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Fletcher Bank Quarry Landfill Site

Landfill Gas Report

Churchill Enviro Limited

Report No. K0047-ST-R002

18 January 2022

Revision 00

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Document Control

Document: Landfill Gas Report
Project: Fletcher Bank Quarry Landfill Site
Client: Churchill Enviro Limited
Report Number: K0047-ST-R002

Document Checking:

Revision	Revision/ Review Date	Details of Issue	Authorised		
			Prepared By	Checked By	Approved By
00	18 January 2022	Issued for ITT	E Greenhalgh	C. Finney	P Roberts

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1 Introduction

1.1 Background

Churchill Enviro Limited operate Fletcher Bank Quarry Landfill Site (the Site) under Environmental Permit referenced EPR/GP3733FE/V002. A Landfill Gas Risk Assessment (LFGRA) referenced K0047-ST-R001 has been prepared to discharge Improvement Condition (IC) 1 listed in Table S1.3 of the Environmental Permit and support a permit variation to increase the annual waste inputs from 150,000 to 350,000 tonnes. This Landfill Gas Report has been prepared to discharge IC2 as detailed below:

A landfill gas report shall be submitted to Environment Agency for approval. The report shall contain appropriate borehole specific background levels and compliance limits for perimeter gas monitoring boreholes BEL1, BEL2, SLR2 and SLR3 and assessment criteria for internal waste boreholes FB106 to FB111. The report shall include any necessary revisions to the landfill gas action plan as contained in Appendix 4 of the Regulatory Specification 2005.

Reference has been made to the following previous documents:

- Fletcher Bank Landfill Gas Risk Assessment referenced K0047-ST-R001 (December 2021)
- TerraConsult Limited Fletcher Bank Quarry Discharge of Pre-Operational Planning Conditions for Bury MBC and Lancashire County Council referenced 1772/R/004/01 (May 2016)

The Site is located in the larger Fletcher Bank Quarry complex, near Bury. The Site was founded in the 1880's and has been subject to sandstone and gritstone quarrying. The site was acquired by Marshalls Mono Ltd in 1969 when they purchased Richard Wild and Company. They operate the quarry and a substantial concrete products manufacturing plant to the southwest of the Site.

The Site is a substantial minerals extraction operation which is being progressively restored with a combination of minerals wastes and imported wastes under a separate restoration scheme. This Site is located in the existing quarry void and is indicated by the green boundary on Drawing No. 1772/3/013 Rev D, attached as Appendix A. The landfill forms a constituent part of the larger restoration scheme for the quarry.

The Site's Environmental Permit was transferred from Marshalls Mono Ltd to Churchill Enviro Limited in March 2011. The Environmental Permit was varied and consolidated permit issued in modern condition format in August 2020 by the Environment Agency.

2 Gas Management Plan

2.1 Control Measures

The predicted volume of landfill gas produced by the site is likely to be significantly lower than the indicative benchmark level of 50-100 m³/hr suggested by Environment Agency guidance LFTGN03¹ where active gas control and treatment (flaring and utilisation) would be required. The nature of the waste deposits (low permeability soils and clays) will also make it very difficult to extract gas from the site.

The main control on the production on gas is by ensuring that the waste received at the site contains low proportions of biodegradable materials. Additional controls on the deposit of wastes that contain odorous substances will prevent an odour nuisance. These would include exclusion of such wastes or rapid covering during placement.

Notwithstanding this, measures will be implemented to ensure that the landfill gas production is monitored to confirm the basis of the qualitative risk model. Perimeter boreholes are installed at site to monitor landfill gas and the site design provides for the installation of in-waste gas monitoring points. The in-waste boreholes will be installed retrospectively on completion of waste deposition and this has not yet been undertaken. When installed these will be at a spatial density of 2 per hectare of waste deposits in accordance with current surrender guidance. The location of the perimeter boreholes are shown on drawing reference 1772/3/013: Environmental Monitoring Plan.

2.2 Monitoring and Sampling Plan

The gas monitoring schedule for the Site are detailed in Table S3.3, S3.4 and S3.6 of the Environmental Permit. These are summarised in Tables 1 to 3.

Table 1 – Permit Table S3.3: Landfill gas in external monitoring boreholes – limits and monitoring requirements

Monitoring Point	Parameter	Limit	Monitoring Frequency
BEL1, BEL2, SLR2 and SLR3	Methane	1% v/v	Monthly
	Carbon Dioxide	1.5% v/v	
	Oxygen	No limit	
	Atmospheric Pressure	No limit	

¹ Guidance on the management of landfill gas (LFTGN03). Environment Agency. September 2004

Table 2 – Permit Table S3.4: Landfill gas emissions from capped surface for cells that have accepted non hazardous biodegradable waste – monitoring

Monitoring Point	Parameter	Monitoring Frequency
Permanently capped zone	Methane concentration	Every 12 months
Temporarily capped zone	Methane concentration	Every 12 months
Whole Site	Total methane emission	As agreed with the Environment Agency
Uncapped areas	Methane concentration	Every 12 months

Table 3 – Permit Table S3.5 Landfill gas – other monitoring requirements

Monitoring Point	Parameter	Monitoring Frequency
In waste gas monitoring boreholes or sealed leachate wells or sacrificial gas extraction system	Methane Carbon Dioxide Oxygen Carbon Monoxide Differential Pressure Atmospheric Pressure	Monthly
	Hydrogen Sulphide	Quarterly

The sampling procedure is included in the Site’s Environmental Management System (EMS). Gas readings are taken on a monthly basis at six perimeter boreholes (SLR2, FB11/01, FB11/02, FB11/02A, FB104R, and BH803). Limits for methane and carbon dioxide are specified in Permit Table S3.3 (Table1 above), however these are specified for boreholes BEL1, BEL2, SLR2 and SLR3. Of those four monitoring points only SLR2 is monitored. Therefore, it is proposed to amend Table 1 of the environmental permit to reflect the perimeter boreholes present onsite and to address IC2.

In-waste boreholes will be installed retrospectively on completion of waste deposition and this has not yet been undertaken. Boreholes will be installed in accordance with Environment Agency Guidance document EPR5.02²: monitoring must be undertaken from permanent monitoring points installed within the waste at a frequency of no less than two boreholes per hectare, with a minimum of four boreholes per site. Four in-waste monitoring will be monitored in accordance with Permit Table S3.5 (Table 3 above) and will also be monitored for flow. IC2 requires assessment criteria for in waste boreholes FB106 to FB111. The assessment criteria for the four in-waste boreholes (name and location to be determined) will be the requirements for surrender outlined in Environment Agency Guidance document EPR5.02.

It is proposed to remove Permit Table S3.4 (Table 2 above) as monitoring landfill gas emissions from capped surfaces is not required for inert landfills. Although the site is classed as a non-

² Landfill (EPR 5.02) and other permanent deposits of waste: How to surrender your environmental permit. Environment Agency. V2. December 2012

hazardous landfill the waste types accepted are predominantly inert in composition with a very low proportion of biodegradable material. The LFGRA has demonstrated that negligible volumes of gas will be produced and concluded that landfill gas does not pose a significant risk to the surrounding environment. Monitoring is undertaken at perimeter boreholes and will be undertaken at in-waste boreholes once installed to confirm the assumptions of the LFGRA and assess any potential risk to surrounding receptors.

2.3 Assessment Criteria – Perimeter Boreholes

2.3.1 Background

It is proposed to provide perimeter borehole methane compliance levels supported by carbon dioxide action levels. Where a breach of the methane compliance level occurs, or, if carbon dioxide concentrations exceed the action level after a sustained increasing trend (as opposed to sporadic exceedances) in the perimeter boreholes is observed, the operator will assess the likelihood of it being as a result of an emission from the landfill and to report back to the Environment Agency with any actions that may be required in accordance with the compliance action plan using the appropriate proforma and timescales. The landfill gas data is attached as Appendix B.

2.3.2 Methane

It is reasonable to assume there are no significant sources of methane in the immediate vicinity of the Site. As such, the current compliance limit of 1% is considered appropriate.

2.3.3 Carbon Dioxide

The waste industry ICoP³ advised that carbon dioxide is not an appropriate choice of gas to use to regulate emissions from landfills because there are alternative sources in the sub-surface environment. The ICoP recommended compliance limits should not be set, but instead the data should be used by the operator to set Management Response Levels (MRL's) on a boreholespecific basis to confirm the conceptual model and inform investigatory actions.

It is proposed to use the accumulated monitoring record to establish methane compliance levels and carbon dioxide MRL's. An understanding of routine data in the context of long-term trends is therefore essential to assessing ground gas conditions. The data set will be screened for anomalies using the appropriate statistical method.

The ICoP follows an approach based on a methodology detailed in the Environment Agency P1-471 guidance⁴ to establish the maximum background level of methane and carbon dioxide. The P1-471 multiple outlier test is a screening tool which 'cleans up' data to estimate baseline statistics. The method standardises and ranks the data ($n - \text{mean} / \text{standard deviation}$) and

³ Industry Code of Practice (ICoP): Perimeter Soil Gas Emissions Criteria and Associated Management. January 2011.

⁴ J.C. Ellis, J.A. Turrell and K.M. Blackmore (2002). Techniques for the Interpretation of Landfill Monitoring Data. Final R&D Technical Report P1 471. Environment Agency.

compares the maximum value (TMax) to a Critical Value at P = 1%. If the TMax is greater than the critical value, then the probability that a value as extreme as this could have arisen by chance from a normal population (of data) is less than 1 in 100.

The MRL's will be augmented where applicable by a Factor of Safety (FoS) to make a clear distinction between background and other sources of gas. The application of a FoS is dependent on the stability of the wider historical data set. An unstable data set is suggested to occur when '...the range in concentration values (between high and low data) is > 8%, but this will be decided on a site-by-site basis'. A stable data set can therefore be presumed when for example the majority of data points are located within the range 0 – 5 % v/v, 5 - 10 % v/v and so on.

The multiple outlier test identifies and 'removes' data points assumed to be erroneous to the wider data set (be they high or low) leaving a statistically significant distribution of data. An unstable data set will be reflected by the majority of values appearing to be randomly distributed between the maximum and minimum values which may be at least > 8 % v/v apart. An objective assessment of the data set must therefore be made (informed by the statistical analysis) to justify whether a TMax / FoS based MRL is appropriate.

Table 4 – Tmax and FoS Derived Carbon Dioxide Management Levels

Tmax Background Carbon Dioxide Concentration	DoS derived Carbon Dioxide Action Level
T _{Max} carbon dioxide concentration in range 0 - 5%	T _{Max} + 1%
T _{Max} carbon dioxide concentration in range 5 – 10%	T _{Max} + 2%
T _{Max} carbon dioxide concentration in range 10 – 20%	T _{Max} + 3%
T _{Max} carbon dioxide concentration in range 20 – 25%	T _{Max} + 4%
T _{Max} carbon dioxide concentration in range >25%	None

The FoS value of between 1 and 5 % v/v will be added to the TMax subject to the distribution and variability of the data set. For example, if data fluctuates in the range 0 to 5 % v/v, 1 % v/v FoS will be added to the TMax, e.g. 5 % v/v, then the MRV will be 6 % v/v. This will allow for future fluctuations above the current TMax or rising trends without the need for immediate further statistical analysis. Table 4 details the FoS applicable to stable data sets according to the TMax background methane and carbon dioxide levels.

The current action level of 1.5% is suitable for BH803 and SLR2. Table 5 summarises the proposed carbon dioxide action levels to be implemented on-site for the remaining monitoring points. The spread sheet with the statistical analysis data is attached in Appendix B.

Table 5 – Proposed Carbon Dioxide Action Levels and Methane Compliance Limits

Location	Carbon Dioxide			Methane
	Average (%v/v)	Tmax (%v/v)	Proposed Action Level (%v/v)	Compliance Limit (%v/v)
Northern Perimeter				
FBE 11-01	0.77	1.8	2.8	1
FBE 11-02	1.41	2.9	3.9	1
FBE 11-02A	0.66	1.6	2.6	1
Eastern Perimeter				
BH803	0.14	0.1	1.5	1
Southern Perimeter				
FB104R	0.69	1.5	2.5	1
Western Perimeter				
SLR2	0.24	0.5	1.5	1

2.4 Contingency Action Plan

2.4.1 Initiation

The action plan is to be implemented by the Site Manager or in his absence the Environment Manager in the event of the following:

- Methane concentrations in the perimeter boreholes breaching the permit compliance level;
- Abnormal, adverse trends in monitoring data;
- Operational problems or failure of the control system;
- Reported events (e.g. odour complaints);
- Confirmed migration events or uncontrolled releases of landfill gas; and,
- Confirmed adverse impacts on local air quality.

2.4.2 Response

If any of the events identified above occur, the following course of action will be implemented iteratively until the cause of the issue has been identified and any adverse effects have ceased or been remediated:

- Report to the Environment Agency in accordance with the permit if the methane compliance level is exceeded and on progress with any resulting actions detailed below:

- Review the monitoring data to identify any other associated rising trends in perimeter methane / carbon dioxide concentrations;
- Repeat the gas monitoring as soon as possible but no later than 7 days to confirm the reproducibility of data. If the repeat reading is below the compliance / action level then no further investigations are required. A watching brief will be maintained on all boreholes however;
- Review the in-waste monitoring data to identify if gas production has increased. The historic data set will be reviewed for trends which may indicate an increase in gas production;
- If in-waste gas production is within its normal range, / or leachate quality is within its normal parameters, then a review of alternative sources / causes of ground gas production will be instigated. This will include changes to site engineering e.g. capping or lining, agricultural practices outside the site boundary such as manure spreading or drainage works;
- If migration is persistently observed in a specific borehole the monitoring data will be reviewed along with the gas field data and changes implemented as required. If the borehole is in a sensitive area e.g. close to housing then consideration will be given to increasing monitoring to a weekly frequency in that borehole or area;
- The surrounding area will be checked for signs of gas or leachate escaping or vegetation die back;
- If elevated levels continue, the area of the migration will be audited to establish potential remediation works to be carried out if required.

In the unlikely event that remedial action is required, a proposal will be provided to the Environment Agency for approval. This may include one or more of the following:

- A gas pumping trial in accordance with Environment Agency Guidance Document LFTGN03 (September 2004) to confirm the assumptions of the Landfill Gas Risk Assessment and establish whether the gas is being produced at a significant rate.
- An options appraisal to establish the most practical and cost effective gas control methodology for the management of low volumes of landfill gas (e.g. biofilters, or low-calorific flares).
- Additional extraction or monitoring points as necessary based on the revised risk assessment / pumping trial.
- A report on the effectiveness of the revised control system after an appropriate period of monitoring.

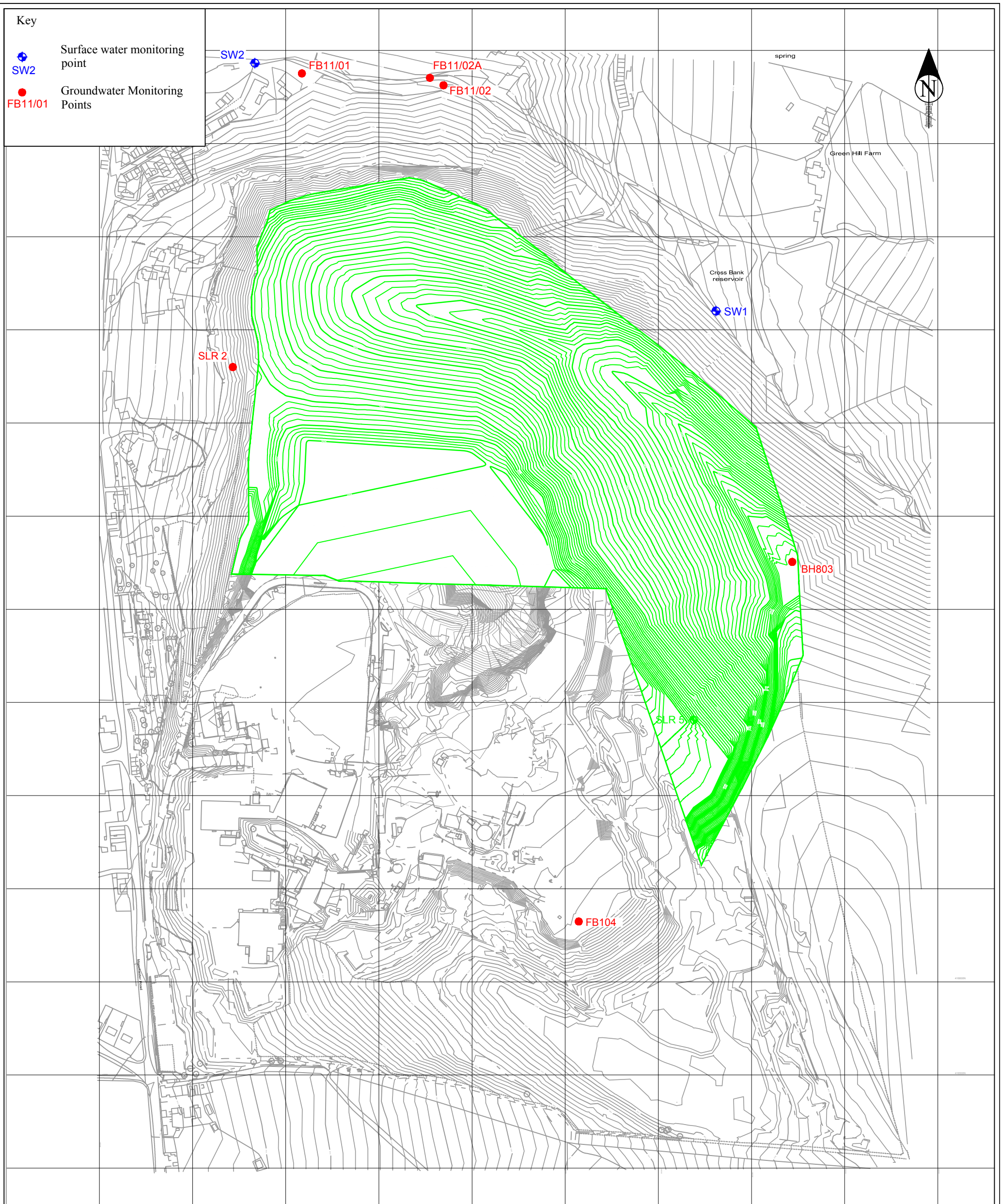
2.5 Maintenance of Perimeter Monitoring Infrastructure

The gas monitoring installations shall be inspected during each routine monitoring visit to ensure that they are fit for purpose. In the event that repairs are required these shall be undertaken within a period of one month. Examples of the kind of issues to be considered are:

- **Wear and tear:** damage by machines, plant or through vandalism. Functioning of seals and valves;
- **Access:** are the monitoring points accessible safely;
- **Settlement:** is the installation leaning over, has it dropped noticeably;
- **Surface water ingress:** is there water pooling around the base of the installation, is there signs of previous ponding / rivulets of running water in the vicinity of the installation.

If any of the above is apparent at any of the installation, then the site manager and relevant personnel should be informed immediately. Should any of the monitoring points become damaged to such an extent that suitable data cannot be recorded; alternative monitoring locations will be proposed and agreed with the Environment Agency. If no suitable alternatives are present, then the damaged wells will be either repaired or replaced if practicable. The nature and location of any replacement, as well as the methods to be used, would be approved by the Environment Agency prior to any works being undertaken.

Appendix A – Drawings



TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client
Churchill Enviro Ltd.

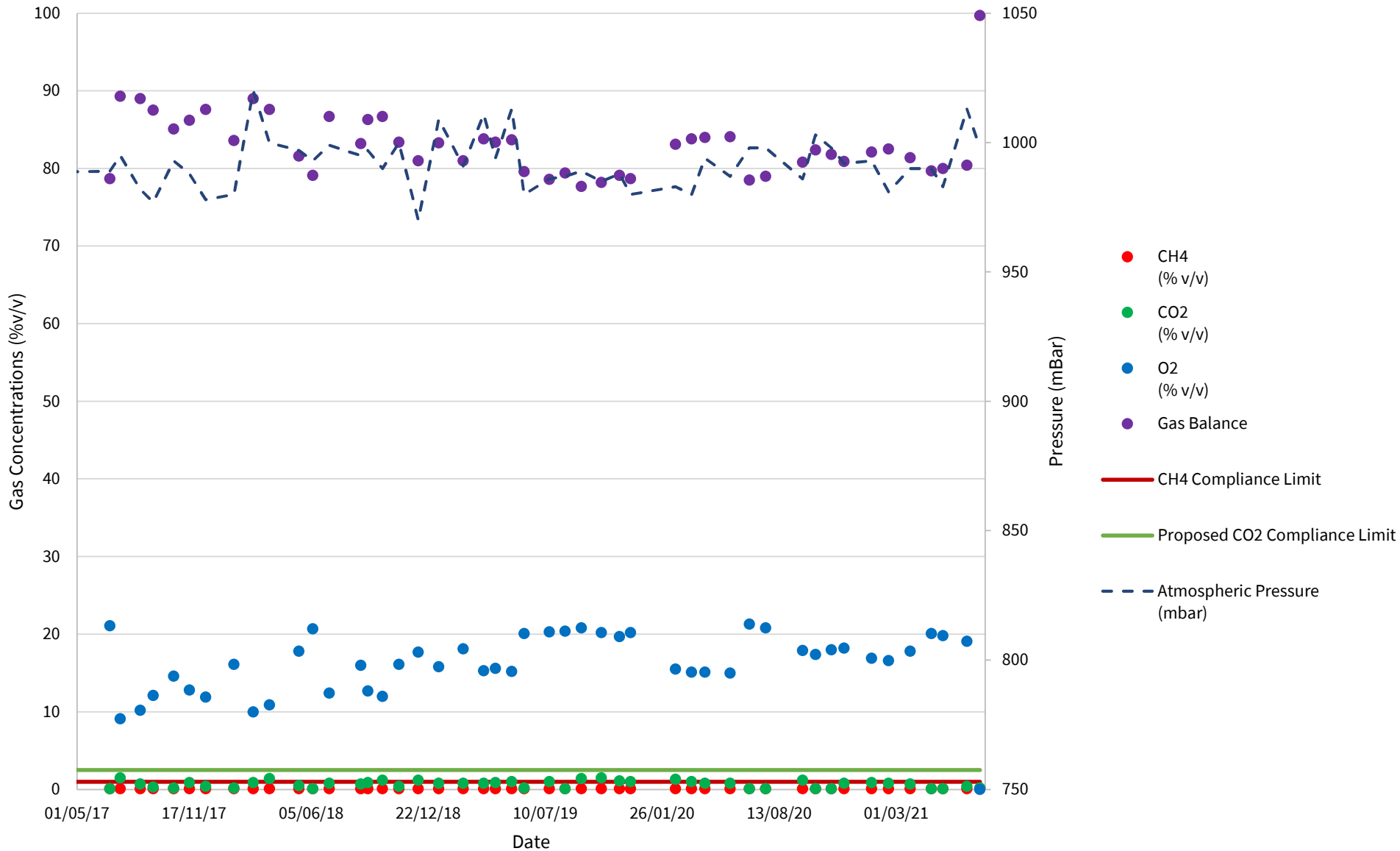
Site
**Fletcher Bank
Landfill Site**

Title
**Environmental Monitoring
Plan**

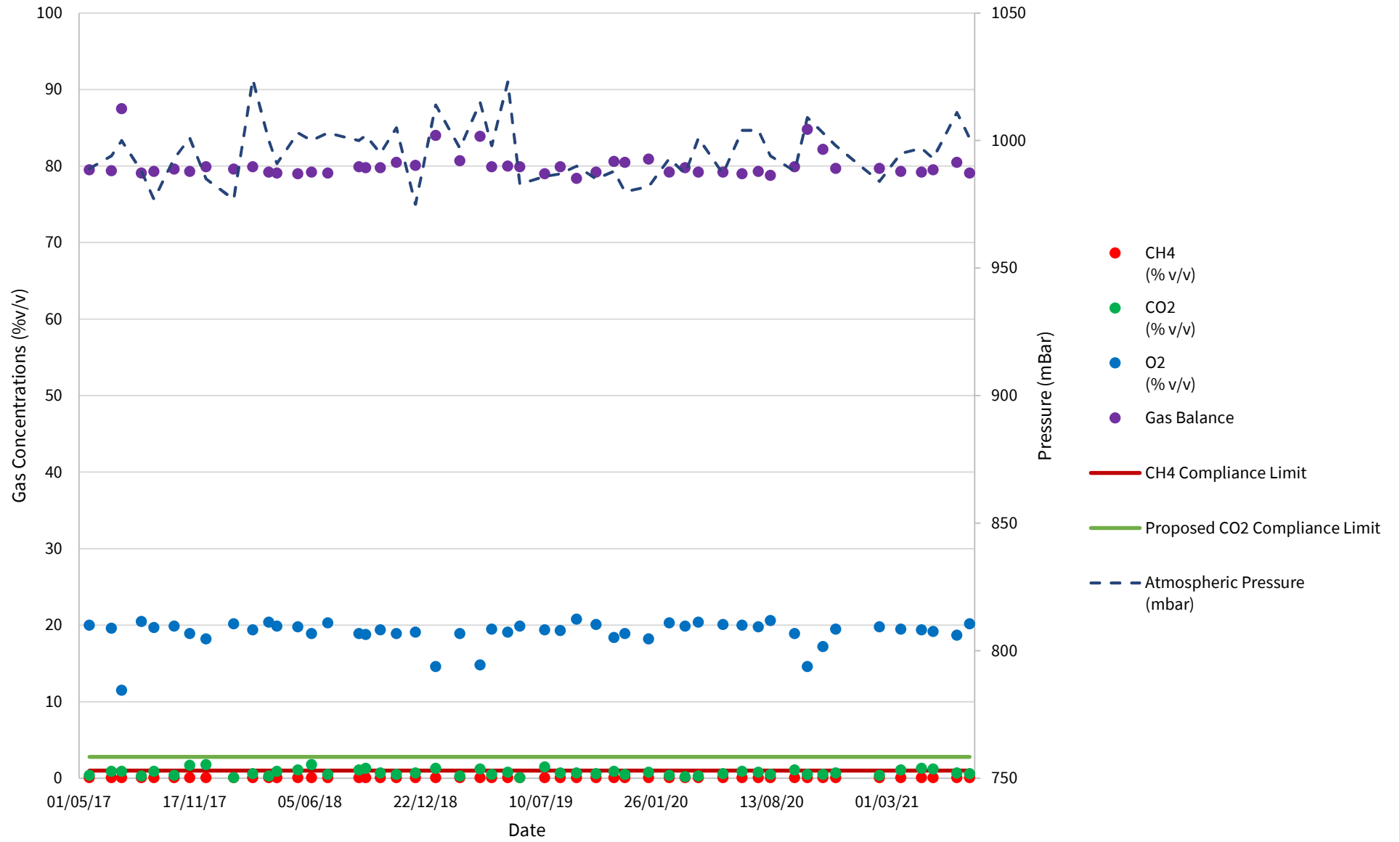
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Drawing No.	1772/3/013	
Rev	Date	Description
A	25/04/16	Added Leachate points
B	23/08/16	Added Eastern BH Mon location
C	24/08/16	Added Western BH Mon location
D	30/09/16	Groundwater Monitoring Points Added
File	17723013envmonplan Rev D.dwg	
Date	09/16	Engineer RB
Drawn	PG	Checked RB

Appendix B – Landfill Gas Data

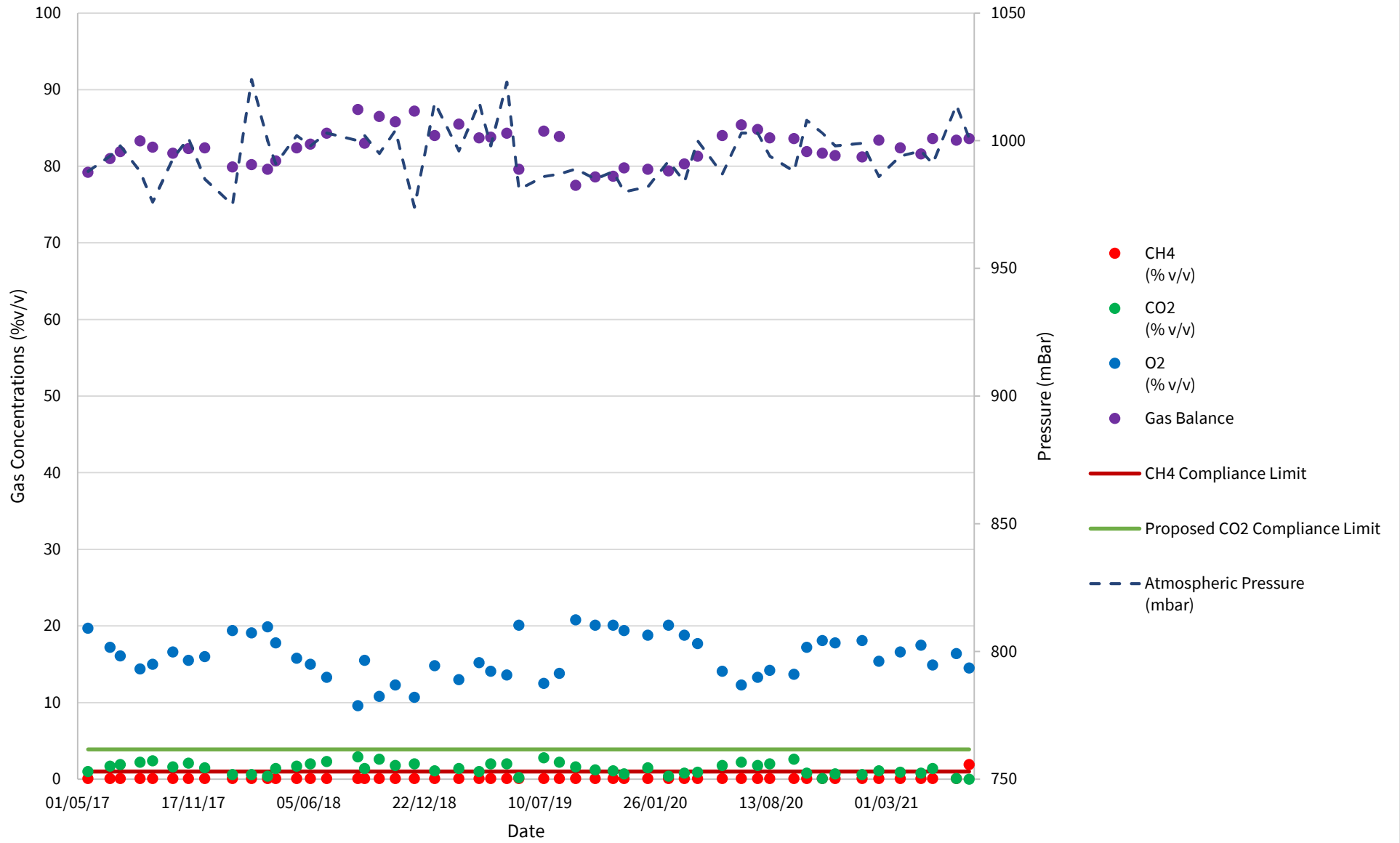
FB104R Gas Concentrations



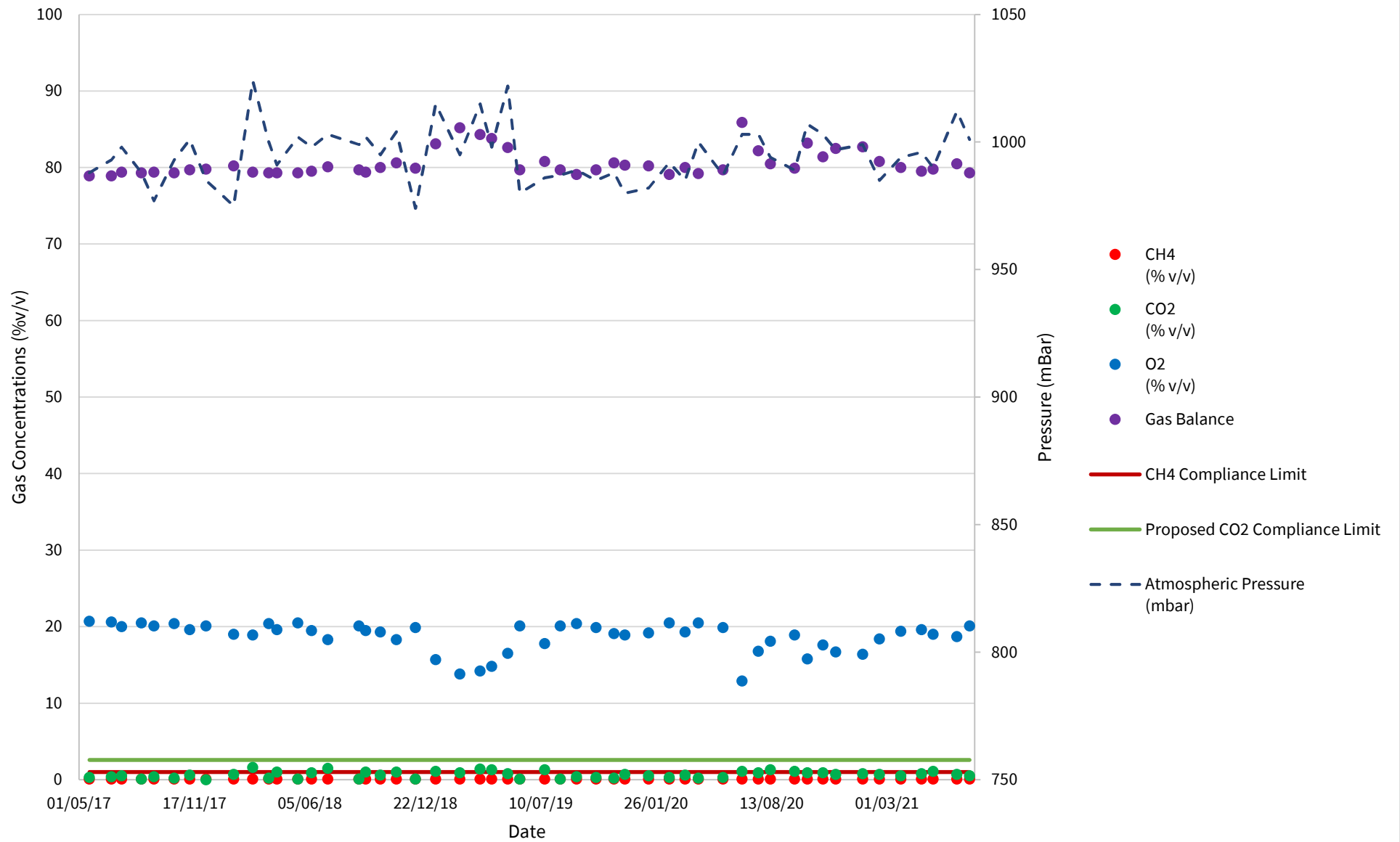
FBE 11-01 Gas Concentrations



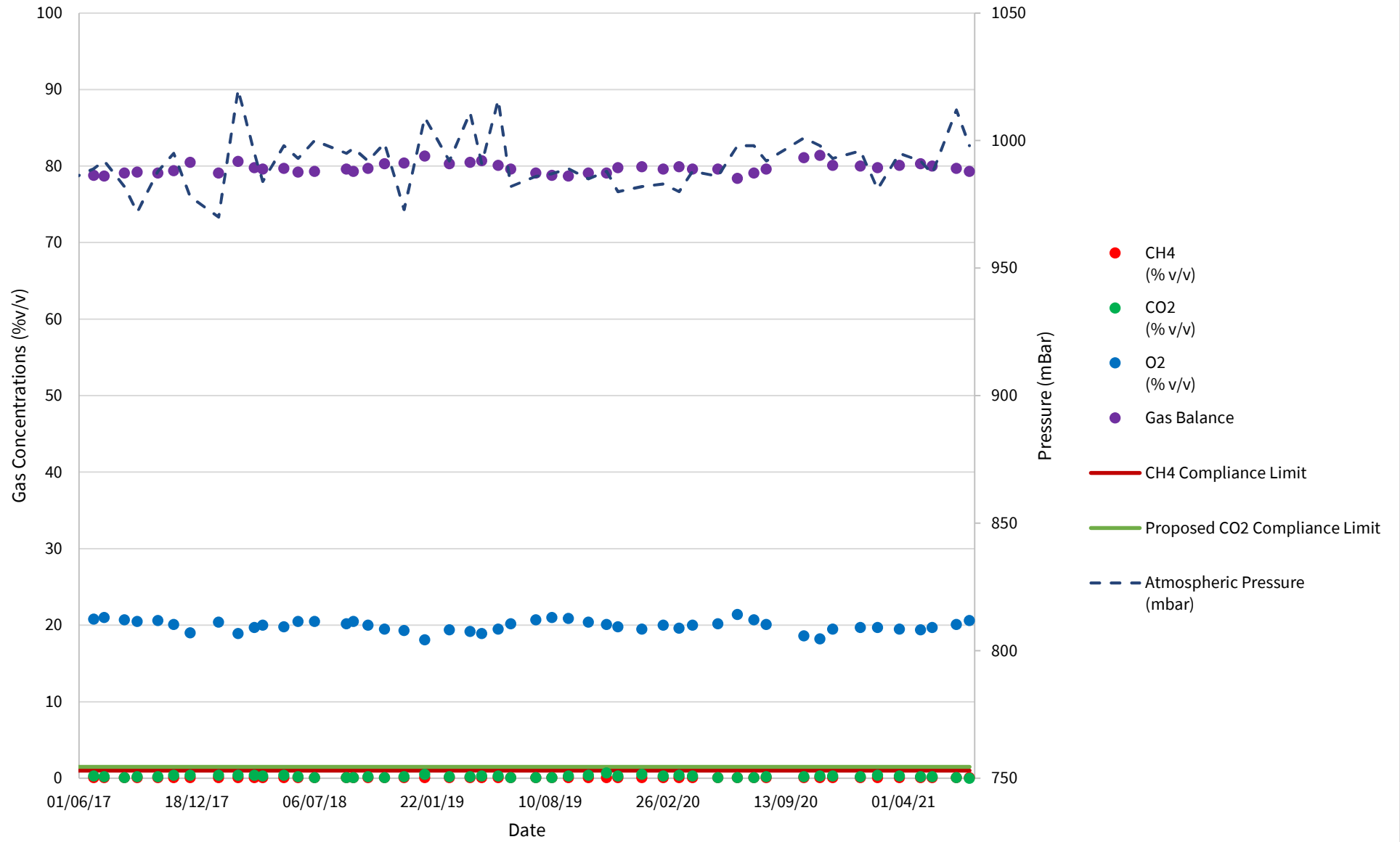
FBE 11-02 Gas Concentrations



FBE 11-02AGas Concentrations



SLR2 Gas Concentrations





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