

# CAULMERT LIMITED

Engineering, Environmental & Planning  
Consultancy Services

## Brookhill Landfill Site

Flintshire County Council Waste Management Services

## Quarterly Monitoring Review

April – June 2016

### Prepared by:

#### Caulmert Limited

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## APPROVAL RECORD

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## 1.0 INTRODUCTION

### 1.1 Background

1.1.1 This report has been compiled in compliance with the Environmental Permit (EP) BV7273 – Variation Notice Number YP3835MJ 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 1<sup>st</sup> of April – 30<sup>th</sup> of June 2016.

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. This data will also be compiled into an Annual Monitoring Review in accordance with the EP, to be submitted by the 31<sup>st</sup> of January 2017.

### 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.

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## 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 23 in-waste locations. Perimeter borehole locations are shown on Drawing 2231.EMP.01, enclosed. Methane, carbon dioxide, oxygen 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. Monitoring data gathered at in-waste gas monitoring locations is also listed in Appendix 1.

### 2.2 Perimeter Boreholes

#### *Methane*

- 2.2.1 None of the monitored perimeter gas boreholes were in breach of their respective methane EP limits during this review.
- 2.2.2 Similar to the previous quarter, no methane was detected at any time during the quarter in BH1, BH4, BH5, BH6, BH7, BH10, BH11, BH12, BH13, BH14, BH15, BH16, BH19, BH23, BH24 and BH25.
- 2.2.3 The highest methane concentrations were detected at BH8 (29.4 %) and BH9 (27.7 %) with average concentrations of 29.0 % and 27.1 % respectively. No increasing trends were observed, with consistent methane concentrations at both locations throughout this review period. These concentrations are compliant with the EP limits for these locations and are very similar to that of the previous quarter.

#### *Carbon Dioxide*

- 2.2.4 Carbon dioxide was recorded in all perimeter gas boreholes during the review period but remained below the relative EP limits throughout the review period in all locations.
- 2.2.5 The maximum recorded carbon dioxide concentration was 3.2 % in BH18.

### 2.3 In-waste Boreholes

- 2.3.1 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.

2.3.2 The average methane concentration in the GV wells was similar to that recorded in the previous quarter, 44.7 % while the average carbon dioxide concentration was 33.8 %.

2.3.3 The maximum H<sub>2</sub>S concentration the GV wells was 28 ppm in well GV41.

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## 3.0 GROUNDWATER

### 3.1 Introduction

3.1.1 Borehole locations are shown on Drawing 2231.EMP.01, enclosed. Groundwater levels were recorded on a monthly basis in monitoring boreholes GW1 – GW8.

3.1.2 Collected samples were analysed for the range of determinants listed below:

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

3.1.3 All groundwater samples collected on the 30<sup>th</sup> of June were also analyzed for the following quarterly parameters:

*Alkalinity - total as CaCO<sub>3</sub>, chemical oxygen demand (COD), sulphate, total oxidised nitrogen, total organic carbon, xylenes, toluene and metals – cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium and zinc.*

3.1.4 Table S4.4 in the EP requires that GW2A, GW3A and GW4 are controlled by individual limits for ammoniacal nitrogen, chloride, nickel, zinc, total xylenes and toluene. The EP limit for total xylenes has been set at 0.011 mg/l, as agreed in a meeting with NRW on the 16<sup>th</sup> of April 2013.

3.1.5 Revised EP limits for ammoniacal nitrogen and chloride were proposed in report reference 1629.9.FCC.JDM.ÅKS.A0<sup>1</sup>, submitted to NRW on the 11<sup>th</sup> of July 2013 and is awaiting review.

3.1.6 Time-series graphs and a results summary of the laboratory analysis data are included in Appendix 2.

### 3.2 Groundwater Levels

3.2.1 Groundwater levels were recorded on the 29<sup>th</sup> of April, 31<sup>st</sup> of May and the 30<sup>th</sup> of June 2016. Time series graphs of the groundwater levels are included in Appendix 2.

### 3.3 Groundwater Quality

3.3.1 Exceedances of the EP limit for ammoniacal nitrogen (1.7 mg/l) were observed in GW2A, GW3A and GW4 during the review period. Maximum concentrations of ammoniacal nitrogen in GW2A, GW3A and GW4 were 6.4 mg/l, 69.4 mg/l and 6.4 mg/l respectively.

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<sup>1</sup> Caulmert Ltd. July 2013. Groundwater Quality Compliance Level Review. 1629.9.FCC.JDM.ÅKS.A0.

- 3.3.2 Exceedances of the EP limit for chloride (60 mg/l) were observed in GW2A and GW3A during the review period. Maximum chloride concentrations were 107 mg/l and 210 mg/l respectively.
- 3.3.3 Maximum ammoniacal nitrogen concentrations in the remaining locations ranged between <0.2 mg/l in GW5A and 17.1 mg/l in GW8.
- 3.3.4 Chloride concentrations in locations with no EP limits ranged between a minimum of 29 mg/l in GW5A and a maximum of 316 mg/l in GW1.1. As in the previous review period, chloride concentrations in GW1.1 remained relatively high throughout the review period.
- 3.3.5 Electrical conductivity ranged between a minimum of 0.23 mS/cm in GW4 and a maximum of 1.85 mS/cm in GW3A.
- 3.3.6 Dissolved oxygen concentrations were generally low and ranged between a minimum of <0.3 mg/l in four locations and a maximum of 7.47 mg/l in GW5A.
- 3.3.7 The pH in the groundwater locations ranged between 6.38 in GW5A and 7.78 in GW6.
- 3.3.8 In the quarterly monitoring round, no xylenes or toluene was detected in any of the locations.
- 3.3.9 Nickel and zinc concentrations remained an order of magnitude below the respective EP limits at all locations.

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## 4.0 LEACHATE

### 4.1 Introduction

4.1.1 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 2231.EMP.01, enclosed. No results for LC3 and LC5 are reported, as agreed with Natural Resources Wales on the 16<sup>th</sup> of April 2013.

4.1.2 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 therefore subject to a trade effluent agreement (Discharge Consent, DC).

4.1.3 Samples collected in June from the leachate chambers only were analyzed for the suite below:

*Alkalinity, ammoniacal nitrogen, biological oxygen demand, calcium, chloride, chemical oxygen demand, magnesium, total organic carbon, pH, potassium, sodium, sulphate and total oxidised nitrogen.*

4.1.4 The treated leachate discharge (Final Discharge, FD) was sampled and analysed for:

*Alkalinity, ammoniacal nitrogen, biochemical oxygen demand (BOD), chemical oxygen demand (COD), chloride, chromium, copper, iron, lead, nickel, nitrate, nitrite, organic carbon pH, sodium, sulphate, suspended solids, TPH and zinc*

4.1.5 Data summaries of leachate and discharge quality can be found in Appendix 3.

## 4.2 Leachate Levels

4.2.1 Table S4.1 in the EP requires that leachate levels must not exceed 2m above the base of each cell. This trigger level was discussed in the Leachate Management Plan. Following an assessment of the lowest achievable leachate levels for each landfill cell, new EP limits were proposed for Cells 2, 3, 4 and 5. These levels, detailed in Table 2 below, were agreed in a meeting between Alison Soper of the Environment Agency and representatives from Flintshire County Council Waste Management Services (then AD Waste Ltd) and Caulmert on the 17<sup>th</sup> of September 2009.

**Table 2: Leachate Level EP limits**

| Landfill Cell | Monitoring Points | Revised Limit (m) |
|---------------|-------------------|-------------------|
| Cell 1        | LC1B & R1         | 2.0               |
| Cell 2        | LC2B & R2         | 3.0               |
| Cell 3        | R3                | 5.5               |
| Cell 4        | LC4B & R4         | 3.0               |
| Cell 5        | R5                | 3.0               |
| Cell 6        | LC6B & R6         | 2.0               |

4.2.2 Leachate levels recorded during this review period are summarised in Table 3 below.

**Table 3: Leachate Head Data (exceedances highlighted in yellow)**

| Landfill Cell | Monitoring Point | April<br>(m above base) | May<br>(m above base) | June<br>(m above base) | Trigger Limit |
|---------------|------------------|-------------------------|-----------------------|------------------------|---------------|
| Cell 1        | BK LC 1B         | 1.72                    | 1.82                  | 1.79                   | 2.00          |
|               | BK R1 B          | 2.14                    | 2.09                  | 2.04                   |               |
| Cell 2        | BK LC 2B         | 0.79                    | 0.72                  | 0.70                   | 3.00          |
|               | BK R2B           | 1.17                    | 1.14                  | 1.11                   |               |
| Cell 3        | BK R3            | 1.06                    | 1.03                  | 1.08                   | 5.50          |
| Cell 4        | BK LC 4B         | 1.14                    | 1.02                  | 0.99                   | 3.00          |
|               | BK R4B           | 2.27                    | 2.26                  | 2.24                   |               |
| Cell 5        | BK R5            | 4.06                    | 4.20                  | 4.17                   | 3.00          |
| Cell 6        | BK LC 6B         | 0.85                    | 0.83                  | 0.81                   | 2.00          |
|               | BK R6B           | 0.40                    | 0.35                  | 0.46                   |               |

4.2.3 The leachate level exceeded the EP limit in R5 throughout the review period, as observed in the previous review period.

4.2.4 Leachate levels at all other locations remained below their respective trigger limits throughout the review.

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**4.3 Leachate Quality**

- 4.3.1 Highest concentrations of key leachate parameters were recorded in LC6 and had similar concentrations compared to the previous quarter. These results are consistent with strongest leachate being present in the most recently completed Cell 6.
- 4.3.2 LC5 showed an increase in concentration of Alkalinity, BOD and COD, with concentrations of 12300 mg/l, 6260 mg/l and 13600 mg/l respectively.

**4.4 Final Discharge to Sewer**

- 4.4.1 The COD consent limit was increased during this review period from 1000 mg/l to 2000 mg/l, in agreement with Welsh Water. The chemical analysis of the final discharge from the leachate treatment plant showed that the COD concentration had increased over the review period to a maximum of 4160 mg/l. With the exception of this maximum concentration, all other concentrations remained below the revised consent limit.
- 4.4.2 The discharge limit for ammoniacal nitrogen (50 mg/l) was exceeded on the 30<sup>th</sup> June with a concentration of 59 mg/l. The concentration was otherwise below the trigger limit throughout the review period.

## 5.0 SURFACE WATER

### 5.1 Introduction

5.1.1 Surface water samples are routinely 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 point<sup>2</sup>.

5.1.3 Collected samples were analysed for the range of determinants listed below:

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

5.1.4 In the EP, Table S4.3 requires that only location P2 be controlled by chemical quality limits. Monitoring locations are shown on Drawing 2231.EMP.01, enclosed. A summary of the laboratory analysis data is included in Appendix 4.

### 5.2 Surface Water Quality

5.2.1 EP limits for COD and suspended solids were exceeded at P2, when it was sampled in April.

5.2.2 Water quality at P4 and SW2 were comparable to the long-term trends for water quality at these locations.

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<sup>2</sup> 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 07/06/2016 to the 05/07/2016 as required by the EP.
- 6.1.2 Location 1 was located on bund by leachate storage tanks and opposite the transfer pad. Location 2 was on the site perimeter near the leachate treatment plant. Location 3 was in Oaks Farm.

### 6.2 Dust Results

- 6.2.1 Dust monitoring results are shown in Table 4 below:

**Table 4: Results from dust monitoring at Brookhill**

| Monitoring Locations | Total Suspended Solids (mg/l) | Result (mg/m <sup>2</sup> /day) | Trigger Level (mg/m <sup>2</sup> /day) |
|----------------------|-------------------------------|---------------------------------|----------------------------------------|
|                      |                               |                                 |                                        |
| Location 1           | 42                            | 37                              | 200                                    |
| Location 2           | 16                            | 14                              | 200                                    |
| Location 3           | 27                            | 24                              | 200                                    |

- 6.2.2 Deposited dust concentrations were below the EP trigger level at all locations during this period.

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## **7.0 CONCLUSIONS**

### **7.1 Landfill Gas**

- 7.1.1 Landfill gas concentration was monitored at locations around the site perimeter on a weekly basis. During this review period, none of the monitored perimeter gas boreholes were in breach of their respective methane or carbon dioxide EP limits.
- 7.1.2 During this review period methane concentrations remained below the instrumental detection limit of 0.1 % in many of the boreholes on site. The highest concentrations were, as expected, in BH8 and BH9 where average concentrations of 29.0 % and 27.1 % respectively were recorded. These boreholes therefore have individually set EP limits, which were not exceeded during this review period.
- 7.1.3 The maximum carbon dioxide concentration was 3.2 % recorded in BH18.

### **7.2 Groundwater**

- 7.2.1 The EP limit for ammoniacal nitrogen was exceeded in GW2A, GW3A and GW4 during the review period. The EP limit for chloride was exceeded in GW2A and GW3A throughout the review period.
- 7.2.2 Concentrations of the majority of parameters within the groundwater were highest in GW3A. The concentrations of most determinants were similar to those recorded in the previous quarter.

### **7.3 Leachate**

- 7.3.1 Exceedances of the EP limit for leachate level was recorded in location R5 throughout the review period. Leachate levels at all other locations remained below their respective trigger limits throughout the review.
- 7.3.2 Highest concentrations of key leachate parameters were generally recorded in LC6 and had similar concentrations compared to the previous quarter. These results are consistent with strongest leachate being present in the most recently completed Cell 6.
- 7.3.3 The COD discharge consent limit was increased during this review period from 1000 mg/l to 2000 mg/l, in agreement with Welsh Water. This new limit was exceeded on one occasion during this review period.

### **7.4 Surface Water**

- 7.4.1 EP limits for COD and suspended solids were exceeded at P2.

7.4.2 Water quality at P4 and SW2 were comparable to the long-term trends for water quality at these locations.

## **7.5 Dust**

7.5.1 Deposited dust concentrations were below the EP limit at all locations during this period.

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- NOTES
1. SURVEY INFORMATION PROVIDED BY SOUTH STAFFS SURVEYS. TITLE: UPDATE SURVEY, REF: 4839a.dwg. DATE: 07.08.2015.
- LEGEND
- BH14 GAS BOREHOLE
  - GW GAS EXTRACTION WELL
  - GW5 GROUND WATER MONITORING BOREHOLE
  - LC5 LEACHATE WELL
  - SW2 SURFACE WATER MONITORING POINT
  - CV COAL VENT
  - LEACHATE MONITORING POINT

| REV | MODIFICATIONS | BY | CH | AP | DATE |
|-----|---------------|----|----|----|------|
|-----|---------------|----|----|----|------|

FLINTSHIRE COUNTY  
COUNCIL WASTE  
MANAGEMENT SERVICES

BROOKHILL LANDFILL SITE

ENVIRONMENTAL  
MONITORING PLAN

|             |     |            |            |
|-------------|-----|------------|------------|
| DRAWN BY    | RWG | DATE       | 01.03.2016 |
| CHECKED BY  | JM  | SCALE @ A1 | 1:750      |
| APPROVED BY | JM  | ISSUE      | Fn         |
|             |     | REVISION   | -          |

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2231.EMP.01



## APPENDIX 1 – LANDFILL GAS

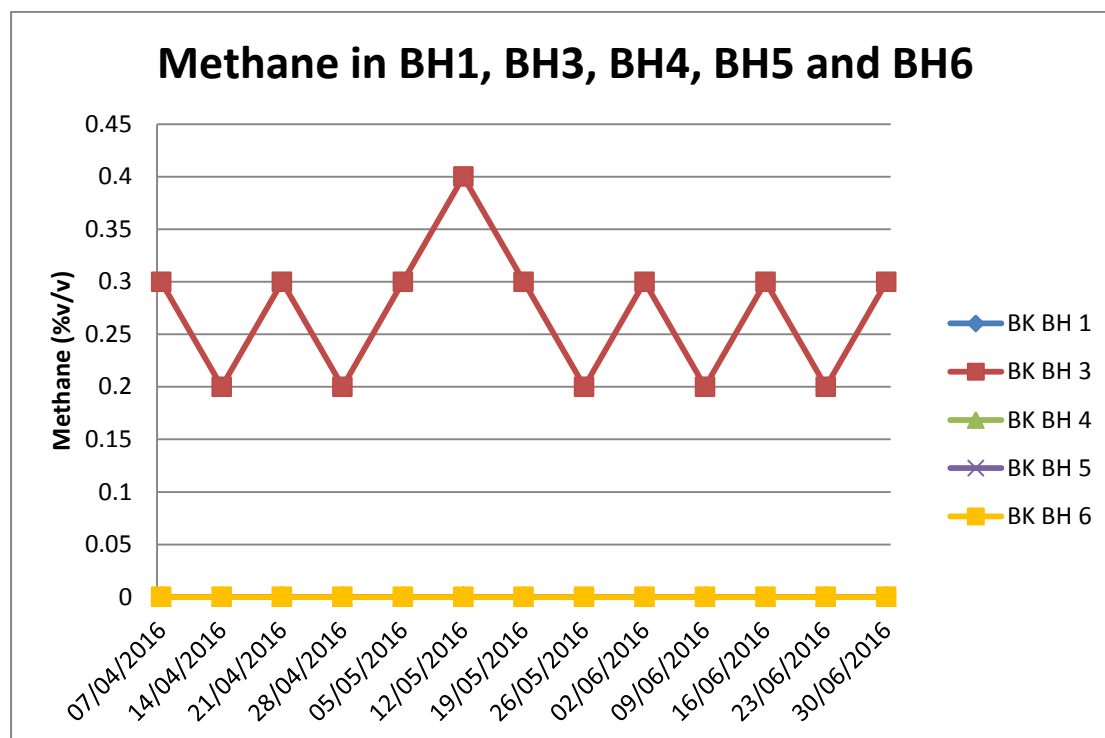
**Table 1: Perimeter Landfill Gas Monitoring Data Summary**

| Location | Data    | CH4 (%v/v) | Trigger | CO2 (%v/v) | Trigger |
|----------|---------|------------|---------|------------|---------|
| BK BH 1  | Min     | 0.00       | 1       | 1.20       | 8.8     |
|          | Max     | 0.00       |         | 1.90       |         |
|          | Average | 0.00       |         | 1.50       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 3  | Min     | 0.20       | 1       | 0.80       | 3.1     |
|          | Max     | 0.40       |         | 1.50       |         |
|          | Average | 0.27       |         | 1.16       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 4  | Min     | 0.00       | 1       | 0.90       | 5.1     |
|          | Max     | 0.00       |         | 1.50       |         |
|          | Average | 0.00       |         | 1.27       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 5  | Min     | 0.00       | 1       | 0.60       | 1.5     |
|          | Max     | 0.00       |         | 1.30       |         |
|          | Average | 0.00       |         | 0.98       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 6  | Min     | 0.00       | 1       | 0.60       | 1.5     |
|          | Max     | 0.00       |         | 1.00       |         |
|          | Average | 0.00       |         | 0.78       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 7  | Min     | 0.00       | 1       | 1.10       | 10      |
|          | Max     | 0.00       |         | 1.60       |         |
|          | Average | 0.00       |         | 1.28       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 8  | Min     | 28.50      | 32.2    | 1.10       | 3.6     |
|          | Max     | 29.40      |         | 1.90       |         |
|          | Average | 28.96      |         | 1.53       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 9  | Min     | 26.50      | 29.6    | 1.00       | 10.4    |
|          | Max     | 27.70      |         | 1.90       |         |
|          | Average | 27.09      |         | 1.39       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 10 | Min     | 0.00       | 1       | 1.40       | 3.9     |
|          | Max     | 0.00       |         | 2.30       |         |
|          | Average | 0.00       |         | 1.83       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 11 | Min     | 0.00       | 1       | 1.30       | 6.5     |
|          | Max     | 0.00       |         | 2.30       |         |
|          | Average | 0.00       |         | 1.85       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 12 | Min     | 0.00       | 1       | 1.00       | 6.6     |
|          | Max     | 0.00       |         | 1.50       |         |
|          | Average | 0.00       |         | 1.30       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 13 | Min     | 0.00       | 1       | 0.80       | 9.4     |
|          | Max     | 0.00       |         | 1.70       |         |
|          | Average | 0.00       |         | 1.28       |         |
|          | Count   | 13         |         | 13         |         |

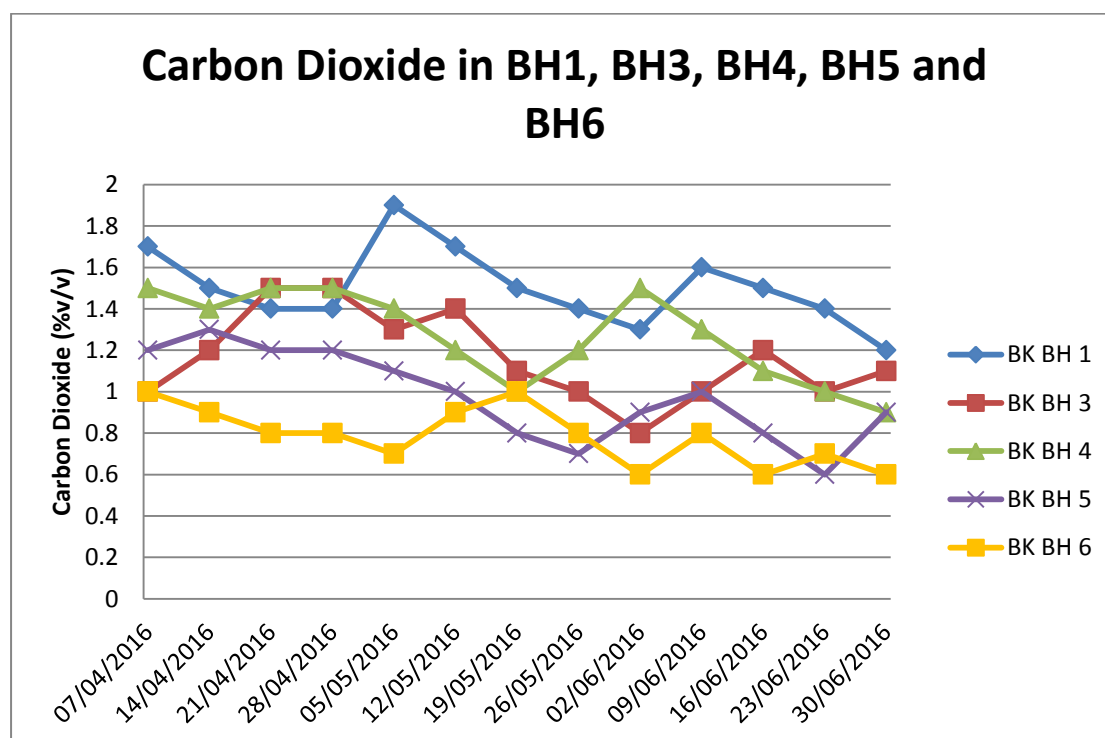
## APPENDIX 1 – LANDFILL GAS

| Location | Data    | CH4 (%v/v) | Trigger | CO2 (%v/v) | Trigger |
|----------|---------|------------|---------|------------|---------|
| BK BH 14 | Min     | 0.00       | 1       | 0.50       | 3.5     |
|          | Max     | 0.00       |         | 1.50       |         |
|          | Average | 0.00       |         | 1.12       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 15 | Min     | 0.00       | 1       | 1.10       | 17.6    |
|          | Max     | 0.00       |         | 1.90       |         |
|          | Average | 0.00       |         | 1.59       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 16 | Min     | 0.00       | 1       | 1.30       | 11.4    |
|          | Max     | 0.00       |         | 2.30       |         |
|          | Average | 0.00       |         | 1.94       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 17 | Min     | 0.20       | 1       | 1.40       | 12.9    |
|          | Max     | 0.40       |         | 2.00       |         |
|          | Average | 0.28       |         | 1.65       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 18 | Min     | 0.10       | 6.8     | 1.50       | 21.2    |
|          | Max     | 0.50       |         | 3.20       |         |
|          | Average | 0.29       |         | 1.98       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 19 | Min     | 0.00       | 1       | 1.20       | 11.2    |
|          | Max     | 0.00       |         | 3.10       |         |
|          | Average | 0.00       |         | 1.90       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 20 | Min     | 0.10       | 1       | 2.00       | 17.6    |
|          | Max     | 0.30       |         | 2.60       |         |
|          | Average | 0.22       |         | 2.26       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 21 | Min     | 0.20       | 1       | 1.40       | 11.4    |
|          | Max     | 0.50       |         | 2.30       |         |
|          | Average | 0.33       |         | 1.91       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 23 | Min     | 0.00       | 1       | 1.10       | 7.3     |
|          | Max     | 0.00       |         | 1.90       |         |
|          | Average | 0.00       |         | 1.38       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 24 | Min     | 0.00       | 1       | 0.60       | 1.5     |
|          | Max     | 0.00       |         | 1.20       |         |
|          | Average | 0.00       |         | 0.91       |         |
|          | Count   | 13         |         | 13         |         |
| BK BH 25 | Min     | 0.00       | 1       | 1.00       | 9.9     |
|          | Max     | 0.00       |         | 1.40       |         |
|          | Average | 0.00       |         | 1.18       |         |
|          | Count   | 13         |         | 13         |         |

## APPENDIX 1 – LANDFILL GAS

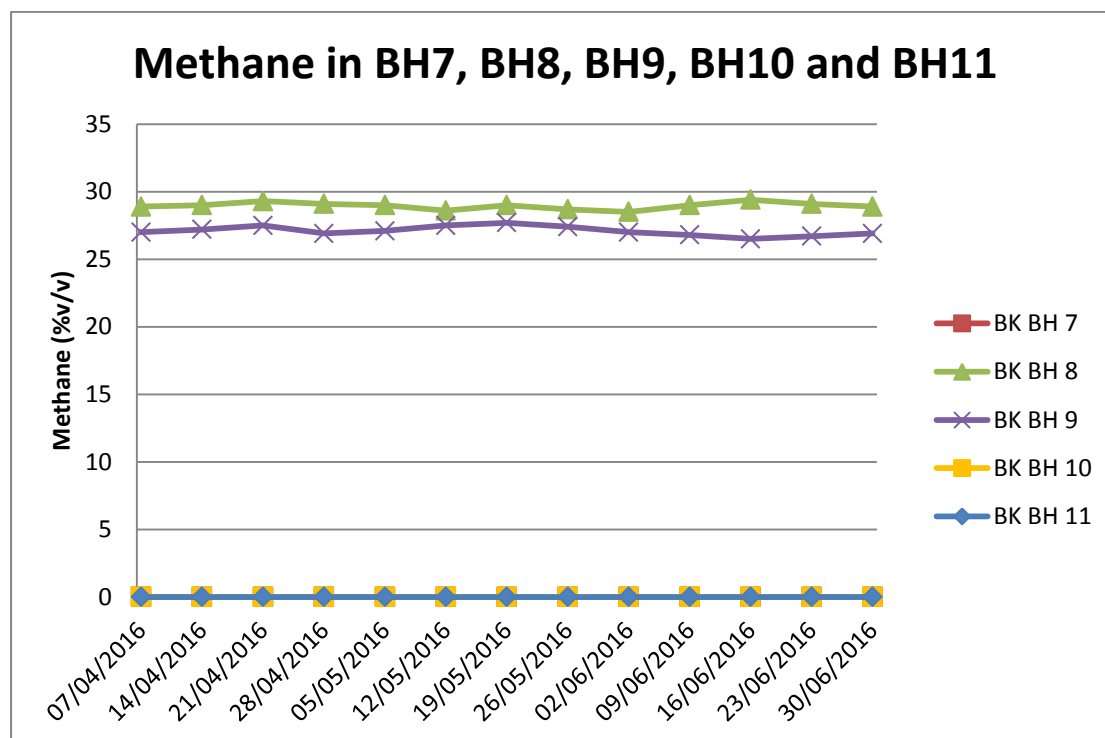


Graph 1: Methane in BH1, BH3, BH4, BH5 and BH6

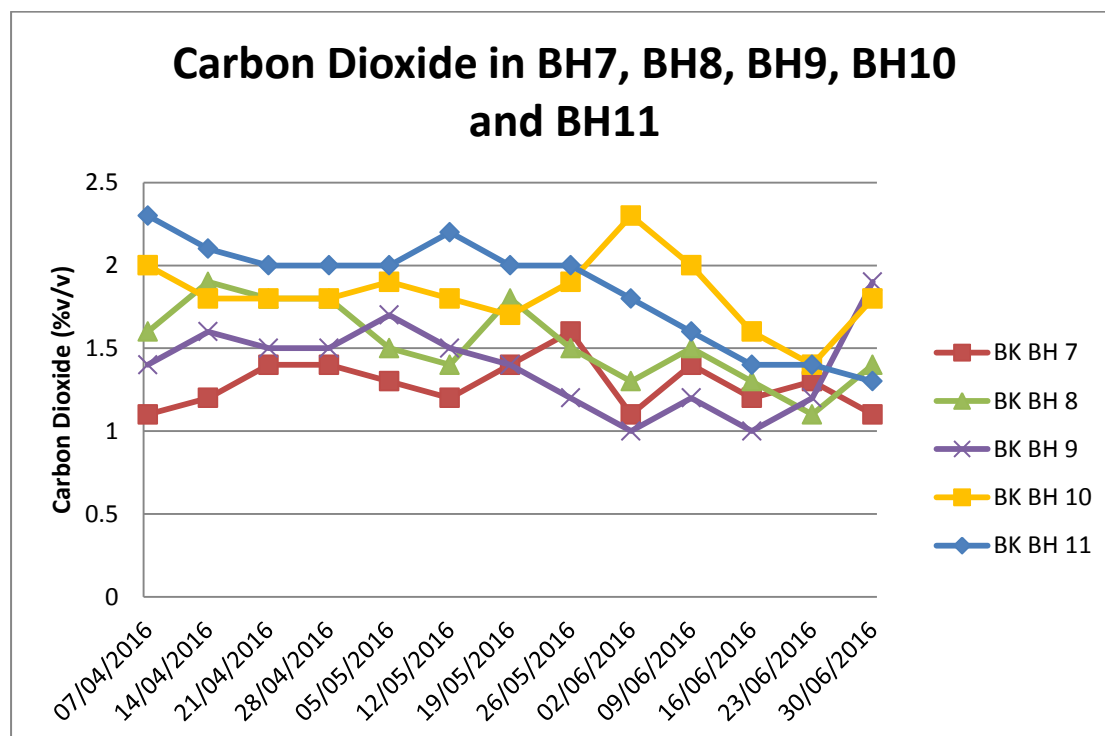


Graph 2: Gas: Carbon dioxide in BH1, BH3, BH4, BH5 and BH6

## APPENDIX 1 – LANDFILL GAS

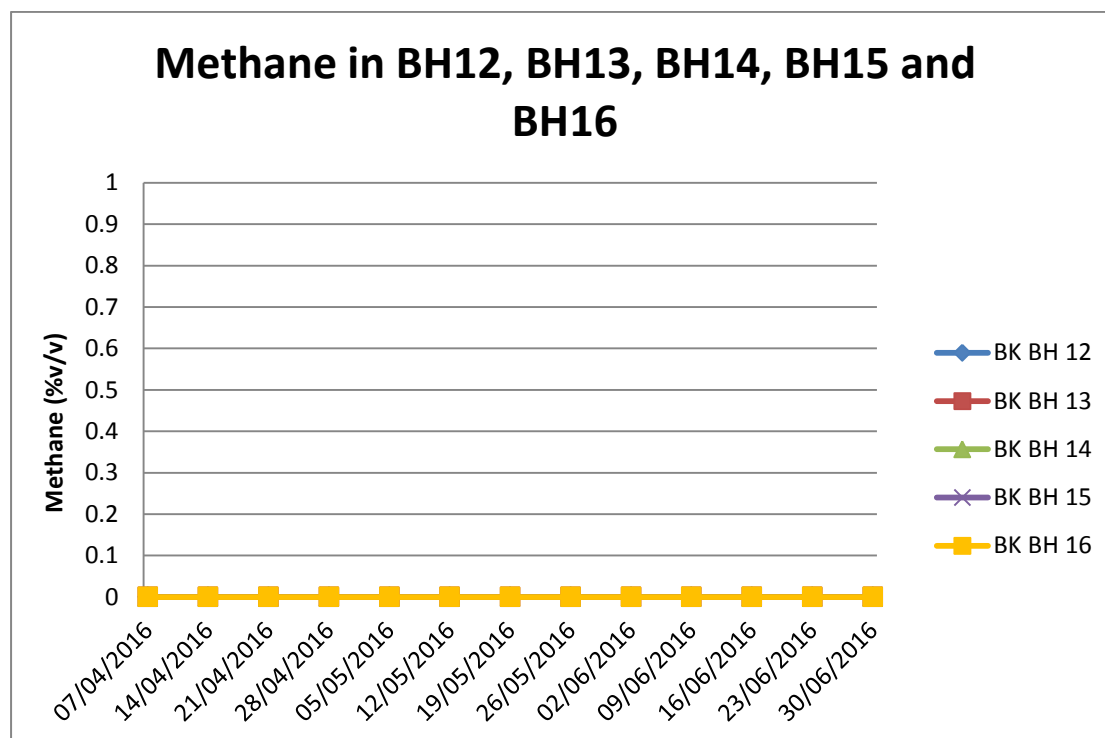


Graph 3: Methane in BH7, BH8, BH9, BH10 and BH11

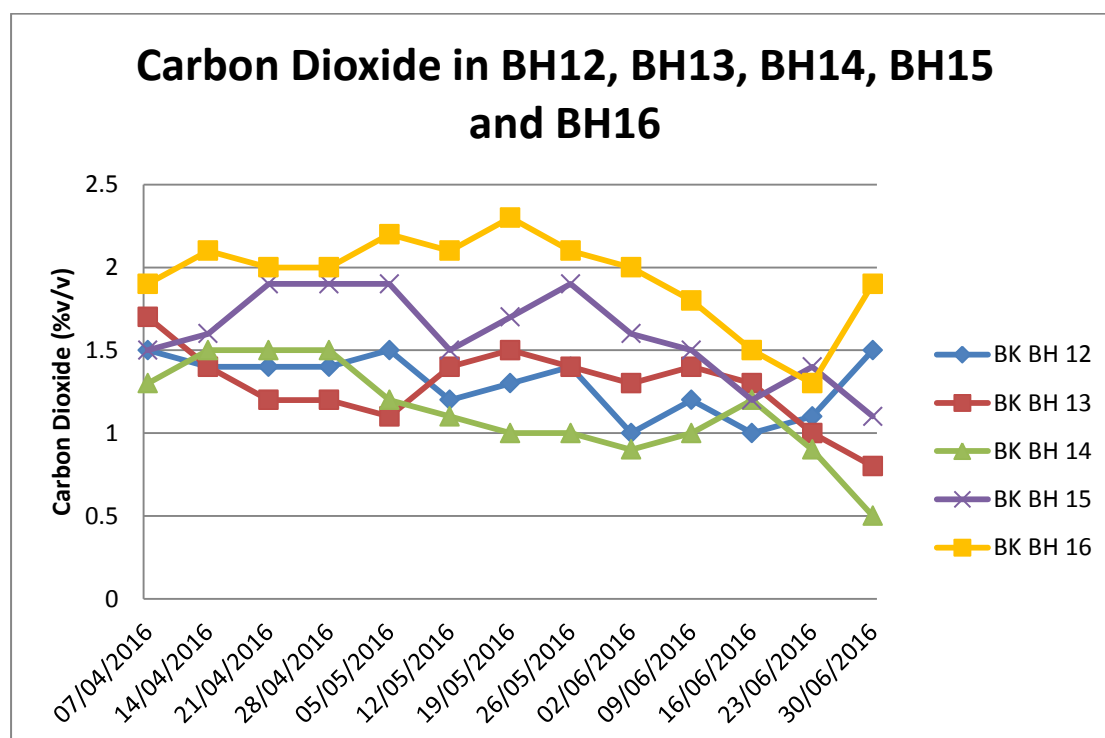


Graph 4: Carbon dioxide in BH7, BH8, BH9, BH10 and BH11

## APPENDIX 1 – LANDFILL GAS

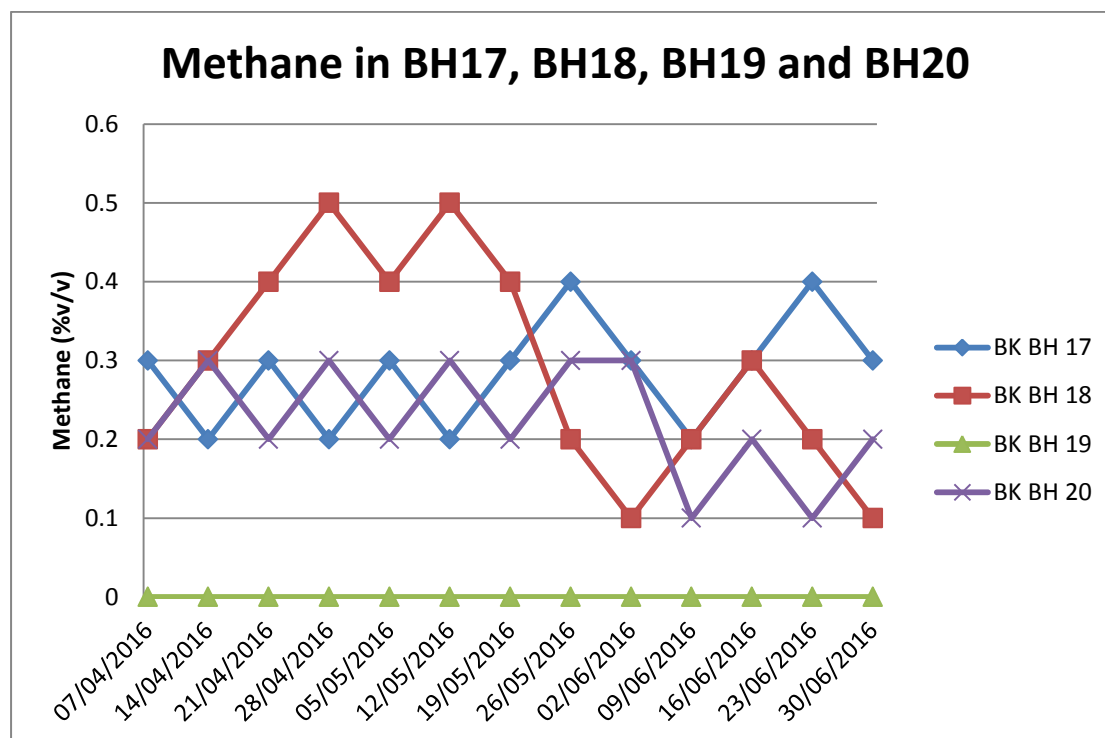


Graph 5: Methane in BH12, BH13, BH14, BH15 and BH16

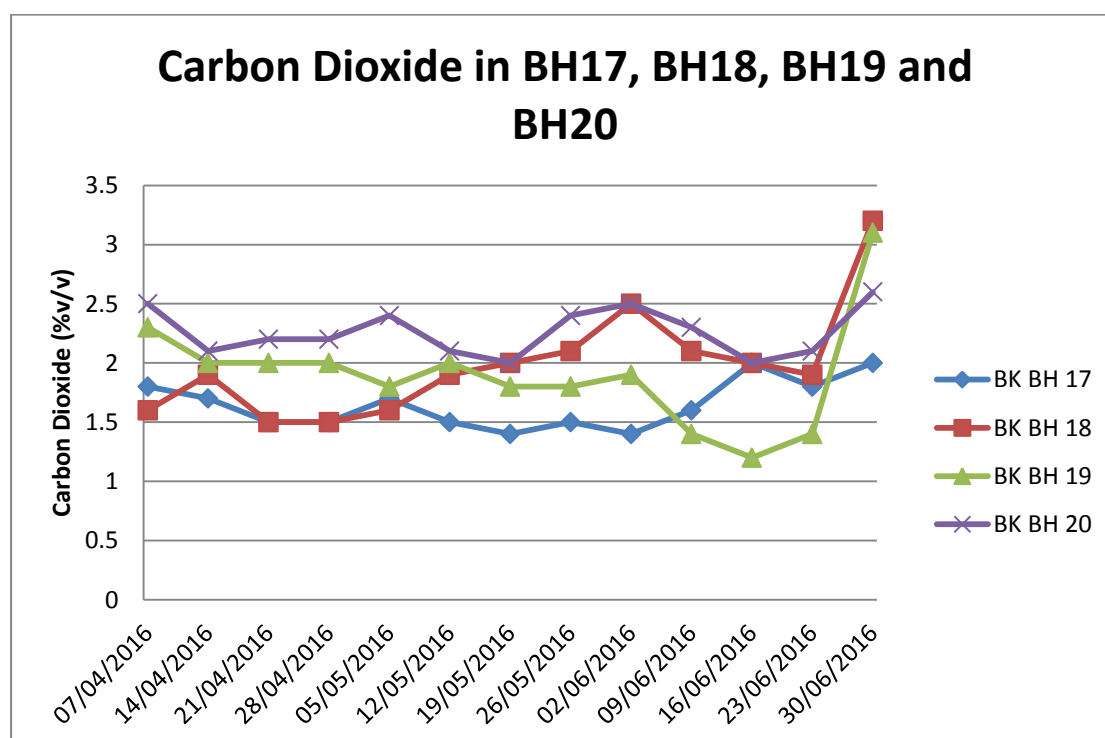


Graph 6: Carbon dioxide in BH12, BH13, BH14, BH15 and BH16

## APPENDIX 1 – LANDFILL GAS

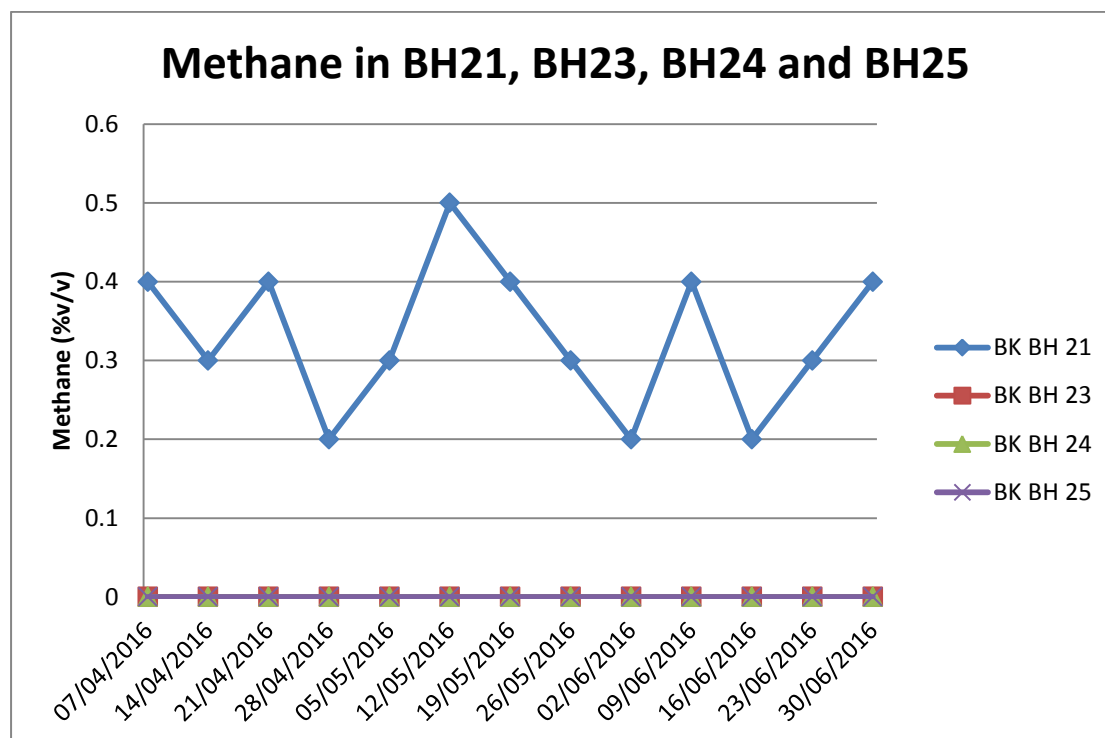


Graph 7: Methane in BH17, BH18, BH19 and BH20

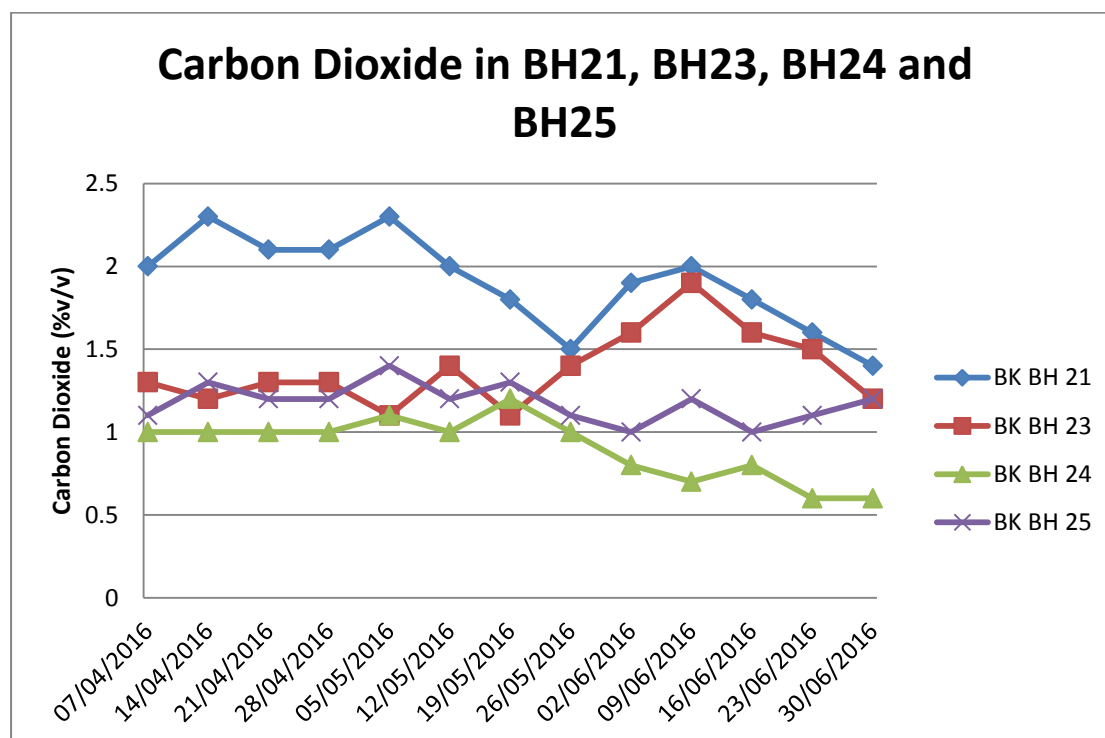


Graph 8: Carbon dioxide in BH17, BH18, BH19 and BH20

## APPENDIX 1 – LANDFILL GAS



Graph 9: Methane in BH21, BH23, BH24 and BH25



Graph 10: Carbon dioxide in BH21, BH23, BH24 and BH25

## APPENDIX 1 – LANDFILL GAS

**Table 2: In waste landfill gas monitoring data summary**

| Monitoring Point     | Date       | CH4 (%) | CO2 (%) | O2 (%) | CO (ppm) | H2S (ppm) |
|----------------------|------------|---------|---------|--------|----------|-----------|
| B+C Manifold         | 19/04/2016 | 46.9    | 37      | 0.4    | 9        | 4         |
|                      | 24/05/2016 | 48.5    | 36.9    | 0.5    | 10       | 9         |
|                      | 29/06/2016 | 48.2    | 36      | 0.6    | 14       | 1         |
| Flare                | 19/04/2016 | 51.6    | 37.9    | 0.5    | 10       | 7         |
|                      | 19/04/2016 | 51.5    | 37.2    | 0.4    | 10       | 7         |
|                      | 24/05/2016 | 50.4    | 38.4    | 0.4    | 12       | 8         |
|                      | 24/05/2016 | 50.9    | 38.9    | 0.3    | 11       | 9         |
|                      | 29/06/2016 | 44.3    | 34.1    | 0.8    | 4        | 0         |
|                      | 29/06/2016 | 48.9    | 36.2    | 0.5    | 11       | 9         |
| GV / LC3.1 + LC3 MAN | 19/04/2016 | 42.3    | 34.5    | 1.3    | 2        | 8         |
|                      | 24/05/2016 | 43.6    | 35.6    | 1.2    | 7        | 7         |
|                      | 29/06/2016 | 44.6    | 33.6    | 1.3    | 5        | 0         |
| GV 2.1               | 19/04/2016 | 48      | 37.9    | 0.6    | 7        | 9         |
|                      | 24/05/2016 | 48.3    | 38      | 0.5    | 9        | 10        |
|                      | 29/06/2016 | 47.9    | 37.5    | 0.4    | 8        | 3         |
| GV 2.2               | 19/04/2016 | 47.1    | 36      | 0.9    | 8        | 7         |
|                      | 24/05/2016 | 47.5    | 36.8    | 1      | 4        | 9         |
|                      | 29/06/2016 | 47      | 36      | 0.9    | 7        | 8         |
| GV 2.2+ LC2B MAN     | 19/04/2016 | 46.5    | 35.2    | 1      | 5        | 6         |
|                      | 24/05/2016 | 47      | 36.1    | 1.1    | 9        | 8         |
|                      | 29/06/2016 | 46.8    | 35.2    | 1.2    | 9        | 0         |
| GV 22                | 19/04/2016 | 35.9    | 30.5    | 2.2    | 6        | 9         |
|                      | 24/05/2016 | 36.2    | 31.5    | 2.5    | 7        | 10        |
|                      | 29/06/2016 | 37.8    | 32.4    | 2.6    | 6        | 12        |
| GV 35 (New Well)     | 19/04/2016 | 48.9    | 33.6    | 0.5    | 7        | 5         |
|                      | 24/05/2016 | 49.2    | 34.5    | 0.4    | 10       | 9         |
|                      | 29/06/2016 | 16.8    | 22.6    | 1.6    | 2        | 0         |
| GV 36 (New Well)     | 19/04/2016 | 25.9    | 25.4    | 2.8    | 8        | 6         |
|                      | 24/05/2016 | 38.9    | 25.4    | 2.5    | 3        | 10        |
|                      | 29/06/2016 | 14.8    | 18.6    | 3.7    | 6        | 0         |
| GV 37 (New Well)     | 19/04/2016 | 33.4    | 27.8    | 1.1    | 5        | 7         |
|                      | 24/05/2016 | 34.5    | 26.9    | 1.4    | 9        | 6         |
|                      | 29/06/2016 | 60.2    | 34.7    | 0      | 1        | 0         |
| GV 38 (New Well)     | 19/04/2016 | 45.2    | 33.8    | 0.9    | 4        | 9         |
|                      | 24/05/2016 | 46.2    | 34.5    | 0.8    | 8        | 10        |
|                      | 29/06/2016 | 49.2    | 31.7    | 0.8    | 3        | 0         |
| GV 39 (New Well)     | 19/04/2016 | 46.9    | 34.9    | 1.1    | 8        | 1         |
|                      | 24/05/2016 | 46      | 36.1    | 1      | 9        | 5         |
|                      | 29/06/2016 | 47.1    | 30.6    | 1.8    | 2        | 0         |
| GV 40 (New Well)     | 19/04/2016 | 44.9    | 35.6    | 1      | 5        | 7         |
|                      | 24/05/2016 | 45.2    | 36      | 1.1    | 5        | 9         |
|                      | 29/06/2016 | 44.5    | 36.2    | 1      | 6        | 3         |
| GV 41 (New Well)     | 19/04/2016 | 44.5    | 35      | 1      | 6        | 28        |
|                      | 24/05/2016 | 44.1    | 34.5    | 1      | 7        | 22        |
|                      | 29/06/2016 | 45.6    | 35.6    | 1.2    | 3        | 0         |
| GV 42 (New Well)     | 19/04/2016 | 37.9    | 30      | 1.4    | 12       | 6         |
|                      | 24/05/2016 | 38.1    | 32.2    | 1.5    | 12       | 9         |
|                      | 29/06/2016 | 37.8    | 33.6    | 1.5    | 11       | 6         |

## APPENDIX 1 – LANDFILL GAS

| Monitoring Point | Date       | CH4 (%) | CO2 (%) | O2 (%) | CO (ppm) | H2S (ppm) |
|------------------|------------|---------|---------|--------|----------|-----------|
| GV 43 (New Well) | 19/04/2016 | 42.6    | 35.8    | 1.5    | 8        | 9         |
|                  | 24/05/2016 | 46.2    | 36.6    | 1.1    | 15       | 10        |
|                  | 29/06/2016 | 45.8    | 37.2    | 1.2    | 14       | 5         |
| GV 44 (New Well) | 19/04/2016 | 38      | 29.9    | 0.7    | 5        | 8         |
|                  | 24/05/2016 | 37.8    | 30.1    | 0.8    | 13       | 7         |
|                  | 29/06/2016 | 40      | 32.6    | 0.9    | 13       | 0         |
| GV 45 (New Well) | 19/04/2016 | 45.8    | 36.9    | 1      | 4        | 4         |
|                  | 24/05/2016 | 44.9    | 37      | 1.1    | 11       | 5         |
|                  | 29/06/2016 | 46      | 38.2    | 1.1    | 11       | 0         |
| GV 46 (New Well) | 19/04/2016 | 48.5    | 40      | 0.5    | 7        | 7         |
|                  | 24/05/2016 | 47.9    | 39.9    | 0.4    | 9        | 8         |
|                  | 29/06/2016 | 48.2    | 38.6    | 0.3    | 10       | 0         |
| GV 47 (New Well) | 19/04/2016 | 46      | 35.1    | 1      | 7        | 8         |
|                  | 24/05/2016 | 46.2    | 36.6    | 1.1    | 8        | 10        |
|                  | 29/06/2016 | 45.9    | 37      | 1      | 8        | 3         |
| GV 48 (New Well) | 19/04/2016 | 59.6    | 40      | 0.1    | 7        | 8         |
|                  | 24/05/2016 | 59.9    | 39.9    | 0.1    | 9        | 9         |
|                  | 29/06/2016 | 60      | 38.9    | 0.3    | 9        | 5         |
| GV 49 (New Well) | 19/04/2016 | 45.1    | 32.5    | 1.1    | 4        | 5         |
|                  | 24/05/2016 | 45.3    | 33.6    | 1      | 10       | 8         |
|                  | 29/06/2016 | 46.2    | 32.8    | 1.1    | 7        | 4         |
| GV B             | 19/04/2016 | 47      | 36.9    | 0.5    | 6        | 7         |
|                  | 24/05/2016 | 47.5    | 36.5    | 0.5    | 7        | 8         |
|                  | 29/06/2016 | 46.9    | 35.4    | 0.2    | 11       | 2         |
| GV C             | 19/04/2016 | 46.5    | 37      | 0.3    | 14       | 8         |
|                  | 24/05/2016 | 48.9    | 37.2    | 0.4    | 11       | 8         |
|                  | 29/06/2016 | 48      | 35.9    | 0.3    | 13       | 0         |
| GV1              | 19/04/2016 | 22.6    | 24.5    | 2.5    | 5        | 7         |
|                  | 24/05/2016 | 23.8    | 25.9    | 2.1    | 4        | 5         |
|                  | 29/06/2016 | 24.6    | 22.6    | 2.3    | 3        | 0         |
| GV10             | 19/04/2016 | 44.5    | 30.1    | 1.3    | 1        | 11        |
|                  | 24/05/2016 | 43.9    | 32.5    | 1.2    | 2        | 12        |
|                  | 29/06/2016 | 40.6    | 33.3    | 1.1    | 5        | 6         |
| GV11             | 19/04/2016 | 38.6    | 26.5    | 1.1    | 4        | 9         |
|                  | 24/05/2016 | 40      | 27.5    | 1.3    | 6        | 10        |
|                  | 29/06/2016 | 38.7    | 26.5    | 1.4    | 8        | 0         |
| GV12             | 19/04/2016 | 51.2    | 33.2    | 0.4    | 6        | 9         |
|                  | 24/05/2016 | 50.6    | 36      | 0.3    | 7        | 11        |
|                  | 29/06/2016 | 50      | 35.8    | 0.5    | 9        | 0         |
| GV12+R3 Manifold | 19/04/2016 | 51      | 33.5    | 0.5    | 5        | 6         |
|                  | 24/05/2016 | 50.8    | 35.6    | 0.5    | 8        | 7         |
|                  | 29/06/2016 | 50.1    | 34.5    | 0.4    | 7        | 0         |
| GV13             | 19/04/2016 | 50      | 35.9    | 0.4    | 4        | 9         |
|                  | 24/05/2016 | 51.5    | 37      | 0.8    | 5        | 10        |
|                  | 29/06/2016 | 0.3     | 1.2     | 19.7   | 0        | 0         |
| GV14             | 19/04/2016 | 49.8    | 37.8    | 0.6    | 2        | 8         |
|                  | 24/05/2016 | 48.6    | 36.9    | 0.4    | 4        | 9         |
|                  | 29/06/2016 | 47      | 37.9    | 0.2    | 7        | 0         |
| GV15             | 19/04/2016 | 50.6    | 33.8    | 0.8    | 5        | 14        |
|                  | 24/05/2016 | 50      | 34.5    | 0.5    | 6        | 12        |
|                  | 29/06/2016 | 52      | 39      | 0.3    | 12       | 0         |

## APPENDIX 1 – LANDFILL GAS

| Monitoring Point   | Date       | CH4 (%) | CO2 (%) | O2 (%) | CO (ppm) | H2S (ppm) |
|--------------------|------------|---------|---------|--------|----------|-----------|
| GV16               | 19/04/2016 | 41.5    | 33.2    | 2.8    | 3        | 11        |
|                    | 24/05/2016 | 42.5    | 34.2    | 3      | 4        | 9         |
|                    | 29/06/2016 | 53      | 40.2    | 0.2    | 3        | 0         |
| GV17               | 19/04/2016 | 38.2    | 33.1    | 2.6    | 13       | 7         |
|                    | 24/05/2016 | 39      | 34      | 2.4    | 11       | 8         |
|                    | 29/06/2016 | 39.2    | 32.1    | 2.5    | 11       | 11        |
| GV17+LC4 Manifold  | 19/04/2016 | 37.9    | 32.8    | 3.2    | 9        | 8         |
|                    | 24/05/2016 | 38.5    | 33.6    | 3      | 10       | 10        |
|                    | 29/06/2016 | 39.6    | 32.5    | 2.7    | 9        | 9         |
| GV18               | 19/04/2016 | 52.3    | 37      | 0.4    | 5        | 9         |
|                    | 24/05/2016 | 52.8    | 36.9    | 0.5    | 6        | 7         |
|                    | 29/06/2016 | 45      | 36.2    | 0.3    | 11       | 0         |
| GV23               | 19/04/2016 | 53.6    | 35.8    | 0.4    | 5        | 8         |
|                    | 24/05/2016 | 52.9    | 36.2    | 0.5    | 4        | 7         |
|                    | 29/06/2016 | 50.1    | 36.2    | 0.5    | 6        | 0         |
| GV24               | 19/04/2016 | 53.1    | 37      | 0.5    | 4        | 8         |
|                    | 24/05/2016 | 53.6    | 37.8    | 0.6    | 6        | 6         |
|                    | 29/06/2016 | 52.9    | 37.8    | 0.6    | 8        | 0         |
| GV25               | 19/04/2016 | 52.6    | 36.5    | 0.4    | 5        | 9         |
|                    | 24/05/2016 | 53.1    | 35.6    | 0.4    | 9        | 10        |
|                    | 29/06/2016 | 39.6    | 35.2    | 0.5    | 11       | 0         |
| GV26               | 19/04/2016 | 51.9    | 34.9    | 0.4    | 2        | 10        |
|                    | 24/05/2016 | 52.4    | 35.2    | 0.5    | 4        | 10        |
|                    | 29/06/2016 | 50.4    | 37.2    | 0.3    | 8        | 5         |
| GV26 + 27 Manifold | 19/04/2016 | 51.5    | 35.6    | 0.5    | 5        | 6         |
|                    | 24/05/2016 | 52      | 36      | 0.6    | 4        | 12        |
|                    | 29/06/2016 | 50      | 37      | 0.5    | 9        | 3         |
| GV27               | 19/04/2016 | 51      | 35.9    | 0.6    | 5        | 21        |
|                    | 24/05/2016 | 51.4    | 36.5    | 0.7    | 6        | 18        |
|                    | 29/06/2016 | 48.2    | 37      | 0.6    | 6        | 4         |
| GV28               | 19/04/2016 | 51.2    | 35.8    | 0.2    | 4        | 9         |
|                    | 24/05/2016 | 51.4    | 36.5    | 0.2    | 5        | 10        |
|                    | 29/06/2016 | 50      | 37      | 0.5    | 8        | 2         |
| GV28+ 29 Manifold  | 19/04/2016 | 51      | 35.6    | 0.3    | 4        | 4         |
|                    | 24/05/2016 | 51.2    | 35.9    | 0.4    | 5        | 5         |
|                    | 29/06/2016 | 49.9    | 36.8    | 0.6    | 7        | 3         |
| GV29               | 19/04/2016 | 50.4    | 35      | 0.5    | 7        | 5         |
|                    | 24/05/2016 | 50.7    | 35.2    | 0.6    | 6        | 5         |
|                    | 29/06/2016 | 49.5    | 35.9    | 0.7    | 9        | 0         |
| GV3                | 19/04/2016 | 50.2    | 35.8    | 0.5    | 6        | 9         |
|                    | 24/05/2016 | 51.6    | 37.4    | 0.6    | 5        | 9         |
|                    | 29/06/2016 | 50.4    | 38.6    | 0.5    | 11       | 6         |
| GV30               | 19/04/2016 | 47      | 36      | 0.9    | 7        | 7         |
|                    | 24/05/2016 | 48.5    | 37.5    | 0.5    | 9        | 9         |
|                    | 29/06/2016 | 45.6    | 36.3    | 1.3    | 11       | 4         |
| GV31               | 19/04/2016 | 46.9    | 35.9    | 1.1    | 4        | 7         |
|                    | 24/05/2016 | 45.5    | 36      | 1      | 8        | 10        |
|                    | 29/06/2016 | 45      | 36.2    | 1.2    | 6        | 5         |
| GV32               | 19/04/2016 | 45.5    | 33.4    | 1.1    | 2        | 7         |
|                    | 24/05/2016 | 44.9    | 35.4    | 1.2    | 4        | 5         |
|                    | 29/06/2016 | 46.2    | 34.7    | 1      | 5        | 0         |

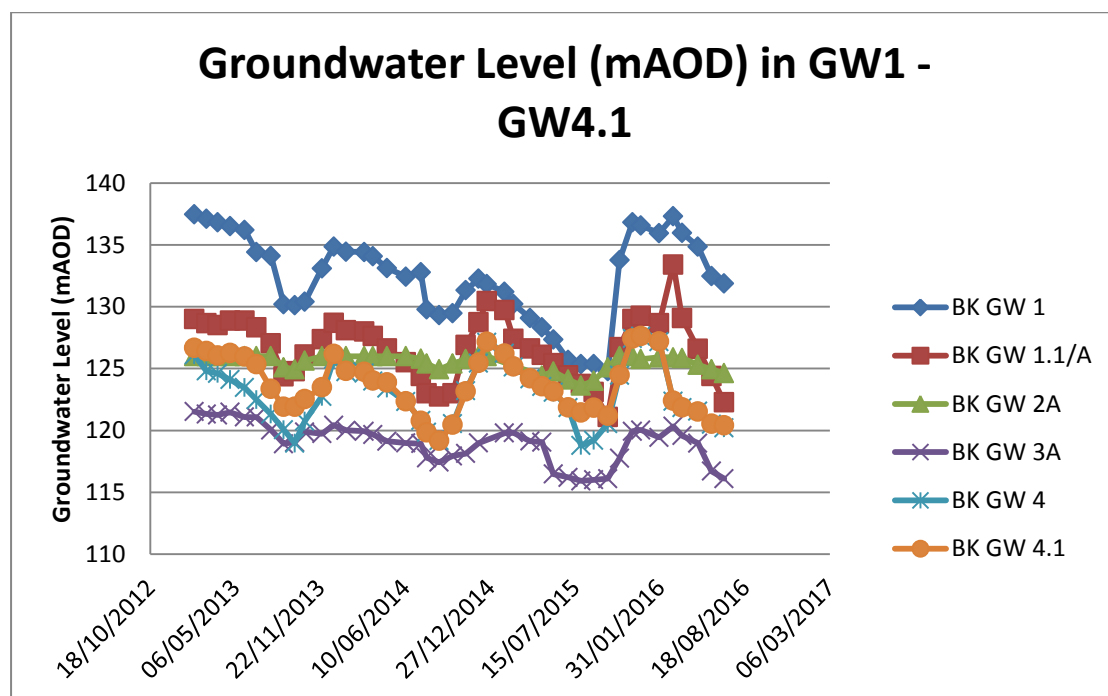
## APPENDIX 1 – LANDFILL GAS

| Monitoring Point | Date       | CH4 (%) | CO2 (%) | O2 (%) | CO (ppm) | H2S (ppm) |
|------------------|------------|---------|---------|--------|----------|-----------|
| GV33             | 19/04/2016 | 45.2    | 35.2    | 0.8    | 5        | 8         |
|                  | 24/05/2016 | 45      | 35.4    | 1      | 7        | 9         |
|                  | 29/06/2016 | 46.1    | 33.6    | 1      | 12       | 3         |
| GV34             | 19/04/2016 | 45.9    | 34      | 1.1    | 4        | 6         |
|                  | 24/05/2016 | 45.8    | 33.9    | 1      | 5        | 7         |
|                  | 29/06/2016 | 45      | 35.5    | 1.1    | 11       | 8         |
| GV4              | 19/04/2016 | 45.9    | 36.9    | 1      | 5        | 4         |
|                  | 24/05/2016 | 44.9    | 36.5    | 1.1    | 6        | 8         |
|                  | 29/06/2016 | 45.9    | 37.1    | 1.2    | 12       | 5         |
| GV6              | 19/04/2016 | 44.8    | 33.6    | 0.9    | 6        | 7         |
|                  | 24/05/2016 | 44.5    | 34.5    | 1      | 7        | 7         |
|                  | 29/06/2016 | 45      | 35      | 1.1    | 14       | 5         |
| GV7              | 19/04/2016 | 25.6    | 21.9    | 2.4    | 5        | 8         |
|                  | 24/05/2016 | 26.9    | 23.7    | 2.3    | 7        | 9         |
|                  | 29/06/2016 | 27.5    | 22.4    | 2      | 9        | 9         |
| GV8              | 19/04/2016 | 39.9    | 25.5    | 1.1    | 4        | 7         |
|                  | 24/05/2016 | 38.5    | 26.5    | 1.4    | 6        | 5         |
|                  | 29/06/2016 | 38.1    | 27      | 1.5    | 6        | 6         |
| GV9              | 19/04/2016 | 48      | 33.5    | 0.6    | 4        | 4         |
|                  | 24/05/2016 | 48.5    | 35.9    | 0.5    | 6        | 6         |
|                  | 29/06/2016 | 48      | 36.1    | 0.4    | 3        | 0         |
| GVA              | 19/04/2016 | 28.5    | 20.5    | 7.5    | 8        | 1         |
|                  | 24/05/2016 | 30.1    | 22.3    | 8      | 9        | 4         |
|                  | 29/06/2016 | 28.5    | 23.9    | 7.9    | 9        | 0         |
| LC1B             | 19/04/2016 | 36.9    | 34.5    | 2.6    | 1        | 3         |
|                  | 24/05/2016 | 37.5    | 35.6    | 2.2    | 4        | 9         |
|                  | 29/06/2016 | 35.4    | 36      | 2.3    | 3        | 0         |
| LC2B             | 19/04/2016 | 46.4    | 34.5    | 1.1    | 5        | 11        |
|                  | 24/05/2016 | 46.8    | 35.5    | 1.2    | 5        | 12        |
|                  | 29/06/2016 | 45.9    | 34.5    | 1.3    | 6        | 9         |
| LC2R?            | 19/04/2016 | 47.5    | 36.9    | 0.8    | 4        | 3         |
|                  | 24/05/2016 | 48.1    | 37.2    | 0.7    | 7        | 7         |
|                  | 29/06/2016 | 47.5    | 36.5    | 0.6    | 5        | 2         |
| LC3              | 19/04/2016 | 41.6    | 35.9    | 2.4    | 9        | 45        |
|                  | 24/05/2016 | 42.6    | 34.9    | 1.8    | 7        | 26        |
|                  | 29/06/2016 | 45.9    | 36.3    | 2.8    | 6        | 9         |
| LC3.1            | 19/04/2016 | 42.3    | 34.5    | 1.3    | 4        | 9         |
|                  | 24/05/2016 | 44      | 35      | 1      | 9        | 10        |
|                  | 29/06/2016 | 44.6    | 33.6    | 1.3    | 8        | 0         |
| LC4              | 19/04/2016 | 36.8    | 32.6    | 3.5    | 2        | 8         |
|                  | 24/05/2016 | 37.5    | 31.8    | 3.3    | 4        | 10        |
|                  | 29/06/2016 | 40      | 32.8    | 3      | 9        | 8         |
| LC4B             | 19/04/2016 | 46.9    | 36.9    | 1.2    | 14       | 5         |
|                  | 24/05/2016 | 46.1    | 37      | 1.1    | 8        | 7         |
|                  | 29/06/2016 | 22.8    | 24.4    | 3.6    | 9        | 0         |
| LC5              | 19/04/2016 | 47.5    | 32.5    | 2.4    | 9        | 6         |
|                  | 24/05/2016 | 48.1    | 33.6    | 2.1    | 5        | 7         |
|                  | 29/06/2016 | 47.5    | 31.7    | 2.2    | 5        | 7         |
| LC6              | 19/04/2016 | 46      | 33.9    | 3.5    | 6        | 9         |
|                  | 24/05/2016 | 47.2    | 34.5    | 3      | 7        | 10        |
|                  | 29/06/2016 | 45.6    | 32.9    | 2.5    | 7        | 10        |

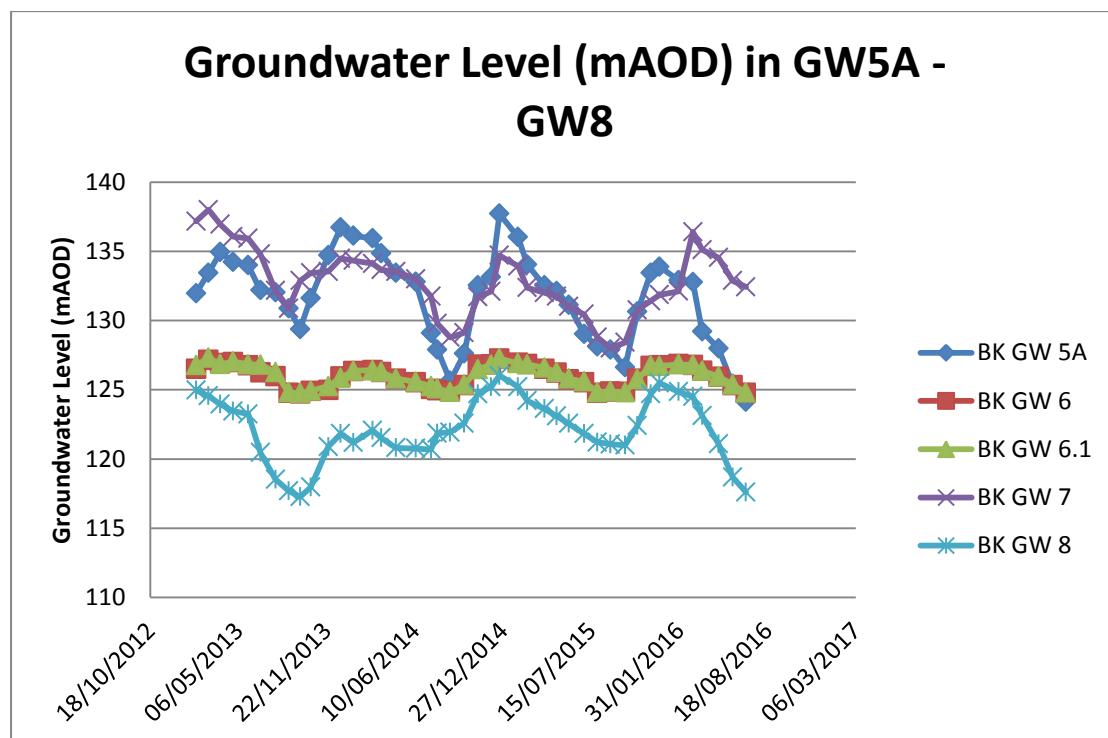
## APPENDIX 1 – LANDFILL GAS

| Monitoring Point  | Date       | CH4 (%) | CO2 (%) | O2 (%) | CO (ppm) | H2S (ppm) |
|-------------------|------------|---------|---------|--------|----------|-----------|
| LC6B              | 19/04/2016 | 50.4    | 36.8    | 0.7    | 9        | 8         |
|                   | 24/05/2016 | 51.4    | 36.5    | 0.5    | 10       | 7         |
|                   | 29/06/2016 | 50.2    | 37.1    | 0.6    | 10       | 7         |
| PW1               | 19/04/2016 | 0.6     | 0       | 15.2   | 11       | 5         |
|                   | 24/05/2016 | 0.9     | 0       | 16     | 12       | 8         |
|                   | 29/06/2016 | 0.8     | 0       | 17.9   | 12       | 8         |
| PW2               | 19/04/2016 | 32.6    | 15.6    | 3.2    | 6        | 7         |
|                   | 24/05/2016 | 33.5    | 16.8    | 3.5    | 9        | 9         |
|                   | 29/06/2016 | 34.9    | 17      | 3.9    | 9        | 9         |
| PW3               | 19/04/2016 | 29.9    | 19.9    | 5      | 6        | 8         |
|                   | 24/05/2016 | 32.4    | 20.4    | 4.9    | 5        | 10        |
|                   | 29/06/2016 | 31.8    | 20.8    | 5      | 5        | 10        |
| PW4               | 19/04/2016 | 45.2    | 34.9    | 0.3    | 8        | 5         |
|                   | 24/05/2016 | 45.8    | 35.9    | 1.1    | 7        | 7         |
|                   | 29/06/2016 | 46.1    | 34.5    | 1.2    | 7        | 7         |
| PW5               | 19/04/2016 | 21.9    | 22.5    | 1      | 9        | 8         |
|                   | 24/05/2016 | 22.4    | 23.9    | 1.6    | 11       | 9         |
|                   | 29/06/2016 | 23.6    | 21.7    | 1.2    | 11       | 9         |
| PW6               | 19/04/2016 | 26      | 20.9    | 1.9    | 7        | 9         |
|                   | 24/05/2016 | 29.8    | 22.7    | 2.6    | 8        | 11        |
|                   | 29/06/2016 | 28.7    | 23.9    | 2      | 8        | 11        |
| R1                | 19/04/2016 | 47.2    | 35.8    | 0.6    | 6        | 8         |
|                   | 24/05/2016 | 45.8    | 35      | 1.1    | 6        | 9         |
|                   | 29/06/2016 | 44.9    | 33.6    | 1.2    | 6        | 9         |
| R1 + R1B Manifold | 19/04/2016 | 48.2    | 35      | 0.7    | 4        | 12        |
|                   | 24/05/2016 | 48.2    | 35.6    | 0.8    | 6        | 11        |
|                   | 29/06/2016 | 47.9    | 34.5    | 0.9    | 6        | 11        |
| R1B               | 19/04/2016 | 49.3    | 34.2    | 0.8    | 8        | 7         |
|                   | 24/05/2016 | 50.2    | 38      | 0.4    | 9        | 8         |
|                   | 29/06/2016 | 49.1    | 37.9    | 0.5    | 9        | 8         |
| R2B               | 19/04/2016 | 50.1    | 36.8    | 0.4    | 11       | 2         |
|                   | 24/05/2016 | 51.2    | 36.1    | 0.3    | 8        | 5         |
|                   | 29/06/2016 | 50.2    | 37.1    | 0.4    | 8        | 5         |
| R3                | 19/04/2016 | 50.5    | 33.7    | 0.6    | 5        | 8         |
|                   | 24/05/2016 | 51      | 34.5    | 0.6    | 6        | 6         |
|                   | 29/06/2016 | 50.4    | 33.6    | 0.6    | 6        | 0         |
| R4B               | 19/04/2016 | 48.9    | 35.6    | 0.2    | 4        | 1         |
|                   | 24/05/2016 | 49.2    | 35.1    | 0.5    | 8        | 3         |
|                   | 29/06/2016 | 35.3    | 29.3    | 3.9    | 9        | 0         |
| R6B               | 19/04/2016 | 49.9    | 32.6    | 0.3    | 5        | 9         |
|                   | 24/05/2016 | 50.5    | 33.6    | 0.4    | 9        | 8         |
|                   | 29/06/2016 | 50.1    | 32.5    | 0.3    | 9        | 8         |

## APPENDIX 2 - GROUNDWATER



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



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

## APPENDIX 2 - GROUNDWATER

**Table 1: Monthly monitoring data (exceedances highlighted)**

| Location | Parameter  | Ammoniacal N | Chloride | Conductivity | Dissolved Oxygen | pH       |
|----------|------------|--------------|----------|--------------|------------------|----------|
|          | Units      | mg/l as N    | mg/l     | mS/cm        | mg/l             | pH Units |
| GW1      | 29/04/2016 | <0.2         | 35       | 2.28         | 5.74             | 7.61     |
|          | 03/06/2016 | 6.8          | 78       | 2.99         | 1.59             | 7.21     |
|          | 30/06/2016 | 12.4         | 88       | 3.29         | <0.3             | 7.34     |
| GW1.1    | 29/04/2016 | 8.2          | 233      | 2.06         | <0.3             | 6.61     |
|          | 03/06/2016 | 9.3          | 316      | 1.75         | <0.3             | 6.47     |
|          | 30/06/2016 | 3.0          | 232      | 1.65         | <0.3             | 6.73     |
| GW2A     | Trigger    | 1.7          | 60       | N/A          | N/A              | N/A      |
|          | 29/04/2016 | 5.8          | 99.6     | 1.18         | <0.3             | 6.86     |
|          | 03/06/2016 | 5.0          | 107.0    | 1.19         | <0.3             | 7.11     |
|          | 30/06/2016 | 6.4          | 105.0    | 1.27         | <0.3             | 7.38     |
| GW3A     | Trigger    | 1.7          | 60       | N/A          | N/A              | N/A      |
|          | 29/04/2016 | 28.7         | 156      | 1.85         | <0.3             | 6.93     |
|          | 03/06/2016 | 28.8         | 173      | 1.84         | <0.3             | 7.1      |
|          | 30/06/2016 | 69.4         | 210      | -            | <0.3             | -        |
| GW4      | Trigger    | 1.7          | 60       | N/A          | N/A              | N/A      |
|          | 29/04/2016 | 2.0          | 11       | 0.23         | 2.48             | 6.89     |
|          | 03/06/2016 | 2.6          | 51       | 0.46         | 0.91             | 6.44     |
|          | 30/06/2016 | 6.4          | 60       | 0.59         | 0.56             | 7.21     |

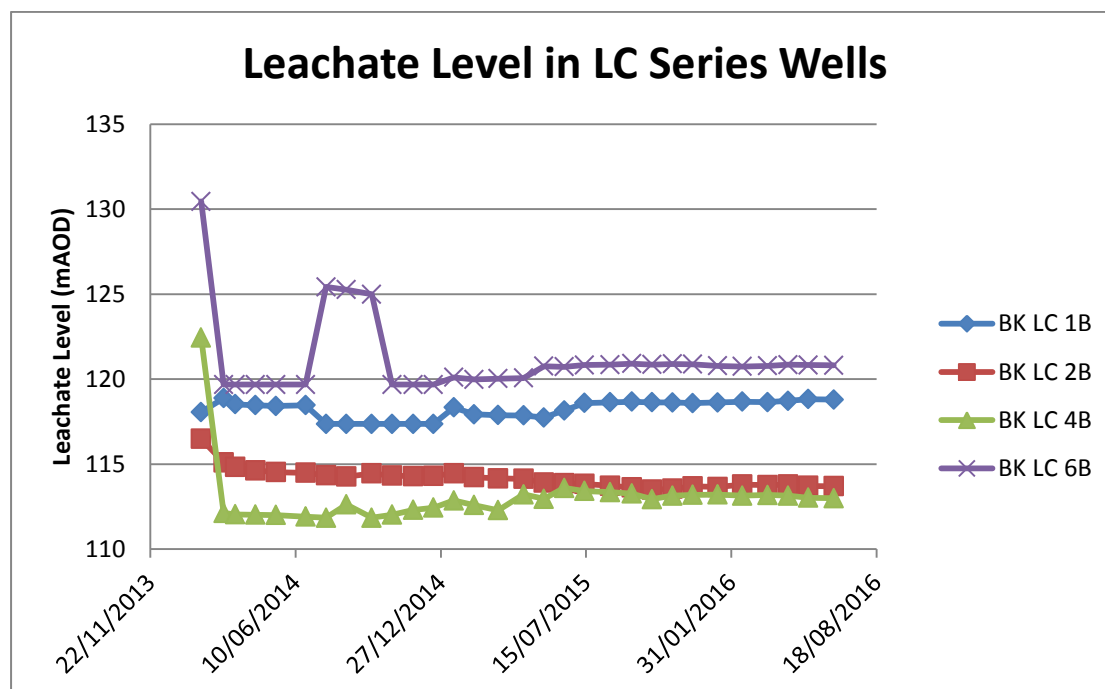
| Location | Parameter  | Ammoniacal N | Chloride | Conductivity | Dissolved Oxygen | pH       |
|----------|------------|--------------|----------|--------------|------------------|----------|
|          | Units      | mg/l as N    | mg/l     | mS/cm        | mg/l             | pH Units |
| GW5A     | 29/04/2016 | <0.2         | 29       | 0.61         | 7.47             | 6.38     |
|          | 03/06/2016 | <0.2         | 31       | 0.64         | 4.90             | 6.68     |
|          | 30/06/2016 | 0.26         | 35       | 0.662        | 3.39             | 7.06     |
| GW6      | 29/04/2017 | <0.2         | 29       | 0.70         | 5.78             | 7.78     |
|          | 03/06/2017 | <0.2         | 29       | 0.66         | 3.94             | 7.51     |
|          | 30/06/2017 | <0.2         | 30       | 0.703        | 3.62             | 7.74     |
| GW7      | 29/04/2018 | 4.0          | 134      | 0.75         | 1.72             | 7.83     |
|          | 03/06/2018 | 3.3          | 145      | 0.75         | 1.96             | 7.68     |
|          | 30/06/2018 | 3.9          | 136      | 0.755        | 1.6              | 7.73     |
| GW8      | 29/04/2019 | 17.1         | 112      | 1.15         | 2.57             | 6.90     |
|          | 03/06/2019 | 15.2         | 135      | 1.28         | -                | 6.82     |
|          | 30/06/2019 | 12.5         | 118      | 1.22         | 2.57             | 7.4      |

## APPENDIX 2 - GROUNDWATER

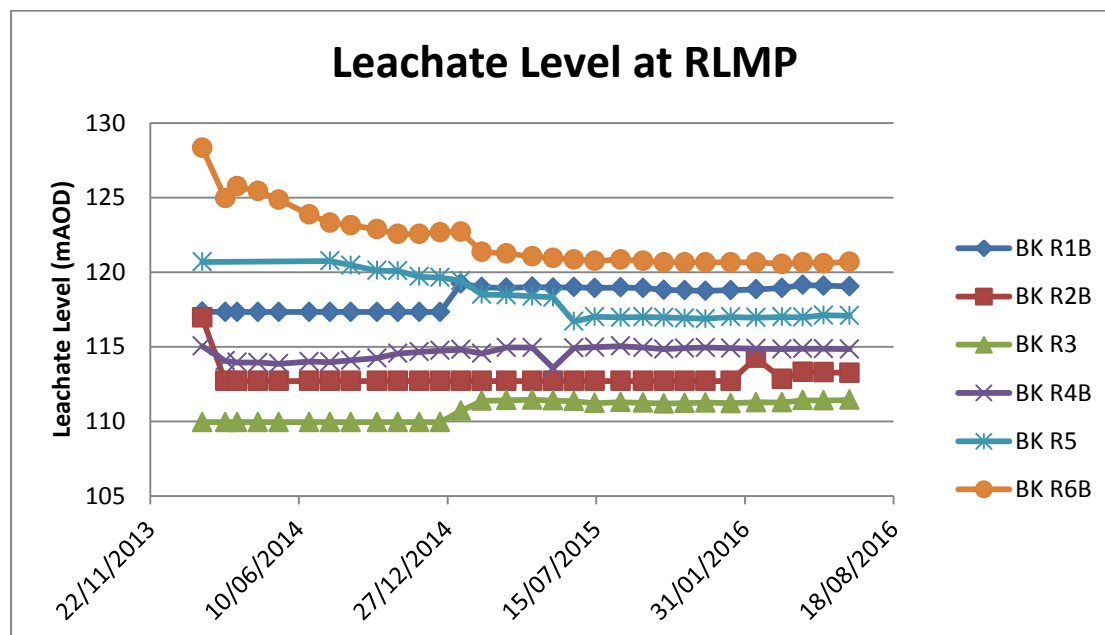
**Table 2: Quarterly monitoring data (exceedances highlighted)**

| Sample Description                          |          | GW1        | GW1.1      | GW2A       | GW3A       | GW4        | GW5A       | GW6        | GW7        | GW8        | Trigger Level |
|---------------------------------------------|----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|---------------|
| Date Sampled                                |          | 30/06/2016 | 30/06/2016 | 30/06/2016 | 30/06/2016 | 30/06/2016 | 30/06/2016 | 30/06/2016 | 30/06/2016 | 30/06/2016 |               |
| <b>Carbon</b>                               |          |            |            |            |            |            |            |            |            |            |               |
| Organic Carbon, Total                       | mg/l     | 43         | 14.9       | 7.67       | 34.7       | 12.9       | <3         | 4.97       | 3.44       | 10.6       |               |
| <b>Inorganics</b>                           |          |            |            |            |            |            |            |            |            |            |               |
| Alkalinity, Total as CaCO <sub>3</sub>      | mg/l     | 1100       | 215        | 384        | 880        | 250        | 110        | 286        | 215        | 435        |               |
| Ammoniacal Nitrogen as N                    | mg/l     | 12.4       | 3.02       | 6.38       | 69.4       | 6.35       | 0.255      | <0.2       | 3.86       | 12.5       | 1.7           |
| Chloride                                    | mg/l     | 88.1       | 232        | 105        | 210        | 59.8       | 34.7       | 29.6       | 136        | 118        | 60            |
| COD, unfiltered                             | mg/l     | 122        | 68.3       | 41.9       | 101        | 59.8       | 22.8       | 11.7       | 22.4       | 31.7       |               |
| Conductivity @ 20 deg.C                     | mS/cm    | 3.290      | 1.650      | 1.270      | -          | 0.590      | 0.662      | 0.703      | 0.755      | 1.220      |               |
| Oxygen, dissolved                           | mg/l     | <0.3       | <0.3       | <0.3       | <0.3       | 0.6        | 3.4        | 3.6        | 1.6        | 2.6        |               |
| pH                                          | pH Units | 7.3        | 6.7        | 7.4        | -          | 7.2        | 7.1        | 7.7        | 7.7        | 7.4        |               |
| Sulphate                                    | mg/l     | 1240       | 325        | 153        | 302        | <2         | 189        | 78         | <2         | 115        |               |
| Total Oxidised Nitrogen as N                | mg/l     | 4.78       | <0.3       | <0.3       | 0.46       | <0.3       | 24.50      | 19.00      | <0.3       | 11.80      |               |
| <b>Filtered (Dissolved) Metals</b>          |          |            |            |            |            |            |            |            |            |            |               |
| Cadmium (diss.filt)                         | mg/l     | <0.0001    | 0.000211   | <0.0001    | 0.000132   | <0.0001    | 0.000135   | <0.0001    | <0.0001    | <0.0001    |               |
| Calcium (diss.filt)                         | mg/l     | 677.0      | 143.0      | 148.0      | 182.0      | 47.5       | 71.6       | 88.1       | 25.0       | 83.5       |               |
| Chromium (diss.filt)                        | mg/l     | 0.0304     | 0.0057     | 0.0155     | 0.0293     | 0.0080     | 0.0040     | 0.0073     | 0.0052     | 0.0143     |               |
| Copper (diss.filt)                          | mg/l     | 0.00485    | <0.00085   | <0.00085   | 0.0014     | <0.00085   | 0.00171    | 0.00288    | <0.00085   | 0.000956   |               |
| Iron (diss.filt)                            | mg/l     | 0.696      | -          | 1.580      | 1.770      | 2.280      | <0.019     | <0.019     | <0.019     | 0.055      |               |
| Lead (diss.filt)                            | mg/l     | 0.000198   | 0.000433   | 0.000265   | 0.000494   | 0.000201   | 0.000043   | 0.000059   | 0.000276   | 0.000295   |               |
| Magnesium (diss.filt)                       | mg/l     | 79.3       | 51.8       | 35.3       | 68.9       | 14.5       | 15.5       | 27.4       | 31.6       | 30.6       |               |
| Manganese (diss.filt)                       | mg/l     | -          | 10.200     | 7.180      | 2.920      | 0.995      | 0.010      | 0.001      | 0.188      | 0.364      |               |
| Nickel (diss.filt)                          | mg/l     | 0.026      | 0.071      | 0.015      | 0.064      | 0.010      | 0.027      | 0.003      | 0.001      | 0.028      | 0.15          |
| Potassium (diss.filt)                       | mg/l     | 163        | 25         | 28.2       | 49.4       | 16.2       | 8.49       | 17         | 20.5       | 31.1       |               |
| Sodium (diss.filt)                          | mg/l     | 63.5       | 91.5       | 52.8       | 161        | 27.6       | 39.4       | 17.1       | 61.7       | 102        |               |
| Zinc (diss.filt)                            | mg/l     | 0.017      | 0.007      | 0.006      | 0.009      | 0.003      | 0.030      | 0.002      | 0.005      | 0.005      | 0.254         |
| <b>TPH Criteria Working Group (TPH CWG)</b> |          |            |            |            |            |            |            |            |            |            |               |
| Sum of detected Xylenes                     | mg/l     | <0.001     | <0.001     | <0.001     | <0.001     | <0.001     | <0.001     | <0.001     | <0.001     | <0.001     | 0.011         |
| Toluene                                     | mg/l     | <0.001     | <0.001     | <0.001     | <0.001     | <0.001     | <0.001     | <0.001     | <0.001     | <0.001     | 0.004         |

### APPENDIX 3



Graph 1: Leachate Levels as mAOD at LC Series Wells



Graph 2: Leachate Levels as mAOD at Remote Leachate Monitoring Points

## APPENDIX 3

**Table 2: Quarterly monitoring data from leachate chambers**

| Parameters                             | Units    | LC1B | LC2B  | LC3  | LC4B  | LC5   | LC6   |
|----------------------------------------|----------|------|-------|------|-------|-------|-------|
| <b>Carbon</b>                          |          |      |       |      |       |       |       |
| Organic Carbon, Total                  | mg/l     | 889  | 120   | 1180 | 1210  | 4360  | 4750  |
| <b>Inorganics</b>                      |          |      |       |      |       |       |       |
| Alkalinity, Total as CaCO <sub>3</sub> | mg/l     | 8680 | 10200 | 9950 | 10500 | 12300 | 12700 |
| Ammoniacal Nitrogen as N               | mg/l     | 2050 | 2580  | 1890 | 2320  | 3150  | 3300  |
| BOD, unfiltered                        | mg/l     | <50  | 315   | 333  | 340   | 6260  | >2610 |
| Chloride                               | mg/l     | 2140 | 2510  | 3540 | 3790  | 3430  | 3480  |
| COD, unfiltered                        | mg/l     | 2390 | 3840  | 4210 | 3690  | 13600 | 13500 |
| pH                                     | pH Units | 7.82 | 7.81  | 7.98 | 8.08  | 8.14  | 8.11  |
| Sulphate                               | mg/l     | <40  | <50   | <40  | <40   | <100  | <100  |
| Total Oxidised Nitrogen as N           | mg/l     | <6   | <6    | <6   | <6    | <6    | <6    |
| <b>Filtered (Dissolved) Metals</b>     |          |      |       |      |       |       |       |
| Calcium (diss.filt)                    | mg/l     | 22.2 | 28.2  | 56.9 | 51.3  | 37.7  | 43.6  |
| Magnesium (diss.filt)                  | mg/l     | 81.6 | 63.3  | 68.7 | 73.3  | 58.1  | 67.4  |
| Potassium (diss.filt)                  | mg/l     | 855  | 679   | 604  | 683   | 743   | 835   |
| Sodium (diss.filt)                     | mg/l     | 1420 | 1270  | 2230 | 2480  | 2300  | 2620  |

### APPENDIX 3

**Table 3: Final Discharge (FD) monitoring data (exceedances highlighted)**

| Sample Description | Date Units     | Alkalinity, Total as CaCO <sub>3</sub> | Ammoniacal Nitrogen as N | BOD, unfiltered | COD, unfiltered | Chloride | Chromium | Copper   | Iron  | Lead     | Nickel   |
|--------------------|----------------|----------------------------------------|--------------------------|-----------------|-----------------|----------|----------|----------|-------|----------|----------|
|                    |                | mg/l                                   | mg/l                     | mg/l            | mg/l            | mg/l     | mg/l     | mg/l     | mg/l  | mg/l     | mg/l     |
|                    | <b>Trigger</b> | -                                      | <b>50</b>                | -               | <b>2000</b>     | -        | <b>2</b> | <b>2</b> | -     | <b>2</b> | <b>2</b> |
| FD                 | 05/04/2016     | 270                                    | 0.587                    | 6.98            | 995             | 1760     | 0.0671   | 0.059    | 5.28  | 0.00309  | 0.192    |
|                    | 29/04/2016     | 210                                    | 0.449                    | 8.01            | 856             | 1680     | -        | -        | 0.747 | -        | -        |
|                    | 03/06/2016     | 280                                    | 8.41                     | 10.8            | 870             | 1810     | -        | -        | 0.823 | -        | -        |
|                    | 30/06/2016     | 198                                    | 59                       | 12.4            | 1160            | 2070     | 0.0922   | 0.0698   | 3.74  | 0.00585  | 0.216    |
|                    | 06/05/2016     | 115                                    | 0.279                    | -               | 1650            | -        | 0.0701   | 0.0508   | -     | 0.00194  | 0.181    |
|                    | 13/05/2016     | 40                                     | 0.71                     | -               | 935             | -        | 0.0642   | 0.0555   | -     | 0.00191  | 0.183    |
|                    | 20/05/2016     | 390                                    | 0.594                    | -               | 4160            | -        | 0.0671   | 0.0428   | -     | 0.00396  | 0.16     |
|                    | 27/05/2016     | 200                                    | 1.48                     | -               | 1400            | -        | 0.0737   | 0.0406   | -     | 0.00185  | 0.164    |

| Sample Description | Date Units     | Nitrate as N | Nitrite as N | Organic Carbon, Total | pH                      | Sodium | Sulphate | Suspended solids, Total | TPH / Oil & Greases | Zinc     |
|--------------------|----------------|--------------|--------------|-----------------------|-------------------------|--------|----------|-------------------------|---------------------|----------|
|                    |                | mg/l         | mg/l         | mg/l                  | pH                      | mg/l   | mg/l     | mg/l                    | mg/l                | mg/l     |
|                    | <b>Trigger</b> | -            | -            | -                     | <b>(&gt;5 - &lt;10)</b> | -      | -        | <b>500</b>              | -                   | <b>2</b> |
| FD                 | 05/04/2016     | -            | <0.152       | 325                   | -                       | 2440   | 67.9     | -                       | 1.22                | 0.118    |
|                    | 29/04/2016     | 895          | <0.152       | 245                   | 7.17                    | 2030   | -        | 176                     | -                   | -        |
|                    | 03/06/2016     | 902          | 4.66         | 266                   | 7.4                     | 1690   | -        | 59                      | -                   | -        |
|                    | 30/06/2016     | -            | 0.619        | 403                   | -                       | 2370   | <20      | -                       | 1.54                | 0.176    |
|                    | 06/05/2016     | 875          | <0.1         | -                     | 6.56                    | -      | -        | 955                     | -                   | 0.13     |
|                    | 13/05/2016     | 735          | 0.173        | -                     | 5.78                    | -      | -        | 238                     | -                   | 0.132    |
|                    | 20/05/2016     | 874          | 0.582        | -                     | 6.8                     | -      | -        | 3800                    | -                   | 0.142    |
|                    | 27/05/2016     | 916          | 0.512        | -                     | 6.65                    | -      | -        | 850                     | -                   | 0.11     |

## APPENDIX 4 – SURFACE WATER

**Table 1: Monthly monitoring data**

| Location | Parameter  | Ammoniacal N | Chloride | COD  | pH       | Suspended Solids |
|----------|------------|--------------|----------|------|----------|------------------|
|          | Units      | mg/l as N    | mg/l     | mg/l | pH Units | mg/l             |
| P2       | 29/04/2016 | 0.59         | 83       | 385  | 7.4      | 370              |
| P2 Limit |            | 1.6          | 250      | 100  | >6 <9    | 100              |
| P4       | 29/04/2016 | 5.32         | 56       | 103  | 7.9      | 7                |
|          | 03/06/2016 | 0.44         | 58       | 114  | 7.7      | 27               |
|          | 30/06/2016 | 4.13         | 53       | 83   | 7.8      | 3                |
| SW2      | 29/04/2016 | 0.56         | 170      | 62   | 7.7      | 56               |
|          | 30/06/2016 | 0.77         | 79       | 82   | 7.3      | 18               |

## Flintshire County Council Deposited Dust Monitoring

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

From: 07/06/2016 To: 05/07/2016  
No. of days 28

Collector: MW

Gauge Bowl No. Location 1 OES1  
Location 2 OES2  
Location 3 OES3

Factor (mg deposit to mg/m<sup>2</sup>) 24.7

| Monitoring Location | Sample Volume (ml) | Total Suspended Solids (mg/l) | mg/m <sup>2</sup> /day |
|---------------------|--------------------|-------------------------------|------------------------|
| Location 1          | 1200               | 42                            | 37                     |
| Location 2          | 4400               | 16                            | 14                     |
| Location 3          | 600                | 27                            | 24                     |

### Comments:

► Dust analysis carried out by SAL Laboratories, Manchester

Location 1: Site Operations - located opposite "new" transfer pad

Location 2: Industrial Estate Boundary - located on perimeter near leachate treatment plant

Location 3: Oaks Farm



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