

AJS/C5313/12125

07 June 2023

Domis Construction Ltd
Unit 2 Block C
14 Hulme Street
Salford
M5 4ZG

For the Attention of Mr Geoff Danby

Dear Geoff

Re: BRWRY Site, New Bridge Street, Manchester – Addendum Ground Gas Risk Assessment

Introduction

This addendum risk assessment has been carried out to supplement and supersede that within the existing Phase II Geo-Environmental Assessment produced for the above site (ref. JEM/C5313/12029) dated April 2023.

Background

The site is located off Dutton Street, Manchester, M3 1LD. It is located within Manchester City Centre, approximately 200m northwest of Manchester Victoria Railway Station, centred on National Grid Reference 383870, 399260.

The site is currently predominantly comprised of disused car parks covered in hardstanding spread over three levels separated by retaining wall structures of varying construction and condition. The site previously housed the Boddington Brewery and as a result there are concrete slabs associated with basements and the previous uses at the site.

We understand outline permission has been granted for the erection of two buildings (a part 17, part 12 storey building and a part 26, part 23 storey building) to form 556 residential units (Use Class C3a) together with the creation of 3490 sqm of commercial floor space (Use Classes A1, A2, A3, B1 and D1) with associated landscaping, access and other associated works, as shown on drawing refs. A2943 200 and BRW-REN-ZZ-00-DR-S-01100-P01 provided to BSL, which are appended for reference.

To date the following reports are available for the site, which should be read in conjunction with this assessment (in date order):

-
- Wardell Armstrong - Phase 1 Contaminated Land Assessment (ref. LO10517 R006.01) issued in January 2018.
 - 1st Line Defence Limited Express Preliminary UXO Risk Assessment (ref. EP7634-00) issued in November 2018.
 - Geotechnical & Environmental Associates (GEA) – Desk Study and Ground Investigation Report (ref. J18242) issued in June 2019.
 - EOD Contracts Ltd Explosive Ordnance Desk Top Study (ref. EOD/23/23040/DTS) issued in February 2023.
 - Brownfield Solutions Ltd (BSL) Site Investigation Proposal (ref. NHA/C5313/11937) issued in March 2023.
 - BSL, Phase II Geo-Environmental Assessment (ref. JEM/C5313/12029) issued in April 2023.
 - BSL, Piling Risk Assessment (ref. JEM/C5313/12036) issued in April 2023.
-

Following the initial assessment of data within the above referenced Phase II report, BSL approached the Environmental Health Department at Manchester City County (MCC) to ascertain whether further, more detailed assessment of the gas risk would be acceptable in order to de-risk the site. A response was received via email from Graeme Souter on May 26th 2023, with an extract below:

“With regard to the declassification of the gas risk from CS2 to CS1, thanks for your thorough justification and reasoning and we can accept the proposals.

Please can you submit this as an addendum ground gas risk assessment to the planning team and also include diagrammatic versions of the CSM too to support the justification”.

The objective of this document is to carry out the above requested assessment and formally document the rationale behind a reduction from Characteristic Situation 2 (CS2) classification for the site, down to CS1, where no specific ground gas mitigation measures would be required.

Updated Risk Assessment

This addendum risk assessment has been carried out in general accordance with the below listed guidance:

-
- CIRIA C665 ‘Assessing Risks Posed by Hazardous Ground Gases to Buildings’. 2007.
 - CL:AIRE RB13 ‘The Utility of Continuous Monitoring in Detection and Prediction of “Worst Case” Ground-Gas Concentrations’. 2011.
 - CL:AIRE RB17 ‘A Pragmatic Approach to Ground Gas Risk Assessment’. 2012.
 - Wilson et al (Ambience and EPG Ltd) ‘Using ternary plots for interpretation of ground gas monitoring results’. 2018.
 - CL:AIRE Technical Bulletin TB17 ‘Ground Gas Monitoring and ‘Worst-Case’ Conditions’. 2018.
 - CL:AIRE Technical Bulletin TB18 ‘Continuous Ground-Gas Monitoring and the Lines of Evidence Approach to Risk Assessment’. 2019.
 - BS 8485+A1: ‘Code of practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings’. 2019.
 - NHBC. ‘Hazardous Ground Gas - An essential guide for housebuilders’. May 2023.
-

Ground Gas Sources, Pathways and Receptors

The main sources of gas on site are considered to be the made ground, former infilled reservoirs (<150 years old), and minor organic matter within the superficial deposits, all with very low gassing potential as per BS8576:2013.

Potential pathways are considered to include diffusive gas migration through granular superficial deposits in the unsaturated zone to below floor slabs. Vectors also include service ducts/trenches within/below the proposed structures. If there was a viable pathway from a viable source, then in theory there could be migration of gases into confined spaces through service penetrations and any cracks in the floor slabs, with inhalation and/or asphyxiation/ explosion depending on the composition of the gases. Whilst a piled foundation solution is proposed for the site, the Piling Risk Assessment carried out has not determined this to be a significant vector for gas migration (ref: JEM/C5313/12036 Piling Risk Assessment April 2023).

Receptors include human site end users (mix of commercial and residential uses), alongside the structures/properties themselves.

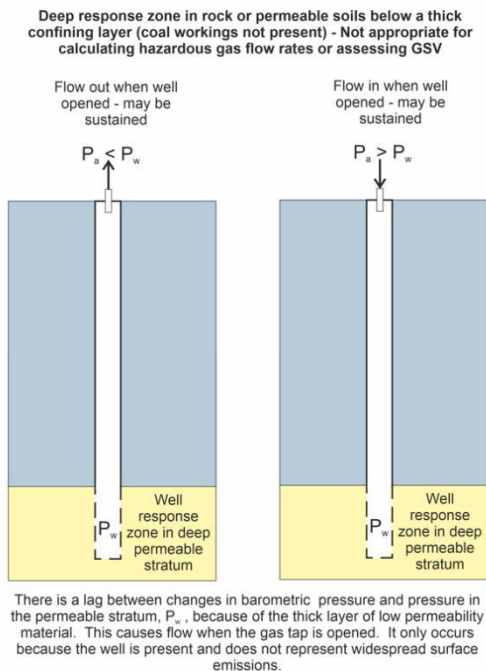
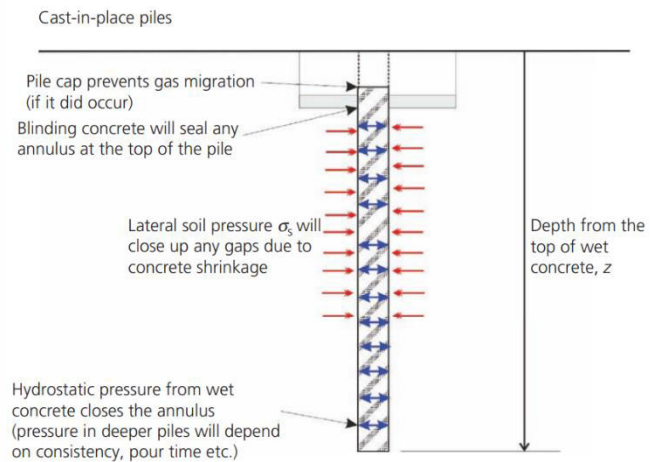
Monitoring Dataset for Assessment

Ground gas and groundwater monitoring standpipes were installed in seven boreholes as part of the Phase II Assessment (ref: JEM/C5313/12029). In addition, one of the GEA boreholes that had been drilled and installed previously and had exhibited locally elevated methane concentrations was accessed. The response zones installed for monitoring include a range of strata to refine the CSM, including the identified sources such as the made ground and in the vicinity of the organic strata and infilled reservoir. It is therefore considered that the monitoring data collected from the installed response zones provides a robust representation of the ground conditions on site.

The monitoring dataset included within the Phase II Assessment far exceeds the minimum suggested requirements within the guidance and is considered to be appropriate for risk assessment purposes in this instance, comprising a total of 11 No. spot monitoring visits and continuous monitoring data from 3 No. devices over just under 3 weeks (C655 suggests 6 spot monitoring visits over 2 months for such a site).

The site is primarily characterised by carbon dioxide well below 5.0% v/v. Methane has been recorded in 2 No. boreholes (out of 9 No. installations) between 0.1% and 3.7% within the continuous monitoring data and between 0.1% and 7.4% during spot monitoring. Flow rates are generally low, with steady rates generally at 0.1 l/hr in near surface installations. Higher flows have been recorded in deep installations, but these are believed to be either due to a groundwater rise giving a piston effect and generating artificial flows or due to barometric pumping as demonstrated graphically overleaf (Fig.1).

Neither of these effects would be replicated during construction, with piles not considered to be providing a pathway based on a piling risk assessment carried out as referenced further above (see also, ICE publishing paper 'Piled foundations and pathways for ground gas migration in the UK' by Wilson and Mortimer. 2017) and as displayed on the diagram overleaf (Fig 2.)

Fig 1. Deep Response Zones

Fig 2. Installation of Piles


Whilst the initial assessment within the BSL Phase II used a conservative higher flow rate due to time constraints with issuing the report, this provided GSVs that pushed the site into Characteristic Situation 2 (CS2), this is considered to be overly conservative based on the above rationale; a flow rate of 0.1 l/hr is much more representative and typical of the conditions encountered, therefore we have revised the derivation of GSVs adopting a flow of 0.1 l/hr. Adopting the highest recorded carbon dioxide and methane concentrations, this provides the worst credible GSVs that are below <0.07 l/h and equate to CS1 conditions.

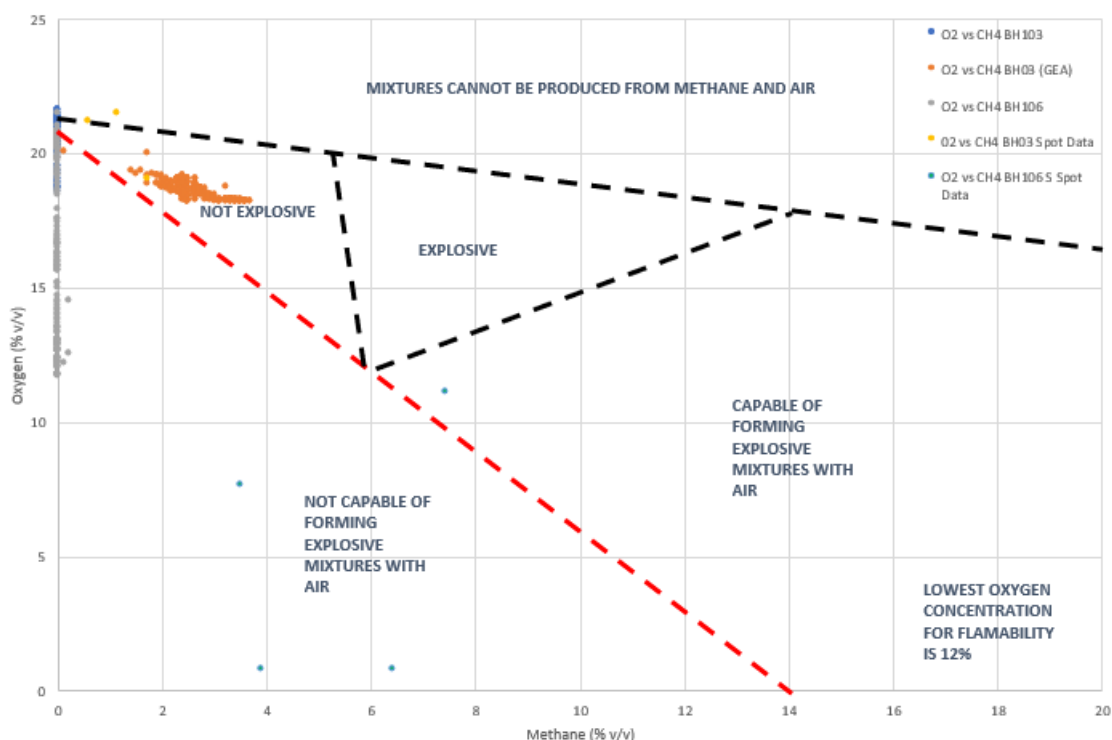
Where methane concentrations above 1% have been recorded, the guidance states that consideration should be given to increasing the classification based on the CSM; there is no mandatory requirement to do so within the guidance, but the rationale for doing so must be robust and defensible.

In regard to the methane detected, the source of the methane in GEA BH03 is considered to be the result of a poor-quality install allowing gases from the above natural superficial strata containing degradable natural organic matter to enter the well. The source of the methane ground gas in BSL BH106 is likely to be the made ground, which is less than 2.2m thick, with no significant putrescible material and underlain by a thick layer of firm to stiff clay. The made ground itself is cohesive in nature, with minimal pore spaces for ground gas build up or storage; i.e. it is highly unlikely that this material could generate enough ground gas to become hazardous or travel rapidly via advective flow, let alone provide a storage reservoir for gas build up and migration or cause a potentially explosive event.

Based on the existing assessment, there is considered to be no significant driver of gas flows from the likely source (organic matter in natural deposits or the made ground/infilled ground – both very low generation potential sources). This is as per suggested within the Ground Gas Handbook (Card, Haines, Wilson) where it states there is typically no main driver for such low generation potential sites.

To further assess the risk from methane and provide further lines of evidence of a minimal risk, we have plotted all methane concentrations from the continuous monitoring data and concentrations above 1% from the spot monitoring data against oxygen concentrations to determine if these mixtures

would actually pose a potential explosion risk. This approach has been previously suggested by Steve Wilson, is now included with the NHBC 'Hazardous Ground Gas - An essential guide for housebuilders' 2023 guide and we have further researched the approach using peer reviewed research papers e.g. "Modified explosive diagram for determining gas-mixture explosibility (Cheng)" <https://www.sciencedirect.com/science/article/abs/pii/S0950423013000338>. The plotted data is presented below:



The graph shows methane concentrations and mixtures are not explosive at BH03, even at methane concentrations up to around 4%, it is not likely to form an explosive mixture in the space above, showing minimal risk. This supports that the site would not require increasing up to CS2 from CS1. Only a single data point out of well over 1300 points shows a potential to form an explosive mixture, which is for BH106 (S). However, we would draw attention back to the CSM, where there is only 2.2m of cohesive made ground with minimal void spacings for gas storage/accumulation and no obvious degradable matter. In addition, these materials will be turned over during enabling works and alteration to proposed site levels, with further compaction to an earthwork's specification and likely reduction of void spacings even further to reduce settlement from a geotechnical perspective; thus further minimising gas storage/potential for migration. A watching brief would remain in place for any significant degradable matter, which would likely be geotechnically unsuitable for inclusion in permanent works and would likely be removed from site.

As a yet further line of evidence and to add to the post construction CSM, the proposed floor slabs will in effect comprise heavily reinforced monolithic cast in situ structures circa 250-350mm thick which will provide an inherent resistance to ground gas migration and due to building regulations, the structures will require a good degree of air-tightness to assist with insulation etc. A drawing is attached detailing construction, which would be heavily reinforced to mitigate against cracking. The structure will also likely include active air ventilation/climate control systems which would further mitigate the minimal risk (exact slab build ups and construction details can be confirmed once more detailed proposals are available). We would also recommend that any service penetrations through the slab

are suitable sealed with expanding foam to further mitigate against any significant ingress and further lower the already assessed low level of risk.

BSL would add that we are not aware of any documented issues at the site or nearby sites in the past in relation to ground gas, unless the LPA are aware of any issues.

All of the above is represented graphically on BSL drawing ref C5313/07 'Ground Gas Conceptual Site Model' which is appended.

Conclusions and Recommendations

On the basis of the monitoring undertaken, the assessment and guidance, the site is classified as CS1 and no specific ground gas protection measures are required.

Boreholes installed with standpipes should be correctly decommissioned in line with EA guidance prior to construction at the site.

Photographic evidence should be provided to show the presence of expanding foam in service entries and internal ventilation measures/air conditioning to provide additional lines of evidence for the above assigned level of risk at the site.

Recommendations made within this assessment should be confirmed with the Local Authority prior to any irrevocable action.

We trust the above meets your requirements. If you have any queries, then please do not hesitate to contact the undersigned.

Yours sincerely

For Brownfield Solutions Ltd

Produced by:



A J Stokoe
BSc (Hons) CSci MEnvSc FGS
Associate
a.stokoe@brownfieldsolutions.co.uk

Checked and approved by:



N Swallow
BSc (Hons) MSc MEnvSc
Senior Project Engineer
n.swallow@brownfield-solutions.co.uk

Enc C5313/01 Site Location Plan
C5313/07 'Ground Gas Conceptual Site Model'
Construction Detail Drawings



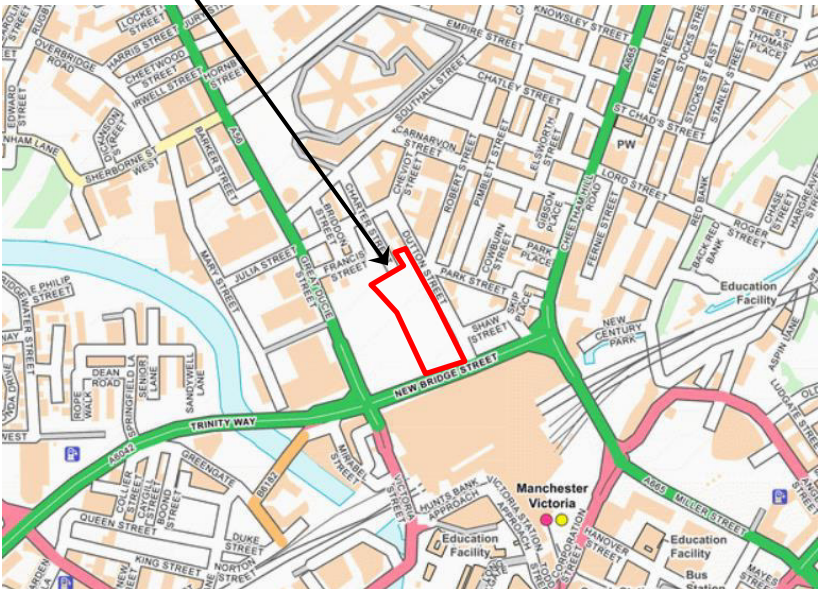
DRAWINGS



SITE LOCATION

NEAREST POSTCODE: M3 1LD

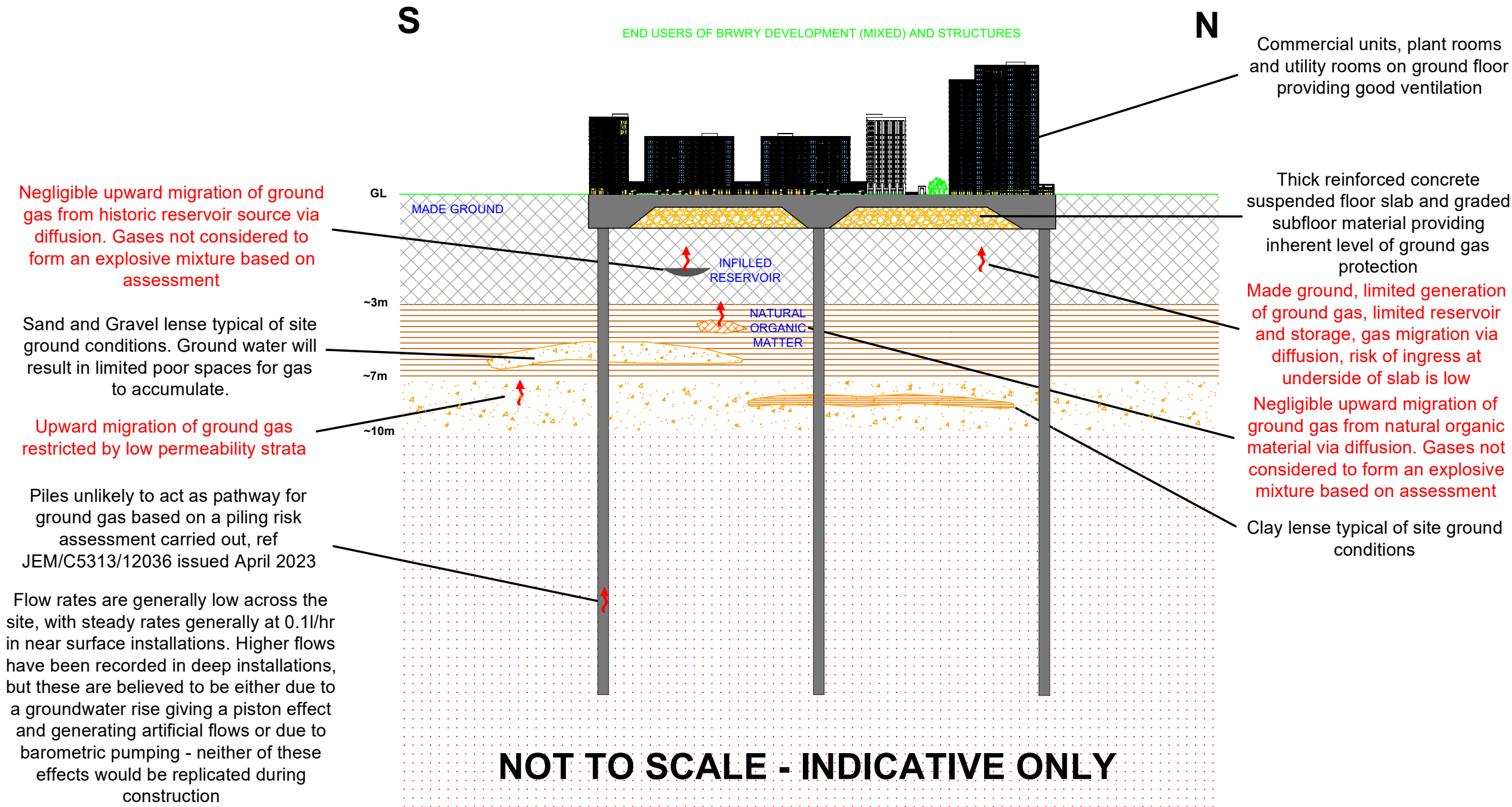
SITE ENTRANCE WHAT3WORDS:
///TITLE.MILE.SPAN



REV	DATE	DESCRIPTION	BY	CKD
 BROWNFIELD SOLUTIONS LTD CEO ENVIRONMENTAL ENGINEERING EXCELLENCE				
CLIENT DOMIS CONSTRUCTION LTD				
PROJECT TITLE BRWRY SITE, NEW BRIDGE STREET, MANCHESTER				
DRAWING TITLE SITE LOCATION PLAN				
DRAWING No. C5313/01	REVISION -	SCALE NTS	DATE 22/03/23	
DRAWN BY SD		CHECKED BY NS		



INDICATIVE CROSS-SECTION TO PROVIDE GENERALISED VIEW OF GROUND CONDITIONS FOR AREAS WHERE ELEVATED METHANE WAS ENCOUNTERED



KEY

- MADE GROUND
- SUPERFICIAL CLAY
- SUPERFICIAL SAND AND GRAVEL
- BEDROCK SANDSTONE

Source

Pathway

Receptor

NOTES

- ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS REPORTS. THIS DRAWING IS COPYRIGHT OF BSL.
- DRAWING NOT FOR CONSTRUCTION PURPOSES.

REV	DATE	DESCRIPTION	BY	CKD



CLIENT
DOMIS CONSTRUCTION LTD

PROJECT TITLE
BRWRY, MANCHESTER

DRAWING TITLE
GROUND GAS
CONCEPTUAL SITE MODEL

DRAWING No.	REVISION	SCALE	DATE
C5313/07	-	NTS	07/06/23
DRAWN BY JM		CHECKED BY AJS	