

CAULMERT LIMITED

Engineering, Environmental & Planning
Consultancy Services

Brookhill Landfill Site

Flintshire County Council Waste Management Services

Quarterly Monitoring Review

January - March 2021

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10418aRev0 Brookhill 08-05-2019– Site Survey

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1.0 INTRODUCTION

1.1 Background

- 1.1.1 This report has been compiled for the first quarter of 2021, in compliance with the Environmental Permit (EP) AP3739KS for Brookhill Landfill Site, held by Flintshire County Council (FCC) Waste Management Services, which requires that the monitoring data collected at the site is reviewed quarterly. The data reviewed by this report was collected between the 1st of January and the 31st March 2021.
- 1.1.2 This report records the monitoring data for landfill gas, leachate, groundwater, surface water and dust, and discusses this data in relation to emission limits set in the EP. Third party information supplied by Flintshire County Council (FCC) Waste Management Services has been used in good faith within this document. Caulmert Ltd has not attempted to verify the information.

1.2 Site Location and Surrounding Land-use

- 1.2.1 Brookhill Landfill Site is located approximately 1.5 km north of Buckley, Flintshire, North Wales at NGR SJ 278 656. The site is accessed via the Pinfold Industrial Estate, Pinfold Lane, which is located off the A494 Mold to Ewloe Road.
- 1.2.2 The site is bound to the east by a wooded, disused railway leading to open grassland. Agricultural land lies to the west of the site. The Pinfold Industrial Estate and a number of residential properties (on the outskirts of Buckley, approximately 400 m away) are situated to the south of the site. A restored refuse tip (Ewloe Barn Landfill) lies to the north of the site. It is currently rough grassland leading to open grazing land and some woodland.
- 1.2.3 The landfill site has been developed in a former quarry, which was worked for Buckley Fireclay and the siltstones and mudstones beneath the Fireclay (known as the Warrant) for use in the manufacturing of bricks and tiles.
- 1.2.4 In 1997, in preparation for the engineering for the landfill site, further Fireclay was removed together with a quantity of coal in the quarry base under agreement with the Coal Authority.
- 1.2.5 Brookhill Landfill Site started accepting waste in 1999. The wastes permitted at the site were stipulated within the site permit. The general waste streams which were permitted at the site through its history can be summarised as:
- Domestic food and organic wastes – approximately 60%,
 - Non-hazardous industrial wastes, (including plastic, paper, cardboard, wood, stone and sand, etc) – approximately 40%,
 - Most special wastes (allowed until June 2004).

- 1.2.6 The special wastes which were tipped at the site were accepted pre-June 2004 (under the WML for the site). Therefore, they would have been deposited predominantly within Cell 1, and the lower parts of Cells 2, 3 and 4. It is unlikely that any of the waste tipped in Cells 5 and 6 contains any 'special waste' waste streams.
- 1.2.7 The site ceased accepting waste in late 2007. The final capping and restoration phases were completed in 2010.

2.0 LANDFILL GAS

2.1 Monitoring regime

- 2.1.1 Routine landfill gas monitoring is carried out on a weekly basis at perimeter locations BH1 to BH25 and monthly at all in-waste locations. Perimeter borehole locations are shown on Drawing 10418a Rev0, enclosed. Methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide, relative pressure and atmospheric pressure are recorded on each visit.
- 2.1.2 Methane and carbon dioxide data from all perimeter boreholes are displayed in a summary table and time-series graphs in Appendix 1. The landfill gas data obtained during the review period was compared with the limits stipulated in the EP (shown in the appendix tables). Monitoring data gathered at in-waste gas monitoring locations is also listed in Appendix 1.
- 2.1.3 As noted in the previous review, a number of wells have been un-accessible due to being buried or flooded. Table 2.1 list the amount of times perimeter boreholes where unable to be monitored during the review period.

Table 2.1: number of times perimeter wells were flooded or buried during quarter 1 2021.

Monitoring	Monitored	Flooded	Buried	Total
BK BH 04	-	12	-	12
BK BH 05	-	12	-	12
BK BH 06	1	11	-	12
BK BH 07	4	8	-	12
BK BH 10	8	4	-	12
BK BH 13	1	11	-	12
BK BH 16	1	-	11	12
BK BH 17	8	-	3	11
BK BH 19	3	9	-	12
BK BH 20	-	12	-	12
BK BH 21	8	-	4	12
BK BH 25	4	8	-	12

2.2 In-waste Boreholes

- 2.2.1 The gas field at Brookhill Landfill Site is monitored and balanced on a regular basis. In accordance with Condition 4.2.2 of the EP, landfill gas monitoring data for the in-waste boreholes for this review period is included in Appendix 1.
- 2.2.2 The average methane concentration in the in-waste gas wells was 49.25 %, similar to the previous quarter's average of 46.32 %.
- 2.2.3 In this quarter the average concentration of CO₂ was 30.86 %, a decrease compared to the average of 32.7 % recorded in the last quarter. Carbon dioxide concentrations ranged from 1.6 % to 42.6 % recorded in GV32 and GV46 respectively.

- 2.2.4 Oxygen concentrations within the in-waste boreholes ranged from 0.0 % to 18 %. On average the total oxygen concentration across the site was 2.2 %, similar to the previous review (2.79 %). Wells with potential air ingress are shown in table 2.2 below.

Table 2.2: Wells with potential Air ingress

Monitoring Point	Series	O2 %			% above 5%
		Min	Max	Average	
BHGV8	GV Wells	9.00	10.80	9.73	100%
BHGV10	GV Wells	10.40	10.40	10.40	100%
BHGV13	GV Wells	8.70	17.10	12.13	100%
BHGV22	GV Wells	0.00	14.90	8.87	67%
BHGV23	GV Wells	0.00	15.90	5.33	33%
BHGV33	GV Wells	0.10	5.60	2.96	20%
BHGV42	GV Wells	1.40	14.40	4.98	25%
BHGV46	GV Wells	0.00	18.00	7.22	60%
BHGW34	Other Wells	0.10	14.40	3.82	25%
BHLC3	LC Wells	10.20	14.60	12.40	100%
BHLC5	LC Wells	1.60	7.20	4.42	50%
BHLC6	LC Wells	0.00	15.80	6.06	40%
BHLC1B	LC Wells	13.40	15.00	14.07	100%
BHLC4B	LC Wells	7.00	16.20	11.17	100%
BHPW1	Other Wells	3.60	17.80	12.03	67%
BHPW2	Other Wells	2.60	10.90	5.70	33%
BHPW6	Other Wells	5.40	15.90	11.67	100%
BHR5	R Wells	17.00	17.60	17.23	100%
BHR6B	R Wells	0.00	5.10	2.55	50%

- 2.2.5 Locations where oxygen concentrations were above 5 % are not utilised for gas extraction, however, they are still monitored.
- 2.2.6 A maximum carbon monoxide concentration of 25 ppm was recorded in GV22, a significant increase compared to the previous reviews 11 ppm (GV8). Trace amounts hydrogen sulphide (H₂S) were detected within LC05 with a maximum concentration of 1 ppm. All other locations remained below detection limit throughout the review period.

2.3 Perimeter Boreholes

Methane

- 2.3.1 BH16 was in breach of its respective methane EP limit (1 %) during this review period at 6.6 % (23rd March). It should be noted that BH16 was Buried for the remainder of the review period so no trend could be discerned. None of the other monitoring locations were in breach of their respective EP Limits (Table S3.5 of the EP) during the review period.
- 2.3.2 The average methane concentration for the perimeter boreholes as a whole this quarter was 2 %, an increase when compared to the previous quarter (0.94 %). Methane concentrations remain significantly below the elevated average detected in quarter two of 2019 (11.2 %).

2.3.3 In keeping with previous trends at the site, the highest methane concentrations were detected at BH8 (27.2 %) and BH9 (16.0 %). Concentrations within BH8 increased significantly during February from 2.9 % (29th January) to 27.2 % (23rd February). BH9 fluctuated throughout the majority of the review period.

2.3.3.1 Average Methane concentrations within all other locations remained below 0.8 %, with 16 boreholes recording no methane on at least one occasion throughout the quarter.

Carbon Dioxide

2.3.4 Carbon dioxide was recorded in all perimeter gas boreholes during the review period. Carbon dioxide concentrations fluctuated in most locations throughout the review period as seen in previous review periods.

2.3.5 Carbon dioxide concentrations at BH8 peaked at 8.1 % on the 23rd March and were consistently above 6 % throughout March, exceeding the EP Limit (3.6 %).

2.3.6 As in the previous review, the maximum concentration this quarter was recorded in BH9 at 10.1 %, a slight increase compared to the previous quarter's maximum of 9.2 %, also recorded in BH9.

2.3.7 Concentrations remained below the relevant EP compliance limits at the remaining perimeter monitoring locations.

3.0 LEACHATE

3.1 Introduction

3.1.1 Leachate levels at leachate chambers LC1B, LC2B, LC4B and LC6B and remote leachate monitoring points R1B, R2B, R3, R4B, R5 and R6B were recorded monthly. Well locations are shown on Drawing Number 10418a Rev0, enclosed. No results for LC3 and LC5 are reported, as agreed with Natural Resources Wales on the 16th of April 2013.

3.1.2 During June and July 2020 the leachate wells LW1 and LW6 were installed as detailed in the CQA Report 3448-CAU-XX-XX-RP-V-0307-A0-C1. No samples were collected from these wells during this Quarter.

3.1.3 Leachate samples are analysed quarterly. Samples were collected on the 23rd March and analysed for:

Total Organic Carbon, Alkalinity, Ammoniacal Nitrogen, Biological Oxygen Demand (BOD), Chloride, Chemical Oxygen Demand (COD), pH, Sulphate, Total Oxidised Nitrogen (TON), Calcium, Magnesium, Potassium and Sodium.

3.1.4 The leachate treatment plant at the site accepts leachate from Brookhill Landfill Site and the nearby Standard Landfill Site. The treated effluent is discharged to public sewer and is subject to a trade effluent agreement (Discharge Consent, DC).

3.1.5 The treated leachate discharge (Final Discharge, FD) was sampled on the 9th January. These samples were analysed for:

Alkalinity, Ammoniacal Nitrogen, Chromium, COD, Copper, Lead, Nickel, Nitrate as N, Nitrite as N, pH, Suspended Solids and Zinc.

3.1.6 Data summaries of leachate and discharge quality can be found in Appendix 2. Leachate levels are represented graphically, in meters above ordinance datum (mAOD) for easier comparison to groundwater levels.

3.2 Leachate Levels

- 3.2.1 Table S4.1 in the EP requires that leachate levels must not exceed 2 m above the base of Cells 1 and 6, and 3 m above the cell base of Cells 2-5.
- 3.2.2 Pumped leachate levels recorded during this review period are summarised in Table 3.1 below. As discussed with NRW, ‘pumped’ leachate levels are recorded after pumps are switched off for up to 4 hours before a dip is obtained. Pumped leachate levels are provided for completeness, and to provide additional information regarding the efficiency of the leachate management strategy at the site.
- 3.2.3 As part of the routine monitoring, ‘rest’ levels of leachate were also recorded, which reflect the head of leachate after 48 hours of recovery (which has been demonstrated to be sufficient amount of time to reach rest, in accordance with report number 3448-VAU-XX-XX-RP-V-9107.A0-C1¹. The rest leachate levels are reported in relation to the compliance limits in Table 3.2 and plotted in Appendix 2.

Leachate Wells

- 3.2.4 As can be seen in Table 3.1, ‘pumped’ leachate levels were consistent throughout the quarter, often close to the base of the respective wells, indicating that leachate extraction is optimised across the site.

Table 3.1: Pumped Leachate Levels (mAOD)

Landfill Cell	Monitoring Point	Pumped Levels 29/01/2021	Pumped Levels 21/02/2021	Pumped Levels 26/03/2021	Base of well (8 th May 2019)
Cell 1	BK LC 1B	119.22	119.2	119.17	119
	BK R1 B	118.82	118.85	118.83	119
Cell 2	BK LC 2B	115.28	115.32	115.3	117
	BK R2B	116.77	116.8	116.78	117
Cell 3	BK R3	111.71	111.74	111.77	113.37
Cell 4	BK LC 4B	114.77	114.75	114.78	115
	BK R4B	115.44	115.42	115.38	115.6
Cell 5	R5	116.72	116.74	116.77	115.91
Cell 6	BK LC 6B	123.61	123.59	123.56	122
	BK R6B	122.18	122.19	122.17	122.24

- 3.2.5 Leachate ‘rest’ levels are presented in Table 3.2 in relation to the relevant compliance limits. As in the previous quarter wells LC2B and R3 have recorded rest leachate levels below their respective compliance limits throughout this quarter. Exceedances were observed in the remaining locations. Overall, a slight decrease in rest levels was observed across the site through the first quarter of 2021 (-0.001 m, Average).
- 3.2.6 The results overall indicate relatively stable leachate levels across the site and suggest extraction may be in equilibrium with leachate generation over the site as a whole. The

¹ Caulmert Ltd, February 2019; Document reference 3448-CAU-XX-XX-RP-V-9107-A0-C1: Brookhill Improvement Actions; Trial of Leachate Extraction from Gas Wells – Interpretative report.

difference between the rest and pumped levels remains around 1m for most wells. This is likely as a result of the ongoing extraction of leachate from gas wells at the site¹.

- 3.2.7 It is also noted that while the rest leachate levels exceeded the compliance limit, the leachate head remained below the level of the surrounding groundwater through this period in all cells managed on the principle of hydraulic containment (see groundwater levels section below).

Table 3.2 – Rest Leachate Levels (mAOD) (exceedances of the EP limit are shown in yellow)

Landfill Cell	Monitoring Point	Rest Level 29/01/2021	Rest Level 21/02/2021	Rest Level 26/03/2020	Compliance limit
Cell 1	LC1B	120	119.9	119.84	119
	BK R1 B	119.42	119.22	119.28	119
Cell 2	LC2B	116.12	116.06	115.96	117
	BK R2B	118.34	117.9	117.82	117
Cell 3	BK R3	112.86	112.74	112.63	113.37
Cell 4	LC4B	115.73	115.58	115.64	115
	BK R4B	116.28	116.12	116.03	115.6
Cell 5	R5	117.76	117.61	117.57	115.91
Cell 6	BK LC 6B	124.45	124.45	124.35	122
	BK R6B	123.45	123.61	123.12	122.24

- 3.2.8 The observed results and compliance limits around the site will be assessed in relation to the relative risk posed by the site as part of the Hydrogeological Risk Assessment, and appropriate management strategies proposed therein as required to manage risks posed by the site.

Gas Wells

- 3.2.9 As indicated in interpretive report 3448-CAU-XX-XX-RP-V-9107¹, a brief update and review of the progress of the leachate extraction from gas wells is to be included in the quarterly reports. Counter readings were only collected during January this quarter. The collected information is summarised here.
- 3.2.10 The counters for the pumps in well GV36, GV45 and GV48 recorded increases during this review period, while the remaining counters did not change, although this is reported as counter malfunction while the pumps remain operational. The pump counter readings for these three wells in total increased by 272107 counts from the previous reading on the 28th December 2020. This is equivalent to ~108.8 m³ of leachate based on the capacity of the pumps (0.4 L per count) installed in those wells. This would be equivalent to ~326.5 m³ for all GV wells if pumps within all 9 GV wells are pumping at a rate equivalent to the average of the three wells listed above.
- 3.2.11 Leachate head continues to be well maintained (Appendix 2, Graph 5), with levels remaining stable throughout the review period and similar to the previous review period. The levels have remained low, while extraction remained sustainable, suggesting steady state conditions.
- 3.2.12 Leachate extraction from these wells will be continued and reported within the quarterly reviews for the site. The extraction in individual areas as well as from the gas-well system as a whole will continue to be reviewed in relation to leachate dynamics and ongoing leachate management strategy for the site. Further interpretation, considering the longer-term trends and further implications will be included in the Annual Report for the site.

3.3 Leachate Quality

- 3.3.1 Ammoniacal nitrogen concentrations ranged from 1620 mg/l in LC1B to 3440 mg/l in LWC5. Concentrations decreased significantly within LC3 from 3430 mg/L (December 2020) to 1630 mg/L (March 2021).
- 3.3.2 Chloride concentrations were highest in LC2 at 2,020 mg/l, a decrease compared to the previous reviews' maxima of 4,650 mg/l in LC3 and LC4B. The average chloride concentration across the leachate wells decreases during this quarter from 3522.5 mg/L (Quarter 4, 2020) to 1887.5 mg/l (Quarter 1, 2021).
- 3.3.3 Concentrations of sulphate were below the limit of detection during this quarter at all leachate wells. This is a significant decrease from an average of 190 mg/L across all wells. This is potentially a laboratory error, as the site average sulphate concentration during 2020 was 101 mg/l. It is considered unlikely that the concentrations would decrease so drastically over this short time frame. It is recommended that a repeat sampling round is carried out to confirm the current leachate concentrations.
- 3.3.4 COD concentrations decreased compared to the previous quarter from 7220 mg/l within LC6 (Quarter 4) to 5690 mg/l, also within LC6. The lowest COD concentration was detected within LC4B at 1820 mg/l.

3.4 Final Discharge to Sewer

- 3.4.1 Final discharge quality was analysed on 9th January for this quarter. Ammoniacal nitrogen exceeded the compliance limit of 50 mg/L at a concentration of 94.4 mg/L.
- 3.4.2 COD concentrations remained below the 2000 mg/l limit at 1060 mg/L. An increase compared to the previous reviews maximum of 920 mg/L (31st December).
- 3.4.3 The concentration of suspended solids was above the 500 mg/l limit with a maximum concentration of 599 mg/l, an increase on the previous reviews' maxima of 328 mg/l.
- 3.4.4 Samples were analysed for the metals, chromium, copper, lead, nickel and zinc. Concentrations remained below the 2 mg/l compliance limit with maximum concentrations of 0.0327 mg/L, 0.0457 mg/L, 0.00866 mg/L, 0.127 mg/L and 0.0564 mg/L, respectively.

4.0 GROUNDWATER

4.1 Introduction

4.1.1 Borehole locations are shown on Drawing 10418aRev0, enclosed. Groundwater levels were recorded on a monthly basis in monitoring boreholes GW1 – GW8.

4.1.2 Samples were collected three times during the first quarter of 2021; 31st January, 26th February and 24th March. Collected samples were analysed monthly for the range of determinants listed below:

pH, electrical conductivity, ammoniacal nitrogen, DO, chloride and dissolved oxygen.

4.1.3 Groundwater samples collected on the 24th March were analysed for the following quarterly parameters:

Total organic carbon, alkalinity, ammoniacal nitrogen, chloride, chemical oxygen demand, electrical conductivity, dissolved oxygen, pH, sulphate, total oxidized nitrogen, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, zinc, benzene, ethylbenzene, m,p-xylene, BTEX, xylenes, toluene.

4.1.4 Time-series graphs and results summary of the laboratory analysis data are included in Appendix 3.

4.2 Groundwater Levels

4.2.1 Time series graphs of the groundwater levels are included in Appendix 3. Groundwater levels decreased in the majority of wells, reflecting seasonal trends with the greatest decrease seen within GW8 at 1.84 m. Groundwater levels within GW6 and GW6.1 increased during the first quarter of 2021 by 0.64m and 0.68 m respectively. On average the remaining wells decreased by 0.85 m during quarter 1 of 2021.

4.3 Groundwater Quality

4.3.1 As in the previous review, exceedances of the EP limit for ammoniacal nitrogen (1.7 mg/L) were observed in GW2A and GW4 throughout the review period. Maximum concentrations of ammoniacal nitrogen in GW2A and GW4 were 4.73 mg/L and 11.1 mg/l respectively. This was a significant decrease compared to the previous review where maximum concentrations within GW2A and GW4 were 38.1 mg/l (November) and 44.3 mg/l (November) respectively. Concentrations within GW3A were below the EP limit with a maximum concentration of 1.49 mg/L during January. Average ammoniacal nitrogen concentrations in the remaining locations were 1.53 mg/L, 1.50 mg/L, 0.94 mg/L, 1.73 mg/L, 3.29 mg/L and 17.33 mg/L in GW1, GW1.1, GW5A, GW6, GW7 and GW8 respectively.

4.3.2 Similar to ammoniacal nitrogen, exceedances of the EP limit for chloride (60 mg/l) were observed in GW2A, GW3A and GW4 throughout the review period. The maximum chloride concentrations in these locations were 92.7 mg/L, 126 mg/L and 127 mg/L respectively.

Concentrations within GW2A and GW3A decreased compared to the previous review (130 mg/L and 132 mg/L respectively), conversely, concentrations within GW4 increase compared to the previous reviews' maxima (96.8 mg/L). Concentrations across the remaining monitoring points ranged from 17.2 mg/L in GW1 to 134 mg/L in GW8.

- 4.3.3 Electrical conductivity measurements ranged from a minimum of 0.25 mS/cm in GW7 to a maximum of 2.27 mS/cm in GW1 and GW1.1. Conductivity remained comparable to the previous quarter, with GW6 remaining low during the review period.
- 4.3.4 The pH in the groundwater locations varied from 6.73 (GW5A) to 7.85 (GW3A and GW7). The range in pH was similar to that during the previous review.
- 4.3.5 Concentrations of iron were significantly higher within GW4 and GW8 at 2.94 mg/L and 2.56 mg/L respectively. It should be noted that iron concentration have decreased significantly since the previous reviews maxima of 7.68 mg/L (GW2A). Iron concentrations in the remaining monitoring locations were below 0.04 mg/L. Concentrations of the metals nickel and zinc remained below their respective compliance limits, 0.15 mg/L and 0.254 mg/L during the first quarter of 2021.
- 4.3.6 It should be noted, both GW1 and GW1.1 contained significantly higher concentrations of the metal's cadmium, calcium, copper, magnesium, potassium and zinc. Concentrations of sulphate and total oxidised nitrogen were also significantly higher in GW1 and GW1.1. Concentrations of lead were below the limit of detection at all monitoring locations with the exception of GW1.1 at 0.00006 mg/L.
- 4.3.7 During the quarterly monitoring round, no benzene, toluene, ethylbenzene or xylenes were detected in any of the locations.

5.0 SURFACE WATER

5.1 Introduction

- 5.1.1 Surface water samples are taken from three locations, SW2, P2 and P4. Water flows in a northerly direction alongside the outside perimeter fence of the western boundary of the site and accumulates in a pond at SW2 before slowly seeping through a man-made underground bypass drain which runs along the outside of the site towards the northern boundary. P2 is a pond to the west, which collects surface water run-off from the landfill. P4 is located in a field to the north west of the site, beyond landfill gas monitoring borehole BH10.
- 5.1.2 As agreed with NRW, water in P2 is only sampled when there is the likelihood of an overflow to the discharge point². P2 was not sampled during this review period.
- 5.1.3 No samples have been taken from SW2 during this review period. Samples were obtained from P4 in all months this quarter.
- 5.1.4 Collected samples were analysed for the range of determinants listed below:

Ammoniacal nitrogen, chloride, chemical oxygen demand (COD), pH and total suspended solids

- 5.1.5 In the EP, Table S4.3 requires that only location P2 be controlled by chemical quality limits. Monitoring locations are shown on Drawing Number 10418aRev0, enclosed. A summary of the laboratory analysis data is included in Appendix 4.

5.2 Surface Water Quality

- 5.2.1 Surface water quality was recorded three times, during January (31st), February (26th) and March (24th) at P4. Ammoniacal nitrogen concentrations were similar to the previous review with concentrations remaining below the detection limit (<0.2 mg/l) throughout the review period.
- 5.2.2 The average concentration of chloride at P4 was 31.9 mg/l, similar to the previous quarter, where the average concentration was 33.8 mg/l.
- 5.2.3 The pH concentration peaked during January at 8.07. The average pH concentration was 7.89, similar to that in the previous review (7.89 mg/l in P4
- 5.2.4 Suspended solids concentration increased significantly compared to the previous review. During quarter one (2021) concentrations ranged from 28.8 mg/L to 608 mg/L at P4. During the previous review concentration ranged from 3.9 mg/l to 8.55 mg/l (November).

² E-mail correspondence, 14.07.2014, Alison Soper (NRW) to Phil Mulhall (FCC).

6.0 DUST

6.1 Introduction

6.1.1 Dust monitoring was undertaken between the 01/03/2021 and the 01/04/2021 as required by the EP.

6.1.2 Location 1 was located on a bund by leachate storage tanks and opposite the transfer pad. Location 2 was on the site perimeter near the electricity meter house. Location 3 was in Oaks Farm.

6.2 Dust Results

6.2.1 Dust monitoring results are shown in Table 4 below, and the lab report is included in Appendix 5.

Table 4: Results from dust monitoring at Brookhill

Monitoring	Total Suspended Solids	Result	Compliance Limit
Locations	(mg/l)	(mg/m ² /day)	(mg/m ² /day)
Location 1	58.6	46.69	200
Location 2	46.4	36.97	200
Location 3	20.1	16.02	200

6.2.2 No exceedances of the compliance limit were noted during this quarter.

7.0 CONCLUSIONS

7.1 Landfill Gas

- 7.1.1 Landfill gas concentration was monitored at locations on a weekly basis at perimeter locations and monthly at all in-waste locations.
- 7.1.2 During this review period methane, carbon dioxide and oxygen concentrations averaged 49.25 %, 30.86 % and 2.2 % respectively. It is suspected that 19 of the in-waste boreholes are demonstrating various amounts of air ingress across the site (Table 2.1).
- 7.1.3 BH16 was in breach of its respective methane EP limit during this review period, however, it was Buried for the remainder of the review period so no trend could be discerned. Methane concentrations within the remaining perimeter boreholes remained below their respective EP limits throughout the review period. Methane concentrations averaged from 2 % in the perimeter wells during this quarter, an increase compared to the previous review's 0.94 %. As in the previous review, the highest concentrations were in BH8 and BH9. These locations are influenced by the neighbouring historic Ewloe Barn Landfill.
- 7.1.4 None of the perimeter gas boreholes were in breach of their respective carbon dioxide EP limits with the exception of BH8. Carbon dioxide concentrations within BH8 exceeded the EP limit throughout March. The maximum carbon dioxide concentration this quarter was recorded in BH9 (10.1 %).

7.2 Leachate

- 7.2.1 Since the first quarter of 2019 leachate levels have been recorded and reported both as 'pumped' levels and as 'rest' levels. Compliance has been assessed using the 'rest' leachate levels.
- 7.2.2 Leachate levels remained steady throughout this quarter of 2021. In this quarter LC2B and R3 were below the limit. The remaining locations recorded exceedances of the respective limits during this review period.
- 7.2.3 During the first Quarter of 2021, leachate continued to be extracted from the gas wells at the site and the recorded extraction and level figures from this system during this period are included in this review for reference¹.
- 7.2.4 The leachate dynamics at the site relative to the surrounding groundwater, compliance limits and management will be reviewed as part of the HRA review for the site, which is ongoing.
- 7.2.5 Maximum concentrations were generally detected within LC5 and LC6, with lower concentrations at LC1B. An over all decrease of several key parameters was noted within the raw leachate.
- 7.2.6 The Final discharge was analysed once during quarter 1. Concentrations of ammoniacal nitrogen and suspended solids exceeded the discharge consent during January.

7.3 Groundwater

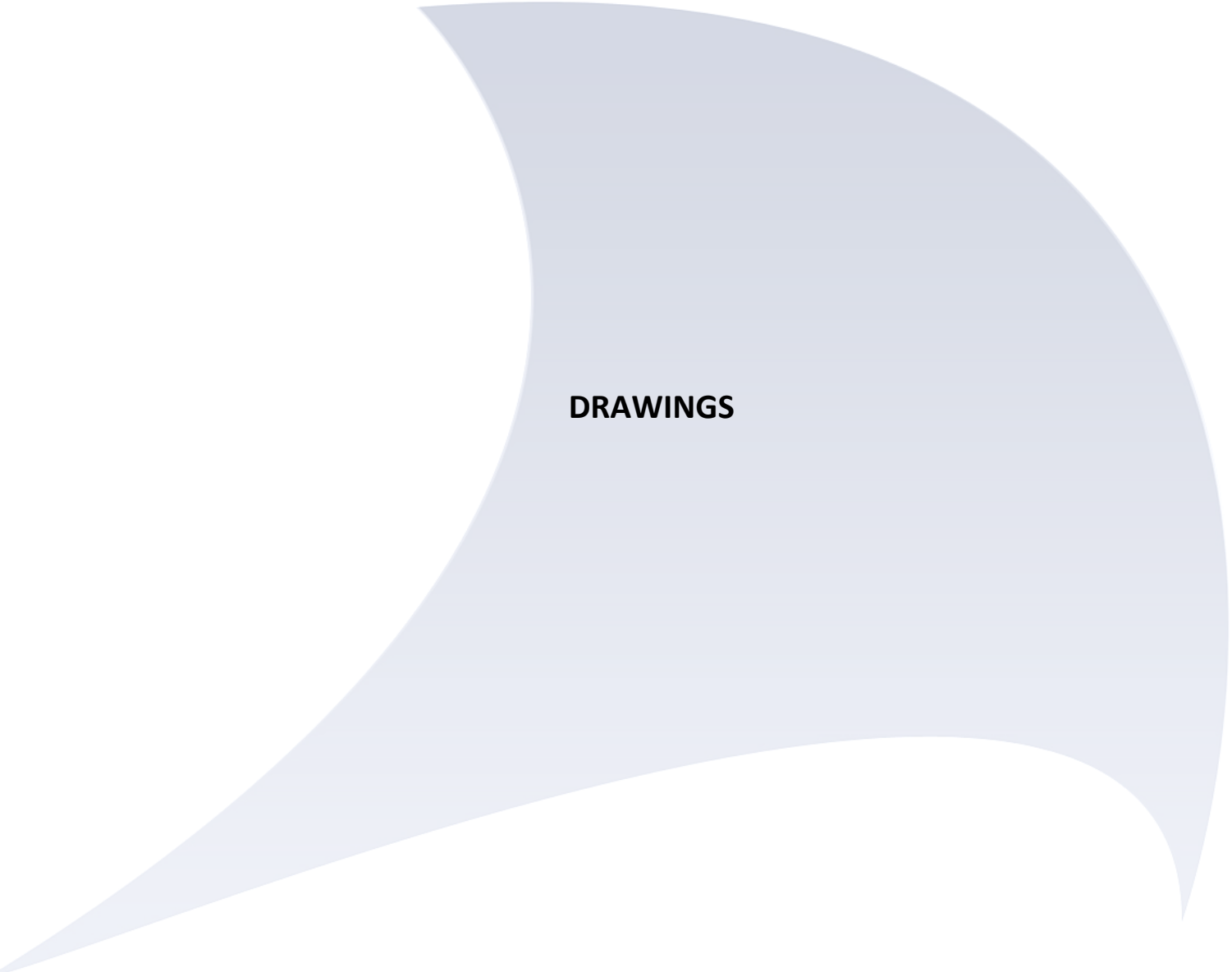
- 7.3.1 Exceedances of the EP limit for ammoniacal nitrogen (1.7 mg/L) were observed in GW2A and GW4 during the review period. The EP limit for chloride was also exceeded in GW2A, GW3A and GW4, as in the previous quarter. Decreases of both ammoniacal nitrogen and chloride seen compared to the previous review with the exception of GW4. Chloride concentrations within GW4 increased compared to the previous review. The recorded concentrations are currently being reviewed in the context of background water quality in other boreholes around the site.
- 7.3.2 It should be noted that GW1 and GW1.1 contained significantly high concentrations of cadmium, Calcium, Copper, magnesium, potassium, zinc, sulfate and total oxidised nitrogen compared to the other monitoring locations. Concentrations of Iron were also significantly higher within GW4 and GW8 compared to the rest of the groundwater monitoring locations.

7.4 Surface Water

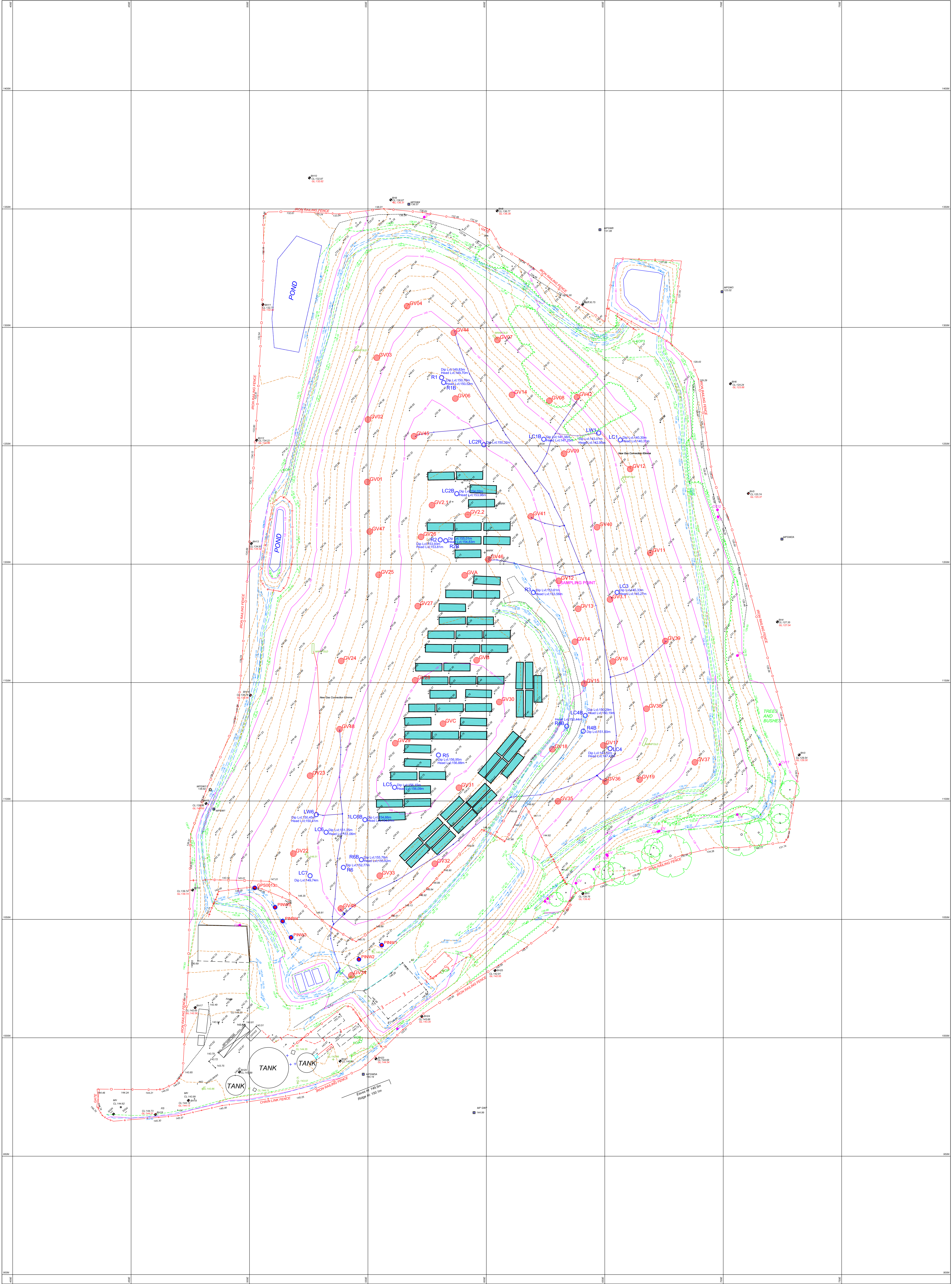
- 7.4.1 Only P4 was sampled during this review period. Both ammoniacal nitrogen and chloride concentrations were similar to those reported in the previous review. Suspended Solid concentrations increased significantly compared to those in the previous review.

7.5 Fugitive emissions (dust)

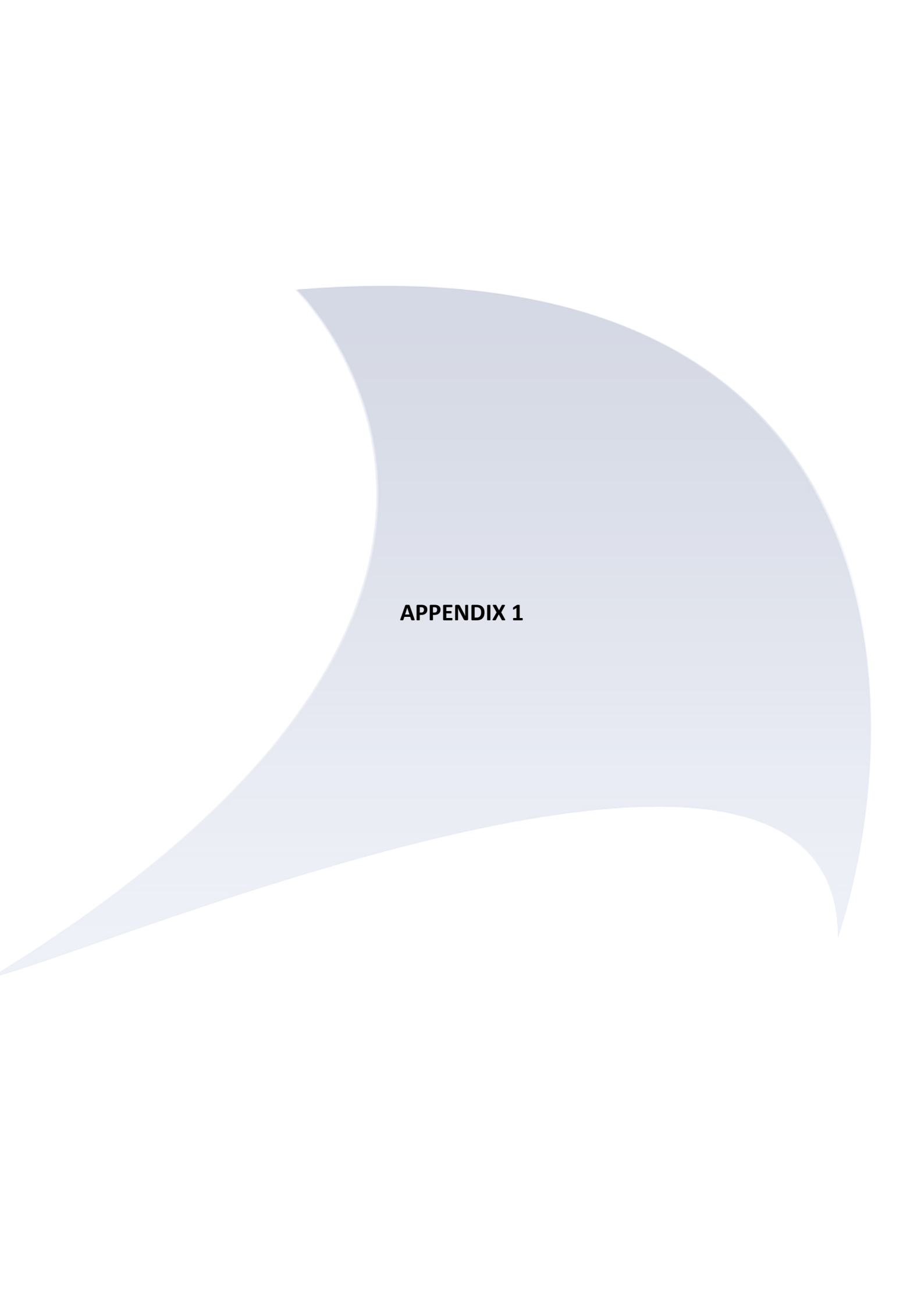
- 7.5.1 No exceedances of the environmental permit were noted during this quarter.



DRAWINGS



SITE Brookhill Landfill Site	SCALE 1:500 @ A0 DRAWING DATE 03/02/2021	CLIENT Sir y Fflint Flintshire COUNCIL English Cymraeg	Levels Relate To : SITE DATUM Co-ordinates : SITE GRID	LC5 Leachate Well GV31 Gas Vent Switched On PIN6 Pin Gas Ven Solar Panel	Leachate Pipe Main 90mm Branch 63mm Air Line Main 63mm Branch 32mm Gas Line Main 63mm	BH5 CL:125.74 Borehole MPGW2A Ground Water Monitoring Point	NOTES	stafsurv LAND SURVEYORS www.stafsurv.com Vernon Courtyard, Main Road, Sudbury, Derbyshire, DE5 5HS T: 01283 584500 F: 01284 584844 E: info@stafsurv.com
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APPENDIX 1

APPENDIX 1 – LANDFILL GAS

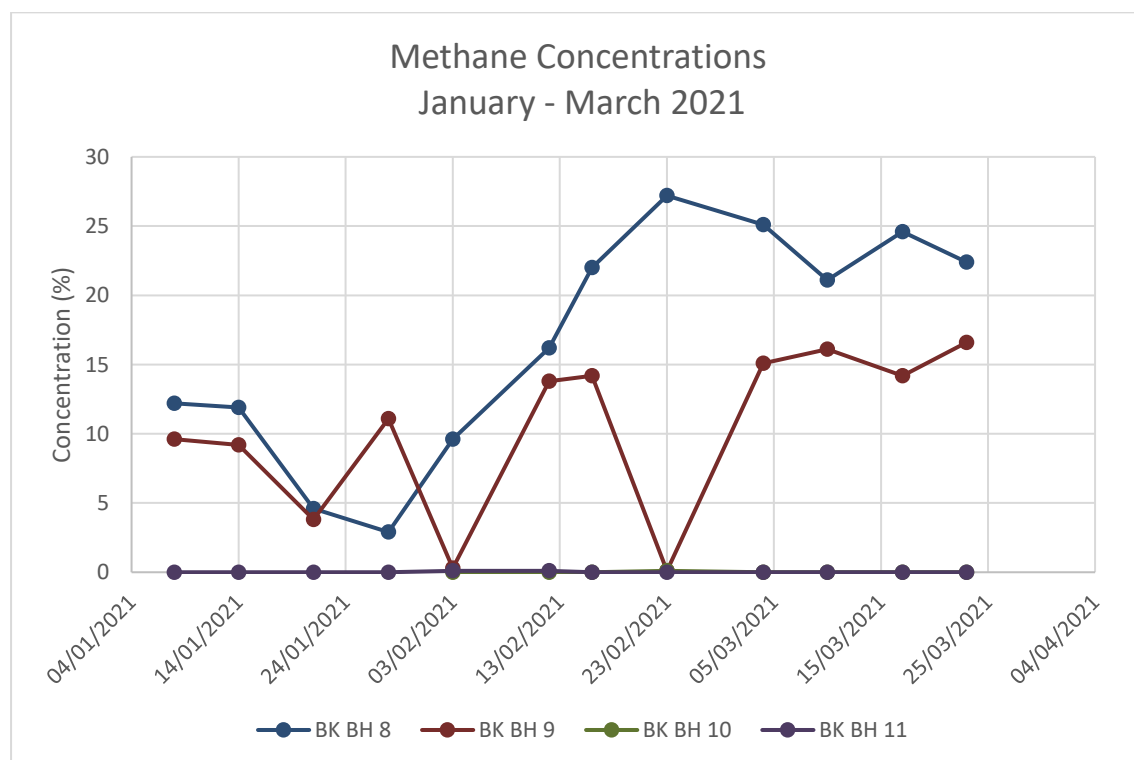
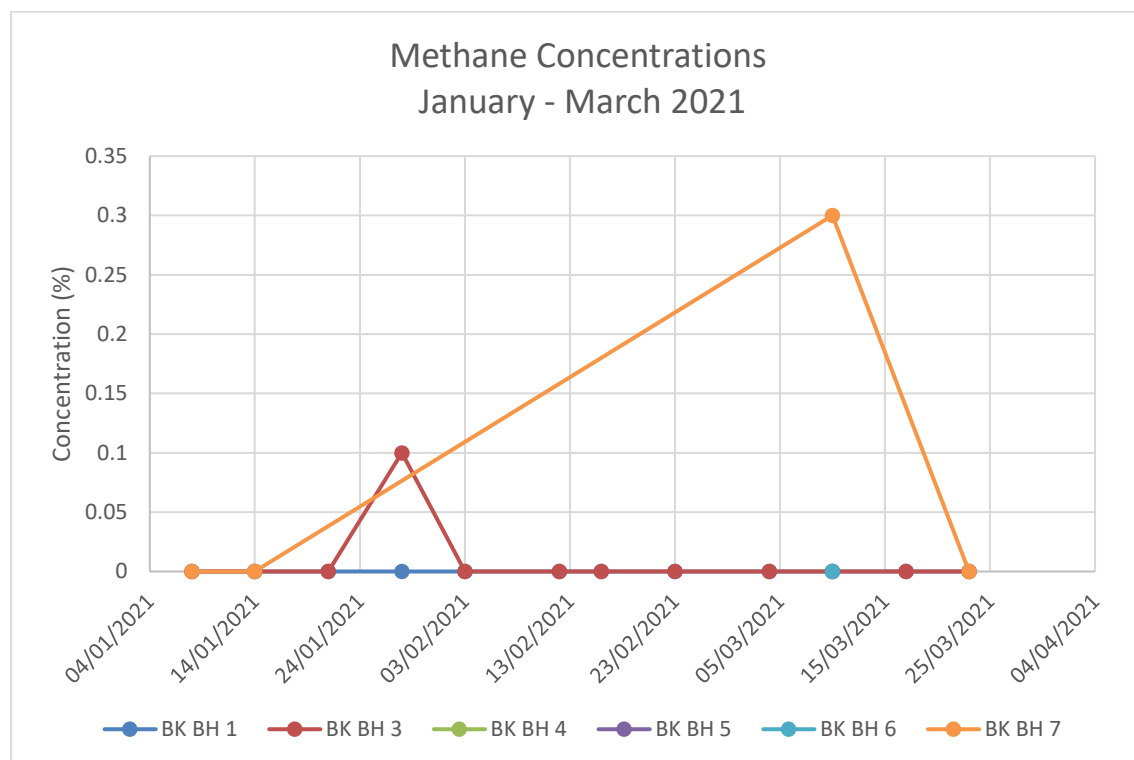
Table 1: Perimeter Landfill Gas Monitoring Data Summary

		CH4 (%)	CH4 Trigger (%)	CO2 (%)	CO2 Trigger (%)
BK BH 1	Min	0.00	1	0.10	8.8
	Max	0.00		1.50	
	Average	0.00		0.38	
	Count	12.00		12.00	
BK BH 3	Min	0.00	1	0.00	3.1
	Max	0.10		2.30	
	Average	0.01		1.20	
	Count	12.00		12.00	
BK BH 4	Min	Flooded	1	Flooded	5.1
	Max				
	Average				
	Count				
BK BH 5	Min	Flooded	1	Flooded	1.5
	Max				
	Average				
	Count				
BK BH 6	Min	0.00	1	0.50	1.5
	Max	0.00		0.50	
	Average	0.00		0.50	
	Count	12.00		12.00	
BK BH 7	Min	0.00	1	0.10	10
	Max	0.30		0.30	
	Average	0.08		0.15	
	Count	12.00		12.00	
BK BH 8	Min	2.90	32.2	2.30	3.6
	Max	27.20		8.10	
	Average	16.65		4.32	
	Count	12.00		12.00	
BK BH 9	Min	0.10	29.6	0.40	10.4
	Max	16.60		10.10	
	Average	10.34		5.68	
	Count	12.00		12.00	
BK BH 10	Min	0.00	1	0.00	3.9
	Max	0.10		1.30	
	Average	0.01		0.34	
	Count	12.00		12.00	
BK BH 11	Min	0.00	1	0.90	6.5
	Max	0.10		2.60	
	Average	0.02		1.57	
	Count	12.00		12.00	
BK BH 12	Min	0.00	1	0.20	6.6
	Max	0.10		3.00	
	Average	0.03		1.59	
	Count	12.00		12.00	
BK BH 13	Min	0.00	1	1.90	9.4
	Max	0.00		1.90	
	Average	0.00		1.90	
	Count	12.00		12.00	

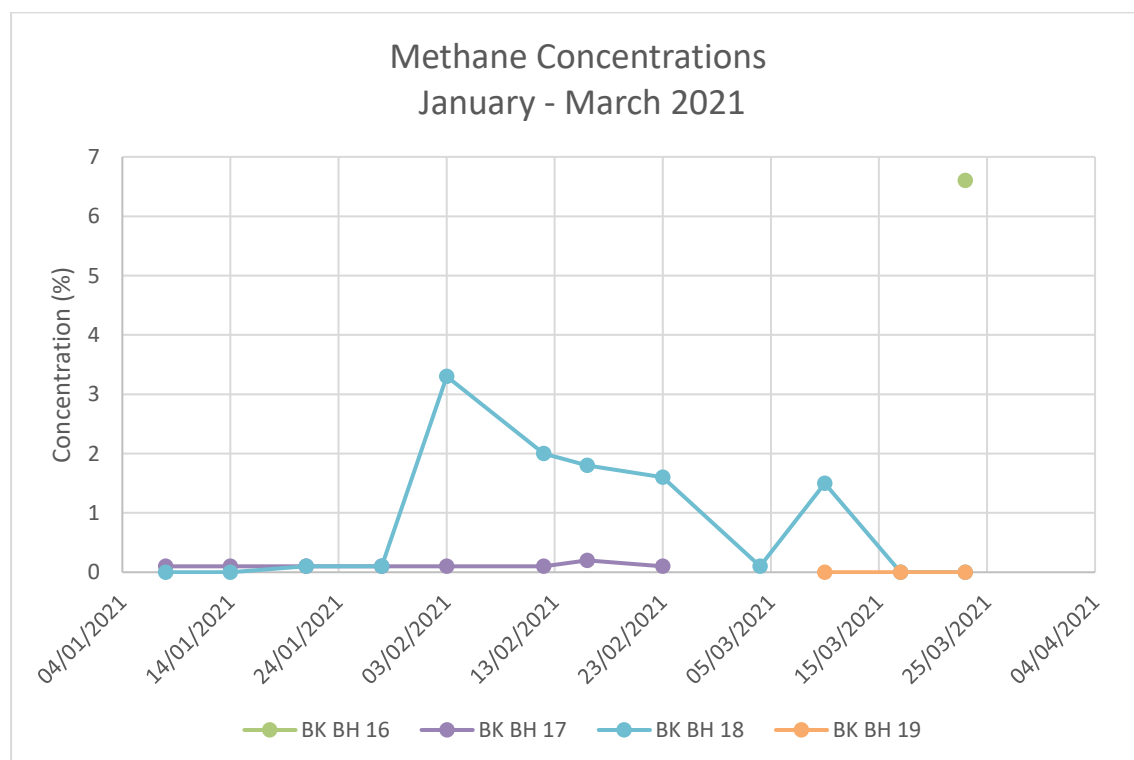
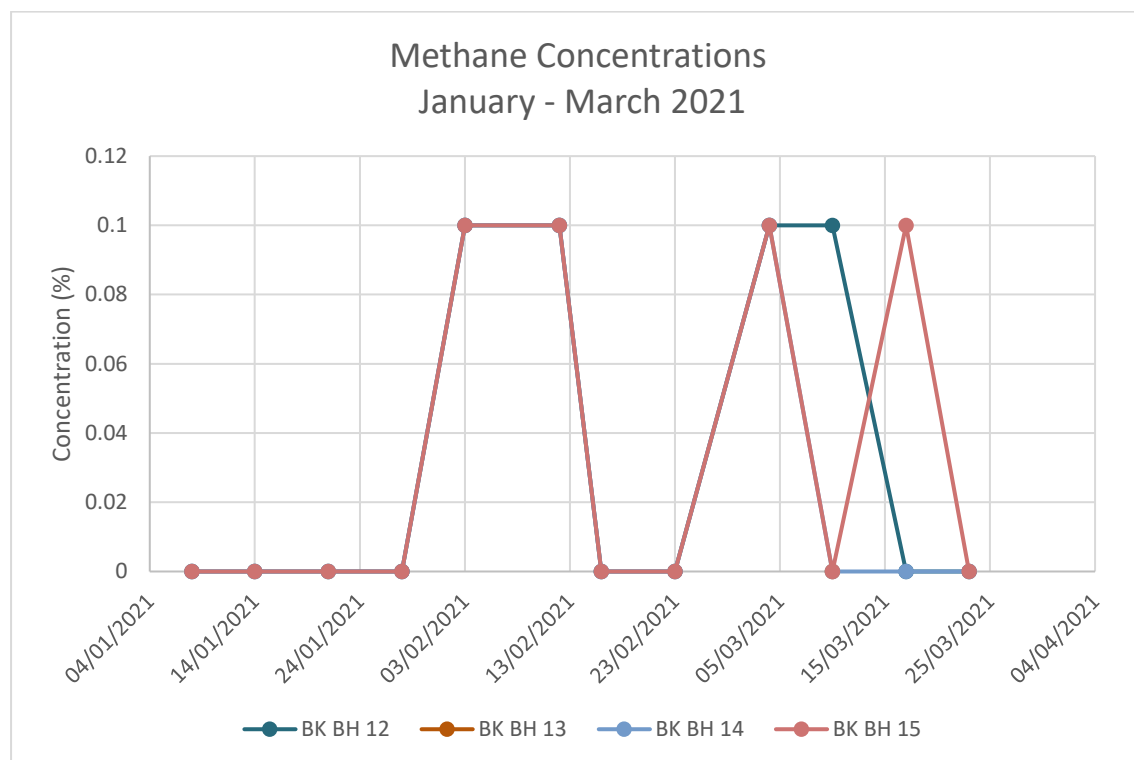
APPENDIX 1 – LANDFILL GAS

		CH4 (%)	CH4 Trigger (%)	CO2 (%)	CO2 Trigger (%)
BK BH 14	Min	0.00	1	0.00	3.5
	Max	0.10		1.20	
	Average	0.02		0.22	
	Count	12.00		12.00	
BK BH 15	Min	0.00	1	0.00	17.6
	Max	0.10		1.80	
	Average	0.03		0.65	
	Count	12.00		12.00	
BK BH 16	Min	6.60	1	2.80	11.4
	Max	6.60		2.80	
	Average	6.60		2.80	
	Count	12.00		12.00	
BK BH 17	Min	0.10	1	0.20	12.9
	Max	0.20		0.30	
	Average	0.11		0.24	
	Count	12.00		12.00	
BK BH 18A	Min	0.00	3.5	0.10	10
	Max	3.30		13.40	
	Average	0.88		5.42	
	Count	12.00		12.00	
BK BH 19	Min	0.00	1	0.20	11.2
	Max	0.00		0.30	
	Average	0.00		0.23	
	Count	12.00		12.00	
BK BH 20	Min	Flooded	1	Flooded	
	Max				
	Average				
	Count				
BK BH 21	Min	0.00	1	0.40	11.4
	Max	0.10		3.70	
	Average	0.05		2.10	
	Count	12.00		12.00	
BK BH 23	Min	0.00	1	0.60	7.3
	Max	0.00		5.70	
	Average	0.00		3.58	
	Count	12.00		12.00	
BK BH 24	Min	0.00	1	0.00	1.5
	Max	0.00		1.30	
	Average	0.00		0.38	
	Count	12.00		12.00	
BK BH 25	Min	0.00	1	0.10	9.9
	Max	0.00		4.70	
	Average	0.00		2.30	
	Count	12.00		12.00	

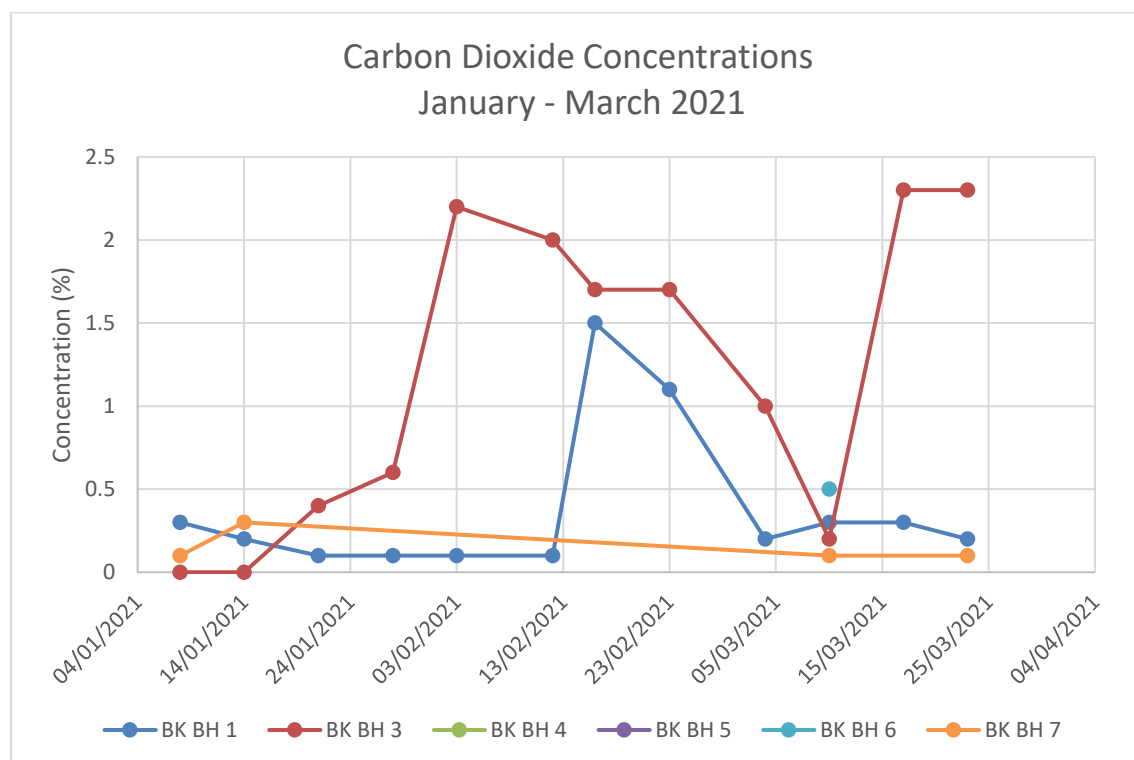
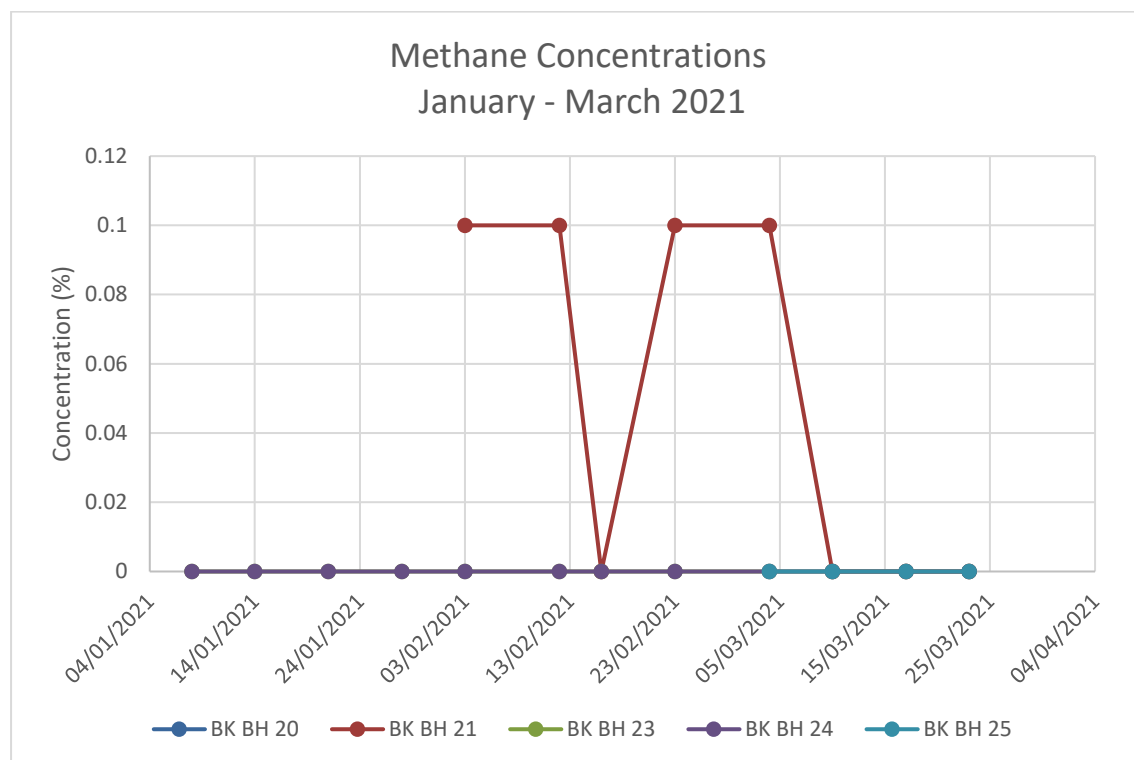
APPENDIX 1 – LANDFILL GAS



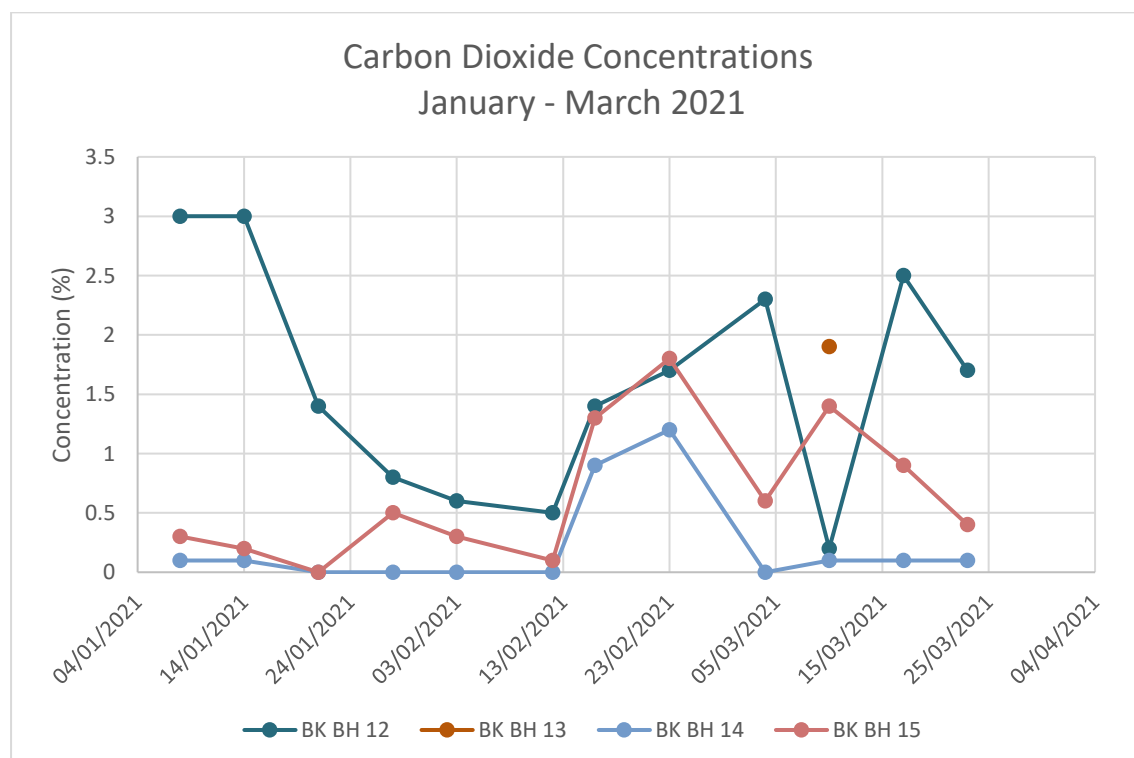
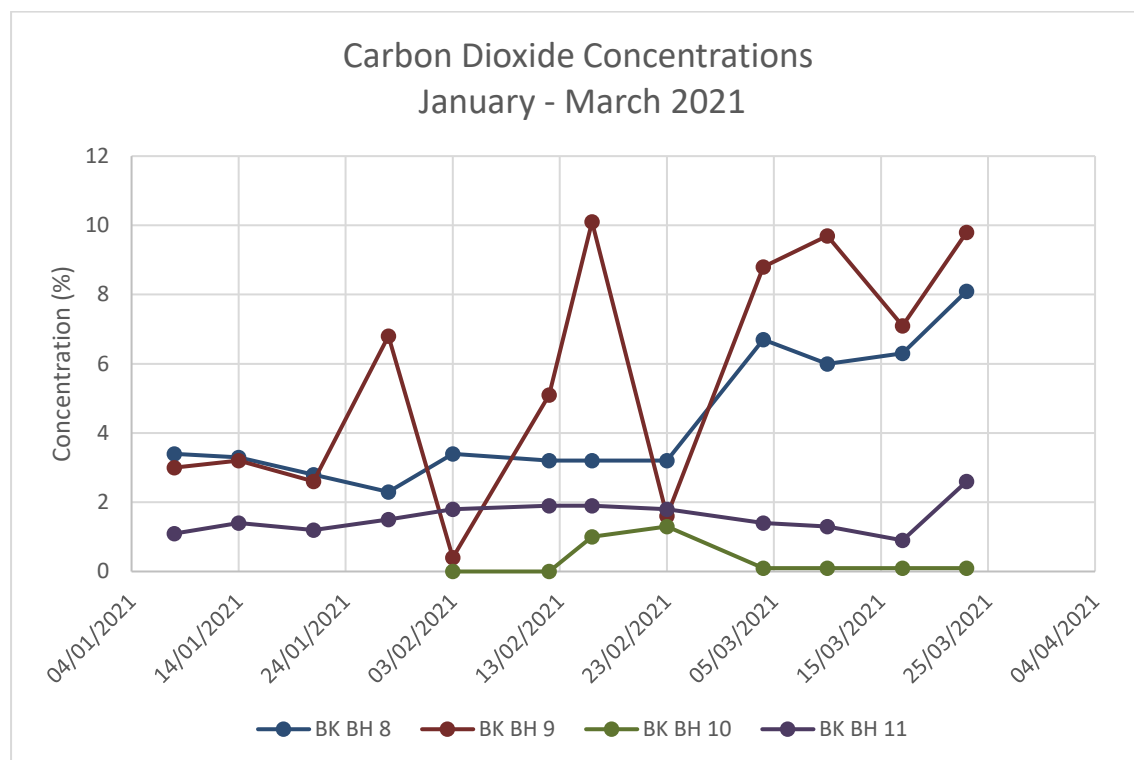
APPENDIX 1 – LANDFILL GAS



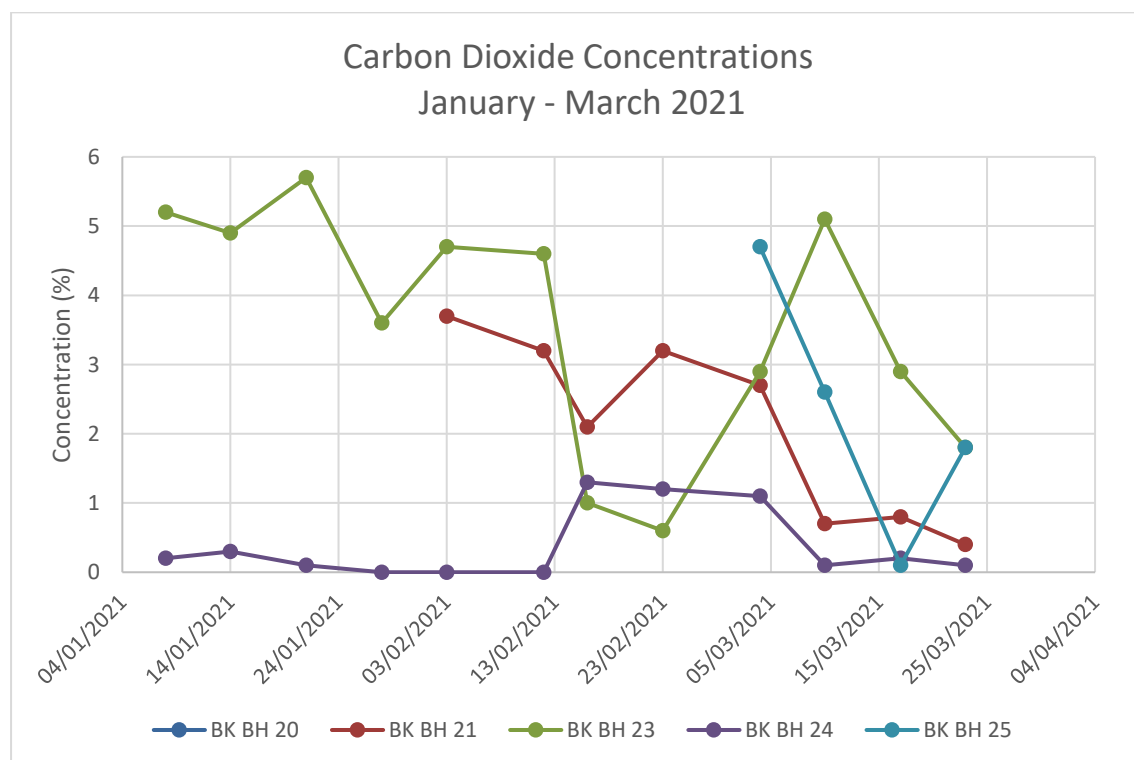
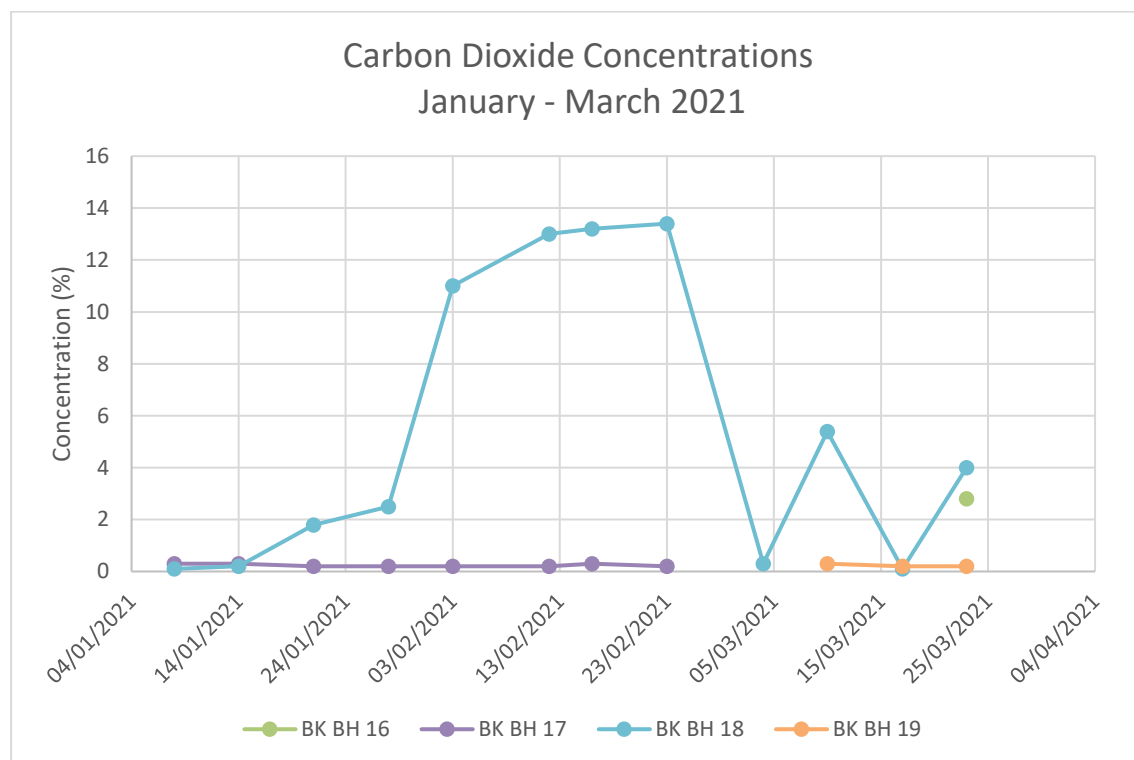
APPENDIX 1 – LANDFILL GAS



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APPENDIX 1 – LANDFILL GAS



APPENDIX 1 – LANDFILL GAS

Table 2: In waste landfill gas monitoring data summary

Monitoring Point	CH4 %			CO2 %			O2 %			Balance %		
	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
BHG010MA	39.5	51	46.38	28.9	36.5	32.35	0.4	2.7	1.48	13.1	28.9	19.8
BHG010MB	35.4	38.8	37.1	27.7	29.3	28.5	2.8	3.8	3.3	29.1	33.1	31.1
BHG01MDA	45.4	54	48.58	33.5	35.1	34.3	0.2	1.1	0.52	11	20.1	16.6
BHG01MDB	38.7	51.6	46	29.3	34.3	31.75	0.4	3.2	1.75	13.7	29.1	20.5
BHGV0001	64.7	67.4	65.93	36.8	37.6	37.07	0	0.2	0.07	0	0	0
BHGV0003	69.8	71.4	70.8	32.2	34.3	33.07	0	0.2	0.1	0	0	0
BHGV0004	45.2	56.7	49.28	25.3	28.7	26.3	0.2	0.3	0.22	14.3	29.3	24.2
BHGV0006	53.3	63	56.32	29.6	36.7	31.6	0.5	2.7	2	0	14.4	10.12
BHGV0007	69.4	82.3	74.87	20.7	32.9	27.8	0	0	0	0	0	0
BHGV0008	22.8	30.1	26.43	13.5	17.2	15.1	9	10.8	9.73	46.3	52.9	48.73
BHGV0009	40.9	58.2	51.66	24.4	30.6	27.56	0.2	0.9	0.4	11	31.3	20.38
BHGV000A	60.7	62	61.37	39.7	41.8	40.9	0	0.2	0.1	0	0	0
BHGV000B	58	60.6	59.13	37.1	38	37.6	0.2	0.4	0.3	1.1	4.5	2.97
BHGV000C	56.6	59.7	58.37	36.9	38.4	37.57	0.2	0.8	0.43	1.6	5.2	3.63
BHGV0010	28.8	28.8	28.8	13.8	13.8	13.8	10.4	10.4	10.4	47	47	47
BHGV0011	48.6	66	54.9	23.2	30.8	26.05	0	0.4	0.15	3.1	27.3	18.9
BHGV0012	46.9	50.9	49.4	35.2	37.3	36.4	0.1	0.6	0.43	11.7	17.3	13.77
BHGV0013	0.2	28.6	11.4	2.9	21.8	13.23	8.7	17.1	12.13	40.9	79.8	63.23
BHGV0014	35.4	45.7	42.32	34.1	37.5	36.26	0.1	0.1	0.1	16.8	30.4	21.32
BHGV0015	43.1	59.4	49.24	35.4	37.8	36.86	0.4	1.4	0.86	4.8	19.7	13.04
BHGV0016	36.7	60	50.28	29	40.2	35.88	0.2	0.8	0.5	0	33.6	13.43
BHGV0018	46.3	54.4	51.13	38.3	39.3	38.63	0	0.5	0.2	6.8	15.3	10.03
BHGV0022	0.7	58.9	26.63	6.5	40.5	20.27	0	14.9	8.87	0.6	77.9	44.23
BHGV0023	0.1	63.5	41.73	6.9	41.3	29	0	15.9	5.33	0	77.1	25.7
BHGV0024	63.5	65.6	64.6	36.8	38.8	37.73	0	0.3	0.13	0	0	0
BHGV0025	47.6	62.2	55.7	35.9	40.1	37.7	0	0.1	0.07	0	15.2	7.33
BHGV0026	63	65.7	64.37	33.6	39.2	37.1	0.1	0.4	0.27	0	0.4	0.13
BHGV0027	59.9	61.3	60.83	41	42.3	41.7	0	0.4	0.23	0	0	0
BHGV0028	60	62.8	61.48	36.9	38.6	37.4	0.1	0.6	0.35	0	2.5	0.82

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Monitoring Point	CH4 %			CO2 %			O2 %			Balance %		
	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
BHGV0029	61.9	63.1	62.7	38.5	38.9	38.77	0	0.5	0.3	0	0	0
BHGV0030	47.1	50.8	49.68	34.9	37	36.2	0	0.5	0.12	12.6	17.5	14
BHGV0031	33.6	42.9	39.15	30.4	32.6	31.95	0.2	0.9	0.5	26.3	32.9	28.4
BHGV0032	60.1	63	61.13	39.8	42.6	41.4	0.2	0.6	0.37	0	0	0
BHGV0033	37.2	60.2	47.54	28	41.2	34	0.1	5.6	2.96	0	29.2	16.1
BHGV0035	38.7	62.1	54.27	29.3	39.1	35.13	0	3.1	1.13	0	28.9	9.83
BHGV0036	46.5	63	57.25	29.2	32.9	31.43	0	0.2	0.05	4.8	24.1	11.27
BHGV0037	59.7	70.4	66.08	32.5	33.8	33.08	0	0.3	0.13	0	7.7	2.5
BHGV0038	45.8	72.6	57.4	25.2	33.6	30.54	0.2	1.9	0.84	0.5	19.5	11.22
BHGV0039	36.4	61.5	52.65	22.6	32.3	28.7	0.4	3.6	1.45	5.6	37.4	17.2
BHGV0040	43.7	64	56.5	29.5	32.2	30.76	0	1.4	0.54	2.8	26.6	12.2
BHGV0041	44.2	50.2	47.83	31	33.7	32.5	0.1	0.5	0.33	15.7	22.9	19.33
BHGV0042	36.3	52.2	44.25	11.2	27.6	21.42	1.4	14.4	4.98	19.1	40.9	29.35
BHGV0043	68	69.9	68.7	33.6	35.3	34.7	0	0.7	0.27	0	0	0
BHGV0044	44.2	68	58.26	28.6	35.6	31.84	0	2.2	0.84	0	25	9.9
BHGV0045	64.8	65.5	65.15	37.2	38.6	38.18	0	0.9	0.22	0	0	0
BHGV0046	0	61.9	32.8	1.6	41.2	24.24	0	18	7.22	0	80.4	36.84
BHGV0047	57.8	64.9	62.1	30.4	38.7	33.95	0.1	0.7	0.32	0	7.3	3.98
BHGV0048	59	63.3	61	36.5	40	38.1	0.2	0.4	0.3	0	1.2	0.67
BHGV0049	56.3	62.9	60.68	37.2	40.3	39.13	0	1.2	0.33	0	5.6	1.53
BHGV0301	58.4	65.3	61.95	36.9	37.8	37.42	0.5	1.1	0.68	0	3.6	1.15
BHGW0034	0.8	40.5	29.2	3.2	19.5	14.45	0.1	14.4	3.82	41.7	81.6	52.52
BHL000C4	32.4	55.9	48.78	26	33.7	31.2	0	0.4	0.24	11.8	41.2	19.78
BHLC0003	10.1	12.2	11.15	7.9	13.1	10.5	10.2	14.6	12.4	64.5	67.4	65.95
BHLC0005	22.4	35.6	29.52	26.1	41.4	32.68	1.6	7.2	4.42	21.4	39.1	33.38
BHLC0006	1.5	63.1	36.2	5.8	39	25.02	0	15.8	6.06	0	79.1	33.14
BHLC001B	1	7.9	3.33	3	7.4	4.8	13.4	15	14.07	71.3	81.2	77.8
BHLC002B	53	65.4	61.78	31.6	38.3	36.3	0	2.2	0.5	0	13.2	2.64
BHLC002R	67.3	76.5	70.53	26.8	35.5	32.4	0.1	0.2	0.13	0	0	0
BHLC004B	1	33.5	18.33	4	24.2	15.13	7	16.2	11.17	35.3	78.8	55.37

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Monitoring Point	CH4 %			CO2 %			O2 %			Balance %		
	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
BHLC006B	51.3	57.7	53.83	36.2	37.2	36.7	0.1	0.7	0.47	4.9	11.9	9
BHM010MA	45.7	52.6	50.13	38	39.3	38.8	0	0.4	0.17	7.9	16.2	10.9
BHM010MB	43.6	52.2	47.23	35.7	38	37	0	0.2	0.1	9.6	20.7	15.67
BHM050MA	62.5	63.4	62.95	37	39.7	38.35	0	0.3	0.15	0	0	0
BHM050MB	62.1	62.9	62.53	34.9	41.4	38.37	0	0.3	0.17	0	2.3	0.77
BHPW0001	0	24.8	13.17	1.9	19.1	9.37	3.6	17.8	12.03	52.5	80.3	65.43
BHPW0002	9.3	26.7	20.4	18.4	19.3	18.93	2.6	10.9	5.7	51.4	61.4	54.97
BHPW0003	6.6	26.6	19.63	13.9	19.9	17.53	2.5	4.8	3.6	51	74.7	59.23
BHPW0004	22.1	53.6	40.75	19.8	30.5	27.02	0	1.4	0.7	15.9	56.7	31.52
BHPW0005	30.5	65.4	55.34	25.7	39	35.3	0	2.3	0.86	0	41.5	9.8
BHPW0006	0.6	5.8	3.37	8.2	17.4	12.17	5.4	15.9	11.67	71.4	75.3	72.8
BHR00001	67.2	69.2	68.43	33.7	34.6	34.27	0	0.3	0.1	0	0	0
BHR00003	54.1	63.1	58.57	28.4	31.6	30.38	1.4	3	2.15	3.8	13.5	8.9
BHR00005	0	0.1	0.07	2.2	4.1	3	17	17.6	17.23	78.8	80.2	79.7
BHR0001B	66.6	67.8	67.2	35.2	37.3	36.27	0	0	0	0	0	0
BHR0002B	41	64.9	56.5	24.3	39.6	34.07	0.1	5	2	0	29.7	9.9
BHR0004B	35.8	43.1	40.32	26	34.8	31.25	0.2	0.6	0.35	21.8	37.9	28.08
BHR0006B	41.5	63.4	52.52	28.5	39.9	34.28	0	5.1	2.55	0	24.5	12.2

APPENDIX 1 – LANDFILL GAS

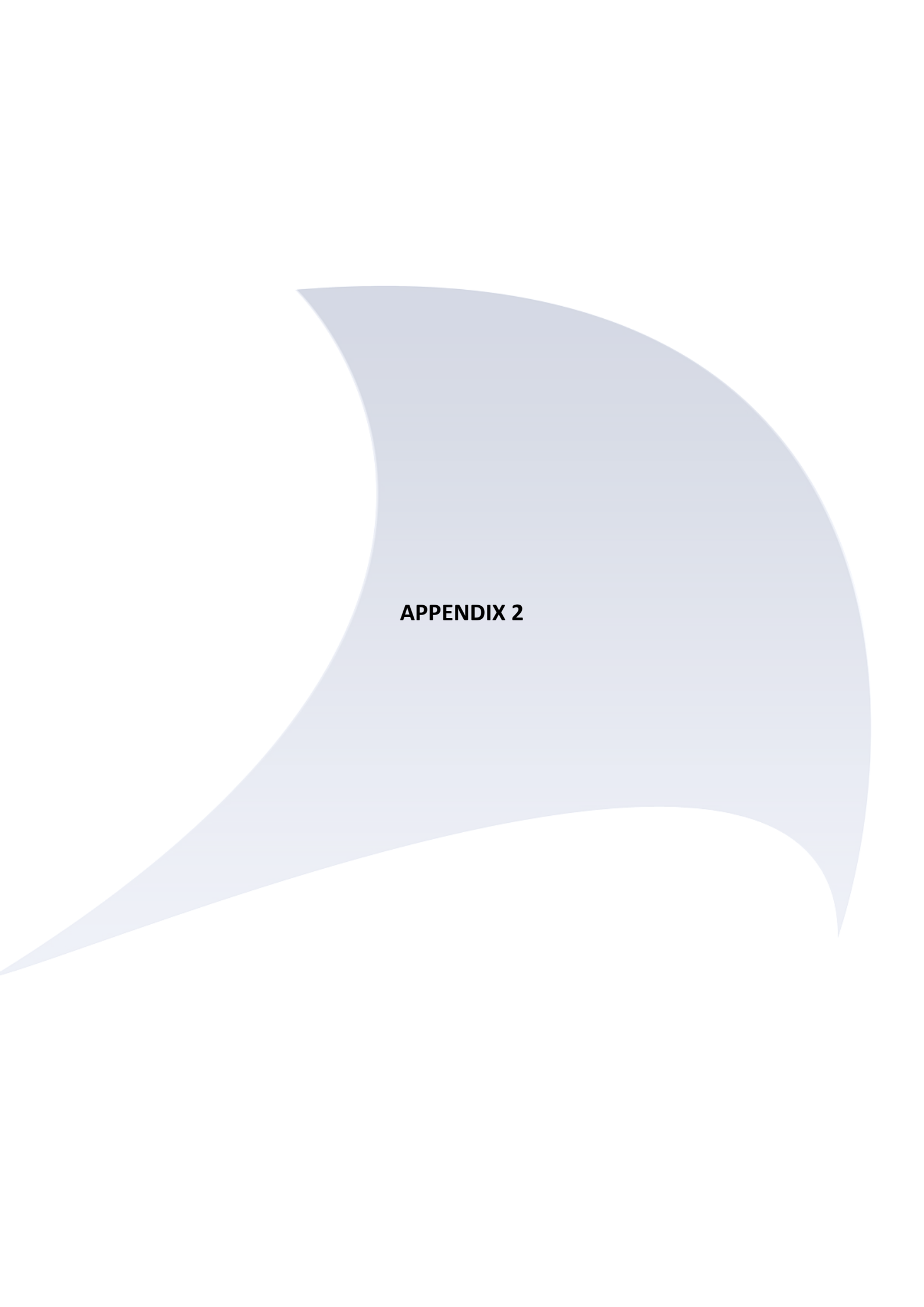
Monitoring Point	Baro (mb)			Rel Pressure (mb)			CO (ppm)			H2S (ppm)		
	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
BHG010MA	981	1006	990.75	-21.34	-9.45	-17.19	0	1	0.25	0	0	0
BHG010MB	994	994	994	-21.22	197.24	88.01	1	1	1	0	0	0
BHG01MDA	981	1006	994.17	154.97	201.36	173.67	0	2	0.83	0	0	0
BHG01MDB	995	1007	1004	-15.29	196.35	121.38	1	3	2	0	0	0
BHGV0001	981	1006	993.33	0	2.35	1.22	0	1	0.33	0	0	0
BHGV0003	982	1007	994.33	0.44	1.55	0.89	0	2	0.67	0	0	0
BHGV0004	982	1007	991.25	0.94	2.44	1.68	0	2	0.5	0	0	0
BHGV0006	983	1007	991.75	1.06	1.9	1.5	0	3	2	0	0	0
BHGV0007	982	1007	994.33	0.59	0.94	0.71	0	1	0.33	0	0	0
BHGV0008	982	1007	994.33	1.44	10.59	7.03	6	10	8	0	0	0
BHGV0009	983	1008	995.4	-21.21	-7.65	-14.31	0	1	0.6	0	0	0
BHGV000A	980	1005	992.67	-0.45	0.49	0.02	0	3	1.33	0	0	0
BHGV000B	980	1005	992.67	-0.79	0.67	-0.15	0	1	0.67	0	0	0
BHGV000C	980	1005	992.67	-2.91	-0.02	-1.34	0	1	0.33	0	0	0
BHGV0010	1008	1008	1008	7.32	7.32	7.32	0	0	0	0	0	0
BHGV0011	983	1007	995	-5.58	-0.44	-2.15	0	1	0.33	0	0	0
BHGV0012	982	1006	994	-18.15	-9.87	-14.76	0	2	0.67	0	0	0
BHGV0013	983	1007	995	-0.01	0.41	0.17	0	0	0	0	0	0
BHGV0014	983	1007	992.6	-18.9	-0.01	-8.55	0	2	1.4	0	0	0
BHGV0015	983	1007	997.4	-18.71	-12.32	-15.54	0	2	1.6	0	0	0
BHGV0016	983	1007	995	-14.52	0.23	-4.85	0	2	1.17	0	0	0
BHGV0018	983	1007	995	-18.36	-13.19	-16.2	0	3	1.67	0	0	0
BHGV0022	982	1006	993.67	-1.49	0.45	-0.32	0	25	8.33	0	0	0
BHGV0023	982	1006	994	-0.14	0.78	0.23	0	1	0.33	0	0	0
BHGV0024	981	1006	993.67	-0.94	-0.05	-0.4	0	1	0.33	0	0	0
BHGV0025	981	1006	993.67	0.27	0.91	0.69	0	1	0.33	0	0	0
BHGV0026	981	1005	993	0.84	1.97	1.44	0	3	1.33	0	0	0
BHGV0027	980	1005	992.67	-0.89	0.97	0.14	1	1	1	0	0	0
BHGV0028	980	1005	995.75	-1.04	1	-0.01	0	2	1	0	0	0

APPENDIX 1 – LANDFILL GAS

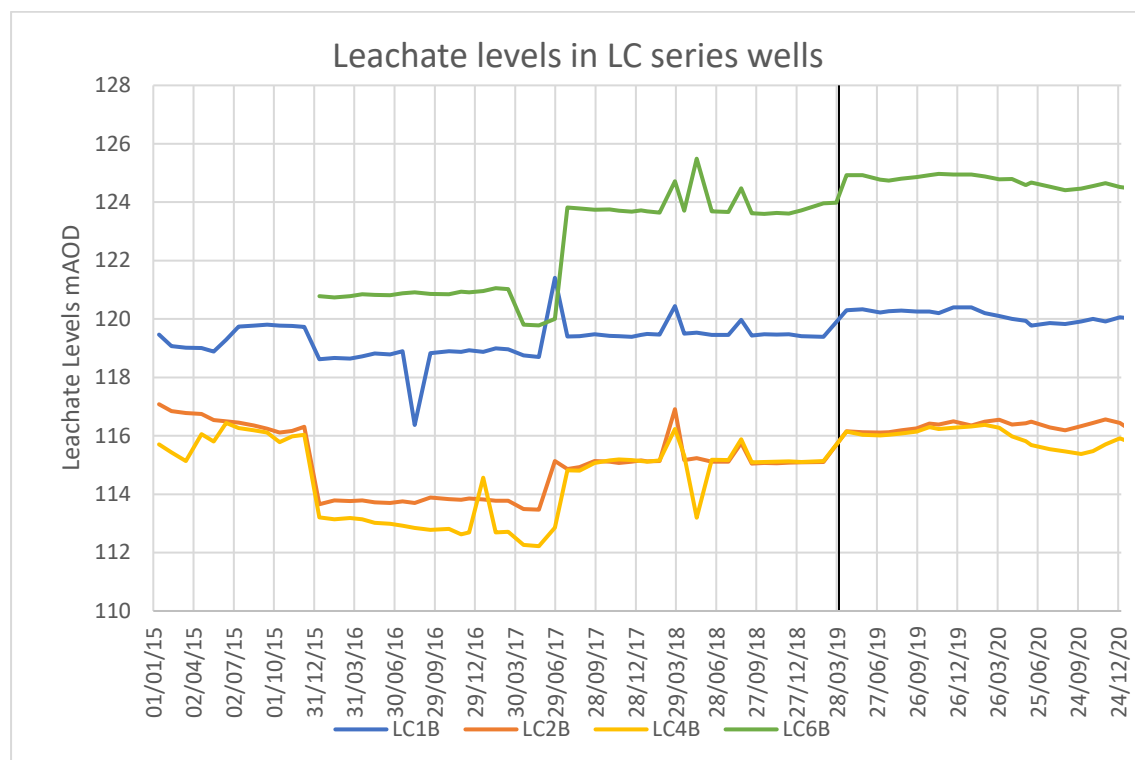
Monitoring Point	Baro (mb)			Rel Pressure (mb)			CO (ppm)			H2S (ppm)		
	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
BHGV0029	980	1005	992.67	-1.01	1.1	0.06	0	1	0.67	0	0	0
BHGV0030	980	1005	989.5	-11.56	-6.59	-9.74	0	2	0.5	0	0	0
BHGV0031	980	1005	992.75	-14.07	-2.52	-9.81	0	1	0.25	0	0	0
BHGV0032	980	1006	993.33	-1.95	0.72	-0.75	0	1	0.67	0	0	0
BHGV0033	981	1005	993	-4.72	0.4	-1.95	1	3	1.6	0	0	0
BHGV0035	982	1007	997.5	-1.02	1.38	0.32	0	2	0.75	0	0	0
BHGV0036	982	1007	994.33	-1.46	0.1	-0.86	0	3	1	0	0	0
BHGV0037	982	1007	994.67	-8.66	0.14	-1.72	0	2	0.83	0	0	0
BHGV0038	982	1006	994	-1.95	0.5	-1.1	2	8	3.8	0	0	0
BHGV0039	983	1007	998	-22.03	0.31	-5.73	0	3	1.75	0	0	0
BHGV0040	983	1008	995.4	-9.14	1.59	-4.74	0	1	0.4	0	0	0
BHGV0041	982	1006	993.67	-17.38	-9.7	-14.44	0	2	0.67	0	0	0
BHGV0042	983	1007	991.75	-0.32	1.28	0.4	0	7	2	0	0	0
BHGV0043	983	1007	994.67	-0.82	1.54	0.49	0	2	0.67	0	0	0
BHGV0044	983	1007	992.2	0.68	1.52	1.24	0	2	0.4	0	0	0
BHGV0045	982	1005	990.5	0.94	2.21	1.49	0	1	0.25	0	0	0
BHGV0046	981	1006	993.2	-1.99	0.2	-0.76	0	3	1.2	0	0	0
BHGV0047	981	1006	990.5	-0.99	0.94	0.14	0	2	0.5	0	0	0
BHGV0048	981	1006	993.33	-0.88	0.84	0.05	0	1	0.33	0	0	0
BHGV0049	981	1006	993.33	-9.85	-0.98	-3.45	0	2	0.5	0	0	0
BHGV0301	982	1007	991.25	-3.12	-0.63	-1.74	0	2	0.75	0	0	0
BHGW0034	981	1006	996.75	-1.24	0.55	-0.12	0	0	0	0	0	0
BHL000C4	982	1007	994.4	-1.69	-0.13	-0.86	0	11	4	0	0	0
BHLC0003	983	1008	995.5	-0.47	-0.14	-0.3	0	0	0	0	0	0
BHLC0005	980	1005	989.5	-0.92	0.97	0.1	0	3	1.25	0	1	0.25
BHLC0006	981	1006	995.8	-1.82	-0.04	-0.65	0	2	0.6	0	0	0
BHLC001B	983	1008	995.33	-3.78	0.39	-1.07	0	1	0.67	0	0	0
BHLC002B	981	1007	993.67	-0.6	1.75	0.51	0	4	1.83	0	0	0
BHLC002R	983	1007	994.67	0.72	0.96	0.8	0	2	1	0	0	0
BHLC004B	983	1007	995	-0.4	0.27	-0.16	1	4	2	0	0	0

APPENDIX 1 – LANDFILL GAS

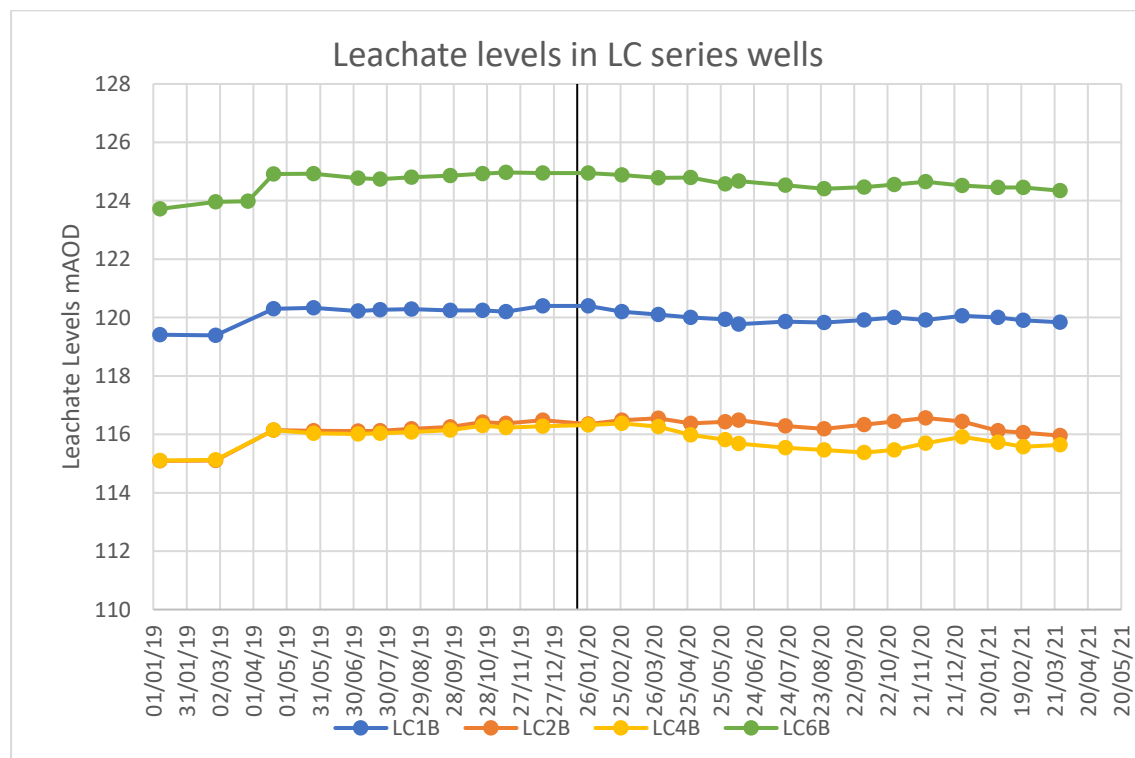
Monitoring Point	Baro (mb)			Rel Pressure (mb)			CO (ppm)			H2S (ppm)		
	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
BHLC006B	981	1005	993	-15.73	-8.04	-13.03	0	1	0.33	0	0	0
BHM010MA	983	1007	995	-20.77	-12.07	-16.23	1	3	2	0	0	0
BHM010MB	982	1007	994.33	-18.64	-12.82	-16.24	0	3	1.67	0	0	0
BHM050MA	994	1006	1000	-1.04	0.9	-0.07	1	4	2.5	0	0	0
BHM050MB	982	1006	994	-0.97	0.91	-0.03	0	1	0.33	0	0	0
BHPW0001	981	1006	993.67	-16.42	0.01	-7.79	0	0	0	0	0	0
BHPW0002	981	1006	993.67	-7.41	1.35	-1.72	0	11	3.67	0	0	0
BHPW0003	981	1006	993.67	-14.85	-5.32	-9.72	0	0	0	0	0	0
BHPW0004	981	1006	996.75	-10.05	-1.11	-4.72	0	0	0	0	0	0
BHPW0005	500	1006	894.8	-16.33	-7.01	-12.11	0	0	0	0	0	0
BHPW0006	981	1006	993.67	-1.16	1.9	0.15	0	0	0	0	0	0
BHR00001	981	1006	993.33	0	1.08	0.42	0	1	0.33	0	0	0
BHR00003	981	1006	993.17	-18.31	5.45	-3.88	0	2	0.5	0	0	0
BHR00005	980	1005	992.67	0	105.2	52.6	0	0	0	0	0	0
BHR0001B	982	1007	994.33	0.88	1.54	1.27	0	1	0.33	0	0	0
BHR0002B	980	1005	992.67	-0.11	0.02	-0.06	0	3	1	0	0	0
BHR0004B	983	1007	992	-19.35	1.92	-9.55	0	2	1.25	0	0	0
BHR0006B	981	1005	996	-1.19	9.18	5.08	2	3	2.5	0	0	0



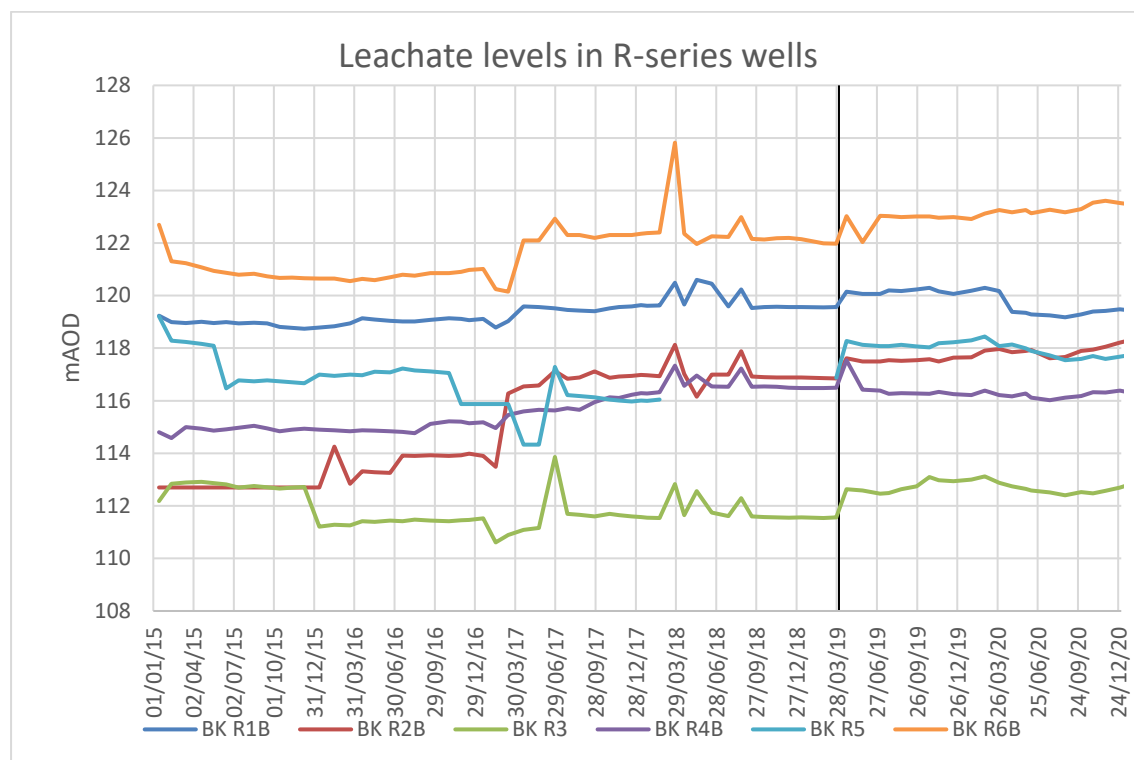
APPENDIX 2



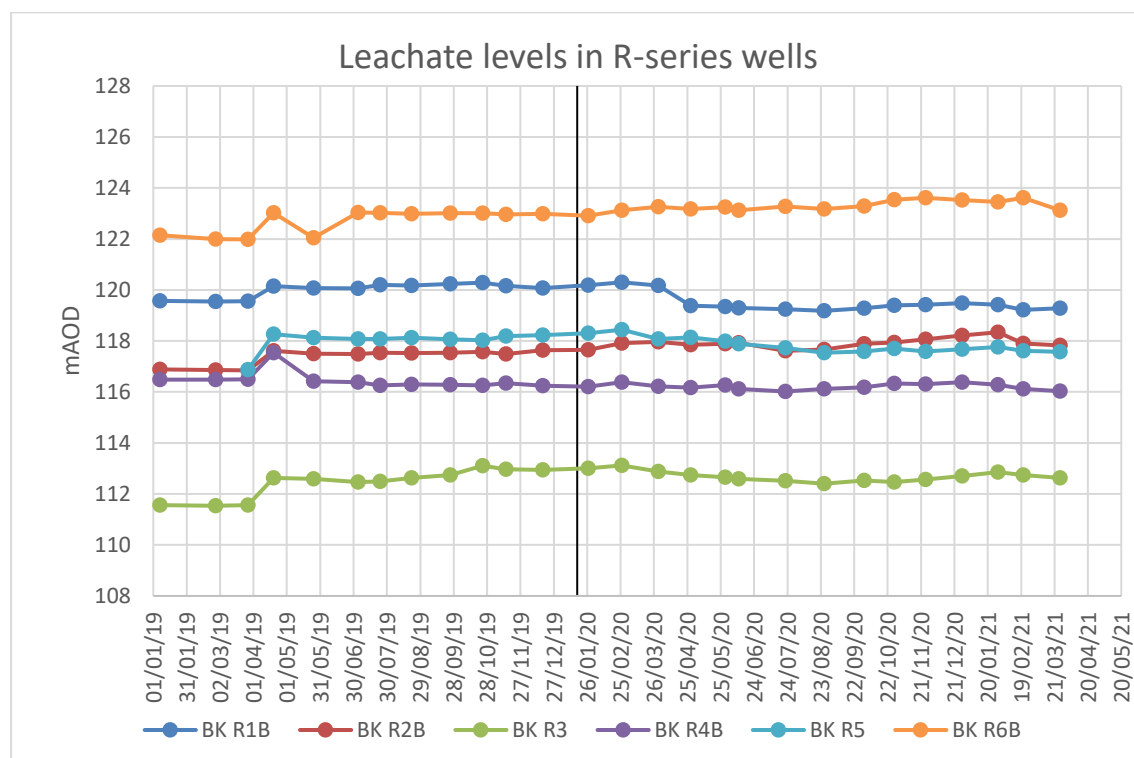
Graph 1: Leachate Levels as mAOD at LC Series Wells since 2015. Points after the black line reflect rest leachate levels



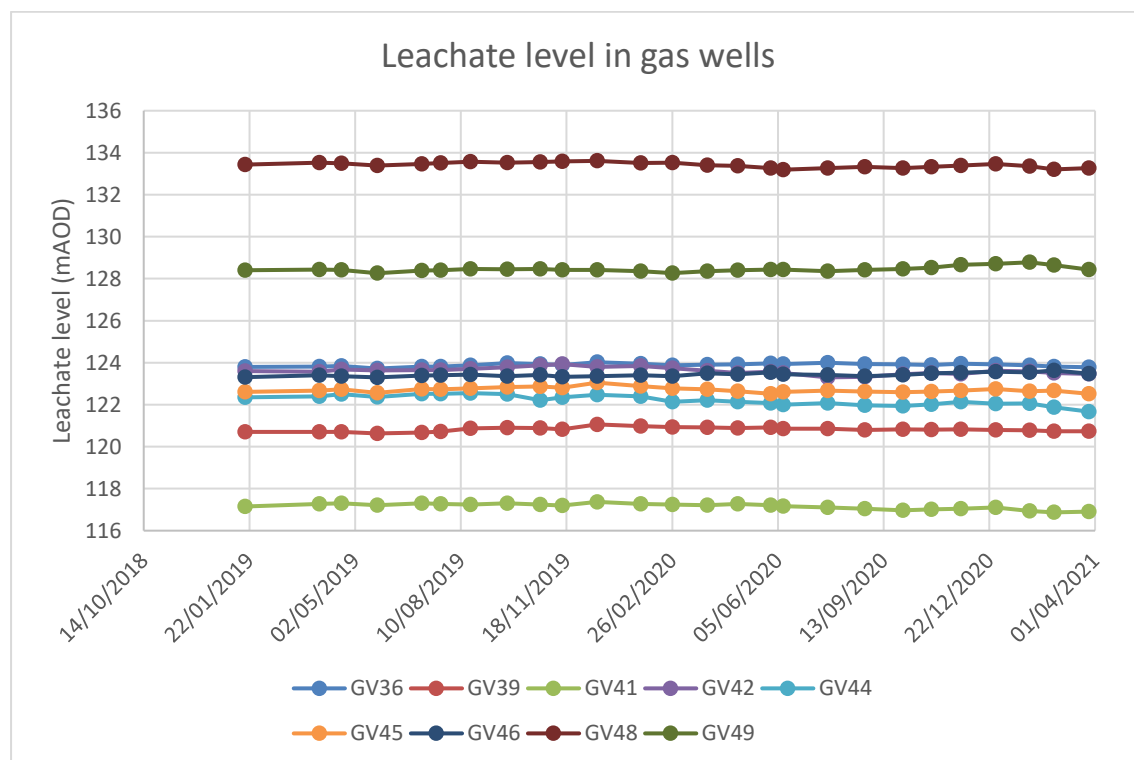
Graph 2: Leachate Levels as mAOD at LC Series Wells since January 2019. Points after the black line reflect the current review period



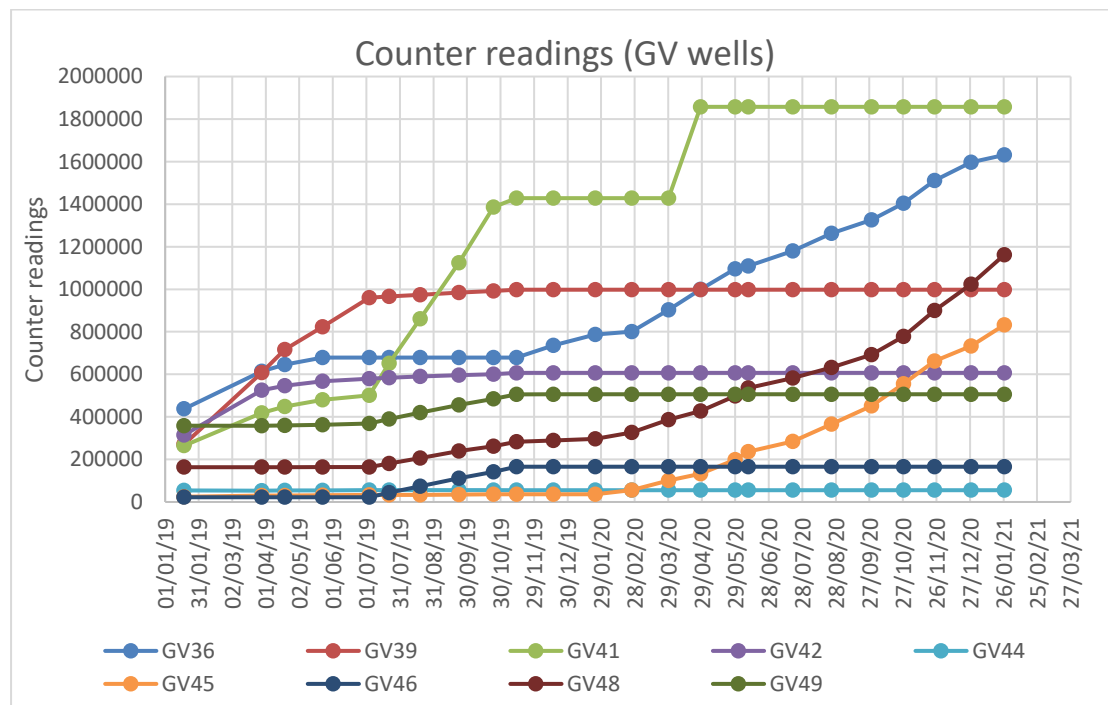
Graph 3: Leachate Levels as mAOD at Remote Leachate Monitoring Points. Points after the black line reflect rest leachate levels



Graph 4: Leachate Levels as mAOD at Remote Leachate Monitoring Points. Points after the black line reflect the current review period.



Graph 5: Leachate Levels as mAOd at in-waste gas wells.



Graph 5: Pump Counter readings in GV wells since commencement of the trial

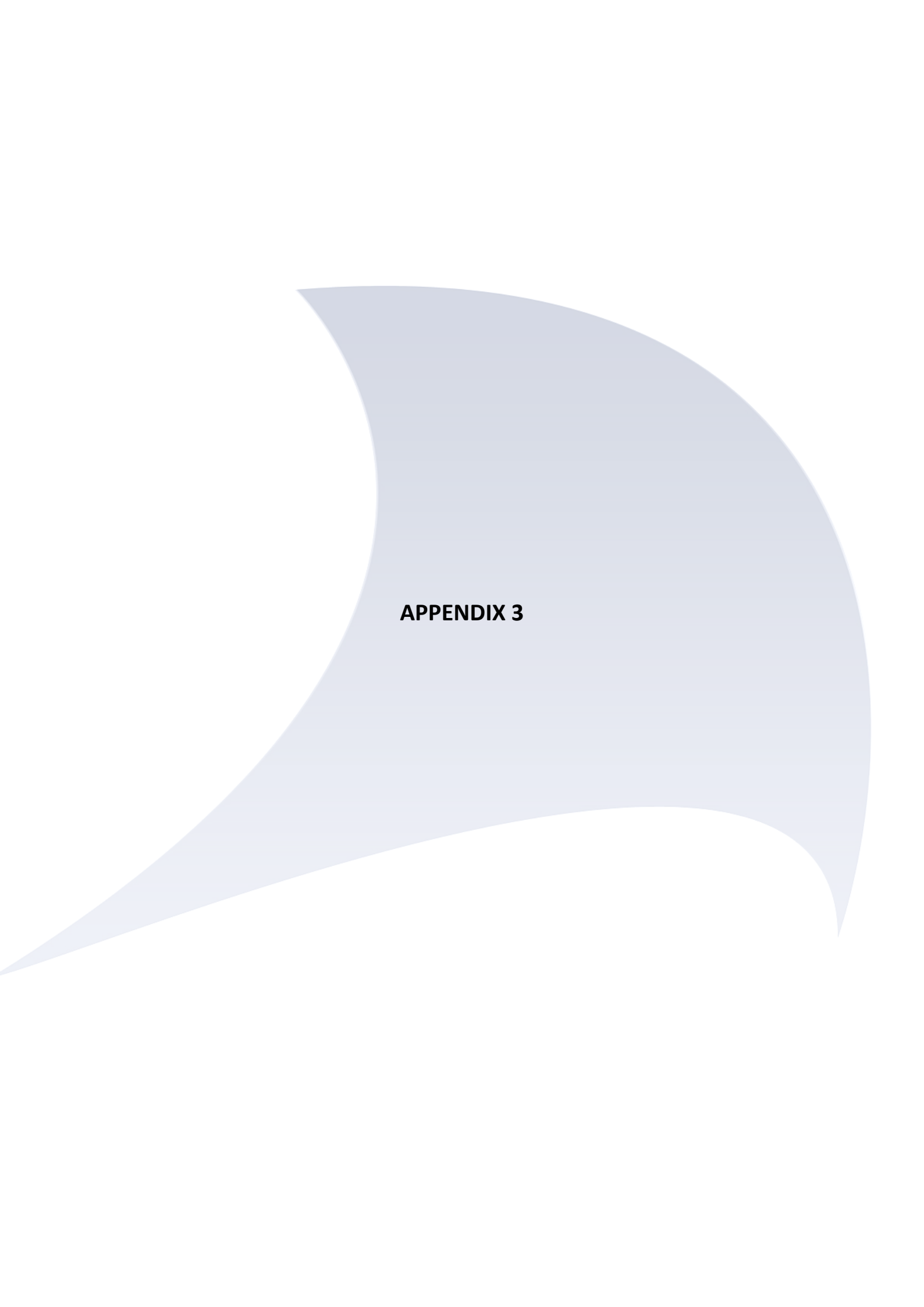
APPENDIX 2

Table 2: Monitoring data from leachate chambers

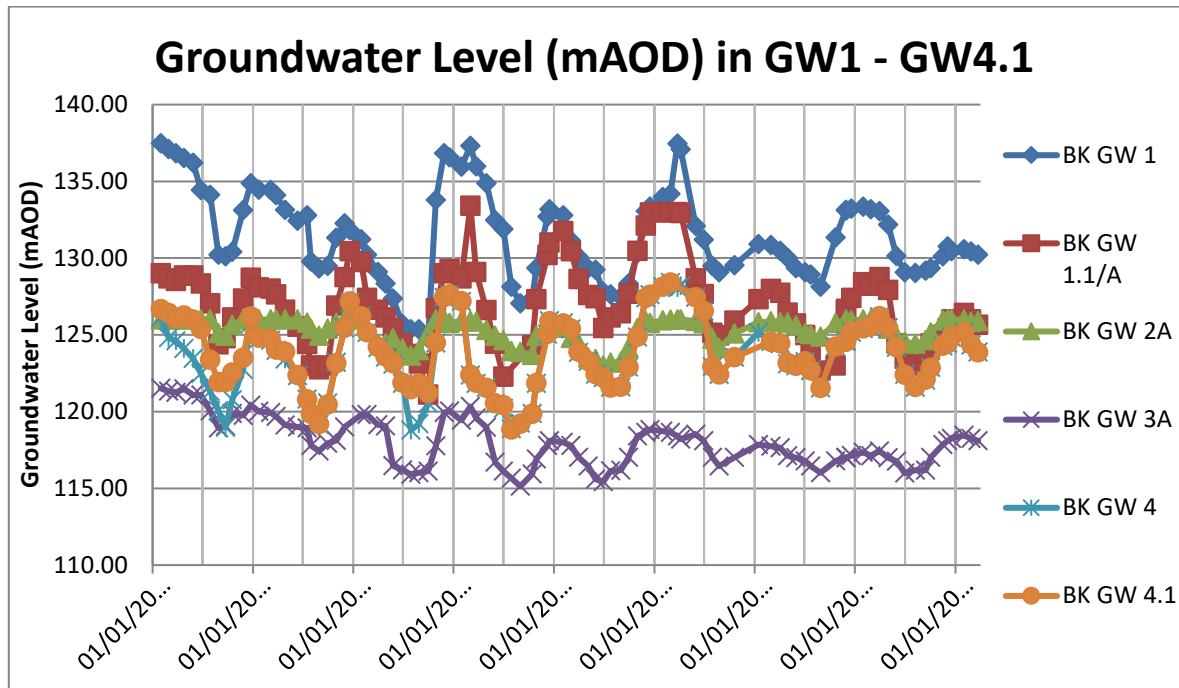
	Units	LC1B	LC2B	LC3	LC4B	LC5	LC6	LW1	LW6
		24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021	24/03/2021
Carbon									
Organic Carbon, Total	mg/l	577	657	562	509	1900	1610		
Inorganics									
Alkalinity, Total as CaCO ₃	mg/l	7370	8320	6900	7260	13200	12300		
Ammoniacal Nitrogen as NH ₃	mg/l	1810	2090	1630	1620	3440	3260		
BOD, Unfiltered	mg/l	97.9	71.4	112	114	395	394		
Chloride	mg/l	1900	2020	1690	1940	-	-		
COD, unfiltered	mg/l	1840	2140	1890	1820	5520	5690		
pH	pH Units	7.61	7.68	7.65	7.6	8	7.94		
Sulphate	mg/l	<40	<40	<40	<20	-	-		
Total Oxidised Nitrogen as NO ₃	mg/l	<3	<3	<3	4.62	-	-		
Filtered (Dissolved) Metals									
Calcium (diss.filt)	mg/l	75.4	26	107	73.7	39.8	37.7		
Magnesium (diss.filt)	mg/l	103	87.3	96.3	101	81.2	77.8		
Potassium (diss.filt)	mg/l	623	881	646	688	897	909		
Sodium (diss.filt)	mg/l	1290	1620	1150	1450	3270	3310		

Table 4: Final Discharge (FD) monitoring data (exceedances highlighted)

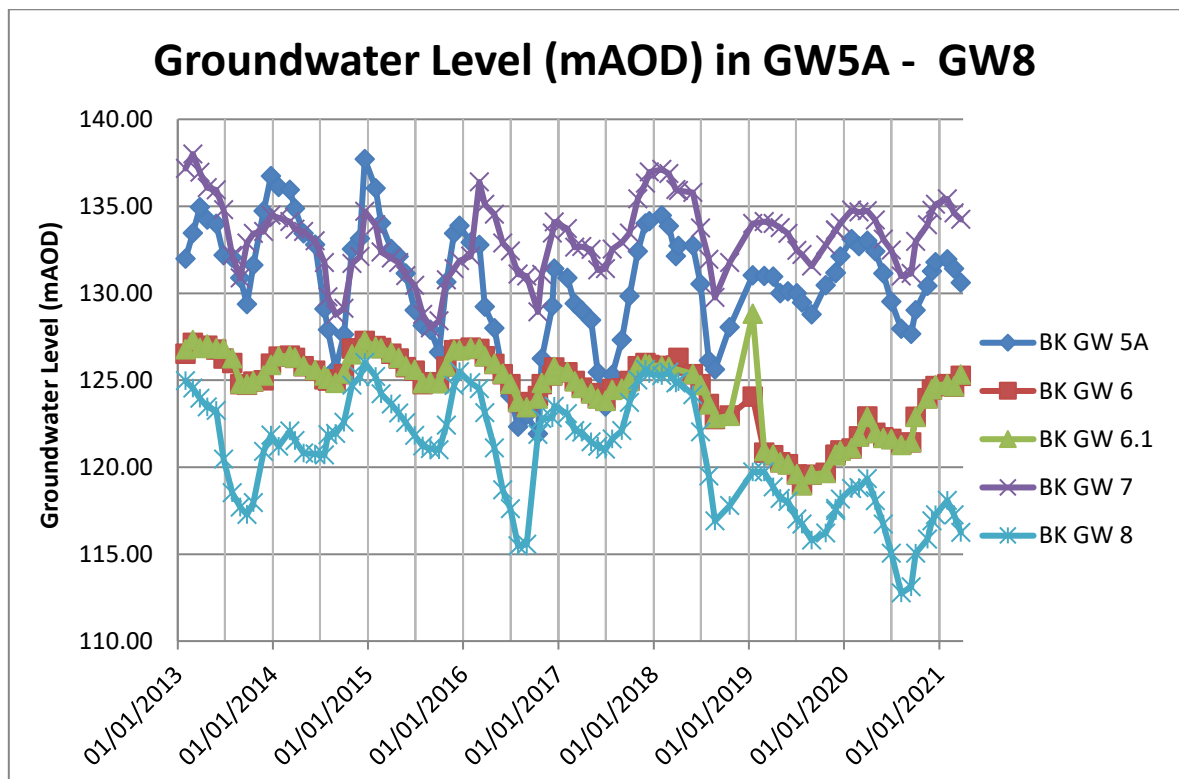
Final Discharge	Alkalinity, Total as CaCO ₃	Ammoniacal Nitrogen as N	COD, unfiltered	Nitrate as N	Nitrite as N	pH	Suspended solids, Total	Chromium (diss.filt)	Copper (diss.filt)	Lead (diss.filt)	Nickel (diss.filt)	Zinc (diss.filt)
Date Unit Compliance Limit	mg/L	mg/L	mg/L	mg/L	mg/L	pH Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	-	50	2000	-	-	>5<10	500	2	2	2	2	2
09/01/2021	1730	94.4	1060	494	1.9	9.64	599	0.0327	0.0457	0.00866	0.127	0.0564



APPENDIX 3



Graph 1: Groundwater level as mAOD at locations GW1 – GW4.1



Graph 2: Groundwater level as mAOD at locations GW5 – GW8

APPENDIX 3 - GROUNDWATER

Table 1: Monthly monitoring data (exceedances highlighted)

Locations	Parameter	Ammoniacal N	BOD (unfiltered)	Chloride	Conductivity	Dissolved Oxygen	pH
	Unit	mg/L as N	mg/L	mg/L	mS/cm	mg/L	pH units
GW1	31/01/2021	<0.2		17.2	1.9	2.15	7.24
	26/02/2021	1.78		23.4	2.17	1.01	7.69
	24/03/2021	2.6	<1	28.5	2.27	0.75	7.32
GW1.1	31/01/2021	<0.2		17.3	1.95	1.23	7.22
	26/02/2021	1.68		22.6	2.27	0.78	7.67
	24/03/2021	2.61	<1	28.5	2.26	1.31	7.44
GW2A	Limit	1.7	N/A	60	N/A	N/A	N/A
	31/01/2021	4.64		89	1.17	<0.3	6.82
	26/02/2021	4.24		76.7	1.14	<0.3	7.16
	24/03/2021	4.73	5.43	92.7	1.17	1.02	6.92
GW3A	Limit	1.7	N/A	60	N/A	N/A	N/A
	31/01/2021	1.49		79	1.22	3.17	7.6
	26/02/2021	0.707		93.6	1.24	10	7.85
	24/03/2021	0.906	2.09	126	1.36	0.92	7.6

Locations	Parameter	Ammoniacal N	Chloride	Conductivity	Dissolved Oxygen	pH
	Unit	mg/L as N	mg/L	mS/cm	mg/L	pH units
GW4	Limit	1.7	60	N/A	N/A	N/A
	31/01/2021	9.47		87.4	1.45	7.38
	26/02/2021	7.75		111	1.13	7.24
	24/03/2021	11.1	<1	127	1.18	1.39
GW5A	31/01/2021	0.642		72.7	0.919	4.08
	26/02/2021	1.14		85.7	1.01	6.04
	24/03/2021	1.03	<1	97.1	0.91	1.51
GW6	31/01/2021	4.73		88	1.18	<0.3
	26/02/2021	<0.2		29.9	0.713	1.8
	24/03/2021	0.25	<1	27.9	0.689	1.87
GW7	31/01/2021	2.27		19	0.25	2.74
	26/02/2021	3.95		103	0.615	3.62
	24/03/2021	3.64	2.34	117	0.605	0.87
GW8	31/01/2021	16.8		106	1.1	0.58
	26/02/2021	16.9		123	1.29	2.07
	24/03/2021	18.3	<1	134	1.29	1.49

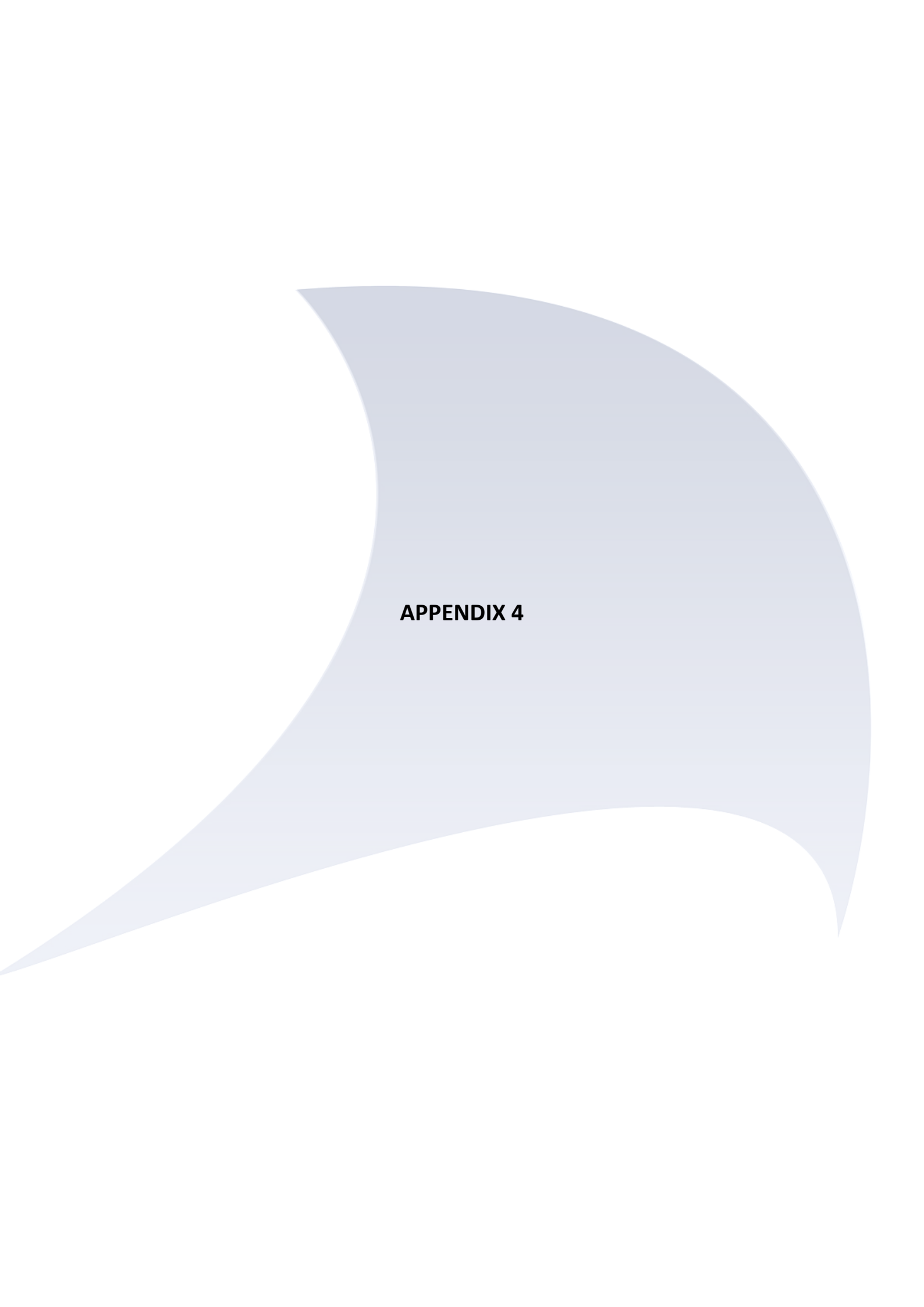
APPENDIX 2 - GROUNDWATER

Table 2: Quarterly monitoring data (exceedances highlighted)

Sample Description		GW1	GW1.1	GW2A	GW3A	GW4	GW5A	GW6	GW7	GW8	GW2A, GW3A, GW4 EP limit
Date Sampled		24/3/21	24/3/21	24/3/21	24/3/21	24/3/21	24/3/21	24/3/21	24/3/21	24/3/21	
Carbon											
Organic Carbon, Total	mg/l	23.4	23.4	11.5	14.4	7.04	4.45	<3	3.2	9.62	
Inorganics											
Alkalinity, Total as CaCO3	mg/l	652	667	545	436	410	243	309	170	464	
COD, unfiltered	mg/l	86.4	78.6	93.5	67	46.1	13.3	<7	14.1	39.1	
Sulphate	mg/l	954	948	116	210	129	147	72.5	<2	122	
Total Oxidised Nitrogen as NO3	mg/l	23.9	23.3	<0.3	17.6	2.42	7.92	11.7	<0.3	1.01	
Filtered (Dissolved) Metals											
Cadmium (diss.filt)	mg/l	0.000253	0.000274	<0.00008	0.000195	<0.00008	0.000088	<0.00008	<0.00008	<0.00008	
Calcium (Dis.Filt)	mg/l	552	544	165	182	108	102	104	19.4	114	
Chromium (diss.filt)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper (diss.filt)	mg/l	0.0137	0.0122	<0.0003	0.00549	<0.0003	0.00207	0.00128	<0.0003	<0.0003	
Iron (Dis.Filt)	mg/l	0.0391	0.138	2.48	<0.019	2.94	<0.019	<0.019	<0.019	2.56	
Lead (diss.filt)	mg/l	<0.0002	0.000632	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	
Magnesium (Dis.Filt)	mg/l	55.7	53.3	41.2	42.5	36.6	29.3	32.1	26.7	40.5	
Manganese (diss.filt)	mg/l	0.501	0.491	5.09	0.942	0.686	0.419	0.0445	0.0974	0.888	
Nickel (diss.filt)	mg/l	0.00829	0.00808	0.0134	0.0277	0.0244	0.0117	0.0017	0.000962	0.0293	0.15 mg/L
Potassium (Dis.Filt)	mg/l	86.2	79.6	32.5	55.2	29	15.7	15.5	21	35.3	
Sodium (Dis.Filt)	mg/l	28.4	26.8	62.7	72.6	96.2	61.9	19.6	61.3	113	
Zinc (diss.filt)	mg/l	0.0582	0.0593	0.00367	0.0195	0.0103	0.0065	0.00371	0.00364	0.0108	0.254 mg/L

APPENDIX 2 - GROUNDWATER

Volatile Organic Compounds (VOCs)											GW2A, GW3A, GW4 EP limit
		GW1	GW1.1	GW2A	GW3A	GW4	GW5A	GW6	GW7	GW8	
Benzene	mg/l	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	
Toluene	mg/l	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	4 µg/l
Ethylbenzene	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
m,p-Xylene	mg/l	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	
o-Xylene	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	
Sum of detected BTEX	mg/l	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	
Sum of detected Xylenes	mg/l	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	3 µg/l



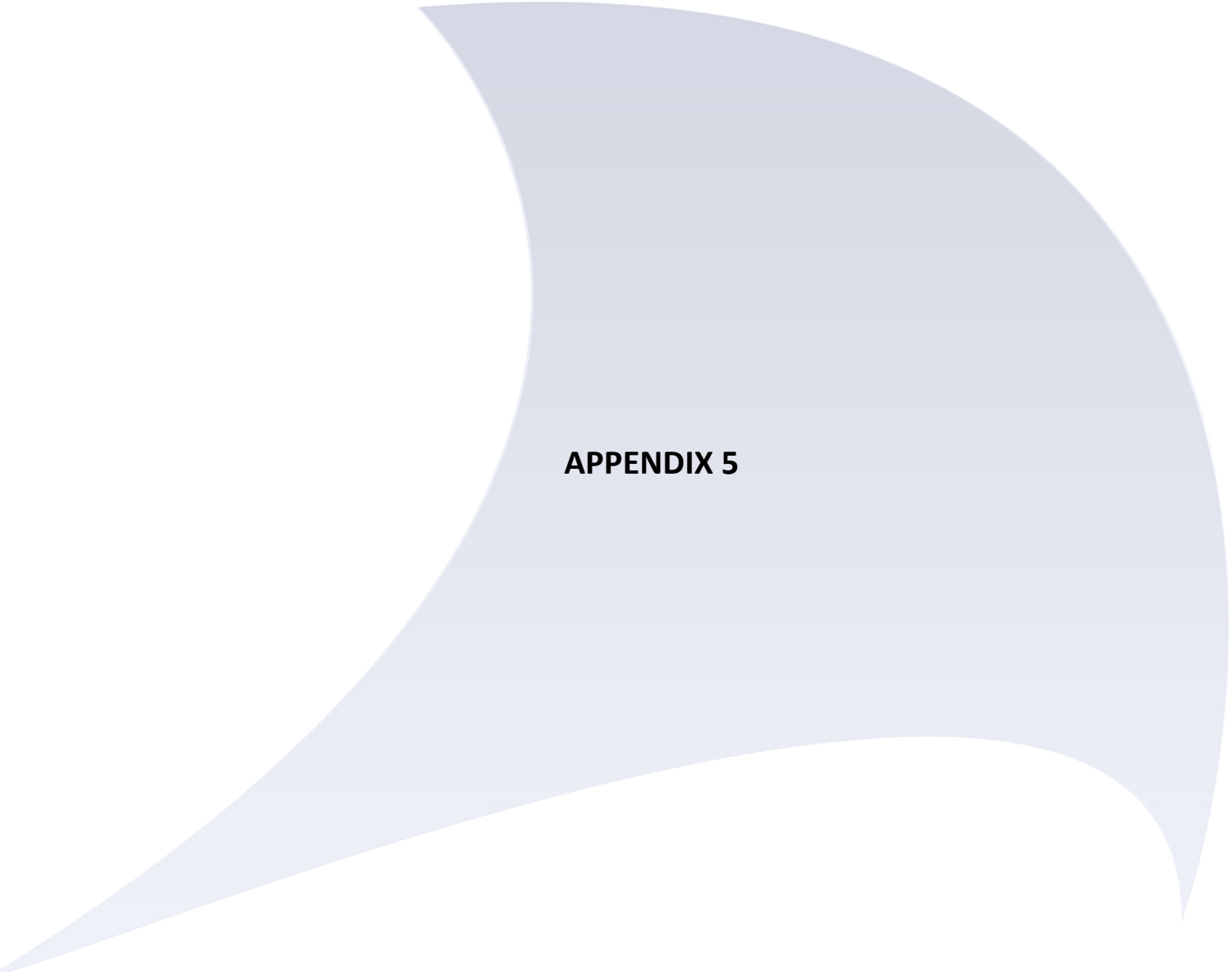
APPENDIX 4

APPENDIX 4 – SURFACE WATER

Table 1: Monthly monitoring data

Location	Parameter		Ammoniacal N	Chloride	COD	pH	Suspended Solids
	Date	Units	mg/l as N	mg/l	mg/l	pH Units	mg/l
Compliance limit (P2)*			1.6	250	100	>6 - <9	100
P4	24/03/2021		<0.2	37.6	397	7.76	608
P4	26/02/2021		<0.2	25.7	132	7.7	83.8
P4	31/01/2021		<0.2	32.3	78.2	8.07	28.8

* the compliance limits do not apply to P4, but are provided for reference.



APPENDIX 5

Flintshire County Council - Deposited Dust Monitoring

Analysis of matter collected in atmospheric deposit gauge during the period of:

From: 01/03/2021

To: 01/04/2021

No. of days

31

Collector: MW Analysis: i2 Analytical Reviewed: MW

Gauge Bowl No.	Make
Location 1	i2 Analytical
Location 2	i2 Analytical
Location 3	i2 Analytical



Factor (mg deposit to mg/m2) 24.7

Monitoring Location	Sample Volume (ml)	Total Suspended Solids (mg/l)	mg/m2/day
Location 1	690	58.6	46.69
Location 2	2480	46.4	36.97
Location 3	2110	20.1	16.02

Comments:

► Dust analysis carried out by i2 analytical

Location 1: Site Operations - located opposite transfer pad

Location 2: Location changed due to access issues with fencing surrounding the LTP. Dust gauge located near to electricity meter housing

Location 3: Oaks Farm (near road)



Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG

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Web: www.caulmert.com