ENVIRONMENTAL PERFORMANCE REPORT

TREHIR LANDFILL SITE

July 2016 – June 2017

CAERPHILLY COUNTY BOROUGH COUNCIL

APPENDICES:

TABLE LIST:

1. INTRODUCTION

Trehir Landfill Site is centred on National Grid Reference (NGR) ST 155 897. The site is located approximately 2.5km north of the centre of Caerphilly. The nearest villages are Bedwas approximately 1.7km east/southeast of the site and Llanbradach approximately 0.9km to the northwest.

The landfill is a former pennant sandstone quarry located on the west-facing slope of Mynydd Y Dimlaith and has a north to south alignment with highpoints varying between approximately 194mAOD and 224mAOD. The surrounding land comprises a mix of grazing and wooded land. Approximately 0.03km west of the site is an embankment, which marks the line of a disused railway.

The Rhymney River flows southwards at an elevation of 73mAOD approximately 0.3km to the west of the site before turning eastwards to the south of the site. The site location is shown on **appendix 1**.

Trehir landfill site has not accepted any waste since August 2005. The restoration works for Phase 2 were carried out during the years 2005/2006 and the landscaping works were carried out in Spring 2010.

Caerphilly County Borough Council (CCBC) approved the transfer of site from Trehir Development Company (TDC) to CCBC and took over the responsibility of the site and site licence from 1st July 2008. CCBC now owns TDC and the site licence was transferred to CCBC in accordance with the Schedule 5 notice of Trehir Quarry Landfill, under Title No. WA410530.

We will detail the works carried out at Trehir between July 2016 and June 2017 and interpret the data collected in that time as per licence condition 55.1 of the Waste Management Licence (WML 30021) Updated reference EPR/GP339 2EH.

The report includes:-

- A review of the risk assessment
- An analysis and review of environmental monitoring results recorded for the site with an interpretation of the trend of results against background levels and the agreed trigger levels.
- Additional parameters over and above chloride and Ammoniacal Nitrogen (There will be contaminants present in the leachate but not represented in the background water quality for the site).

Monitoring is undertaken in accordance with the Waste Management licence Number WML 30021 including any modifications introduced during the monitoring period.

Seven Trent Services, formerly Seven Trent Laboratories was subsequently sold to ALS Limited. From February 2013 ALS Ltd carried out all monthly gas

and leachate monitoring. Enitial (Initial Projects Ltd), carried out the monitoring of the gas field and gas flare. This contract responsibility was then taken over by Alphagen Renewables in 2016.

The current monitoring requirements are as follows:-

- Leachate Monitoring and Reporting
- Groundwater monitoring and reporting
- Surface water monitoring and reporting
- Landfill gas monitoring and reporting
- Gas generator and gas field monitoring and reporting
- Flow meter readings

The site is inspected regularly by the Authority's team of COTC staff.

The existing site drainage arrangements are shown on plan as **appendix 2**.

Environmental performance is monitored both internally through CCBC Management System and externally by regulatory bodies notably Natural Resources Wales (NRW) and Dwr Cymru Welsh Water (DCWW).

Monitoring Reference Point	Location	Sample Type
W1	Upstream of SW outlet	Water
W2	2m down from concrete apron	Water
W3	Dip 30m up from bridge	Water
New river discharge	Under bridge on rocks downstream of SW outlet	Water
O8	Trehir old landfill from channel MH	Water
LD1	From CA Site and French drain	Water
LD2	French drain opposite Old Trehir Access barrier	Water
N2	Middle of CCBC Field	Gas/Water
NBH6	SE corner of CCBC field	Gas/Water
NBH5	SW corner of CCBC field	Gas/Water
NBH4	By W chamber (K20)	Gas/Water
W5/W4	(U) (M) (L) – grid cover needs access	Water
NBH3	On haul road by access to lower plateau	Gas/Water
NBH7	Bore hole on railway line nearest CA Site (larger)-(usually dry)	Gas/Water
NBH8	Deep borehole on railway line smaller of 2 boreholes	Gas/Water
NBH2	On haul road opposite sweeper bay	Gas/Water
O3	Chamber start of haul road, toe of embankment	Water
NBH1	Borehole by gas flare, weighbridge	Gas/Water
N4	Lower field on steep slope	Gas/Water
N6	Surcharging borehole on railway line bottom of embankment needs purging then sampling, cannot take gas readings.	Gas/Water
N5	Borehole by overhead cables on Gibbons railway line	Gas/Water
O5	Chamber – usually dry – by toe of landfill/Gibbons gate	Water
GWS	Ground water sump pump	Water
N8	By main access gate. Drash for summer access.	Gas/Water
R8	By garage	Gas

Table 1: Location of Trehir Monitoring Points

2. RESTORATION WORKS COMPLETION

2.1. Landscaping, Planting and Grassland Management

2.1.1 Landscaping

The entire site has been grass seeded to reduce visual impact and restore to rough pasture.

The restored landscaping scheme for approximately 8 hectares, which includes woodland planting, hedgerow planting and fencing. The planting was completed in Spring 2010 and a 5-year aftercare programme is in place. The new hedges and woodland areas are well established and provide good cover within enclosures.

The fence, and boundary between the common land and the landfill was agreed with the commoners and the works re-established the area of land used by the commoners for grazing.

2.1.2 Control of Invasive Plants

The Authority's Invasive Plant Species Officer is continuing to target pockets of Japanese Knotweed on the site as part of an ongoing treatment programme.

2.1.3 Grazing Land

An area of 5.7 acres shown as a field to the east of the site remains in the ownership of the Authority. Recently, interest was expressed in selling the land. However, after careful consideration it was decided that a land transfer deal was not viable.

2.2 Surface water ditches maintenance

The surface water ditches are maintained to ensure the flow of surface water to the S.W. culvert chamber and reduces seepage of surface water into the landfill mass.

This year the flanks of the ditch have been cut back and the concrete cloth section has been cleared of detritus to ensure the area is blockage free (works completed 30th May 2017).

3. AFTERCARE PERIOD MANAGEMENT

3.1 Waste management licence

A modification of the waste management licence WML30021 was granted by the Environment Agency in January 2007 and the site was managed using the techniques and in the manner described in the closure plan submitted on 3rd March 2006 and subsequent correspondence.

The Environmental Permit (EAWML 30021) was transferred to Caerphilly County Borough Council on 27th January 2011. Updated reference EPR/GP3392EH.

The expenditure plan covers a period of 60 years post closure and the financial provision calculations are for the entire Trehir Site, 9.3 hectares and the whole drainage and gas installations and the maximum value of provision is £2,344,196.00 which was contained in Schedule 1 of the Local Authority Performance Deed EPR/GP3392EH in January 2011.

3.2 Site maintenance & clearance

3.2.1 Cleansing

The site remains subject to cleansing patrols and rapid response clearance works are undertaken in the event of fly tipping on the access points to the site. Mechanical sweepers are in use here and helps to reduce detritus and aid surface water flows.

Further work is progressing on deterring fly tipping in and around the site.

3.2.2 Pest Control

The Authority's pest control team continue to patrol and are able to respond to any issues arising from pests/rodents.

3.3 EPR Compliance Assessment Report

Natural Resources Wales (NRW) inspects Trehir Landfill to ensure compliance with the Site licence. The latest inspection took place on the 17th of October, 2016 (Ref: CAR NRW 0026514). Subsequently, the Authority has been working on the comments raised and have been undertaking appropriate investigations and remedial work.

This has included:

- a programme of maintenance and repair work on the network of monitoring points.
- Access improvement works to sampling points

- enhancement of the landfill gas management systems on the site.

- native wildflower seeding over the area of die back (mid section) on the western flank of the landfill mass. The area of die back continues to be monitored with no discernible expansion of the bare areas.

- dialogue with the environmental monitoring contractor

4. STABILITY RISK ASSESSMENT

4.1 Leachate head trigger levels

The trigger level identified in the waste licence is 12.5m over the quarry base ie: leachate head. Leachate level must be maintained up to maximum level of 12.5 metres in the landfill to prevent leachate outbreak risk.

Leachate Monitoring Wells - Levels

Location - Starting with SE Well M2/3 (P)
Moving North below crash barrier through 5 wells to M1/5 then dropping down a row to the lower well M1/2 and moving south to SW Well M2/1

Monitoring Point	Depth of casing to ground level (m)	Ground Level (AOD)	Quarry base level (AOD)
M2/3 (P)	.15	131.9	121.24
M2/4 (P)	.30	130.9	117.68
M2/5 (P)	.30	130.1	114.65
M1/3 (P)	.83	129.8	114.11
M1/4 (P)	.77	129.6	115.88
M1/5	1.50	127.3	112.78
M1/2	.30	119.8	110.01
M1/1 (P)	.65	120.8	109.45
M2/2	.75	121.4	111.24
M2/1	.40	121.7	111.75

Table 2: Leachate Monitoring Wells – Levels

(Leachate head levels are also monitored to control waste mass stability as defined in the site stability study dated 2003 and the Leachate head levels development assessment dated January 2006).

4.2 Leachate monitoring boreholes

The Trehir Landfill Site has 10 monitoring points for leachate levels within the waste mass. Levels are recorded from ground level measuring the distance to the leachate below ground level using a dip censor on a monthly basis by ALS. The leachate head is monitored on a quarterly basis.

4.3 Leachate head levels monitoring results

The Leachate head levels reported are detailed in **appendix 4**.

4.3.1 Monitoring Points

Maintenance works on and around the site's network of monitoring points is continuing.

4.3.2 The depth of water level

The depth of water level in each borehole was recorded from ground level to the surface water level and it is noted that the trigger level of 12.5 metres above quarry base level was not exceeded on any occasion during the year July 2016 to June 2017.

4.3.3 Stability of the waste mass

Leachate head levels were monitored monthly until June 2009 when permission was given by the EA to reduce frequency to quarterly checks and show that the leachate head levels in the waste mass remain lower than the stability trigger levels.

4.3.4 Leachate head levels are maintained below the Waste Management Licence trigger level

During the period July 2016 – June 2017, the leachate head levels have remained stable and below 10 metres above the quarry base level.

4.3.5 Settlement Survey

The level of detail of the survey should be based on the stability risk assessment. As the leachate head levels have remained stable and well below the 12.5 metres above quarry base level the Environment Agency decided on 8th November 2010 that the survey frequency should be reconfigured to four yearly intervals.

The latest topographical survey was carried out in March 2017 with plans and cross-sections produced by John Vincent Surveys to calculate settlement and stability. Caerphilly CBC Engineers subsequently compared the data of this survey with that of the previous 2013 survey and created a graphic showing the areas of variation. This has revealed that the summit of the site has settled whilst the lower reaches of the western flank have moved slightly towards the river.

In summary, the last two surveys reveal that there has been a small amount of movement of the landfill mass over the last 8 years.

The contoured plan and cross sections are shown under **appendix 5.**

5. LEACHATE MONITORING AND MANAGEMENT

5.1 Leachate flow monitoring and flow results

The existing monitoring stations have been inspected and refurbished where necessary and a number of additional relevant sample points included.

The monitoring regime has been reviewed and amended further with a view to understanding the characteristics of the leachate flows, groundwater flows and sources together with surface water contamination levels and volumes.

A new replacement "Area- Velocity" Flowmeter had been fitted to measure the surface and clean groundwater flow to the river. Both flow meters are now housed in a secure steel cabinet sited on Old Trehir former landfill site.

The new monitoring sensors that we installed have downloaded additional data to provide flows and volumes against time to assist.

The results of monitoring the quality of the groundwater and surface water inputs to the leachate drainage system from the groundwater cut-off suggests that these were of a quality acceptable to the Regulator for direct discharge to surface water. By removing the groundwater input to the leachate drainage system the frequency which water from the leachate drainage system is discharged to the river reduced, as did the volumes that are discharged. On-going monitoring following the separation of these aspects of the drainage system from the leachate drainage system will continue to determine the effects on the flow and quality of the discharge.

The Environment Agency agreed to the diversion of this clean ground water from the leachate system to river and the new drainage system has been constructed to reduce flows.

The consented foul limit to foul sewer from the site was 3 l/s. However, considering the significant and ongoing improvements that have been made on site, with regards to leachate volume discharged to sewer and the previous relaxing of limits to 10l/s, Dwr Cymru Welsh Water (DCWW) relaxed the consented flow to 5/ls on 11th January 2011. This relaxation will be revisited by DCWW when further works have been implemented on site. Both leachate discharge flows to sewer and groundwater to river are measured by Flow Meters **appendix 6**.

On November 21st 2016 remote monitoring system was introduced to enable officers to assess flow rates "live".
Any leachate flows in excess of the discharge consent to the sewer will flow to the river. This tip leachate discharge has Environmental Agency Wales consent – No. AN0110701/2/1 and a volume band of 20 – 100m³/day (C1) into the river (S1). The content band lists numeric conditions against a range of chemicals (B5). The references C1, S1 and B5 are defined in the

Environmental Agency's 'Environmental Permitting Charging Scheme Guidance'. The Authority has continued to pay annual subsistence charges for discharge to the River Rhymney.

We note that the leachate flow from Trehir is significantly lower that 10l/s most of the time. The highest flows are recorded during heavy rain events due to ground water drains connections to the leachate drainage system. These groundwater drains are being monitored separately to determine their quality and input into the leachate system.

It is also worth noting that the DCWW Sampling is consistently classed as satisfactory.

5.2 Leachate Monitoring and Results

5.2.1 Leachate monitoring points

Leachate quality is monitored at points 03, 05 and 08 in agreement with the EA. Leachate monitoring points are shown on the leachate-monitoring plan in **appendix 7**.

5.2.2 Leachate monitoring frequencies

ALS are contracted to undertake leachate monitoring at Trehir. Some parameters are analysed on a monthly basis and other quarterly and six monthly in accordance with the monitoring requirements identified in the closure report. See Leachate analytical suites.

Dwr Cymru /Welsh Water also take samples at sampling point 300012, the leachate chamber with the V-notch flow record. It is worth noting that the DCWW inspection records consistently confirm that the compositional character of this particular sampling point is satisfactory.

Leachate Analytical Suites

Suite A	Suite B	Suite C
Ammoniacal Nitrogen	Ammoniacal Nitrogen	Ammoniacal Nitrogen
Biological Oxygen Demand	Biological Oxygen Demand	Cadmium
Chemical Oxygen Demand	Calcium	Calcium
Chloride	Chemical Oxygen Demand	Chemical Oxygen Demand
Electrical Conductivity	Chloride	Copper
Field Temperature	Electrical Conductivity	Chloride
pH	Field Temperature	Chromium
	Magnesium	Dissolved Oxygen
	pH	Electrical Conductivity
	Potassium	Field Temperature
	Sodium	Iron
	Sulphate	Lead
	Total Alkalinity	Manganese
	Total Organic Carbon	Magnesium
	Total Oxidised Nitrogen	Nickel
		pH
		Potassium
		Sodium
		Sulphate
		Total Alkalinity
		Total Organic Carbon
		Total Oxidised Nitrogen
		Zinc

Annual Leachate Monitoring Schedule

January	Suite A
February	Suite A
March	Suite B
April	Suite A
May	Suite A
June	Suite C
July	Suite A
August	Suite A
September	Suite B
October	Suite A
November	Suite A
December	Suite C

Table 3: Leachate Analytical Suites

5.2.3 Leachate test results

Copies of all analysis results have been sent to the NRW on a monthly basis and are summarised on **appendix 8.**

Sample point 05 has remained dry throughout the year (period July 2016 to June 2017).

Leachate test results were compliant with Welsh Water discharge consent requirements during the period July 2016 – June 2017.

Determinants name	Limits (mg/l)
Ammonia	250
Suspended solid	400
Copper	2
Zinc	2
Lead	2
Chromium	2
Nickel	2
PH	6<ph<10

Table 4: Welsh Water discharge consent limits

5.3 Leachate infrastructure maintenance

Levels of silt in the penstock chamber and the V notch chamber are regularly controlled and cleaned when necessary to prevent any silt discharge to sewer/river and to prevent any erratic readings on both flow meters.

Additional security measures have been put in place to minimise theft including locking manhole covers and padlocked chamber covers.

The flow meter is serviced annually in accordance with the terms of the maintenance contract.

6. GROUNDWATER MONITORING AND MANAGEMENT

6.1 Ground water monitoring

6.1.1 Ground water monitoring points

Groundwater monitoring is undertaken at points N2, N4, N5, N6, N8, W4, NBH1, NBH2, NBH3, NBH4, NBH6, NBH8, Land drain 1 and Land drain 2 The groundwater monitoring points are located on **appendix 9.**

N2 is located in the field to the rear of the landfill and is considered by the EA to represent background levels.

W4 (upper, middle, lower) are collection chambers for water issuing through the back wall of the site (East face) behind the lining system. During 2012 and 2013 there was no water flowing from these pipes into the chamber.

N6 is an artesian borehole located southwest in the late Mr. Gibbon's field.

A report undertaken by Golder Associates recommended works to be undertaken at Borehole 6, if practicable, to install an appropriate head works to the borehole which would prevent overflow during winter periods. The Environment Agency recommended capping the borehole to prevent any surcharging. The landowner's agent was notified in January 2011 but permission to undertake works on BH6 has not been granted.

6.1.2 Groundwater monitoring frequencies

ALS presently undertake groundwater monitoring at Trehir, some parameters are monitored on a monthly basis and others quarterly in accordance with the monitoring requirements identified in the closure report.

Land drain 1 (LD1) and Land drain 2 (LD2) have been included on the schedule. LD1 takes ground water flows from the Civic Amenity Site area and LD2 receives groundwater from the embankment between Pandy Lane and the Civic Amenity Site. It was agreed with the Regulator that if the levels remained below the trigger levels for 3 months flows could be redirected to the river.

The trigger levels in the HRA are:
Ammoniacal Nitrogen 0.6mg/l
Ph 6 – 9
Chloride 250mg/l
COD 40mg/l

The trigger levels for N8 and Groundwater Sump (GWS) are:

Ammoniacal Nitrogen	-	GWS – 69mg/l
	-	N8 5mg/l
Chloride	-	GWS 231mg/l
	-	N8 171mg/l

Determinants	Monitoring frequencies
Water level	Monthly
pH	Monthly
Temperature	Monthly
Electrical conductivity	Monthly
Dissolved oxygen	Monthly
Ammoniacal nitrogen	Monthly
Chlorides	Monthly
Sulphates	Quarterly
Total alkalinity (as CaCO3 at pH 4.5)	Quarterly
Total oxidised nitrogen	Quarterly
Total oxidised carbon	Quarterly
Na	Quarterly
K	Quarterly
Ca	Quarterly
Mg	Quarterly
Fe	Quarterly
Mn	Quarterly
Cd	Quarterly
Cr	Quarterly
Cu	Quarterly
Ni	Quarterly
Pb	Quarterly
Zn	Quarterly

Table 5: Groundwater monitoring and sampling programme

The frequency of the determinants sampled and analysed are shown above.

In addition to the above, a complete analysis of List 1 substances will be monitored annually as prescribed by the licence/permit.

6.2 Groundwater test results

Copies of all groundwater analyses have been sent to the regulator on a monthly basis and are presented on **appendix 10.**

N2 monitors groundwater hydraulically up gradient of the site and all data demonstrated concentrations of Ammoniacal nitrogen below 0.3mg/l.

The routine groundwater monitoring data for the period July 2016 to June 2017 show boreholes NBH1, NBH2, NBH3 (located down hydraulic gradient from the site) demonstrate consistently elevated concentrations of Ammoniacal nitrogen in comparison with the Drinking Water Standard.

6.3 Groundwater infrastructure maintenance

The ground water pump was upgraded to improve efficiency in pumping contaminated flows from the groundwater sump into the leachate drain and to maximise the potential for a consistent flow over the V-notch weir (which measures flows to the trunk sewer) but retain the capability to empty the volume stored in the ground water sump chamber (approximately 25m^3) on 2nd November 2011. The pump has variable control rates of flow so that it can vary the flow from the ground water sump to an optimum level delivering more consistent flows to the truck sewer.

A Bronze annual service/maintenance contract is in place with ITT Flygt Ltd for the groundwater Grundfos sump pump.

6.4 Land Drains

Monitoring of chambers identified as Land Drain 1 and Land Drain 2 commenced in April 2009 to sample two of the main sources of flows into the leachate sewer with a view to identifying the quality and volume of these sources.

6.4.1 Land Drainage Test Results

The sampling of the various flows entering the leachate system is to identify if any flows can be diverted into other drainage systems to reduce flows to the trunk sewer. The results are shown as Land Drain 1 and Land drain 2 in **appendix 8**. (Land Drain 2 showed levels of Ammoniacal Nitrogen, PH, Chloride and COD to be below the trigger level, set by the Environment Agency for a period over 3 consecutive months.

The flows monitored in chamber Land Drain 2 were free of contamination and a scheme was completed in early 2011 where clean water was diverted out of the leachate sewer into a system that discharged into the river.

6.4.2 Toe Drain

The toe drain to the landfill was lined in March 2011 using 13mm thick concrete cloth over 210 metres. The width of the concrete lining is 1.1 metres and is a flexible cement impregnated fabric that helps carry the flow of the surface water to the river.

7. SURFACE WATER MONITORING AND MANAGEMENT

7.1 Surface water monitoring

7.1.1 Surface water monitoring points

Surface water monitoring is undertaken at points W1, W2, W3, W5 and NSWD. These surface water-monitoring points are located in **appendix 11**.

- W1 is located upstream of the outfall.
- W2 is located at the outfall.
- W3 is located downstream of the outfall.
- NSWG is the new surface water discharge to the river (since the segregation of leachate and surface water runoff from site has been implemented.
- W5 is a spring issuing to the northern edge of the landfill.

7.1.2 Surface water monitoring frequencies

ALS Environmental undertake surface water monitoring at Trehir, some parameters are monitored on a monthly basis and others quarterly in accordance with the monitoring requirements identified in the close report.

Determinants	Monitoring frequencies
Water level	Monthly
Ph	Monthly
Temperature	Monthly
Electrical conductivity	Monthly
Dissolved oxygen	Monthly
Ammoniacal nitrogen	Monthly
Chlorides	Monthly
Sulphates	Quarterly
Total alkalinity(as CaCO3 at pH 4.5)	Quarterly
Total oxidised nitrogen	Quarterly
Total oxidised carbon	Quarterly
Na	Quarterly
K	Quarterly
Ca	Quarterly
Mg	Quarterly
Fe	Quarterly
Mn	Quarterly
Cd	Quarterly
Cr	Quarterly
Cu	Quarterly
Ni	Quarterly
Pb	Quarterly
Zn	Quarterly

Table 6: Surface water monitoring and sampling programme

Frequency of determinants analysed are shown in Table 4.
All the determinants have been analysed on a monthly basis.

7.2 Surface water test results

Copies of all surface water analysis have been sent to the regulator on a monthly basis and are presented on **appendix 12**

7.2.1 W2

As stated in the discharge consent, the discharge shall not contain more than:

Determinants name	EA limits (mg/1)
BOD + ATU (5 days)	72
Suspended solids	100
Ammoniacal Nitrogen	20
Total mineral oil	5
Copper	0.14
Zinc	0.9
Cadmium	0.006
Lead	0.28
Chromium	0.08
Iron	14
Nickel	0.1
Phenol	0.028

Table 7: Environment Agency discharge consent limits (W2)

7.2.2 NSWD

A surface water discharge consent to the river was granted by the Environment Agency on 17th May 2007. This was issued to the development company (TDC) operating the landfill at the time. Following their demise the Authority continued to pay the subsistence charges for the consent. In July 2016 a new consent was issued to Caerphilly County Borough EPR /AB3196HG.

7.3 Surface water management

7.3.1 Surface water ditches cleaning

Surface water ditches are inspected regularly by our COTC officer. Ditches are cleaned when necessary. The ditches have been piped in 6 locations to allow vehicular crossing to gain access over the site.

The toe drain to the landfill was lined in March 2011 using 13mm thick concrete cloth over 210 metres. The width of the concrete lining is 1.1 metres and is a flexible cement impregnated fabric that helps carry the flow of the surface water to the river.

7.3.2 Surface Water - access road

The access road from Pandy Road into the landfill site was reconstructed to improve surface water flows to the road gullies.
The road gullies to the CA Site are cleaned on a regular basis to maintain surface water drainage efficiency.

8. GAS MANAGEMENT AND MONITORING

8.1 Landfill gas management

8.1.1 Gas Collection

Landfill gas collection infrastructure was installed on site supported by a temporary flare stack in spring/summer 2009.

8.1.2 Energy Regeneration

After many years of feasibility studies and procurement dialogue, the Authority finally commissioned a landfill gas specialist company Alphagen Renewables to engineer an energy recovery scheme at Trehir.

The scheme became fully operational in January 2016 and is presently generating electricity for the National Grid. The scheme involves the use of a micro-generator which is forecast to generate energy for the grid for at least 15 years.

Outlined below are the latest figures for energy production.

Date	Generated (kWh)	Exported (kWh)
July 2016	36,462	34,083
August 2016	37,601	35,061
September 2016	37,180	34,694
October 2016	33,820	31,523
November 2016	35,953	33,156
December 2016	37,972	35,019
January 2017	37,398	34,016
February 2017	35,313	31,657
March 2017	38,861	35,152
April 2017	36,012	33,211
May 2017	35,496	32,611
June 2017	31,167	28,888
TOTAL	**43,3235**	**399,071**

Table 8: Energy Production

8.2 Gas monitoring

8.2.1 Gas monitoring points

Gas external to the landfill waste is monitored at 12 locations.

- R2 is located in the field to the rear of the site, which is also N2 for purposes of the water analysis. This is considered as a background monitoring point.

- R4 is located on the southern edge of the site close to the boundary on neighbouring land, which is also N4 for purposes of the water analysis.

- R5 is located on the dismantled railway embankment to the southwest corner of the site on neighbouring land, which is also N5 for the purposes of the water analysis.

- R7 is located adjacent to the access road from Pandy Lane, which is also N8 for the purposes of water analysis.

- R8 is located adjacent to the garage.

- The gas migration is also monitored at boreholes NBH1 to NBH7.

Gas monitoring point locations are shown on **appendix 13**.

8.2.2 Gas monitoring frequencies

Migration boreholes are checked for soundness and monitored in accordance with requirements on a monthly basis. All results from monitoring are passed on to the Natural Resources Wales.

At each visit Methane, Oxygen and Carbon Dioxide components are measured and recorded. The barometric pressure is also read and recorded.

ALS undertake the gas monitoring at the same time as the water analysis.

8.2.3 Landfill Gas monitoring

The external landfill gas monitoring and sampling programme is defined in table 9. below:

Landfill gas monitoring determinants	Monitoring frequencies	Units and accuracies	Trigger levels
Methane	Monthly	% v/v and 0.1%	>1%
Carbon Dioxide	Monthly with methane monitoring	% v/v and 0.1%	>1.5%
Oxygen	Monthly with methane monitoring	% v/v and 0.1%	<18%
Atmospheric pressure	Monthly with methane monitoring	mbar and to 1 mbar	None
Differential pressure	Monthly with methane monitoring	mbar and to 1 mbar	Not applicable
Water level in monitoring well	Monthly with methane monitoring	Metres	Not applicable

Table 9: External landfill gas monitoring and sampling programme

8.2.4 Gas monitoring in buildings

The weighbridge offices are no longer manned and the gas monitoring equipment has been decommissioned.

8.3 Gas results

Copies of all gas analysis are sent to the regulator and are represented in **appendix 14.**

8.4 Landfill gas infrastructure

In the event of gas monitoring locations being damaged, the necessary corrective works have been carried out, such as the replacement of bungs and valves.

8.5 Landfill Gas Management

A 5-year gas management contract at Trehir was awarded to Initial Projects Ltd in September 2011. This contract terminated in January 2016. In waste gas well monitoring is now carried out by Alphagen Renewables.

Monitoring of the flare has been undertaken for the following parameters.

- Nitrogen Oxides (NO_x)
- Carbon Monoxide (CO)
- Oxygen
- Total VOCs (as C)

Monitoring was conducted while the Flare was operating at its optimum temperature shown at **appendix 15.** Monitoring will be extended to include newly installed Engine as part of next sampling (due September 2016).

Attached are Alphagen Renewables performance information of the stack and power generation unit (ESG stack emissions data). These systems are located adjacent the old weighbridge compound on the Western edge of the site.

9. CONCLUSION

The Local Authority took over the management of the closed Trehir Landfill Site from Trehir Development Company after a period of decline in site management.

Caerphilly County Borough Council put resources into the site in carrying out repairs and improving maintenance and access to monitoring of gas and water points.

Caerphilly County Borough Council has commissioned a gas flare, which burns methane from the landfill and minimise methane gas emissions into the atmosphere as well as reducing gas migration. This control system has been complimented with the commissioning of a micro generation unit that creates electricity for the grid.

The Waste Management Licence 320021, Trehir Quarry landfill, was transferred on 27th January 2011 (GP3392EH). The Financial Provisions document has a final quantum at £2,344,196 and the Financial Provisions Profile is contained in Schedule 1 of the Local Authority Performance Deed.

Further improvements have been made in the reporting period including:

- a new discharge consent has been issued by the regulator (July 2016)
- a remote monitoring system for the offsite flow meters has been operational since (November 2016)

The Authority plans to continue to make further improvements and this is includes the following:

- Further maintenance and repair work on boreholes & monitoring points
- review of renewables contract
- Enhancing landfill gas capture
- Remediating the areas of vegetation die back
- Feasibility studies on use of the site as an open space

Despite the continuing financial and resource pressures affecting public services the Authority remains committed to working with the regulatory agencies to deliver a practicable and sustainable aftercare programme for the Trehir Site.

Moreover, we will continue to remain alert to the developments in remediation technology and landfill aftercare.

APPENDICES

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Appendix 2	**Existing Site Drainage Layout Plan**
Appendix 3	**Compliance Assessment Report**
Appendix 4	**Leachate Head Levels Monitoring Results**
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Appendix 11	**Surface Water Drainage Arrangements & Monitoring Points. Location Plan**
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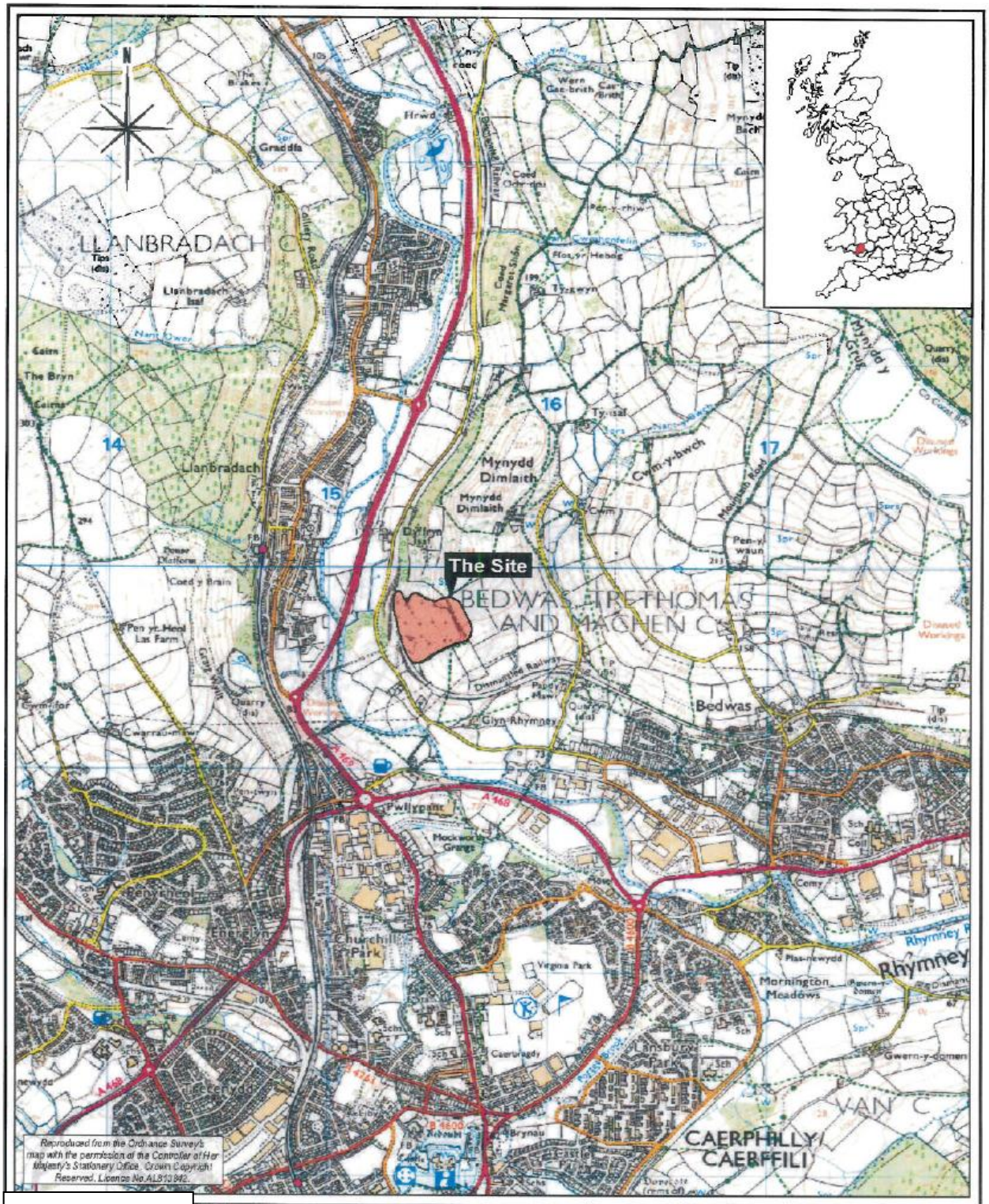
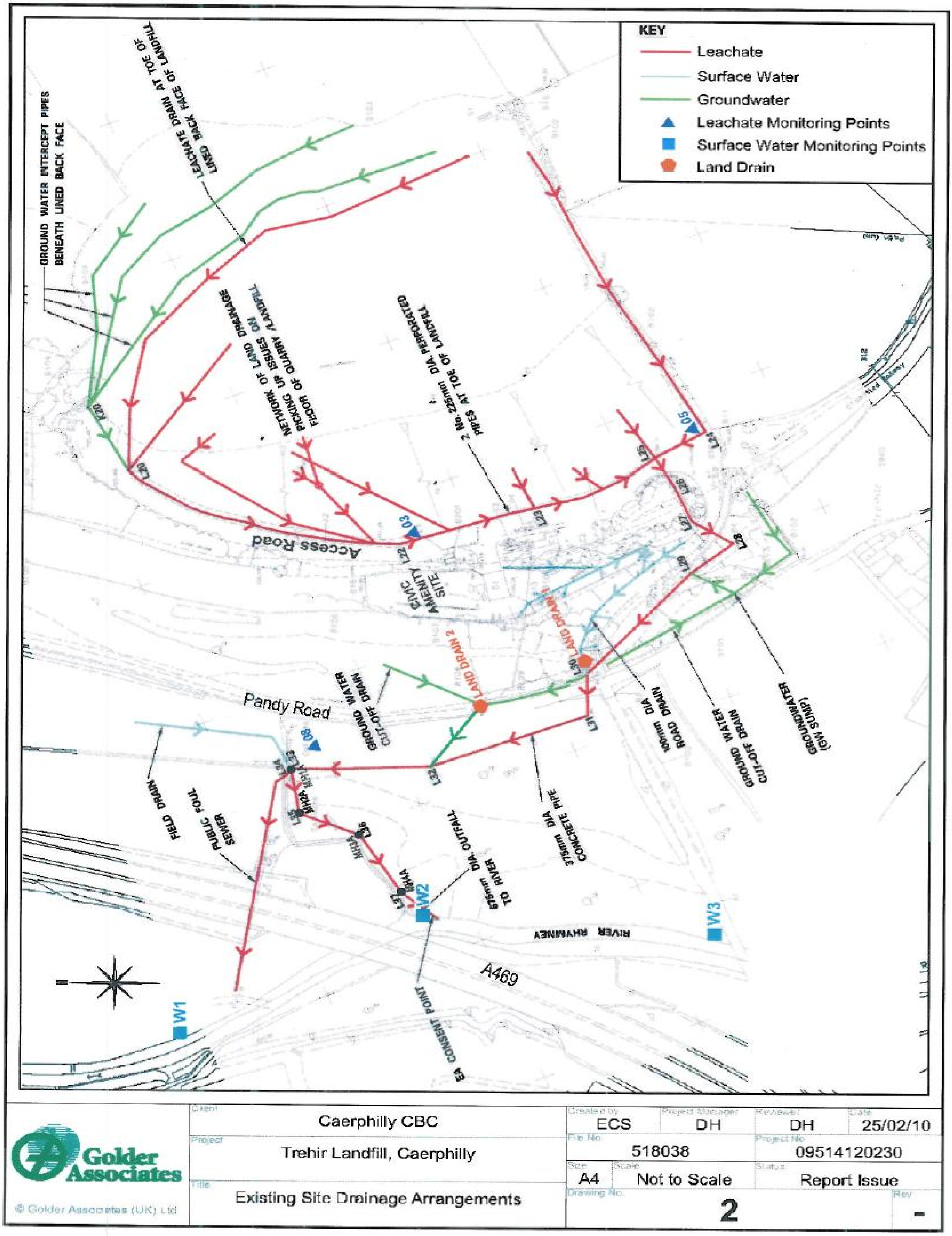
Appendix 15	**Results of Stack Test:** **Stack Emissions Monitoring Report – Gas** **Stack Emissions Monitoring Report – A2 Flare** **Periodic Monitoring of Raw Landfill Gas - Trehir**

APPENDIX 1 - Site Location Plan



Client: Caerphilly CBC		Created by: ECS	Project Manager: DH	Reviewer: DH	Date: 25/02/10
Project: Trehir Landfill, Caerphilly		File No: 518037		Project No: 09514120230	
Title: Site Location Plan		Size: A4	Scale: 1:50,000	Status: Report Issue	
		Drawing No: 1			Rev: -

APPENDIX 2 - Existing Site Drainage Layout Plans



APPENDIX 3 –Compliance Assessment Report - October 2016

Cyfoeth Naturiol Cymru Natural Resources Wales

Compliance Assessment Report

Report ID: CAR_NRW0026514

This form will report compliance with your permit as determined by an NRW officer

Site	Trehir Quarry Landfill	Permit Ref	GP3392EH		
Operator/Permit holder	Caerphilly County Borough Council				
Regime	Waste Operations				
Date of assessment	17/10/2016	Time in	10:30	Out	14:30
Assessment type	Audit				
Parts of the permit assessed	See below				
Lead officer's name	Ward, Tyrone				
Accompanied by	ALS				
Recipient's name/position	Rhodri Lloyd/ Service Manager	Date issued	21/10/2016		

Section 1 – Compliance Assessment Summary

This is based on the requirements of the permit under the Environmental Permitting Regulations. A detailed explanation is captured in "Compliance Assessment Report Detail" (Section 2) and any actions you may need to take are given in the "Action(s)" (section 4). This summary details where we believe any non-compliance with the permit has occurred, the relevant condition and how the non-compliance has been categorised using our Compliance Classification Scheme (CCS). CCS Scores can be consolidated or suspended where appropriate, to reflect the impact of some non-compliances more accurately. For more details of our CCS scheme, contact your local office.

Permit conditions and compliance summary	CCS Category	Condition(s) breached
A1 - Specified by permit	A	
B1 - Infrastructure - Engineering for prevention and control of emissions	C4	2.1
B2 - Infrastructure - Closure and decommissioning	A	
C1 - General Management - Staff competency/training	A	
C3 - General Management - Materials acceptance	A	
D1 - Incident Management - Site security	A	
F1 - Amenity - Odour	A	
F2 - Amenity - Noise	A	
F3 - Amenity - Dust/fibres/particulates and litter	A	
F4 - Amenity - Pests/birds and scavengers	A	
F5 - Amenity - Deposits on road	A	
G1 - Monitoring and Records, Maintenance and Reporting - Monitoring of emissions and environment	A	
G4 - Monitoring and Records, Maintenance and Reporting - Reporting and notification to Natural Resources Wales	C4	5.6

KEY: See Section 5 for breach categories, suspended scores will be indicated as such.
A = Assessed or assessed in part (no evidence of non-compliance), **X** = Action only,
O = Ongoing non-compliance, not scored.

Number of breaches recorded	2	**Total compliance score** (see section 5 for scoring scheme)	0.2

If the Number of breaches recorded is greater than zero, please see Section 3 for our proposed enforcement response

Page 1 of 5

Section 2 – Compliance Assessment Report Detail

This section contains a report of our findings and will usually include information on:

- The part(s) of the permit that were assessed (eg. Maintenance, training, combustion plant, etc)
- Where the type of assessment was 'Data Review' details of the report/results triggering the assessment
- Any non-compliances identified
- Any non-compliances with directly applicable legislation
- Details of any multiple non-compliances
- Information on the compliance score accrued inc.
- Details of advice given
- Any other areas of concern
- Any actions requested
- Any examples of good practice
- A reference to photos taken

Site inspection 17th October

Check monitoring and sampling

TW accompanied ALS technicians to observe sampling procedures. Random checks of leachate, groundwater and perimeter landfill gas sampling.

Appropriate equipment is in place along with techniques for collection, handling and storage of samples. Field results with comments recorded on a spreadsheet. **Action** ALS/CCBC to ensure that sampling technician's comments are reported; and that any remedial measures are carried out in a timely manner. This includes, for example:-

- Unable to locate monitoring points due to overgrown areas, and
- Defective headworks such as missing caps or bungs, bent casing, or unable to reach a Waterra tube.

Site inspection

The planting areas are now well established, including rough pasture use on phase 2.

Weather during the visit was very heavy and persistent showers. Despite this the surface water collection ditch along at the toe of the site remained largely dry. On the shallower section some vegetation was noted, along with general debris. **Action** CCBC to clean the concrete cloth section of ditch out.

We discussed access to the leachate level monitoring points on phase 1 flank. Some of the wells are in a planting area, which is now heavily overgrown. (As a result ALS were unable to locate 3/10 of the wells) **Action** CCBC to improve access to, locate and mark all phase 1 LL wells, and ensure they remain in a serviceable condition.

Random inspection of perimeter sampling points – since last inspection bungs and taps have been replaced; though see comments above.

There is a bare soil strip on the phase 2 flank which has persisted since the last inspection; and over the summer. This strip is also visible from the main A469 road. TW used a gazomat TDL methane analyser to measure surface emissions, with results <10ppm. (On 6th July 15 however 700-800 ppm was recorded) The strip corresponds to surface water collection pipework connecting two chambers. This system overlays the GCL cap. Whilst some local settlement / movement may be expected, there is no obvious instability or outbreaks in the surrounding area. The bare soil strip is not thought to be the result of sheep or burrowing animals. **Action** CCBC to investigate further, and submit proposals.

Photo showing bare soil strip on Phase 2 flank

The gas engine was not running during inspection, with all gas going to the flare. After an enquiry to AlphaGen, they reported that the engine has been performing extremely well recently, however there may be an issue with condensate. **Action** AlphaGen/NRW to discuss improving condensate management.

Random inspection of gas extraction wells revealed that all were turned on, but no apparent flow (very low flow likely) Due to settlement, it is likely that some wells may have become blocked or damaged. **Action** CCBC please forward the latest dip results and details of any camera surveys. Some wells may require de-silting, or blocked/damaged wells may be considered for decommissioning / replacing.

Other matters

Separately, there is some HHW has been fly tipped outside of the CA site, discussed with CCBC to arrange for removal.

2016 monthly monitoring data and Annual Performance Report received and reviewed.

Cyfoeth Naturiol Cymru Natural Resources Wales	**EPR Compliance Assessment Report**	**Report ID: CAR_NRW0026514**

This form will report compliance with your permit as determined by an NRW officer

Site	Trehir Quarry Landfill	Permit Ref	GP3392EH
Operator/Permit holder	Caerphilly County Borough Council	Date	17/10/2016

Section 3 – Enforcement Response

You must take immediate action to rectify any non-compliance and prevent repetition.
Non-compliance with your permit conditions constitutes an offence and can result in criminal prosecutions and/or suspension or revocation of a permit. Please read the detailed assessment in Section 2 and the steps you need to take in Section 4 below.

Section 4 – Action(s)

This section summarises the actions identified during the assessment along with the timescales for when they will need to be completed.

Criteria Ref.	CCS Category	Action required/advised	Due Date
See Section 1 above			
B1	C4	Discussed ongoing improvements	30/12/2016
G4	C4	Need to improve reporting procedures	30/12/2016

Section 5 – Compliance notes for the Operator

To ensure you correct actual or potential non-compliance we may

- Advise on corrective actions verbally or in writing
- Require you to take specific actions verbally or in writing
- Issue a notice
- Require you to review your procedures or management system
- Change some of the conditions of your permit
- Decide to undertake a full review of your permit

Any breach of a permit condition is an offence and we may take legal action against you

- We will normally provide advice and guidance to assist you to come back into compliance either after an offence is committed or where we consider that an offence is likely to be committed. This is without prejudice to any other enforcement response that we consider may be required.
- Enforcement action can include the issue of a formal caution, prosecution, the service of a notice and/or suspension or revocation of the permit.

See our Enforcement and Civil Sanctions guidance for further information

This report does not relieve the site operator of the responsibility to

- Ensure you comply with the conditions of the permit at all times and prevent pollution of the environment
- Ensure you comply with other legislative provisions which may apply

Non-compliance scores and categories

CCS category	Description	Score
C1	A non-compliance that could have a major environmental effect	60
C2	A non-compliance which could have a significant environmental effect	31
C3	A non-compliance which could have a minor environmental effect	4
C4	A non-compliance which has no potential environmental effect	0.1

Operational Risk Appraisal (Opra) - Compliance assessment findings may affect your Opra score and/or your charges. This score influences the resource we use to assess permit compliance.

Section 6 – General information

Data protection notice

The information on this form will be processed by the Natural Resources Wales (NRW) to fulfil its regulatory and monitoring functions and to maintain the relevant public register(s). The NRW may also use and/or disclose it in connection with:

- Offering/providing you with its literature/services relating to environmental matters
- Consulting with the public, public bodies and other organisations (eg. Health and Safety Executive, local authorities) on environmental issues
- Carrying out statistical analysis, research and development on environmental issues
- Providing public register information to enquirers
- Investigating possible breaches of environmental law
- Assessing customer service satisfaction and improving its service
- Freedom of Information Act/Environmental Regulations request

The NRW may pass it on to its agents/representatives to do these things on its behalf. You should ensure that any persons named on this form are informed of the contents of this data protection notice.

Disclosure of information

The NRW will provide a copy of this report to the public register(s). However, if you consider that any information contained in this reports should not be released to the public register(s) on the grounds of commercial confidentiality, you must write to your local area office within twenty working days of receipt of this form indicating which information it concerns and why it should not be released, giving your reasons in full.

Customer charter

What can I do if I disagree with this compliance assessment report?

If you are unable to resolve the issue with your site officer, you should firstly discuss the matter with officer's line managers using the informal appeals procedure. If you wish to raise your dispute further through our official Complaints and Commendations procedure, phone our general enquiry number 0300 065 3000 (Mon to Fri 08.00 – 18.00) and ask for the Customer Contact team or send an email to enquiries@naturalresourceswales.gov.uk. If you are still dissatisfied you can make a complaint to the Public Services Ombudsman for Wales. For advice on how to complain to the Ombudsman phone their helpline on 0845 607 0987.

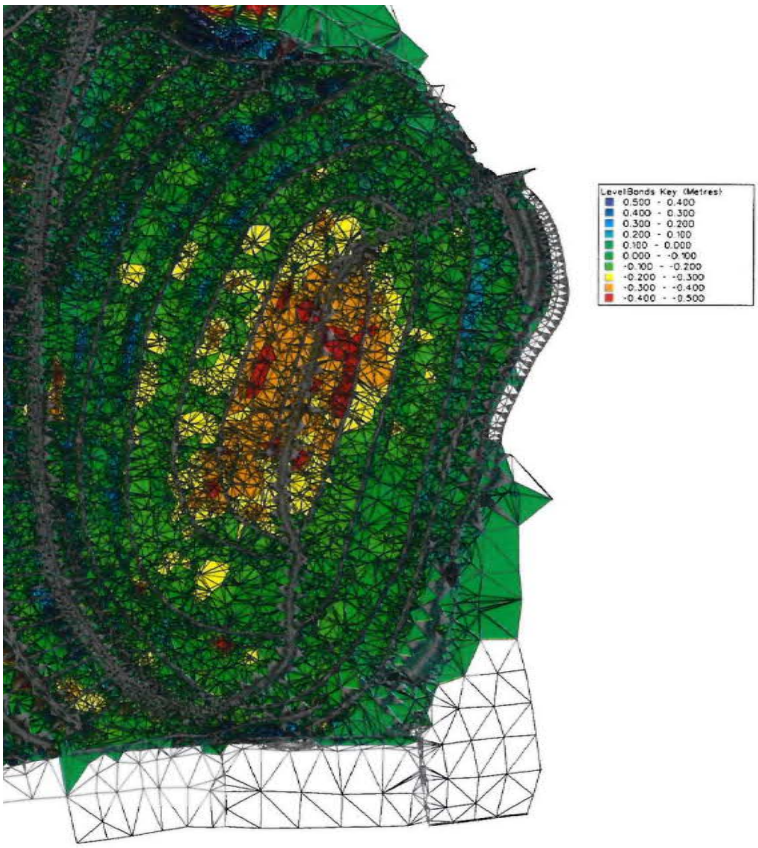
Welsh Language
If you would like this form in Welsh please contact your Regulatory Officer.

APPENDIX 4 - Leachate Head Levels Monitoring Results

MONITORING POINTS M11 – M25 **July 2016 – June 2017**

Monitoring Point	Water Level (m)											
	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
M11	-	C.N.L	-	Unable to locate	Unable to locate	-	-	-	8.10	-	-	5.21
M12	-	C.N.L	-	Unable to locate	Unable to locate	-	-	-	8.78 (no cap on well)	-	-	9.17
M13	-	6.97	-	7.97	6.07	-	-	-	5.20	-	-	6.70
M14	-	7.45	-	7.53	7.36	-	-	-	7.28	-	-	11.57
M15	-	2.49	-	Unable to locate	Unable to locate	-	-	-	-	-	-	CNL
M21	-	Dry	-	Dry	Dry	-	-	-	-	-	-	
M22	-	7.87	-	7.96	7.53	-	-	-	-	-	-	
M23	-	8.03	-	8.32	8.54	-	-	-	-	-	-	
M24	-	C.N.L	-	5.45	5.21	-	-	-	-	-	-	
M25	-	6.56	-	6.24	6.32	-	-	-	-	-	-	

APPENDIX 5 - CONTOURED SURVEY & CROSS SECTIONS



APPENDIX 6 - DAILY SUMMARY OF FLOWS TO SEWER

V-notch weir L/s

July 2016 – June 2017

Date	Total flow	Mean flow	Highest flow	Lowest flow
July 2016				
01/07/2016	198.036M³	2.29L/s	3.06L/s first recorded at 00:15	1.76L/s first recorded at 17:15
02/07/2016	161.500M³	1.87L/s	2.65L/s first recorded at 10:00	1.47L/s first recorded at 14:30
03/07/2016	138.000M³	1.60L/s	2.18L/s first recorded at 05:15	1.29L/s first recorded at 14:00
04/07/2016	127.702M³	1.48L/s	2.06L/s first recorded at 07:45	1.18L/s first recorded at 16:30
05/07/2016	116.139M³	1.34L/s	2.00L/s first recorded at 08:15	1.06L/s first recorded at 14:15
06/07/2016	109.759M³	1.27L/s	1.88L/s first recorded at 01:45	1.06L/s first recorded at 00:45
07/07/2016	108.474M³	1.26L/s	1.88L/s first recorded at 03:00	1.06L/s first recorded at 00:30
08/07/2016	108.250M³	1.25L/s	1.88L/s first recorded at 05:00	1.00L/s first recorded at 10:00
09/07/2016	112.349M³	1.30L/s	2.65L/s first recorded at 22:30	1.00L/s first recorded at 01:00
10/07/2016	111.932M³	1.30L/s	2.18L/s first recorded at 02:45	1.00L/s first recorded at 11:00
11/07/2016	109.858M³	1.27L/s	2.18L/s first recorded at 06:30	1.00L/s first recorded at 11:45
12/07/2016	73.470M³	0.85L/s	1.76L/s first recorded at 00:15	0.47L/s first recorded at 11:00
13/07/2016	54.433M³	0.63L/s	1.18L/s first recorded at 02:00	0.47L/s first recorded at 00:45
14/07/2016	54.440M³	0.63L/s	1.18L/s first recorded at 04:45	0.35L/s first recorded at 14:00
15/07/2016	51.748M³	0.60L/s	1.06L/s first recorded at 01:30	0.35L/s first recorded at 01:15
16/07/2016	47.320M³	0.55L/s	1.06L/s first recorded at 01:30	0.35L/s first recorded at 01:15
17/07/2016	47.453M³	0.55L/s	1.06L/s first recorded at 00:15	0.35L/s first recorded at 00:45
18/07/2016	44.369M³	0.51L/s	1.06L/s first recorded at 01:00	0.35L/s first recorded at 00:15
19/07/2016	43.908M³	0.51L/s	1.06L/s first recorded at 00:45	0.35L/s first recorded at 00:15
20/07/2016	42.604M³	0.49L/s	1.06L/s first recorded at 03:15	0.29L/s first recorded at 11:00
21/07/2016	42.495M³	0.49L/s	1.00L/s first recorded at 01:15	0.29L/s first recorded at 02:45
22/07/2016	39.051M³	0.45L/s	1.00L/s first recorded at 03:00	0.29L/s first recorded at 00:30
23/07/2016	37.219M³	0.43L/s	1.00L/s first recorded at 03:15	0.29L/s first recorded at 00:30
24/07/2016	45.930M³	0.53L/s	2.29L/s first recorded at 14:00	0.29L/s first recorded at 04:30
25/07/2016	37.882M³	0.44L/s	1.00L/s first recorded at 00:15	0.29L/s first recorded at 02:45
26/07/2016	39.350M³	0.46L/s	1.06L/s first recorded at 23:30	0.29L/s first recorded at 00:15
27/07/2016	41.360M³	0.48L/s	1.35L/s first recorded at 03:15	0.29L/s first recorded at 09:30
28/07/2016	42.739M³	0.49L/s	1.47L/s first recorded at 11:30	0.29L/s first recorded at 00:30
29/07/2016	42.964M³	0.50L/s	1.06L/s first recorded at 10:00	0.29L/s first recorded at 07:15
30/07/2016	36.416M³	0.42L/s	1.00L/s first recorded at 03:15	0.29L/s first recorded at 00:15
31/07/2016	33.998M³	0.39L/s	1.00L/s first recorded at 10:45	0.29L/s first recorded at 00:15
August 2016				
01/08/2016	125.075M³	1.45L/s	6.65L/s first recorded at 21:00	0.29L/s first recorded at 00:15
02/08/2016	126.746M³	1.47L/s	3.29L/s first recorded at 23:15	0.29L/s first recorded at 17:15
03/08/2016	151.940M³	1.76L/s	3.06L/s first recorded at 02:00	1.00L/s first recorded at 21:00
04/08/2016	121.249M³	1.40L/s	3.18L/s first recorded at 01:00	0.88L/s first recorded at 22:30
05/08/2016	83.919M³	0.97L/s	1.59L/s first recorded at 01:15	0.65L/s first recorded at 14:00
06/08/2016	67.482M³	0.78L/s	1.35L/s first recorded at 02:00	0.59L/s first recorded at 06:15
07/08/2016	60.313M³	0.70L/s	1.29L/s first recorded at 03:00	0.47L/s first recorded at 05:30
08/08/2016	53.379M³	0.62L/s	1.18L/s first recorded at 05:45	0.47L/s first recorded at 00:15
09/08/2016	49.165M³	0.57L/s	1.06L/s first recorded at 02:30	0.35L/s first recorded at 00:15
10/08/2016	46.643M³	0.54L/s	1.06L/s first recorded at 02:00	0.35L/s first recorded at 00:45
11/08/2016	44.668M³	0.52L/s	1.06L/s first recorded at 05:45	0.35L/s first recorded at 00:15
12/08/2016	43.471M³	0.50L/s	1.06L/s first recorded at 03:15	0.35L/s first recorded at 00:15
13/08/2016	41.807M³	0.48L/s	1.06L/s first recorded at 06:45	0.29L/s first recorded at 11:30
14/08/2016	38.730M³	0.45L/s	1.00L/s first recorded at 09:15	0.29L/s first recorded at 00:15
15/08/2016	36.381M³	0.42L/s	1.00L/s first recorded at 04:30	0.29L/s first recorded at 00:15

Date	Total flow	Mean flow	Highest flow	Lowest flow
16/08/2016	34.633M³	0.40L/s	1.00L/s first recorded at 08:00	0.29L/s first recorded at 00:30
17/08/2016	34.249M³	0.40L/s	1.00L/s first recorded at 21:00	0.29L/s first recorded at 00:45
18/08/2016	33.468M³	0.39L/s	1.00L/s first recorded at 05:15	0.29L/s first recorded at 00:15
19/08/2016	55.044M³	0.64L/s	2.65L/s first recorded at 18:30	0.29L/s first recorded at 00:30
20/08/2016	207.151M³	2.40L/s	7.76L/s first recorded at 10:45	0.29L/s first recorded at 00:45
21/08/2016	191.085M³	2.21L/s	3.06L/s first recorded at 03:30	1.65L/s first recorded at 23:30
22/08/2016	186.321M³	2.16L/s	3.06L/s first recorded at 07:30	1.65L/s first recorded at 00:15
23/08/2016	169.164M³	1.96L/s	2.76L/s first recorded at 00:45	1.59L/s first recorded at 18:15
24/08/2016	149.282M³	1.73L/s	2.76L/s first recorded at 23:15	1.35L/s first recorded at 17:15
25/08/2016	168.884M³	1.95L/s	4.47L/s first recorded at 19:45	1.35L/s first recorded at 03:30
26/08/2016	167.499M³	1.94L/s	2.65L/s first recorded at 03:15	1.59L/s first recorded at 18:15
27/08/2016	148.946M³	1.72L/s	2.35L/s first recorded at 01:45	1.47L/s first recorded at 07:45
28/08/2016	158.774M³	1.84L/s	8.06L/s first recorded at 15:30	1.35L/s first recorded at 07:30
29/08/2016	137.835M³	1.60L/s	2.18L/s first recorded at 02:15	1.29L/s first recorded at 20:30
30/08/2016	127.190M³	1.47L/s	2.18L/s first recorded at 00:15	1.18L/s first recorded at 21:00
31/08/2016	126.318M³	1.46L/s	2.18L/s first recorded at 08:45	1.18L/s first recorded at 14:30
September 2016				
01/09/2016	119.462M³	1.38L/s	2.06L/s first recorded at 02:45	1.18L/s first recorded at 02:15
02/09/2016	117.233M³	1.36L/s	2.00L/s first recorded at 01:00	1.06L/s first recorded at 19:15
03/09/2016	433.643M³	5.02L/s	10.16L/s first recorded at 14:30	1.06L/s first recorded at 00:30
04/09/2016	422.039M³	4.88L/s	8.00L/s first recorded at 00:15	2.76L/s first recorded at 22:00
05/09/2016	290.815M³	3.37L/s	5.47L/s first recorded at 02:30	2.59L/s first recorded at 22:45
06/09/2016	225.254M³	2.61L/s	3.47L/s first recorded at 00:45	2.05L/s first recorded at 20:45
07/09/2016	193.561M³	2.24L/s	3.00L/s first recorded at 01:45	1.88L/s first recorded at 14:15
08/09/2016	175.720M³	2.03L/s	3.35L/s first recorded at 00:00	1.65L/s first recorded at 12:45
09/09/2016	188.005M³	2.18L/s	5.59L/s first recorded at 00:00	1.65L/s first recorded at 05:30
10/09/2016	310.655M³	3.60L/s	6.76L/s first recorded at 01:00	2.65L/s first recorded at 23:45
11/09/2016	233.040M³	2.70L/s	3.59L/s first recorded at 01:15	2.18L/s first recorded at 21:00
12/09/2016	202.284M³	2.34L/s	3.06L/s first recorded at 02:45	2.00L/s first recorded at 14:30
13/09/2016	201.163M³	2.33L/s	6.29L/s first recorded at 09:45	1.88L/s first recorded at 06:45
14/09/2016	180.440M³	2.09L/s	2.76L/s first recorded at 00:30	1.76L/s first recorded at 16:30
15/09/2016	168.595M³	1.95L/s	2.59L/s first recorded at 06:00	1.65L/s first recorded at 14:00
16/09/2016	156.552M³	1.81L/s	2.47L/s first recorded at 00:45	1.59L/s first recorded at 10:45
17/09/2016	149.481M³	1.73L/s	2.35L/s first recorded at 03:00	1.47L/s first recorded at 20:00
18/09/2016	147.180M³	1.70L/s	2.47L/s first recorded at 20:00	1.47L/s first recorded at 00:45
19/09/2016	153.717M³	1.78L/s	2.59L/s first recorded at 07:45	1.59L/s first recorded at 00:15
20/09/2016	147.624M³	1.71L/s	2.35L/s first recorded at 04:00	1.47L/s first recorded at 01:45
21/09/2016	138.669M³	1.60L/s	2.29L/s first recorded at 00:45	1.29L/s first recorded at 08:45
22/09/2016	134.009M³	1.55L/s	2.18L/s first recorded at 10:15	1.35L/s first recorded at 00:15
23/09/2016	161.642M³	1.87L/s	2.76L/s first recorded at 13:45	1.35L/s first recorded at 00:15
24/09/2016	198.563M³	2.30L/s	10.00L/s first recorded at 23:30	1.35L/s first recorded at 05:00
25/09/2016	301.183M³	3.49L/s	8.47L/s first recorded at 00:15	2.47L/s first recorded at 15:00
26/09/2016	311.046M³	3.60L/s	8.76L/s first recorded at 14:45	2.47L/s first recorded at 06:15
27/09/2016	308.797M³	3.57L/s	4.76L/s first recorded at 02:15	2.76L/s first recorded at 23:30
28/09/2016	251.083M³	2.91L/s	4.00L/s first recorded at 21:15	2.35L/s first recorded at 13:15
29/09/2016	365.471M³	4.23L/s	6.76L/s first recorded at 04:30	2.47L/s first recorded at 00:30
30/09/2016	382.694M³	4.43L/s	5.76L/s first recorded at 04:45	3.06L/s first recorded at 01:15
October 2015				
01/10/2016	554.049M³	6.41L/s	9.00L/s first recorded at 15:15	3.65L/s first recorded at 01:45
02/10/2016	418.477M³	4.84L/s	7.18L/s first recorded at 00:30	3.35L/s first recorded at 22:30
03/10/2016	289.112M³	3.35L/s	4.29L/s first recorded at 00:15	2.65L/s first recorded at 20:30
04/10/2016	245.174M³	2.84L/s	3.47L/s first recorded at 01:00	2.35L/s first recorded at 17:15
05/10/2016	217.390M³	2.52L/s	3.29L/s first recorded at 00:45	2.18L/s first recorded at 14:15
06/10/2016	198.429M³	2.30L/s	3.00L/s first recorded at 03:15	2.00L/s first recorded at 19:30

Date	Total flow	Mean flow	Highest flow	Lowest flow
07/10/2016	188.823M³	2.19L/s	2.88L/s first recorded at 00:15	2.00L/s first recorded at 00:30
08/10/2016	177.682M³	2.06L/s	2.76L/s first recorded at 02:30	1.76L/s first recorded at 17:00
09/10/2016	169.168M³	1.96L/s	2.65L/s first recorded at 02:15	1.65L/s first recorded at 17:30
10/10/2016	161.170M³	1.87L/s	2.59L/s first recorded at 02:45	1.65L/s first recorded at 00:15
11/10/2016	159.572M³	1.85L/s	2.47L/s first recorded at 19:00	1.59L/s first recorded at 20:00
12/10/2016	156.668M³	1.81L/s	2.47L/s first recorded at 08:45	1.59L/s first recorded at 09:30
13/10/2016	153.614M³	1.78L/s	2.47L/s first recorded at 02:00	1.59L/s first recorded at 01:00
14/10/2016	153.375M³	1.78L/s	2.47L/s first recorded at 00:15	1.59L/s first recorded at 00:30
15/10/2016	179.827M³	2.08L/s	4.88L/s first recorded at 14:45	1.59L/s first recorded at 00:15
16/10/2016	165.084M³	1.91L/s	3.29L/s first recorded at 04:45	1.59L/s first recorded at 04:00
17/10/2016	208.837M³	2.42L/s	6.76L/s first recorded at 10:00	1.59L/s first recorded at 00:15
18/10/2016	209.658M³	2.43L/s	3.29L/s first recorded at 04:15	2.00L/s first recorded at 22:30
19/10/2016	184.240M³	2.13L/s	2.76L/s first recorded at 03:45	1.76L/s first recorded at 21:00
20/10/2016	167.511M³	1.94L/s	2.59L/s first recorded at 13:45	1.65L/s first recorded at 14:45
21/10/2016	161.268M³	1.87L/s	2.47L/s first recorded at 03:00	1.59L/s first recorded at 19:00
22/10/2016	157.239M³	1.82L/s	2.47L/s first recorded at 04:45	1.59L/s first recorded at 04.15
23/10/2016	155.684M³	1.80L/s	2.35L/s first recorded at 03:00	1.59L/s first recorded at 00:30
24/10/2016	155.880M³	1.80L/s	2.65L/s first recorded at 17:30	1.59L/s first recorded at 00:15
25/10/2016	145.680M³	1.69L/s	2.35L/s first recorded at 01:00	1.47L/s first recorded at 04:30
26/10/2016	142.394M³	1.65L/s	2.29L/s first recorded at 14:45	1.35L/s first recorded at 18:45
27/10/2016	140.390M³	1.62L/s	2.29L/s first recorded at 10:45	1.35L/s first recorded at 00:45
28/10/2016	135.821M³	1.57L/s	2.18L/s first recorded at 00:45	1.35L/s first recorded at 00:15
29/10/2016	133.891M³	1.55L/s	2.18L/s first recorded at 00:30	1.35L/s first recorded at 00:15
30/10/2016	133.540M³	1.55L/s	2.18L/s first recorded at 01:00	1.35L/s first recorded at 00:45
31/10/2016	133.159M³	1.54L/s	2.18L/s first recorded at 02:15	1.29L/s first recorded at 11:15
November 2016 *(* New recording system from 25th November 2016)*				
01/11/2016	132.340M³	1.53L/s	2.18L/s first recorded at 03:00	1.35L/s first recorded at 00:15
02/11/2016	132.010M³	1.53L/s	2.18L/s first recorded at 00:45	1.29L/s first recorded at 08:45
03/11/2016	131.877M³	1.53L/s	2.18L/s first recorded at 02:15	1.29L/s first recorded at 01:45
04/11/2016	132.282M³	1.53L/s	2.18L/s first recorded at 05:30	1.35L/s first recorded at 00:45
05/11/2016	132.106M³	1.53L/s	2.18L/s first recorded at 14:30	1.29L/s first recorded at 13:45
06/11/2016	131.125M³	1.52L/s	2.06L/s first recorded at 01:15	1.29L/s first recorded at 09:45
07/11/2016	129.045M³	1.49L/s	2.06L/s first recorded at 06:00	1.29L/s first recorded at 07:30
08/11/2016	157.009M³	1.82L/s	5.88L/s first recorded at 23:30	1.29L/s first recorded at 01:00
09/11/2016	189.557M³	2.19L/s	4.59L/s first recorded at 00:15	1.59L/s first recorded at 21:45
10/11/2016	149.378M³	1.73L/s	2.35L/s first recorded at 01:15	1.47L/s first recorded at 12:45
11/11/2016	140.360M³	1.62L/s	2.29L/s first recorded at 01:15	1.35L/s first recorded at 03:30
12/11/2016	219.971M³	2.55L/s	3.76L/s first recorded at 03:15	1.35L/s first recorded at 00:45
13/11/2016	179.229M³	2.07L/s	2.88L/s first recorded at 02:00	1.65L/s first recorded at 18:30
14/11/2016	159.368M³	1.84L/s	2.47L/s first recorded at 00:15	1.59L/s first recorded at 09:45
15/11/2016	150.351M³	1.74L/s	2.35L/s first recorded at 03:15	1.47L/s first recorded at 06:15
16/11/2016	148.136M³	1.71L/s	2.35L/s first recorded at 02:15	1.47L/s first recorded at 03:00
17/11/2016	236.799M³	2.74L/s	6.65L/s first recorded at 11:15	1.47L/s first recorded at 00:30
18/11/2016	277.791M³	3.22L/s	4.18L/s first recorded at 00:45	2.47L/s first recorded at 23:45
19/11/2016	271.695M³	3.14L/s	7.59L/s first recorded at 00:00	2.29L/s first recorded at 08:30
20/11/2016	711.640M³	8.24L/s	11.76L/s first recorded at 01:45	4.88L/s first recorded at 23:30
21/11/2016	700.761M³	8.11L/s	11.29L/s first recorded at 14:15	4.88L/s first recorded at 04:15
22/11/2016	681.656M³	7.89L/s	8.88L/s first recorded at 00:15	6.47L/s first recorded at 23:45
23/11/2016	521.348M³	6.03L/s	7.18L/s first recorded at 02:15	4.76L/s first recorded at 23:00
24/11/2016	200.930³	2.33L/s	5.88L/s first recorded at 00:30	0.00L/s first recorded at 11:30

DAILY FLOWS FROM SEWER & RIVER 25/11/2016 – 30/06/2017

25th – 30th November 2016

UTC+1.00	1. Caerphilly Council Sewer Outfall SUM [lps*s]		1. Caerphilly Council River Outfall SUM [lps*s]	
2016-11-25, Fr	315049.78	315.049 m³/s	-324.65	-0.32465 m³/s
2016-11-26, Sa	269239.78	269.239 m³/s	-309.43	-0.30943 m³/s
2016-11-27, Su	241706.92	241.706 m³/s	-576.56	-0.57656 m³/s
2016-11-28, Mo	220870.58	220.870 m³/s	-556.02	-0.55602 m³/s
2016-11-29, Tu	203477.69	203.477 m³/s	411.97	0.41197 m³/s
2016-11-30, We	187277.03	187.277 m³/s	624.59	0.62459 m³/s

1st – 31st December 2016

UTC+1.00	1. Caerphilly Council Sewer Outfall SUM [lps*s]		1. Caerphilly Council River Outfall SUM [lps*s]	
2016-12-01, Th	180522.28	180.522 m³/s	596.78	0.59678 m³/s
2016-12-02, Fr	175156.94	175.156 m³/s	46.02	0.04602 m³/s
2016-12-03, Sa	169354.91	169.354 m³/s	-359.59	-0.35959 m³/s
2016-12-04, Su	164801.13	164.801 m³/s	372.38	0.37238 m³/s
2016-12-05, Mo	160010.33	160.010 m³/s	-74.16	-0.07416 m³/s
2016-12-06, Tu	156699.28	156.669 m³/s	-461.93	-0.46193 m³/s
2016-12-07, We	155773.58	155.773 m³/s	-722.76	-0.72276 m³/s
2016-12-08, Th	174141.50	174.141 m³/s	-998.29	-0.99829 m³/s
2016-12-09, Fr	163724.22	163.724 m³/s	-673.61	-0.67361 m³/s
2016-12-10, Sa	265961.66	265.961 m³/s	191.70	0.19170 m³/s
2016-12-11, Su	276009.25	276.009 m³/s	515.40	0.51540 m³/s
2016-12-12, Mo	227390.23	227.390 m³/s	533.10	0.53310 m³/s
2016-12-13, Tu	315798.25	315.798 m³/s	277.14	0.27714 m³/s
2016-12-14, We	313044.75	313.044 m³/s	-380.33	-0.38033 m³/s
2016-12-15, Th	414062.09	414.062 m³/s	9705.15	9.70515 m³/s
2016-12-16, Fr	386796.53	386.796 m³/s	-49.13	-0.04913 m³/s
2016-12-17, Sa	260427.94	260.427 m³/s	148.42	0.14842 m³/s
2016-12-18, Su	228877.25	228.877 m³/s	494.17	0.49417 m³/s
2016-12-19, Mo	218434.56	218.434 m³/s	-21.45	-0.02145 m³/s
2016-12-20, Tu	212987.03	212.987 m³/s	525.60	0.52560 m³/s
2016-12-21, We	236500.98	236.500 m³/s	548.85	0.54885 m³/s
2016-12-22, Th	221473.19	221.473 m³/s	834.07	0.83407 m³/s
2016-12-23, Fr	291267.00	291.267 m³/s	1188.97	1.18897 m³/s
2016-12-24, Sa	323859.94	323.859 m³/s	-136.80	-0.13680 m³/s
2016-12-25, Su	293608.00	293.608 m³/s	17.92	0.01792 m³/s
2016-12-26, Mo	305112.09	305.112 m³/s	489.30	0.48930 m³/s
2016-12-27, Tu	253600.88	253.600 m³/s	1003.27	1.00327 m³/s
2016-12-28, We	231015.77	231.015 m³/s	916.35	0.91635 m³/s

2016-12-29, Th	221543.45	221.543 m³/s	881.70	0.88170 m³/s
2016-12-30, Fr	208614.59	208.614 m³/s	174.45	0.17445 m³/s
2016-12-31, Sa	202296.09	202.296 m³/s	503.10	0.50310 m³/s

1st - 31st January 2017

UTC+1.00	1. Caerphilly Council Sewer Outfall SUM [lps*s]		1. Caerphilly Council River Outfall SUM [lps*s]	
2017-01-01, Su	337861.00	337.861 m³/s	450.90	0.45090 m³/s
2017-01-02, Mo	299275.09	299.275 m³/s	723.30	0.72330 m³/s
2017-01-03, Tu	247712.52	247.712 m³/s	808.42	0.80842 m³/s
2017-01-04, We	224488.36	224.488 m³/s	2.02	0.00202 m³/s
2017-01-05, Th	206970.53	206.970 m³/s	1078.80	1.07880 m³/s
2017-01-06, Fr	202084.88	202.084 m³/s	673.42	0.67342 m³/s
2017-01-07, Sa	200719.20	200.719 m³/s	215.27	0.21527 m³/s
2017-01-08, Su	192731.56	192.731 m³/s	255.60	0.25560 m³/s
2017-01-09, Mo	342463.00	342.463 m³/s	-397.20	-0.39720 m³/s
2017-01-10, Tu	325746.72	325.746 m³/s	230.92	0.23092 m³/s
2017-01-11, We	263076.50	263.076 m³/s	321.52	0.32152 m³/s
2017-01-12, Th	255503.88	255.503 m³/s	576.52	0.57652 m³/s
2017-01-13, Fr	238382.67	238.382 m³/s	835.20	0.83520 m³/s
2017-01-14, Sa	223614.30	223.614 m³/s	486.81	0.48681 m³/s
2017-01-15, Su	210543.64	210.543 m³/s	157.65	0.15765 m³/s
2017-01-16, Mo	202756.67	202.756 m³/s	340.27	0.34027 m³/s
2017-01-17, Tu	187729.48	187.729 m³/s	524.25	0.52425 m³/s
2017-01-18, We	184442.69	184.442 m³/s	631.35	0.63135 m³/s
2017-01-19, Th	177002.05	177.002 m³/s	788.10	0.78810 m³/s
2017-01-20, Fr	170663.89	170.663 m³/s	504.52	0.50452 m³/s
2017-01-21, Sa	175999.11	175.999 m³/s	933.60	0.93360 m³/s
2017-01-22, Su	172275.75	172.275 m³/s	730.95	0.73095 m³/s
2017-01-23, Mo	167616.83	167.616 m³/s	840.97	0.84097 m³/s
2017-01-24, Tu	165712.22	165.712 m³/s	848.77	0.84877 m³/s
2017-01-25, We	163956.09	163.956 m³/s	287.70	0.28770 m³/s
2017-01-26, Th	164234.25	164.234 m³/s	849.85	0.84985 m³/s
2017-01-27, Fr	177927.41	177.927 m³/s	700.74	0.70074 m³/s
2017-01-28, Sa	291542.41	291.542 m³/s	563.77	0.56377 m³/s
2017-01-29, Su	569250.50	569.250 m³/s	100676.02	100.67602 m³/s
2017-01-30, Mo	561748.75	561.748 m³/s	26603.15	26.60315 m³/s
2017-01-31, Tu	550170.88	550.170 m³/s	10730.85	10.73085 m³/s

1st – 28th February 2017

UTC+1.00	1. Caerphilly Council Sewer Outfall SUM [lps*s]		1. Caerphilly Council River Outfall SUM [lps*s]	
2017-02-01, We	696855.44	696.855 m³/s	121401.47	121.40147 m³/s
2017-02-02, Th	713453.50	713.453 m³/s	165929.55	165.92955 m³/s
2017-02-03, Fr	584119.81	584.119 m³/s	5814.67	5.81467 m³/s
2017-02-04, Sa	549619.88	549.619 m³/s	1179.38	1.17938 m³/s
2017-02-05, Su	465841.84	465.841 m³/s	-347.55	-0.34755 m³/s
2017-02-06, Mo	438492.72	438.492 m³/s	1482.22	1.48222 m³/s
2017-02-07, Tu	579384.19	579.384 m³/s	6694.94	6.69494 m³/s
2017-02-08, We	402114.22	402.114 m³/s	352.12	0.35212 m³/s
2017-02-09, Th	331531.59	331.531 m³/s	628.95	0.62895 m³/s
2017-02-10, Fr	293293.25	293.293 m³/s	255.75	0.25575 m³/s
2017-02-11, Sa	268702.66	268.702 m³/s	728.92	0.72892 m³/s
2017-02-12, Su	250389.66	250.389 m³/s	658.11	0.65811 m³/s
2017-02-13, Mo	232573.61	232.573 m³/s	495.75	0.49575 m³/s
2017-02-14, Tu	218758.45	218.758 m³/s	664.72	0.66472 m³/s
2017-02-15, We	217656.97	217.656 m³/s	-217.59	-0.21759 m³/s
2017-02-16, Th	207101.03	207.101 m³/s	93.30	0.09330 m³/s
2017-02-17, Fr	202722.92	202.722 m³/s	42.37	0.04237 m³/s
2017-02-18, Sa	196206.64	196.206 m³/s	232.27	0.23227 m³/s
2017-02-19, Su	193050.45	193.050 m³/s	78.15	0.07815 m³/s
2017-02-20, Mo	188407.53	188.407 m³/s	-319.80	-0.31980 m³/s
2017-02-21, Tu	192478.78	192.478 m³/s	-47.70	-0.04770 m³/s
2017-02-22, We	222798.44	222.798 m³/s	-40.88	-0.04088 m³/s
2017-02-23, Th	514656.72	514.656 m³/s	16245.53	16.24553 m³/s
2017-02-24, Fr	336855.88	336.855 m³/s	111.67	0.11167 m³/s
2017-02-25, Sa	460539.22	460.539 m³/s	92022.68	92.02268 m³/s
2017-02-26, Su	734989.38	734.989 m³/s	204246.67	204.24667 m³/s
2017-02-27, Mo	703170.13	703.170 m³/s	235852.88	235.85288 m³/s
2017-02-28, Tu	659005.06	659.005 m³/s	177674.61	177.67461 m³/s

1st – 31st March 2017

UTC+1.00	1. Caerphilly Council Sewer Outfall SUM [lps*s]		1. Caerphilly Council River Outfall SUM [lps*s]	
2017-03-01, We	520834.34	520.834 m³/s	3082.43	3.08243 m³/s
2017-03-02, Th	429078.16	429.078 m³/s	-355.95	-0.35595 m³/s
2017-03-03, Fr	599468.00	599.468 m³/s	148354.64	148.35464 m³/s
2017-03-04, Sa	587855.50	587.855 m³/s	53351.10	53.35110 m³/s
2017-03-05, Su	736493.19	736.493 m³/s	181068.08	181.06808 m³/s

2017-03-06, Mo	642400.44	642.400 m³/s	81066.45	81.06645 m³/s
2017-03-07, Tu	481557.59	481.557 m³/s	-496.35	-0.49635 m³/s
2017-03-08, We	463976.88	463.976 m³/s	-1387.88	-1.38788 m³/s
2017-03-09, Th	404491.34	404.491 m³/s	-719.55	-0.71955 m³/s
2017-03-10, Fr	348990.13	348.990 m³/s	-561.00	-0.56100 m³/s
2017-03-11, Sa	320895.00	320.895 m³/s	-427.88	-0.42788 m³/s
2017-03-12, Su	295134.97	295.134 m³/s	-334.88	-0.33488 m³/s
2017-03-13, Mo	262908.41	262.908 m³/s	38.85	0.03885 m³/s
2017-03-14, Tu	242571.20	242.571 m³/s	-725.78	-0.72578 m³/s
2017-03-15, We	230967.63	230.967 m³/s	-123.60	-0.12360 m³/s
2017-03-16, Th	226378.75	226.378 m³/s	108.45	0.10845 m³/s
2017-03-17, Fr	229384.47	229.384 m³/s	210.07	0.21007 m³/s
2017-03-18, Sa	224331.64	224.331 m³/s	-88.95	-0.08895 m³/s
2017-03-19, Su	297857.25	297.857 m³/s	-536.85	-0.53685 m³/s
2017-03-20, Mo	781970.88	781.970 m³/s	212671.27	212.67127 m³/s
2017-03-21, Tu	565112.88	565.112 m³/s	10082.85	10.08285 m³/s
2017-03-22, We	796320.69	796.320 m³/s	274183.28	274.18328 m³/s
2017-03-23, Th	546536.81	546.536 m³/s	3659.93	3.65993 m³/s
2017-03-24, Fr	412880.63	412.880 m³/s	-734.33	-0.73433 m³/s
2017-03-25, Sa	343941.34	343.941 m³/s	-395.17	-0.39517 m³/s
2017-03-26, Su	298245.22	298.245 m³/s	-424.20	-0.42420 m³/s
2017-03-27, Mo	282862.53	282.862 m³/s	-45.45	-0.04545 m³/s
2017-03-28, Tu	273911.84	273.911 m³/s	-231.38	-0.23138 m³/s
2017-03-29, We	282055.09	282.055 m³/s	-663.53	-0.66353 m³/s
2017-03-30, Th	320603.22	320.603 m³/s	-563.63	-0.56363 m³/s
2017-03-31, Fr	314255.25	314.255 m³/s	-293.33	-0.29333 m³/s

1st – 30th April 2017

UTC+1.00	1. Caerphilly Council Sewer Outfall SUM [lps*s]		1. Caerphilly Council River Outfall SUM [lps*s]	
2017-04-01, Sa	529217.75	529.217 m³/s	15976.50	15.97650 m³/s
2017-04-02, Su	369055.06	369.055 m³/s	-241.35	-0.24135 m³/s
2017-04-03, Mo	304444.03	304.444 m³/s	-112.05	-0.11205 m³/s
2017-04-04, Tu	277262.59	277.262 m³/s	-840.53	-0.84053 m³/s
2017-04-05, We	255208.05	255.208 m³/s	-48.45	-0.04845 m³/s
2017-04-06, Th	240888.89	240.888 m³/s	-159.74	-0.15974 m³/s
2017-04-07, Fr	229807.64	229.807 m³/s	-122.85	-0.12285 m³/s
2017-04-08, Sa	224358.75	224.358 m³/s	-290.18	-0.29018 m³/s
2017-04-09, Su	219897.41	219.897 m³/s	-747.67	-0.74767 m³/s
2017-04-10, Mo	208781.16	208.781 m³/s	-184.80	-0.18480 m³/s
2017-04-11, Tu	203125.86	203.125 m³/s	5.85	0.00585 m³/s
2017-04-12, We	199154.88	199.154 m³/s	-146.48	-0.14648 m³/s
2017-04-13, Th	193955.84	193.955 m³/s	102.07	0.10207 m³/s
2017-04-14, Fr	194264.27	194.264 m³/s	-406.65	-0.40665 m³/s

2017-04-15, Sa	187957.75	187.957 m³/s	-39.00	-0.03900 m³/s
2017-04-16, Su	182220.81	182.220 m³/s	58.19	0.05819 m³/s
2017-04-17, Mo	174032.27	174.032 m³/s	-105.68	-0.10568 m³/s
2017-04-18, Tu	165419.30	165.419 m³/s	160.87	0.16087 m³/s
2017-04-19, We	161387.67	161.387 m³/s	-29.53	-0.02953 m³/s
2017-04-20, Th	157007.19	157.007 m³/s	-427.62	-0.42762 m³/s
2017-04-21, Fr	157298.72	157.298 m³/s	-71.13	-0.07113 m³/s
2017-04-22, Sa	155899.58	155.899 m³/s	-386.02	-0.38602 m³/s
2017-04-23, Su	154807.25	154.807 m³/s	-243.90	-0.24390 m³/s
2017-04-24, Mo	162822.77	162.822 m³/s	174.75	0.17475 m³/s
2017-04-25, Tu	163635.69	163.635 m³/s	-69.67	-0.06967 m³/s
2017-04-26, We	157377.11	157.377 m³/s	396.62	0.39662 m³/s
2017-04-27, Th	155145.67	155.145 m³/s	290.12	0.29012 m³/s
2017-04-28, Fr	149091.11	149.091 m³/s	200.69	0.20069 m³/s
2017-04-29, Sa	148644.48	148.644 m³/s	24.87	0.002487 m³/s
2017-04-30, Su	152632.23	152.632 m³/s	-525.07	-0.52507 m³/s

1st – 31st May 2017

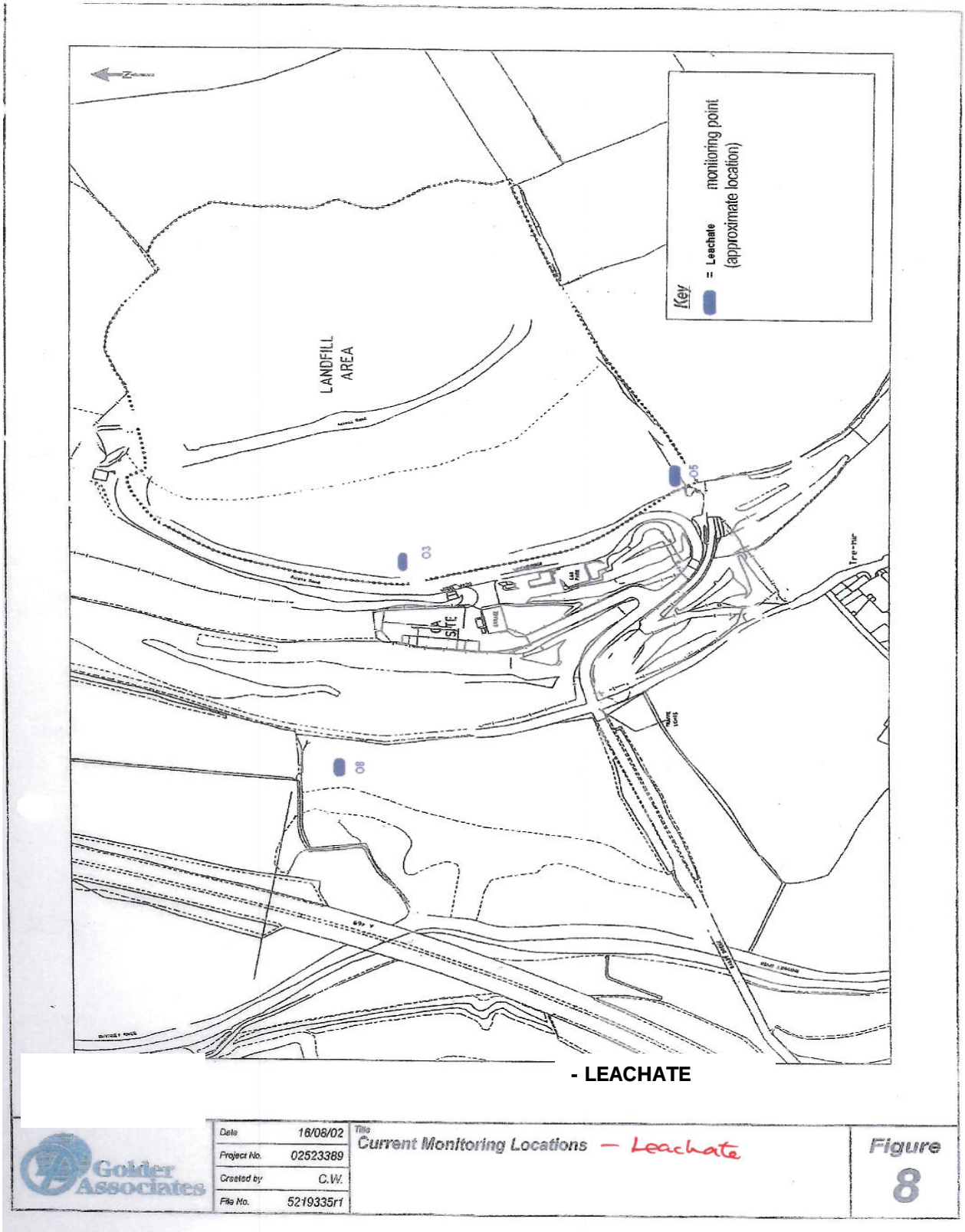
UTC+1.00	1. Caerphilly Council Sewer Outfall SUM [lps*s]		1. Caerphilly Council River Outfall SUM [lps*s]	
2017-05-01, Mo	161465.64	161.465 m³/s	-53.95	-0.05395 m³/s
2017-05-02, Tu	152248.03	152.248 m³/s	-30.22	-.0.03022 m³/s
2017-05-03, We	147013.91	147.013 m³/s	159.56	0.15956 m³/s
2017-05-04, Th	145142.23	145.142 m³/s	-60.36	-0.06036 m³/s
2017-05-05, Fr	141277.88	141.277 m³/s	-685.09	-0.68509 m³/s
2017-05-06, Sa	140834.11	140.834 m³/s	-114.06	-0.11406 m³/s
2017-05-07, Su	142475.75	142.475 m³/s	-177.18	-0.17718 m³/s
2017-05-08, Mo	137156.20	137.156 m³/s	-50.88	-0.05088 m³/s
2017-05-09, Tu	136852.39	136.852 m³/s	-61.01	-0.06101 m³/s
2017-05-10, We	144808.19	144.808 m³/s	29.01	0.02901 m³/s
2017-05-11, Th	157643.16	157.643 m³/s	-541.58	-0.54158 m³/s
2017-05-12, Fr	169815.33	169.815 m³/s	-91.48	-0.09148 m³/s
2017-05-13, Sa	157373.27	157.373 m³/s	-211.39	-0.21139 m³/s
2017-05-14, Su	158842.59	158.842.m³/s	-227.78	-0.22778 m³/s
2017-05-15, Mo	199157.83	199.157 m³/s	-36.48	-0.03648 m³/s
2017-05-16, Tu	220292.91	220.292 m³/s	-635.69	-0.63569 m³/s
2017-05-17, We	258984.77	258.984 m³/s	23.32	0.02332 m³/s
2017-05-18, Th	220804.84	220.804 m³/s	-74.98	-0.07498 m³/s
2017-05-19, Fr	175274.66	175.274 m³/s	-104.19	-0.10419 m³/s
2017-05-20, Sa	156552.72	156.552 m³/s	140.94	0.14094 m³/s
2017-05-21, Su	145336.31	145.336 m³/s	-734.94	-0.73494 m³/s
2017-05-22, Mo	140584.27	140.584.m³/s	-382.04	-0.38204 m³/s
2017-05-23, Tu	136727.75	136.727 m³/s	-333.56	-0.33356 m³/s
2017-05-24, We	132202.17	132.202 m³/s	-742.03	-0.74203 m³/s

2017-05-25, Th	127960.41	127.960 m³/s	-748.70	-0.74870 m³/s
2017-05-26, Fr	126037.40	126.037 m³/s	-1014.84	-1.01484 m³/s
2017-05-27, Sa	137278.55	137.278 m³/s	533.00	0.53300 m³/s
2017-05-28, Su	125962.22	125.962 m³/s	-521.64	-0.52164 m³/s
2017-05-29, Mo	126132.92	126.132 m³/s	-348.96	-0.34896 m³/s
2017-05-30, Tu	121257.09	121.257 m³/s	-249.00	-0.24900 m³/s
2017-05-31, We	120372.27	120.372 m³/s	-157.72	-0.15772 m³/s

1st – 30th June 2017

UTC+1.00	1. Caerphilly Council Sewer Outfall SUM [lps*s]		1. Caerphilly Council River Outfall SUM [lps*s]	
2017-06-01, Th	117553.64	117.553 m³/s	-872.28	-0.87228 m³/s
2017-06-02, Fr	117683.94	117.683 m³/s	-372.17	-0.37217 m³/s
2017-06-03, Sa	114366.54	114.366 m³/s	-87.53	-0.08753 m³/s
2017-06-04, Su	116348.35	116.348 m³/s	31.30	0.03130 m³/s
2017-06-05, Mo	324443.88	324.443 m³/s	10370.47	10.3707 m³/s
2017-06-06, Tu	303772.66	303.772 m³/s	-646.31	-0.64631 m³/s
2017-06-07, We	199989.11	199.989 m³/s	-236.65	-0.23665 m³/s
2017-06-08, Th	531969.75	531.969 m³/s	25478.41	25.47841 m³/s
2017-06-09, Fr	352478.88	352.478 m³/s	-665.86	-0.66586 m³/s
2017-06-10, Sa	287296.88	287.296 m³/s	-377.24	-0.37724 m³/s
2017-06-11, Su	317299.94	317.299 m³/s	-1032.35	-1.03235 m³/s
2017-06-12, Mo	221000.72	221.000 m³/s	-209.17	-0.20917 m³/s
2017-06-13, Tu	179865.52	179.865 m³/s	-382.66	-0.38266 m³/s
2017-06-14, We	162267.80	162.267 m³/s	-371.73	-0.37173 m³/s
2017-06-15, Th	155641.78	155.641 m³/s	-252.44	-0.25244 m³/s
2017-06-16, Fr	147937.80	147.937 m³/s	-652.82	-0.65282 m³/s
2017-06-17, Sa	143994.73	143.994 m³/s	-641.79	-0.64179 m³/s
2017-06-18, Su	140968.83	140.968 m³/s	-768.80	-0.76880 m³/s
2017-06-19, Mo	136811.59	136.811 m³/s	-999.03	-0.99903 m³/s
2017-06-20, Tu	134701.38	134.701 m³/s	-1006.72	-1.00672 m³/s
2017-06-21, We	135733.25	135.733. m³/s	-972.53	-0.97253 m³/s
2017-06-22, Th	124779.69	124.779 m³/s	-915.57	-0.91557 m³/s
2017-06-23, Fr	116927.23	116.927 m³/s	-192.04	-0.19204 m³/s
2017-06-24, Sa	115779.55	115.779 m³/s	-269.95	-0.26995 m³/s
2017-06-25, Su	115235.78	115.235 m³/s	-89.46	-0.08946 m³/s
2017-06-26, Mo	115325.77	115.325 m³/s	-142.23	-0.14223 m³/s
2017-06-27, Tu	115861.31	115.861 m³/s	-742.07	-0.74207 m³/s
2017-06-28, We	128070.38	128.070 m³/s	75.90	0.07590 m³/s
2017-06-29, Th	124901.80	124.901 m³/s	124.50	0.12450 m³/s
2017-06-30, Fr	122237.84	122.237 m³/s	73.63	0.07363 m³/s

APPENDIX 7 - Leachate Monitoring Location Plan



APPENDIX 8 - Leachate Test Results - 03, 05, 08

Borehole No. 03 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	-	-	-	-	-	-	-	9.3	18.1	10.5	-	-
Cadmium Total as Cd	Mg/l	-	-	-	-	-	-	-				-	-
Calcium, Total as Ca	Mg/l	-	-	-	-	-	-	-		105		-	-
Chromium, Total as Cr	Mg/l	-	-	-	-	-	-	-				-	-
Copper, Total as Cu	Mg/l	-	-	-	-	-	-	-				-	-
Iron, Total as Fe	Mg/l	-	-	-	-	-	-	-				-	
Lead, Total as Pb	Mg/l	-	-	-	-	-	-	-				-	-
Magnesium, Total as Mg	Mg/l	-	-	-	-	-	-	-		36.2		-	-
Manganese, Total as Mn	Mg/l	-	-	-	-	-	-	-				-	-
Nickel, Total as Ni	Mg/l	-	-	-	-	-	-	-				-	-
Potassium, Total as K	Mg/l	-	-	-	-	-	-	-		69.1		-	-
Sodium, Total as Na	Mg/l	-	-	-	-	-	-	-		140		-	-
Zinc, Total as Zn	Mg/l	-	-	-	-	-	-	-				-	-
pH	PH units	-	-	-	-	-	-	-	8.0	7.3	7.7	-	-
Conductivity – Electrical 20C	uS/cm	-	-	-	-	-	-	-	1890	2140	3550	-	-
Alkalinity as CaCO3	Mg/l	-	-	-	-	-	-	-		806		-	-
Ammoniacal Nitrogen as N	Mg/l	-	-	-	-	-	-	-	90.7	98.2	12.3	-	-
Chloride as CI	Mg/l	-	-	-	-	-	-	-	155	162	344	-	-
Nitrogen, Total Oxidised as N	Mg/l	-	-	-	-	-	-	-		5.4		-	-
Sulphate as SO4	Mg/l	-	-	-	-	-	-	-		25.8		-	-
Dissolved Oxygen concentration	Mg/l	-	-	-	-	-	-	-				-	-
COD (Total)	Mg/l	-	-	-	-	-	-	-	109	97.0	282	-	-
TOC (Filtered)	Mg/l	-	-	-	-	-	-	-		29.1		-	-
Water Level to top of Casing	m	-	-	-	-	-	-	-				-	-
BOD	Mg/l	-	-	-	-	-	-	-	7	6	15	-	-

Borehole No. 05 July 2016– June 2017

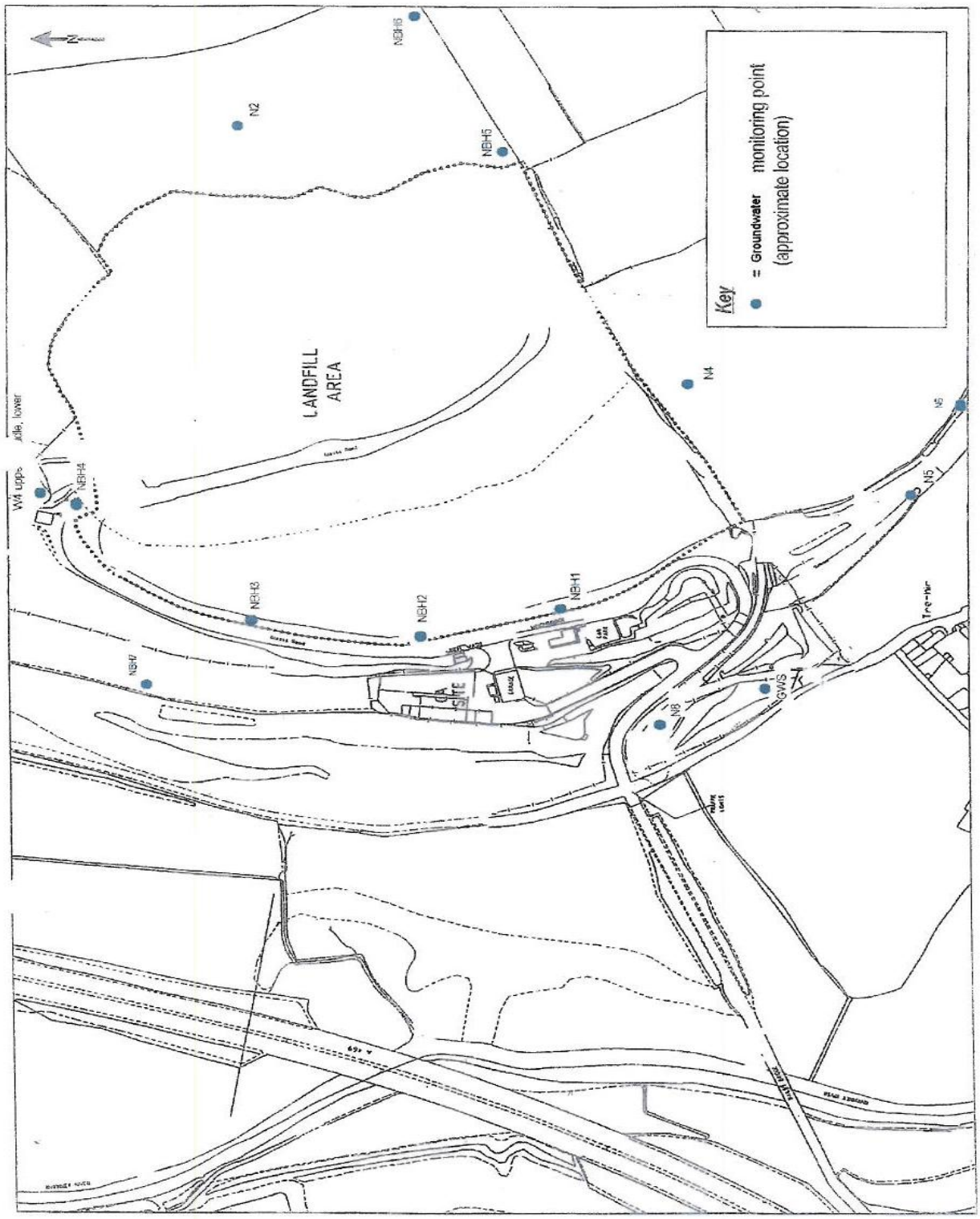
	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Total as Cd	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Calcium, Total as Ca	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, Total as Cr	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Copper, Total as Cu	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Iron, Total as Fe	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Lead, Total as Pb	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium, Total as Mg	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Manganese, Total as Mn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nickel, Total as Ni	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Potassium, Total as K	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sodium, Total as Na	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Zinc, Total as Zn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
pH	PH units	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity – Electrical 20C	uS/cm	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity as CaCO3	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Ammoniacal Nitrogen as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chloride as CI	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen, Total Oxidised as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate as SO4	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen concentration	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
COD (Total)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
TOC (Filtered)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chloride as Cl, High Level		-	-	-	-	-	-	-	-	-	-	-	-
Water Level to top of Casing	m	-	-	-	-	-	-	-	-	-	-	-	-
BOD	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-

Borehole No. 08 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	15.5	16.9	14.1	15.2	10.9	11.1	10.0	6.2	11.6	11.6	12.3	14.5
Cadmium Total as Cd	Mg/l						<0.0006						<0.0006
Calcium, Total as Ca	Mg/l						92.4			89.6			69.3
Chromium, Total as Cr	Mg/l						0.004						0.005
Copper, Total as Cu	Mg/l						<0.009						<0.009
Iron, Total as Fe	Mg/l						1.20						1.01
Lead, Total as Pb	Mg/l						<0.006						<0.006
Magnesium, Total as Mg	Mg/l						23.8			23.5			22.3
Manganese, Total as Mn	Mg/l						0.563						0.631
Nickel, Total as Ni	Mg/l						0.014						0.012
Potassium, Total as K	Mg/l						39.9			43.3			51.9
Sodium, Total as Na	Mg/l						93.9			84.7			111
Zinc, Total as Zn	Mg/l						0.08						<0.018
pH	PH units	7.1	8.3	8.2	8.0	7.9	8.0	7.7	8.3	8.0	8.1	7.5	7.7
Conductivity – Electrical 20C	uS/cm	2210	1180	1260	1030	1140	1290	1080	1440	1420	1670	1080	1610
Alkalinity as CaCO3	Mg/l						476			429			550
Ammoniacal Nitrogen as N	Mg/l	4.16	20.1	35.3	43.3	15.9	43.0	22.6	51.7	49.9	4.02	13.5	62.1
Chloride as CI High level	Mg/l	223	119	134	103	104	124	84.7	113	104	166	325	142
Nitrogen, Total Oxidised as N	Mg/l						20.9			16.1			20.1
Sulphate as SO4	Mg/l						23.4			21.1			17.2
Dissolved Oxygen Fixed	Mg/l						*Analyst Comment 15749320						4.7
Dissolved Oxygen Unfixed							3.4						
COD (Total)	Mg/l	141	65.0	67.0	62.0	77.0	73.0	58.0	70.0	89.0	111	41.0	90.0
TOC (Filtered)	Mg/l						22.1			20.5			28.1
Water Level to top of Casing	m												
BOD	Mg/l	7	5	4	6	5		2	4	10	5	5	

***Analyst Comments for 15749320:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised. {/*}Ammonia analysed by colorimetric method{*/} Sample analysed for DO from an unfixed bottle.

APPENDIX 9 - Groundwater Monitoring Locations Plan



Date	16/08/02	Title: Current Monitoring Locations - GROUNDWATER	Figure 8
Project No.	02523369		
Created by	C.W.		
File No.	5219335r1		

APPENDIX 10 - Groundwater Test Results – MHL28, N2, N4, N5, N6, N8, Ground Water Sump NBH1, NBH2, NBH3, NBH4, NBH6, NBH8, Land drain 1, Land drain 2

Borehole No. MHL28 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	14.1	18.4	15.0	17.1	11.0	14.8	11.2	7.3	9.7	12.2	12.8	12.5
Cadmium Total as Cd	Mg/l						<0.0006						<0.0006
Calcium, Total as Ca	Mg/l						126			131			109
Chromium, Total as Cr	Mg/l						0.009						0.017
Copper, Total as Cu	Mg/l						<0.009						<0.009
Iron, Total as Fe	Mg/l						2.69						4.46
Lead, Total as Pb	Mg/l						<0.006						<0.006
Magnesium, Total as Mg	Mg/l						36.5			32.7			47.4
Manganese, Total as Mn	Mg/l						1.22						1.68
Nickel, Total as Ni	Mg/l						0.018						0.026
Potassium, Total as K	Mg/l						84.8			14.0			135
Sodium, Total as Na	Mg/l						167			34.2			295
Zinc, Total as Zn	Mg/l						<0.018						0.02
pH	PH units	7.3	8.1	7.9	8.1	8.0	8.1	7.7	8.3	7.1	8.2	8.0	7.7
Conductivity – Electrical 20C	uS/cm	3560	2270	3010	1810	1610	2140	1380	1870	811	3150	3410	4010
Alkalinity as CaCO3	Mg/l						1070			368			1590
Ammoniacal Nitrogen as N	Mg/l	198	106	196	118	56.1	115	47.3	88.7	0.55	11.3	183	198
Chloride as CI	Mg/l	337	207	339	197	105	192	82.7	156	71.8	314	12.2	345
Nitrogen, Total Oxidised as N	Mg/l						16.0			17.9			25.7
Sulphate as SO4	Mg/l						21.3			15.4			<4.4
Dissolved Oxygen Fixed	Mg/l						*Analyst Comment 15749321						1.8
Dissolved Oxygen Unfixed	Mg/l						2.6						
COD (Total)	Mg/l	265	161	323	144	98.0	186	70.0	102	936	234	245	285
TOC (Filtered)	Mg/l						48.7			7.3			78.0
Water Level to top of Casing	m												
BOD	Mg/l	22	15	19	9	7		4	5	6	7	14	

December *Analyst Comments for 15749321: This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised. {/*}Ammonia analysed by colorimetric method{*/} Sample analysed for DO from an unfixed bottle

Borehole No. N2 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	13.4	13.4	12.1	15.1	11.3	11.1	10.8	8.9	9.8	10.7	12.1	11.7
Cadmium Total as Cd	Mg/l						<0.0006			<0.0006			<0.0006
Calcium, Total as Ca	Mg/l						20.0			20.3			19.7
Chromium, Total as Cr	Mg/l						<0.002			<0.002			<0.002
Copper, Total as Cu	Mg/l						<0.009			<0.009			<0.009
Iron, Total as Fe	Mg/l						1.20			0.35			0.87
Lead, Total as Pb	Mg/l						<0.006			<0.006			<0.006
Magnesium, Total as Mg	Mg/l						9.5			9.7			9.6
Manganese, Total as Mn	Mg/l						0.116			0.021			0.108
Nickel, Total as Ni	Mg/l						0.005			<0.003			<0.003
Potassium, Total as K	Mg/l						0.81			0.92			0.98
Sodium, Total as Na	Mg/l						4.70			4.43			4.69
Zinc, Total as Zn	Mg/l						<0.18			<0.018			<0.018
pH	PH units	6.2	7.3	7.0	6.6	6.5	6.9	6.5	7.4	6.9	7.1	6.7	6.7
Conductivity – Electrical 20C	uS/cm	128	155	136	152	145	179	154	192	199	205	195	186
Alkalinity as CaCO3	Mg/l						78.8			78.4			71.4
Ammoniacal Nitrogen as N	Mg/l	0.44	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41
Chloride as CI	Mg/l	11.8	12.7	12.6	10.4	8.6	9.9	8.2	9.1	12.2	11.6	14.8	12.5
Nitrogen, Total Oxidised as N	Mg/l	7.4					<0.7			0.8			1.0
Sulphate as SO4	Mg/l						11.2			11.8			12.4
Dissolved Oxygen concentration	Mg/l		6.8	6.4	6.0	5.3	3.0	6.4	1.9	3.5	2.0	<0.5	3.5
COD (Total)	Mg/l	<11.0	13.0	14.0	<11.0	41.0	15.0	39.0	<11.0	<11.0	27.0	19.0	<11.0
TOC (Filtered)	Mg/l						<0.7			<0.7			0.8
Water Level to top of Casing	m	9.10	9.40	7.42	9.81	7.03	7.75	4.60	4.23	3.24	10.26	10.71	8.64
BOD	Mg/l												

December - **Analyst Comments for 15749329:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised

Borehole No. N4 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Total as Cd	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Calcium, Total as Ca	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, Total as Cr	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Copper, Total as Cu	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Iron, Total as Fe	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Lead, Total as Pb	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium, Total as Mg	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Manganese, Total as Mn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nickel, Total as Ni	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Potassium, Total as K	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sodium, Total as Na	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Zinc, Total as Zn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
pH	PH units	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity – Electrical 20C	uS/cm	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity as CaCO3	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Ammoniacal Nitrogen as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chloride as CI	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen, Total Oxidised as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate as SO4	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen concentration	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
COD (Total)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
TOC (Filtered)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Water Level to top of Casing	m	-	-	-	-	-	-	-	-	-	-	-	-
BOD	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-

Borehole No. N5 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	-	-	13.0	14.1	10.7	11.1	11.3	9.3	11.5	10.9	11.9	12.1
Cadmium Total as Cd	Mg/l	-	-				<0.0006			<0.0006			<0.0006
Calcium, Total as Ca	Mg/l	-	-				96.2			90.5			103
Chromium, Total as Cr	Mg/l	-	-				0.007			<0.002			0.005
Copper, Total as Cu	Mg/l	-	-				0.036			<0.009			0.012
Iron, Total as Fe	Mg/l	-	-				13.4			5.57			13.3
Lead, Total as Pb	Mg/l	-	-				0.030			<0.006			0.012
Magnesium, Total as Mg	Mg/l	-	-				56.2			52.1			61.2
Manganese, Total as Mn	Mg/l	-	-				1.03			0.788			1.17
Nickel, Total as Ni	Mg/l	-	-				0.054			0.030			0.040
Potassium, Total as K	Mg/l	-	-				7.15			7.92			8.96
Sodium, Total as Na	Mg/l	-	-				49.7			45.3			52.7
Zinc, Total as Zn	Mg/l	-	-				0.145			0.02			0.05
pH	PH units	-	-	7.2	7.0	7.2	7.3	7.0	7.7	7.3	7.6	7.0	7.0
Conductivity – Electrical 20C	uS/cm	-	-	326	639	1370	1250	1310	1120	1130	1130	1240	1390
Alkalinity as CaCO3	Mg/l	-	-				495			356			464
Ammoniacal Nitrogen as N	Mg/l	-	-	<0.41	0.56	2.18	1.82	2.21	1.29	1.59	2.10	2.33	2.81
Chloride as CI	Mg/l	-	-	32.1	91.7	223	218	214	174	165	180	206	223
Nitrogen, Total Oxidised as N	Mg/l	-	-				<0.7			<0.7			<0.7
Sulphate as SO4	Mg/l	-	-				16.7			15.3			15.1
Dissolved Oxygen concentration	Mg/l	-	-	4.7	6.0	0.5	2.0	0.5	1.0	4.3	7.3	<0.5	<0.5
COD (Total)	Mg/l	-	-	60.0	15.0	113	216	212	248	64.0	252	318	192
TOC (Filtered)	Mg/l	-	-				17.4			10.4			13.8
Water Level to top of Casing	m	-	-	6.98	5.79	7.90	Blocked	5.57	3.28	2.34	5.45	7.77	7.36
BOD	Mg/l	-	-										

December - Analyst Comments for 15749323: This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. N6 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	13.7	13.8	12.3	14.3	11.9	11.3	11.1	9.1	11.0	10.9	11.5	15.2
Cadmium Total as Cd	Mg/l						0.0033			0.0019			<0.0006
Calcium, Total as Ca	Mg/l						64.9			62.6			66.6
Chromium, Total as Cr	Mg/l						0.003			<0.002			<0.002
Copper, Total as Cu	Mg/l						0.011			<0.009			<0.009
Iron, Total as Fe	Mg/l						5.62			4.59			5.32
Lead, Total as Pb	Mg/l						0.010			<0.006			<0.006
Magnesium, Total as Mg	Mg/l						38.9			37.7			41.0
Manganese, Total as Mn	Mg/l						7.14			6.50			6.48
Nickel, Total as Ni	Mg/l						0.035			0.025			0.023
Potassium, Total as K	Mg/l						17.4			17.9			22.5
Sodium, Total as Na	Mg/l						46.8			44.0			48.0
Zinc, Total as Zn	Mg/l						0.05			0.03			<0.018
pH	PH units	6.5	7.5	7.2	7.0	7.0	7.1	6.8	7.2	7.0	7.2	6.8	6.8
Conductivity – Electrical 20C	uS/cm	885	968	907	847	962	916	918	886	957	945	967	1020
Alkalinity as CaCO3	Mg/l						472			385			459
Ammoniacal Nitrogen as N	Mg/l	20.0	21.5	19.3	19.7	21.4	20.3	20.0	17.1	17.6	20.1	22.6	24.0
Chloride as CI	Mg/l	59.0	63.8	66.3	63.0	60.5	67.4	59.0	55.4	62.8	57.8	62.6	62.3
Nitrogen, Total Oxidised as N	Mg/l						<0.7			<0.7			<0.7
Sulphate as SO4	Mg/l						22.7			21.0			17.1
Dissolved Oxygen concentration	Mg/l	2.6	2.6	0.5	0.6	0.5	1.0	<0.5	0.7	0.5	<0.5	<0.5	<0.5
COD (Total)	Mg/l	59.0	60.0	69.0	36.0	71.0	53.0	104	49.0	50.0	89.0	50.0	26.0
TOC (Filtered)	Mg/l						8.4			7.1			7.8
Water Level to top of Casing	m	0.00	0.00	0.00	0.00	0.00		0.00	0.00		0.50	1.30	10.00
BOD	Mg/l												

December - **Analyst Comments for 15749324:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. N8 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	12.9	14.1	12.8	12.2	9.3	11.1	11.1	9.3	11.2	10.9	11.7	12.1
Cadmium Total as Cd	Mg/l						<0.0006			<0.0006			<0.0006
Calcium, Total as Ca	Mg/l						85.1			72.3			68.2
Chromium, Total as Cr	Mg/l						<0.002			<0.002			0.003
Copper, Total as Cu	Mg/l						<0.009			<0.009			<0.009
Iron, Total as Fe	Mg/l						1.54			2.02			4.07
Lead, Total as Pb	Mg/l						<0.006			<0.006			0.008
Magnesium, Total as Mg	Mg/l						46.3			44.2			43.5
Manganese, Total as Mn	Mg/l						1.33			1.24			1.17
Nickel, Total as Ni	Mg/l						0.010			0.011			0.012
Potassium, Total as K	Mg/l						2.78			2.59			2.64
Sodium, Total as Na	Mg/l						15.1			13.6			13.0
Zinc, Total as Zn	Mg/l						0.03			<0.018			0.03
pH	PH units	6.7	8.0	7.7	7.3	7.3	7.5	7.2	7.8	7.4	7.7	7.2	7.2
Conductivity – Electrical 20C	uS/cm	851	859	800	799	848	832	816	808	863	862	805	852
Alkalinity as CaCO3	Mg/l						189			129			123
Ammoniacal Nitrogen as N	Mg/l	3.00	1.88	2.29	1.48	1.14	1.73	0.75	<0.41	<0.41	<0.41	<0.41	<0.41
Chloride as CI	Mg/l	189	186	188	194	186	191	195	193	201	197	193	195
Nitrogen, Total Oxidised as N	Mg/l						<0.7			<0.7			<0.7
Sulphate as SO4	Mg/l						27.3			36.8			44.1
Dissolved Oxygen concentration	Mg/l	5.9	2.1	1.7	1.8	2.1	1.9	3.8	4.6	6.6	5.9	<0.5	6.0
COD (Total)	Mg/l	36.0	43.0	35.0	20.0	54.0	28.0	29.0	58.0	40.0	88.00	49.0	43.0
TOC (Filtered)	Mg/l						2.1			1.8			1.7
Water Level to top of Casing	m	4.10	4.30	4.19	4.51	2.96	4.49	3.0	2.72	2.2	2.83	3.17	4.59
BOD	Mg/l												

December - **Analyst Comments for 15749325:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. SUMP July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	15.0	14.0	14.1	13.2	11.1	11.0	9.5	8.9	15.7	10.7	11.1	-
Cadmium Total as Cd	Mg/l						0.0053			<0.0006			-
Calcium, Total as Ca	Mg/l						82.6			102			-
Chromium, Total as Cr	Mg/l						0.014			0.007			-
Copper, Total as Cu	Mg/l						0.021			0.031			-
Iron, Total as Fe	Mg/l						221			3.68			-
Lead, Total as Pb	Mg/l						0.043			<0.006			-
Magnesium, Total as Mg	Mg/l						26.6			29.0			-
Manganese, Total as Mn	Mg/l						11.3			1.23			-
Nickel, Total as Ni	Mg/l						0.040			0.014			-
Potassium, Total as K	Mg/l						24.6			62.9			-
Sodium, Total as Na	Mg/l						58.0			126			-
Zinc, Total as Zn	Mg/l						0.354			0.04			-
pH	PH units	6.8	7.7	7.5	7.4	7.2	7.3	7.0	7.3	8.0	7.4	7.0	-
Conductivity – Electrical 20C	uS/cm	3290	1470	1350	1230	1320	1250	911	967	1960	1480	1440	-
Alkalinity as CaCO3	Mg/l						460			746			-
Ammoniacal Nitrogen as N	Mg/l	25.1	18.7	21.2	21.0	9.14	10.9	3.23	4.08	96.4	17.8	16.0	-
Chloride as CI	Mg/l	208	192	181	189	147	155	87.9	101	145	202	189	-
Nitrogen, Total Oxidised as N	Mg/l						36.9			9.5			-
Sulphate as SO4	Mg/l						24.0			18.3			-
Dissolved Oxygen concentration	Mg/l	4.6	6.6	2.9	5.4	4.7	5.8	6.6	6.1	7.0	3.8	2.1	-
COD (Total)	Mg/l	106	1110	2280	301	464	137	159	1010	182	1440	815	-
TOC (Filtered)	Mg/l						14.6			24.8			-
Water Level to top of Casing	m												-
BOD	Mg/l												-

-

December - **Analyst Comments for 15749335:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. NBH1 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	12.2	14.5	13.3	17.2	10.7	15.7	14.0	11.7	13.2	13.9	12.7	15.2
Cadmium Total as Cd	Mg/l						0.0018			0.0175			<0.0120
Calcium, Total as Ca	Mg/l						124			443			215
Chromium, Total as Cr	Mg/l						0.023			0.301			0.108
Copper, Total as Cu	Mg/l						0.026			0.374			0.194
Iron, Total as Fe	Mg/l						66.7			785			291
Lead, Total as Pb	Mg/l						0.048			0.697			0.229
Magnesium, Total as Mg	Mg/l						24.3			78.7			47.0
Manganese, Total as Mn	Mg/l						1.82			20.0			7.91
Nickel, Total as Ni	Mg/l						0.042			0.579			0.178
Potassium, Total as K	Mg/l						38.2			30.9			52.8
Sodium, Total as Na	Mg/l						74.5			41.2			116
Zinc, Total as Zn	Mg/l						0.173			2.53			0.939
pH	PH units	6.9	7.2	7.4	7.3	7.3	7.4	7.1	7.3	7.1	7.3	7.1	7.4
Conductivity – Electrical 20C	uS/cm	2350	1930	1490	1480	1720	1340	1470	1310	1270	1890	2300	2620
Alkalinity as CaCO3	Mg/l						666			1150			1320
Ammoniacal Nitrogen as N	Mg/l	76.6	55.2	42.4	44.6	28.6	22.0	23.6	21.7	17.5	57.0	72.6	82.9
Chloride as CI	Mg/l	237	207	143	174	162	116	110	84.2	81.8	187	249	278
Nitrogen, Total Oxidised as N	Mg/l						9.0			4.7			15.7
Sulphate as SO4	Mg/l						30.5			<4.4			20.1
Dissolved Oxygen concentration	Mg/l	0.5	1.0	1.7	<0.5	0.8	1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
COD (Total)	Mg/l	155	111	109	187	170	371	6780	3150	972	10800	10400	3240
TOC (Filtered)	Mg/l						20.7			12.8			50.0
Water Level to top of Casing	m	3.00	3.10	3.22	3.15	2.51	3.70	3.75	4.20	2.66	3.30	3.27	3.60
BOD	Mg/l						-						

December - **Analyst Comments for 15749326:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised

Borehole No. NBH2 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	-	-	-	-	-	-	-	-	-	-	-	14.9
Cadmium Total as Cd	Mg/l	-	-	-	-	-	-	-	-	-	-	-	<0.0060
Calcium, Total as Ca	Mg/l	-	-	-	-	-	-	-	-	-	-	-	138
Chromium, Total as Cr	Mg/l	-	-	-	-	-	-	-	-	--	-	-	<0.020
Copper, Total as Cu	Mg/l	-	-	-	-	-	-	-	-		-	-	0.123
Iron, Total as Fe	Mg/l	-	-	-	-	-	-	-	-	-	-	-	43.5
Lead, Total as Pb	Mg/l	-	-	-	-	-	-	-	-	-	-	-	0.147
Magnesium, Total as Mg	Mg/l	-	-	-	-	-	-	-	-	-	-	-	38.2
Manganese, Total as Mn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	2.51
Nickel, Total as Ni	Mg/l	-	-	-	-	-	-	-	-	-	-	-	0.057
Potassium, Total as K	Mg/l	-	-	-	-	-	-	-	-	-	-	-	33.6
Sodium, Total as Na	Mg/l	-	-	-	-	-	-	-	-	-	-	-	67.4
Zinc, Total as Zn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	1.95
pH	PH units	-	-	-	-	-	-	-	-	-	-	-	7.0
Conductivity – Electrical 20C	uS/cm	-	-	-	-	-	-	-	-	-	-	-	2140
Alkalinity as CaCO3	Mg/l	-	-	-	-	-	-	-	-	-	-	-	1080
Ammoniacal Nitrogen as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	90.3
Chloride as CI	Mg/l	-	-	-	-	-	-	-	-	-	-	-	164
Nitrogen, Total Oxidised as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	<0.7
Sulphate as SO4	Mg/l	-	-	-	-	-	-	-	-	-	-	-	<4.4
Dissolved Oxygen concentration	Mg/l	-	-	-	-	-	-	-	-	-	-	-	<0.5
COD (Total)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	598
TOC (Filtered)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	26.7
Water Level to top of Casing	m	-	-	-	-	-	-	-	-	-	-	-	3.46
BOD	Mg/l	-	-	-	-	-	-	-	-	-	-	-	

Borehole No. NBH3 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	14.1	15.0	13.9	15.1	9.3	14.2	8.2	7.9	12.3	12.3	14.2	14.2
0.0006Cadmium Total as Cd	Mg/l						<0.0006			<0.0006			0.0006
Calciu124m, Total as Ca	Mg/l						139			123			124
Chromium0.008, Total as Cr	Mg/l						0.003			0.005			0.008
Copper, Total as0.015 Cu	Mg/l						<0.009			0.011			0.015
Iron, Total as Fe109	Mg/l						41.6			18.4			109
Lead, Total as Pb0.014	Mg/l						0.007			0.007			0.014
Magnesium, Total as M24.6g	Mg/l						25.1			19.7			24.6
Manganese, Total as Mn	Mg/l						1.35			1.27			1.76
Nickel, Total as Ni	Mg/l						0.016			0.016			0.026
Potassium, Total as K	Mg/l						18.6			14.2			20.1
Sodium, Total as Na	Mg/l						32.1			18.4			32.7
Zinc, Total as Zn	Mg/l						0.03			0.05			0.05
pH	PH units	6.6	7.0	7.1	6.9	6.8	6.9	6.7	6.9	6.8	6.8	6.7	6.8
Conductivity – Electrical 20C	uS/cm	1380	1060	1110	1080	1170	1010	886	979	913	957	1290	1430
Alkalinity as CaCO3	Mg/l						577			404			705
Ammoniacal Nitrogen as N	Mg/l	26.6	19.4	19.8	18.5	15.7	13.6	7.32	9.32	7.99	11.7	24.9	26.9
Chloride as CI	Mg/l	62.6	51.5	42.3	46.2	42.3	42.9	28.0	32.2	25.9	31.7	59.9	60.7
Nitrogen, Total Oxidised as N	Mg/l						6.4			3.8			4.7
Sulphate as SO4	Mg/l						27.1			33.4			26.4
Dissolved Oxygen concentration	Mg/l	<0.5	2.4	1.7	2.0	0.9	1.9	2.6	3.3	1.7	0.8	<0.5	2.2
COD (Total)	Mg/l	153	103	62.0	20.0	150	56.0	225	112	118	62.0	64.0	246
TOC (Filtered)	Mg/l						8.0			4.4			10.2
Water Level to top of Casing	M	7.45	6.50	6.50	8.42	5.94	6.33	5.33	6.41	5.50	7.10	7.20	6.85
BOD	Mg/l												

December - **Analyst Comments for 15749327:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. NBH4 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	13.6	13.0	14.3	13.8	10.6	13.4	8.7	8.9	13.0	13.2	-	-
Cadmium Total as Cd	Mg/l						0.0014			<0.0006		-	-
Calcium, Total as Ca	Mg/l						47.5			88.8		-	-
Chromium, Total as Cr	Mg/l						0.002			<0.002		-	-
Copper, Total as Cu	Mg/l						0.011			<0.009		-	-
Iron, Total as Fe	Mg/l						89.1			10.9		-	-
Lead, Total as Pb	Mg/l						0.013			<0.006		-	-
Magnesium, Total as Mg	Mg/l						15.2			24.2		-	-
Manganese, Total as Mn	Mg/l						9.88			6.07		-	-
Nickel, Total as Ni	Mg/l						0.049			0.016		-	-
Potassium, Total as K	Mg/l						2.23			3.57		-	-
Sodium, Total as Na	Mg/l						8.12			8.41			-
Zinc, Total as Zn	Mg/l						0.05			<0.018		-	
pH	PH units	6.3	7.4	6.9	6.6	6.4	6.6	6.4	6.9	6.8	6.6	-	-
Conductivity – Electrical 20C	uS/cm	427	410	395	448	482	411	542	583	633	468	-	-
Alkalinity as CaCO3	Mg/l						171			308		-	-
Ammoniacal Nitrogen as N	Mg/l	1.24	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	-	-
Chloride as CI	Mg/l	13.3	14.6	15.3	12.9	10.9	14.7	13.6	14.3	12.8	16.4	-	-
Nitrogen, Total Oxidised as N	Mg/l						<0.7			<0.7		-	-
Sulphate as SO4	Mg/l						62.7			64.6		-	-
Dissolved Oxygen concentration	Mg/l	4.4	7.1	6.8	9.2	5.9	11.7	3.7	6.5	6.6	5.3	-	-
COD (Total)	Mg/l	62.0	43.0	61.0	<11.0	238	181	84.0	90.0	30.0	73.0	-	-
TOC (Filtered)	Mg/l						1.9			2.5		-	-
Water Level to top of Casing	m	17.20	12.51	17.49	16.50	15.53	17.5	17.6	16.57	16.16	12.20	-	-
BOD	Mg/l											-	-

December - **Analyst Comments for 15749328:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. NBH5 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	12.9	12.7	13.0	13.7	10.7	-	10.8	9.7	9.7	10.6	11.1	10.9
Cadmium Total as Cd	Mg/l						-			<0.0006			<0.0006
Calcium, Total as Ca	Mg/l						-			66.5			64.0
Chromium, Total as Cr	Mg/l						-			<0.002			<0.002
Copper, Total as Cu	Mg/l						-			<0.009			<0.009
Iron, Total as Fe	Mg/l						-			1.00			9.31
Lead, Total as Pb	Mg/l						-			<0006			<0.006
Magnesium, Total as Mg	Mg/l						-			13.9			16.6
Manganese, Total as Mn	Mg/l						-			0.885			1.23
Nickel, Total as Ni	Mg/l						-			<0.003			0.006
Potassium, Total as K	Mg/l						-			5.64			6.08
Sodium, Total as Na	Mg/l						-			8.93			10.4
Zinc, Total as Zn	Mg/l						-			0.06			0.129
pH	PH units	6.2	7.1	6.7	6.6	6.3	-	6.5	7.1	6.9	6.5	6.4	6.5
Conductivity – Electrical 20C	uS/cm	4456	426	519	523	529	-	535	514	475	503	496	507
Alkalinity as CaCO3	Mg/l						-			202			184
Ammoniacal Nitrogen as N	Mg/l	1.61	<0.41	<0.41	<0.41	<0.41	-	<0.41	<0.41	<0.41	0.95	<0.41	0.58
Chloride as CI	Mg/l	16.6	20.2	20.4	18.4	20.6	-	16.4	15.5	12.4	19.1	18.8	17.2
Nitrogen, Total Oxidised as N	Mg/l						-			6.1			6.1
Sulphate as SO4	Mg/l						-			33.7			50.3
Dissolved Oxygen concentration	Mg/l	3.3	4.1	3.6	7.7	1.8	-	2.6	3.4	1.9	1.5	<0.5	2.5
COD (Total)	Mg/l	237	226	1020	36.0	74.0	-	26.0	24.0	22.0	30.0	30.0	18.0
TOC (Filtered)	Mg/l						-			3.2			4.2
Water Level to top of Casing	m	6.70	7.08	6.74	5.35	6.10	-	5.4	5.45	5.21	7.03	7.10	6.21
BOD	Mg/l						-						

December – No sample received – No Test

Borehole No. NBH6 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	13.6	-	13.2	14.3	-	12.4	-	9.5	10.0	-	-	12.1
Cadmium Total as Cd	Mg/l		-			-	<0.0006	-		0.0008	-	-	0.0298
Calcium, Total as Ca	Mg/l		-			-	69.5	-		12.2	-	-	43.5
Chromium, Total as Cr	Mg/l		-			-	<0.002	-		0.004	-	-	0.102
Copper, Total as Cu	Mg/l		-			-	<0.009	-		0.013	-	-	0.605
Iron, Total as Fe	Mg/l		-			-	20.6	-		4.44	-	-	124
Lead, Total as Pb	Mg/l		-			-	<0.006	-		0.013	-	-	0.461
Magnesium, Total as Mg	Mg/l		-			-	16.5	-		5.2	-	-	23.2
Manganese, Total as Mn	Mg/l		-			-	1.35	-		0.430	-	-	4.23
Nickel, Total as Ni	Mg/l		-			-	0.007	-		0.013	-	-	0.473
Potassium, Total as K	Mg/l		-			-	5.52	-		0.99	-	-	<3.60
Sodium, Total as Na	Mg/l		-			-	11.0	-		6.35	-	-	<6.00
Zinc, Total as Zn	Mg/l		-			-	0.02	-		0.02	-	-	1.06
pH	PH units	6.5	-	7.0	6.9	-	6.6	-	7.0	6.8	-	-	6.7
Conductivity – Electrical 20C	uS/cm	238	-	266	250	-	501	-	169	149	-	-	255
Alkalinity as CaCO3	Mg/l		-			-	211	-		40.8	-	-	126
Ammoniacal Nitrogen as N	Mg/l	1.03	-	<0.41	<0.41	-	<0.41	-	<0.41	<0.41	-	-	0.91
Chloride as CI	Mg/l	12.4	-	9.4	9.8	-	20.7	-	12.8	18.0	-	-	13.0
Nitrogen, Total Oxidised as N	Mg/l		-			-	9.8	-		0.9	-	-	<0.7
Sulphate as SO4	Mg/l		-			-	48.3	-		4.5	-	-	16.6
Dissolved Oxygen concentration	Mg/l	4.2	-	2.7	3.6	-	2.2	-	4.8	7.7	-	-	<0.5
COD (Total)	Mg/l	260	-	37.0	<11.0	-	42.0	-	69.0	61.0	-	-	3310
TOC (Filtered)	Mg/l		-			-	4.2	-		<0.7	-	-	1.4
Water Level to top of Casing	m	16.61	-	13.84	12.40	-	5.80	-	8.92	5.82	-	-	18.78
BOD	Mg/l		-			-	-	-			-	-	

December - **Analyst Comments for 15749330:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. NBH8 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Total as Cd	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Calcium, Total as Ca	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, Total as Cr	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Copper, Total as Cu	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Iron, Total as Fe	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Lead, Total as Pb	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium, Total as Mg	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Manganese, Total as Mn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nickel, Total as Ni	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Potassium, Total as K	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sodium, Total as Na	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Zinc, Total as Zn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
pH	PH units	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity – Electrical 20C	uS/cm	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity as CaCO3	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Ammoniacal Nitrogen as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chloride as CI	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen, Total Oxidised as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate as SO4	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen concentration	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
COD (Total)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
TOC (Filtered)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Water Level to top of Casing	m	-	-	-	-	-	-	-	-	-	-	-	-
BOD	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-

Borehole No. LAND DRAIN 1 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	13.1	19.4	12.7	14.1	9.5	12.2	10.6	5.9	13.3	10.3	13.7	13.6
Cadmium Total as Cd	Mg/l						<0.0006			<0.0006			<0.0006
Calcium, Total as Ca	Mg/l						101			88.4			83.4
Chromium, Total as Cr	Mg/l						0.004			0.004			0.010
Copper, Total as Cu	Mg/l						<0.009			<0.009			<0.009
Iron, Total as Fe	Mg/l						1.48			2.19			1.84
Lead, Total as Pb	Mg/l						<0.006			<0.006			<0.006
Magnesium, Total as Mg	Mg/l						35.6			25.3			32.6
Manganese, Total as Mn	Mg/l						1.02			0.838			1.09
Nickel, Total as Ni	Mg/l						0.021			0.011			0.016
Potassium, Total as K	Mg/l						52.4			47.5			86.9
Sodium, Total as Na	Mg/l						118			93.3			192
Zinc, Total as Zn	Mg/l						0.02			<0.018			<0.018
pH	PH units	7.2	8.2	7.9	7.5	8.0	7.9	7.6	8.0	8.0	8.3	7.3	7.6
Conductivity – Electrical 20C	uS/cm	594	1940	2340	516	1560	1570	1220	776	1540	3100	1140	2690
Alkalinity as CaCO3	Mg/l						617			519			1010
Ammoniacal Nitrogen as N	Mg/l	172	72.4	125	2.28	48.0	47.8	32.5	5.65	61.1	198	23.5	145
Chloride as CI	Mg/l	335	200	268	45.4	101	169	83.0	56.6	115	304	124	228
Nitrogen, Total Oxidised as N	Mg/l						33.1			13.8			25.6
Sulphate as SO4	Mg/l						23.6			20.2			11.3
Dissolved Oxygen concentration	Mg/l	1.9	6.1	3.1	4.4	4.0	6.3	6.2	3.9	4.8	1.8	6.7	4.2
COD (Total)	Mg/l	236	114	188	24.0	86.0	77.0	53.0	29.0	103	246	41.0	188
TOC (Filtered)	Mg/l						26.2			20.3			50.5
Water Level to top of Casing	m												
BOD	Mg/l												

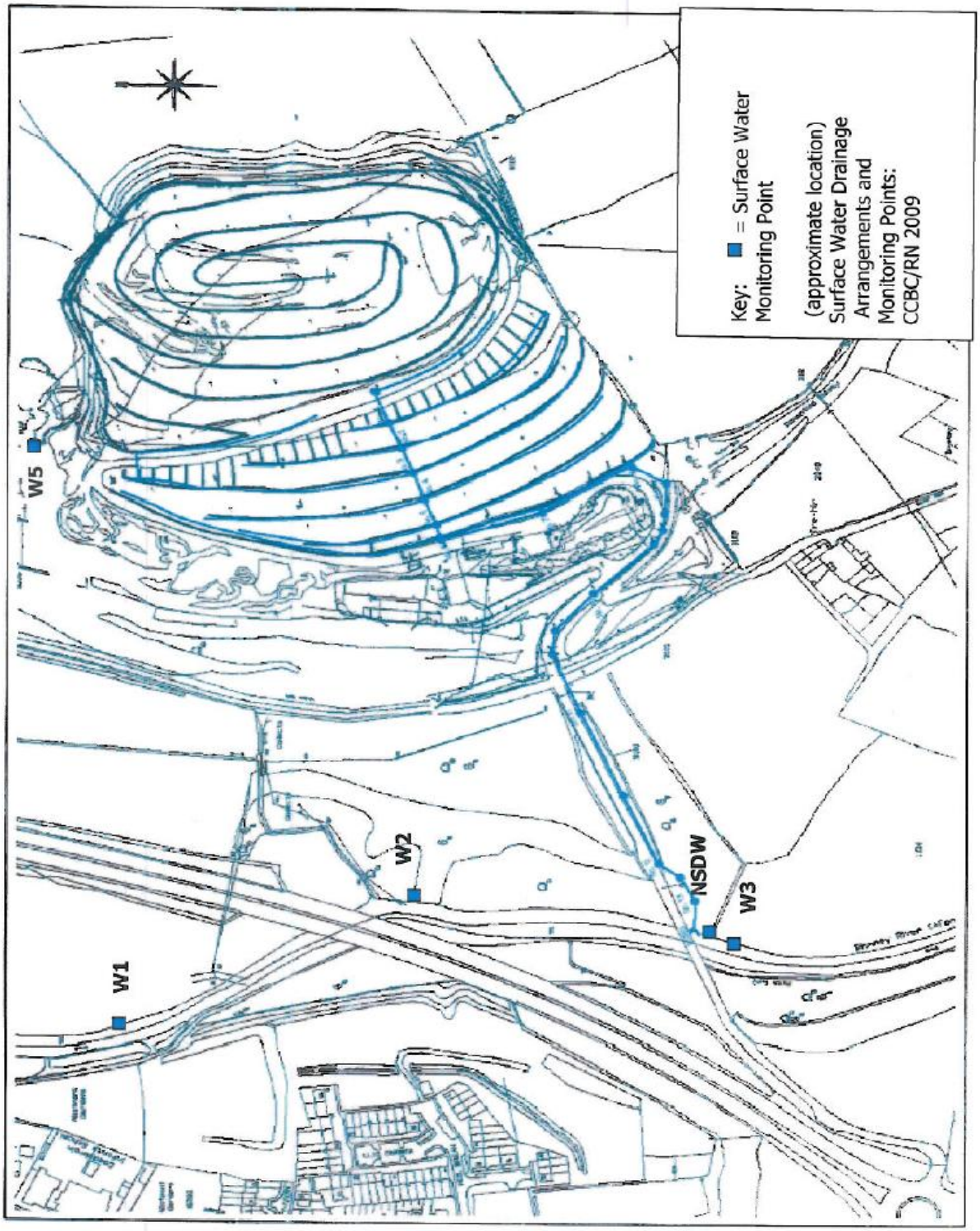
December - **Analyst Comments for 15749336:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. LAND DRAIN 2 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	14.0	18.6	13.0	14.6	9.6	8.5	7.9	5.9	8.9	9.8	11.9	-
Cadmium Total as Cd	Mg/l						<0.0006			<0.0006			-
Calcium, Total as Ca	Mg/l						91.0			80.1			-
Chromium, Total as Cr	Mg/l						<0.002			<0.002			-
Copper, Total as Cu	Mg/l						<0.009			<0.009			-
Iron, Total as Fe	Mg/l						<0.23			<0.23			-
Lead, Total as Pb	Mg/l						<0.006			<0.006			-
Magnesium, Total as Mg	Mg/l						23.5			20.1			-
Manganese, Total as Mn	Mg/l						<0.007			0.044			-
Nickel, Total as Ni	Mg/l						0.009			0.004			-
Potassium, Total as K	Mg/l						13.2			15.5			-
Sodium, Total as Na	Mg/l						58.2			47.2			-
Zinc, Total as Zn	Mg/l						0.02			0.09			-
pH	PH units	7.3	8.5	8.3	8.0	8.2	8.1	7.7	8.3	8.1	8.4	8.1	-
Conductivity – Electrical 20C	uS/cm	939	843	924	726	805	829	753	882	802	860	921	-
Alkalinity as CaCO3	Mg/l						318			257			-
Ammoniacal Nitrogen as N	Mg/l	0.68	<0.41	<0.41	<0.41	<0.41	1.32	<0.41	<0.41	<0.41	<0.41	<0.41	-
Chloride as CI	Mg/l	101	94.9		90.5	94.9	98.6	74.8	89.3	72.1	86.7	97.1	-
Nitrogen, Total Oxidised as N	Mg/l						10.4			15.8			-
Sulphate as SO4	Mg/l						31.6			33.5			-
Dissolved Oxygen concentration	Mg/l	14.4	5.7	8.9	8.7	9.0	12.5	9.9	11.3	9.6	6.2	9.4	-
COD (Total)	Mg/l	421	24.0	50.0	13.0	23.0	13.0	18.0	25.0	30.0	61.0	53.0	-
TOC (Filtered)	Mg/l						5.4			4.1			-
Water Level to top of Casing	m												-
BOD	Mg/l												-

December - **Analyst Comments for 15749338:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

APPENDIX 11 - Surface Water Drainage Arrangements and Monitoring Points



Key: ■ = Surface Water monitoring point (approximate location)

Surface Water Drainage Arrangements and Monitoring Points
CCBC/RN 2009

APPENDIX 12 - Surface Water Analysis Results – W1, W2, W3 W5, New Stream 1, New Stream 2, New Stream 3.

Borehole No. W1 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	16.7	16.3	14.1	14.6	7.3	8.0	9.2	6.1	8.3	12.1	13.2	14.4
Cadmium Total as Cd	Mg/l						<0.0006			<0.0006			<0.0006
Calcium, Total as Ca	Mg/l						28.8			17.0			44.1
Chromium, Total as Cr	Mg/l						<0.002			<0.002			<0.002
Copper, Total as Cu	Mg/l						<0.009			<0.009			<0.009
Iron, Total as Fe	Mg/l						17.8			1.69			0.37
Lead, Total as Pb	Mg/l						<0.006			<0.006			<0.006
Magnesium, Total as Mg	Mg/l						15.8			11.4			22.8
Manganese, Total as Mn	Mg/l						0.335			0.086			0.028
Nickel, Total as Ni	Mg/l						0.005			<0.003			<0.003
Potassium, Total as K	Mg/l						4.94			4.01			8.55
Sodium, Total as Na	Mg/l						15.5			10.3			17.2
Zinc, Total as Zn	Mg/l						0.02			<0.018			<0.018
pH	PH units	8.0	8.2	8.4	8.2	8.0	7.5	7.3	7.8	7.6	8.4	8.1	8.2
Conductivity – Electrical 20C	uS/cm	485	265	406	357	262	308	258	257	243	510	475	478
Alkalinity as CaCO3	Mg/l						110			64.0			148
Ammoniacal Nitrogen as N	Mg/l	1.47	<0.41	<0.41	<0.41	<0.41	0.65	0.51	0.51	<0.41	<0.41	<0.41	<0.41
Chloride as CI	Mg/l	20.0	16.0	15.6	14.5	14.9	29.2	23.3	23.2	21.2	19.2	19.1	17.9
Nitrogen, Total Oxidised as N	Mg/l						2.2			2.0			<0.7
Sulphate as SO4	Mg/l						23.6			26.6			90.9
Dissolved Oxygen concentration	Mg/l	9.7	8.2	10.5	10.4	11.1	9.2	9.0	10.5	9.7	11.1	*	9.8
COD (Total)	Mg/l	<11.0	<11.0	<11.0	<11.0	36.0	24.0	17.0	<11.0	144	16.0	<11.0	<11.0
TOC (Filtered)	Mg/l						2.2			1.1			1.5
Water Level to top of Casing	m												
BOD	Mg/l												

December - **Analyst Comments for 15749331:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

*June 17 - **Analyst Comments for 16105245**: {/*}Fixed Dissolved Oxygen result be provided as an indicative results of >14.5mg/l.{*/}

Borehole No. W2 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	16.5	16.3	14.1	14.5	7.4	8.2	8.9	6.1	8.8	12.0	13.2	14.7
Cadmium Total as Cd	Mg/l						<0.0006			<0.0006			<0.0006
Calcium, Total as Ca	Mg/l						42.6			34.5			43.7
Chromium, Total as Cr	Mg/l						<0.002			<0.002			<0.002
Copper, Total as Cu	Mg/l						<0.009			<0.009			<0.009
Iron, Total as Fe	Mg/l						0.63			0.70			0.33
Lead, Total as Pb	Mg/l						<0.006			<0.006			<0.006
Magnesium, Total as Mg	Mg/l						16.9			13.6			22.7
Manganese, Total as Mn	Mg/l						0.064			0.061			0.029
Nickel, Total as Ni	Mg/l						0.004			<0.003			<0.003
Potassium, Total as K	Mg/l						9.38			7.23			8.54
Sodium, Total as Na	Mg/l						25.0			17.7			16.9
Zinc, Total as Zn	Mg/l						<0.018			<0.018			<0.018
pH	PH units	8.1	8.2	8.4	8.2	8.0	7.8	7.4	7.9	7.6	8.4	8.1	8.2
Conductivity – Electrical 20C	uS/cm	483	265	406	357	261	466	386	293	405	510	474	473
Alkalinity as CaCO3	Mg/l						182			139			147
Ammoniacal Nitrogen as N	Mg/l	1.40	<0.41	<0.41	<0.41	<0.41	4.59	1.18	1.00	2.45	<0.41	<0.41	<0.41
Chloride as CI	Mg/l	20.1	16.0	15.6	13.8	14.2	40.7	32.6	24.8	30.5	18.9	19.1	20.8
Nitrogen, Total Oxidised as N	Mg/l						4.9			4.2			<0.7
Sulphate as SO4	Mg/l						20.2			24.8			92.3
Dissolved Oxygen concentration	Mg/l	8.9	8.4	10.0	10.2	9.2	9.2	9.0	9.2	8.9	10.9	8.7	9.0
COD (Total)	Mg/l	<11.0	12.0	<11.0	<11.0	22.0	18.0	14.0	<11.0	235	14.0	<11.0	<11.0
TOC (Filtered)	Mg/l						4.8			2.6			1.4
Water Level to top of Casing	m												
BOD	Mg/l												

December - **Analyst Comments for 15749332:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. W3 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	16.5	16.1	14.1	14.5	7.1	8.1	8.9	6.1	9.0	12.2	13.2	14.3
Cadmium Total as Cd	Mg/l						<0.0006			<0.0006			<0.0006
Calcium, Total as Ca	Mg/l						33.5			25.0			45.2
Chromium, Total as Cr	Mg/l						<0.002			<0.002			<0.002
Copper, Total as Cu	Mg/l						<0.009			<0.009			<0.009
Iron, Total as Fe	Mg/l						0.43			0.33			0.33
Lead, Total as Pb	Mg/l						<0.006			<0.006			<0.006
Magnesium, Total as Mg	Mg/l						14.1			9.8			23.3
Manganese, Total as Mn	Mg/l						0.019			0.026			0.023
Nickel, Total as Ni	Mg/l						<0.003			<0.003			<0.003
Potassium, Total as K	Mg/l						4.64			3.81			8.80
Sodium, Total as Na	Mg/l						13.7			10.2			17.8
Zinc, Total as Zn	Mg/l						0.07			<0.018			<0.018
pH	PH units	8.1	8.2	8.4	8.2	7.9	8.1	7.8	8.2	8.0	8.4	8.1	8.2
Conductivity – Electrical 20C	uS/cm	1520	262	406	357	261	310	300	296	263	510	475	475
Alkalinity as CaCO3	Mg/l						105			80.8			148
Ammoniacal Nitrogen as N	Mg/l	0.53	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41	<0.41
Chloride as CI	Mg/l	20.4	15.6	15.7	13.6	14.5	16.4	26.4	15.6	14.7	18.9	19.6	19.2
Nitrogen, Total Oxidised as N	Mg/l						<0.7			0.9			<0.7
Sulphate as SO4	Mg/l						51.1			38.7			93.5
Dissolved Oxygen concentration	Mg/l	9.2	8.2	10.2	9.5	9.7	12.8	9.3	11.6	11.4	10.8	8.5	9.2
COD (Total)	Mg/l	<11.0	18.0	<11.0	<11.0	21.0	20.0	19.0	<11.0	114	51.0	<11.0	<11.0
TOC (Filtered)	Mg/l						2.7			1.9			1.4
Water Level to top of Casing	m												
BOD	Mg/l												

December - **Analyst Comments for 15749333:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. W5 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	-	-	15.0	-	9.9	9.2	9.3	9.3	9.6	-	12.4	13.9
Cadmium Total as Cd	Mg/l	-	-		-		<0.006			<0.0006	-		<0.0006
Calcium, Total as Ca	Mg/l	-	-		-		7.45			8.17	-		7.00
Chromium, Total as Cr	Mg/l	-	-		-		<0.002			<0.002	-		<0.002
Copper, Total as Cu	Mg/l	-	-		-		<0.009			<0.009	-		<0.009
Iron, Total as Fe	Mg/l	-	-		-		0.26			<0.23	-		0.24
Lead, Total as Pb	Mg/l	-	-		-		<0.006			<0.006	-		<0.006
Magnesium, Total as Mg	Mg/l	-	-		-		5.7			6.4	-		5.5
Manganese, Total as Mn	Mg/l	-	-		-		0.050			0.041	-		0.058
Nickel, Total as Ni	Mg/l	-	-		-		<0.003			<0.003	-		<0.003
Potassium, Total as K	Mg/l	-	-		-		0.84			1.08	-		1.02
Sodium, Total as Na	Mg/l	-	-		-		6.50			6.18	-		6.09
Zinc, Total as Zn	Mg/l	-	-		-		<0.018			<0.018	-		<0.018
pH	PH units	-	-	7.7	-	7.7	7.6	7.2	7.7	7.3	-	7.7	7.6
Conductivity – Electrical 20C	uS/cm	-	-	1.27	-	126	118	131	133	145	-	127	121
Alkalinity as CaCO3	Mg/l	-	-		-		29.0			24.0	-		23.4
Ammoniacal Nitrogen as N	Mg/l	-	-	<0.41	-	<0.41	<0.41	<0.41	<0.41	<0.41	-	<0.41	<0.41
Chloride as CI	Mg/l	-	-	11.3	-	11.7	12.8	16.2	12.6	17.4	-		15.3
Nitrogen, Total Oxidised as N	Mg/l	-	-		-		1.3			4.6	-		1.9
Sulphate as SO4	Mg/l	-	-		-		6.6			7.2	-		7.3
Dissolved Oxygen concentration	Mg/l	-	-	10.0	-	10.8	9.9	9.5	11.0	10.6	-	6.7	8.8
COD (Total)	Mg/l	-	-	14.0	-	15.0	23.0	15.0	<11.0	92.0	-	<11.0	<11.0
TOC (Filtered)	Mg/l	-	-		-		2.0			<0.7	-		2.00
Water Level to top of Casing	m	-	-		-						-		
BOD	Mg/l	-	-		-						-		

December - **Analyst Comments for 15749334:** This sample has been analysed for Magnesium, Total as Mg, Sodium Total as Na outside recommended stability times. It is therefore possible that the results provided may be compromised.

Borehole No. NEW STREAM 1 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Total as Cd	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Calcium, Total as Ca	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, Total as Cr	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Copper, Total as Cu	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Iron, Total as Fe	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Lead, Total as Pb	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium, Total as Mg	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Manganese, Total as Mn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nickel, Total as Ni	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Potassium, Total as K	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sodium, Total as Na	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Zinc, Total as Zn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
pH	PH units	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity – Electrical 20C	uS/cm	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity as CaCO3	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Ammoniacal Nitrogen as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chloride as CI	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen, Total Oxidised as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate as SO4	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen concentration	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
COD (Total)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
TOC (Filtered)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Water Level to top of Casing	m	-	-	-	-	-	-	-	-	-	-	-	-
BOD	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-

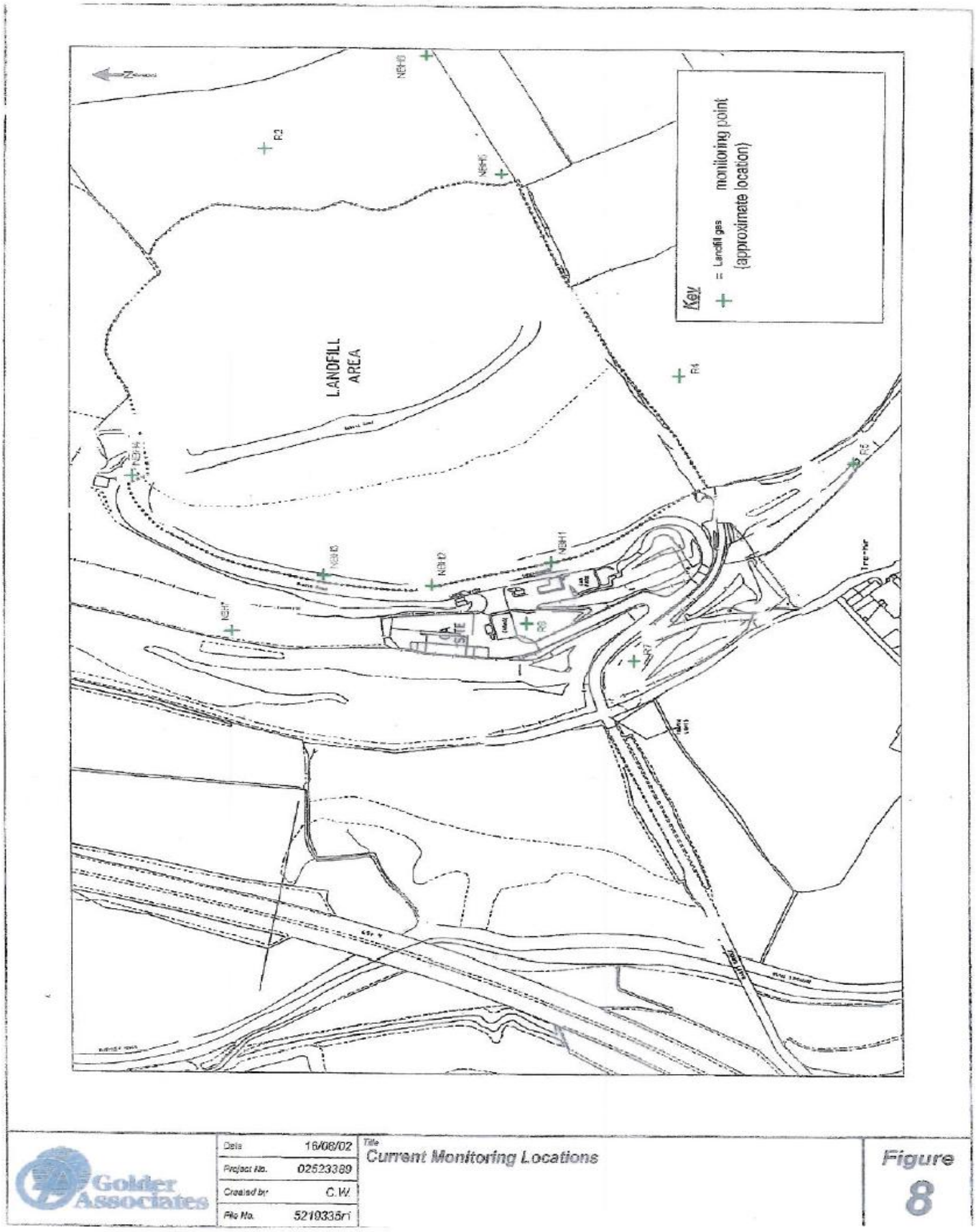
Borehole No. NEW STREAM 2 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Total as Cd	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Calcium, Total as Ca	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, Total as Cr	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Copper, Total as Cu	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Iron, Total as Fe	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Lead, Total as Pb	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium, Total as Mg	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Manganese, Total as Mn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nickel, Total as Ni	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Potassium, Total as K	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sodium, Total as Na	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Zinc, Total as Zn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
pH	PH units	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity – Electrical 20C	uS/cm	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity as CaCO3	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Ammoniacal Nitrogen as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chloride as CI	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen, Total Oxidised as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate as SO4	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen concentration	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
COD (Total)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
TOC (Filtered)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Water Level to top of Casing	m	-	-	-	-	-	-	-	-	-	-	-	-
BOD	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-

Borehole No. NEW STREAM 3 July 2016 – June 2017

	Units	July 16	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	June 17
Field Temperature	Deg C	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Total as Cd	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Calcium, Total as Ca	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, Total as Cr	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Copper, Total as Cu	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Iron, Total as Fe	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Lead, Total as Pb	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium, Total as Mg	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Manganese, Total as Mn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nickel, Total as Ni	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Potassium, Total as K	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sodium, Total as Na	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Zinc, Total as Zn	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
pH	PH units	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity – Electrical 20C	uS/cm	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity as CaCO3	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Ammoniacal Nitrogen as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Chloride as CI	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen, Total Oxidised as N	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate as SO4	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen concentration	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
COD (Total)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
TOC (Filtered)	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-
Water Level to top of Casing	m	-	-	-	-	-	-	-	-	-	-	-	-
BOD	Mg/l	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX 13 - Gas Monitoring Point Locations Plan



APPENDIX 14 - Gas Monitoring Results – N2, N4, N5, N6, N8, W1(U), W1(M), WI(L), NBH1, NBH2, NBH3, NBH4, NBH5, NBH6, NBH7, NBH8, Land Drain 1, Land Drain 2

FIELD MONITORING DATA - July 2016 – June 2017
MONITORING POINT N2

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	N2						
July 16		9.10	13.4	<0.1	0.4	20.1	998
August 16		9.40	13.4	<0.1	0.3	20.1	1009
September 16		7.42	12.1	0.3	3.8	16.6	1004
October 16		9.81	15.1	0.1	0.1	16.3	997
November 16		7.03	11.3	<0.1	4.5	15.7	1011
December 16		7.75	11.1	<0.1	4.3	17.3	1001
January 17		4.60	10.8	0.1	3.4	17.7	992
February 17		4.23	8.9	0.1	3.7	17.6	1007
March 17		3.24	9.8	<0.1	2.8	17.8	997
April 17		1.26	10.7	<0.1	1.8	20.5	1003
May 17	Broken Gas Tap	10.71	12.1	<0.1	0.3	20.8	1005
June 17	Broken Gas Tap	8.64	11.7	<0.1	0.3	20.8	986

MONITORING POINT N4

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	N4						
July 16	Blocked – Gas cap missing	-	-	0.1	0.3	20.2	1001
August 16	Blocked – Gas cap missing	-	-	-	-	-	-
September 16	Blocked	-	-	0.1	0.9	20.2	1011
October 16	Blocked	-	-	<0.1	0.1	20.3	1009
November 16	Blocked	-	-	<0.1	0.3	20.9	1017
December 16	Blocked	-	-	<0.1	0.5	20.6	1006
January 17	Blocked	-	-	<0.1	1.5	19.2	997
February 17	Blocked	-	-	<0.1	0.1	20.9	1014
March 17	Blocked – no bung	-	-	<0.1	0.2	19.7	1003
April 17	No Bung - Dry	12.75	-	<0.1	0.6	20.6	1008
May 17	Blocked – no gas tap	-	-	<0.1	1.0	20.2	1012
June 17	Dry/blocked, no gas tap	2.56	-	<0.1	2.3	18.3	992

MONITORING POINT N5

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	N5						
July 16	Blocked – Gas cap missing	-	-	0.1	0.3	20.7	1001
August 16	Blocked – Gas cap missing	-	-	-	-	-	-
September 16	Spot Sample – not enough tubing. Gas cap installed	6.98	12	0.0	0.2	20	1010
October 16		5.79	14.1	0.1	0.3	19.9	1010
November 16		7.90	10.7	0.2	0.3	20.0	1019
December 16		7.90	11.1	<0.1	0.4	20.7	1006
January 17		5.57	11.3	<0.1	1.8	19.3	997
February 17		3.28	9.3	<0.1	0.1	20.1	1014
March 17		2.34	11.5	<0.1	0.2	20.3	1004
April 17	No bung	5.45	10.9	<0.1	1.1	20.0	1008
May 17		7.77	11.9	<0.1	1.0	19.9	1014
June 17		7.36	12.1	<0.1	0.9	20.5	992

MONITORING POINT N6

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	N6						
July 16	Artesian Well	0.00	13.7	-	-	-	-
August 16	Waterlogged	0.00	13.8	-	-	-	-
September 16	Waterlogged New tubing & valve	0.00	12.3	-	-	-	-
October 16	Artesian Well	0.00	14.3	-	-	-	-
November 16	Artesian Well	0.00	11.9	-	-	-	-
December 16		-	11.3	-	-	-	-
January 17	Artesian Well	-	11.1	-	-	-	-
February 17	Artesian Well	0.00	9.1	-	-	-	-
March 17	Artesian Well	0.00	11.0	-	-	-	-
April 17	No bung	0.50	10.9	<0.1	0.1	20.5	1008
May 17	No gas tap	1.30	11.5	<0.1	0.1	20.7	1014
June 17	Waterrlogged	10.00	15.2	-	-	-	-

MONITORING POINT N8

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	N8						
July 16		4.10	12.9	0.2	2.1	18.9	1001
August 16		4.30	14.1	1.7	3.2	19.3	1005
September 16		4.19	12.8	0.0	0.2	20.3	1010
October 16		4.51	12.2	0.1	0.2	21.3	1006
November 16		2.96	9.3	0.2	0.2	20.6	1016
December 16		2.96	11.1	<0.1	0.5	19.3	1005
January 17		3.00	11.1	<0.1	0.4	20.2	999
February 17		2.72	9.3	<0.1	0.2	20.9	1014
March 17		2.20	11.2	<0.1	0.3	20.0	1006
April 17	No Bung	2.83	10.9	<0.1	0.2	20.7	1012
May 17	No gas tap	2.17	11.7	<0.1	0.2	20.8	1015
June 17	No gas tap	4.59	12.1	<0.1	0.1	20.9	994

MONITORING POINT R8

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	R8						
July 16	No access – Due to dense vegetation	-	-	-	-	-	-
August 16	No access – Due to dense vegetation	-	-	-	-	-	-
September 16	No access – Due to dense vegetation	-	-	-	-	-	-
October 16	No access – Due to dense vegetation	-	-	-	-	-	-
November 16	No access – Due to dense vegetation	-	-	-	-	-	-
December 16	No access – Due to dense vegetation	-	-	-	-	-	-
January 17	No access – Due to dense vegetation	-	-	-	-	-	-
February 17	No access – Due to dense vegetation	-	-	-	-	-	-
March 17	Could not locate	-	-	-	-	-	-
April 17	Could not locate	-	-	-	-	-	-
May 17	Could not locate	-	-	-	-	-	-
June 17	Could not locate	-	-	-	-	-	-

MONITORING POINT – GROUNDWATER SUMP

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	GROUNDWATER SUMP						
July 16	Dense vegetation	-	15.0	-	-	-	-
August 16		-	14.1	-	-	-	-
September 16		-	14.1	-	-	-	-
October 16		-	13.2	-	-	-	-
November 16		-	11.1	-	-	-	-
December 16		-	11.0	-	-	-	-
January 17		-	9.5	-	-	-	-
February 17		-	8.9	-	-	-	-
March 17		-	15.7	-	-	-	-
April 17		-	10.7	-	-	-	-
May 17	Overgrown	-	11.1	-	-	-	-
June 17	Overgrown	-	-	-	-	-	-

MONITORING POINT WI (U)

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	WI (U)						
July 16	Dry	-	-	-	-	-	-
August 16	Dry	-	-	-	-	-	-
September 16	Dry	-	-	-	-	-	-
October 16	Dry	-	-	-	-	-	-
November 16	Dry	-	-	-	-	-	-
December 16	Dry	-	-	-	-	-	-
January 17	Dry	-	-	-	-	-	-
February 17	Dry	-	-	-	-	-	-
March 17	Dry	-	-	-	-	-	-
April 17	Dry	-	-	-	-	-	-
May 17	Dry	-	-	-	-	-	-
June 17	Dry	-	-	-	-	-	-

MONITORING POINT WI (M)

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	WI (M)						
July 16	Dry	-	-	-	-	-	-
August 16	Dry	-	-	-	-	-	-
September 16	Dry	-	-	-	-	-	-
October 16	Dry	-	-	-	-	-	-
November 16	Dry	-	-	-	-	-	-
December 16	Dry	-	-	-	-	-	-
January 17	Dry	-	-	-	-	-	-
February 17	Dry	-	-	-	-	-	-
March 17	Dry	-	-	-	-	-	-
April 17	Dry	-	-	-	-	-	-
May 17	Dry	-	-	-	-	-	-
June 17	Dry	-	-	-	-	-	-

MONITORING POINT WI (L)

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	WI (L)						
July 16	Dry	-	-	-	-	-	-
August 16	Dry	-	-	-	-	-	-
September 16	Dry	-	-	-	-	-	-
October 16	Dry	-	-	-	-	-	-
November 16	Dry	-	-	-	-	-	-
December 16	Dry	-	-	-	-	-	-
January 17	Dry	-	-	-	-	-	-
February 17	Dry	-	-	-	-	-	-
March 17	Dry	-	-	-	-	-	-
April 17	Dry	-	-	-	-	-	-
May 17	Dry	-	-	-	-	-	-
June 17	Dry	-	-	-	-	-	-

MONITORING POINT O3

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	O3						
July 16	Dry – sludge	-	-	-	-	-	-
August 16	Dry	-	-	-	-	-	-
September 16	Dry	-	-	-	-	-	-
October 16	Dry	-	-	-	-	-	-
November 16	Dry	-	-	-	-	-	-
December 16	Dry	-	-	-	-	-	-
January 17	Dry	-	-	-	-	-	-
February 17		-	9.3	-	-	-	-
March 17		-	18.1	-	-	-	-
April 17		-	16.5	-	-	-	-
May 17	Dry	-	-	-	-	-	-
June 17	Dry	-	-	-	-	-	-

MONITORING POINT O5

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	O5						
July 16		-	-	-	-	-	-
August 16		-	-	-	-	-	-
September 16		-	-	-	-	-	-
October 16		-	-	-	-	-	-
November 16		-	-	-	-	-	-
December 16		-	-	-	-	-	-
January 17	Dry	-	-	-	-	-	-
February 17	Dry	-	-	-	-	-	-
March 17	Dry	-	-	-	-	-	-
April 17	Dry	-	-	-	-	-	-
May 17	Dry	-	-	-	-	-	-
June 17	Dry	-	-	-	-	-	-

MONITORING POINT O8

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	O8						
July 16		-	15.5	-	-	-	-
August 16		-	16.9	-	-	-	-
September 16		-	14.1	-	-	-	-
October 16		-	15.2	-	-	-	-
November 16		-	10.9	-	-	-	-
December 16		-	11.1	-	-	-	-
January 17		-	10.0	-	-	-	-
February 17		-	6.2	-	-	-	-
March 17		-	11.6	-	-	-	-
April 17		-	11.6	-	-	-	-
May 17		-	12.3	-	-	-	-
June 17		-	14.5	-	-	-	-

MONITORING POINT MHL28

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	W1						
July 16	Overgrown	-	14.1	-	-	-	-
August 16		-	18.4	-	-	-	-
September 16		-	15.0	-	-	-	-
October 16		-	17.1	-	-	-	-
November 16		-	11.0	-	-	-	-
December 16		-	14.8	-	-	-	-
January 17		-	11.2	-	-	-	-
February 17		-	7.3	-	-	-	-
March 17		-	9.7	-	-	-	-
April 17		-	12.2	-	-	-	-
May 17		-	12.8	-	-	-	-
June 17		-	12.5	-	-	-	-

MONITORING POINT W1

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	W1						
July 16	Overgrown	-	16.7	-	-	-	-
August 16		-	16.3	-	-	-	-
September 16		-	14.1	-	-	-	-
October 16		-	14.6	-	-	-	-
November 16		-	7.3	-	-	-	-
December 16		-	8.0	-	-	-	-
January 17		-	9.2	-	-	-	-
February 17		-	6.1	-	-	-	-
March 17		-	8.3	-	-	-	-
April 17		-	12.1	-	-	-	-
May 17		-	13.2	-	-	-	-
June 17		-	14.4	-	-	-	-

MONITORING POINT W2

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	W2						
July 16	Overgrown	-	16.5	-	-	-	-
August 16		-	16.3	-	-	-	-
September 16		-	14.1	-	-	-	-
October 16		-	14.5	-	-	-	-
November 16		-	7.4	-	-	-	-
December 16		-	8.2	-	-	-	-
January 17		-	8.9	-	-	-	-
February 17		-	6.1	-	-	-	-
March 17		-	8.8	-	-	-	-
April 17		-	12.0	-	-	-	-
May 17		-	13.2	-	-	-	-
June 17		-	14.7	-	-	-	-

MONITORING POINT W3

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	W3						
July 16		-	16.5	-	-	-	-
August 16		-	16.1	-	-	-	-
September 16		-	14.5	-	-	-	-
October 16		-	7.1	-	-	-	-
November 16		-	-	-	-	-	-
December 16		-	8.1	-	-	-	-
January 17		-	9.3	-	-	-	-
February 17		-	6.1	-	-	-	-
March 17		-	9.0	-	-	-	-
April 17		-	12.2	-	-	-	-
May 17		-	13.2	-	-	-	-
June 17		-	14.3	-	-	-	-

MONITORING POINT W5

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	W5						
July 16	Dry/overgrown	-	-	-	-	-	-
August 16	Dry/overgrown	-	-	-	-	-	-
September 16		-	15	-	-	-	-
October 16		-	-	-	-	-	-
November 16	Dry	-	9.9	-	-	-	-
December 16	Dry	-	9.2	-	-	-	-
January 17		-	9.3	-	-	-	-
February 17		-	9.3	-	-	-	-
March 17		-	9.6	-	-	-	-
April 17	Dry	-	-	-	-	-	-
May 17		-	12.4	-	-	-	-
June 17		-	13.9	-	-	-	-

MONITORING POINT – NEW RIVER DISCHARGE

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	NRD						
July 16	Dry	-	-	-	-	-	-
August 16	Dry	-	-	-	-	-	-
September 16	Dry	-	-	-	-	-	-
October 16	Dry	-	-	-	-	-	-
November 16	Dry	-	-	-	-	-	-
December 16	Dry	-	-	-	-	-	-
January 17	Dry	-	-	-	-	-	-
February 17	Dry	-	-	-	-	-	-
March 17		-	7.0	-	-	-	-
April 17	Dry	-	-	-	-	-	-
May 17	Dry	-	-	-	-	-	-
June 17	Dry	-	-	-	-	-	-

MONITORING POINT – NBH1

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	NBH1						
July 16		3.00	12.2	0.2	4.9	16.7	1004
August 16		3.10	14.5	<0.1	1.9	19.3	1011
September 16		3.22	13.3	<0.1	5.4	16.3	1010
October 16		3.15	17.2	<0.1	3.5	20.0	1004
November 16		2.51	10.7	<0.1	4.1	17.1	1009
December 16		3.70	15.7	<0.1	6.4	17.2	1006
January 17		3.75	14.0	<0.1	1.1	19.9	997
February 17		4.20	11.7	<0.1	1.5	18.6	1014
March 17		2.66	13.2	<0.1	6.1	16.3	1004
April 17	Loose Bung	3.30	13.9	<0.1	0.1	20.6	1007
May 17		3.27	12.7	<0.1	2.2	18.3	1011
June 17		3.60	15.2	<0.1	0.3	20.7	992

MONITORING POINT – NBH2

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	NBH2						
July 16	Borehole blocked – Gas cap missing	-	-	0.1	1.2	18.9	1002
August 16	Blocked – Gas cap missing	-	-	<0.1	0.2	20.8	1011
September 16	Blocked	-	-	<0.1	0.2	21.3	1010
October 16	Blocked	-	-	<0.1	0.3	20.5	1000
November 16	Blocked	-	-	<0.1	0.1	20.8	1009
December 16		-	-	<0.1	0.3	21.1	1006
January 17		-	-	<0.1	0.3	20.9	997
February 17	Blocked	-	-	<0.1	0.2	20.9	1014
March 17	Blocked	0.75	-	<0.1	0.7	18.8	1003
April 17	Blocked – No Bung	0.75	-	<0.1	2.3	19.2	1007
May 17	Locked. No gas tap	-	-	<0.1	0.7	20.4	1011
June 17	No gas tap	3.46	14.9	<0.1	0.1	20.6	989

MONITORING POINT – NBH3

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	NBH3						
July 16	Casing dislodged	7.45	14.1	<0.1	0.4	20.2	1003
August 16	Gas cap missing	6.50	15	<0.1	0.8	19.2	1011
September 16	Tubing & valve installed	6.50	13.9	0.2	0.3	21.4	1008
October 16		8.42	15.1	<0.1	0.2	20.5	1000
November 16		5.94	9.3	<0.1	0.2	21.2	1009
December 16		6.33	14.2	<0.1	0.4	20.7	1006
January 17		5.33	8.2	0.1	0.2	20.4	997
February 17		6.41	7.9	<0.1	0.1	20.8	1013
March 17		5.50	12.3	<0.1	0.2	20.0	1003
April 17	No Bung – Spot sample	7.10	12.3	<0.1	1.7	20.2	1007
May 17	No cap on borehole	7.20	14.2	<0.1	0.1	20.7	1012
June 17		6.85	14.2	<0.1	0.2	20.5	989

MONITORING POINT – NBH4

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	NBH4						
July 16	Gas cap missing	17.20	13.6	<0.1	0.2	18.6	1002
August 16		12.51	13.0	0.3	0.3	20.2	1005
September 16	Valve & gas cap installed.	17.49	14.3	0.2	0.5	21.0	1004
October 16		16.50	13.8	<0.1	0.1	20.7	1000
November 16		15.53	10.6	0.2	0.1	20.5	1011
December 16		17.50	13.4	<0.1	1.2	19.6	1001
January 17		17.60	8.7	0.1	0.6	20.9	994
February 17		16.57	8.9	0.3	3.2	18.6	1007
March 17		16.16	13.0	<0.1	1.3	18.9	1000
April 17		12.20	13.2	<0.1	1.8	19.8	1007
May 17	Dry	-	-	<0.1	0.1	20.8	1008
June 17	No gas tap	12.32	_	<0.1	0.1	20.8	989

MONITORING POINT – NBH5

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	NBH5						
July 16	Spot sample	6.70	12.9	<0.1	0.9	19.0	1002
August 16		7.08	12.7	0.1	0.9	20.8	1006
September 16	Spot sample	6.74	13.0	0.2	4.2	16.8	1004
October 16		5.35	13.7	0.1	0.2	17.3	998
November 16		6.10	10.7	<0.1	10.7	6.1	1008
December 16	DRY	-	-	<0.1	6.5	12.3	1002
January 17		5.4	10.8	0.1	8.4	18.9	995
February 17	Spot Sample	5.45	9.7	<0.1	0.2	20.5	1007
March 17	Spot Sample	5.21	9.7	<0.1	6.3	9.8	1000
April 17		7.03	10.6	<0.1	2.8	17.0	1005
May 17	Spot sample taken	7.10	11.1	<0.1	4.2	13.3	1008
June 17		6.21	10.9	<0.1	3.0	17.0	989

MONITORING POINT – NBH6

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	NBH6						
July 16		16.61	13.6	<0.1	0.5	19.5	1002
August 16	Sample Dry	19.89	-	<0.1	0.5	19.9	1007
September 16		13.84	13.2	0.4	1.2	20.4	1004
October 16		12.40	14.3	0.1	0.1	20.3	998
November 16		18.89	11.0	<0.1	0.5	20.6	1009
December 16	Spot Sample	5.80	12.4	<0.1	0.4	20.8	1002
January 17		-	-	0.1	0.5	20.1	992
February 17		8.92	-	<0.1	1.7	18.2	1007
March 17		5.82	10	<0.1	0.6	20.9	999
April 17	Gas bung loose – Waterra Tubing sunk. Unable to sample			<0.1	0.2	20.7	1005
May 17	Dry, loose bung	-	-	<0.1	0.1	20.8	1006
June 17		18.78	12.1	<0.1	1.3	20.5	988

MONITORING POINT – NBH7

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	NBH7						
July 16	Unable to locate due to dense vegetation	-	-	-	-	-	-
August 16	Unable to locate due to dense vegetation	-		<0.1	0.1	20.8	1005
September 16	Dry - Gas cap installed	-	-	0.1	0.3	21.4	1010
October 16	Dry	-	-	<0.1	1.5	19.3	1000
November 16	Dry	-	-	<0.1	1.6	20.3	1002
December 16	Dry	-	-	<0.1	1.0	19.2	1006
January 17		-	-	0.1	1.1	20.7	998
February 17	Dry	-	-	<0.1	1.7	19.8	1013
March 17	Dry – 2 sample points?	-	-	-	-	-	-
April 17	Front Back	7.89 5.98	12.07 12.1	<0.1 <0.1	1.1 0.9	19.7 20.0	1007 1007
May 17	Front Back	- -	12.07 12.1	<0.1 <0.1	0.6 0.1	19.9 20.8	1013 1013
June 17	Front Back	7.80 5.90	- -	<0.1 <0.1	0.1 0.1	20.8 20.8	994 994

MONITORING POINT – NBH8

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	NBH8						
July 16	Unable to locate due to dense vegetation	-	-	-	-	-	-
August 16	Unable to locate due to dense vegetation	-	-	<0.1	0.1	20.8	1005
September 16	Unable to locate due to dense vegetation	-	-	-	-	-	-
October 16	Dry	-	-	<0.1	0.1	19.9	1000
November 16	Dry	-	-	<0.1	0.8	20.0	1002
December 16	Dry	-	-	<0.1	1.0	20.4	1006
January 17	Dry	-	-	0.1	1.2	18.2	998
February 17	Dry	-	-	<0.1	0.2	20.7	1013
Dry	Dry	2.56	-	<0.1	1.3	16.4	1003
April 17	Dry	-	-	<0.1	0.9	19.9	1007
May 17	Dry, no cap on borehole	-	-	<0.1	0.1	20.7	1013
June 17		2.53	-	<0.1	0.2	20.5	993

MONITORING POINT – NEW STREAM 1

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	New Stream 1						
July 16		-	-	-	-	-	-
August 16		-	-	-	-	-	-
September 16		-	-	-	-	-	-
October 16		-	-	-	-	-	-
November 16		-	-	-	-	-	-
December 16		-	-	-	-	-	-
January 17		-	-	-	-	-	-
February 17		-	-	-	-	-	-
March 17		-	-	-	-	-	-
April 17		-	-	-	-	-	-
May 17		-	-	-	-	-	-
June 17		-	-	-	-	-	-

MONITORING POINT – NEW STREAM 2

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	New Stream 2						
July 16		-	-	-	-	-	-
August 16		-	-	-	-	-	-
September 16		-	-	-	-	-	-
October 16		-	-	-	-	-	-
November 16		-	-	-	-	-	-
December 16		-	-	-	-	-	-
January 17		-	-	-	-	-	-
February 17		-	-	-	-	-	-
March 17		-	-	-	-	-	-
April 17		-	-	-	-	-	-
May 17		-	-	-	-	-	-
June 17		-	-	-	-	-	-

MONITORING POINT – NEW STREAM 3

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	New Stream 3						
July 16		-	-	-	-	-	-
August 16		-	-	-	-	-	-
September 16		-	-	-	-	-	-
October 16		-	-	-	-	-	-
November 16		-	-	-	-	-	-
December 16		-	-	-	-	-	-
January 17		-	-	-	-	-	-
February 17		-	-	-	-	-	-
March 17		-	-	-	-	-	-
April 17		-	-	-	-	-	-
May 17		-	-	-	-	-	-
June 17		-	-	-	-	-	-

MONITORING POINT – LAND DRAIN 1

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	Land Drain 1						
July 16		13.1	-	-	-	-	-
August 16		19.4	-	-	-	-	-
September 16		12.7	-	-	-	-	-
October 16		14.1	-	-	-	-	-
November 16		9.5	-	-	-	-	-
December 16		12.2	-	-	-	-	-
January 17		10.6	-	-	-	-	-
February 17		5.9	-	-	-	-	-
March 17		13.3	-	-	-	-	-
April 17		10.3	-	-	-	-	-
May 17		13.7	-	-	-	-	-
June 17		13.6	-	-	-	-	-

MONITORING POINT – LAND DRAIN 2

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	Land Drain 2						
July 16		14.0	-	-	-	-	-
August 16		18.6	-	-	-	-	-
September 16		13.0	-	-	-	-	-
October 16		14.6	-	-	-	-	-
November 16		9.6	-	-	-	-	-
December 16		8.5	-	-	-	-	-
January 17		7.9	-	-	-	-	-
February 17		5.9	-	-	-	-	-
March 17		8.9	-	-	-	-	-
April 17		9.8	-	-	-	-	-
May 17		11.9	-	-	-	-	-
June 17	Dry	-	-	-	-	-	-

MONITORING POINT –THE WELL

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	The Well						
July 16		-	-	-	-	-	-
August 16		-	-	-	-	-	-
September 16		-	-	-	-	-	-
October 16		-	-	-	-	-	-
November 16		-	-	-	-	-	-
December 16		-	-	-	-	-	-
January 17		-	-	-	-	-	-
February 17		-	-	-	-	-	-
March 17		-	-	-	-	-	-
April 17		-	-	-	-	-	-
May 17		-	-	-	-	-	-
June 17		-	-	-	-	-	-

MONITORING POINT –LOWER FIELD POND

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	Lower Field Pond						
July 16		-	-	-	-	-	-
August 16		-	-	-	-	-	-
September 16		-	-	-	-	-	-
October 16		-	-	-	-	-	-
November 16		-	-	-	-	-	-
December 16		-	-	-	-	-	-
January 17		-	-	-	-	-	-
February 17		-	-	-	-	-	-
March 17		-	-	-	-	-	-
April 17		-	-	-	-	-	-
May 17		-	-	-	-	-	-
June 17		-	-	-	-	-	-

MONITORING POINT –FIELD BY OAK

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	Field by Oak						
July 16		-	-	-	-	-	-
August 16		-	-	-	-	-	-
September 16		-	-	-	-	-	-
October 16		-	-	-	-	-	-
November 16		-	-	-	-	-	-
December 16		-	-	-	-	-	-
January 17		-	-	-	-	-	-
February 17		-	-	-	-	-	-
March 17		-	-	-	-	-	-
April 17		-	-	-	-	-	-
May 17		-	-	-	-	-	-
June 17		-	-	-	-	-	-

MONITORING POINT – STONE SHELTER STREAM

Month	Monitoring Point	Water Level (m)	Temp (Deg C)	CH4	CO2	O2	Atoms Press mBar
	Stone Shelter Stream						
July 16		-	-	-	-	-	-
August 16		-	-	-	-	-	-
September 16		-	-	-	-	-	-
October 16		-	-	-	-	-	-
November 16		-	-	-	-	-	-
December 16		-	-	-	-	-	-
January 17		-	-	-	-	-	-
February 17		-	-	-	-	-	-
March 17		-	-	-	-	-	-
April 17		-	-	-	-	-	-
May 17		-	-	-	-	-	-
June 17		-	-	-	-	-	-

APPENDIX 15 – STACK EMISSIONS MONITORING REPORT – GAS ENGINE

STACK EMISSIONS MONITORING REPORT – A2 FLARE

PERIODIC MONITORING OF RAW LANDFILL GAS – TREHIR LANDFILL SITE

LSO 160831
AlphaGen - Trehir - Er

LSO 160831 Alphagen
Trehir Trace gas moni

LSO 160831
AlphaGen - Trehir - Fl

STACK EMISSIONS MONITORING REPORT

Units C & D
Bankside Trade Park
Cirencester
GL7 1YT
Tel: 01285 700593

Your contact at ESG
Mike Davies Business Manager - South Tel: 07976 297465 Email: mike.davies@esg.co.uk

Operator & Address:
AlphaGen Projects Ltd Trehir Land Fill Site Pandy Lane Llanbraddach Caerphilly CF83 3RP

Permit:
EPR Permit: LFTGN 08

Release Point:
A1 - Gas Engine

Sampling Date(s):
31st August 2016

ESG Job Number:	LSO 160831
Report Date:	22nd September 2016
Version:	1
Report By:	David May
MCERTS Number:	MM 07 862
MCERTS Level:	MCERTS Level 2 - Operations Manager
Technical Endorsements:	1, 2, 3 & 4
Report Approved By:	Mike Davies
MCERTS Number:	MM 02 087
Business Title:	MCERTS Level 2 - Business Manager
Technical Endorsements:	1, 2, 3 & 4
Signature:	

UKAS TESTING
1015

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

CONTENTS

EXECUTIVE SUMMARY

MONITORING OBJECTIVES

AlphaGen Projects Ltd operates a power generation process at Trehir Land Fill Site which is subject to EPR Permit LFTGN 08, under the Environmental Permitting Regulations 2010.

ESG were commissioned by AlphaGen Projects Ltd to carry out stack emissions monitoring to determine the release of prescribed pollutants from the following Plant under normal operating conditions.

The results of these tests shall be used to demonstrate compliance with a set of emission limit values for prescribed pollutants as specified in the Plant's EPR Permit, LFTGN 08.

Plant

A1 - Gas Engine

Operator

AlphaGen Projects Ltd
Trehir Land Fill Site
Pandy Lane
Llanbraddach
Caerphilly
CF83 3RP

EPR Permit: LFTGN 08

Stack Emissions Monitoring Test House

ESG - Cirencester Laboratory
Units C & D
Bankside Trade Park
Cirencester
GL7 1YT
UKAS and MCERTS Accreditation Number: 1015

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.
MCERTS accredited results will only be claimed where both the sampling and analytical stages are UKAS accredited.

EXECUTIVE SUMMARY

EMISSIONS SUMMARY					
Parameter	**Units**	**Result**	**LFTGN 08[2010] Uncertainty +/-**	**Calculated Uncertainty +/-**	**Limit**
NMVOC's	mg/m³	1.89	-	1.93	75
Volatile Organic Compounds	mg/m³	1191.5	476.6	28.6	1000
Volatile Organic Compounds ppm	ppm	716.6	17.2	17.2	
Oxides of Nitrogen (as NO_2)	mg/m³	340.1	102.0	7.6	500
Oxides of Nitrogen (as NO_2) ppm	ppm	176.0	52.8	3.9	
Carbon Monoxide	mg/m³	535.4	107.1	13.9	1400
Carbon Monoxide ppm	ppm	451.9	90.4	11.7	
Oxygen	% v/v	4.1	0.2	-	
Moisture	%	8.5	0.31	-	

ND - NoneDetected
The result is considered non compliant if the result minus the MU is above the limit (LFGTN 08 [2010])
The MU for the purposes of compliance assessment is calculated from values in LFTGN 08 [2010]. i.e. 20% of the result for CO, 30% of the result for NOx & 40% of the result for VOCs.

Reference conditions are 273K, 101.3kPa, dry gas 5% Oxygen.

EXECUTIVE SUMMARY

MONITORING TIMES			
Parameter	**Sampling Date(s)**	**Sampling Times**	**Sampling Duration**
NMVOC's Run 1	31 August 2016	10:20 - 10:50	30 minutes
Volatile Organic Compounds Run 1	31 August 2016	10:00 - 11:00	60 minutes
Combustion Gases	31 August 2016	10:00 - 11:00	60 minutes

EXECUTIVE SUMMARY

PROCESS DETAILS

Parameter	Process Details
Description of process	Power Generation
Maximim Rate	50 KW
Actual Rate	50 KW
Fuel used during monitoring	Biogas
% Methane	37.8
% Carbon Dioxide	37
% Oxygen	0
Abatement	None

EXECUTIVE SUMMARY

Monitoring Methods

The selection of standard reference / alternative methods employed by ESG is determined, wherever possible by the hierarchy of method selection outlined in Environment Agency Technical Guidance Note (Monitoring) M2. i.e. CEN, ISO, BS, US EPA etc.

MONITORING METHODS						
Species	**Method** Standard Reference Method / Alternative Method	**ESG Technical Procedure**	**UKAS Lab Number**	**MCERTS Accredited Method**	**Limit of Detection (LOD)**	**Calculated MU +/- %**
NMVOC's	SRM - BS EN 13649	AE 118	1015	Yes	0.63 mg/m³	102.3%
VOCs	SRM - BS EN 12619:2013	AE 102	1015	Yes	0.22 mg/m³	2.4%
NO_X	SRM - BS EN 14792	AE 102	1015	Yes	0.48 mg/m³	2.2%
CO	SRM - BS EN 15058	AE 102	1015	Yes	1.3 mg/m³	2.6%
O_2	AM - BS EN 14789	AE 102	1015	Yes	0.01%	6.1%
H_2O	SRM - BS EN 14790	AE 105	1015	Yes	0.09%	3.58%

EXECUTIVE SUMMARY

Analytical Methods

The following tables list the analytical methods employed together with the custody and archiving details:

SAMPLING METHODS WITH SUBSEQUENT ANALYSIS							
Species	**Analytical Technique**	**Analytical Procedure**	**UKAS Lab Number**	**UKAS Accredited Lab Analysis**	**Analysis Lab (ESG or Subcontract)**	**Sample Archive Location**	**Archive Period**
NMVOC's	GC-MS	ASC GC-MS	1045	Yes	Bretby	Bretby	3 months

ON-SITE TESTING							
Species	**Analytical Technique**	**Analytical Procedure**	**UKAS Lab Number**	**MCERTS Accredited Analysis**	**Laboratory**	**Data Archive Location**	**Archive Period**
VOCs	Flame Ionisation Detection	AE 102	1015	Yes	ESG - Cirencester	ESG - Cirencester	5 years
NO_X	Chemiluminescence	AE 102	1015	Yes	ESG - Cirencester	ESG - Cirencester	5 years
CO	Non Dispersive Infra Red	AE 102	1015	Yes	ESG - Cirencester	ESG - Cirencester	5 years
O_2	Zirconia Cell	AE 102	1015	Yes	ESG - Cirencester	ESG - Cirencester	5 years
H_2O	Gravimetric	AE 105	1015	Yes	ESG - Cirencester	-	-

EXECUTIVE SUMMARY

SAMPLING LOCATION					
Sampling Plane Validation Criteria	**Value**	**Units**	**Requirement**	**Compliant**	**Method**
Lowest Differential Pressure	-	Pa	>= 5 Pa	-	BS EN 15259
Lowest Gas Velocity	-	m/s	-	-	-
Highest Gas Velocity	-	m/s	-	-	-
Ratio of Gas Velocities	-	: 1	< 3 : 1	-	BS EN 15259
Mean Velocity	-	m/s	-	-	-
Maximum angle of flow with regard to duct axis	-	°	< 15°	-	BS EN 15259
No local negative flow	-	-	-	-	BS EN 15259

DUCT CHARACTERISTICS		
	Value	**Units**
Shape	Circular	-
Depth	Unable to measure	m
Width	-	m
Area	-	m^2
Port Depth	-	mm

SAMPLING LINES & POINTS		
	Isokinetic	**Non-Iso & Gases**
Sample port size	-	Top of Stack
Number of lines used	-	1
Number of points / line	-	1
Duct orientation	-	Vertical

SAMPLING PLATFORM	
General Platform Information	
Permanent / Temporary Platform / Ground level / Floor Level / Roof	Permanent
Inside / Outside	Outside

M1 Platform requirements	
Is there a sufficient working area so work can be performed in a compliant manner	Yes
Platform has 2 levels of handrails (approximately 0.5 m & 1.0 m high)	N/A
Platform has vertical base boards (approximately 0.25 m high)	N/A
Platform has removable chains / self closing gates at the top of ladders	N/A
Handrail / obstructions do not hamper insertion of sampling equipment	N/A
Depth of Platform = >Stack depth / diameter + wall and port thickness + 1.5m	Yes

Sampling Platform Improvement Recommendations (if applicable)

The sampling location meets all the requirements as specified in EA Guidance Note M1.

EXECUTIVE SUMMARY

Sampling & Analytical Method Deviations

In this instance there were no deviations from the sampling and analytical methods employed.

APPENDICES

CONTENTS

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

MONITORING SCHEDULE					
Species	**Method** Standard Reference Method / Alternative Method	**ESG Technical Procedure**	**UKAS Lab Number**	**MCERTS Accredited Method**	**Number of Samples**
NMVOC's	SRM - BS EN 13649	AE 118	1015	Yes	1
VOCs	SRM - BS EN 12619:2013	AE 102	1015	Yes	1
NOx	SRM - BS EN 14792	AE 102	1015	Yes	1
CO	SRM - BS EN 15058	AE 102	1015	Yes	1
O_2	AM - BS EN 14789	AE 102	1015	Yes	1
H_2O	SRM - BS EN 14790	AE 105	1015	Yes	1

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

CALIBRATEABLE EQUIPMENT CHECKLIST

Extractive Sampling		Instrumental Analyser/s		Miscellaneous	
Equipment	**Equipment I.D.**	**Equipment**	**Equipment I.D.**	**Equipment**	**Equipment I.D.**
Control Box DGM	P1757	Horiba PG-250 Analyser	P1301	Laboratory Balance	-
Box Thermocouples	P1757	FT-IR Gasmet	-	Tape Measure	-
Meter In Thermocouple	P1757	FT-IR Oven Box	-	Stopwatch	-
Meter Out Thermocouple	P1757	Bernath 3006 FID	-	Protractor	-
Control Box Timer	P1757	Signal 3030 FID	P2596	Barometer	P1313
Oven Box	-	Servomex	-	Digital Micromanometer	-
Probe	-	JCT Heated Head Filter	-	Digital Temperature Meter	-
Probe Thermocouple	-	Thermo FID	-	Stack Thermocouple	-
Probe	-	Stackmaster	-	Mass Flow Controller	-
Probe Thermocouple	-	FTIR Heater Box for Heated Line	-	MFC Display module	-
S-Pitot	-	Anemometer	-	1m Heated Line (1)	-
L-Pitot	-	Ecophysics NOx Analyser	-	1m Heated Line (2)	-
Site Balance	P1906	Chiller (JCT/MAK 10)	P2050	1m Heated Line (3)	-
Last Impinger Arm	-	Heated Line Controller (1)	P1897	5m Heated Line (1)	-
Dioxins Cond. Thermocouple	-	Heated Line Controller (2)	-	10m Heated Line (1)	-
Callipers	-	Site temperature Logger	-	10m Heated Line (2)	-
Small DGM	-		-	15m Heated Line (1)	-
Heater Controller	-		-	20m Heated Line (1)	P2404
Inclinometer (Swirl Device)	-		-	20m Heated Line (2)	-

NOTE: If the equipment I.D is represented by a dash (-), then this piece of equipment has not been used for this test.

CALIBRATION GASES

Gas (traceable to ISO 17025)	Cylinder I.D Number	Supplier	ppm	%	Analytical Tolerance +/- %
Oxygen	CJ5	BOC	-	10.1	2.0
Propane	DJ5	BOC	800	-	2.0
Nitric Oxide	SA3	BOC	202	-	2.0
Carbon Monoxide	CJ5	BOC	822	-	2.0
-	-	-	-	-	-

STACK EMISSIONS MONITORING TEAM

MONITORING TEAM								
Personnel	**MCERTS Number**	**MCERTS**		**TE / H&S Qualifications and Expiry Date**				
		Level	**Expiry**	**TE1**	**TE2**	**TE3**	**TE4**	**H&S**
David May	MM 07 862	MCERTS Level 2	Nov-17	Dec-19	Sep-20	Mar-20	Sep-19	Nov-17
Jamie Whiteman	MM 11 1134	MCERTS Level 1	Sep-16	Oct-18	Feb-18	-	-	Sep-16

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

NMVOC'S SUMMARY					
Test	Sampling Times	Concentration mg/m³	LOD mg/m³	Limit mg/m³	Emission Rate g/hr
Run 1	10:20 - 10:50 31 August 2016	1.89	0.630	75	-
Field Blank	-	1.26	-	-	-

Reference conditions are 273K, 101.3kPa, dry gas 5% Oxygen.

NMVOC'S QUALITY ASSURANCE CHECKLIST

Leak Test Results	Mean Sampling Rate l/min	Pre sampling leak rate l/min	Post sampling leak rate l/min	Acceptable leak rate l/min	Leak Tests Acceptable?
Run 1	1	0.01	0.01	0.02	Yes

	Type of tube	Max. Tube Temperature °C	Max. Storage / Transit Temp. °C
Run 1	Charcoal	22	24

Tube sampling temperature should be < 40°C

NMVOC'S ADSORPTION EFFICIENCY

Parameter	Total ug	Back ug	Adsorption Efficiency %	Acceptable Adsorption Efficiency %	Adsorption Efficiency Acceptable ?
Run 1	60	20	67	95	N/A <30% ELV

N/A - As the result is less than 30% of the ELV an absorption efficiency greater than 95% is not required.

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

VOLATILE ORGANIC COMPOUNDS SUMMARY

Test	Sampling Times	Concentration mg/m³	LOD mg/m³	Limit mg/m³	Emission Rate g/hr
Run 1	10:00 - 11:00 31 August 2016	1191.5	0.22	1000	-

Reference conditions are 273K, 101.3kPa, dry gas 5% Oxygen.

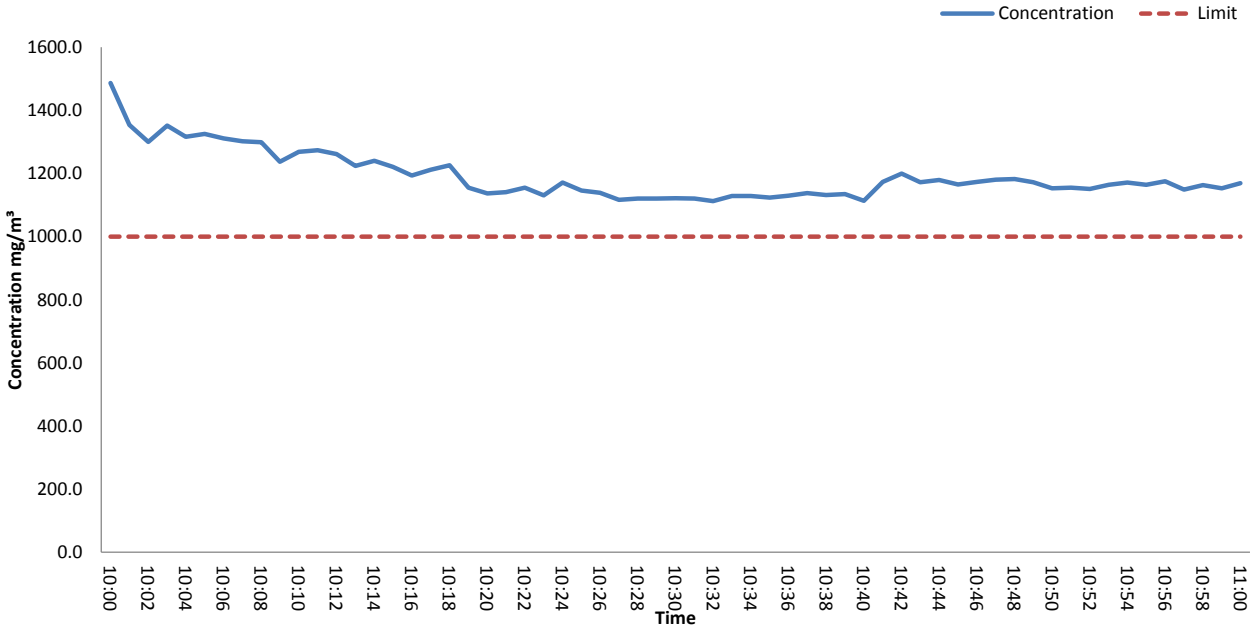
INSTRUMENTAL SPAN & ZERO CHECKS

PRE-SAMPLING CALIBRATION CHECKS RUN 1								
Date	31 August 2016							
Start Time	09:35							
End Time	09:45							
Gas	Gas Conc (ppm)	Range	Instrument Zero Reading	Instrument Span Reading	Instrument Zero Reading	Zero Down line reading	Span down line reading	Leak Rate (%)
Propane	800.0	1000	0.00	800.0	0.00	0.00	800.0	0.00

Zero and Span gas contained 10.1% Oxygen

POST-SAMPLING CALIBRATION CHECKS RUN 1				
Date	31 August 2016			
Start Time	11:05			
End Time	11:15			
Gas	Zero down line reading	Span down line reading	Zero Drift (%)	Span Drift (%)
Propane	1.00	800.0	0.13	-0.13

VOLATILE ORGANIC COMPOUNDS EMISSIONS CHART



Reference conditions are 273K, 101.3kPa, dry gas 5% Oxygen.

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

COMBUSTION GASES SUMMARY

Test	Sampling Time and Date	Concentration mg/m³	LOD mg/m³	Limit mg/m³	Emission Rate g/hr
NOx	10:00 - 11:00 31 August 2016	340.1	0.48	500	-
CO	10:00 - 11:00 31 August 2016	535.43	1.30	1400	-

Test	Sampling Time and Date	Concentration %	LOD %
O_2	10:00 - 11:00 31 August 2016	4.06	0.01

Reference conditions are 273K, 101.3kPa, dry gas 5% Oxygen.

PRE-SAMPLING CALIBRATION DATA

Date	31 August 2016
Start Time	09:30
End Time	09:55

Chiller Temperature (°C)	3.0
Requirement	< 4°C
Compliant	Yes

Gas	Range (ppm / %)	Zero Reading at analyser	Span Reading at analyser	Zero Check at analyser	Zero Check down line	Span Check down line	Response Time (Secs)	Leak Rate %
NO	250	0.00	202.0	0.20	0.40	200.9	22	0.54
CO	1000	0.00	822.0	0.10	0.20	819.0	25	0.36
O_2	10	0.00	10.10	0.01	0.05	10.14	26	-0.40

POST-SAMPLING CALIBRATION DATA

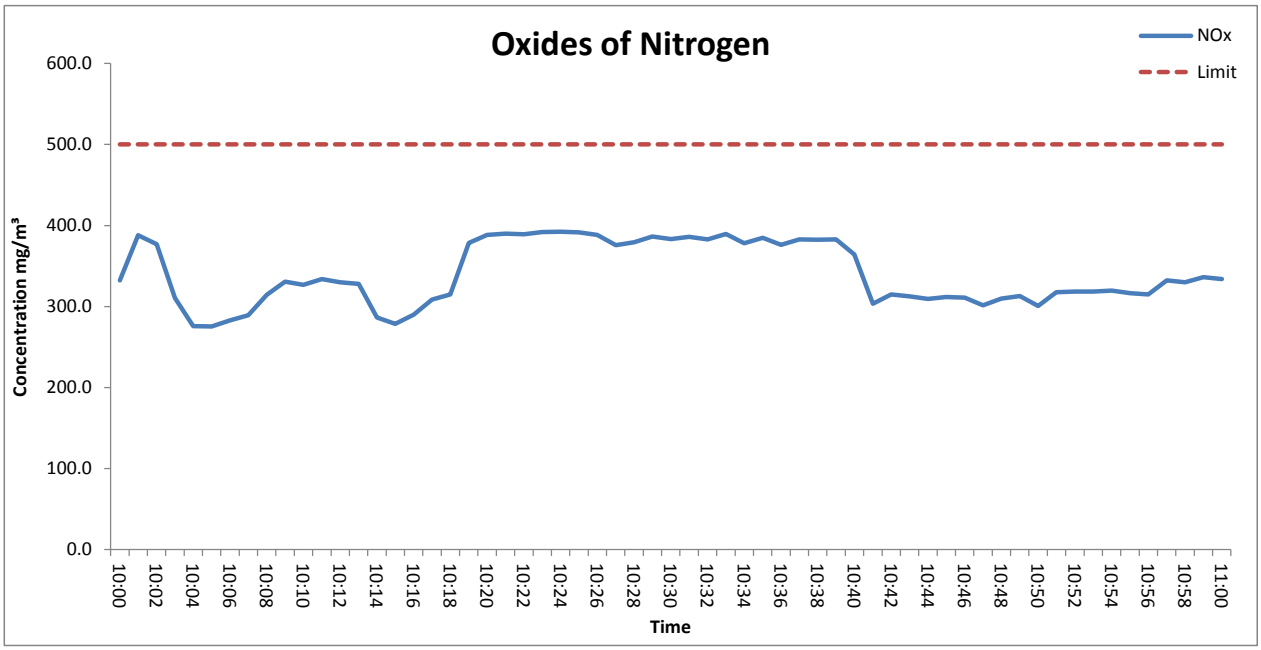
Date	31 August 2016
Start Time	11:05
End Time	11:15

Chiller Temperature (°C)	2.0
Requirement	< 4°C
Compliant	Yes

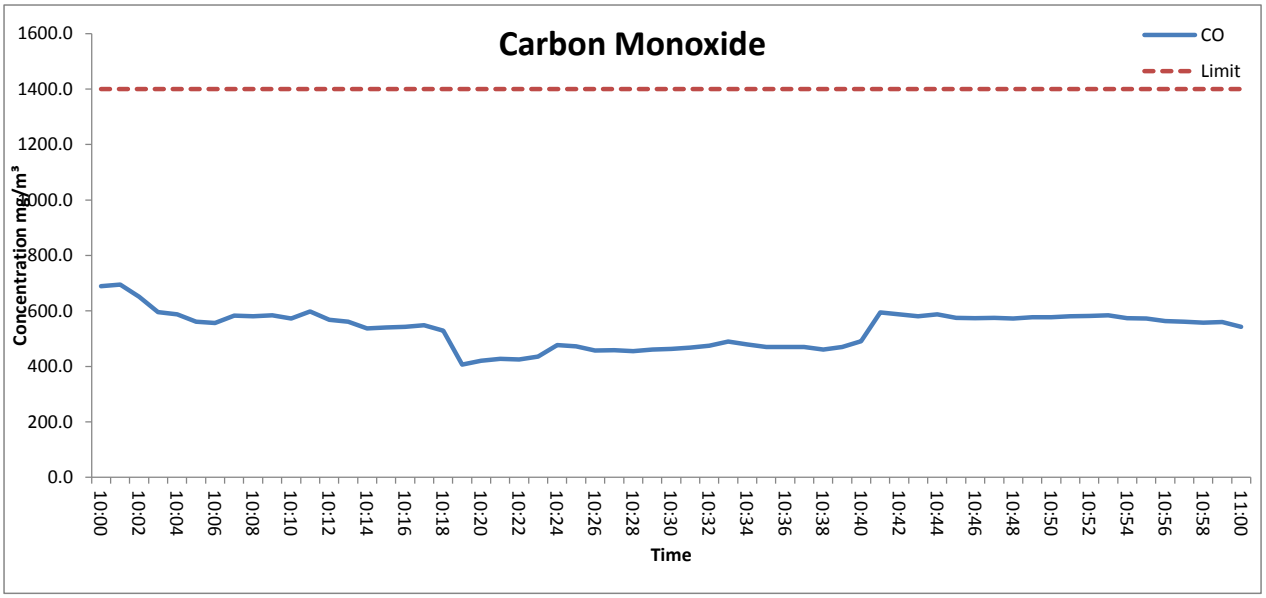
Gas	Zero Check down line	Span Check down line	Zero Drift (%)	Span Drift (%)
NO	0.20	201.1	-0.08	0.16
CO	0.30	818.0	0.01	-0.11
O_2	0.07	10.20	0.20	0.40

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

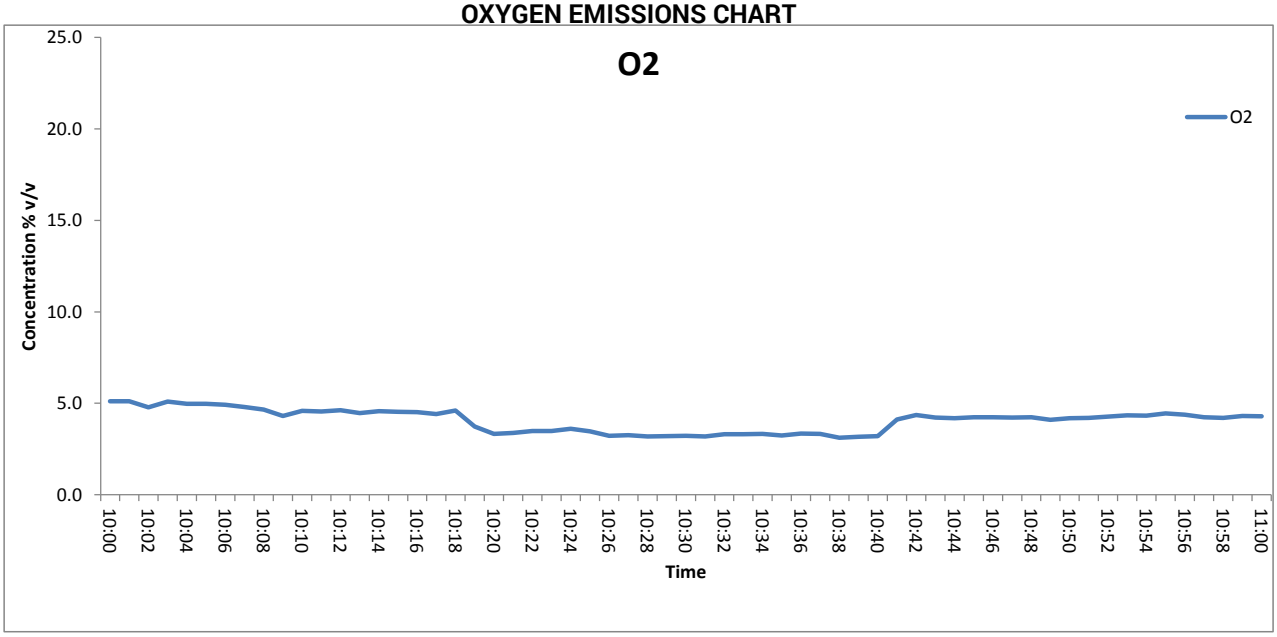
OXIDES OF NITROGEN (as NO_2) EMISSIONS CHART



CARBON MONOXIDE EMISSIONS CHART



OXYGEN EMISSIONS CHART



APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

MOISTURE CALCULATIONS

Moisture Determination - Non Isokinetic							
Test Number	Sampling Time and Date	Start Weight kg	End Weight kg	Total gain kg	Concentration %	LOD %	Uncertainty %
Run 1	10:30 - 11:00 31 August 2016	3.2411	3.2519	0.0108	8.5	0.09	3.6

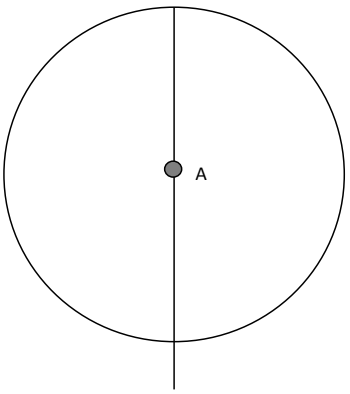
Moisture Quality Assurance							
Test Number	Sampling Duration mins	Total Volume Sampled l	Sampling Rate l/min	Start Leak Rate l/min	End Leak Rate l/min	Acceptable Leak Rate l/min	Leak Tests Acceptable?
Run 1	30	144	4.8	0.050	0.050	0.096	Yes

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK DIAGRAM

	Value	Units
Stack Depth	Unable to measure	m
Stack Width	-	m
Area	-	m^2

Non-Isokinetic/Gases Sampling			
Sampling Point	Distance (% of Depth)	Distance into Stack	Units
A	~50	-	m



Sampling Line

Isokinetic Sampling			
Sampling Point	Distance (% of Depth)	Distance into Stack (m)	Swirl °
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

○ Isokinetic sampling point
● Isokinetic sampling points not used
◉ Non Isokinetic/Gases sampling point

SAMPLING LOCATION

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - NMVOC'S

Run	Sampled Volume m³	Sampled Gas Temp K	Sampled Gas Pressure kPa	Sampled Gas Humidity % by volume	Oxygen Content % by volume	Limit of Detection % by mass	Leak %	Uncollected Mass mg
MU required	**≤ 2%**	**≤ 2%**	**≤ 1%**	**≤ 1%**	**≤ 10%**	**≤ 5% of ELV**	**≤ 2%**	**≤ 10% of ELV**
Run 1	0.00002	2	0.5	1	0.1	0.02	-	-
as a %	0.0667	0.6803	0.4919	1.0000	2.4616	0.84	1.0000	0.0533
compliant?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Run	Volume (STP) m³	Mass of NMVOC's mg	O2 Correction -	Leak mg/m³	Uncollected Mass mg	Lab Uncertainty mg	Combined uncertainty
Run 1	0.028	0.060	0.945	0.011	0.023	-	-
MU as mg/m³	0.000	0.630	0.011	0.011	0.727	0.094	**0.966**
MU as %	0.000	33.333	-	0.577	38.490	5.000	-

R1 - Uncertainty expressed at a 95% confidence level (where k = 2)	**1.933**	**mg/m³**	**102.34**	**%**

Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - MOISTURE

Run	Sampled Volume m³	Sampled Gas Temp K	Sampled Gas Pressure kPa	Sampled Gas Humidity % by volume	Oxygen Content % by volume	Leak %
MU required	**≤ 2%**	**≤ 2%**	**≤ 1%**	**≤ 1%**	**≤ 10%**	**≤ 2%**
Run 1	0.000	2.0	0.50	1.0	0.1	-
as a %	0.07	0.26	0.49	1.0	2.46	1.04
compliant?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Run	Volume (STP) m³	Mass Gained mg	O2 Correction -	Leak mg/m³	Uncollected Mass mg	Combined uncertainty
Run 1	0.1	10800	0.9	451.1	58	-
MU as % v/v	0.11	0.09	0.03	0.06	0.05	**0.16**
MU as %	1.2	0.9	0.59	0.6	0.5	-

R1 - Uncertainty expressed at a 95% confidence level (where k = 2)	**0.32**	**% v/v**	**3.58**	**%**

Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - VOLATILE ORGANIC COMPOUNDS RUN 1

Measured Concentration	1191.5	mg/m^3
Limit	1000	mg/m^3
Calibration Gas Concentration	1280	mg/m^3
Range	1600	mg/m^3

Performance characteristics	Value	Units	specification	MU Met?
Response time	32	seconds	<180	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.25	% full scale	<1 % range	Yes
Repeatability at span level	0.15	% full scale	<2 % range	Yes
Deviation from linearity	0.70	% of value	<2 % range	Yes
Zero drift	0.13	% full scale	<2% range / 24hr	Yes
Span drift	-0.13	% full scale	<2% range / 24hr	Yes
volume or pressure flow dependence	0.02	% of full scale/3 kPa	<2 % / 3 kPa	Yes
atmospheric pressure dependence	0.80	% of full scale/2 kPa	<3% / 2 kPa	Yes
ambient temperature dependence	0.01	% full scale/10K	<3% range / 10 K	Yes
dependence on voltage	0.10	% full scale/10V	< 0.1%vol /10 volt	Yes
losses in the line (leak)	0.00	% of value	< 2% of span gas value	Yes
Uncertainty of calibration gas	1.0	% of value	< 2% of value	Yes

Performance characteristic	Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero	ur0	0.02
Standard deviation of repeatability at span level	urs	0.02
Lack of fit	ufit	6.47
Drift	u0dr	0.00
volume or pressure flow dependence	uspres	0.01
atmopsheric pressure dependence	uapres	0.39
ambient temperature dependence	utemp	0.00
Dependence on voltage	uvolt	1.38
losses in the line (leak)	uleak	0.00
Uncertainty of calibration gas	ucalib	6.88
Uncertainty in factor	uf	10.26

Measurement uncertainty Measured Concentration	1191.50	mg/m^3
Combined uncertainty	14.01	mg/m^3
Expanded uncertainty	28.03	mg/m^3

Expanded uncertainty expressed with a level of confidence of 95%	**2.80**	**% ELV**
Expanded uncertainty expressed with a level of confidence of 95%	**28.03**	**mg/m^3**
Expanded uncertainty expressed with a level of confidence of 95%	**2.35**	**% value**

Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - OXIDES OF NITROGEN

Limit value	500	mg/m^3
Concentration @ Ref conditions	340.1	mg/m^3
Cal gas conc	414.1	mg/m^3
Analyser Full Scale	513	mg/m^3

Performance characteristics	Value	Units	specification	MU Met?
Response time	22	seconds	180	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.25	% full scale	<1 % range	Yes
Repeatability at span level	0.15	% full scale	<2 % range	Yes
Deviation from linearity	0.70	% of value	<2 % range	Yes
Zero drift	-0.08	% full scale	<2% range / 24hr	Yes
Span drift	0.16	% full scale	<2% range/24hr	Yes
volume or pressure flow dependence	0.02	% of full scale/3 kPa	<2 % / 3 kPa	Yes
atmospheric pressure dependence	0.80	% of full scale/2 kPa	<3% / 2 kPa	Yes
ambient temperature dependence	0.01	% full scale/10K	<3% range / 10 K	Yes
dependence on voltage	0.10	% full scale/10V	< 0.1%vol /10 volt	Yes
losses in the line (leak)	0.54	% of value	< 2% of value	Yes
Uncertainty of calibration gas	1.0	% of value	< 2% of value	Yes

Performance characteristic	Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero	ur0	0.02
Standard deviation of repeatability at span level	urs	0.02
Lack of fit	ufit	2.07
Drift	u0dr	0.03
volume or pressure flow dependence	uspres	0.002
atmopsheric pressure dependence	uapres	0.13
ambient temperature dependence	utemp	0.00001
Dependence on voltage	uvolt	0.44
losses in the line (leak)	uleak	1.14
Uncertainty of calibration gas	ucalib	2.09
Uncertainty in factor	uf	2.48

Measurement uncertainty (Concentration Measured)	361.29	mg/m^3
Combined uncertainty	4.04	mg/m^3
Expanded at a 95% confidence interval	8.08	mg/m^3

Expanded uncertainty expressed with a level of confidence of 95%	**1.6**	**% ELV**

Expanded uncertainty expressed with a level of confidence of 95%	**8.1**	**mg/m^3**

Expanded uncertainty expressed with a level of confidence of 95%	**2.2**	**% value**

Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - CARBON MONOXIDE

Limit value	1400	mg/m^3
Concentration @ Ref conditions	535.4	mg/m^3
Cal gas conc	1027.5	mg/m^3
Analyser Full Scale	1250	mg/m^3

Performance characteristics	Value	Units	specification	MU Met?
Response time	25	seconds	180	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.25	% full scale	<1 % range	Yes
Repeatability at span level	0.15	% full scale	<2 % range	Yes
Deviation from linearity	0.70	% of value	<2 % range	Yes
Zero drift	0.01	% full scale	<2% range / 24hr	Yes
Span drift	-0.11	% full scale	<2% range/24hr	Yes
volume or pressure flow dependence	0.02	% of full scale/3 kPa	<2 % / 3 kPa	Yes
atmospheric pressure dependence	0.80	% of full scale/2 kPa	<3% / 2 kPa	Yes
ambient temperature dependence	0.01	% full scale/10K	<3% range / 10 K	Yes
dependence on voltage	0.10	% full scale/10V	< 0.1%vol /10 volt	Yes
losses in the line (leak)	0.36	% of value	< 2% of value	Yes
Uncertainty of calibration gas	1.0	% of value	< 2% of value	Yes

Performance characteristic	Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero	ur0	0.02
Standard deviation of repeatability at span level	urs	0.02
Lack of fit	ufit	5.05
Drift	u0dr	-0.03
volume or pressure flow dependence	uspres	0.005
atmopsheric pressure dependence	uapres	0.31
ambient temperature dependence	utemp	0.00001
Dependence on voltage	uvolt	1.08
losses in the line (leak)	uleak	1.19
Uncertainty of calibration gas	ucalib	3.26
Uncertainty in factor	uf	3.88

Measurement uncertainty (Concentration Measured)	564.9	mg/m^3
Combined uncertainty	7.3	mg/m^3
Expanded uncertainty	14.7	mg/m^3

Expanded uncertainty expressed with a level of confidence of 95%	**1.0**	**% ELV**
Expanded uncertainty expressed with a level of confidence of 95%	**14.7**	**mg/m^3**
Expanded uncertainty expressed with a level of confidence of 95%	**2.6**	**% value**

Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - OXYGEN

Reference	5	%vol
Reported Concentration	4.06	%vol
Calibration gas	10.1	%vol
Analyser Full Scale	10	%vol

Performance characteristics	Value	Units	specification	MU Met?
Response time	26	seconds	< 200 s	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.015	% by volume	<0.2 % range	Yes
Repeatability at span level	0.014	% by volume	<0.4 % range	Yes
Deviation from linearity	0.13	% vol	<0.3 % volume	Yes
Zero drift (during measurement period)	0.02	% vol at zero level	<2% of volume / 24hr	Yes
Span drift (during measurement period)	0.04	% vol at span level	<2% volume/24hr	Yes
volume or pressure flow dependence	0.02	% of fs / 10l/h	<1% range	Yes
atmospheric pressure dependence	0.80	% of fs/kPa	< 1.5 % range	Yes
ambient temperature dependence	0.01	% by volume /10K	<0.3% volume 10 K	Yes
Combined interference	0.06	% range	<2% range	Yes
Dependence on voltage	0.10	% by volume /10V	< 0.1%vol /10 volt	Yes
Losses in the line (leak)	-0.40	% of value	< 2% of value	Yes
Uncertainty of calibration gas	1.0	% of value	< 2% of value	Yes

Performance characteristic	Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero	ur0	-
Standard deviation of repeatability at span level	urs	0.0018
Lack of fit	ufit	0.08
Drift	u0dr	0.0208
volume or pressure flow dependence	uspres	0.00001
atmospheric pressure dependence	uapres	0.00
ambient temperature dependence	utemp	0.0005
Combined interference (from mcerts)	-	0.03
dependence on voltage	uvolt	0.09
losses in the line (leak)	uleak	-0.01
Uncertainty of calibration gas	ucalib	0.02

Measurement uncertainty (Concentration Measured)	4.06	%vol
Combined uncertainty	0.12	%vol
% of value	3.04	%

Expanded uncertainty expressed with a level of confidence of 95%	**6.1**	**% of value**
Expanded uncertainty expressed with a level of confidence of 95%	**0.25**	**% vol**

Developed for the STA by R Robinson, NPL

END OF REPORT

STACK EMISSIONS MONITORING REPORT

Units C & D
Bankside Trade Park
Cirencester
GL7 1YT
Tel: 01285 700593

Your contact at ESG
Mike Davies Business Manager - South Tel: 07976 297465 Email: mike.davies@esg.co.uk

Operator & Address:
AlphaGen Projects Ltd Trehir Land Fill Site Pandy Lane Llanbraddach Caerphilly CF83 3RP

Permit:
EPR Permit: LFTGN 08

Release Point:
A2 - Flare

Sampling Date(s):
31st August 2016

ESG Job Number:	LSO 160831
Report Date:	22nd September 2016
Version:	1
Report By:	David May
MCERTS Number:	MM 07 862
MCERTS Level:	MCERTS Level 2 - Operations Manager
Technical Endorsements:	1, 2, 3 & 4
Report Approved By:	Mike Davies
MCERTS Number:	MM 02 087
Business Title:	MCERTS Level 2 - Business Manager
Technical Endorsements:	1, 2, 3 & 4
Signature:	

UKAS TESTING
1015

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

CONTENTS

EXECUTIVE SUMMARY

MONITORING OBJECTIVES

AlphaGen Projects Ltd operates a landfill gas flare process at Trehir Land Fill Site which is subject to EPR Permit LFTGN 08, under the Environmental Permitting Regulations 2010.

ESG were commissioned by AlphaGen Projects Ltd to carry out stack emissions monitoring to determine the release of prescribed pollutants from the following Plant under normal operating conditions.

The results of these tests shall be used to demonstrate compliance with a set of emission limit values for prescribed pollutants as specified in the Plant's EPR Permit, LFTGN 08.

Plant

A2 - Flare

Operator

AlphaGen Projects Ltd
Trehir Land Fill Site
Pandy Lane
Llanbraddach
Caerphilly
CF83 3RP

EPR Permit: LFTGN 08

Stack Emissions Monitoring Test House

ESG - Cirencester Laboratory
Units C & D
Bankside Trade Park
Cirencester
GL7 1YT
UKAS and MCERTS Accreditation Number: 1015

EXECUTIVE SUMMARY

EMISSIONS SUMMARY					
Parameter	**Units**	**Result**	**LFTGN 08[2010] Uncertainty +/-**	**Calculated Uncertainty +/-**	**Limit**
NMVOC's	mg/m³	2.87	-	2.94	75
Volatile Organic Compounds	mg/m³	8.85	3.54	1.35	10
Volatile Organic Compounds ppm	ppm	3.47	0.53	0.53	
Oxides of Nitrogen (as NO_2)	mg/m³	100.74	30.22	6.62	150
Oxides of Nitrogen (as NO_2) ppm	ppm	34.18	10.25	2.25	
Carbon Monoxide	mg/m³	1.98	0.40	14.91	50
Carbon Monoxide ppm	ppm	1.10	0.22	8.28	
Oxygen	% v/v	8.4	0.3	-	
Moisture	%	9.0	0.33	-	

ND - NoneDetected
The result is considered non compliant if the result minus the MU is above the limit (LFGTN 08 [2010])
The MU for the purposes of compliance assessment is calculated from values in LFTGN 08 [2010]. i.e. 20% of the result for CO, 30% of the result for NOx & 40% of the result for VOCs.

Reference conditions are 273K, 101.3kPa, dry gas 3% Oxygen.

EXECUTIVE SUMMARY

MONITORING TIMES			
Parameter	**Sampling Date(s)**	**Sampling Times**	**Sampling Duration**
NMVOC's Run 1	31 August 2016	11:40 - 12:10	30 minutes
Volatile Organic Compounds Run 1	31 August 2016	11:30 - 12:30	60 minutes
Combustion Gases	31 August 2016	11:30 - 12:30	60 minutes

EXECUTIVE SUMMARY

PROCESS DETAILS

Parameter	Process Details
Description of process	Landfill Gas Flare
Fuel used during monitoring	Biogas
% Methane	37.8
% Carbon Dioxide	37
% Oxygen	0
Abatement	None

EXECUTIVE SUMMARY

Monitoring Methods

The selection of standard reference / alternative methods employed by ESG is determined, wherever possible by the hierarchy of method selection outlined in Environment Agency Technical Guidance Note (Monitoring) M2. i.e. CEN, ISO, BS, US EPA etc.

MONITORING METHODS						
Species	**Method** Standard Reference Method / Alternative Method	**ESG Technical Procedure**	**UKAS Lab Number**	**MCERTS Accredited Method**	**Limit of Detection (LOD)**	**Calculated MU +/- %**
NMVOC's	SRM - BS EN 13649	AE 118	1015	Yes	0.958 mg/m³	102.3%
VOCs	SRM - BS EN 12619:2013	AE 102	1015	Yes	0.22 mg/m³	15.3%
NO_X	SRM - BS EN 14792	AE 102	1015	Yes	0.74 mg/m³	6.6%
CO	SRM - BS EN 15058	AE 102	1015	Yes	1.98 mg/m³	752.7%
O_2	AM - BS EN 14789	AE 102	1015	Yes	0.01%	3.4%
H_2O	SRM - BS EN 14790	AE 105	1015	Yes	0.09%	3.65%

EXECUTIVE SUMMARY

Analytical Methods

The following tables list the analytical methods employed together with the custody and archiving details:

SAMPLING METHODS WITH SUBSEQUENT ANALYSIS							
Species	**Analytical Technique**	**Analytical Procedure**	**UKAS Lab Number**	**UKAS Accredited Lab Analysis**	**Analysis Lab (ESG or Subcontract)**	**Sample Archive Location**	**Archive Period**
NMVOC's	GC-MS	ASC GC-MS	1045	Yes	Bretby	Bretby	3 months

ON-SITE TESTING							
Species	**Analytical Technique**	**Analytical Procedure**	**UKAS Lab Number**	**MCERTS Accredited Analysis**	**Laboratory**	**Data Archive Location**	**Archive Period**
VOCs	Flame Ionisation Detection	AE 102	1015	Yes	ESG - Cirencester	ESG - Cirencester	5 years
NO_X	Chemiluminescence	AE 102	1015	Yes	ESG - Cirencester	ESG - Cirencester	5 years
CO	Non Dispersive Infra Red	AE 102	1015	Yes	ESG - Cirencester	ESG - Cirencester	5 years
O_2	Zirconia Cell	AE 102	1015	Yes	ESG - Cirencester	ESG - Cirencester	5 years
H_2O	Gravimetric	AE 105	1015	Yes	ESG - Cirencester	-	-

EXECUTIVE SUMMARY

SAMPLING LOCATION					
Sampling Plane Validation Criteria	**Value**	**Units**	**Requirement**	**Compliant**	**Method**
Lowest Differential Pressure	-	Pa	>= 5 Pa	-	BS EN 15259
Lowest Gas Velocity	-	m/s	-	-	-
Highest Gas Velocity	-	m/s	-	-	-
Ratio of Gas Velocities	-	: 1	< 3 : 1	-	BS EN 15259
Mean Velocity	-	m/s	-	-	-
Maximum angle of flow with regard to duct axis	-	°	< 15°	-	BS EN 15259
No local negative flow	-	-	-	-	BS EN 15259

DUCT CHARACTERISTICS		
	Value	**Units**
Shape	Circular	-
Depth	Unable to measure	m
Width	-	m
Area	-	m^2
Port Depth	-	mm

SAMPLING LINES & POINTS		
	Isokinetic	**Non-Iso & Gases**
Sample port size	-	Top of Stack
Number of lines used	-	1
Number of points / line	-	1
Duct orientation	-	Vertical

SAMPLING PLATFORM	
General Platform Information	
Permanent / Temporary Platform / Ground level / Floor Level / Roof	Permanent
Inside / Outside	Outside

M1 Platform requirements	
Is there a sufficient working area so work can be performed in a compliant manner	Yes
Platform has 2 levels of handrails (approximately 0.5 m & 1.0 m high)	N/A
Platform has vertical base boards (approximately 0.25 m high)	N/A
Platform has removable chains / self closing gates at the top of ladders	N/A
Handrail / obstructions do not hamper insertion of sampling equipment	N/A
Depth of Platform = >Stack depth / diameter + wall and port thickness + 1.5m	Yes

Sampling Platform Improvement Recommendations (if applicable)

The sampling location meets all the requirements as specified in EA Guidance Note M1.

EXECUTIVE SUMMARY

Sampling & Analytical Method Deviations

In this instance there were no deviations from the sampling and analytical methods employed.

APPENDICES

CONTENTS

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

MONITORING SCHEDULE					
Species	**Method** Standard Reference Method / Alternative Method	**ESG Technical Procedure**	**UKAS Lab Number**	**MCERTS Accredited Method**	**Number of Samples**
NMVOC's	SRM - BS EN 13649	AE 118	1015	Yes	1
VOCs	SRM - BS EN 12619:2013	AE 102	1015	Yes	1
NOx	SRM - BS EN 14792	AE 102	1015	Yes	1
CO	SRM - BS EN 15058	AE 102	1015	Yes	1
O_2	AM - BS EN 14789	AE 102	1015	Yes	1
H_2O	SRM - BS EN 14790	AE 105	1015	Yes	1

APPENDIX 1 - Monitoring Schedule, Calibration Checklist & Monitoring Team

CALIBRATEABLE EQUIPMENT CHECKLIST

Extractive Sampling		Instrumental Analyser/s		Miscellaneous	
Equipment	**Equipment I.D.**	**Equipment**	**Equipment I.D.**	**Equipment**	**Equipment I.D.**
Control Box DGM	P1757	Horiba PG-250 Analyser	P1301	Laboratory Balance	-
Box Thermocouples	P1757	FT-IR Gasmet	-	Tape Measure	-
Meter In Thermocouple	P1757	FT-IR Oven Box	-	Stopwatch	-
Meter Out Thermocouple	P1757	Bernath 3006 FID	-	Protractor	-
Control Box Timer	P1757	Signal 3030 FID	P2596	Barometer	P1313
Oven Box	-	Servomex	-	Digital Micromanometer	-
Probe	-	JCT Heated Head Filter	-	Digital Temperature Meter	-
Probe Thermocouple	-	Thermo FID	-	Stack Thermocouple	-
Probe	-	Stackmaster	-	Mass Flow Controller	-
Probe Thermocouple	-	FTIR Heater Box for Heated Line	-	MFC Display module	-
S-Pitot	-	Anemometer	-	1m Heated Line (1)	-
L-Pitot	-	Ecophysics NOx Analyser	-	1m Heated Line (2)	-
Site Balance	P1906	Chiller (JCT/MAK 10)	P2050	1m Heated Line (3)	-
Last Impinger Arm	-	Heated Line Controller (1)	P1897	5m Heated Line (1)	-
Dioxins Cond. Thermocouple	-	Heated Line Controller (2)	-	10m Heated Line (1)	-
Callipers	-	Site temperature Logger	-	10m Heated Line (2)	-
Small DGM	-		-	15m Heated Line (1)	-
Heater Controller	-		-	20m Heated Line (1)	P2404
Inclinometer (Swirl Device)	-		-	20m Heated Line (2)	-

NOTE: If the equipment I.D is represented by a dash (-), then this piece of equipment has not been used for this test.

CALIBRATION GASES

Gas (traceable to ISO 17025)	Cylinder I.D Number	Supplier	ppm	%	Analytical Tolerance +/- %
Oxygen	CE4	BOC	-	10.3	2.0
Propane	CE4	BOC	30	-	2.0
Nitric Oxide	SA3	BOC	202	-	2.0
Carbon Monoxide	CE4	BOC	157	-	2.0
-	-	-	-	-	-

STACK EMISSIONS MONITORING TEAM

MONITORING TEAM								
Personnel	**MCERTS Number**	**MCERTS**		**TE / H&S Qualifications and Expiry Date**				
		Level	**Expiry**	**TE1**	**TE2**	**TE3**	**TE4**	**H&S**
David May	MM 07 862	MCERTS Level 2	Nov-17	Dec-19	Sep-20	Mar-20	Sep-19	Nov-17
Jamie Whiteman	MM 11 1134	MCERTS Level 1	Sep-16	Oct-18	Feb-18	-	-	Sep-16

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

NMVOC'S SUMMARY					
Test	Sampling Times	Concentration mg/m³	LOD mg/m³	Limit mg/m³	Emission Rate g/hr
Run 1	11:40 - 12:10 31 August 2016	2.87	0.96	75	-
Field Blank	-	1.92	-	-	-

Reference conditions are 273K, 101.3kPa, dry gas 3% Oxygen.

NMVOC'S QUALITY ASSURANCE CHECKLIST

Leak Test Results	Mean Sampling Rate l/min	Pre sampling leak rate l/min	Post sampling leak rate l/min	Acceptable leak rate l/min	Leak Tests Acceptable?
Run 1	1	0.01	0.01	0.02	Yes

	Type of tube	Max. Tube Temperature °C	Max. Storage / Transit Temp. °C
Run 1	Charcoal	22	24

Tube sampling temperature should be < 40°C

NMVOC'S ADSORPTION EFFICIENCY

Parameter	Total ug	Back ug	Adsorption Efficiency %	Acceptable Adsorption Efficiency %	Adsorption Efficiency Acceptable ?
Run 1	60	20	67	95	N/A <30% ELV

N/A - As the result is less than 30% of the ELV an absorption efficiency greater than 95% is not required.

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

VOLATILE ORGANIC COMPOUNDS SUMMARY

Test	Sampling Times	Concentration mg/m³	LOD mg/m³	Limit mg/m³	Emission Rate g/hr
Run 1	11:30 - 12:30 31 August 2016	8.9	0.22	10	-

Reference conditions are 273K, 101.3kPa, dry gas 3% Oxygen.

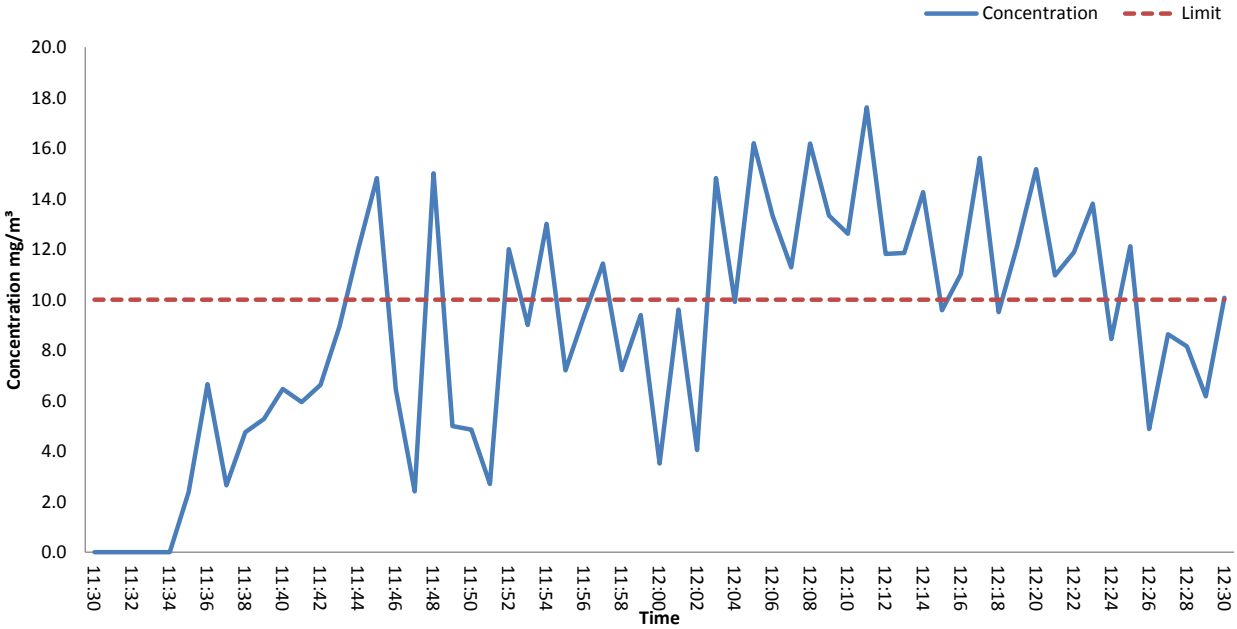
INSTRUMENTAL SPAN & ZERO CHECKS

PRE-SAMPLING CALIBRATION CHECKS RUN 1								
Date	31 August 2016							
Start Time	11:20							
End Time	11:30							
Gas	Gas Conc (ppm)	Range	Instrument Zero Reading	Instrument Span Reading	Instrument Zero Reading	Zero Down line reading	Span down line reading	Leak Rate (%)
Propane	30.0	100	0.00	30.0	0.00	0.00	30.5	-1.67

Zero and Span gas contained 10.3% Oxygen

POST-SAMPLING CALIBRATION CHECKS RUN 1				
Date	31 August 2016			
Start Time	12:35			
End Time	12:45			
Gas	Zero down line reading	Span down line reading	Zero Drift (%)	Span Drift (%)
Propane	0.00	30.5	0.00	0.00

VOLATILE ORGANIC COMPOUNDS EMISSIONS CHART



Reference conditions are 273K, 101.3kPa, dry gas 3% Oxygen.

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

COMBUSTION GASES SUMMARY

Test	Sampling Time and Date	Concentration mg/m³	LOD mg/m³	Limit mg/m³	Emission Rate g/hr
NOx	11:30 - 12:30 31 August 2016	100.7	0.74	150	-
CO	11:30 - 12:30 31 August 2016	1.98	1.98	50	-

Test	Sampling Time and Date	Concentration %	LOD %
O_2	11:30 - 12:30 31 August 2016	8.45	0.01

Reference conditions are 273K, 101.3kPa, dry gas 3% Oxygen.

PRE-SAMPLING CALIBRATION DATA

Date	31 August 2016
Start Time	11:20
End Time	11:28

Chiller Temperature (°C)	3.0
Requirement	< 4°C
Compliant	Yes

Gas	Range (ppm / %)	Zero Reading at analyser	Span Reading at analyser	Zero Check at analyser	Zero Check down line	Span Check down line	Response Time (Secs)	Leak Rate %
NO	250	0.00	202.0	0.00	0.30	201.4	22	0.30
CO	1000	0.00	157.0	0.10	0.30	157.2	23	-0.13
O_2	10	0.00	10.30	0.02	0.04	10.23	24	0.68

POST-SAMPLING CALIBRATION DATA

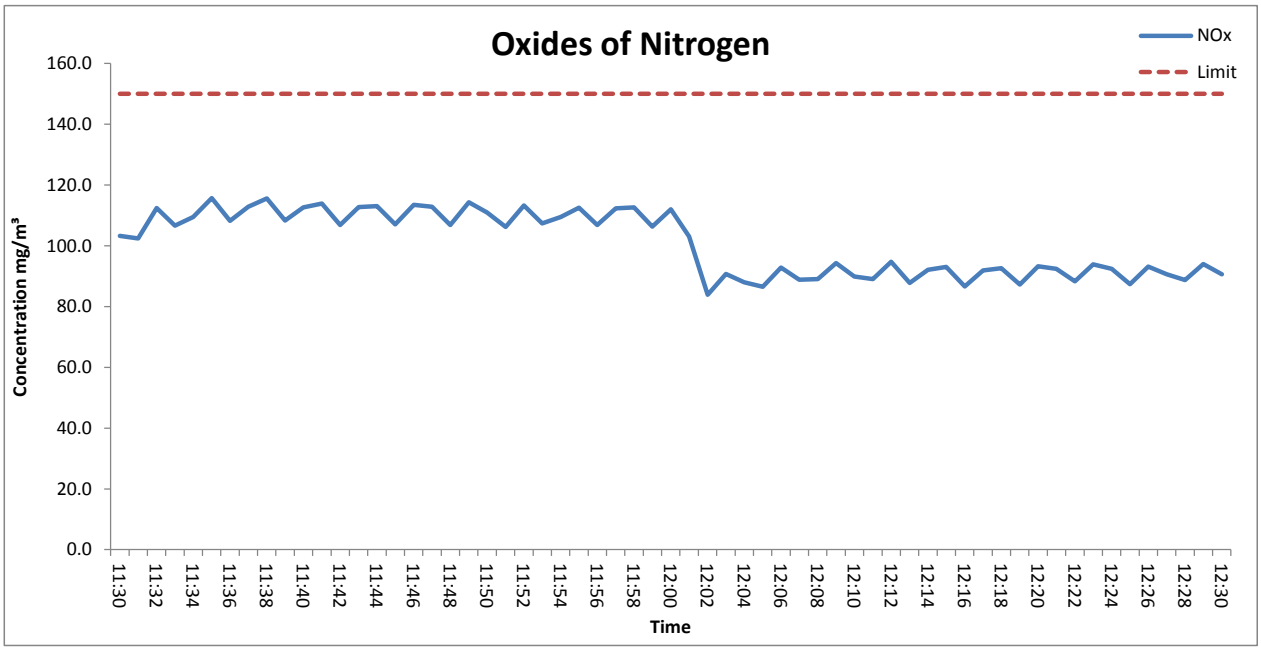
Date	31 August 2016
Start Time	12:35
End Time	12:50

Chiller Temperature (°C)	2.0
Requirement	< 4°C
Compliant	Yes

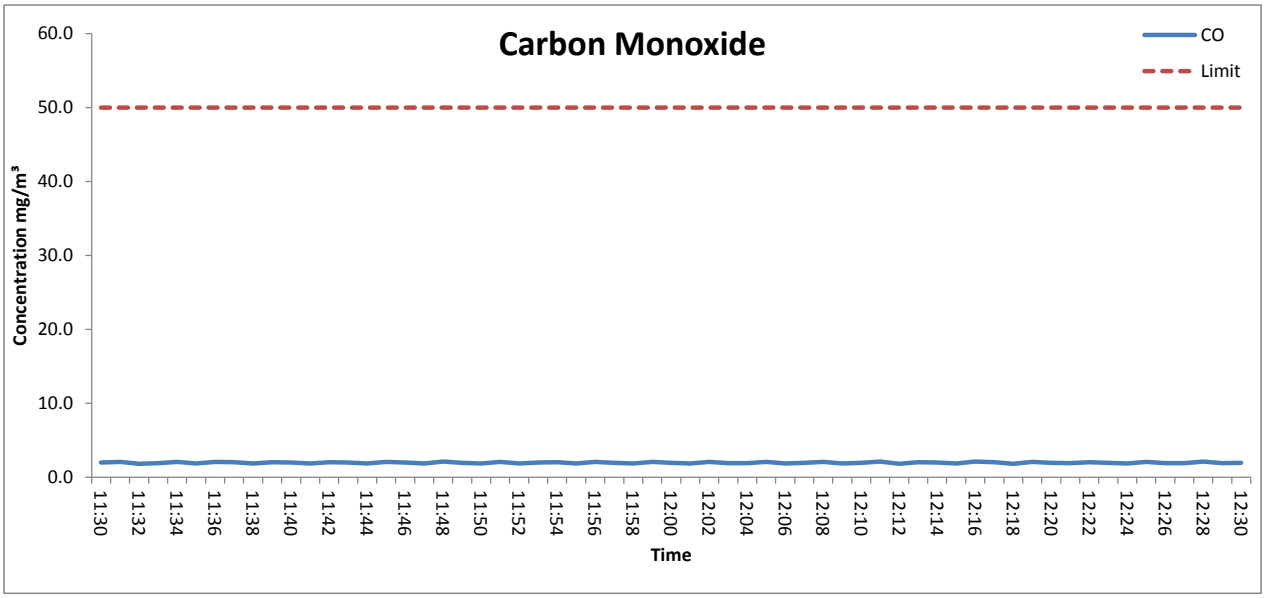
Gas	Zero Check down line	Span Check down line	Zero Drift (%)	Span Drift (%)
NO	0.20	201.4	-0.04	0.04
CO	0.10	156.4	-0.02	-0.06
O_2	0.09	10.33	0.50	0.50

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

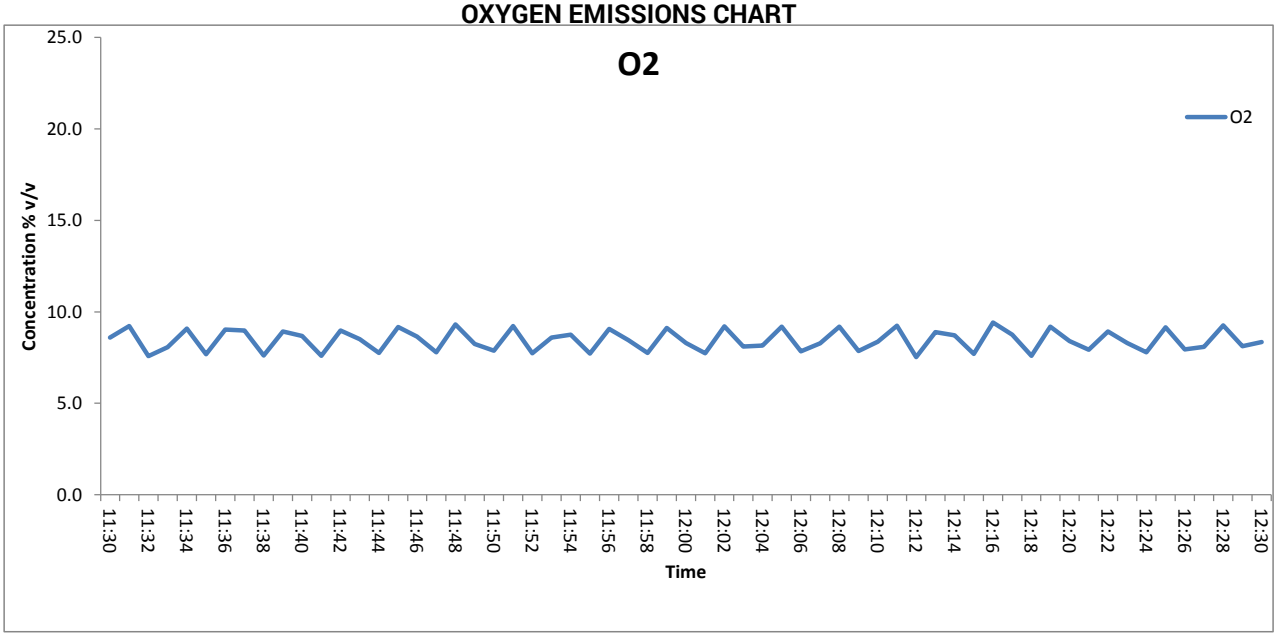
OXIDES OF NITROGEN (as NO_2) EMISSIONS CHART



CARBON MONOXIDE EMISSIONS CHART



OXYGEN EMISSIONS CHART



APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

MOISTURE CALCULATIONS

Moisture Determination - Non Isokinetic							
Test Number	Sampling Time and Date	Start Weight kg	End Weight kg	Total gain kg	Concentration %	LOD %	Uncertainty %
Run 1	11:30 - 12:00 31 August 2016	3.2519	3.2635	0.0116	9.0	0.09	3.6

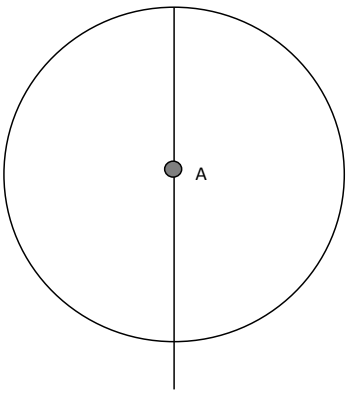
Moisture Quality Assurance							
Test Number	Sampling Duration mins	Total Volume Sampled l	Sampling Rate l/min	Start Leak Rate l/min	End Leak Rate l/min	Acceptable Leak Rate l/min	Leak Tests Acceptable?
Run 1	30	146	4.9	0.050	0.050	0.097	Yes

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK DIAGRAM

	Value	Units
Stack Depth	Unable to measure	m
Stack Width	-	m
Area	-	m^2

Non-Isokinetic/Gases Sampling			
Sampling Point	Distance (% of Depth)	Distance into Stack	Units
A	~50	-	m



Sampling Line

Isokinetic Sampling			
Sampling Point	Distance (% of Depth)	Distance into Stack (m)	Swirl °
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
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-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

○ Isokinetic sampling point
● Isokinetic sampling points not used
◉ Non Isokinetic/Gases sampling point

SAMPLING LOCATION

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - NMVOC'S

Run	Sampled Volume m³	Sampled Gas Temp K	Sampled Gas Pressure kPa	Sampled Gas Humidity % by volume	Oxygen Content % by volume	Limit of Detection % by mass	Leak %	Uncollected Mass mg
MU required	**≤ 2%**	**≤ 2%**	**≤ 1%**	**≤ 1%**	**≤ 10%**	**≤ 5% of ELV**	**≤ 2%**	**≤ 10% of ELV**
Run 1	0.00002	2	0.5	1	0.1	0.02	-	-
as a %	0.0667	0.6803	0.4919	1.0000	1.1840	1.28	1.0000	0.0533
compliant?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Run	Volume (STP) m³	Mass of NMVOC's mg	O2 Correction -	Leak mg/m³	Uncollected Mass mg	Lab Uncertainty mg	Combined uncertainty
Run 1	0.028	0.060	1.434	0.017	0.023	-	-
MU as mg/m³	0.000	0.958	0.023	0.017	1.106	0.144	**1.471**
MU as %	0.000	33.333	-	0.577	38.490	5.000	-

R1 - Uncertainty expressed at a 95% confidence level (where k = 2)	**2.942**	**mg/m³**	**102.34**	**%**

Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - MOISTURE

Run	Sampled Volume m³	Sampled Gas Temp K	Sampled Gas Pressure kPa	Sampled Gas Humidity % by volume	Oxygen Content % by volume	Leak %
MU required	**≤ 2%**	**≤ 2%**	**≤ 1%**	**≤ 1%**	**≤ 10%**	**≤ 2%**
Run 1	0.000	2.0	0.50	1.0	0.1	-
as a %	0.07	0.26	0.49	1.0	1.18	1.03
compliant?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Run	Volume (STP) m³	Mass Gained mg	O2 Correction -	Leak mg/m³	Uncollected Mass mg	Combined uncertainty
Run 1	0.1	11600	1.4	471.3	58	-
MU as % v/v	0.12	0.09	0.04	0.06	0.05	**0.17**
MU as %	1.2	0.9	0.80	0.6	0.5	-

R1 - Uncertainty expressed at a 95% confidence level (where k = 2)	**0.34**	**% v/v**	**3.65**	**%**

Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - VOLATILE ORGANIC COMPOUNDS RUN 1

Measured Concentration	8.9	mg/m^3
Limit	10	mg/m^3
Calibration Gas Concentration	48	mg/m^3
Range	160	mg/m^3

Performance characteristics	Value	Units	specification	MU Met?
Response time	32	seconds	<180	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.25	% full scale	<1 % range	Yes
Repeatability at span level	0.15	% full scale	<2 % range	Yes
Deviation from linearity	0.70	% of value	<2 % range	Yes
Zero drift	0.00	% full scale	<2% range / 24hr	Yes
Span drift	0.00	% full scale	<2% range / 24hr	Yes
volume or pressure flow dependence	0.02	% of full scale/3 kPa	<2 % / 3 kPa	Yes
atmospheric pressure dependence	0.80	% of full scale/2 kPa	<3% / 2 kPa	Yes
ambient temperature dependence	0.01	% full scale/10K	<3% range / 10 K	Yes
dependence on voltage	0.10	% full scale/10V	< 0.1%vol /10 volt	Yes
losses in the line (leak)	-1.67	% of value	< 2% of span gas value	Yes
Uncertainty of calibration gas	1.0	% of value	< 2% of value	Yes

Performance characteristic	Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero	ur0	0.02
Standard deviation of repeatability at span level	urs	0.02
Lack of fit	ufit	0.65
Drift	u0dr	0.00
volume or pressure flow dependence	uspres	0.00
atmopsheric pressure dependence	uapres	0.04
ambient temperature dependence	utemp	0.00
Dependence on voltage	uvolt	0.14
losses in the line (leak)	uleak	-0.09
Uncertainty of calibration gas	ucalib	0.05
Uncertainty in factor	uf	0.11

Measurement uncertainty Measured Concentration	8.85	mg/m^3
Combined uncertainty	0.68	mg/m^3
Expanded uncertainty	1.36	mg/m^3

Expanded uncertainty expressed with a level of confidence of 95%	**13.58**	**% ELV**
Expanded uncertainty expressed with a level of confidence of 95%	**1.36**	**mg/m^3**
Expanded uncertainty expressed with a level of confidence of 95%	**15.34**	**% value**

Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - OXIDES OF NITROGEN

Limit value	150	mg/m^3
Concentration @ Ref conditions	100.7	mg/m^3
Cal gas conc	414.1	mg/m^3
Analyser Full Scale	513	mg/m^3

Performance characteristics	Value	Units	specification	MU Met?
Response time	22	seconds	180	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.25	% full scale	<1 % range	Yes
Repeatability at span level	0.15	% full scale	<2 % range	Yes
Deviation from linearity	0.70	% of value	<2 % range	Yes
Zero drift	-0.04	% full scale	<2% range / 24hr	Yes
Span drift	0.04	% full scale	<2% range/24hr	Yes
volume or pressure flow dependence	0.02	% of full scale/3 kPa	<2 % / 3 kPa	Yes
atmospheric pressure dependence	0.80	% of full scale/2 kPa	<3% / 2 kPa	Yes
ambient temperature dependence	0.01	% full scale/10K	<3% range / 10 K	Yes
dependence on voltage	0.10	% full scale/10V	< 0.1%vol /10 volt	Yes
losses in the line (leak)	0.30	% of value	< 2% of value	Yes
Uncertainty of calibration gas	1.0	% of value	< 2% of value	Yes

Performance characteristic	Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero	ur0	0.02
Standard deviation of repeatability at span level	urs	0.02
Lack of fit	ufit	2.07
Drift	u0dr	-0.02
volume or pressure flow dependence	uspres	0.002
atmopsheric pressure dependence	uapres	0.13
ambient temperature dependence	utemp	0.00001
Dependence on voltage	uvolt	0.44
losses in the line (leak)	uleak	0.12
Uncertainty of calibration gas	ucalib	0.41
Uncertainty in factor	uf	0.80

Measurement uncertainty (Concentration Measured)	70.17	mg/m^3
Combined uncertainty	2.31	mg/m^3
Expanded at a 95% confidence interval	4.61	mg/m^3

Expanded uncertainty expressed with a level of confidence of 95%	**3.1**	**% ELV**

Expanded uncertainty expressed with a level of confidence of 95%	**4.6**	**mg/m^3**

Expanded uncertainty expressed with a level of confidence of 95%	**6.6**	**% value**

Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - CARBON MONOXIDE

Limit value	50	mg/m^3
Concentration @ Ref conditions	2.0	mg/m^3
Cal gas conc	196.25	mg/m^3
Analyser Full Scale	1250	mg/m^3

Performance characteristics	Value	Units	specification	MU Met?
Response time	23	seconds	180	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.25	% full scale	<1 % range	Yes
Repeatability at span level	0.15	% full scale	<2 % range	Yes
Deviation from linearity	0.70	% of value	<2 % range	Yes
Zero drift	-0.02	% full scale	<2% range / 24hr	Yes
Span drift	-0.06	% full scale	<2% range/24hr	Yes
volume or pressure flow dependence	0.02	% of full scale/3 kPa	<2 % / 3 kPa	Yes
atmospheric pressure dependence	0.80	% of full scale/2 kPa	<3% / 2 kPa	Yes
ambient temperature dependence	0.01	% full scale/10K	<3% range / 10 K	Yes
dependence on voltage	0.10	% full scale/10V	< 0.1%vol /10 volt	Yes
losses in the line (leak)	-0.13	% of value	< 2% of value	Yes
Uncertainty of calibration gas	1.0	% of value	< 2% of value	Yes

Performance characteristic	Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero	ur0	0.02
Standard deviation of repeatability at span level	urs	0.02
Lack of fit	ufit	5.05
Drift	u0dr	0.00
volume or pressure flow dependence	uspres	0.005
atmopsheric pressure dependence	uapres	0.31
ambient temperature dependence	utemp	0.00001
Dependence on voltage	uvolt	1.08
losses in the line (leak)	uleak	0.00
Uncertainty of calibration gas	ucalib	0.01
Uncertainty in factor	uf	0.02

Measurement uncertainty (Concentration Measured)	1.4	mg/m^3
Combined uncertainty	5.2	mg/m^3
Expanded uncertainty	10.3	mg/m^3

Expanded uncertainty expressed with a level of confidence of 95%	**20.7**	**% ELV**
Expanded uncertainty expressed with a level of confidence of 95%	**10.3**	**mg/m^3**
Expanded uncertainty expressed with a level of confidence of 95%	**752.7**	**% value**

Developed for the STA by R Robinson, NPL

APPENDIX 3 - Measurement Uncertainty Budget Calculations

MEASUREMENT UNCERTAINTY BUDGET - OXYGEN

Reference	3	%vol
Reported Concentration	8.45	%vol
Calibration gas	10.3	%vol
Analyser Full Scale	10	%vol

Performance characteristics	Value	Units	specification	MU Met?
Response time	24	seconds	< 200 s	Yes
Logger sampling interval	60	seconds	-	-
Measurement period	60	minutes	-	-
Number of readings in measurement	60	-	-	-
Repeatability at zero	0.015	% by volume	<0.2 % range	Yes
Repeatability at span level	0.014	% by volume	<0.4 % range	Yes
Deviation from linearity	0.13	% vol	<0.3 % volume	Yes
Zero drift (during measurement period)	0.05	% vol at zero level	<2% of volume / 24hr	Yes
Span drift (during measurement period)	0.05	% vol at span level	<2% volume/24hr	Yes
volume or pressure flow dependence	0.02	% of fs / 10l/h	<1% range	Yes
atmospheric pressure dependence	0.80	% of fs/kPa	< 1.5 % range	Yes
ambient temperature dependence	0.01	% by volume /10K	<0.3% volume 10 K	Yes
Combined interference	0.06	% range	<2% range	Yes
Dependence on voltage	0.10	% by volume /10V	< 0.1%vol /10 volt	Yes
Losses in the line (leak)	0.68	% of value	< 2% of value	Yes
Uncertainty of calibration gas	1.0	% of value	< 2% of value	Yes

Performance characteristic	Uncertainty	Value of uncertainty quantity
Standard deviation of repeatability at zero	ur0	-
Standard deviation of repeatability at span level	urs	0.0018
Lack of fit	ufit	0.08
Drift	u0dr	0.0525
volume or pressure flow dependence	uspres	0.00001
atmospheric pressure dependence	uapres	0.00
ambient temperature dependence	utemp	0.0005
Combined interference (from mcerts)	-	0.03
dependence on voltage	uvolt	0.09
losses in the line (leak)	uleak	0.03
Uncertainty of calibration gas	ucalib	0.05

Measurement uncertainty (Concentration Measured)	8.45	%vol
Combined uncertainty	0.14	%vol
% of value	1.69	%

Expanded uncertainty expressed with a level of confidence of 95%	**3.4**	**% of value**
Expanded uncertainty expressed with a level of confidence of 95%	**0.29**	**% vol**

Developed for the STA by R Robinson, NPL

END OF REPORT

Periodic monitoring of raw landfill gas

Trehir Landfill Site

Report	LSO160831-TG
Permit Number	EPR
Date	31 August 2016
Version	1

1015

PERIODIC MONITORING OF RAW LANDFILL GAS

TREHIR LANDFILL SITE

Report prepared for

Alphagen Projects Ltd
Trehir Landfill Site
Pandy Lane
Llanbraddach, Caerphilly
CF83 3RP

Report prepared by

ESG Limited
Units C&D
Bankside Business Park
Cirencester
Gloucestershire
GL7 1YT

Approved **Mr M Davies**

Issue history

Version	Date	Approved	
LSO160831-TG, 1	23 November 2016	M Davies	
First issue			

1 Introduction

Alphagen Projects Ltd (Alphagen) contracted Environmental Scientifics Group (ESG) to undertake monitoring of the landfill gas supply to its combustion operations at their Trehir Landfill site.

2 Test methodology

Alphagen requested that samples of landfill gas be collected and analysed for the priority trace components (LFTGN04, Table 1.1) specified in Environment Agency guidance (Guidance for monitoring trace components in landfill gas – LFTGN04 v3.0, 2010). The test methodology should be in accordance with that specified within LFTGN04.

Based on LFTGN04 the priority trace gas components are sampled using a combination of four sampling media as shown in Table 1.

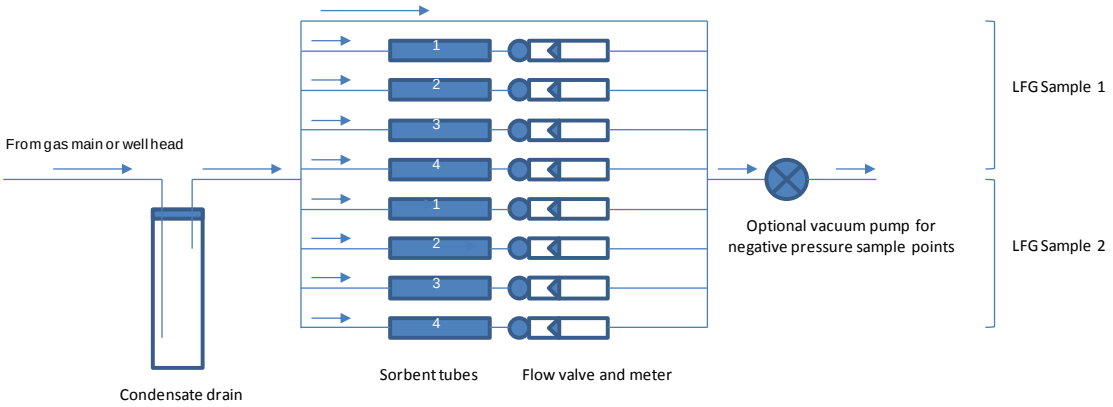
Table 1 Sampling media and analytical methods

Trace component	CAS number	Sampling method	Analytical method
1,1-dichloroethane	75-34-3	Dual solid sorbent	ATD-GC-MS
1,2-dichloroethane	107-06-2	Dual solid sorbent	ATD-GC-MS
1,1-dichloroethene	75-35-4	Dual solid sorbent	ATD-GC-MS
1,2-dichloroethene	540-59-0	Dual solid sorbent	ATD-GC-MS
1,3-butadiene	106-99-0	Dual solid sorbent	ATD-GC-MS
1-butanethiol	109-79-5	Dual solid sorbent	ATD-GC-MS
1-pentene	109-67-1	Dual solid sorbent	ATD-GC-MS
1-propanethiol	107-03-9	Dual solid sorbent	ATD-GC-MS
2-butoxyethanol	111-76-2	Dual solid sorbent	ATD-GC-MS
Arsenic (as As)	7440-38-2	Charcoal	ICP-MS
Benzene	71-43-2	Dual solid sorbent	ATD-GC-MS
Butyric acid	107-92-6	Dual solid sorbent	ATD-GC-MS
Carbon disulphide	75-15-0	Dual solid sorbent	ATD-GC-MS
Chloroethane	75-00-3	Dual solid sorbent	ATD-GC-MS
Chloroethene (vinyl chloride)	75-01-4	Dual solid sorbent	ATD-GC-MS
Dichloromethane	75-09-2	Dual solid sorbent	ATD-GC-MS
Dimethyl disulphide	624-92-0	Dual solid sorbent	ATD-GC-MS
Dimethyl sulphide	75-18-3	Dual solid sorbent	ATD-GC-MS
Ethanal (acetaldehyde)	75-07-0	Silica gel/2,4 DNPH	HPLC-DAD
Ethanethiol	75-08-1	Dual solid sorbent	ATD-GC-MS
Ethyl butyrate	105-54-4	Dual solid sorbent	ATD-GC-MS
Furan (1,4-epoxy-1,3-butadiene)	110-00-9	Dual solid sorbent	ATD-GC-MS
Hydrogen sulphide	7783-06-4	Charcoal	IC
Methanal (formaldehyde)	50-00-0	Silica gel/2,4 DNPH	HPLC-DAD
Methanethiol	74-93-1	Dual solid sorbent	ATD-GC-MS
Styrene	100-42-5	Dual solid sorbent	ATD-GC-MS
Tetrachloromethane	56-23-5	Dual solid sorbent	ATD-GC-MS
Toluene	108-88-3	Dual solid sorbent	ATD-GC-MS
Trichloroethene	79-01-6	Dual solid sorbent	ATD-GC-MS

ATD – automated thermal desorption
GC-MS – gas chromatography and mass spectrometry
ICP-MS – inductively couple plasma/mass spectrometry
HPLC-DAD – high performance liquid chromatography and diode array detection
IC – ion chromatography

Sampling for all components is undertaken simultaneously using a multiple stream sampler as shown in Figure 1.

Figure 1 Landfill gas sampling arrangement



A sample is taken from either the gas main or well head and passed through a condensate drain to remove excess moisture. The sample gas is then split to pass through a series of up to eight regulated rotameters arranged in two banks of four. There is also a bypass stream for excess sample. This allows the duplicate simultaneous sampling at regulated flow rates onto four sampling media. The flow rates and sampling duration are set in accordance with LFTGN04 requirements as summarised in Table 2.

Table 2 Sampling media and analytical methods

Media	Target species	Sampling rate (ml/min)	Sampling duration (min)	Sample volume (l)
Dual solid sorbent (Tenax/Sulficarb)	VOCs	20	10	0.2
Silica gel and 2,4 DNPH (SKC 226-119)	Aldehydes	20	50	1.0
Activated carbon 1 (SKC 226-09)	Arsenic	100	50	5.0
Activated carbon 2 (SKC 226-09)	Hydrogen sulphide	100	50	5.0

In the case of negative pressure sources it is necessary to employ a vacuum pump at the sampler's common outlet. This is not normally required with positive pressure systems

The samples are subject to the analytical procedures described in Table 1 to provide a mass on the collected sample which can then be related to the volume of gas sampled to provide a component concentration in the sampled landfill gas.

The sampling followed internal procedure GAS15 and is accredited under test certificate 1015.

3 Site information

Sample point details			
Date	31 August 2016	Site	Trehir Power Plant
Ambient temperature	24.5 ^{o}C	Atmospheric pressure	101.5 kPa
Monitoring organisation	ESG UKAS 1015	Analytical laboratory	ESG UKAS 1015
Location of sampling point	Pre Carbon Scrubber	Area of influence of collection system sampled	All
Type of sample point	¼" Tail	Temperature of gas	33^{o}C
Pressure at sample point	Not measured	Type of waste	Not recorded
Status of gas system	Active	Age of waste	Not recorded

4 Preliminary checks and field measurements

Parameter		Concentration
Methane	%	42.8
Carbon dioxide	%	31
Oxygen	%	0.1
Nitrogen (by difference)	%	26.1
Hydrogen sulphide	ppmv	30
Carbon monoxide	ppmv	0

*carbon monoxide is measured with a hydrogen sulphide filter in the sampling line.

Preliminary bulk gas measurements were undertaken using a Gasdata GFM436 electrochemical cell analyser (no P2652). Reported measurements are spot readings following gas sampling for a period of 5 minutes.

5 Results of landfill gas analysis

The results of the sampling and analysis are summarised in Table 3 below.

Table 3 Priority trace component measurement results

Parameter		**Concentration (µg/m^3,STP)**
1 Pentene		109
1,1-Dichloroethane		<33
1,1-Dichloroethylene		<49
1,2-Dichloroethane	*	<54
1,2-Dichloroethylene		816
1,3-Butadiene		<38
1,4 epoxy 1,3 butadiene		218
1-Propanethiol		<109
2-butoxyethanol		<109
Benzene	*	1904
Butyric acid		<218
Carbon disulphide		871
Carbon tetrachloride	*	<54
Chloroethane		<54
Dichloromethane	*	54
Dimethyl disulphide		54
Dimethyl sulphide		<54
Ethyl butyrate		<49
Ethyl mercaptan		<163
Methyl mercaptan		<544
N-Butyl mercaptan		<163
Styrene	*	<54
Toluene	*	4135
Trichloroethylene	*	<54
Vinyl chloride monomer		<163
Arsenic	*	202
Hydrogen sulphide	*	69640
Acetaldehyde	*	109
Formaldehyde	*	109

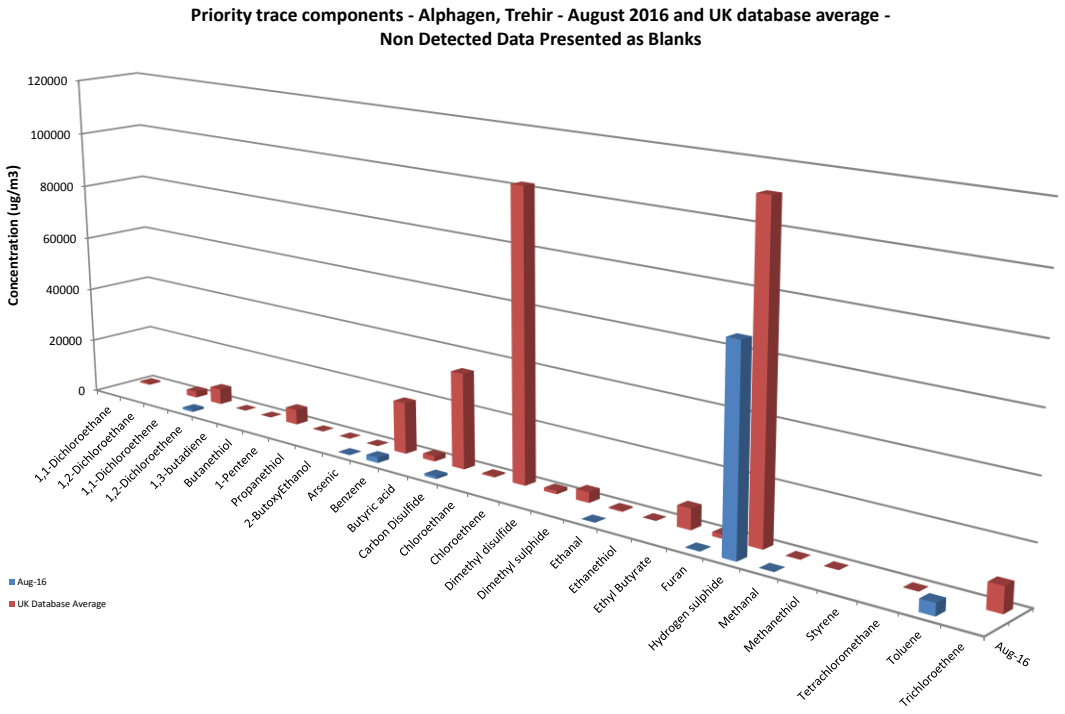
* indicates result is UKAS accredited

< indicates result is below the method limit of detection

The above reported results are the maximum concentrations measured for each parameter in two samples.

The maximum results of the current analyses are compared with historical data and the UK database average in Figure 2.

Figure 2 Historical priority trace component analysis results at Trehir



6 NOTES

Sampling of landfill gas was undertaken in accordance with ESG procedure GAS15 and is UKAS accredited under certificate 1015.

Analysis of collected samples was undertaken by ESG's Bretby laboratory. The analytical results which fall within ESG's scope of accreditation under certificate 1015 are identified in Table 3.

The priority component measurements which can be considered to be within the scope of UKAS accreditation are identified in Table 3.

Any interpretations and opinions expressed are outside of the scope of UKAS accreditation.

Contact:

Mr Mike Davies
ESG Limited
Units C&D
Bankside Trade Park
Cirencester
Gloucestershire
GL7 1YT

T: 07976 297465
E: mike.davies@esg.co.uk