-1}$	N	<1.5	-	-
METALS-L	Cadmium	$\mu g.l^{-1}$	N	<0.11	-	-
METALS-L	Lead	$\mu g.l^{-1}$	N	<4.1	-	-
1455	Arsenic	$\mu g.l^{-1}$	S-A	0.62	-	-
METALS-L	Barium	$\mu g.l^{-1}$	N	101	-	-
METALS-L	Boron	$\mu g.l^{-1}$	N	222	-	-
METALS-L	Barium	$\mu g.l^{-1}$	N	101	-	-
METALS-L	Beryllium	$\mu g.l^{-1}$	N	<0.5	-	-
METALS-L	Iron	$\mu g.l^{-1}$	N	93.1	-	-
METALS-L	Manganese	$\mu g.l^{-1}$	N	180	-	-
METALS-L	Calcium	$mg.l^{-1}$	N	93.9	-	-
METALS-L	Magnesium	$mg.l^{-1}$	N	19.3	-	-
METALS-L	Sodium	$mg.l^{-1}$	N	89.0	-	-
METALS-L	Potassium	$mg.l^{-1}$	N	47.1	-	-
METALS-L	Phosphate total	$mg.l^{-1}$	N	<0.21	-	-
1455	Mercury	$\mu g.l^{-1}$	S-A	<0.05	-	-
ORG-L17	Mecoprop	$\mu g.l^{-1}$	N	<0.1	-	-
ORG-L02	Naphthalene	µg.l-1	N	<0.05	-	-
ORG-L02	Acenapthylene	µg.l-1	N	<0.05	-	-
ORG-L02	Acenaphthene	µg.l-1	N	<0.05	-	-
ORG-L02	Fluorene	µg.l-1	N	<0.05	-	-
ORG-L02	Phenanthrene	µg.l-1	N	<0.05	-	-
ORG-L02	Anthracene	µg.l-1	N	<0.05	-	-
ORG-L02	Fluoranthene	µg.l-1	N	<0.05	-	-
ORG-L02	Pyrene	µg.l-1	N	<0.05	-	-
ORG-L02	Benzo(a)anthracene	µg.l-1	N	<0.05	-	-
ORG-L02	Chrysene	µg.l-1	N	<0.05	-	-
ORG-L02	Benzo(b)Fluoranthene	µg.l-1	N	<0.05	-	-
ORG-L02	Benzo(a)pyrene	µg.l-1	N	<0.05	-	-
ORG-L02	Indeno(123-cd)pyrene	µg.l-1	N	<0.05	-	-
ORG-L02	Benzo(ghi)perylene	µg.l-1	N	<0.05	-	-
ORG-L02	Dibenza(ah)anthracene	µg.l-1	N	<0.05	-	-
ORG-L02	Total PAHs	µg.l-1	N	<1.0	-	-

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Analytical Method	Method Code	Accreditation Status
Determination of Metals in water by ICP-MS (Sub-contracted method)	1455	ISO 17025
Determination of pH in waters by discrete analyser ECM unit (In-house method)	INORG-L01	ISO 17025
Determination of Conductivity in water by ECM discrete analyser (In-house method)	INORG-L02	ISO 17025
Determination of Alkalinity in water by discrete analyser (In-house method)	INORG-L09	ISO 17025
Determination of suspended solids in water by gravimetric analysis (In-house method)	INORG-L10	ISO 17025
Determination of ammonia in waters by Discrete Analyser (In-house method)	INORG-L12	ISO 17025
Determination of Chloride in water by Discrete Analyser (In-house method)	INORG-L13	ISO 17025
Determination of Ortho-phosphate in water by Discrete Analyser (In-house method)	INORG-L21.1	ISO 17025
Determination of metals in waters by ICP-OES (In-house method)	METALS-L	ISO 17025
Determination of PAHs in water by GC-MS (In-house method)	ORG-L02	None
Determination of mecoprop in waters by GC-MS (In-house method)	ORG-L17	None

Disposal Times:

All water samples will be retained for a period of two weeks and all soil samples retained for a period of one month following the date of the issued certificate.

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A full list of determinants relating to abbreviations such as PAHs, VOCs, SVOCs, PCBs etc. is available upon request.

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[I/S]: Insufficient Sample
[U/S]: Unsuitable Sample
[A]: Date of Sampling not supplied
[B]: Sample age exceeds recommended storage time
[C]: Samples not received in appropriate containers
[D]: Broken Container
< "Less Than"
> "Greater Than"

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Tel: 01269 844558
Fax: 01269 841867
Email: info@decusuk.co.uk

Certificate of Analysis Number: 6863

Project/Site name:	Nant Y Caws
Quotation Number:	DS230428
Order Number:	1537 / 2280
Sample Matrix:	Groundwater, Surface Water

Samples Taken:	18/07/2023
Samples Received:	19/07/2023
Date Instructed:	19/07/2023
Analysis Complete:	19/07/2023
Report Issued:	24/07/2023
Sampled By:	Jack Morgan

Amendment Records:
None

UKAS TESTING
4303

Approved by: Adam Whitehouse

Signature:

Title: Laboratory Manager

Client: Geotechnology Ltd
FAO: Ben Rees

Certificate of Analysis Number: 6863

Results of analysis of 7 samples recieved on the 19/07/2023

Report Date
24/07/2023

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**190723005**	**190723006**	**190723007**
Client Sample Reference:				BH101	BH103	BH104
Sample Date:				18/07/2023	18/07/2023	18/07/2023
Sample Matrix:				Groundwater	Groundwater	Groundwater
INORG-L01	pH	pH units	A	7.8	7.8	7.4
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	398	372	495
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	286	267	376
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	0.04	0.04	0.23
INORG-L13	Chloride	$mg.l^{-1}$	A	15.0	15.6	13.8
METALS-L	Sodium	$mg.l^{-1}$	A	15.3	-	12.5
METALS-L	Potassium	$mg.l^{-1}$	A	0.78	0.64	0.90

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**190723008**	**190723009**	**190723010**
Client Sample Reference:				BH105	BH117	SW1NYC
Sample Date:				18/07/2023	18/07/2023	18/07/2023
Sample Matrix:				Groundwater	Groundwater	Surface Water
INORG-L01	pH	pH units	A	7.4	7.5	8.3
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	455	497	484
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	353	347	228
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	0.04	0.01	0.02
INORG-L13	Chloride	$mg.l^{-1}$	A	12.4	25.5	46.8
METALS-L	Sodium	$mg.l^{-1}$	A	11.0	12.2	26.0
METALS-L	Potassium	$mg.l^{-1}$	A	0.75	0.55	-

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**190723011**	**-**	**-**
Client Sample Reference:				SW4NYC	-	-
Sample Date:				18/07/2023	-	-
Sample Matrix:				Surface Water	-	-
INORG-L01	pH	pH units	A	8.3	-	-
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	335	-	-
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	195	-	-
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	0.02	-	-
INORG-L13	Chloride	$mg.l^{-1}$	A	26.2	-	-
METALS-L	Potassium	$mg.l^{-1}$	A	18.8	-	-

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Certificate of Analysis Number: 6863

Results of analysis of 7 samples recieved on the 19/07/2023

Analytical Method	Method Code	Accreditation Status
Determination of pH in waters by discrete analyser ECM unit (In-house method)	INORG-L01	ISO 17025
Determination of Conductivity in water by ECM discrete analyser (In-house method)	INORG-L02	ISO 17025
Determination of Alkalinity in water by discrete analyser (In-house method)	INORG-L09	ISO 17025
Determination of ammonia in waters by Discrete Analyser (In-house method)	INORG-L12	ISO 17025
Determination of Chloride in water by Discrete Analyser (In-house method)	INORG-L13	ISO 17025
Determination of metals in waters by ICP-OES (In-house method)	METALS-L	ISO 17025

Disposal Times:

All water samples will be retained for a period of two weeks and all soil samples retained for a period of one month following the date of the issued certificate.

All results only relate to the items tested.

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Tel: 01269 844558
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Email: info@decusuk.co.uk

Certificate of Analysis Number: 7101

Project/Site name:	Nant Y Caws
Quotation Number:	DS230430
Order Number:	1537/2280
Sample Matrix:	Groundwater, Surface Water, Leachate

Samples Taken:	23/10/2023
Samples Received:	24/10/2023
Date Instructed:	24/10/2023
Analysis Complete:	27/10/2023
Report Issued:	30/10/2023
Sampled By:	Jack Morgan

Amendment Records:
None

UKAS TESTING
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Approved by: Adam Whitehouse

Signature:

Title: Laboratory Manager

Certificate of Analysis Number: 7101

Results of analysis of 9 samples recieved on the 24/10/2023

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**241023037**	**241023038**	**241023039**
Client Sample Reference:				BH101	BH103	BH104
Sample Date & Time:				23/10/2023	23/10/2023	23/10/2023
Sample Matrix:				Groundwater	Groundwater	Groundwater
INORG-L01	pH	pH units	A	7.4	7.3	7.0
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	474	434	598
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	293	270	345
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	0.35	0.10	0.06
INORG-L13	Chloride	$mg.l^{-1}$	A	13.5	13.8	7.2
METALS-L	Sodium	$mg.l^{-1}$	A	18.0	16.5	13.2
METALS-L	Potassium	$mg.l^{-1}$	A	1.2	1.1	0.81

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**241023040**	**241023041**	**241023042**
Client Sample Reference:				BH105	BH117	SW1NYC
Sample Date & Time:				23/10/2023	23/10/2023	23/10/2023
Sample Matrix:				Groundwater	Groundwater	Surface Water
INORG-L01	pH	pH units	A	7.0	7.0	7.6
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	526	567	434
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	352	342	212
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	0.10	0.21	0.66
INORG-L13	Chloride	$mg.l^{-1}$	A	12.5	22.3	21.3
INORG-L10	Total Suspended Solids	$mg.l^{-1}$	A	-	-	4.0
METALS-L	Sodium	$mg.l^{-1}$	A	13.6	12.8	-
METALS-L	Potassium	$mg.l^{-1}$	A	1.0	0.53	23.0

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**241023043**	**241023044**	**241023045**
Client Sample Reference:				SW4NYC	RunOff	L1
Sample Date & Time:				23/10/2023	23/10/2023	23/10/2023
Sample Matrix:				Surface Water	Surface Water	Leachate
INORG-L01	pH	pH units	A	7.6	7.6	7.2
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	611	608	1,321
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	299	391	-
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	2.1	0.09	-
INORG-L13	Chloride	$mg.l^{-1}$	A	29.1	11.9	-
INORG-L10	Total Suspended Solids	$mg.l^{-1}$	A	4.0	<1.5	2.4
METALS-L	Potassium	$mg.l^{-1}$	A	45.9	18.6	-

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Analytical Method	Method Code	Accreditation Status
Determination of pH in waters by discrete analyser ECM unit (In-house method)	INORG-L01	ISO/IEC 17025
Determination of Conductivity in water by ECM discrete analyser (In-house method)	INORG-L02	ISO/IEC 17025
Determination of Alkalinity in water by discrete analyser (In-house method)	INORG-L09	ISO/IEC 17025
Determination of suspended solids in water by gravimetric analysis (In-house method)	INORG-L10	ISO/IEC 17025
Determination of ammonia in waters by Discrete Analyser (In-house method)	INORG-L12	ISO/IEC 17025
Determination of Chloride in water by Discrete Analyser (In-house method)	INORG-L13	ISO/IEC 17025
Determination of metals in waters by ICP-OES (In-house method)	METALS-L	ISO/IEC 17025

Key and Comments:

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[U/S]: Unsuitable Sample.
[A]: Date of Sampling not supplied.
[B]: Sample tested outside the recommended stability times, results may be compromised.
[C]: Samples not received in appropriate containers, results may be compromised.
[D]: Broken Container, results may be compromised.
[T]: Transportation storage temperature is outside the recommended range, results maybe compromised.
[H]: High levels of non-target bacterial growth present which could have suppressed the growth of the target species.
[M]: Media quality control failure, results may be compromised.
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< "Less Than"
> "Greater Than"
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Uncertainties of measurement values are avaliable upon request.

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* Accreditation Status
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UKAS TESTING
4303

Ben Rees
Geotechnology Ltd
Ty Coed
5 Cefn yr Allt
Aberdulais
Neath

Decus Research Limited
ExCAL House
Capel Hendre Industrial Estate
Ammanford
Carmarthenshire
SA18 3SJ

Tel: 01269 844558
Fax: 01269 841867
Email: info@decusuk.co.uk

Certificate of Analysis Number: 7101

Project/Site name:	Nant Y Caws
Quotation Number:	DS230430
Order Number:	1537/2280
Sample Matrix:	Groundwater, Surface Water, Leachate

Samples Taken:	23/10/2023
Samples Received:	24/10/2023
Date Instructed:	24/10/2023
Analysis Complete:	27/10/2023
Report Issued:	30/10/2023
Sampled By:	Jack Morgan

Amendment Records:
None

UKAS TESTING
4303

Approved by: Adam Whitehouse

Signature:

Title: Laboratory Manager

Certificate of Analysis Number: 7101

Results of analysis of 9 samples recieved on the 24/10/2023

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**241023037**	**241023038**	**241023039**
Client Sample Reference:				BH101	BH103	BH104
Sample Date & Time:				23/10/2023	23/10/2023	23/10/2023
Sample Matrix:				Groundwater	Groundwater	Groundwater
INORG-L01	pH	pH units	A	7.4	7.3	7.0
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	474	434	598
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	293	270	345
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	0.35	0.10	0.06
INORG-L13	Chloride	$mg.l^{-1}$	A	13.5	13.8	7.2
METALS-L	Sodium	$mg.l^{-1}$	A	18.0	16.5	13.2
METALS-L	Potassium	$mg.l^{-1}$	A	1.2	1.1	0.81

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**241023040**	**241023041**	**241023042**
Client Sample Reference:				BH105	BH117	SW1NYC
Sample Date & Time:				23/10/2023	23/10/2023	23/10/2023
Sample Matrix:				Groundwater	Groundwater	Surface Water
INORG-L01	pH	pH units	A	7.0	7.0	7.6
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	526	567	434
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	352	342	212
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	0.10	0.21	0.66
INORG-L13	Chloride	$mg.l^{-1}$	A	12.5	22.3	21.3
INORG-L10	Total Suspended Solids	$mg.l^{-1}$	A	-	-	4.0
METALS-L	Sodium	$mg.l^{-1}$	A	13.6	12.8	-
METALS-L	Potassium	$mg.l^{-1}$	A	1.0	0.53	23.0

Code	Determinand	Units	*	Sample Identification		
Laboratory Sample Number:				**241023043**	**241023044**	**241023045**
Client Sample Reference:				SW4NYC	RunOff	L1
Sample Date & Time:				23/10/2023	23/10/2023	23/10/2023
Sample Matrix:				Surface Water	Surface Water	Leachate
INORG-L01	pH	pH units	A	7.6	7.6	7.2
INORG-L02	Conductivity	$\mu S.cm^{-1}$	A	611	608	1,321
INORG-L09	Alkalinity	$mg.l^{-1}$ as HCO_3	A	299	391	-
INORG-L12	Ammonia	$mg.l^{-1}$ as N	A	2.1	0.09	-
INORG-L13	Chloride	$mg.l^{-1}$	A	29.1	11.9	-
INORG-L10	Total Suspended Solids	$mg.l^{-1}$	A	4.0	<1.5	2.4
METALS-L	Potassium	$mg.l^{-1}$	A	45.9	18.6	-

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Determination of Alkalinity in water by discrete analyser (In-house method)	INORG-L09	ISO/IEC 17025
Determination of suspended solids in water by gravimetric analysis (In-house method)	INORG-L10	ISO/IEC 17025
Determination of ammonia in waters by Discrete Analyser (In-house method)	INORG-L12	ISO/IEC 17025
Determination of Chloride in water by Discrete Analyser (In-house method)	INORG-L13	ISO/IEC 17025
Determination of metals in waters by ICP-OES (In-house method)	METALS-L	ISO/IEC 17025

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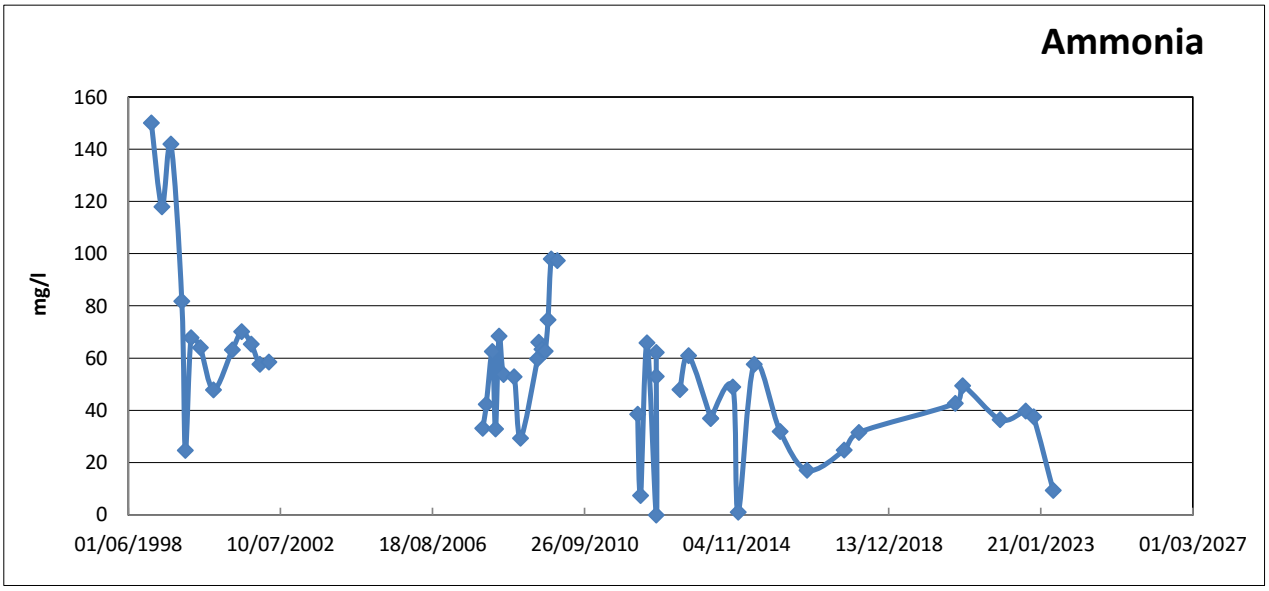
4303

NANT Y CAWS
PHASE 1
CLOSED LANDFILL

ENVIRONMENTAL
PERMIT 34183

Environmental
Monitoring Review

Appendix 2
Leachate Chemistry
Report Number 2396r1v1d1123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mg/l
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140
120
100
80
60
40
20
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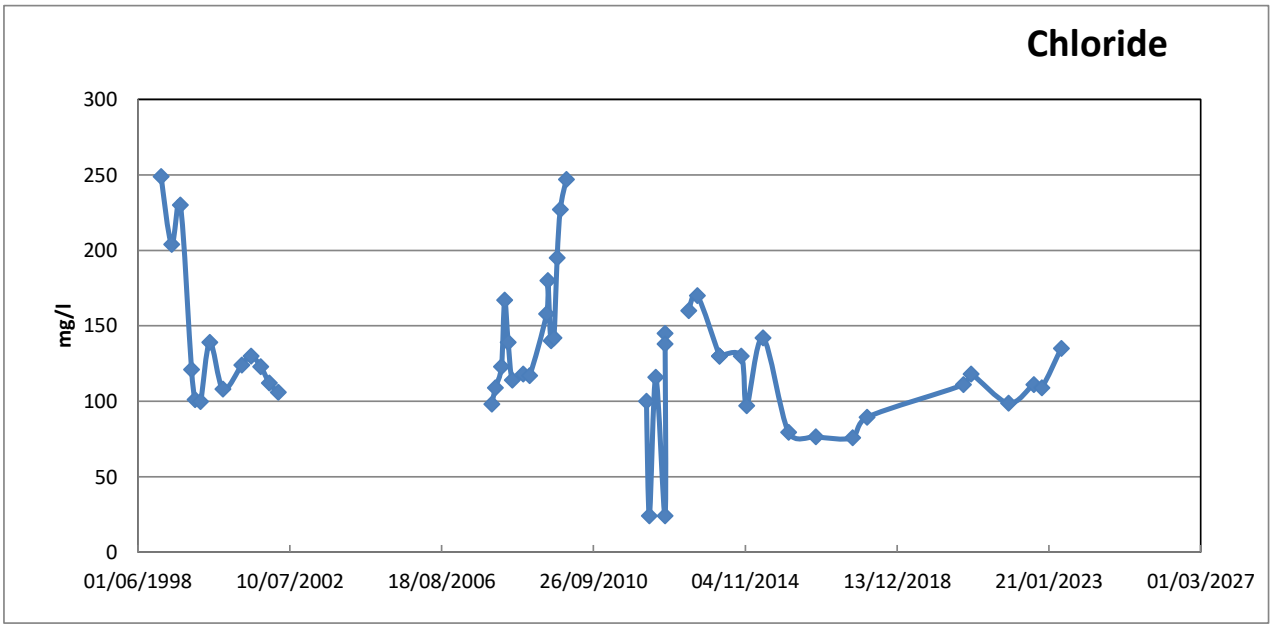
10/07/2002
18/08/2006
26/09/2010
04/11/2014
13/12/2018
21/01/2023
01/03/2027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mg/l
300
250
200
150
100
50
0
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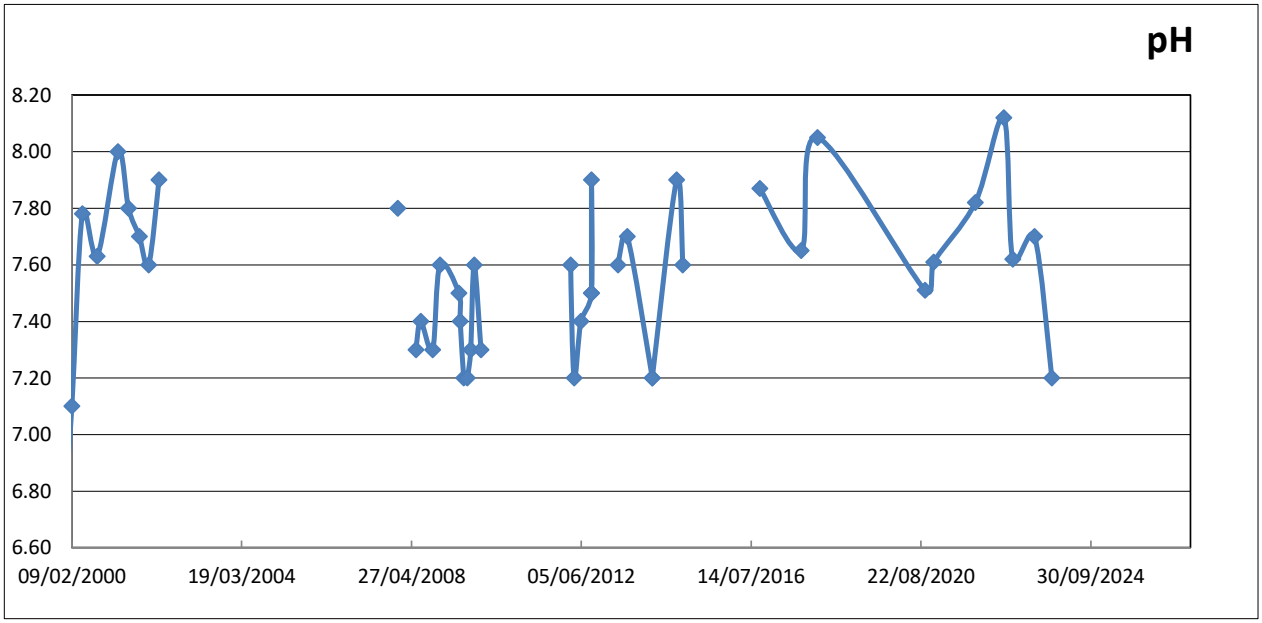
10/07/2002
18/08/2006
26/09/2010
04/11/2014
13/12/2018
21/01/2023
01/03/2027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8.20
8.00
7.80
7.60
7.40
7.20
7.00
6.80
6.60
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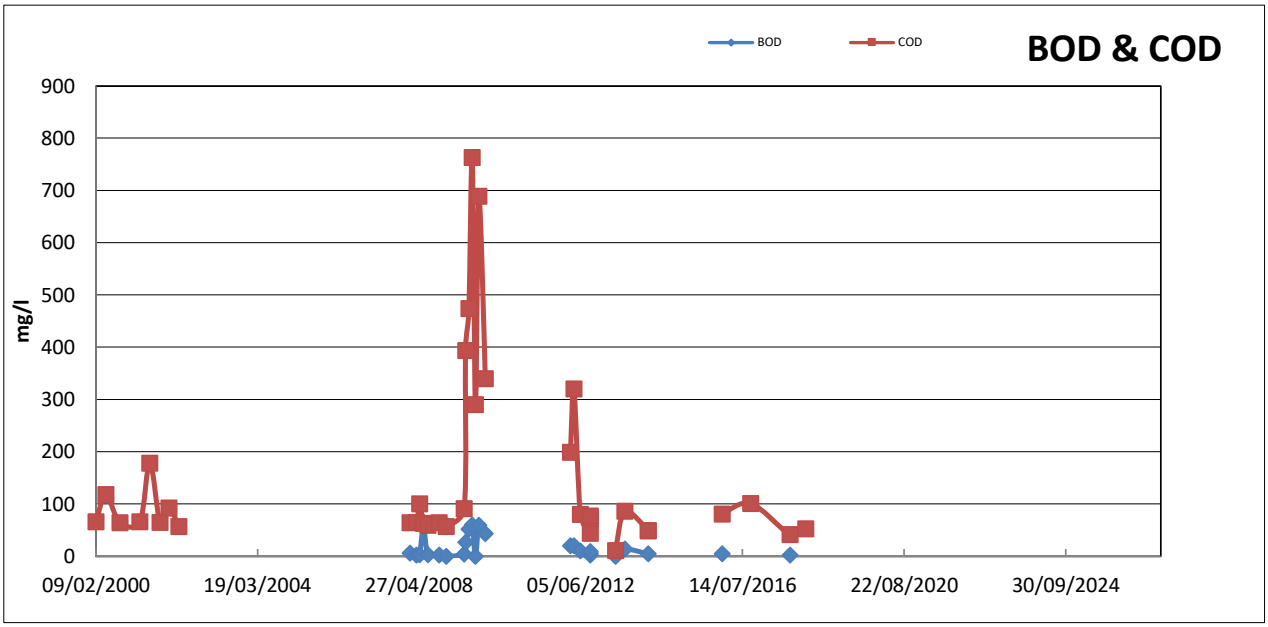
19/03/2004
27/04/2008
05/06/2012
14/07/2016
22/08/2020
30/09/2024


BOD & COD
BOD
COD
mg/l
900
800
700
600
500
400
300
200
100
0
09/02/2000
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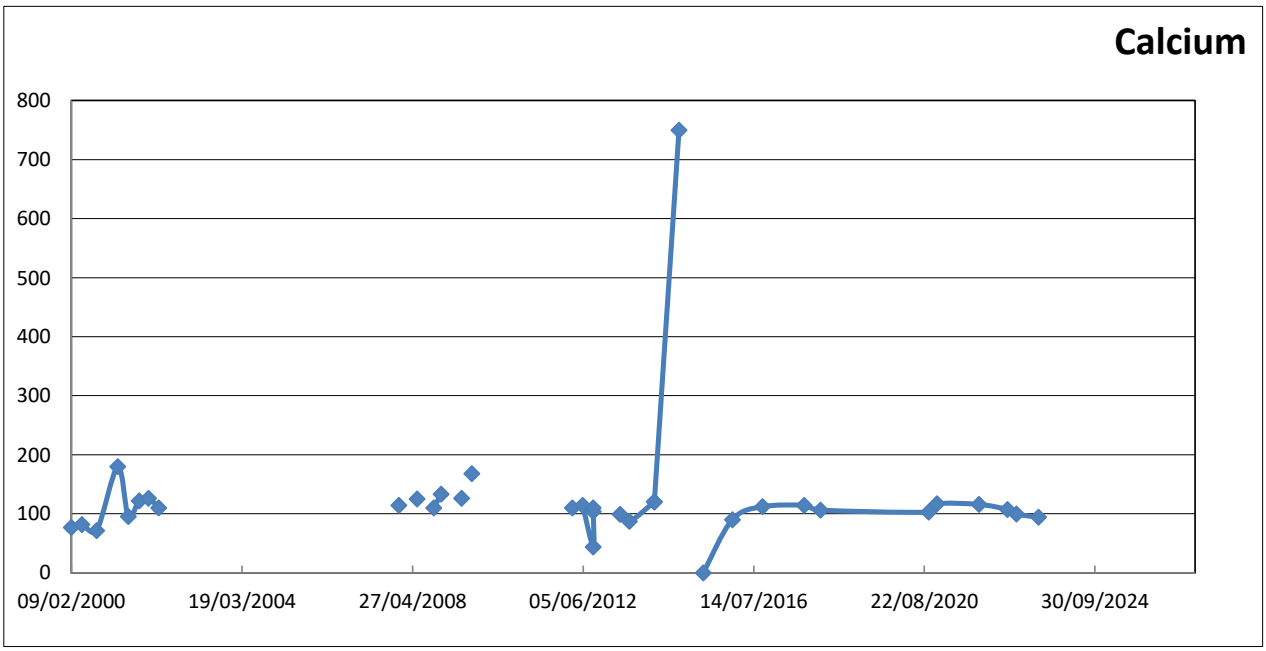
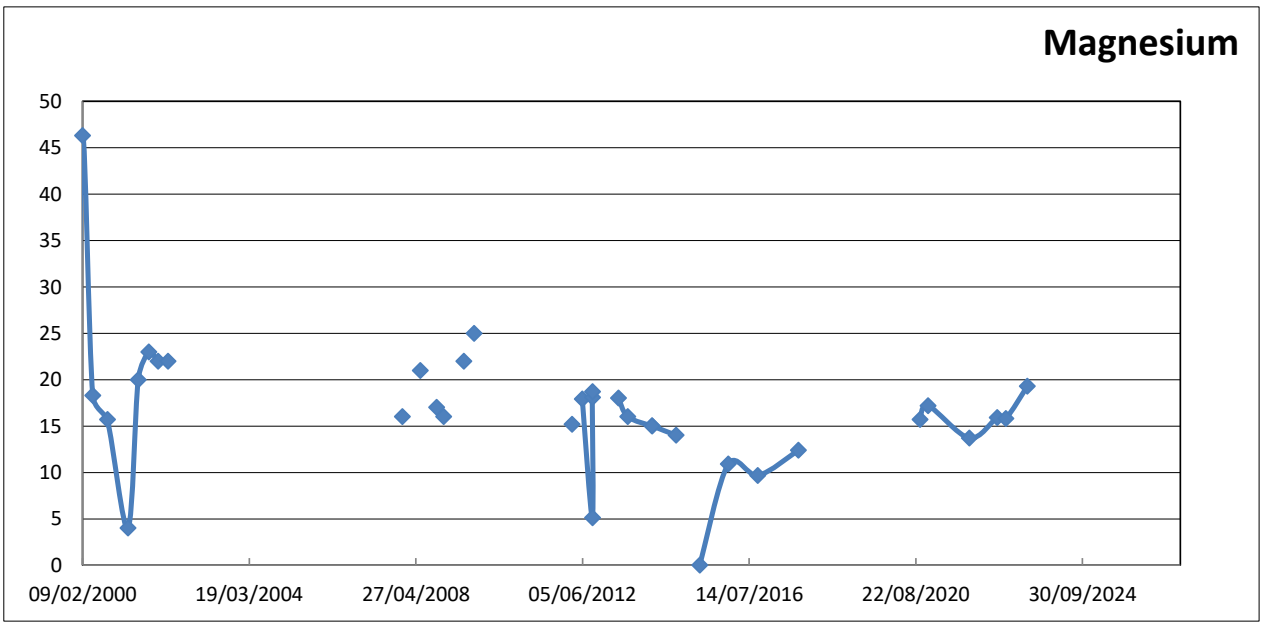
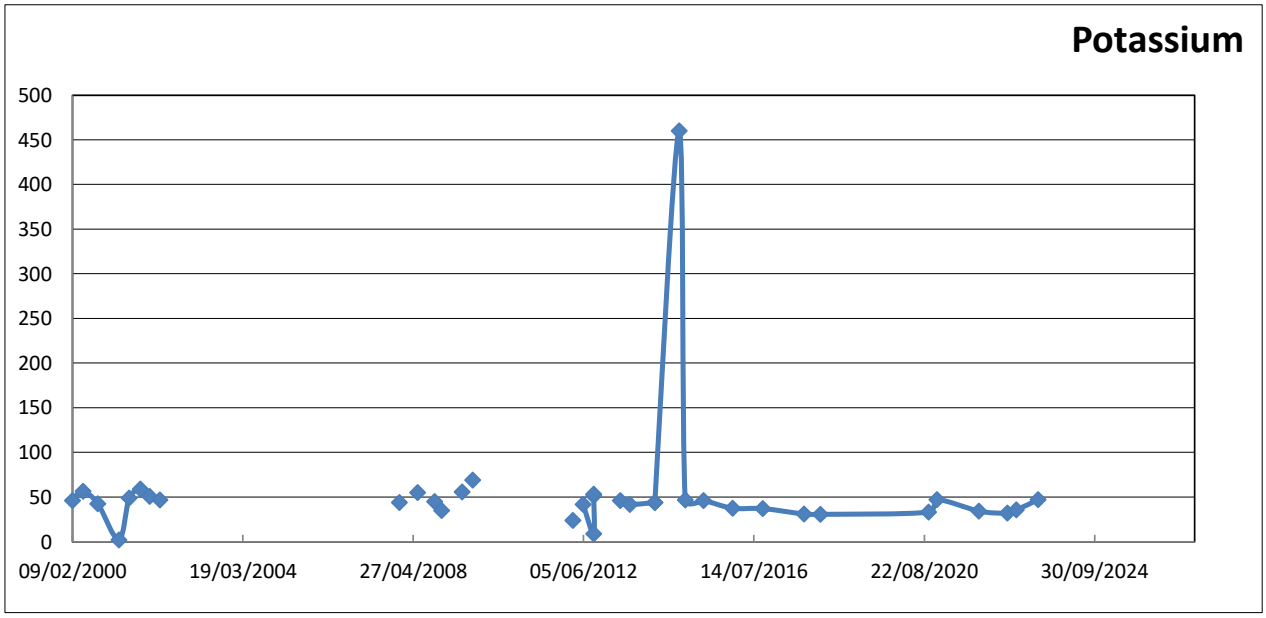
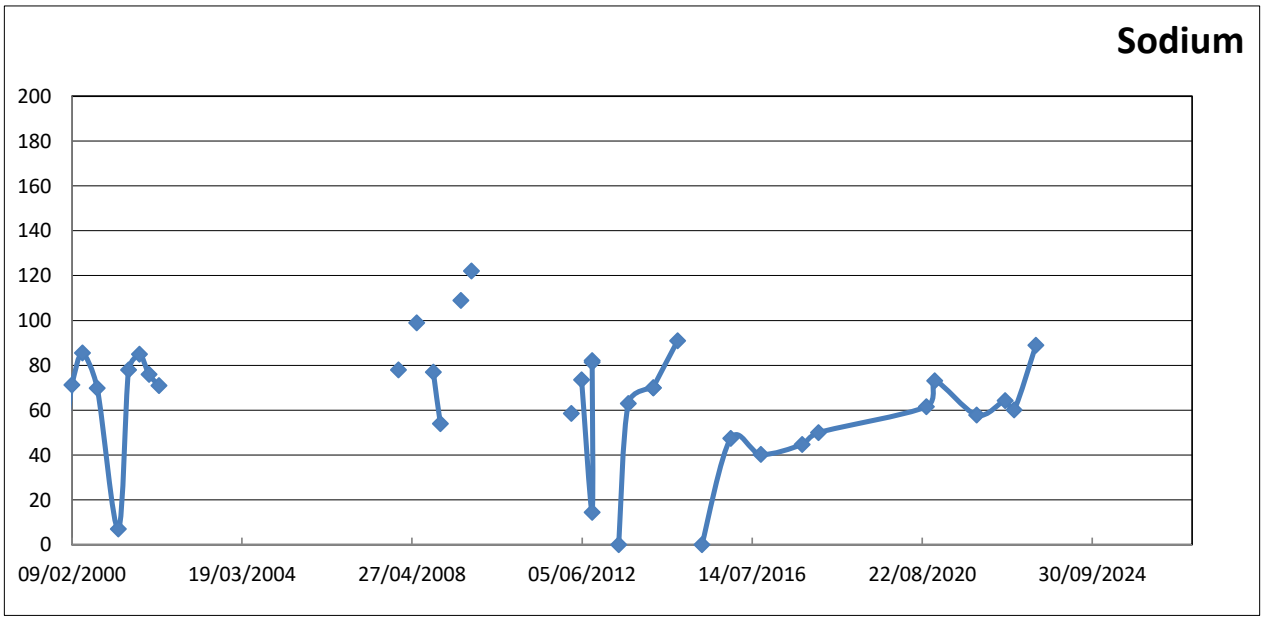
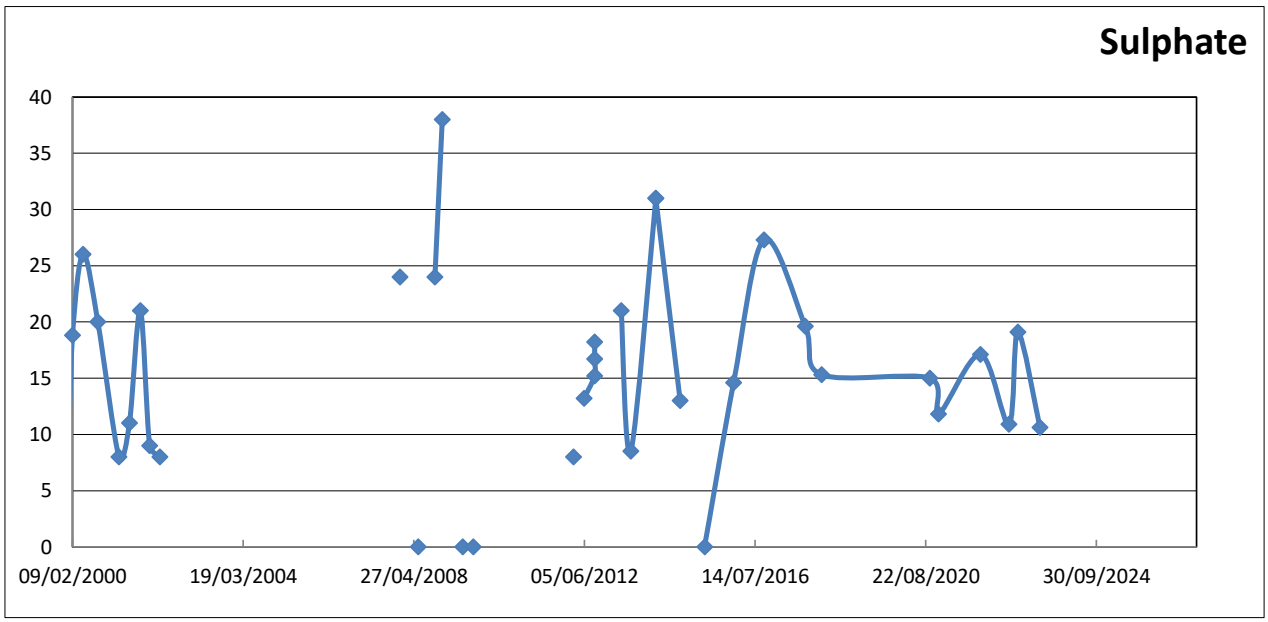
27/04/2008
05/06/2012
14/07/2016
22/08/2020
30/09/2024

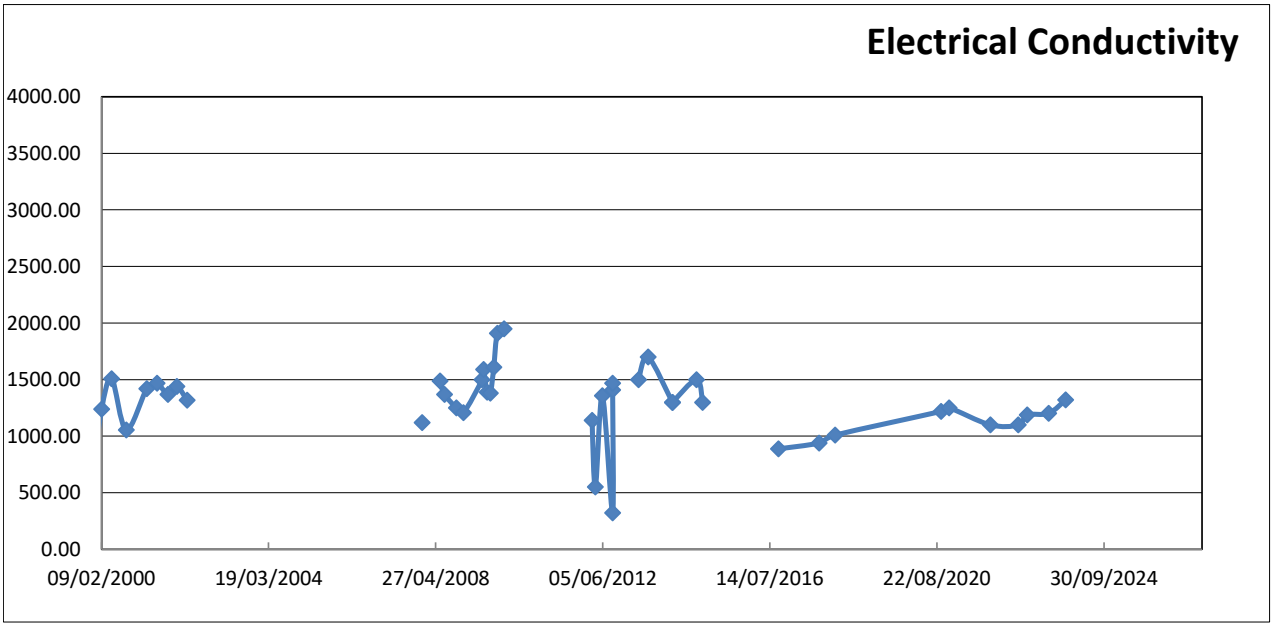

Calcium
800
700
600
500
400
300
200
100
0
09/02/2000
19/03/2004
27/04/2008
05/06/2012
14/07/2016
22/08/2020
30/09/2024

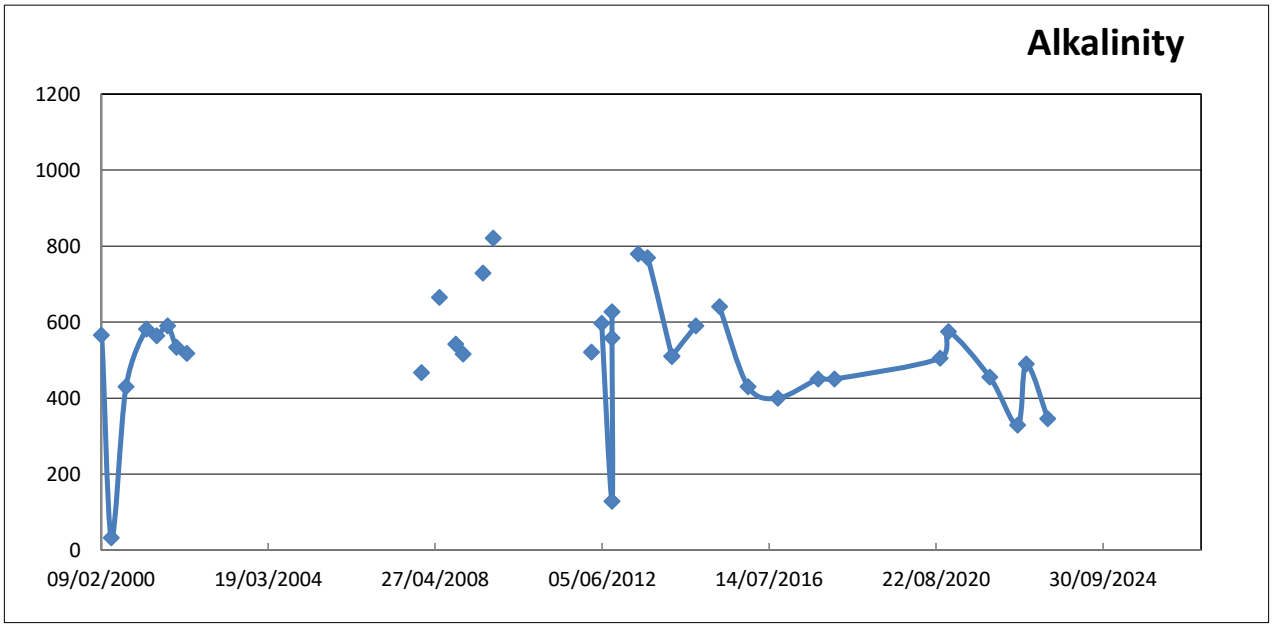

Magnesium
50
45
40
35
30
25
20
15
10
5
0
09/02/2000
19/03/2004
27/04/2008
05/06/2012
14/07/2016
22/08/2020
30/09/2024

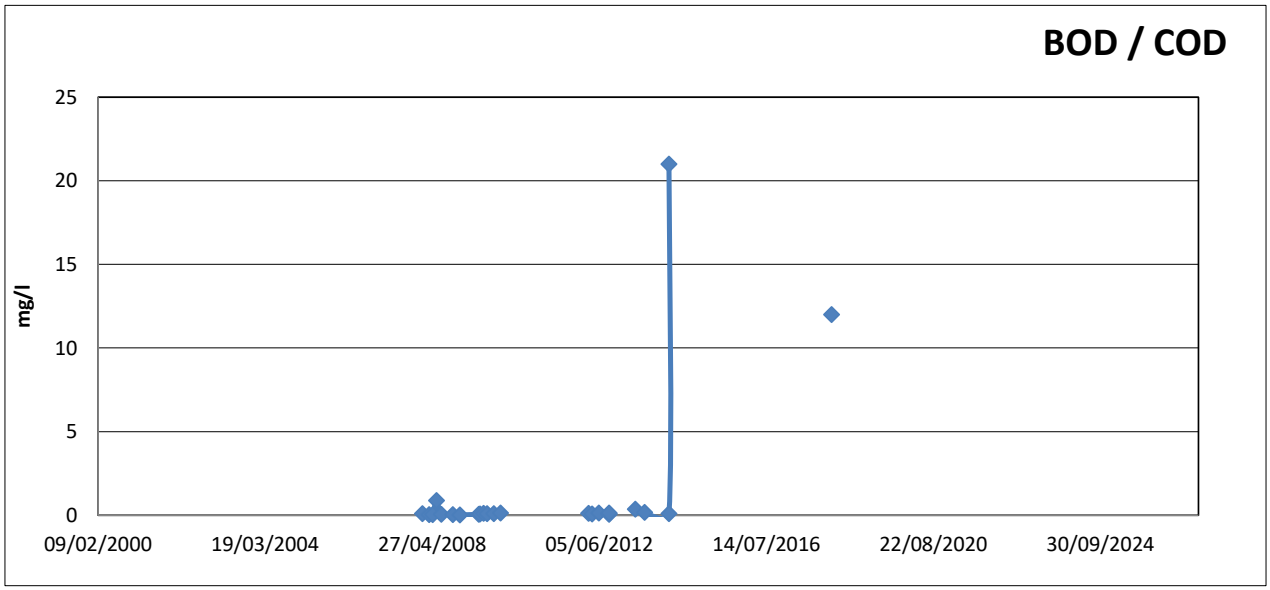

Potassium
500
450
400
350
300
250
200
150
100
50
0
09/02/2000
19/03/2004
27/04/2008
05/06/2012
14/07/2016
22/08/2020
30/09/2024


Sodium
200
180
160
140
120
100
80
60
40
20
0
09/02/2000
19/03/2004
27/04/2008
05/06/2012
14/07/2016
22/08/2020
30/09/2024


Sulphate
40
35
30
25
20
15
10
5
0
09/02/2000
19/03/2004
27/04/2008
05/06/2012
14/07/2016
22/08/2020
30/09/2024


Electrical Conductivity
4000.00
3500.00
3000.00
2500.00
2000.00
1500.00
1000.00
500.00
0.00
09/02/2000
19/03/2004
27/04/2008
05/06/2012
14/07/2016
22/08/2020
30/09/2024


Alkalinity
1200
1000
800
600
400
200
0
09/02/2000
19/03/2004
27/04/2008
05/06/2012
14/07/2016
22/08/2020
30/09/2024


BOD / COD
mg/l
25
20
15
10
5
0
09/02/2000
19/03/2004
27/04/2008
05/06/2012
14/07/2016
22/08/2020
30/09/2024

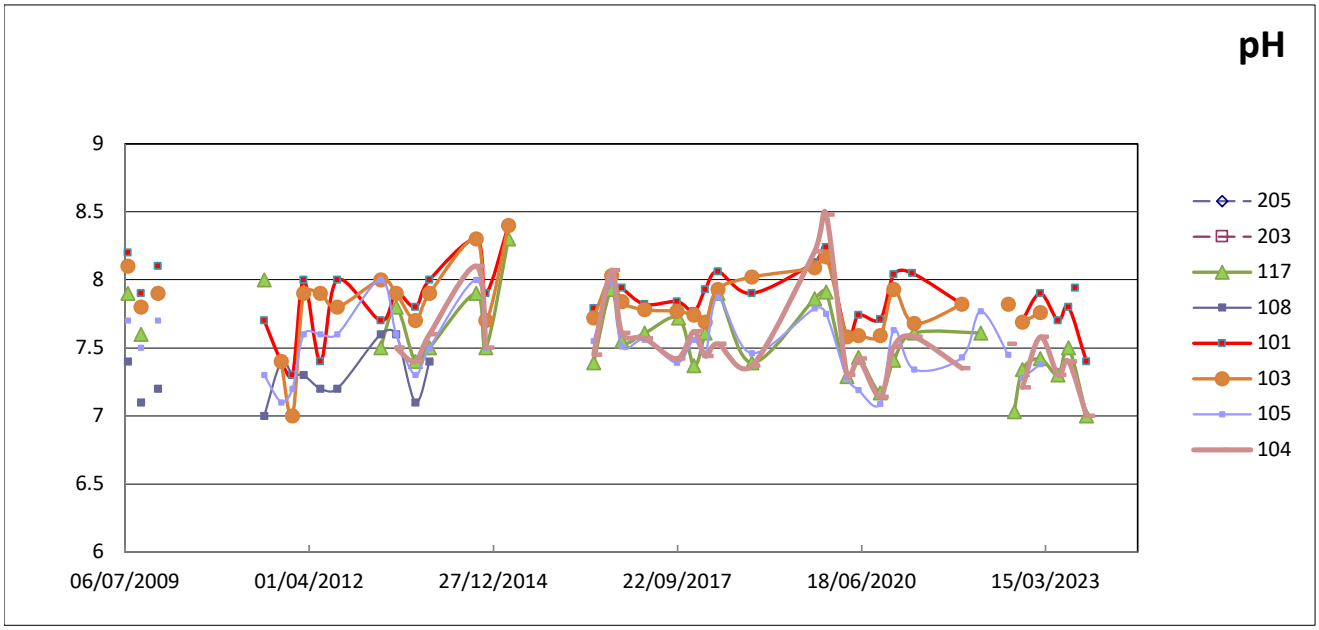
NANT Y CAWS
PHASE 1
CLOSED LANDFILL

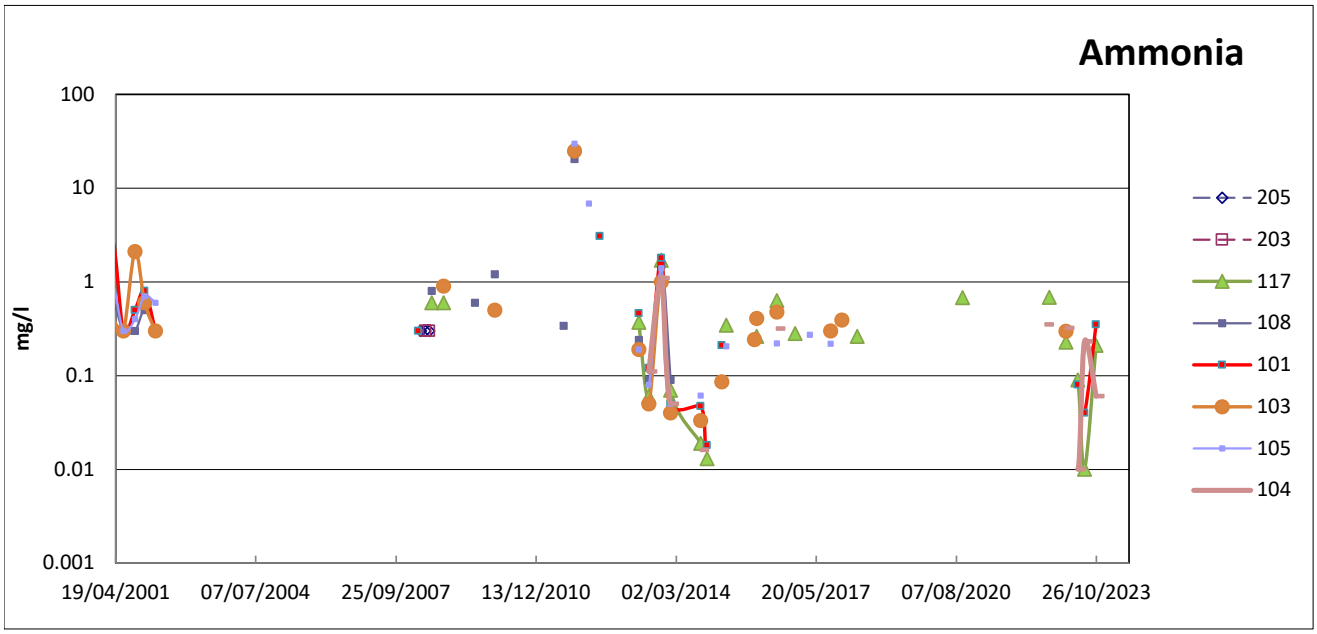
ENVIRONMENTAL
PERMIT 34183

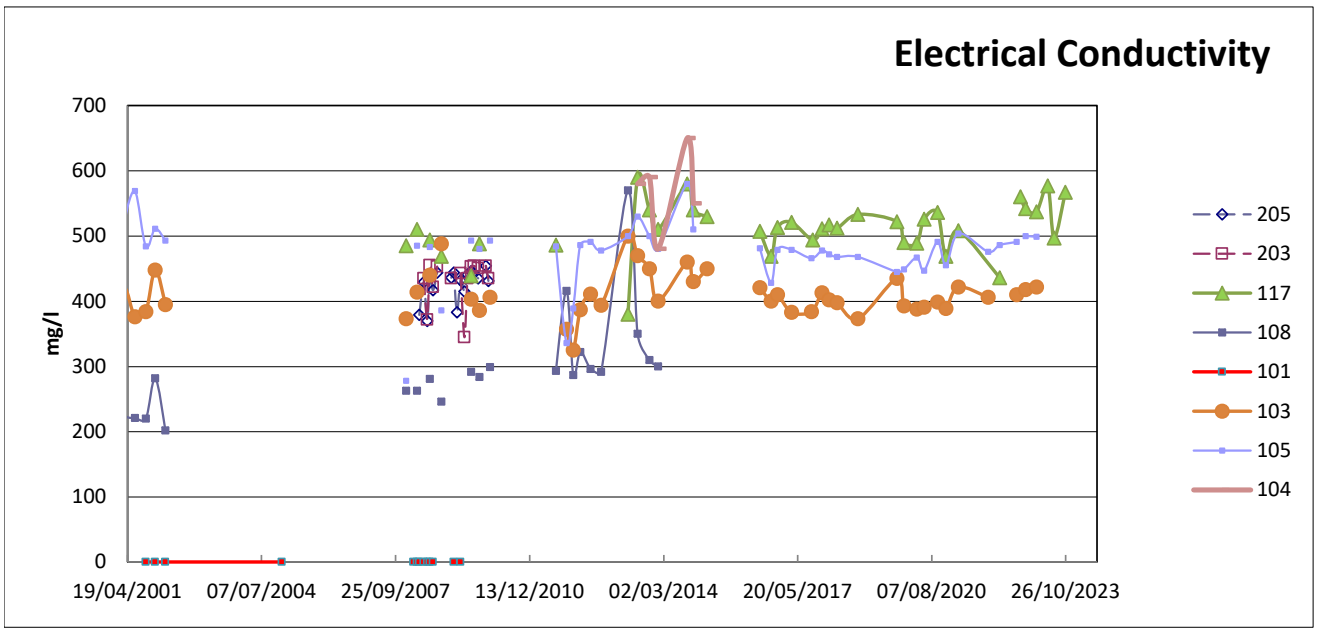
Environmental Monitoring Review

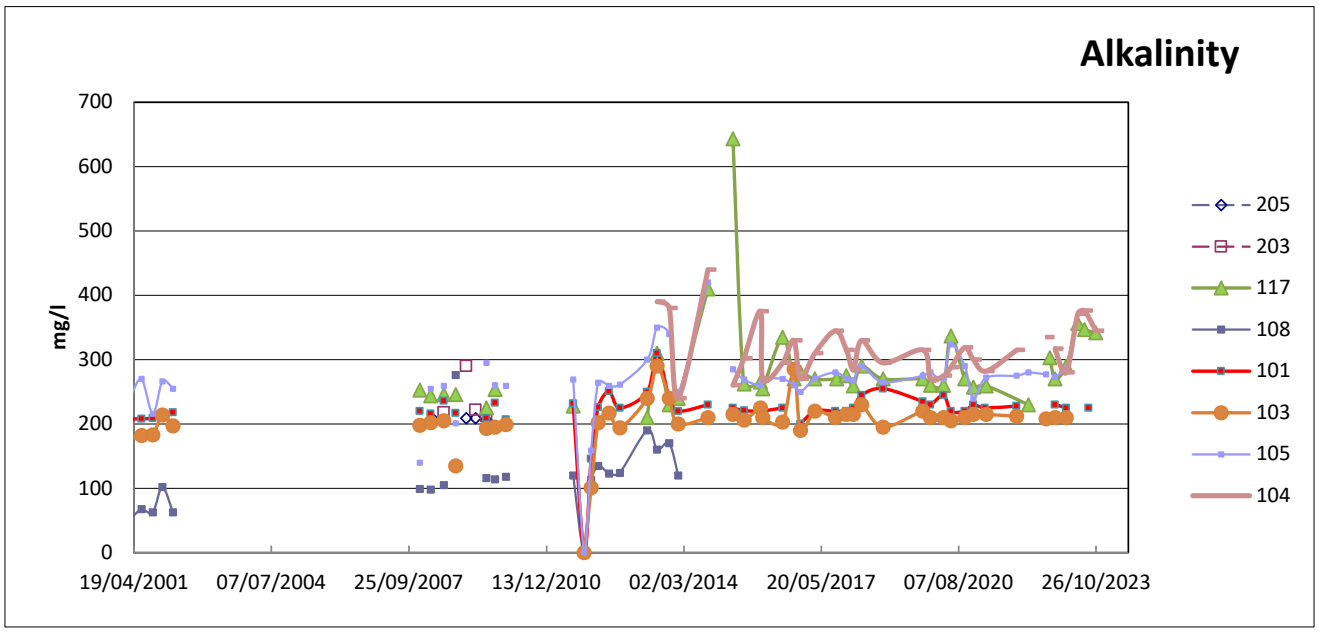
Appendix 3 Groundwater Chemistry

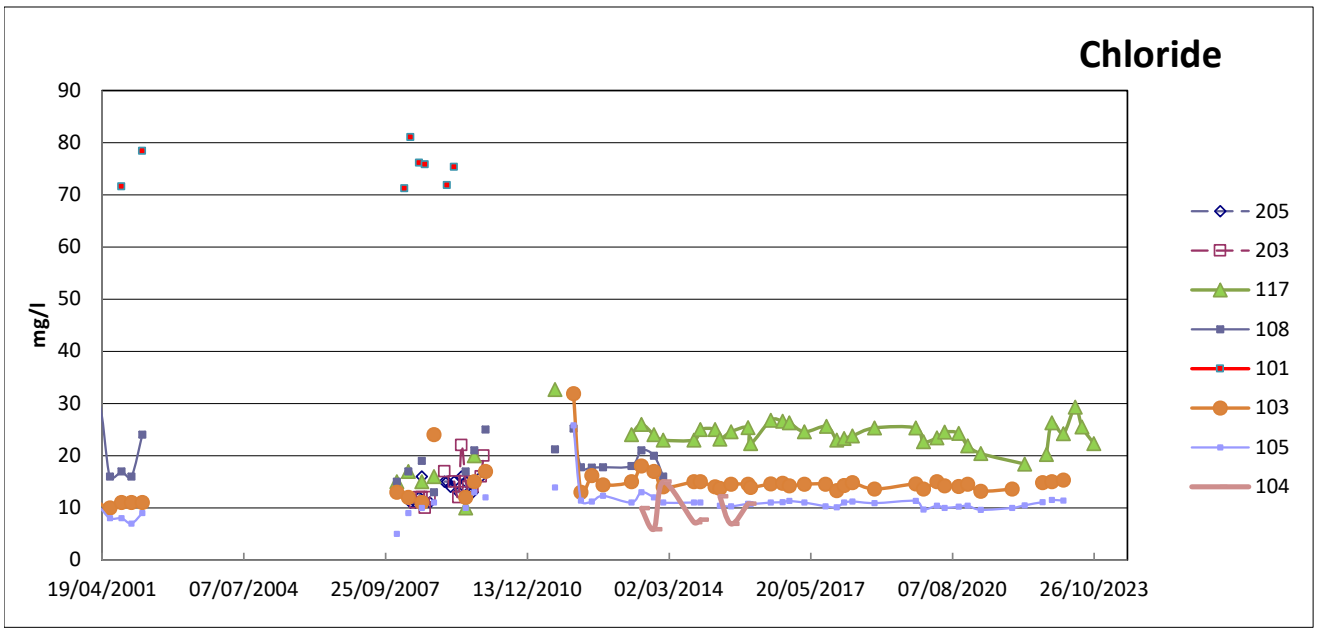
Report Number 2396r1v1d1123

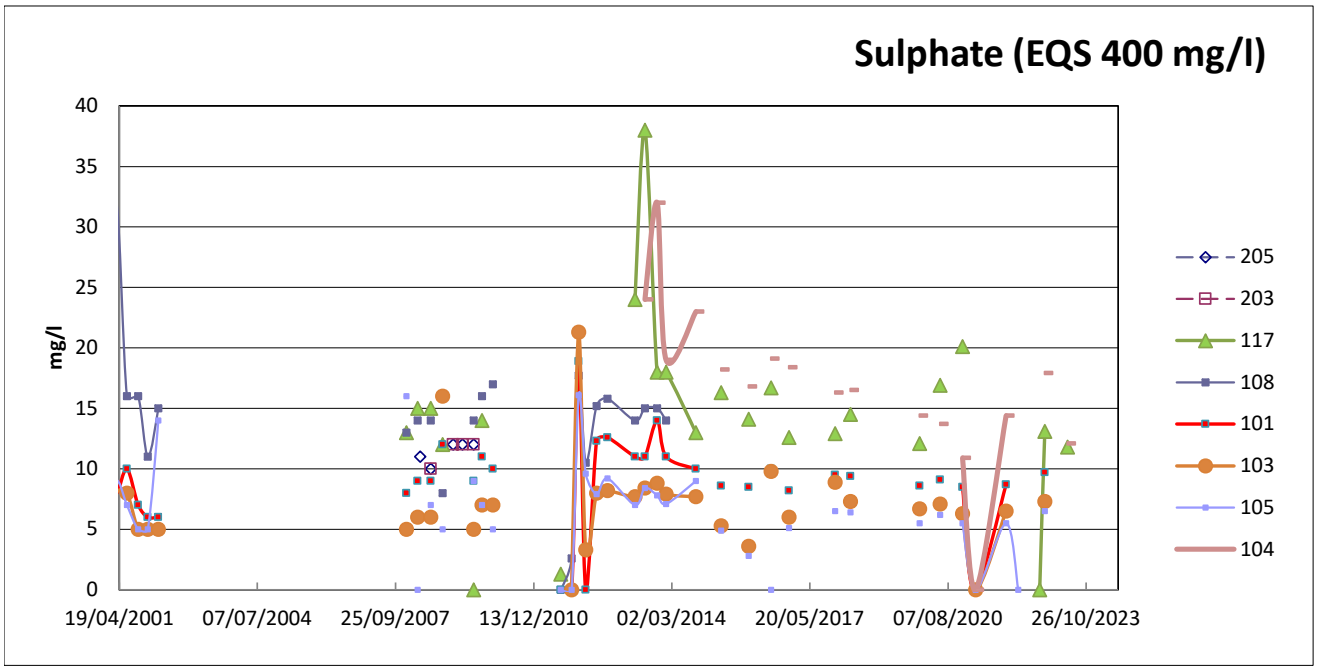

pH
9
8.5
8
7.5
7
6.5
6
06/07/2009
01/04/2012
27/12/2014
22/09/2017
18/06/2020
15/03/2023
205
203
117
108
101
103
105
104


Ammonia
mg/l
100
10
1
0.1
0.01
0.001
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
205
203
117
108
101
103
105
104


Electrical Conductivity
mg/l
700
600
500
400
300
200
100
0
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
205
203
117
108
101
103
105
104


Alkalinity
mg/l
700
600
500
400
300
200
100
0
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
205
203
117
108
101
103
105
104


Chloride
mg/l
90
80
70
60
50
40
30
20
10
0
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
205
203
117
108
101
103
105
104


Sulphate (EQS 400 mg/l)
mg/l
40
35
30
25
20
15
10
5
0
19/04/2001
07/07/2004
25/09/2007
13/12/2010
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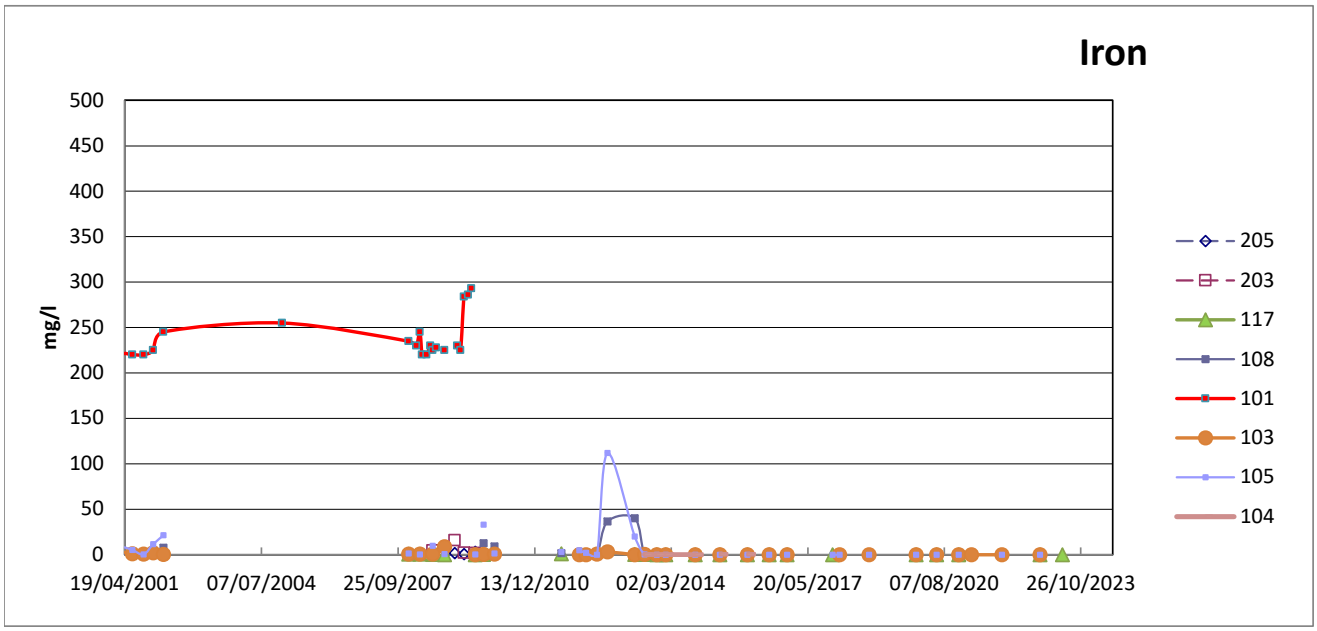
205
203
117
108
101
103
105
104


Iron
500
450
400
350
300
250
200
150
100
50
0
mg/l
19/04/2001
07/07/2004
25/09/2007
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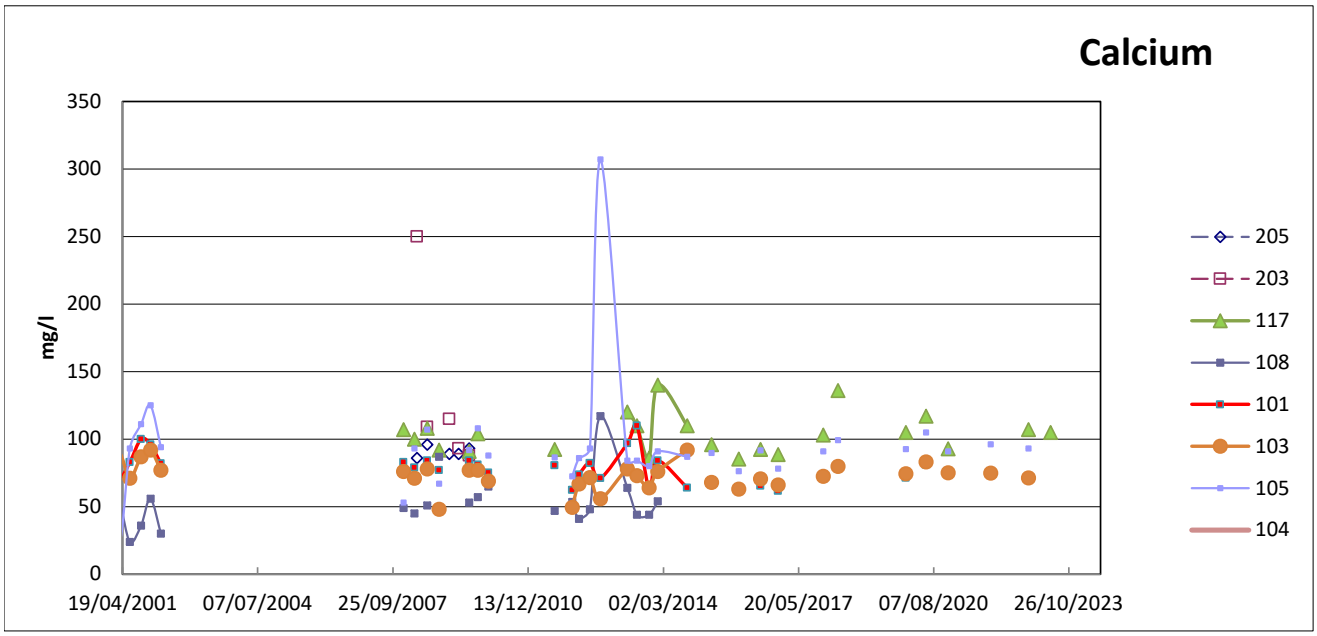
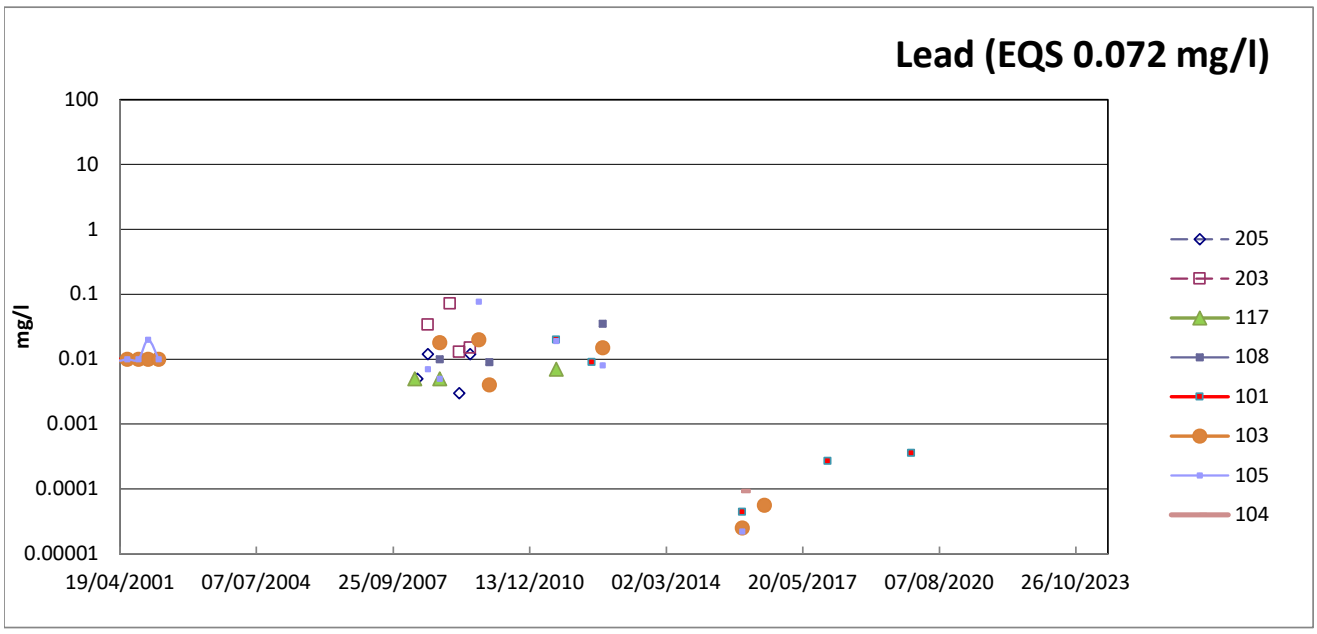
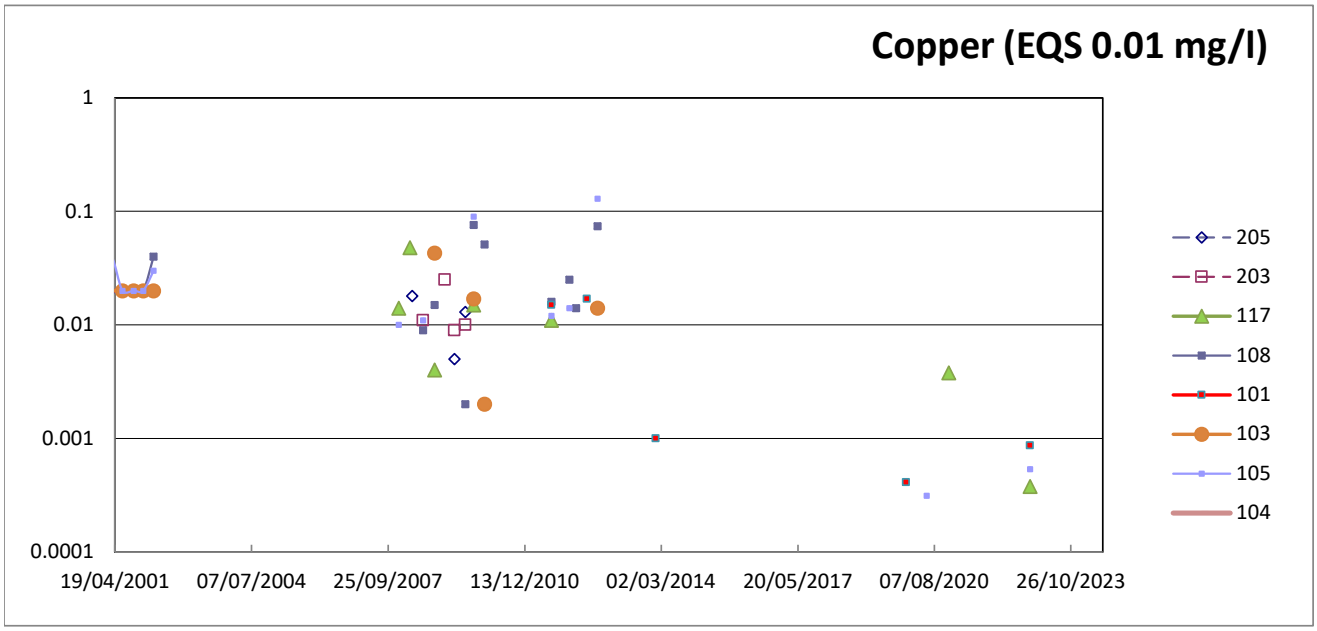
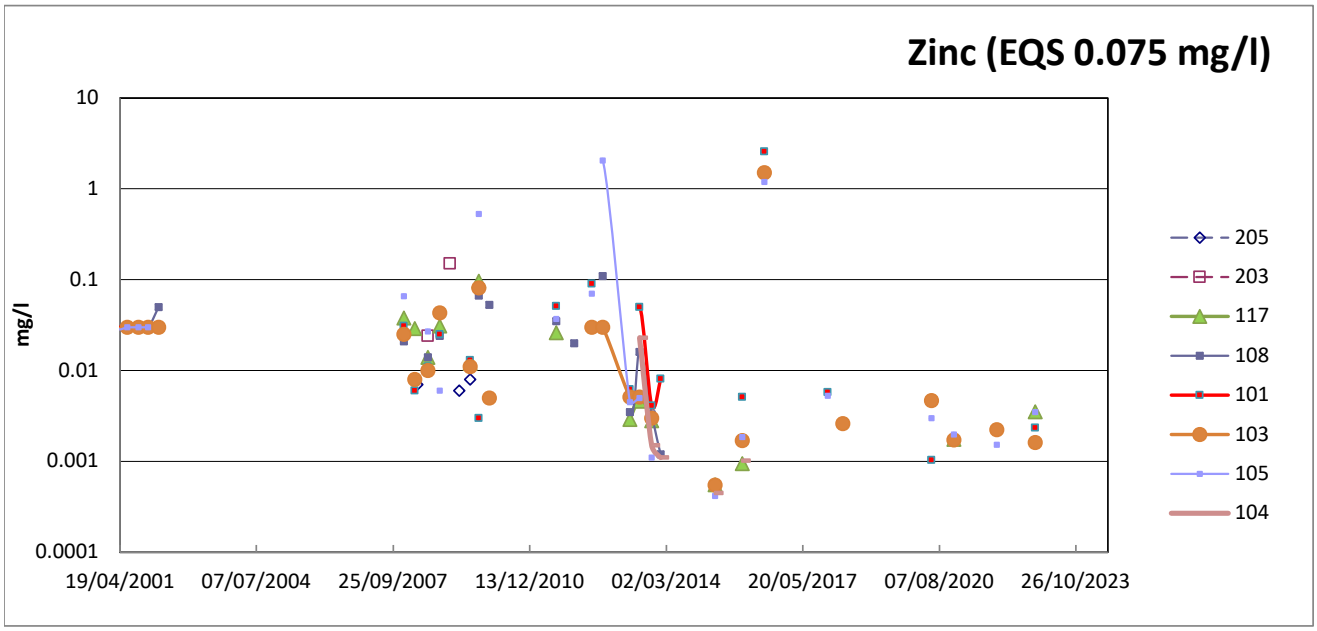
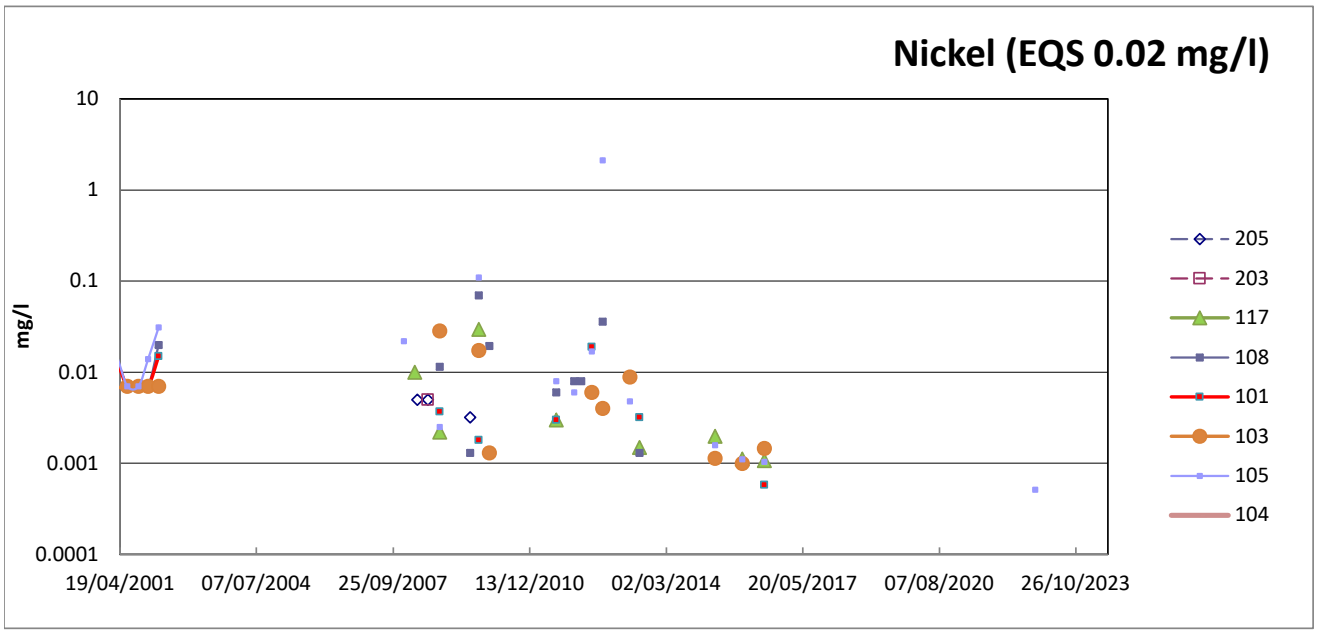
26/10/2023
205
203
117
108
101
103
105
104

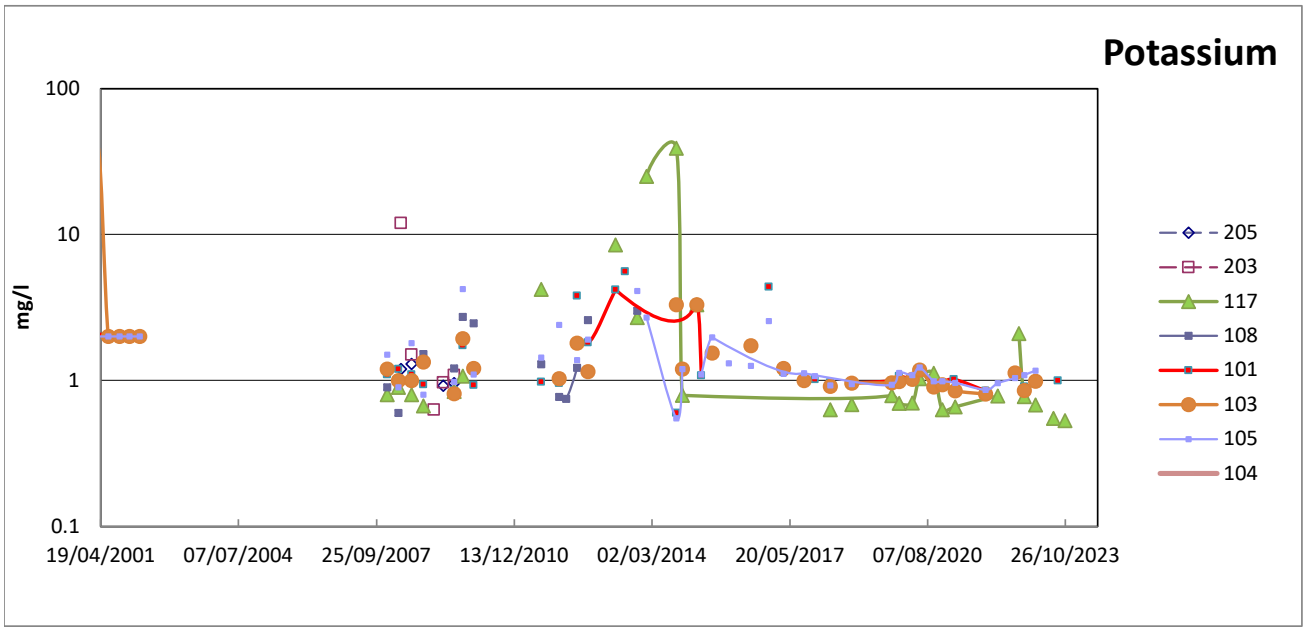

Calcium
350
300
250
200
150
100
50
0
mg/l
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
205
203
117
108
101
103
105
104

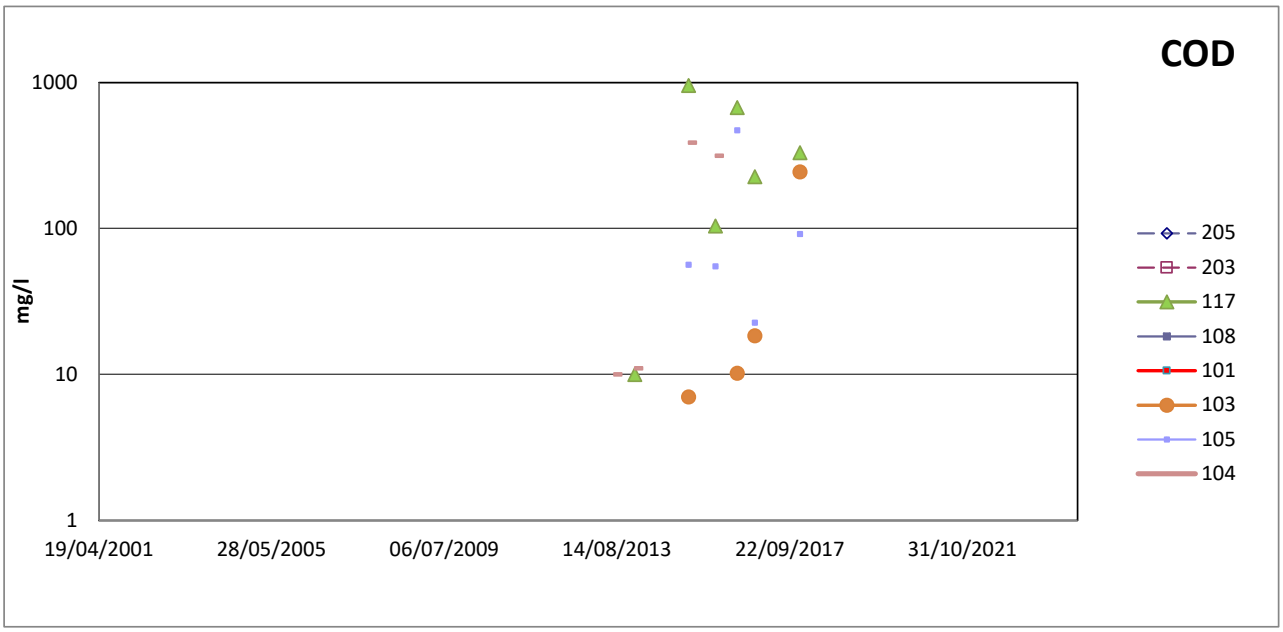

Lead (EQS 0.072 mg/l)
100
10
1
0.1
0.01
0.001
0.0001
0.00001
mg/l
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
205
203
117
108
101
103
105
104


Copper (EQS 0.01 mg/l)
1
0.1
0.01
0.001
0.0001
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
205
203
117
108
101
103
105
104


Zinc (EQS 0.075 mg/l)
mg/l
10
1
0.1
0.01
0.001
0.0001
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
205
203
117
108
101
103
105
104


Nickel (EQS 0.02 mg/l)
mg/l
10
1
0.1
0.01
0.001
0.0001
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
205
203
117
108
101
103
105
104


Potassium
100
10
1
0.1
mg/l
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
205
203
117
108
101
103
105
104


COD
1000
100
10
1
mg/l
19/04/2001
28/05/2005
06/07/2009
14/08/2013
22/09/2017
31/10/2021
205
203
117
108
101
103
105
104

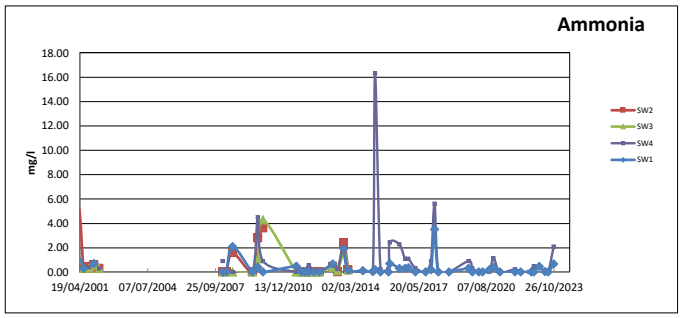
NANT Y CAWS
PHASE 1
CLOSED LANDFILL

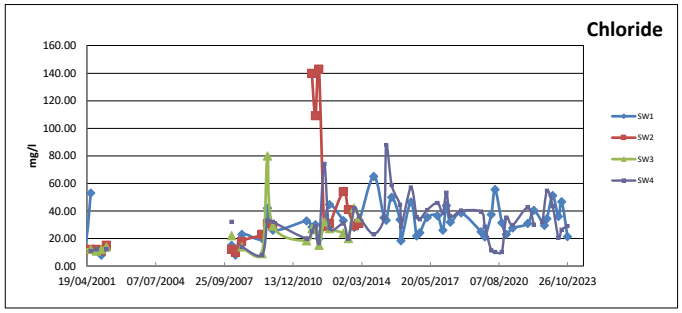
ENVIRONMENTAL
PERMIT 34183

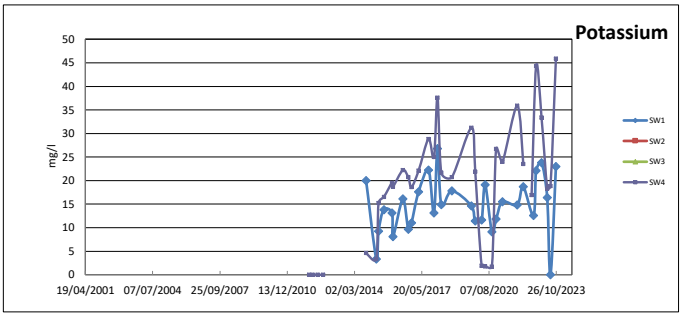
Environmental Monitoring Review

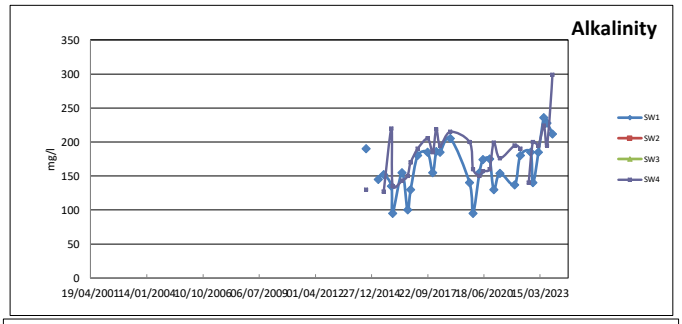
Appendix 4
Surface Water Chemistry

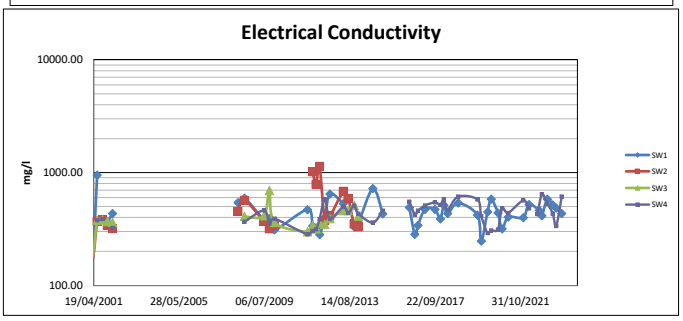
Report Number 2396r1v1d1123

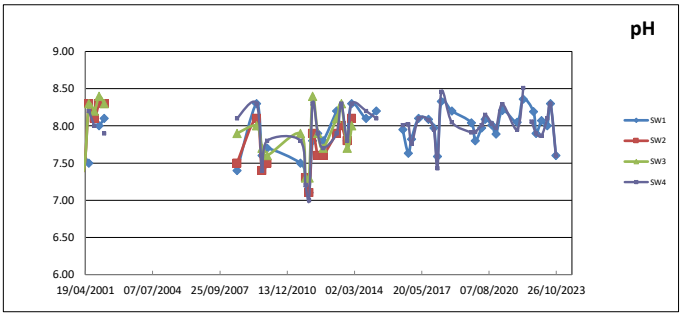

Ammonia
mg/l
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
19/04/2001 07/07/2004 25/09/2007 13/12/2010 02/03/2014 20/05/2017 07/08/2020 26/10/2023
SW2
SW3
SW4
SW1

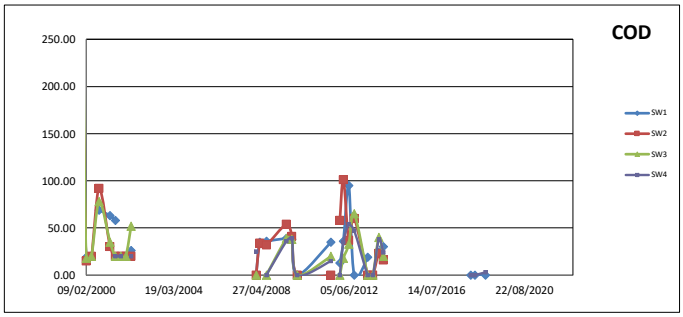

Chloride
mg/l
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
19/04/2001 07/07/2004 25/09/2007 13/12/2010 02/03/2014 20/05/2017 07/08/2020 26/10/2023
SW1
SW2
SW3
SW4

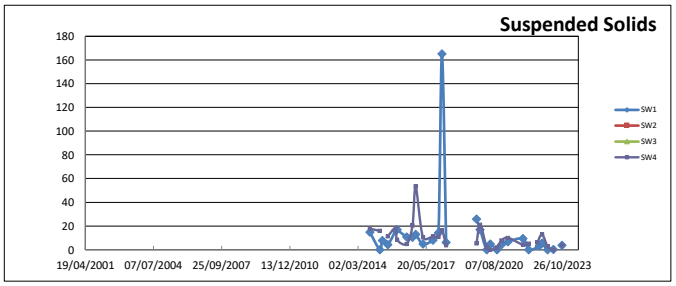

Potassium
mg/l
50
45
40
35
30
25
20
15
10
5
0
19/04/2001 07/07/2004 25/09/2007 13/12/2010 02/03/2014 20/05/2017 07/08/2020 26/10/2023
SW1
SW2
SW3
SW4


Alkalinity
mg/l
350
300
250
200
150
100
50
0
19/04/2001 14/01/2004 10/10/2006 06/07/2009 01/04/2012 27/12/2014 22/09/2017 18/06/2020 15/03/2023
SW1
SW2
SW3
SW4


Electrical Conductivity
mg/l
10000.00
1000.00
100.00
19/04/2001 28/05/2005 06/07/2009 14/08/2013 22/09/2017 31/10/2021
SW1
SW2
SW3
SW4


pH
9.00
8.50
8.00
7.50
7.00
6.50
6.00
19/04/2001 07/07/2004 25/09/2007 13/12/2010 02/03/2014 20/05/2017 07/08/2020 26/10/2023
SW1
SW2
SW3
SW4


COD
250.00
200.00
150.00
100.00
50.00
0.00
09/02/2000
19/03/2004
27/04/2008
05/06/2012
14/07/2016
22/08/2020
SW1
SW2
SW3
SW4


Suspended Solids
180
160
140
120
100
80
60
40
20
0
19/04/2001
07/07/2004
25/09/2007
13/12/2010
02/03/2014
20/05/2017
07/08/2020
26/10/2023
SW1
SW2
SW3
SW4

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Environmental Monitoring Review

Appendix 5
Isopachyte of Topographic Surface

Report Number 2396r1v1d1123

Rev	Date	Status/Ammendments	

CLIENT

CWM Environmental Ltd

Legend

Fill Levels	Cut Levels
2.4	0.0
2.0	-0.4
1.6	-0.8
1.2	-1.2
0.8	-1.6
0.4	-2.0
0.0	-2.4

FILL - 2019 > 2015
CUT - 2015 > 2019

PROJECT

Nantycaws Annual Topographic Survey - 2019

TITLE

Nantycaws 2019 - 2015 Drone Survey Isopachyte

NOTES

Survey Imagery acquired with Yuneec H520 hexcopter on 23/09/2019.

Isopachyte has been generated by subtracting the 2015 Digital Surface Model (DSM) from the September 2019 DSM. Digital surface model includes structures, vehicles and other equipment present at the time of survey.

As both surface models include vegetation and structures, some areas of cut or fill on the plan are likely the result of changes in these features between the two surveys.

NOTES

DRAWING NUMBER			REVISION
1952 Drawing 2			0
SCALE AT A1	DATE	DRAWN	CHECKED
1:750	11.19	KJT	DRAFT

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