Caulmert Limited

Engineering, Environmental & Planning
Consultancy Services

Standard Landfill Site

Flintshire County Council Waste Management Services

Quarterly Monitoring Review
January – March 2018

Prepared by:

Caulmert Limited
InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG
Tel: 01248 672666
Fax: 01248 672601
Email: dianabrookshaw@caulmert.com
Web: www.caulmert.com

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Project Manager: **Sean O'Brien**

Caulmert Limited: **Intec, Parc Menai, Bangor, Gwynedd, LL57 4FG 01248**

Tel: **672666**

Author	Lizzy Gibney	**Date**	21/05/2018
Reviewer	Sean O'Brien	**Date**	22/05/2018
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DISCLAIMER

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1.0 INTRODUCTION

1.1 Background

1.1.1 This report reviews environmental monitoring data collected during the first quarter of 2018 at Standard Landfill Site, Buckley, as required by Natural Resources Wales (NRW). The data reviewed by this report was collected between the 1st of January and the 31st of March 2018.

1.1.2 This report records and discusses the monitoring data collected for landfill gas, groundwater, leachate, and surface water. For details regarding the site location, surrounding land-use, site history and development and environmental context please refer to the Standard Landfill Site Annual Monitoring Review 2017, document reference 3031-CAU-XX-XX-RP-V-0314.A0-C1, submitted to Natural Resources Wales by Caulmert Ltd, on behalf of Flintshire County Council Waste Management Services in February 2018.

2.0 LANDFILL GAS

2.1 Introduction

2.1.1 Routine landfill gas (LFG) monitoring was carried out on a weekly basis at 28 perimeter boreholes during the review period. Methane, carbon dioxide, oxygen, relative pressure and atmospheric pressure were recorded at each borehole.

2.1.2 Borehole locations are shown on the drawing 'Environmental Monitoring Locations' 0987/1/002, enclosed. A summary table displaying methane and carbon dioxide concentrations can be found in Appendix 1.

2.2 Methane

2.2.1 As in the previous review period, Methane was only detected in BH22, where the maximum concentration was 0.3 % and the average concentration was 0.24 % (slightly lower than the averageof the previous quarter, which was 0.27 %).

2.2.2 A methane compliance of 1.0 % was proposed for BH22 in EPR Compliance Assessment Report (CAR) ID 37073/0202764 issued by Natural Resources Wales (NRW) on the 27th of February 2014. The proposed compliance limit was not exceeded at BH22 during this review period.

2.3 Carbon Dioxide

2.3.1 Carbon dioxide compliance limits were agreed with the Environment Agency (now NRW) during Q3 of 2011 and can be found in Appendix 1 along with the monitoring data. The carbon dioxide compliance limit for boreholes BH16 and BH22, 3.0 % and 3.1 % respectively, were approved in EPR Compliance Assessment Report (CAR) ID 37073/0202764.

2.3.2 Carbon dioxide levels in BH16 ranged between 1.9 % and 2.9 % over the review period, below the 3.0 % limit. In BH22 carbon dioxide concentrations ranged between 2 % and 2.6 %, below the limit of 3.1 %

2.3.3 The minimum recorded value of CO2 in this quarter was 1.2 % recorded in BH5.2 and BH12, and the maximum was 3.9 % recorded in BH2 and BH5.4.

2.3.4 Carbon dioxide concentrations remained below the compliance limits in all locations throughout the review period.

3.0 LEACHATE

3.1 Introduction

3.1.1 Leachate levels were recorded monthly at nine leachate monitoring locations, LC2 (LC2.1/LC), LC3, LC4, LC7, S1, S2, S3, SSR5 (LS5) and SSR6 (LS6). On this monitoring occasion, the nearest well to LC2 was sampled (LC) as there was no access to LC2.

3.1.2 Well locations are shown on the enclosed Environmental Monitoring Location drawing.

3.2 Leachate Levels

3.2.1 Leachate levels were recorded monthly. A summary table of leachate levels, in metres below ground level (mBGL) and metres above Ordnance Datum (mAOD), can be found in Appendix 2.

3.2.2 Table 1 below displays minimum, maximum and average leachate head levels in metres above well base. Leachate levels remained low over the review period. Average levels range between 1.22 m above well base in LS6 to 1.71 m above well base in LC7.

Table 1: Leachate Head Levels in metres above well base

Location	Leachate head (m above cell base)		
	Min	Max	Average
LC2.1	1.35	1.38	1.37
LC3	1.57	1.63	1.60
LC4	1.55	1.58	1.57
LC7	1.68	1.71	1.70
LS5	1.26	1.28	1.27
LS6	1.22	1.23	1.22
S1	1.34	1.37	1.36
S2	1.53	1.60	1.56
S3	1.50	1.52	1.51

3.3 Leachate Quality

3.3.1 A summary of the leachate quality is shown in Table 2.2 in Appendix 2.

3.3.2 Concentrations of ammoniacal nitrogen (as N) within the leachate ranged between 11.3 mg/l in S1 and a maximum concentration of 1300 mg/l in LC2. Chloride concentrations ranged from 388 mg/l in S2 to 1690 mg/l in LC2.

3.3.3 Concentrations of COD ranged from 47.7 mg/l in S1 to 2400 mg/l in LC2. These concentrations are on average similar to the previous quarter.

4.0 GROUNDWATER

4.1 Introduction

4.1.1 During the review period groundwater levels were recorded on a monthly basis at eight groundwater monitoring boreholes, GW1, GW2, GW2R, GW3, GW4, GW5, GW6 and GW7R. Location GW2R was installed in October 2016 to replace GW2. Samples collected at these locations were analysed for the quarterly suite of chemicals.

4.2 Groundwater Levels

4.2.1 Groundwater level data was recorded on a monthly basis in metres below ground level (mBGL). Where borehole cover level to Ordinance Datum was available this was used to calculate the groundwater level in metres above Ordnance Datum (mAOD).

4.2.2 Groundwater levels, in mBGL and mAOD are displayed in a summary table included in Appendix 3. Groundwater levels remained stable over the review period

4.3 Groundwater Quality

4.3.1 A groundwater quality summary table for this review period is included in Appendix 3.

4.3.2 Ammoniacal nitrogen (as N) and chloride concentrations in GW6 have shown a generally decreasing trend since a leachate outbreak in 2013. The concentration of ammoniacal nitrogen decreased from 17.8 mg/l in Q4 of 2017 to 9.66 mg/l in this quarter. Ammoniacal nitrogen concentrations at other monitoring points range from detection limit of <0.2 mg/l (GW2R, GW3, GW4, GW5) to 1.17 mg/l in GW7.

4.3.3 Chloride concentration in GW6 was similar in Q1 of 2018 with the concentration of 80.2 mg/l as opposed to 73.2 mg/l which was recorded in the last quarter of 2017.

4.3.4 In Q4 of 2017 the highest concentration of COD was recorded in GW2A at 157mg/l. The concentrations in the first quarter of 2018 were higher, with GW2A recording 227 mg/l, and a maximum of 858 mg/l being recorded in GW5.

4.3.5 No creosols, phenols or xylenes were detected in the groundwater during this review period.

4.3.6 Mercury was undetected in GW3. The maximum concentration was recorded in GW1 at 0.00356 mg/l. Iron was not detected in 3 of the 7 locations, with a maximum of 1.59 mg/l recorded at GW7.

5.0 SURFACE WATER

5.1 Introduction

5.1.1 Surface water samples were collected at 3 locations in the first quarter of 2018. The results can be found in Appendix 4.

5.1.2 No ammoniacal nitrogen was detected in any surface water samples in this quarter. Chloride was highest in SW4, with a concentration of 101 mg/l compared to 28.5 mg/l and 27.6 mg/l in SW5 and SW6 respectively.

5.1.3 Iron was undetected in SW4, with low concentrations in other locations of 0.057 mg/l and 0.067 mg/l.

6.0 CONCLUSIONS

6.1 Landfill gas

6.1.1 None of the permitted trigger levels for methane or carbon dioxide were exceeded during this review period.

6.1.2 Methane was only detected in BH22, remaining below the compliance limit of 1.0 % throughout the review period, with an average concentration of 0.24%.

6.2 Leachate

6.2.1 Leachate levels remained low for the duration of the review period.

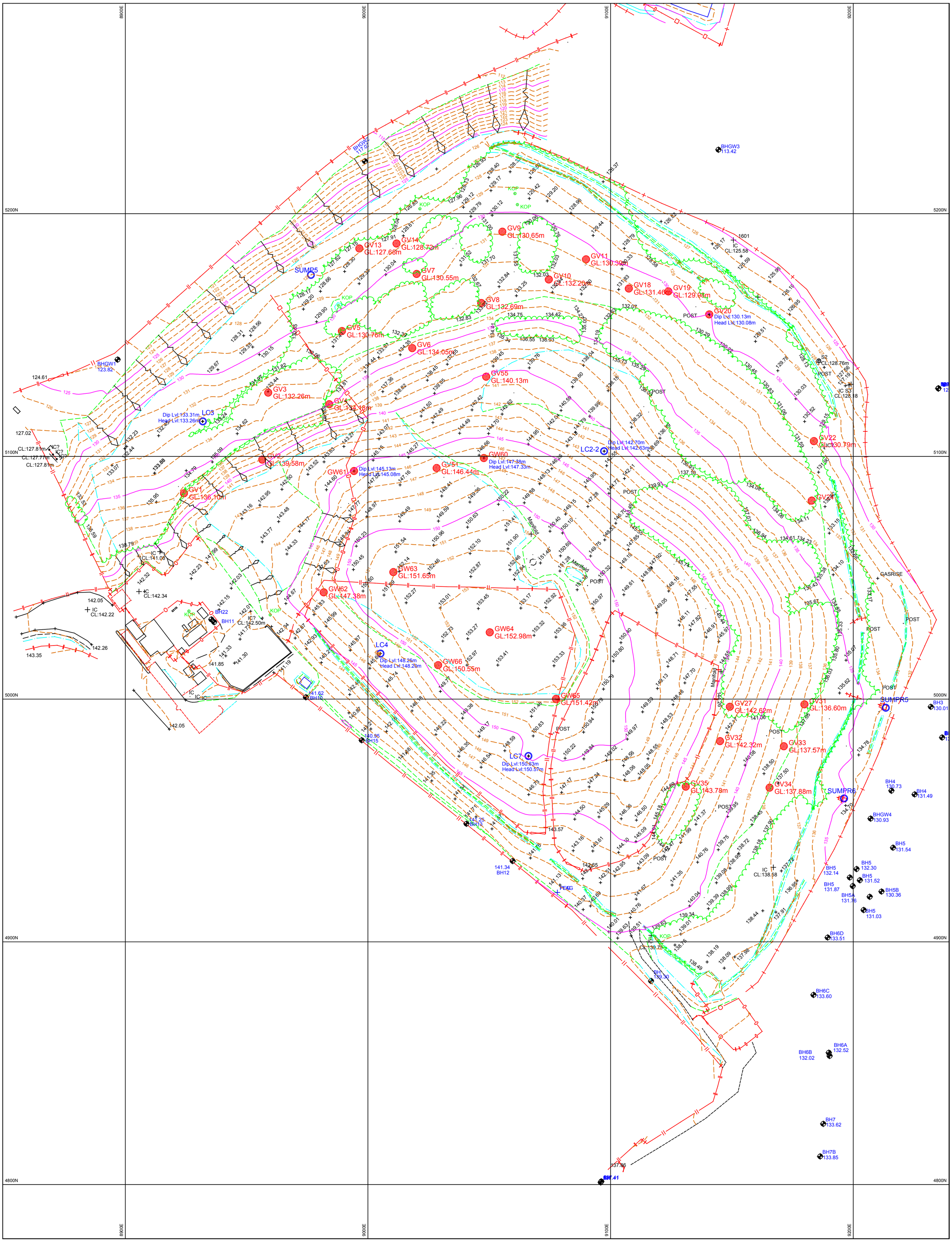
6.2.2 Leachate quality results indicate that a medium to strong leachate is present. This is to be expected given the age of the waste mass and the closed and capped nature of the site.

6.3 Groundwater

6.3.1 GW6 continued to display the highest concentrations of most parameters potentially due to the residual impact of the leachate outbreak close to this borehole which was detected in May 2013. The concentrations of key leachate indicator parameters have continue to show decreasing trends.

6.4 Surface Water

6.4.1 Surface water concentrations generally indicated good water quality in the three sampled locations.



CYNGOR Sir y Fflint Flintshire COUNTY COUNCIL English Cymraeg	SITE: Standard Landfill PROJECT: Site Survey	SCALE: 1:1000 @ A2 DATE: 09/05/2017 DRAWING No.: 9250a	NOTES Site Grid Shown Levels Relate to Site Datum	stafsurv LAND SURVEYORS www.stafsurv.com Vernon Courtyard, Main Road, Sudbury, Derbyshire. DE6 5HS T 01283 584800 > F 01284 584844 > E info@stafsurv.com

Appendix 1

APPENDIX 1

Table 1 – Summary of Landfill Gas Concentrations

Location	Methane (%v/v)					Carbon Dioxide (%v/v)				
	Min	Max	Ave	Count	Limit	Min	Max	Ave	Count	Limit
BH 1	0.0	0.0	0.0	13	**1**	1.4	1.9	1.7	13	**5.4**
BH 1.1	0.0	0.0	0.0	13	**1**	2.2	3.5	3.0	13	**5.4**
BH 2.0	0.0	0.0	0.0	13	**1**	2.4	3.9	3.3	13	**7.1**
BH 2.1	0.0	0.0	0.0	13	**1**	2.4	3.5	3.1	13	**7.6**
BH 2.2	0.0	0.0	0.0	13	**1**	1.8	2.7	2.3	13	**5.8**
BH 3.0	0.0	0.0	0.0	13	**1**	1.5	2.6	2.0	13	**6.7**
BH 3.1	0.0	0.0	0.0	13	**1**	2.1	3.4	3.0	13	**7.8**
BH 4.0	0.0	0.0	0.0	13	**1**	2.0	2.8	2.4	13	**10.7**
BH 4.1	0.0	0.0	0.0	13	**1**	2.0	2.6	2.3	13	**7.1**
BH 4.2	0.0	0.0	0.0	13	**1**	1.5	2.9	2.3	13	**8.6**
BH 5.0	0.0	0.0	0.0	13	**1**	1.5	2.3	1.8	13	**19.4**
BH 5.1	0.0	0.0	0.0	13	**1**	2.1	2.9	2.4	13	**5.8**
BH 5.2	0.0	0.0	0.0	13	**1**	1.2	1.9	1.6	13	**9.6**
BH 5.3	0.0	0.0	0.0	13	**1**	2.4	3.6	3.1	13	**6**
BH 5.4	0.0	0.0	0.0	13	**1**	1.4	3.9	2.4	13	**16**
BH 5.5	0.0	0.0	0.0	13	**1**	1.6	2.4	2.1	13	**17.1**
BH 5.7	0.0	0.0	0.0	13	**1**	2.1	2.8	2.4	13	**7.1**
BH 6.0	0.0	0.0	0.0	13	**1**	2.1	3.2	2.6	13	**8.9**
BH 6.1	0.0	0.0	0.0	13	**1**	2.1	3.4	2.8	13	**3.7**
BH 6.2	0.0	0.0	0.0	13	**1**	1.6	2.4	2.0	13	**6.1**
BH 6.3	0.0	0.0	0.0	13	**1**	1.9	2.6	2.2	13	**8.2**
BH 7.0	0.0	0.0	0.0	13	**1**	2.0	2.5	2.2	13	**6.2**
BH 7.1	0.0	0.0	0.0	13	**1**	1.6	2.5	2.2	13	**5.5**
BH 12	0.0	0.0	0.0	13	**1**	1.2	2.9	1.8	13	**6.5**
BH 13	0.0	0.0	0.0	13	**1**	1.4	2.5	1.8	13	**5.2**
BH 15	0.0	0.0	0.0	13	**1**	2.0	2.9	2.4	13	**8.3**
BH 16	0.0	0.0	0.0	13	**1**	1.9	2.9	2.4	13	**3**
BH 22	0.1	0.3	0.2	13	**1**	2.0	2.6	2.3	13	**3.1**

Appendix 2

APPENDIX 2

Table 2.1 - Leachate Levels

Location	Date	Dip Level (mBGL)	Leachate Level (mAOD)	Leachate Level Head (m)
LC/LC2.1	02/01/2018	29.62	1.38	1.38
	06/02/2018	29.63	1.37	1.37
	05/03/2018	29.65	1.35	1.35
LC3	02/01/2018	3.27	1.57	1.57
	06/02/2018	3.25	1.59	1.59
	05/03/2018	3.21	1.63	1.63
LC4	02/01/2018	17.42	1.58	1.58
	06/02/2018	17.43	1.57	1.57
	05/03/2018	17.45	1.55	1.55
LC7	02/01/2018	18.60	1.71	1.71
	06/02/2018	18.63	1.68	1.68
	05/03/2018	18.60	1.71	1.71
LS5	02/01/2018	28.81	3.19	1.27
	06/02/2018	28.84	3.16	1.26
	05/03/2018	28.79	3.21	1.28
LS6	02/01/2018	29.95	3.05	1.22
	06/02/2018	29.91	3.09	1.23
	05/03/2018	29.93	3.07	1.22
S1	02/01/2018	3.06	1.37	1.37
	06/02/2018	3.09	1.34	1.34
	05/03/2018	3.07	1.36	1.36
S2	02/01/2018	1.75	1.6	1.60
	06/02/2018	1.80	1.55	1.55
	05/03/2018	1.82	1.53	1.53
S3	02/01/2018	3.57	1.52	1.52
	06/02/2018	3.59	1.5	1.50
	05/03/2018	3.58	1.51	1.51

Table 2.2 - Leachate Quality Data Summary

Parameter	Unit	LC2	LC3	LC4	LC7	S1	S2	S3	SSR5	SSR6
Inorganics										
Alkalinity, Total as CaCO3	**mg/l**	6680	4660	3930	4530	2100	1570	2730	3930	3970
Ammoniacal Nitrogen as N	**mg/l**	1300	741	554	751	11.3	193	445	642	651
Ammoniacal Nitrogen as NH4	**mg/l**	1670	953	712	966	14.5	248	572	825	837
BOD, unfiltered	**mg/l**	297	98.1	47.3	77.5	2.93	40.6	47.9	81.3	80.5
Chloride	**mg/l**	1690	1200	955	1180	491	388	664	993	991
Chlorine, Total (Residual)	**mg/l**	2	1.6	1.4	2	1	1.2	1.4	1.6	2
COD, unfiltered	**mg/l**	2400	1240	858	1230	47.7	391	632	1080	1140
Conductivity @ 20 deg.C	**mS/cm**	14.2	10.1	8.52	9.76	5.13	4.06	6.31	8.84	8.86
pH	**pH Units**	8.03	8.01	8.09	7.85	7.69	7.59	7.67	8.32	8.12
Total Oxidised Nitrogen as N	**mg/l**	-	-	-	-	1.43	0.513	<0.5	-	-
Filtered (Dissolved) Metals										
Magnesium (diss.filt)	**mg/l**	89.7	128	143	133	41.4	66.5	47	63.1	62.2
Potassium (diss.filt)	**mg/l**	594	420	322	405	153	133	237	371	374
Sodium (diss.filt)	**mg/l**	1450	979	658	981	345	315	559	948	934

Appendix 3

APPENDIX 3

Table 3.1 - Groundwater Levels

Location	Date	Dip Level (mBGL)	Groundwater Level (m AOD)
GW 1	16/01/2018	32	92.08
	20/02/2018	32.16	91.92
	19/03/2018	33.18	90.9
GW 2	16/01/2018	9.1	108.11
	20/02/2018	9.1	108.11
	19/03/2018	9.1	108.11
GW 2R	16/01/2018	38.16	79.05
	20/02/2018	38.97	78.24
	19/03/2018	37.87	79.34
GW 3	16/01/2018	29.98	83.44
	20/02/2018	31.2	82.22
	19/03/2018	34.54	78.88
GW 4	16/01/2018	36.44	94.56
	20/02/2018	37.83	93.17
	19/03/2018	39.5	91.5
GW 5	16/01/2018	2.67	132.19
	20/02/2018	2.88	131.98
	19/03/2018	2.95	131.91
GW 6	16/01/2018	25.23	98.34
	20/02/2018	26	97.57
	19/03/2018	24.54	99.03
GW 7R	16/01/2018	54.14	87.86
	20/02/2018	55.04	86.96
	19/03/2018	57.38	84.62

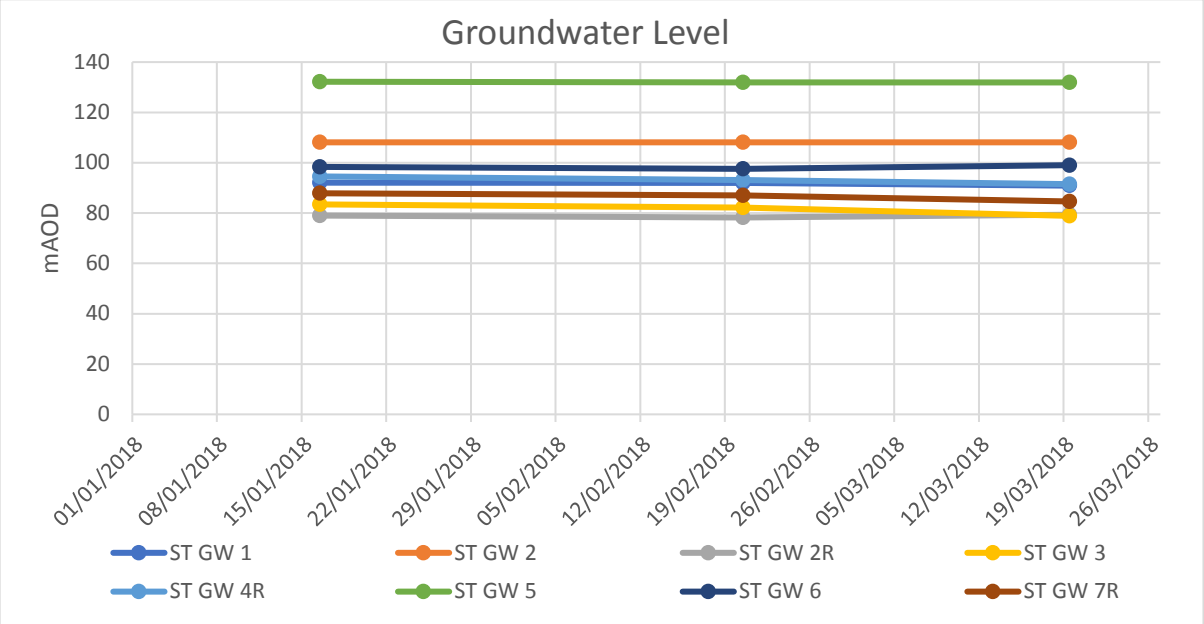


Table 3.2 - Groundwater Quality Data Summary

Parameter		GW1	GW2R	GW3	GW4R	GW5	GW6	GW7
Carbon								
Organic Carbon, Total	mg/l	57.8	74.8	3.05	19.5	19.9	11.3	<3
Inorganics								
Alkalinity, Total as CaCO3	mg/l	55	115	155	170	155	65	300
Ammoniacal Nitrogen as N	mg/l	0.259	<0.2	<0.2	<0.2	<0.2	9.66	1.17
Ammoniacal Nitrogen as NH4	mg/l	0.333	<0.3	<0.3	<0.3	<0.3	12.4	1.5
BOD, unfiltered	mg/l	<3	<2.5	<1.67	<3	<5	<1.67	3.29
Chloride	mg/l	52.3	75.1	60.6	32	9.4	80.2	56.6
Chlorine, Total (Residual)	mg/l	0.02	0.05	0.04	0.05	0.04	0.04	0.05
COD, unfiltered	mg/l	478	227	20.8	101	858	75.3	66.8
Cyanide, Total	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrate as NO3	mg/l	3.19	3.16	3.02	1.48	0.996	137	<0.3
Nitrite as NO2	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
pH	pH	6.43	6.49	6.95	6.73	6.91	5.52	7.08
Sulphate	mg/l	217	151	265	240	15	389	145
Total Oxidised Nitrogen as NO3	mg/l	3.19	3.17	3.03	1.49	1.02	137	<0.3
Filtered (Dissolved) Metals								
Iron (diss.filt)	mg/l	0.0267	0.113	<0.019	0.204	<0.019	<0.019	1.59
Magnesium (diss.filt)	mg/l	26.6	25.6	43.2	32.9	6.98	33.4	32.8
Potassium (diss.filt)	mg/l	9.71	8.29	6.39	7.83	3.23	25.4	13.2
Sodium (diss.filt)	mg/l	27	36.6	37.8	22	5.7	70.3	60.1
Unfiltered (Total) Metals								
Arsenic (tot.unfilt)	mg/l	0.00268	0.0801	<0.002	0.0335	0.0193	0.00304	0.0131
Cadmium (tot.unfilt)	mg/l	<0.0005	<0.0005	<0.0005	0.0062	<0.0005	0.00216	<0.0005
Calcium (tot.unfilt)	mg/l	62.4	66.5	103	111	88.9	92.1	96.2
Copper (tot.unfilt)	mg/l	0.00996	0.00763	0.00118	0.0433	0.0672	0.0118	0.0107
Lead (tot.unfilt)	mg/l	0.00292	0.00377	<0.001	0.272	0.122	0.00942	0.00987
Mercury (tot.unfilt)	mg/l	0.00356	0.000046	<0.00002	0.000045	0.000182	0.000025	0.000024
Nickel (tot.unfilt)	mg/l	0.00483	0.0472	0.00137	0.355	0.0535	0.0689	0.015
Zinc (tot.unfilt)	mg/l	0.137	0.0477	0.0191	0.715	0.22	0.114	0.108
Phenols								
Cresols	mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Phenol	mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Phenols, Total Detected monohydric	mg/l	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Xylenols	mg/l	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008

Appendix 4

APPENDIX 4

Table 4 –Surface Water Quality

Parameter	Units	SW4	SW5	SW6
Inorganics				
Alkalinity, Total as CaCO3	mg/l	235	190	190
Ammoniacal Nitrogen as N	mg/l	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH4	mg/l	<0.3	<0.3	<0.3
BOD, unfiltered	mg/l	<1	2.82	3.37
Chloride	mg/l	101	28.5	27.6
Chlorine, Total (Residual)	mg/l	0.04	0.04	0.04
COD, unfiltered	mg/l	28.2	35.3	32.8
Conductivity @ 20 deg.C	mS/cm	0.965	0.649	0.649
Nitrate as NO3	mg/l	21.9	<0.3	<0.3
pH	pH Units	8.17	7.75	7.82
Sulphate	mg/l	187	168	165
Total Oxidised Nitrogen as N	mg/l	4.96	<0.1	<0.1
Filtered (Dissolved) Metals				
Iron (diss.filt)	mg/l	<0.019	0.0567	0.0666
Magnesium (diss.filt)	mg/l	20.7	34.9	36.3
Potassium (diss.filt)	mg/l	14.5	8.45	8.84
Sodium (diss.filt)	mg/l	57	19.8	20.7
Unfiltered (Total) Metals				
Calcium (tot.unfilt)	mg/l	154	86.9	84.3

Registered Office:
InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG
Tel: 01248 672666
Fax: 01248 672601
Email: contact@caulmert.com
Web: www.caulmert.com