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## CALCULATION FRONT SHEET

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PROJECT TITLE	PLYMOUTH EFW
CLIENT	MVV UMWELT

DISCIPLINE	STRUCTURES
CALCULATION TITLE/NUMBER	GROUND GAS ASSESSMENT
AUTHOR	CROSSFIELD CONSULTING

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## 1 SCOPE

This document provides a detailed ground gas assessment following current published guidance document all of which are referenced in the report.

## 2 REFERENCES

### **Previous Reports and Documents**

Landmark (September 2009) *Envirocheck Report* (for MVV Umwelt GmbH) Ref. 28953943\_1\_1

Geotechnics (August 2010) *Ground Investigation at Proposed Energy from Waste Plant, Devonport, Plymouth - Factual Report* (for MVV Umwelt GmbH) Ref. PE100930

Scott Wilson (June 2011) *Energy from Waste, Combined Heat and Power Facility North Yard, Devonport Environmental Permit Application - Non-Technical Summary*

Geotechnics (July 2011) *Additional Ground Gas Monitoring records – Draft* Ref. 110891

Geotechnics (July 2011) *Plymouth EFW Gas Monitoring Pressures*

### **Technical References**

BRE BR211 (2007) *Radon: Guidance on protective measures for new buildings* BRE Press

BSI (1999) *BS 5930 – 1999 & 2007 Code of Practice for Site Investigations* British Standards Institution

BSI (2001) *BS 10175 – 2001 Code of Practice for Investigation of Potentially Contaminated Sites* British Standards Institution

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CIRIA C552 (2001) *Contaminated Land Risk Assessment: A Guide to Good Practice* Construction Industry Research Association

CIRIA Report C665 (2007) *Assessing Risks posed by Hazardous Ground Gases to Buildings* Construction Industry Research Association

Devon County Council (2004) *Local Planning Guidance Note - A guide for Developers to the Assessment and Remediation of Land Affected by Contamination in Devon*

Environment Agency (2001) *Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on pollution Prevention* NGWCLC Report NC/99/73 EA

Environment Agency (2004) *Model Procedures for the Management of Land Contamination* CLR11 EA

NHBC/RSK Report 10627-R01.04 (2007) *Guidance on Evaluation of Development Proposals on sites where Methane and Carbon Dioxide are Present* National House Building Council

Office of the Deputy Prime Minister (2004) *Planning Policy Statement 23: Planning and Pollution*

*Control* HMSO

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Wilson S, Card G & Haines S (2009) *Ground Gas Handbook* Whittles Publishing, Dunbeath

### 3 REFERENCE DRAWINGS

Drawings are included in the report.

**GHA LIVIGUNN LIMITED**

**PROPOSED ENERGY FROM WASTE FACILITY  
DEVONPORT, PLYMOUTH**

**GROUND GAS ASSESSMENT**

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## 1. INTRODUCTION

At Weston Mill, Devonport, Plymouth, it is proposed to develop a site within an area of reclaimed land, formerly part of Weston Mill Lake. The proposed development comprises an energy from waste plant (EFW). The proposed facility includes waste storage bunkers, furnaces, boilers, turbines/generators, electric control equipment and emissions plant, together with access roads and ancillary facilities.

The assessment presented in this report is based on the factual information from ground investigations undertaken during the period 2010 to 2011 and as outlined below:

- Geotechnics (August 2010) Factual Report No. PE100830 prepared for GHA Livigunn Ltd (includes ground gas monitoring data for the period July to October 2010).
- Geotechnics (July 2011) Draft Fieldwork In Situ Gas Monitoring Instrument Records prepared for Kier Construction (includes ground gas monitoring data for the period April to June 2011).

A detailed risk assessment of landfill type ground gases is presented in the context of the current EFW development proposals. This assessment considers all the presently available data and supersedes a preliminary assessment undertaken by Scott Wilson and included in their Environmental Statement, dated May 2011. In particular, the assessment by Scott Wilson did not consider in detail the foundations proposed and was unable to consider the most recent ground gas data for the site.

Reference to potential sources of contamination associated with soils or groundwater are outside the scope of this report. However, it is understood that risks to the development associated with potential contamination from soil or groundwater sources have been considered by others, and it has been concluded that there was no unacceptable risk to end users or the wider environment (which includes a nearby designated SAC, namely a site designated under Council Directive 92/43/EEC: 'Habitats Directive').

This report contains the information obtained from the recent ground gas monitoring (as referenced above). Reference is also made to relevant information from previous investigations. An environmental assessment is presented based on all the relevant factual data from the ground investigations and an appraisal of potential development constraints and engineering solutions are included in relation to ground gas issues.

It is considered that the report complies with Planning Policy Statement PPS23 (2004) and is in general accordance with guidance published by the Environment Agency and Plymouth City Council.

Issues relating to potentially contaminated land or ground gases are also material considerations in relation to the requirements of the Building Regulations. The assessment presented in this report is compatible with the published risk assessment approach referenced by the regulations and including the guidance published in BS8485 (2007).

## **2. THE SITE**

### **2.1 Location**

The site is within the area of the Her Majesty's Naval Base, Devonport, located between the northern shore of Weston Mill Lake and Savage Road, as shown on Figure 1. The National Grid Reference for the site is SX 447 573.

### **2.2 Site Description**

The following description is based on the condition of the site as reported by Geotechnics in 2010. At this time, the site was essentially undeveloped and included large mounds of demolition material, with broken/crushed concrete and similar materials. The mounds extend to approximately 12 mOD above a general site level of approximately 7.7 mOD.

### **2.3 Desk Study Information**

Details of the desk study completed for the development are presented in a report by Landmark (September 2009). Supplementary information has been obtained from the Environment Agency web-site and UK Radon and is presented in Appendix I. A summary of relevant information in relation to the proposed development and ground gases is outlined below.

With reference to the records of landfills included in the above information, it is noted that two closed landfill sites are recorded in the vicinity of the proposed development:

*Weston Mill Lake North Landfill* – this closed landfill extends over the area of the major proposed structures and continues to the northeast. Since closure of the landfill, the area of the proposed EFW plant has been used for materials processing (concrete crushing/screening etc) and has included temporary building structures.

*HMS Drake Recreation Ground Landfill* – this closed landfill is located to the southeast of the proposed development and extends to within approximately 50 m of the proposed structures. Since closure, the landfill has been redeveloped with a large commercial building together with separate amenity developments.

Based on the historical map information, it is noted that the site area formerly comprised mud flats associated with the northern side of Weston Mill Lake, a tidal creek extending eastwards from the Hamoaze (estuary of the River Tamar). The only structure recorded within the site comprised Barn Quay, constructed before the first edition Ordnance Survey map, dated 1867. This quay extended into the creek from its northern shore. The maps indicate the creek remained unchanged in 1981. However, between 1981 and the subsequent map published in 1985, it is noted that the section of the creek within the site had been infilled. This infilling appears to have been completed by 1993, when roads are indicated across Weston Mill Lake North Landfill and amenity facilities had been constructed on HMS Drake Recreation Ground.

At present, records of the materials placed within the above landfills are not available. It is understood that Scott Wilson has outstanding enquiries in this regard. However, details of the ground conditions within the site have been determined by ground investigations, as outlined in Section 4. This information describes the materials placed within the site at the time of the landfilling operations.

With reference to the guidance published in BRE BR211(2007), it is noted that the site is located within a designated “radon affected area” and as such “basic” protection measures are normally required for new buildings to meet the requirements of the current Building Regulations. As the BRE data relates to requirements assessed over 1 km<sup>2</sup> areas, supplementary information has been obtained from UK Radon for the nearest postal address to the site, which is included in Appendix I and confirms that “basic” precautions would be appropriate.

### **3. PUBLISHED GEOLOGY**

The 1:50,000 scale geological map, Sheet 348 “Plymouth” published by the British Geological Survey, indicate the site to be underlain by superficial deposits of Alluvium, together with Made Ground

The underlying solid strata comprise Devonian Saltash Formation strata, of slaty mudstones and siltstones, locally laminated, and with thin lenses and horizons of limestone. In the vicinity, near-vertical dykes of gabbro-type intrusive igneous rocks are indicated. It is uncertain if such igneous strata extend below the site. Indicated to the southwest and to the east of the site, are strata of the St Germans Tuff, which include lavas/basalts and tuffs (primarily rock strata derived from volcanic ashes). The tuffs are likely to be conformable with the mudstone and siltstone strata.

Bedding structures are indicated to dip steeply down to the south. D<sub>1</sub> slaty cleavage is shown to dip less steeply to the south, typically at between 40° and 50°. A fault zone, trending northeast to southwest is indicated immediately to the south of the site. It is noted that the site is within an over-thrust section of strata with complex fold structures. Most of the larger geological structures (folds and thrust-faults) trend east-northeast to west-southwest.

### **4. GROUND CONDITIONS**

#### **4.1 Ground Investigation**

Relevant ground investigation records are presented in the August 2010 report by Geotechnics. The works have included trial pits, light cable percussion boreholes, static cone penetration tests and rotary drillholes. The investigation has been undertaken in phases, with a total of more than 54 exploratory holes undertaken within the site.

Ground gas monitoring has been undertaken utilising standpipes installed in selected boreholes, which have included the area of the proposed EFW plant. Two phases of ground gas monitoring have been completed, as listed on Table 1 and summarised below. Record sheets relating to these investigations are presented in Appendix II, together with relevant atmospheric pressure data.

- 2010 gas monitoring by Geotechnics within 14 No. standpipes on six occasions between July and October.
- 2011 gas monitoring by Geotechnics within 7 No. standpipes on three occasions between April and June. This monitoring included monitoring at hourly intervals during each site visit, to provide data for comparison with tidal water levels within the nearby creek.

The ground gas monitoring included standpipes that had response zones within the Made Ground, and additional standpipes associated with conditions within the underlying Alluvium and Devonian rock strata.

It is noted that the ground gas data to date includes measurements when atmospheric pressures are relatively low (ie. below 1005 mb) together with some data when atmospheric pressures are falling.

## **4.2 Strata Encountered**

### *Made Ground*

Made Ground, of tipped materials, is recorded across the site and extend to depths of up to 13 m. The materials generally comprise sandy gravel and cobbles, of predominantly crushed/broken concrete. Traces of timber, small metal fragments and plastic are reported in localised zones of the material, indicative that only very small volumes of such materials are included in the Made Ground. This is confirmed by the organic fractions recorded in the analytical test data, with a median value of 1%.

### *Alluvium*

Beneath the Made Ground, Alluvial soils of soft consistency clays and silts are recorded to depths of between 6 m and 22 m (generally increasing in thickness southwards across the site). The Alluvium includes traces and partings of organic material. However, horizons of peat or significant volumes of highly organic soils appear to be absent. This is verified by the organic fractions recorded in the analytical test data, with a median value of 1%.

### *Devonian Strata*

Beneath the superficial deposits, a thin horizon of highly weathered rock strata is present. This comprises clayey gravels and is generally up to 0.7 m thick. Below this, the rock strata generally comprise weak narrowly foliated slates with quartz veins and steeply dipping cleavage. These strata have been proven to depths of approximately 30 m.

## **4.3 Groundwater**

Groundwater is recorded at approximately 1 mOD, within the Made Ground. The groundwater conditions are based on observations made during the periods of the fieldwork. It should be noted that groundwater levels may vary. However, the extensive groundwater data indicates negligible seasonal or tidal influences.

## **4.4 Ground Gas**

Details of the ground gas measurements are presented in Appendix II and are summarised in Table 1. The results of ground gas monitoring indicate no effective emission of gases from the ground. Methane concentrations are essentially below 0.1% and carbon dioxide concentrations below 0.5% and with no detectable trace gases (carbon monoxide and hydrogen sulphide).

Relatively high methane concentrations of 86%, falling to 23.5% over the monitoring period, are recorded at a single standpipe (BH1A 18), together with no detectable elevated pressures and generally negligible flows. It is noted that this standpipe is sealed within the saturated natural strata at depth. A standpipe at the same location and within the overlying Made Ground generally records negligible methane concentrations (also with minimal flows).

## 5. PROPOSED DEVELOPMENT

With reference to the Non-Technical Summary report by Scott Wilson (June 2011), the proposed EFW development comprises the following, and the area of the main structure is included in Figure 2.

- Tipping Hall – unloading area for waste carriers. This area is fully enclosed and is monitored.
  - Waste Bunker Hall with Waste Handling Cranes – this comprises a deep concrete silo type structure that extends to a depth of approximately 9 m below the general floor level of the plant. The Waste Bunker receives tipped wastes (that will include highly putrescible domestic wastes). Hence, the lower levels of tipped wastes are likely to be anaerobic and include methane.
  - Bale Store/Baling System – when necessary, wastes may be baled and sealed in plastic film, which will create anaerobic conditions within the bales. The bales will then be stored in the Bale Store, for subsequent discharge into the Waste Bunker when appropriate.
  - Turbine Hall with Steam Turbine Generator
  - Boiler House with Grate, Boiler and Ancillary Systems
  - Flue Gas Cleaning System and Chimney
  - Air-cooled Condensers
  - Water Treatment Plant
  - Bottom Ash Handling System
  - Administration Block
  - Workshop and Stores
- These facilities are generally located above-ground on a substantial concrete slab and are separated from the waste storage areas.

It is understood that the various sections of the structure where putrescible wastes are stored in bulk will be subject to gas monitoring and control systems and that such waste storage areas are isolated from other sections of the plant.

## 6. ASSESSMENT OF POTENTIAL GROUND GASES

### 6.1 Assessment Criteria

Assessment of ground gases has been undertaken using a risk assessment based approach, as recommended within the Environmental Protection Act (1990), CLEA Model (2002), BS 10175 (2001), Environment Agency CLR11 (2004), BS 8485 (2007) and The Building Regulations 2000 Approved Document C 2004 (2006). This approach considers the likely source of ground gases, given the history and location of the site, and the possible migration pathways by which these potentially hazardous substances may reach likely receptors, such as end users of the site, in the context of the proposed development.

Based on the Conceptual Site Model, consideration is given below to identified pollution linkages and a risk evaluation is undertaken of each possible source-pathway-receptor linkage that may occur at the

site. Where risks are identified as “negligible”, then by implication such risks are within normally accepted levels for the proposed development, and the further reduction of such risks by remediation works (or other risk management works) is considered unnecessary. Where risks are identified that are “low” as defined in CIRIA C552 (2001), or worse, then consideration is given to the management of the identified risks, with appropriate recommended actions that may include engineering solutions with remediation works or soil gas protection and control systems as described below. Reference is made to relevant assessment criteria published in BS 8485 (2007), and related CIRIA reports, as listed in the References.

It is noted that the gas measurements provide a consistent data set and thus give additional lines of evidence and improve the confidence in the overall risk assessment for the proposed development.

The conceptual site model used in this assessment is presented in Table 2.

## **6.2 Potential Sources of Ground Gases**

Most of the Made Ground below the site appears to have been placed between 1981 and 1985, with final completion of filling by 1993. It is noted that minimal volumes of putrescible/organic materials are indicated within the fill. Very small volumes of material with hydrocarbon odours have been reported. However, on the basis of the recorded ground conditions, there is effectively no potential source of harmful ground gases within these strata.

Within the underlying Alluvium, traces of organic material are recorded. However, it is evident that significant volumes of peat or other highly organic soils are not present. It is also demonstrated that the Alluvium deposits are below groundwater levels and the potential for gas generation in saturated strata is significantly reduced (as outlined in the various publications by CIRIA). Hence, there is no potential source of harmful ground gases within these strata.

The Devonian slates below the site are not associated with mineworkings or other potential sources of harmful gases.

The results of ground gas monitoring indicate no effective emission of gases from the ground. Similarly, the recorded ground gas concentrations are essentially compatible with the presence of very limited volumes of petroleum-contaminated soils or traces of organic material, as observed and outlined above.

It is acknowledged that a single monitoring standpipe (BH 1A18) is associated with flow that has once reached 0.4 l/hr (an instantaneous flow, that reduced to below measurable values) and with concentrations that, on other occasions, record methane at 86%. These measurements are characteristic of a very limited volume of natural organic soil that is not degrading at a significant rate (due to being saturated and confined at depth). The following conditions are also applicable:

- Overall methane concentrations show a declining trend during the period July 2010 to June 2011.
- Within the detailed monitoring programme (of 7 measurements over a six-hour monitoring period), methane concentrations show a declining trend.
- There appears to be no tidal influence on the recorded ground gases.

- Gas flow/emission is sporadic and is not maintained (during the 7 measurements over a six-hour monitoring period, flows are just as likely to be reversed and into the ground as flows out of the ground). Realistic and long-term flows are demonstrated to be less than 0.2 litres/hour.
- The relatively high methane concentration is recorded within Alluvium and rock strata at depths in excess of 9 m. At the same location, monitoring data for the overlying Made Ground demonstrates that there is effectively no upward migration of the recorded methane (nor oxidation to form carbon dioxide). On this basis, it appears that there is no gas migration from the deep Alluvium into the overlying Made Ground. If ground gas migration is not occurring at these levels, then it is not possible for the gases recorded at depth to reach the surface or enter building structures. Similarly, there would be no valid mechanism for off-site migration to occur.

An additional landfill is recorded adjacent to the site at HMS Drake Recreation Ground. However, it is noted that this landfill has been recently redeveloped with building structures. On this basis, it appears that satisfactory ground gas mitigation measures have been implemented to protect the development and preclude off-site migration. As both the HMS Drake Recreation Ground Landfill and the Weston Mill Lake North Landfill were operated at the same time and for the same purposes of land reclamation, it is likely that the materials are similar in each landfill and that both landfills may be safely developed.

It is noted that a potential sources of radon soil gas are considered to be present in the area, such that “basic” precautions are required for new buildings. Such precautions would comprise the installation of an enhanced damp-proof membrane, such that the membrane extends over the entire footprint of building structures (including any wall cavities), membrane joints are sealed/lapped and service penetrations through the membrane sealed to be resistant to gas entry.

### 6.3 Pollutant Linkages and Risk Assessment – Ground Gases

On the basis of the above assessment, it is considered that there are no potential sources of hazardous soils gases/vapours within influencing distance of the proposed development, as outlined in Table 2.

Therefore, based on all the information, it is considered that the mitigation of ground gas risks is only necessary in relation to possible radon emissions. To simplify construction and provide suitable precautions, it is recommended that the precautions required against radon extend across the area of buildings that are accessed by personnel, occupied by plant and are not protected by other suitable gas control systems.

With reference to all of the available data and the guidance published in BS8485 (2007), it is noted that the following assessment is applicable in relation to the construction presently proposed (ie. substantial reinforced concrete slabs that include enhanced damp-proof membrane details to provide radon protection):

<i>Characteristic Gas Situation representative for the site:</i>	1
<i>Recorded Characteristic Hazardous Gas Flow:</i>	0.003 (maximum value for shallow strata)
<i>Hazard Potential:</i>	Negligible/Very Low

*Required Gas Protection:* Landfill type gases: None – proposed industrial/commercial building and the construction details inherent in this development provide adequate protection

Radon – “Basic” protection (1200 gauge polyethylene membrane with gas-resistant details at joins, service penetrations and extending over entire building footprint)

*Gas Protection Provided:* Score 2 (from Table 3 BS8485:2007)  
Score 4 in areas where monitoring/alarm systems are fitted (compatible with a Characteristic Gas Situation: 3 to 4)

Therefore, on the basis of all the available information, it is considered that specific protection against potentially combustible ground gases is not necessary in the substructure of the proposed industrial/commercial building.

Notwithstanding the foregoing, it is noted that the proposed development includes the following:

- Proposed building structures include a 1200 gauge polyethylene radon gas-resistant membrane that includes lapped and taped joints that are sealed against service penetrations and extend over wall cavities.
- Proposed buildings include a substantial reinforced concrete floor slab, with limited service penetrations in relation to the floor area.
- The proposed installation of piles will not loosen strata, create voids, or in any way increase ground permeability leading to enhanced ground gas flow, due to the inherent physical properties of soils. Rather, piling operations normally tend to increase the strata density around piles and an intimate bond is formed between the piles and surrounding strata. Additional confirmatory data is provided in the Environment Agency Report NGWCLC Report NC/99/73 (2001).
- The main structures of the waste to energy facility that extend below ground are associated with the storage of highly putrescible wastes. These structures will include gas control/protection measures, to safely control gases, vapours and odours emitted from the wastes, which will be much more significant than any potential ingress of ground gases.
- Extensive controls are included in the plant associated with the bulk storage of putrescible wastes and their separation from control equipment and personnel, in compliance with the health and safety requirements of the plant and associated operational procedures (including fire safety requirements).
- Sensitive areas of the proposed plant are essentially located above ground.

In view of the above, it is noted that risks in relation to future ground gas emissions are demonstrated to be negligible. It is evident that the works associated with site development provide a reduction to risks associated with ground gas emission. There is no valid mechanism in relation to a potential future increase in ground gas emissions associated with the present construction operations or the completed development. None of the site development operations are associated with a potential

increase in ground gas emission risks in relation to the proposed development as now designed. On this basis, additional ground gas monitoring is considered to be unnecessary.

Notwithstanding this, the proposed development includes significant precautionary features that are compatible with the levels of protection included on sites with significant ground gas emissions. Hence, the proposed construction details provide a very conservative/cautious solution such that the proposed development may be permitted in compliance with guidance published in PPS23 (2004).

## **7. SUMMARY**

An energy from waste plant is proposed at Devonport, Plymouth. The facility is located on an area designated as a former landfill, which is associated with infilling and reclamation of a tidal creek and mudflats in the 1980s.

Ground investigation data records that the Made Ground/tipped landfill materials are associated with negligible amounts of putrescible/degradable materials. Hence, there is no evidence of a significant source of potential landfill gas emission from the landfill materials. This is verified by the ground gas data, which indicates negligible emissions such that Characteristic Situation 1 (BS8485:2007) is applicable.

Below the Made Ground/tipped landfill materials, deep Alluvium is present. These soils include traces of organic material but no peat horizons are recorded and it is evident that large volumes of putrescible/degradable materials capable of emitting hazardous landfill type gases are not present. The ground gas data is compatible with these ground conditions and it has been demonstrated that ground gases are not migrating from the Alluvium and into overlying strata or to shallow depth.

With reference to the foregoing information, it is evident that there is no valid potential source of harmful landfill-type ground gases that may affect the proposed development.

It is, however, noted that the site is within a designated “radon affected area”, such that precautions are recommended to preclude potential radon ingress. Such precautions should comply with the requirements for “basic” precautions, outlined in BRE BR211 (2007). With reference to the current guidance provided in BS8485 (2007), it is evident that ground gas precautions in addition to these are not necessary for the proposed building.

Notwithstanding the above assessment, it is noted that the proposed building will include significant precautions against ground gas entry, provided by a radon gas-resistant membrane, a substantial ground bearing floor slab and additional control systems within the main structure.

It is evident that there is no valid mechanism for ground gas emissions to increase and the piling and other construction operations associated with site development should not result in an increase in ground gas emission risks. Hence, it is considered that there will be little benefit in undertaking additional ground gas monitoring.

It is considered that a number of “lines of evidence” support the assessment and recommended construction details such that a “robust” solution is provided in relation to ground gas assessment and adopted details in the proposed development such that the proposed development may be permitted in compliance with guidance published in PPS23 (2004).

## REFERENCES

### Previous Reports and Documents

Landmark (September 2009) *Envirocheck Report* (for MVV Umwelt GmbH) Ref. 28953943\_1\_1

Geotechnics (August 2010) *Ground Investigation at Proposed Energy from Waste Plant, Devonport, Plymouth - Factual Report* (for MVV Umwelt GmbH) Ref. PE100930

Scott Wilson (June 2011) *Energy from Waste, Combined Heat and Power Facility North Yard, Devonport Environmental Permit Application - Non-Technical Summary*

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BSI (2007) *BS 8485 – 2007 Code of Practice for the Characterization and Remediation from Ground Gas in affected developments* British Standards Institution

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Wilson S, Card G & Haines S (2009) *Ground Gas Handbook* Whittles Publishing, Dunbeath

## GENERAL NOTES

1. This report is provided in the context of the stated development proposals and should not be used in a different context.
2. The accuracy of map extracts cannot be guaranteed and it should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.
3. Any borehole data from the British Geological Survey sources are included on the following basis: “The British Geological Survey accept no responsibility for omissions or misinterpretation of the data from their Data Bank as this may be old or obtained from non-BGS sources and may not represent current interpretation.
4. Where any data supplied by the Client or by other external sources, including previous site investigation data, have been used it has been assumed that the information is correct unless otherwise stated. No responsibility can be accepted by Crossfield Consulting Limited for inaccuracies within the data supplied by others.
5. Exploratory hole locations provided in the report are generally established by tape measurement from existing features or boundaries. Hole locations are not accurately surveyed and ground levels at these locations are not obtained unless specifically requested.
6. Any assessments made in this report are based on the ground conditions indicated by the trial pits and/or boreholes, together with the results of any field or laboratory testing undertaken and, where appropriate, other relevant site data which may have been obtained for the site. Variations in ground conditions may occur between exploratory hole locations and there may be special conditions appertaining to the site which have not been revealed by the investigation and which have not been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available.
7. The report is provided for the sole use by the Client and is confidential to the Client’s professional advisers. No responsibility whatsoever for the contents of this report will be accepted to any person other than the Client.
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## **TABLES**

**SUMMARY OF GROUND GAS CONDITIONS**

Date	Standpipe Ref	Methane C <sub>hg</sub> CH <sub>4</sub> (%)	Carbon Dioxide C <sub>hg</sub> CO <sub>2</sub> (%)	Oxygen (%)	Trace Gases		Atm <sup>1</sup> (mb)	Standpipe Pressure <sup>2</sup> (mb)	Ground Gas <sup>2,3</sup> Flow Rate (litre/hr)	Characteristic Hazardous gas	Characteristic Hazardous gas
					H <sub>2</sub> S (ppm)	CO (ppm)				Flow Rate Methane Q <sub>hgs</sub> CH <sub>4</sub> <sup>4</sup> (litre/hr)	Flow Rate Carbon Dioxide Q <sub>hgs</sub> CO <sub>2</sub> <sup>4</sup> (litre/hr)
27.07.10	BH 1A 7 <sup>#</sup>	<0.1	<0.1	20.4	<1	<1	1024R	-	<0.1	0.0001	0.0001
	BH 1A 18 <sup>#</sup>	76.0	0.9	3.5	<1	<1	1024R	-	<0.1	0.076	0.0009
	BH 2	<0.1	0.6	15.2	<1	<1	1024R	-	<0.1	0.0001	0.0006
	BH 3	<0.1	0.6	16.9	<1	<1	1024R	-	<0.1	0.0001	0.0006
	BH 6B	<0.1	<0.1	20.6	<1	<1	1024R	-	<0.1	0.0001	0.0001
	BH 7	<0.1	0.3	20.2	<1	<1	1024R	-	<0.1	0.0001	0.0003
	BH 8A	<0.1	0.3	19.9	<1	<1	1024R	-	<0.1	0.0001	0.0003
	BH 12A	<0.1	<0.1	20.1	<1	<1	1024R	-	<0.1	0.0001	0.0001
	BH 15	<0.1	<0.1	20.3	<1	<1	1024R	-	<0.1	0.0001	0.0001
	BH 17	<0.1	<0.1	20.2	<1	<1	1024R	-	<0.1	0.0001	0.0001
	BH 18	<0.1	<0.1	5.8	<1	<1	1024R	-	<0.1	0.0001	0.0001
	BH 19	<0.1	<0.1	17.9	<1	<1	1024R	-	-0.2	-0.0002	-0.0002
	BH 21	<0.1	<0.1	21.1	<1	<1	1024R	-	<0.1	0.0001	0.0001
	BH 22	1.1	0.2	16.4	<1	<1	1024R	-	<0.1	0.0011	0.0002
11.08.10	BH 1A 7	<0.1	<0.1	20.7	<1	<1	1016R	-	<0.1*	0.0001	0.0001
	BH 1A 18	86.0	0.8	13.9	<1	<1	1016R	-	<0.1*	0.086	0.0008
	BH 2	<0.1	1.1	12.6	<1	<1	1016R	-	<0.1	0.0001	0.0011
	BH 3	<0.1	0.3	18.9	<1	<1	1016R	-	<0.1	0.0001	0.0003
	BH 6B	<0.1	1.1	11.1	<1	<1	1016R	-	<0.1	0.0001	0.0011
	BH 7	<0.1	1.9	18.6	<1	<1	1016R	-	<0.1	0.0001	0.0019
	BH 8A	-	-	-	-	-	1016R	-	-	-	-
	BH 12A	<0.1	2.9	2.6	<1	<1	1024R	-	<0.1	0.0001	0.0029
	BH 15	<0.1	1.9	18.6	<1	<1	1016R	-	<0.1	0.0001	0.0019
	BH 17	<0.1	2.7	11.7	<1	<1	1016R	-	<0.1	0.0001	0.0027
	BH 18	<0.1	0.2	8.1	<1	<1	1016R	-	<0.1	0.0001	0.0002
	BH 19	<0.1	<0.1	20.3	<1	<1	1016R	-	<0.1	0.0001	0.0001
	BH 21	0.2	<0.1	20.6	<1	<1	1016R	-	<0.1	0.0002	0.0001
	BH 22	<0.1	0.3	17.8	<1	<1	1016R	-	<0.1	0.0001	0.0003

\* Instantaneous value of 0.45 l/hr recorded, value reduced to < 0.1l/hr and no flows subsequently detected.

# BH 1A 7 denotes standpipe with response zone 1.5 - 7.0 m.

# BH 1A 18 denotes standpipe with response zone 9.0-18.0 m.

Refer to Notes at end of Table

**TABLE 1**  
Page 2 of 4

Date	Standpipe Ref	Methane C <sub>hg</sub> CH <sub>4</sub> (%)	Carbon Dioxide C <sub>hg</sub> CO <sub>2</sub> (%)	Oxygen (%)	Trace Gases		Atm <sup>1</sup> (mb)	Standpipe Pressure <sup>2</sup> (mb)	Ground Gas <sup>2,3</sup> Flow Rate (litre/hr)	Characteristic Hazardous gas Flow Rate Methane Q <sub>hgs</sub> CH <sub>4</sub> <sup>4</sup> (litre/hr)	Characteristic Hazardous gas Flow Rate Carbon Dioxide Q <sub>hgs</sub> CO <sub>2</sub> <sup>4</sup> (litre/hr)
					H <sub>2</sub> S (ppm)	CO (ppm)					
24.08.10	BH 1A 7	1.1	<0.1	19.6	<1	<1	1013R	-	<0.1	0.0011	0.0001
	BH 1A 18	11.0	0.3	16.7	<1	<1	1013R	-	<0.1	0.011	0.0003
	BH 2	<0.1	1.6	12.6	<1	<1	1013R	-	<0.1	0.0001	0.0016
	BH 3	0.1	3.1	9.8	<1	<1	1013R	-	<0.1	0.0001	0.0031
	BH 6B	<0.1	1.2	10.9	<1	<1	1013R	-	<0.1	0.0001	0.0012
	BH 7	<0.1	1.9	17.0	<1	<1	1013R	-	<0.1	0.0001	0.0019
	BH 8A	-	-	-	-	-	1013R	-	-	-	-
	BH 12A	<0.1	0.6	17.2	<1	<1	1013R	-	<0.1	0.0001	0.0006
	BH 15	<0.1	0.4	17.3	<1	<1	1013R	-	<0.1	0.0001	0.0004
	BH 17	<0.1	4.9	7.8	<1	<1	1013R	-	<0.1	0.0001	0.0049
	BH 18	<0.1	0.6	7.7	<1	<1	1013R	-	<0.1	0.0001	0.0006
	BH 19	<0.1	0.4	15.2	<1	<1	1013R	-	<0.1	0.0001	0.0004
	BH 21	<0.1	0.2	19.6	<1	<1	1013R	-	<0.1	0.0001	0.0002
	BH 22	<0.1	0.4	17.6	<1	<1	1013R	-	<0.1	0.0001	0.0004
08.09.10	BH 1A 7	<0.1	<0.1	20.2	<1	<1	1004R	-	<0.1	0.0001	0.0001
	BH 1A 18	78.0	0.6	4.1	<1	<1	1004R	-	<0.1	0.078	0.0006
	BH 2	<0.1	0.8	6.8	<1	<1	1004R	-	<0.1	0.0001	0.0008
	BH 3	21.0	1.3	14.1	<1	<1	1004R	-	-0.1	-0.021	-0.0013
	BH 6B	<0.1	<0.1	9.5	<1	<1	1004R	-	<0.1	0.0001	0.0001
	BH 7	<0.1	0.3	19.5	<1	<1	1004R	-	<0.1	0.0001	0.0003
	BH 8A	-	-	-	-	-	1004R	-	-	-	-
	BH 12A	<0.1	<0.1	20.4	<1	<1	1004R	-	<0.1	0.0001	0.0001
	BH 15	<0.1	0.4	16.4	<1	<1	1004R	-	-0.1	-0.0001	-0.0004
	BH 17	<0.1	2.7	9.2	<1	<1	1004R	-	<0.1	0.0001	0.0027
	BH 18	<0.1	0.6	8.0	<1	<1	1004R	-	<0.1	0.0001	0.0006
	BH 19	<0.1	<0.1	20.6	<1	<1	1004R	-	-0.1	-0.0001	-0.0001
	BH 21	<0.1	<0.1	19.9	<1	<1	1004R	-	<0.1	0.0001	0.0001
	BH 22	<0.1	0.4	20.1	<1	<1	1004R	-	<0.1	0.0001	0.0004
21.09.10	BH 1A 7	<0.1	<0.1	20.4	<1	<1	1018S	-	0.1	0.0001	0.0001
	BH 1A 18	50.0	0.5	7.4	<1	<1	1018S	-	<0.1	0.05	0.0005
	BH 2	<0.1	0.3	7.0	<1	<1	1018S	-	<0.1	0.0001	0.0003
	BH 3	<0.1	1.6	13.0	<1	<1	1018S	-	<0.1	0.0001	0.0016
	BH 6B	<0.1	1.4	13.5	<1	<1	1018S	-	<0.1	0.0001	0.0014
	BH 7	<0.1	1.2	19.2	<1	<1	1018S	-	<0.1	0.0001	0.0012
	BH 8A	-	-	-	-	-	1018S	-	-	-	-
	BH 12A	<0.1	1.8	14.7	<1	<1	1018S	-	<0.1	0.0001	0.0018
	BH 15	<0.1	0.4	17.8	<1	<1	1018S	-	<0.1	0.0001	0.0004
	BH 17	<0.1	<0.1	20.7	<1	<1	1018S	-	<0.1	0.0001	0.0001
	BH 18	<0.1	0.4	10.2	<1	<1	1018S	-	<0.1	0.0001	0.0004
	BH 19	<0.1	0.6	12.4	<1	<1	1018S	-	<0.1	0.0001	0.0006
	BH 21	<0.1	<0.1	20.7	<1	<1	1018S	-	<0.1	0.0001	0.0001
	BH 22	<0.1	0.4	17.9	<1	<1	1018S	-	<0.1	0.0001	0.0004

Refer to Notes at end of Table

**TABLE 1**  
Page 3 of 4

Date	Standpipe Ref	Methane C <sub>hg</sub> CH <sub>4</sub> (%)	Carbon Dioxide C <sub>hg</sub> CO <sub>2</sub> (%)	Oxygen (%)	Trace Gases		Atm <sup>1</sup> (mb)	Standpipe Pressure <sup>2</sup> (mb)	Ground Gas <sup>2,3</sup> Flow Rate (litre/hr)	Characteristic Hazardous gas Flow Rate Methane Q <sub>hgs</sub> CH <sub>4</sub> <sup>4</sup> (litre/hr)	Characteristic Hazardous gas Flow Rate Carbon Dioxide Q <sub>hgs</sub> CO <sub>2</sub> <sup>4</sup> (litre/hr)
					H <sub>2</sub> S (ppm)	CO (ppm)					
05.10.10	BH 1A 7	1.2	<0.1	20.8	<1	<1	1000R	-	<0.1	0.0012	0.0001
	BH 1A 18	44.0	1.1	8.3	<1	<1	1000R	-	<0.1	0.044	0.0011
	BH 2	<0.1	0.3	1.9	<1	<1	1000R	-	<0.1	0.0001	0.0003
	BH 3	<0.1	2.4	10.8	<1	<1	1000R	-	<0.1	0.0001	0.0024
	BH 6B	<0.1	<0.1	12.7	<1	<1	1000R	-	<0.1	0.0001	0.0001
	BH 7	<0.1	1.9	17.7	<1	<1	1000R	-	<0.1	0.0001	0.0019
	BH 8A	-	-	-	-	-	1000R	-	-	-	-
	BH 12A	<0.1	3.0	5.5	<1	<1	1000R	-	<0.1	0.0001	0.0030
	BH 15	<0.1	0.5	17.4	<1	<1	1000R	-	<0.1	0.0001	0.0005
	BH 17	<0.1	<0.1	20.7	<1	<1	1000R	-	<0.1	0.0001	0.0001
	BH 18	<0.1	1.0	10.2	<1	<1	1000R	-	<0.1	0.0001	0.001
	BH 19	<0.1	<0.1	20.7	<1	<1	1000R	-	<0.1	0.0001	0.0001
	BH 21	<0.1	<0.1	21.0	<1	<1	1000R	-	<0.1	0.0001	0.0001
	BH 22	<0.1	0.4	17.5	<1	<1	1000R	-	<0.1	0.0001	0.0004
05.04.11	BH 1A 7	< 0.1	< 0.1	20.8	<1	<1	1023R	<0.1	-0.4	-0.0004	-0.0004
	BH 1A 18	7.1	< 0.1	15.0	<1	<1	1022R	<0.1	-0.1	-0.0071	-0.0001
	BH 2	< 0.1	0.3	8.4	<1	<1	1022R	1.0	0.5	0.0005	0.0015
	BH 3	< 0.1	< 0.1	20.3	<1	<1	1022R	<0.1	<0.1	0.0001	0.0001
	BH 6B	< 0.1	< 0.1	20.2	<1	<1	1022R	<0.1	<0.1	0.0001	0.0001
	BH 7	-	-	-	-	-	-	-	-	-	-
	BH 8A	-	-	-	-	-	-	-	-	-	-
	BH 12A	-	-	-	-	-	-	-	-	-	-
	BH 15	-	-	-	-	-	-	-	-	-	-
	BH 17	< 0.1	< 0.1	18.1	<1	<1	1022R	<0.1	0.2	0.0002	0.0002
	BH 18	-	-	-	-	-	-	-	-	-	-
	BH 19	-	-	-	-	-	-	-	-	-	-
	BH 21	-	-	-	-	-	-	-	-	-	-
	BH 22	< 0.1	< 0.1	20.2	<1	<1	1022R	<0.1	0.4	0.0004	0.0004
25.05.11	BH 1A 7	< 0.1	< 0.1	18.7	<1	<1	1022F	<0.1	0.1	0.0001	0.0001
	BH 1A 18	19.5	0.4	15.2	<1	<1	1023F	<0.1	0.4	0.078	0.0016
	BH 2	< 0.1	0.2	14.3	<1	<1	1023F	<0.1	0.3	0.0003	0.0006
	BH 3	< 0.1	2.9	11.5	<1	<1	1023F	<0.1	0.3	0.0003	0.0087
	BH 6B	< 0.1	< 0.1	13.1	<1	<1	1023F	<0.1	<0.1	0.0001	0.0001
	BH 7	-	-	-	-	-	-	-	-	-	-
	BH 8A	-	-	-	-	-	-	-	-	-	-
	BH 12A	-	-	-	-	-	-	-	-	-	-
	BH 15	-	-	-	-	-	-	-	-	-	-
	BH 17	< 0.1	0.6	18.9	<1	<1	1023F	<0.1	0.1	0.0001	0.0006
	BH 18	-	-	-	-	-	-	-	-	-	-
	BH 19	-	-	-	-	-	-	-	-	-	-
	BH 21	-	-	-	-	-	-	-	-	-	-
	BH 22	< 0.1	< 0.1	20.7	<1	<1	1023F	<0.1	0.2	0.0002	0.0002

Refer to Notes at end of Table

**TABLE 1**  
Page 4 of 4

Date	Standpipe Ref	Methane $C_{hg} CH_4$ (%)	Carbon Dioxide $C_{hg} CO_2$ (%)	Oxygen (%)	Trace Gases		Atm <sup>1</sup> (mb)	Standpipe Pressure <sup>2</sup> (mb)	Ground Gas <sup>2,3</sup> Flow Rate (litre/hr)	Characteristic Hazardous gas Flow Rate Methane $Q_{hgs} CH_4$ <sup>4</sup> (litre/hr)	Characteristic Hazardous gas Flow Rate Carbon Dioxide $Q_{hgs} CO_2$ <sup>4</sup> (litre/hr)
					H <sub>2</sub> S (ppm)	CO (ppm)					
23.06.11	BH 1A 7	<0.1	<0.1	20.6	<1	<1	1019R	<0.1	<0.1	0.0001	0.0001
	BH 1A 18	23.5	0.2	14.5	<1	<1	1019R	<0.1	0.1	0.0235	0.0002
	BH 2	<0.1	0.2	14.5	<1	<1	1019R	<0.1	<0.1	0.0001	0.0002
	BH 3	<0.1	<0.1	20.5	<1	<1	1019R	<0.1	-0.2	-0.0002	-0.0002
	BH 6B	<0.1	0.6	16.9	<1	<1	1019R	<0.1	<0.1	0.0001	0.0006
	BH 7	-	-	-	-	-	-	-	-	-	-
	BH 8A	-	-	-	-	-	-	-	-	-	-
	BH 12A	-	-	-	-	-	-	-	-	-	-
	BH 15	-	-	-	-	-	-	-	-	-	-
	BH 17	<0.1	<0.1	20.9	<1	<1	1019R	<0.1	<0.1	0.0001	0.0001
	BH 18	-	-	-	-	-	-	-	-	-	-
	BH 19	-	-	-	-	-	-	-	-	-	-
	BH 21	-	-	-	-	-	-	-	-	-	-
	BH 22	<0.1	<0.1	20.9	<1	<1	1019R	<0.1	<0.1	0.0001	0.0001

**NOTES:**

1. Atm denotes atmospheric pressure. R: rising F: falling S: static (pressure trend is over day of measurement, as indicated on the record sheets and supplementary atmospheric pressure records by Geotechnics in Appendix II).
2. Negative recorded flow/pressure values (shown in grey) are indicative of flow from the atmosphere into the standpipe and are associated with negligible ground gas emissions to atmosphere.
3. Ground Gas Flow Rate (q) measured at the gas tap on monitoring standpipe.
4. Characteristic Hazardous Gas Flow Rate ( $Q_{hgs}$ ) = ( $C_{hg} / 100$ ) x q (from BS 8485:2007). This value has been calculated for each gas under representative recorded flow conditions.  
This parameter is synonymous with the "Gas Screening Value" (GSV) in NHBC/RSK Report 10627-R01.04 (2007) and in CIRIA C665 (2007).
5. Ground Gas monitoring equipment: Gas Data LMS
6. Groundwater data is presented on Table I-2
7. During the period April to June 2011, each ground gas monitoring visit comprised an initial set of ground gas measurements at each standpipe, followed by repeat measurements at approximately hourly intervals and extending over a six hour period. The data summarised above is based on the final set of ground gas concentrations together with the average flow/pressure values recorded.

TABLE 2

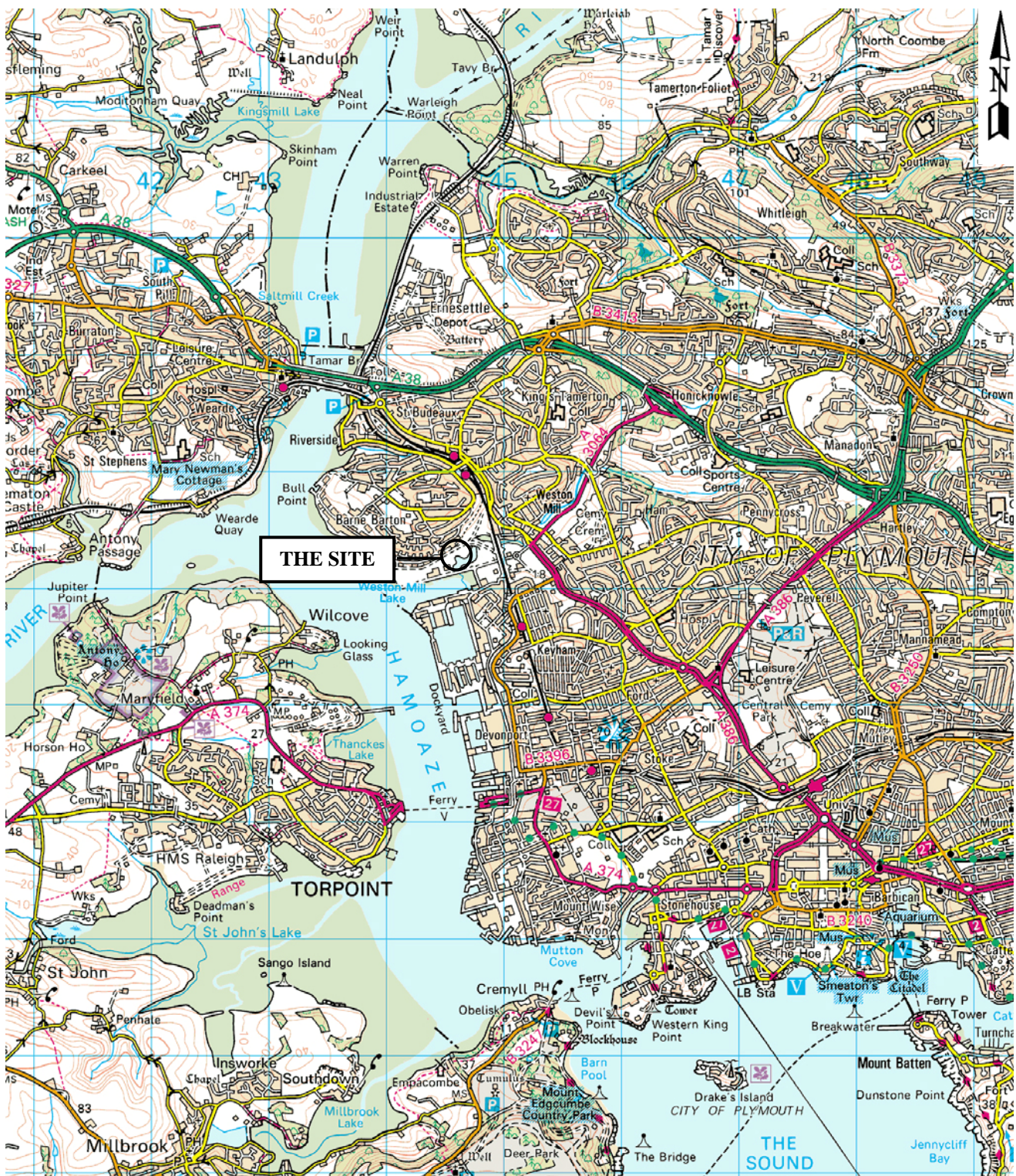
**CONCEPTUAL SITE MODEL: GROUND GASES**

Potential Gas Source	Potential Migration Routes	Receptors and Assessed Pollutant Linkage
<p><b>Solids</b>  <i>Made Ground:</i>  Predominantly “inert” materials with traces only of organic materials in soils which may be associated with a potential minor source.  No evidence of a significant source of potentially mobile or highly toxic substances.</p> <p><i>Alluvium:</i>  Clays with silts with traces of organic material, but with no peat horizons or significant volumes of organic soils, may be associated with a potential minor source.</p> <p><b>Liquids</b>  No evidence of a significant source.</p> <p><b>Gases</b>  <i>Ground Gases:</i>  Generally low concentrations, with localised areas of elevated Methane and Carbon dioxide, but negligible flow/emission, commensurate with the traces of putrescible material/organic soils recorded.</p> <p><i>Radon:</i>  Possible significant source as a designated Radon Affected Area.</p>	<p><b>Movement of gases</b>  No recorded flow/emission out of the ground and no elevated borehole pressures such that no significant migration is evident from shallow depth.</p> <p>Ground permeability may be moderate within the Made Ground but is indicated to be very low within the underlying Alluvium of clays with silts</p>	<p><b>Human Health – Gases</b>  <i>Landfill type Ground Gases</i> – No Pollutant Linkage  <i>Radon</i> – Possible Pollutant Linkage</p>

NOTE: The above conceptual model is based on CIRIA C552 (2001) and BS 10175 (2001).

## FIGURES

**FIGURE 1**

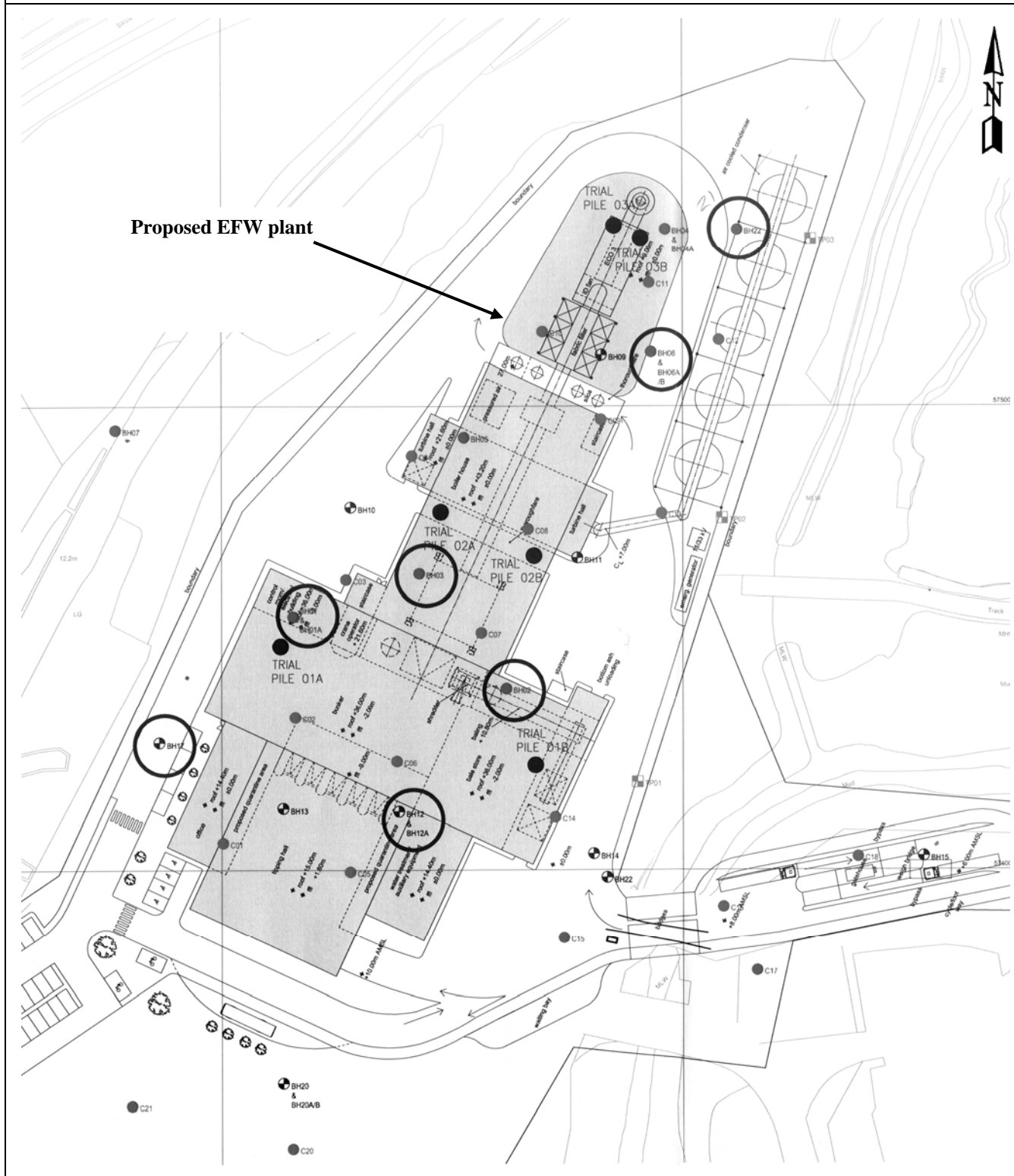


**SITE LOCATION PLAN**

Scale 1: 50,000

Reproduced from the 2006, 1:50,000 Ordnance Survey map with the permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office, © Crown copyright. Licence No.100014660

**FIGURE 2**



**SITE PLAN**

Scale 1: 1250

Plan based on Drawing No. QC8223/10 B by GHA Livgunn

## **APPENDIX I**

## **APPENDIX I – SUPPLEMENTARY DESK STUDY INFORMATION**

### ***Environment Agency***

An enquiry was made to the search facility on the Environment Agency web site, with respect to Landfill Boundaries. Information from this search is presented in this Appendix

### ***UK Radon***

A Radon Risk Report was obtained from UK Radon, based on data provided by the British Geological Survey and the Health Protection Agency. This report relates to the post code area applicable to the site and provides guidance for new buildings in compliance with the Building Regulations.



Enter a postcode or place name:

Other topics for this area...

Waste

Devonport, City of Plymouth

Go

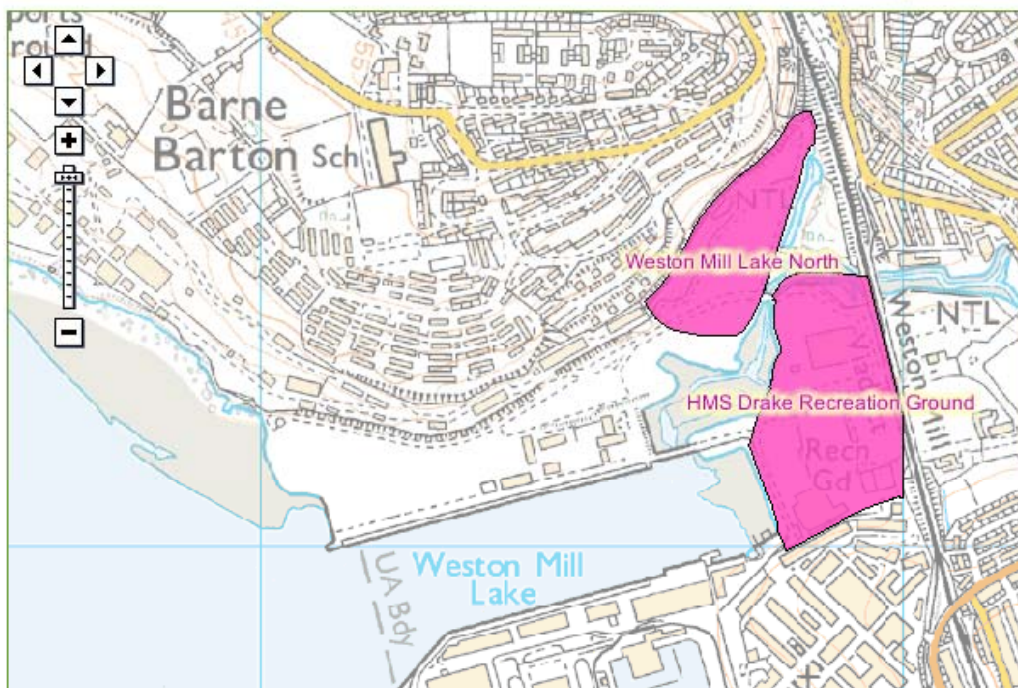
Landfill

Map legend

- ☒ Authorised Landfill
- ☐ Site boundary
- ☒ Historic landfill
- ☐ Site boundary

X: 244,405;Y: 57,302 at scale 1:10,000

Text only version



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© Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380,  
contains Royal Mail data © Royal Mail copyright and database right 2011.

## **Radon Risk Report for addresses in England and Wales**

Issued by the Health Protection Agency and the British Geological Survey using Address Point®. Fee paid £3.00 + VAT. Email receipt issued by Secure Trading Ltd.

Address searched: 1 Talbot Gardens, Plymouth, PL5 1BU

Numerical grid reference for this address:

244626 East

57434 North

Date of report: 05/08/2011

### **Guidance for existing properties**

#### **Is this property in a radon Affected Area? - YES**

The answer to the standard enquiry on house purchase known as CON29 Standard Enquiry of Local Authority; 3.13 Radon Gas: Location of the Property in a Radon Affected Area is:

**Yes, this property is in a Radon Affected Area as defined by the Health Protection Agency.**

**The estimated probability of the property being above the Action Level for radon is: 5-10%**

The result may not be valid for buildings larger than 25 metres.

This report informs you of the estimated probability that this particular property is above the Action Level for radon. This does not necessarily mean there is a radon problem in the property; the only way to find out whether it is above or below the Action Level is to carry out a radon measurement in an existing property.

Radon Affected Areas are designated by the Health Protection Agency. HPA advises that radon gas should be measured in all properties within Radon Affected Areas.

If you are buying a currently occupied property in a Radon Affected Area, you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were above the Radon Action Level and if so, whether remedial measures were installed, radon levels were re-tested, and the results of re-testing confirmed the effectiveness of the measures.

Further information is available from HPA or [www.ukradon.org](http://www.ukradon.org).

### **Guidance for new buildings and extensions to existing properties**

#### **What is the requirement under Building Regulations for radon protection in new buildings and extensions at the property location? - Basic Protection**

If you are buying a new property in a Radon Affected Area, you should ask the builder whether radon protective measures were incorporated in the construction of the property.

See the Radon and Building Regulations for more details.

Report design 27 July 2011. V 2011.05

## **APPENDIX II**

## **APPENDIX II – GROUND GAS MONITORING RECORDS**

### ***Ground Gas Investigation and Monitoring***

The fieldwork record sheets presented in this Appendix relate to works by Geotechnics and comprise the following:

- 2010 gas monitoring within 14 No. standpipes on six occasions between July and October.
- 2011 gas monitoring within 7 No. standpipes on three occasions between April and June. This monitoring included monitoring at hourly intervals during each site visit, to provide data for comparison with tidal water levels within the nearby creek.

On each monitoring occasion, the monitoring was undertaken using a Gas Data LMS instrument and the following parameters recorded:

- Ground gas flow and pressure (from standpipe and relative to atmospheric conditions)
- Atmospheric pressure on site during monitoring site visit (2011 data)
- Concentration (% v/v) of methane, carbon dioxide, nitrogen and oxygen
- Concentration (ppm v/v) of hydrogen sulphide and carbon monoxide
- Groundwater level in monitoring standpipe

Where fluctuating measurements were recorded, reference is made on the record sheets. It is understood that standpipe gas taps remained closed between each monitoring visit.

In addition, atmospheric pressure measurements for the monitoring periods are included in this Appendix. This data has been obtained from a nearby weather station.

The locations of the ground gas monitoring standpipes are shown in relation to the proposed EFW plant on Figure II-1 at the end of the Appendix.

### ***Rationale of Monitoring***

The rationale of the ground gas monitoring programme comprised the measurement of ground gas concentrations and flows across the area of proposed development with seven monitoring standpipes located below or immediately adjacent to the proposed EFW plant to provide spatial data across the development to permit characterisation of the ground gas conditions below the proposed plant. The monitoring programme has included the following elements:

- Standpipes with response zones in the Made Ground, to provide data on gas emissions from shallow depth together with potential generation within the Made Ground materials.
- Standpipes with response zones restricted to within the underlying Alluvium and rock strata, to provide data on potential gas generation at depth.

- Measurement of pressures and flows to permit an assessment of potential ground gas emission/flow at surface and support the calculation of Characteristic Flow Rates (as defined in BS8485:2007).
- Measurement of ground gases within standpipes with a closed gas tap between measurements to provide data on ground gas accumulation within a confined volume below ground (most conservative/precautionary scenario, not representative of the proposed development).
- Measurement of instantaneous and continuing flows and concentrations, which provide data on the dissipation of accumulated ground gases and steady-state flows/emissions respectively.
- Measurements over a significant period to provide an indication of seasonal variations, including some relatively low pressure conditions and one period of falling pressure.











Project PROPOSED ENERGY FROM WASTE PLANT, DEVONPORT,  
PLYMOUTH

**Borehole** BH2

Sheet No. 1 (2 of 2)

Client            MVV UMWELT GMBH

Installation Type	Standpipe	Diameter	50mm
Depth to Base	30.00m	Cover Type	Flush lockable protective cover
Filter Zone	3.00 - 30.00m	Ground Level	8.07 m OD
Date Installed	13 July 2010		

Remarks





Project PROPOSED ENERGY FROM WASTE PLANT, DEVONPORT,  
PLYMOUTH

Project No PE100830  
Borehole BH6B  
Sheet No. 1 (1 of 2)

Installation Details									
Installation Type		standpipe				Diameter		50mm	
Depth to Base		30.00m				Cover Type		Flush lockable protective cover	
Filter Zone		1.50 - 30.00m				Ground Level		7.80 m OD	
Date Installed		16 July 2010							
Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	CO2 (Steady Reading) (% VOL)	O2 (Steady Reading) (% VOL)	N2 (Steady Reading) (% VOL)	H2S (Steady Reading) (ppm)	Remarks
27-Jul-2010	11:10:00	6.31	0.0	0.0	0.0	20.6	79.3	0	Had to remove bung to allow water to drain off
11-Aug-2010	11:30:00	6.04	0.0	0.0	1.1	11.1	87.7	0	
24-Aug-2010	08:40:00	6.32	0.0	0.0	1.2	10.9	87.8	0	
8-Sep-2010	12:35:00	5.80	0.0	0.0	0.0	9.5	90.6	0	Had to remove bung to allow water to drain.
21-Sep-2010	11:05:00	6.55	0.0	0.0	1.4	13.5	85.0	0	
5-Oct-2010	10:40:00	6.13	0.0	0.0	0.0	12.7	87.3	0	Had to remove bung to allow water to drain off
Remarks									



## **FIELDWORK - Insitu Gas Monitoring - Instrument Record**

Project PROPOSED ENERGY FROM WASTE PLANT, DEVONPORT,  
PLYMOUTH

Project No PE100830

Borehole BH7

Client            MVV UMWELT GMBH

Sheet No. 1 (1 of 2)

## Installation Details

Installation Type	Standpipe
Depth to Base	18.00m
Filter Zone	1.50 - 18.00m
Date Installed	20 July 2010

Diameter	50mm
Cover Type	Flush lockable protective cover
Ground Level	12.80 m OD

[illegible]

Remarks



Form 003/1

Project PROPOSED ENERGY FROM WASTE PLANT, DEVONPORT,  
PLYMOUTH

**Borehole** BH7

Sheet No. 1 (2 of 2)

Client            MVV UMWELT GMBH

Installation Type	Standpipe	Diameter	50mm
Depth to Base	18.00m	Cover Type	Flush lockable protective cover
Filter Zone	1.50 - 18.00m	Ground Level	12.80 m OD
Date Installed	20 July 2010		

Remarks

Project PROPOSED ENERGY FROM WASTE PLANT, DEVONPORT,  
PLYMOUTH

Borehole BH8A

Sheet No. 1 (1 of 2)

Client            MVV UMWELT GMBH

Installation Type	standpipe	Diameter	50mm
Depth to Base	9.20m	Cover Type	Flush lockable protective cover
Filter Zone	1.50 - 9.20m	Ground Level	13.68 m OD
Date Installed	21 July 2010		

Remarks

**FIELDWORK - Insitu Gas Monitoring - Instrument Record**

Project PROPOSED ENERGY FROM WASTE PLANT, DEVONPORT,  
PLYMOUTH

Project No PE100830  
Borehole BH8A  
Sheet No. 1 (2 of 2)

Client      MVV UMWELT GMBH

## Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	9.20m	Cover Type	Flush lockable protective cover
Filter Zone	1.50 - 9.20m	Ground Level	13.68 m OD
Date Installed	21 July 2010		

Date	Time	CO (Steady Reading) (ppm)	Barometric Pressure (mBars)	Flow Rate (Peak/Stable) (l/hr)	Remarks
27-Jul-2010	13:10:00	0	1021	0.0	

Remarks













## **FIELDWORK** - Insitu Gas Monitoring - Instrument Record

Project PROPOSED ENERGY FROM WASTE PLANT, DEVONPORT,  
PLYMOUTH

Project No PE100830

Borehole BH18

Client            MVV UMWELT GMBH

Sheet No. 1 (1 of 2)

## Installation Details

Installation Type      Standpipe

Diameter 50mm

Depth to Base 16.00m

Cover Type	Flush lockable protective cover
------------	---------------------------------

Filter Zone 1.50 - 16.00m

Ground Level 10.97 m OD

Date Installed 8 July 2010

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	CO2 (Steady Reading) (% VOL)	O2 (Steady Reading) (% VOL)	N2 (Steady Reading) (% VOL)	H2S (Steady Reading) (ppm)	Remarks
27-Jul-2010	12:55:00	9.71	0.0	0.0	0.0	5.8	94.1	0	Had to remove bung to allow water to drain.
11-Aug-2010	12:35:00	9.55	0.0	0.0	0.2	8.1	91.6	0	
24-Aug-2010	09:30:00	9.70	0.0	0.0	0.6	7.7	91.6	0	
8-Sep-2010	11:35:00	9.37	0.0	0.0	0.6	8.0	90.7	0	
21-Sep-2010	11:40:00	9.74	0.0	0.0	0.4	10.2	89.3	0	
5-Oct-2010	11:55:00	9.69	0.0	0.0	1.0	10.2	88.7	0	

Remarks



Form 003/1





## FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project PROPOSED ENERGY FROM WASTE PLANT, DEVONPORT,  
PLYMOUTH

Project No PE100830

**Borehole** BH19

Client            MVV UMWELT GMBH

Sheet No. 1 (2 of 2)

## Installation Details

Installation Type	Standpipe
Depth to Base	17.00m
Filter Zone	1.50 - 17.00m
Date Installed	12 July 2010

Diameter	50mm
Cover Type	Flush lockable protective cover
Ground Level	11.38 m OD

Date	Time	CO (Steady Reading)  (ppm)	Barometric Pressure  (mBars)	Flow Rate (Peak/Stable)  (l/hr)	Remarks
27-Jul-2010	12:47:00	0	1025	-0.2	
11-Aug-2010	12:28:00	0	1016	0.0	
24-Aug-2010	12:05:00	0	1010	0.0	
8-Sep-2010	11:25:00	0	1004	-0.1	
21-Sep-2010	11:40:00	0	1018	0.0	
5-Oct-2010	12:00:00	0	997	0.0	

Remarks





## FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project No PE100830  
Borehole BH22  
Sheet No. 1 (1 of 2)

**Borehole** BH22  
**Sheet No.** 1 (1 of 2)

## Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	10.00m	Cover Type	Flush lockable protective cover
Filter Zone	1.50 - 10.00m	Ground Level	5.23 m OD
Date Installed	19 July 2010		

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	CO2 (Steady Reading) (% VOL)	O2 (Steady Reading) (% VOL)	N2 (Steady Reading) (% VOL)	H2S (Steady Reading) (ppm)	Remarks
27-Jul-2010	12:35:00	4.58	1.1	21.4	0.2	16.4	82.2	0	CO2 dropped to zero after 30 seconds.
11-Aug-2010	12:21:00	4.52	0.0	0.0	0.3	17.8	81.8	0	
24-Aug-2010	09:22:00	4.17	0.0	0.0	0.4	17.6	81.9	0	
8-Sep-2010	12:00:00	4.50	0.0	0.0	0.4	20.1	79.8	0	
21-Sep-2010	11:35:00	4.55	0.0	0.0	0.4	17.9	81.7	0	
5-Oct-2010	12:30:00	4.50	0.0	0.0	0.4	17.5	82.0	0	

Remarks

Project PROPOSED ENERGY FROM WASTE PLANT, DEVONPORT,  
PLYMOUTH

**Borehole** BH22

Sheet No. 1 (2 of 2)

Client            MVV UMWELT GMBH

Installation Type	Standpipe	Diameter	50mm
Depth to Base	10.00m	Cover Type	Flush lockable protective cover
Filter Zone	1.50 - 10.00m	Ground Level	5.23 m OD
Date Installed	19 July 2010		

Remarks

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No

PE110891

Borehole

BH1A (P1)

Client KIER CONSTRUCTION LIMITED

Sheet No.

1 (1 of 3)

## Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	7.00m	Cover Type	Flush lockable protective cover
Filter Zone	1.50 - 7.00m	Ground Level	7.62 m OD
Date Installed	13 July 2010		

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Remarks
5-Apr-2011	09:30:00	6.28	0	0	0	20.8	79.1	0	1mm sized white insects in base of pipe
5-Apr-2011	10:32:00	6.27	0	0	0	20.8	79.1	0	
5-Apr-2011	11:26:00	6.28	0	0	0	20.7	79.2	0	
5-Apr-2011	12:05:00	6.26	0	0	0	20.7	79.2	0	
5-Apr-2011	13:26:00	6.23	0	0	0	21.0	78.9	0	
5-Apr-2011	14:32:00	6.21	0	0	0	20.9	79.0	0	
5-Apr-2011	15:15:00	6.26	0	0	0.2	20.2	79.5	0	
25-May-2011	09:21:00	6.47	0	1.0	2.9	15.8	81.2	0	
25-May-2011	10:27:00	6.47	0	0	0.5	20.0	79.4	0	
25-May-2011	11:27:00	6.47	0	0	1.5	18.8	79.7	0	
25-May-2011	12:31:00	6.44	0	0	3.4	14.5	82.0	0	
25-May-2011	13:29:00	6.44	0	0	3.5	13.3	83.1	0	
25-May-2011	14:29:00	6.46	0	0	1.8	17.1	81.0	0	
25-May-2011	15:35:00	6.46	0	0	2.3	15.7	81.9	0	
23-Jun-2011	09:29:00	5.86	10	>>>>	0.0	20.8	79.1	0	CH4 and LEL dropped to zero after 30 secs.
23-Jun-2011	10:28:00	5.86	0	0	0.0	20.6	79.3	0	
23-Jun-2011	11:28:00	5.86	0	0	0.0	20.7	79.2	0	
23-Jun-2011	12:28:00	5.86	11.0	>>>>	0.0	20.9	79.0	0	CH4 and LEL dropped to zero after 30 secs.
23-Jun-2011	13:28:00	5.86	0	0	0	20.8	79.1	0	
23-Jun-2011	14:28:00	5.86	0	0.5	0.0	20.6	79.3	0	LEL dropped to zero after 30 secs.
23-Jun-2011	15:28:00	5.86	0	0	0	20.6	79.3	0	

Remarks

geotechnics

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No

PE110891

Borehole

BH1A (P1)

Client KIER CONSTRUCTION LIMITED

Sheet No.

1 (2 of 3)

## Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	7.00m	Cover Type	Flush lockable protective cover
Filter Zone	1.50 - 7.00m	Ground Level	7.62 m OD
Date Installed	13 July 2010		

Date	Time	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Diff. Pressure (mBars)	Flow Rate (Peak/Stable) (l/hr)	Gas Sample Taken (Yes/No)	Wind ()	Cloud ()	Remarks
5-Apr-2011	09:30:00	0	1020	0	-0.4	No	Moderate	Overcast	1mm sized white insects in base of pipe
5-Apr-2011	10:32:00	0	1021	0	0	No	Moderate	Overcast	
5-Apr-2011	11:26:00	0	1022	0	-0.1	No	Moderate	Overcast	
5-Apr-2011	12:05:00	0	1022	0	0	No	Moderate	Overcast	
5-Apr-2011	13:26:00	0	1022	0	-0.4	No	Moderate	Overcast	
5-Apr-2011	14:32:00	0	1024	0	0	No	Moderate	Overcast	
5-Apr-2011	15:15:00	0	1023	0	-0.1	No	Moderate	Overcast	
25-May-2011	09:21:00	0	1024	0	-0.6/0	No	Light	Slight	
25-May-2011	10:27:00	0	1023	0	0	No	Light	Slight	
25-May-2011	11:27:00	0	1022	0	0.2/0	No	Light	Slight	
25-May-2011	12:31:00	0	1022	0	0.9/0	No	Light	Slight	
25-May-2011	13:29:00	0	1022	0	0.1/0	No	Light	Slight	
25-May-2011	14:29:00	0	1023	0	0.1	No	Light	Slight	
25-May-2011	15:35:00	0	1023	0	0	No	Light	Slight	
23-Jun-2011	09:29:00	0	1018	0	0.1	No	Light	Cloudy	CH4 and LEL dropped to zero after 30 secs.
23-Jun-2011	10:28:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	11:28:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	12:28:00	0	1019	0	0	No	Light	Cloudy	CH4 and LEL dropped to zero after 30 secs.
23-Jun-2011	13:28:00	0	1019	0	0	No	Light	None	
23-Jun-2011	14:28:00	0	1020	0	0	No	Light	None	LEL dropped to zero after 30 secs.
23-Jun-2011	15:28:00	0	1020	0	0	No	Light	None	

Remarks

**geotechnics**

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No

PE110891

Borehole

BH1A (P1)

Client KIER CONSTRUCTION LIMITED

Sheet No.

1 (3 of 3)

## Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	7.00m	Cover Type	Flush lockable protective cover
Filter Zone	1.50 - 7.00m	Ground Level	7.62 m OD
Date Installed	13 July 2010		

Date	Time	Rain ( )	Equipment Used ( )	Monitored by ( )	Remarks
5-Apr-2011	09:30:00	Slight	Gas Data LMSxi	GMSL	1mm sized white insects in base of pipe
5-Apr-2011	10:32:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	11:26:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	12:05:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	13:26:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	14:32:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	15:15:00	Slight	Gas Data LMSxi	GMSL	
25-May-2011	09:21:00	Dry	Gas Data LMSxi	SU	
25-May-2011	10:27:00	Dry	Gas Data LMSxi	SU	
25-May-2011	11:27:00	Dry	Gas Data LMSxi	SU	
25-May-2011	12:31:00	Dry	Gas Data LMSxi	SU	
25-May-2011	13:29:00	Dry	Gas Data LMSxi	SU	
25-May-2011	14:29:00	Dry	Gas Data LMSxi	SU	
25-May-2011	15:35:00	Dry	Gas Data LMSxi	SU	
23-Jun-2011	09:29:00	Slight	Gas Data LMSxi	CE	CH4 and LEL dropped to zero after 30 secs.
23-Jun-2011	10:28:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	11:28:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	12:28:00	Slight	Gas Data LMSxi	CE	CH4 and LEL dropped to zero after 30 secs.
23-Jun-2011	13:28:00	Dry	Gas Data LMSxi	CE	
23-Jun-2011	14:28:00	Dry	Gas Data LMSxi	CE	LEL dropped to zero after 30 secs.
23-Jun-2011	15:28:00	Dry	Gas Data LMSxi	CE	

Remarks

**geotechnics**

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No

PE110891

Borehole

BH1A (P2)

Client KIER CONSTRUCTION LIMITED

Sheet No.

1 (1 of 3)

## Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	18.00m	Cover Type	Flush lockable protective cover
Filter Zone	9.00 - 18.00m	Ground Level	7.62 m OD
Date Installed	13 July 2010		

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Remarks
5-Apr-2011	09:25:00	5.26	28.5	>>>>	0.3	46.0	25.1	0	
5-Apr-2011	10:27:00	5.26	17.0	>>>>	0.1	16.0	66.8	0	
5-Apr-2011	11:23:00	5.30	11.5	>>>>	0.0	17.4	71.0	0	
5-Apr-2011	12:03:00	5.31	13.0	>>>>	0.0	17.0	69.9	0	
5-Apr-2011	13:24:00	5.33	15.5	>>>>	0.1	16.5	67.8	0	
5-Apr-2011	14:26:00	5.32	5.7	>>>>	0.0	19.4	74.8	0	
5-Apr-2011	15:12:00	5.34	7.1	>>>>	0.0	18.7	74.1	0	
25-May-2011	09:16:00	5.52	42.5	>>>>	0.6	10.1	46.7	0	
25-May-2011	10:24:00	5.51	35.5	>>>>	0.5	11.2	52.7	0	
25-May-2011	11:25:00	5.50	24.5	>>>>	0.4	14.0	61.0	0	
25-May-2011	12:28:00	5.51	31.0	>>>>	0.5	12.2	56.2	0	
25-May-2011	13:27:00	5.50	24.0	>>>>	0.4	13.9	61.6	0	
25-May-2011	14:27:00	5.50	19.5	>>>>	0.4	15.1	64.9	0	
25-May-2011	15:33:00	5.50	19.5	>>>>	0.4	15.2	64.0	0	
23-Jun-2011	09:25:00	5.25	43.5	>>>>	0.3	9.7	46.4	0	
23-Jun-2011	10:25:00	5.26	30.5	>>>>	0.2	12.7	56.5	0	
23-Jun-2011	11:25:00	5.24	32.5	>>>>	0.3	12.2	54.9	0	
23-Jun-2011	12:25:00	5.26	28.0	>>>>	0.2	13.2	58.5	0	
23-Jun-2011	13:25:00	5.26	28.0	>>>>	0.2	13.5	58.7	0	
23-Jun-2011	14:25:00	5.25	26.0	>>>>	0.2	14.0	59.7	0	
23-Jun-2011	15:25:00	5.25	23.5	>>>>	0.2	14.5	61.7	0	

Remarks

geotechnics

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No

PE110891

Borehole

BH1A (P2)

Client KIER CONSTRUCTION LIMITED

Sheet No.

1 (2 of 3)

## Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	18.00m	Cover Type	Flush lockable protective cover
Filter Zone	9.00 - 18.00m	Ground Level	7.62 m OD
Date Installed	13 July 2010		

Date	Time	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Diff. Pressure (mBars)	Flow Rate (Peak/Stable) (l/hr)	Gas Sample Taken (Yes/No)	Wind ()	Cloud ()	Remarks
5-Apr-2011	09:25:00	0	1020	0	0	Yes	Moderate	Overcast	
5-Apr-2011	10:27:00	0	1021	0	-0.1	No	Moderate	Overcast	
5-Apr-2011	11:23:00	0	1022	0	-0.2	No	Moderate	Overcast	
5-Apr-2011	12:03:00	0	1022	0	-0.2	No	Moderate	Overcast	
5-Apr-2011	13:24:00	0	1022	0	0	No	Moderate	Overcast	
5-Apr-2011	14:26:00	0	1023	0	0	No	Moderate	Overcast	
5-Apr-2011	15:12:00	0	1023	0	0	No	Moderate	Overcast	
25-May-2011	09:16:00	0	1024	0	0.4/0.1	No	Light	Slight	
25-May-2011	10:24:00	0	1023	0	0	No	Light	Slight	
25-May-2011	11:25:00	0	1023	0	-0.2/0	No	Light	Slight	
25-May-2011	12:28:00	0	1022	0	0.7/0	No	Light	Slight	
25-May-2011	13:27:00	0	1022	0	0	No	Light	Slight	
25-May-2011	14:27:00	0	1023	0	0	No	Light	Slight	
25-May-2011	15:33:00	0	1023	0	0.5	No	Light	Slight	
23-Jun-2011	09:25:00	0	1018	0	2.4/0	No	Light	Cloudy	
23-Jun-2011	10:25:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	11:25:00	0	1018	0	0.2	No	Light	Cloudy	
23-Jun-2011	12:25:00	0	1019	0	0	No	Light	Cloudy	
23-Jun-2011	13:25:00	0	1019	0	7.0/0.5	No	Light	None	
23-Jun-2011	14:25:00	0	1020	0	0.5	No	Light	None	
23-Jun-2011	15:25:00	0	1020	0	-0.5	No	Light	None	

Remarks

**geotechnics**

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No

PE110891

Borehole

BH1A (P2)

Client KIER CONSTRUCTION LIMITED

Sheet No.

1 (3 of 3)

Installation Details					
Installation Type		Standpipe		Diameter	
Depth to Base		18.00m		50mm	
Filter Zone		9.00 - 18.00m		Cover Type	
Date Installed		13 July 2010		Flush lockable protective cover	
				Ground Level	
				7.62 m OD	
Date	Time	Rain	Equipment Used	Monitored by	Remarks
		()	()	()	
5-Apr-2011	09:25:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	10:27:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	11:23:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	12:03:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	13:24:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	14:26:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	15:12:00	Slight	Gas Data LMSxi	GMSL	
25-May-2011	09:16:00	Dry	Gas Data LMSxi	SU	
25-May-2011	10:24:00	Dry	Gas Data LMSxi	SU	
25-May-2011	11:25:00	Dry	Gas Data LMSxi	SU	
25-May-2011	12:28:00	Dry	Gas Data LMSxi	SU	
25-May-2011	13:27:00	Dry	Gas Data LMSxi	SU	
25-May-2011	14:27:00	Dry	Gas Data LMSxi	SU	
25-May-2011	15:33:00	Dry	Gas Data LMSxi	SU	
23-Jun-2011	09:25:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	10:25:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	11:25:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	12:25:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	13:25:00	Dry	Gas Data LMSxi	CE	
23-Jun-2011	14:25:00	Dry	Gas Data LMSxi	CE	
23-Jun-2011	15:25:00	Dry	Gas Data LMSxi	CE	
Remarks					

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Client KIER CONSTRUCTION LIMITED

Borehole BH2

Sheet No. 1 (1 of 3)

Installation Details									
Installation Type		Standpipe		Diameter		50mm			
Depth to Base		30.00m		Cover Type		Flush lockable protective cover			
Filter Zone		3.00 - 30.00m		Ground Level		8.07 m OD			
Date Installed		13 July 2010							
Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Remarks
5-Apr-2011	09:40:00	6.83	0	0	0.2	9.6	90.1	0	
5-Apr-2011	10:44:00	6.90	0	0	0.3	8.5	91.1	0	
5-Apr-2011	11:37:00	6.95	0	0	0.3	9.0	90.6	0	
5-Apr-2011	12:13:00	7.00	0	0	0.3	7.8	91.8	0	
5-Apr-2011	13:47:00	7.07	0	0	0.3	8.9	90.7	0	
5-Apr-2011	14:44:00	7.13	0	0	0.4	6.0	93.5	0	
5-Apr-2011	15:24:00	7.15	0	0	0.3	8.4	91.2	0	
25-May-2011	09:43:00	7.52	0.6	7.5	0.0	10.8	88.5	0	
25-May-2011	10:47:00	7.46	0	0	0.2	13.5	86.2	0	
25-May-2011	11:45:00	7.38	0	0	0.2	13.7	86.0	0	
25-May-2011	12:49:00	7.38	0	0	0.2	13.9	85.8	0	
25-May-2011	13:40:00	7.34	0	0	0.2	14.1	85.6	0	
25-May-2011	14:45:00	7.34	0	0	0.2	14.4	85.3	0	
25-May-2011	15:48:00	7.34	0	0	0.2	14.3	85.4	0	
23-Jun-2011	09:38:00	7.30	0	0	0.2	12.2	87.5	0	
23-Jun-2011	10:38:00	7.26	0	0	0.2	14.3	85.4	0	
23-Jun-2011	11:38:00	7.21	0	0	0.2	14.5	85.2	0	
23-Jun-2011	12:38:00	7.17	0	0	0.2	14.4	85.3	0	
23-Jun-2011	13:38:00	7.15	0	0	0.2	14.2	85.5	0	
23-Jun-2011	14:38:00	7.20	0	0	0.2	14.2	85.5	0	
23-Jun-2011	15:38:00	7.22	0	0	0.2	14.5	85.2	0	
Remarks									

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Borehole BH2

Client KIER CONSTRUCTION LIMITED

Sheet No. 1 (2 of 3)

## Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	30.00m	Cover Type	Flush lockable protective cover
Filter Zone	3.00 - 30.00m	Ground Level	8.07 m OD
Date Installed	13 July 2010		

Date	Time	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Diff. Pressure (mBars)	Flow Rate (Peak/Stable) (l/hr)	Gas Sample Taken (Yes/No)	Wind ()	Cloud ()	Remarks
5-Apr-2011	09:40:00	0	1020	4	1.7	No	Moderate	Overcast	
5-Apr-2011	10:44:00	0	1021	1	0.5	No	Moderate	Overcast	
5-Apr-2011	11:37:00	0	1021	1	0.4	No	Moderate	Overcast	
5-Apr-2011	12:13:00	0	1022	1	0.5	No	Moderate	Overcast	
5-Apr-2011	13:47:00	0	1023	1	0.4	No	Moderate	Overcast	
5-Apr-2011	14:44:00	0	1023	0	-0.1	No	Moderate	Overcast	
5-Apr-2011	15:24:00	0	1023	0	0.2	No	Moderate	Overcast	
25-May-2011	09:43:00	0	1024	0	0.5	No	Light	Slight	
25-May-2011	10:47:00	0	1023	0	0.2	No	Light	Slight	
25-May-2011	11:45:00	0	1023	0	0.7/0.2	No	Light	Slight	
25-May-2011	12:49:00	0	1022	0	1.0/0.4	No	Light	Slight	
25-May-2011	13:40:00	0	1022	0	0.4/0.3	No	Light	Slight	
25-May-2011	14:45:00	0	1022	0	0.1	No	Light	Slight	
25-May-2011	15:48:00	0	1023	0	0.7/0.3	No	Light	Slight	
23-Jun-2011	09:38:00	0	1018	0	0.1	No	Light	Cloudy	
23-Jun-2011	10:38:00	0	1018	0	0.1	No	Light	Cloudy	
23-Jun-2011	11:38:00	0	1018	0	0.2 - 0.5	No	Light	Cloudy	
23-Jun-2011	12:38:00	0	1019	0	0.0	No	Light	Cloudy	
23-Jun-2011	13:38:00	0	1019	0	-0.4	No	Light	None	
23-Jun-2011	14:38:00	0	1020	0	-0.3	No	Light	None	
23-Jun-2011	15:38:00	0	1020	0	0	No	Light	None	

Remarks

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# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Client KIER CONSTRUCTION LIMITED

Borehole BH2

Sheet No. 1 (3 of 3)

Installation Details					
Installation Type		Standpipe		Diameter	
Depth to Base		30.00m		50mm	
Filter Zone		3.00 - 30.00m		Cover Type	
Date Installed		13 July 2010		Flush lockable protective cover	
				Ground Level	
				8.07 m OD	
Date	Time	Rain	Equipment Used	Monitored by	Remarks
		()	()	()	
5-Apr-2011	09:40:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	10:44:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	11:37:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	12:13:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	13:47:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	14:44:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	15:24:00	Slight	Gas Data LMSxi	GMSL	
25-May-2011	09:43:00	Dry	Gas Data LMSxi	SU	
25-May-2011	10:47:00	Dry	Gas Data LMSxi	SU	
25-May-2011	11:45:00	Dry	Gas Data LMSxi	SU	
25-May-2011	12:49:00	Dry	Gas Data LMSxi	SU	
25-May-2011	13:40:00	Dry	Gas Data LMSxi	SU	
25-May-2011	14:45:00	Dry	Gas Data LMSxi	SU	
25-May-2011	15:48:00	Dry	Gas Data LMSxi	SU	
23-Jun-2011	09:38:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	10:38:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	11:38:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	12:38:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	13:38:00	Dry	Gas Data LMSxi	CE	
23-Jun-2011	14:38:00	Dry	Gas Data LMSxi	CE	
23-Jun-2011	15:38:00	Dry	Gas Data LMSxi	CE	
Remarks					

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Client KIER CONSTRUCTION LIMITED

Borehole BH3

Sheet No. 1 (1 of 3)

## Installation Details

Installation Type	Standpipe	Diameter	50mm
Depth to Base	29.80m	Cover Type	Flush lockable protective cover
Filter Zone	1.50 - 29.80m	Ground Level	
Date Installed	19 July 2010		

Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Remarks
5-Apr-2011	09:35:00	6.92	0	0	1.5	14.1	84.3	0	
5-Apr-2011	10:37:00	6.92	0	0	4.7	2.1	93.1	0	
5-Apr-2011	11:29:00	6.92	0	0	3.5	7.6	88.8	0	
5-Apr-2011	12:08:00	6.98	0	0	0.0	20.6	79.3	0	
5-Apr-2011	13:30:00	7.04	0	0	0.0	20.7	79.0	0	
5-Apr-2011	14:37:00	7.08	0	0	0.0	20.7	79.2	0	
5-Apr-2011	15:21:00	7.11	0	0	0.0	20.6	79.3	0	
25-May-2011	09:38:00	7.46	0	0.9	1.8	12.4	85.7	0	
25-May-2011	10:43:00	7.48	0	0	3.6	9.5	86.8	0	
25-May-2011	11:41:00	7.46	0	0	3.7	9.0	87.2	0	
25-May-2011	12:45:00	7.43	0	0	4.0	8.0	87.9	0	
25-May-2011	13:43:00	7.37	0	0	4.3	6.0	89.6	0	
25-May-2011	14:42:00	7.39	0	0	1.4	15.9	82.6	0	
25-May-2011	15:45:00	7.39	0	0	2.9	11.5	85.5	0	
23-Jun-2011	09:35:00	7.30	0	0	1.0	16.1	82.8	0	
23-Jun-2011	10:35:00	7.29	0	0	0.0	20.5	79.4	0	
23-Jun-2011	11:35:00	7.26	0	0	0.0	20.6	79.3	0	
23-Jun-2011	12:35:00	7.22	0	0	0.0	20.6	79.3	0	
23-Jun-2011	13:35:00	7.20	0	0	0.0	20.4	79.5	0	
23-Jun-2011	14:35:00	7.20	0	0	0.0	20.5	79.4	0	
23-Jun-2011	15:35:00	7.21	0	0	0.0	20.5	79.4	0	

Remarks

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# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Borehole BH3

Client KIER CONSTRUCTION LIMITED

Sheet No. 1 (2 of 3)

Installation Details									
Installation Type		Standpipe		Diameter		50mm			
Depth to Base		29.80m		Cover Type		Flush lockable protective cover			
Filter Zone		1.50 - 29.80m		Ground Level					
Date Installed		19 July 2010							
Date	Time	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Diff. Pressure (mBars)	Flow Rate (Peak/Stable) (l/hr)	Gas Sample Taken (Yes/No)	Wind ()	Cloud ()	Remarks
5-Apr-2011	09:35:00	0	1020	0	0	No	Moderate	Overcast	
5-Apr-2011	10:37:00	0	1021	0	0	No	Moderate	Overcast	
5-Apr-2011	11:29:00	0	1022	0	0.9	No	Moderate	Overcast	
5-Apr-2011	12:08:00	0	1022	-1	-0.3	No	Moderate	Overcast	
5-Apr-2011	13:30:00	0	1022	-2	-0.5	No	Moderate	Overcast	
5-Apr-2011	14:37:00	0	1023	0	0	No	Moderate	Overcast	
5-Apr-2011	15:21:00	0	1023	0	0	No	Moderate	Overcast	
25-May-2011	09:38:00	0	1024	0	0.1	No	Light	Slight	
25-May-2011	10:43:00	0	1023	0	0.2	No	Light	Slight	
25-May-2011	11:41:00	0	1023	0	0.4/0.2	No	Light	Slight	
25-May-2011	12:45:00	0	1022	0	0.5/0	No	Light	Slight	
25-May-2011	13:43:00	0	1022	0	0.2/0	No	Light	Slight	
25-May-2011	14:42:00	0	1023	0	0.1/0	No	Light	Slight	
25-May-2011	15:45:00	0	1023	0	0	No	Light	Slight	
23-Jun-2011	09:35:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	10:35:00	0	1018	0	-0.2	No	Light	Cloudy	
23-Jun-2011	11:35:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	12:35:00	0	1019	0	0	No	Light	Cloudy	
23-Jun-2011	13:35:00	0	1019	0	-0.2	No	Light	None	
23-Jun-2011	14:35:00	0	1020	0	-0.3	No	Light	None	
23-Jun-2011	15:35:00	0	1020	0	-0.1	No	Light	None	
Remarks									



# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Client KIER CONSTRUCTION LIMITED

Borehole BH6B

Sheet No. 1 (1 of 3)

Installation Details									
Installation Type		Standpipe		Diameter		50mm			
Depth to Base		30.00m		Cover Type		Flush lockable protective cover			
Filter Zone		1.50 - 30.00m		Ground Level					
Date Installed		16 July 2010							
Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Remarks
5-Apr-2011	09:45:00	6.28	0	0	0.7	14.8	84.4	0	
5-Apr-2011	10:48:00	6.31	0	0	0.0	20.4	79.5	0	
5-Apr-2011	11:42:00	6.33	0	0	0.0	20.4	79.5	0	
5-Apr-2011	12:18:00	6.34	0	0	0.0	20.5	79.4	0	
5-Apr-2011	13:35:00	6.35	0	0	0.0	20.6	79.3	0	
5-Apr-2011	14:50:00	6.36	0	0	0.0	20.3	79.6	0	
5-Apr-2011	15:28:00	6.37	0	0	0.0	20.2	79.7	0	
25-May-2011	09:48:00	6.80	0.6	11.9	0.8	15.5	83.0	0	
25-May-2011	10:52:00	6.81	0	0	0	20.6	79.3	0	
25-May-2011	11:50:00	6.77	0	0	0	20.6	79.4	0	
25-May-2011	12:54:00	6.77	0	0	0.1	19.9	79.9	0	
25-May-2011	13:52:00	6.80	0	0	0	20.4	79.5	0	
25-May-2011	14:48:00	6.78	0	0	0.5	17.9	81.5	0	
25-May-2011	15:51:00	6.79	0	0	0	20.3	79.6	0	
23-Jun-2011	09:40:00	6.54	0	0	0.7	15.4	83.8	0	
23-Jun-2011	10:42:00	6.54	0	0	0.0	20.2	79.7	0	
23-Jun-2011	11:42:00	6.53	0	0	0.0	20.4	79.5	0	
23-Jun-2011	12:42:00	6.53	0	0	0.4	18.3	81.2	0	
23-Jun-2011	13:42:00	6.54	0	0	0.0	20.5	79.4	0	
23-Jun-2011	14:42:00	6.55	0	0	0.0	19.9	80.0	0	
23-Jun-2011	15:42:00	6.56	0	0	0.6	16.9	82.4	0	
Remarks									

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Borehole BH6B

Client KIER CONSTRUCTION LIMITED

Sheet No. 1 (2 of 3)

## Installation Details

Installation Type Standpipe  
 Depth to Base 30.00m  
 Filter Zone 1.50 - 30.00m  
 Date Installed 16 July 2010  
 Diameter 50mm  
 Cover Type Flush lockable protective cover  
 Ground Level

Date	Time	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Diff. Pressure (mBars)	Flow Rate (Peak/Stable) (l/hr)	Gas Sample Taken (Yes/No)	Wind ()	Cloud ()	Remarks
5-Apr-2011	09:45:00	0	1020	0	0	No	Moderate	Overcast	
5-Apr-2011	10:48:00	0	1020	0	0	No	Moderate	Overcast	
5-Apr-2011	11:42:00	0	1021	0	0.2	No	Moderate	Overcast	
5-Apr-2011	12:18:00	0	1022	0	0	No	Moderate	Overcast	
5-Apr-2011	13:35:00	0	1022	0	0	No	Moderate	Overcast	
5-Apr-2011	14:50:00	0	1023	0	0	No	Moderate	Overcast	
5-Apr-2011	15:28:00	0	1023	0	0	No	Moderate	Overcast	
25-May-2011	09:48:00	0	1024	0	-0.3	No	Light	Slight	
25-May-2011	10:52:00	0	1023	0	0.3/0	No	Light	Slight	
25-May-2011	11:50:00	0	1023	0	0	No	Light	Slight	
25-May-2011	12:54:00	0	1022	0	-0.2	No	Light	Slight	
25-May-2011	13:52:00	0	1022	0	-0.4/0	No	Light	Slight	
25-May-2011	14:48:00	0	1023	0	0.2/0	No	Light	Slight	
25-May-2011	15:51:00	0	1023	0	0	No	Light	Slight	
23-Jun-2011	09:40:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	10:42:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	11:42:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	12:42:00	0	1019	0	0.1	No	Light	Cloudy	
23-Jun-2011	13:42:00	0	1019	0	0	No	Light	None	
23-Jun-2011	14:42:00	0	1019	0	0	No	Light	None	
23-Jun-2011	15:42:00	0	1020	0	0	No	Light	None	

Remarks

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# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Client KIER CONSTRUCTION LIMITED

Borehole BH6B

Sheet No. 1 (3 of 3)

Installation Details					
Installation Type		Standpipe		Diameter	
Depth to Base		30.00m		50mm	
Filter Zone		1.50 - 30.00m		Cover Type	
Date Installed		16 July 2010		Ground Level	
Date		Time		Rain	
				Equipment Used	
				Monitored by	
				Remarks	
5-Apr-2011	09:45:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	10:48:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	11:42:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	12:18:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	13:35:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	14:50:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	15:28:00	Slight	Gas Data LMSxi	GMSL	
25-May-2011	09:48:00	Dry	Gas Data LMSxi	SU	
25-May-2011	10:52:00	Dry	Gas Data LMSxi	SU	
25-May-2011	11:50:00	Dry	Gas Data LMSxi	SU	
25-May-2011	12:54:00	Dry	Gas Data LMSxi	SU	
25-May-2011	13:52:00	Dry	Gas Data LMSxi	SU	
25-May-2011	14:48:00	Dry	Gas Data LMSxi	SU	
25-May-2011	15:51:00	Dry	Gas Data LMSxi	SU	
23-Jun-2011	09:40:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	10:42:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	11:42:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	12:42:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	13:42:00	Dry	Gas Data LMSxi	CE	
23-Jun-2011	14:42:00	Dry	Gas Data LMSxi	CE	
23-Jun-2011	15:42:00	Dry	Gas Data LMSxi	CE	
Remarks					

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Client KIER CONSTRUCTION LIMITED

Borehole BH17

Sheet No. 1 (1 of 3)

Installation Details									
Installation Type		Standpipe		Diameter		50mm			
Depth to Base		15.30m		Cover Type		Flush lockable protective cover			
Filter Zone		1.50 - 15.30m		Ground Level					
Date Installed		6 July 2010							
Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Remarks
5-Apr-2011	09:15:00	5.54	0	0	0.1	17.9	81.9	0	
5-Apr-2011	10:20:00	5.52	0	0	0.8	17.5	81.6	0	
5-Apr-2011	11:18:00	5.53	0	0	2.2	11.7	86.0	0	
5-Apr-2011	11:58:00	5.54	0	0	0.0	20.6	79.3	0	
5-Apr-2011	13:20:00	5.54	0	0	0.2	20.2	79.5	0	
5-Apr-2011	14:22:00	5.53	0	0	0.0	21.1	78.8	0	
5-Apr-2011	15:05:00	5.53	0	0	0.0	20.7	79.2	0	
25-May-2011	09:28:00	5.63	0.6	12.8	1.6	17.5	80.2	0	
25-May-2011	10:32:00	5.61	0	0	0	20.7	79.2	0	
25-May-2011	11:31:00	5.60	0	0	0	20.8	79.1	0	
25-May-2011	12:34:00	5.60	0	0	1.7	17.3	80.9	0	
25-May-2011	13:33:00	5.60	0	0	0.8	18.4	80.7	0	
25-May-2011	14:33:00	5.60	0	0	1.0	17.9	80.9	0	
25-May-2011	15:37:00	5.60	0	0	0.6	18.9	80.4	0	
23-Jun-2011	09:20:00	5.55	0	0	3.3	12.1	84.5	0	
23-Jun-2011	10:20:00	5.55	0	0	0.0	20.6	79.3	0	
23-Jun-2011	11:20:00	5.55	0	0	0.0	20.7	79.2	0	
23-Jun-2011	12:20:00	5.55	0	0	0.0	20.7	79.2	0	
23-Jun-2011	13:20:00	5.55	0	0	0.0	20.7	79.2	0	
23-Jun-2011	14:20:00	5.55	0	0	0.0	20.7	79.2	0	
23-Jun-2011	15:20:00	5.55	0	0	0.0	20.9	79.0	0	
Remarks									

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Borehole BH17

Client KIER CONSTRUCTION LIMITED

Sheet No. 1 (2 of 3)

## Installation Details

Installation Type Standpipe Diameter 50mm  
 Depth to Base 15.30m Cover Type Flush lockable protective cover  
 Filter Zone 1.50 - 15.30m Ground Level  
 Date Installed 6 July 2010

Date	Time	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Diff. Pressure (mBars)	Flow Rate (Peak/Stable) (l/hr)	Gas Sample Taken (Yes/No)	Wind ()	Cloud ()	Remarks
5-Apr-2011	09:15:00	0	1020	0	-0.2	No	Moderate	Overcast	
5-Apr-2011	10:20:00	0	1021	0	0	No	Moderate	Overcast	
5-Apr-2011	11:18:00	0	1022	0	0	No	Moderate	Overcast	
5-Apr-2011	11:58:00	0	1022	0	0	No	Moderate	Overcast	
5-Apr-2011	13:20:00	0	1023	0	0.5	No	Moderate	Overcast	
5-Apr-2011	14:22:00	0	1024	0	0	No	Moderate	Overcast	
5-Apr-2011	15:05:00	0	1024	0	0.2	No	Moderate	Overcast	
25-May-2011	09:28:00	0	1024	0	0.3/0	No	Light	Slight	
25-May-2011	10:32:00	0	1023	0	0.3/0	No	Light	Slight	
25-May-2011	11:31:00	0	1023	0	0.2/0	No	Light	Slight	
25-May-2011	12:34:00	0	1022	0	0.2/0	No	Light	Slight	
25-May-2011	13:33:00	0	1022	0	-0.2/0	No	Light	Slight	
25-May-2011	14:33:00	0	1023	0	-0.1/0	No	Light	Slight	
25-May-2011	15:37:00	0	1023	0	0	No	Light	Slight	
23-Jun-2011	09:20:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	10:20:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	11:20:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	12:20:00	0	1019	0	0	No	Light	Cloudy	
23-Jun-2011	13:20:00	0	1019	0	0.2	No	Light	None	
23-Jun-2011	14:20:00	0	1020	0	0	No	Light	None	
23-Jun-2011	15:20:00	0	1020	0	-0.2	No	Light	None	

Remarks

geotechnics

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Client KIER CONSTRUCTION LIMITED

Borehole BH17

Sheet No. 1 (3 of 3)

Installation Details					
Installation Type		Standpipe		Diameter	
Depth to Base		15.30m		50mm	
Filter Zone		1.50 - 15.30m		Cover Type	
Date Installed		6 July 2010		Flush lockable protective cover	
Ground Level					
Date	Time	Rain	Equipment Used	Monitored by	Remarks
		()	()	()	
5-Apr-2011	09:15:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	10:20:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	11:18:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	11:58:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	13:20:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	14:22:00	Slight	Gas Data LMSxi	GMSL	
5-Apr-2011	15:05:00	Slight	Gas Data LMSxi	GMSL	
25-May-2011	09:28:00	Dry	Gas Data LMSxi	SU	
25-May-2011	10:32:00	Dry	Gas Data LMSxi	SU	
25-May-2011	11:31:00	Dry	Gas Data LMSxi	SU	
25-May-2011	12:34:00	Dry	Gas Data LMSxi	SU	
25-May-2011	13:33:00	Dry	Gas Data LMSxi	SU	
25-May-2011	14:33:00	Dry	Gas Data LMSxi	SU	
25-May-2011	15:37:00	Dry	Gas Data LMSxi	SU	
23-Jun-2011	09:20:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	10:20:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	11:20:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	12:20:00	Slight	Gas Data LMSxi	CE	
23-Jun-2011	13:20:00	Dry	Gas Data LMSxi	CE	
23-Jun-2011	14:20:00	Dry	Gas Data LMSxi	CE	
23-Jun-2011	15:20:00	Dry	Gas Data LMSxi	CE	
Remarks					

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Client KIER CONSTRUCTION LIMITED

Borehole BH22

Sheet No. 1 (1 of 3)

Installation Details									
Installation Type		Standpipe		Diameter		50mm			
Depth to Base		10.00m		Cover Type		Flush lockable protective cover			
Filter Zone		1.50 - 10.00m		Ground Level					
Date Installed		19 July 2010							
Date	Time	Depth to Water (m bgl)	Methane CH4 (% VOL)	Methane CH4 (% LEL)	Carbon Dioxide CO2 (% VOL)	Oxygen O2 (% VOL)	Nitrogen N2 (% VOL)	Hydrogen Sulphide H2S (ppm)	Remarks
5-Apr-2011	09:50:00	6.50	0	0	0.0	20.5	79.4	0	
5-Apr-2011	10:55:00	6.40	0	0	0.0	20.5	79.4	0	
5-Apr-2011	11:46:00	6.44	0	0	0.0	20.6	79.3	0	
5-Apr-2011	12:24:00	6.44	0	0	0.0	20.6	79.3	0	
5-Apr-2011	13:41:00	6.45	0	0	0.0	20.5	79.4	0	
5-Apr-2011	14:55:00	6.46	0	0	0.0	20.2	79.7	0	
5-Apr-2011	15:31:00	6.46	0	0	0.0	20.2	79.7	0	
25-May-2011	10:01:00	4.82	0.7	13.1	0.3	19.0	79.9	0	
25-May-2011	10:36:00	4.52	0.2	3.3	0.3	19.0	80.4	0	
25-May-2011	11:36:00	4.24	0	0	0.3	19.3	80.3	0	
25-May-2011	12:39:00	4.19	0	0	0.5	18.4	81.4	0	
25-May-2011	13:38:00	4.36	0	0	0.4	18.6	80.9	0	
25-May-2011	14:36:00	4.63	0	0	0.3	19.4	80.2	0	
25-May-2011	15:41:00	4.75	0	0	0.0	20.7	79.2	0	
23-Jun-2011	09:15:00	4.61	1.1	21.7	0.5	19.4	78.9	0	
23-Jun-2011	10:15:00	4.61	0	0	0.4	19.2	80.3	0	
23-Jun-2011	11:15:00	4.00	0	0	0.1	20.3	79.5	0	
23-Jun-2011	12:15:00	4.05	0	0	0.4	19.6	79.9	0	
23-Jun-2011	13:15:00	4.40	0	0	0.2	20.5	79.2	0	
23-Jun-2011	14:15:00	4.59	0	0	0.4	19.9	79.6	0	
23-Jun-2011	15:15:00	4.64	0	0	0.0	20.9	79.0	0	
Remarks									

# FIELDWORK - Insitu Gas Monitoring - Instrument Record

Project SWDWP - ADDITIONAL GAS MONITORING

Project No PE110891

Client KIER CONSTRUCTION LIMITED

Borehole BH22

Sheet No. 1 (2 of 3)

## Installation Details

Installation Type Standpipe  
 Depth to Base 10.00m  
 Filter Zone 1.50 - 10.00m  
 Date Installed 19 July 2010  
 Diameter 50mm  
 Cover Type Flush lockable protective cover  
 Ground Level

Date	Time	Carbon Monoxide CO (ppm)	Barometric Pressure (mBars)	Diff. Pressure (mBars)	Flow Rate (Peak/Stable) (l/hr)	Gas Sample Taken (Yes/No)	Wind ()	Cloud ()	Remarks
5-Apr-2011	09:50:00	0	1020	0	0.5	No	Moderate	Overcast	
5-Apr-2011	10:55:00	0	1021	0	0.5	No	Moderate	Overcast	
5-Apr-2011	11:46:00	0	1021	-2	-0.4	No	Moderate	Overcast	
5-Apr-2011	12:24:00	0	1022	0	0.4	No	Moderate	Overcast	
5-Apr-2011	13:41:00	0	1023	0	0.2	No	Moderate	Overcast	
5-Apr-2011	14:55:00	0	1024	-1	-0.2	No	Moderate	Overcast	
5-Apr-2011	15:31:00	0	1023	0	0.1	No	Moderate	Overcast	
25-May-2011	10:01:00	0	1024	0	0.3/0	No	Light	Slight	
25-May-2011	10:36:00	0	1023	0	0	No	Light	Slight	
25-May-2011	11:36:00	0	1023	0	0.4/0	No	Light	Slight	
25-May-2011	12:39:00	0	1022	0	0	No	Light	Slight	
25-May-2011	13:38:00	0	1022	0	-0.3/0	No	Light	Slight	
25-May-2011	14:36:00	0	1023	0	0.1	No	Light	Slight	
25-May-2011	15:41:00	0	1023	0	0.2/0	No	Light	Slight	
23-Jun-2011	09:15:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	10:15:00	0	1018	0	0	No	Light	Cloudy	
23-Jun-2011	11:15:00	0	1020	0	0	No	Light	Cloudy	
23-Jun-2011	12:15:00	0	1020	0	0	No	Light	Cloudy	
23-Jun-2011	13:15:00	0	1020	0	0	No	Light	None	
23-Jun-2011	14:15:00	0	1020	0	0	No	Light	None	
23-Jun-2011	15:15:00	0	1020	0	0	No	Light	None	

Remarks



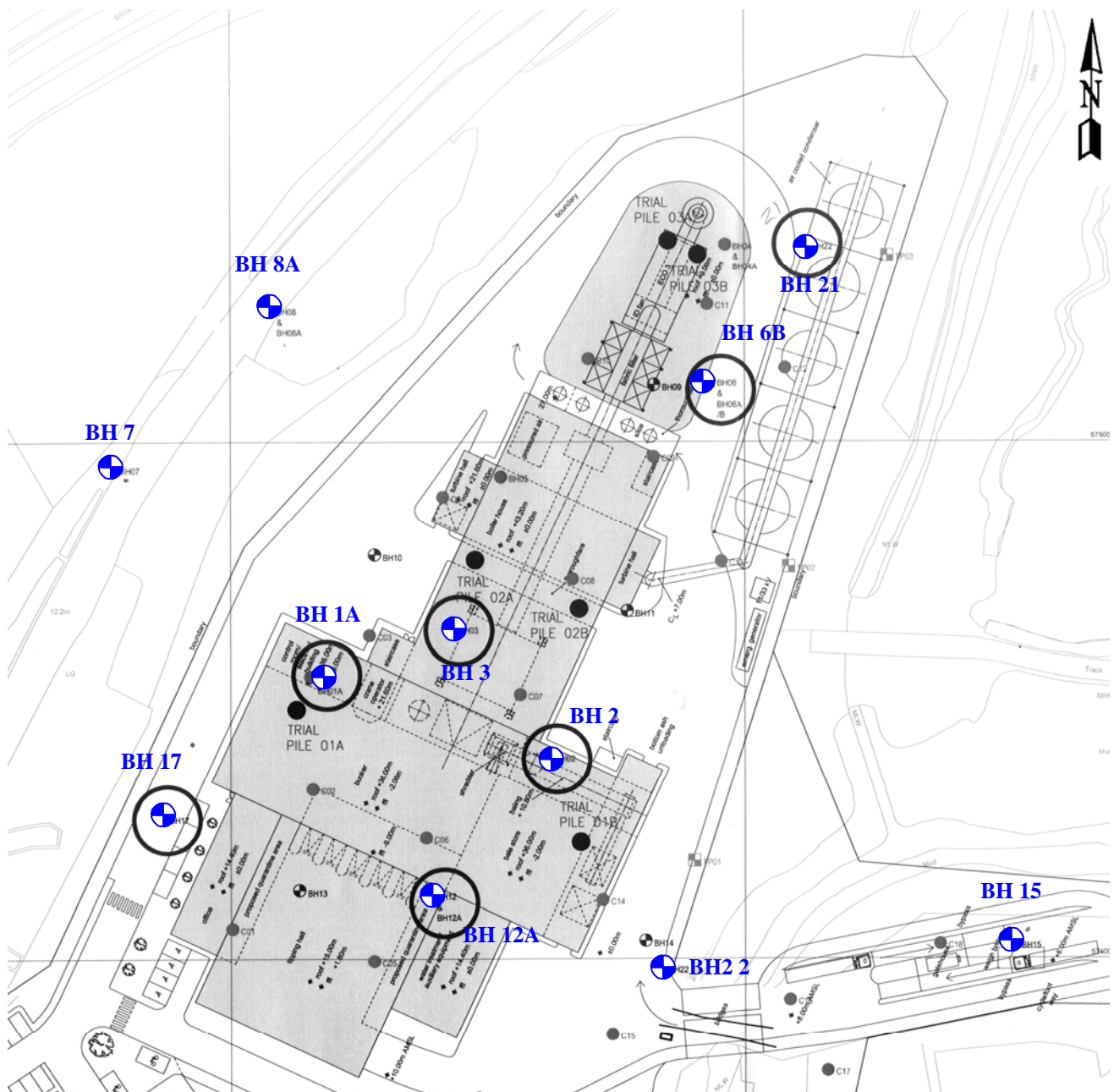
### **Plymouth EfW Gas Monitoring Pressures**

Data Obtained from [www.wunderground.com](http://www.wunderground.com) (Weather underground)

Data applies to Roborough, located 7 miles North of Plymouth EfW

<b><u>Date</u></b>	<b><u>Sea Level Pressure (hPa)</u></b>
26/07/10	1020.24
27/07/10	1020.20
28/07/10	1020.36
10/08/10	1010.71
11/08/10	1016.12
12/08/10	1019.62
23/08/10	1002.97
24/08/10	1013.42
25/08/10	1008.75
07/09/10	999.81
08/09/10	1004.09
09/09/10	1017.68
20/09/10	1014.95
21/09/10	1018.33
22/09/10	1015.23
04/10/10	1000.17
05/10/10	1000.33
06/10/10	1008.00
04/04/11	1022.29
05/04/11	1022.58
06/04/11	1025.71
24/05/11	1029.12
25/05/11	1020.57
26/05/11	1012.45
22/06/11	1010.21
23/06/11	1018.74
24/06/11	1024.07

**FIGURE II-1**



**Notes:**

1. BH1A includes two monitoring standpipes BH1A 7 (response zone 1 m to 7 m) BH1A 18 (response zone 9 m to 18 m).
2. BHs 18 and 19 are located to the south and are remote from the proposed EFW plant.
3. For details of standpipe installations, borehole data and gas monitoring measurements, refer to records by Geotechnics.

**LOCATIONS OF GAS MONITORING STANDPIPES**

Scale 1:1250

Plan based on Drawing No. QC8223/10 B by GHA Livgunn