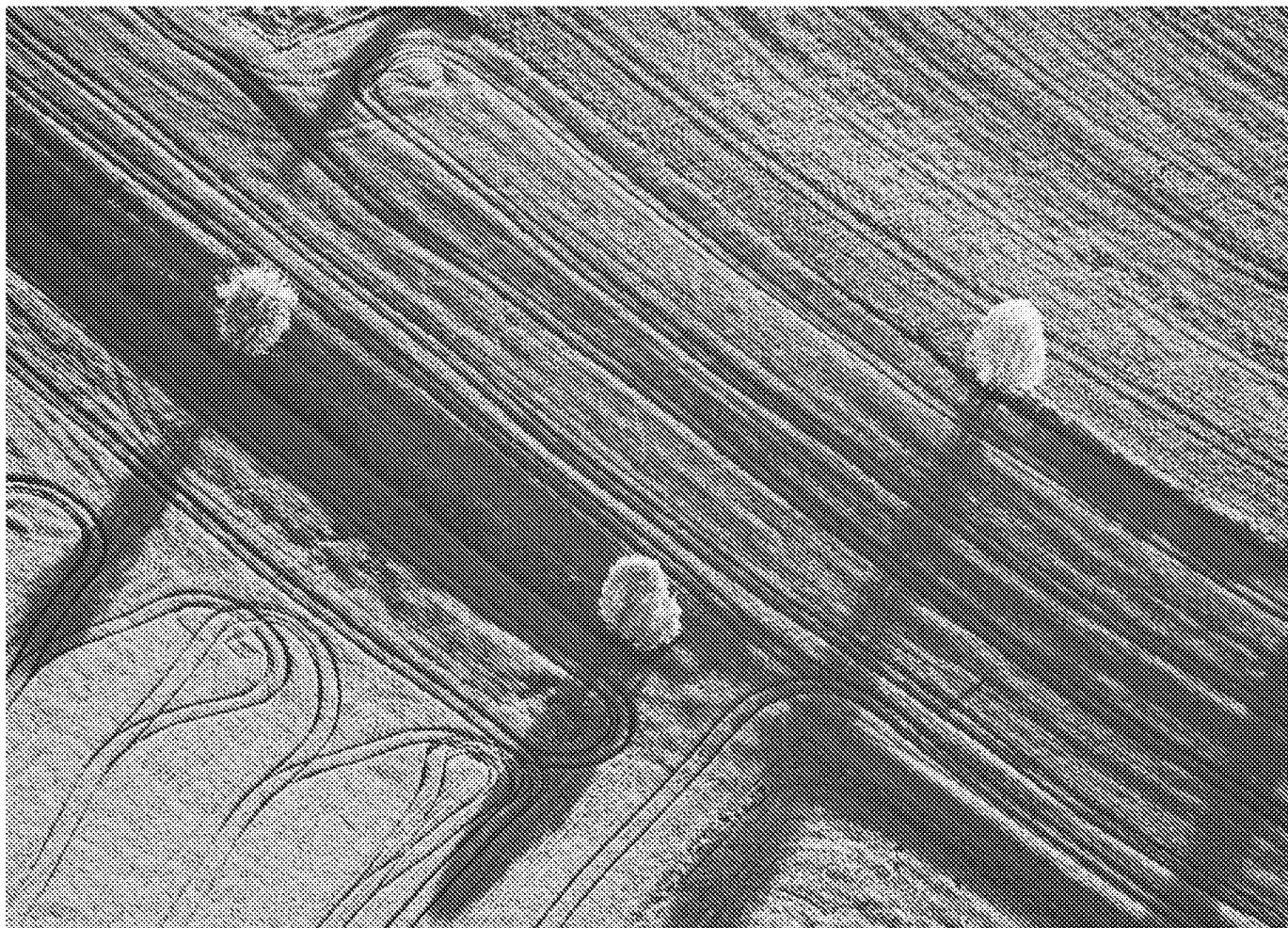




BDW Southern Counties

Water Lane, Angmering

Supplementary Environmental Assessment

305145 R01 (00)

DECEMBER 2020





RSK GENERAL NOTES

Project No.: 305145 R01 (00)

Title: Supplementary Environmental Assessment: Water Lane, Angmering, West Sussex

Client: BDW Southern Counties

Date: December 2020

Office: RSK Environment Limited, Unit 26, Basepoint Abbey Enterprise Centre, Premier Way, Romsey, SO51 9AQ

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

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EXECUTIVE SUMMARY

Commissioning and purpose of assessment	RSK Environment Limited (RSK) was commissioned by BDW Southern Counties to carry out a Supplementary Environmental Assessment at Water Lane, Angmering, West Sussex, BN16 4AW.
DESK-BASED ASSESSMENT (DATA REVIEW)	
Site description and proposed development	The site currently comprises agricultural fields and occupies an area of 9 hectares and is being considered for residential development.
Previous site investigation (SI) reports	The following reports detail previous works on the site: - Idom Merebrook Ltd. (May 2017). Geo-Environmental Assessment, report ref: GEA-19495-16-306REVB; - Idom Merebrook Ltd. (December 2018) Supplementary site investigation (SI), report ref: L-19495-2.4.2-18-S432-DCE Rev.A; - Idom Merebrook Ltd. (May 2017) Water level monitoring – November 2016 to March 2017 report ref: L-19459-2.4.2-17-S256-SMJ; - Idom Merebrook Ltd. (December 2018) Soakage Tests, report ref: L-19495-2.4.2-18-S698-RMH; - Idom Merebrook Ltd. (August 2018) Supplementary ground gas assessment, report ref: L-19495-2.4.2-18-S455-LMH; and, - RSK. (March 2020) Soakaway Testing, report ref: 305145 L01 (00).
History of site and surrounding area	The site has remained as undeveloped agricultural land. Historical development of the surrounding area indicated gravel pits 75 m west and 100 m north west and plant nurseries adjacent to the west and south of the site from 1897 – 1970.
Geology and environmental setting	The geological records of the site indicated it is underlain by Superficial Alluvium deposits, in the northernmost tip, Head Deposits across the north of the site and River Terrace Deposits to the south of the site. The bedrock geology is London Clay Formation within the north and the Lambeth Group within the south. Idom Merebrook reported that the site is located within a radon affected area as between 5% and 10% of the houses are above the action level and as such basic radon protection measures are required. Previous intrusive works at the site have encountered topsoil or made ground, underlain by River Terrace Deposits and locally by superficial head deposits, followed by the Lambeth Group. Made ground has been recorded in 7 locations only (MTP118, MTP120, MTP121, MTP123, MTP124, MSA103, MSA104). The thickness of made ground in MTP120 was not proven, with this location terminated at 2.9 m below ground level (bgl). It is noted that anthropogenic materials noted on the borehole log for MTP120 comprised brick and concrete. The made ground observations in the other locations were restricted to fragments of brick identified within the topsoil layer. The superficial Head and River Terrace Deposits are designated as Secondary Undifferentiated and Secondary A Aquifers respectively. The London Clay Formation is designated as Unproductive Strata and the Lambeth Group is designated as a Secondary A Aquifer. The site is not located within a groundwater source protection zone and there are no active groundwater abstractions within a 1 km radius of the site. The nearest surface water feature to the site is a partially culverted watercourse which flows alongside Water Lane on the northern section of the site.

Revised initial conceptual site model (CSM) and preliminary risk assessment (PRA)	Potentially complete contaminant linkages identified with a risk estimate of moderate to low or above include: • ground gases emanating from the made ground onsite – via migration and ingress of ground gases into future buildings and existing off-site buildings, build-up in confined spaces and explosion/ asphyxiation; and • ground gases emanating from the infilled gravel pits off-site – via migration and ingress of ground gases into future buildings, build-up in confined spaces and explosion/ asphyxiation.
INTRUSIVE INVESTIGATION & ASSESSMENT	
SI scope	The objective of the work is: • to supplement existing data in order to identify any land contamination to the proposed development and to support discharge of relevant planning conditions; and • to identify the need for any additional investigation or remediation works to demonstrate that the site is suitable for its proposed use. 7no. window sample boreholes were drilled to a depth of 3.00 m bgl and installed with gas and groundwater monitoring wells. Three gas monitoring visits have been undertaken over a period of 6 weeks in November and December 2020.
SI factual findings	The intrusive investigation encountered topsoil overlying Head Deposits within all locations. River Terrace Deposits were encountered within four locations (WS1, WS4, WS6 and WS7) beneath the Head Deposits at depths of circa 1.10 m to 2.1 m bgl. The Lambeth Group was encountered within a single location (WS3) located in the north east of the site. No groundwater was encountered during the intrusive investigation. However, groundwater was encountered during the subsequent gas monitoring visits at depths ranging between 0.57 m and 10.07 m bgl.
Refined conceptual site model and geo-environmental assessment	The site investigation and subsequent gas monitoring programme has been designed to provide additional evidence to justify downgrading the site from a characteristic situation 2 (CS2)/Amber 2 ground gas classification to a CS1/Green classification. Based on the data obtained from the three monitoring visits, the RSK results agree with the three gas monitoring visits undertaken within 2018 by Idom Merebrook and hence provides further evidence to justify downgrading the ground gas classification for the site from CS2/Amber 1 to CS1/Green. As such it is recommended that the site is downgraded from a CS2/ Amber to CS1/Green and no ground gas protection measures are required for future buildings. Please note, as confirmed within the radon report appended to this report, in accordance with at least part of the site being located within a radon affected area, with between 5% and 10% of the houses above the action level, basic radon protection measures need to be incorporated into the proposed development unless further information requested from British Geological Survey (BGS) and National House Building Council (NHBC) deems this not to be required.
<i>The information given in this summary is necessarily incomplete and is provided for initial briefing purposes only. The summary must not be used as a substitute for the full text of the report.</i>	

1 INTRODUCTION

1.1 Commissioning

RSK Environment Limited (RSK) was commissioned by BDW Southern Counties to carry out a Supplementary Environmental Assessment of land at Water Lane, Angmering, West Sussex, BN16 4AW. The project was carried out to an agreed brief as set out in RSK's proposal (Ref. 305145 T02 (02), dated 16th October 2020).

RSK's service constraints are shown in **Appendix A**.

The site in question is being considered for development for residential use. The planned layout of the site is shown in **Appendix B**.

1.2 Objectives

The objective of the work is:

- to supplement existing data in order to identify any land contamination to the proposed development and to support discharge of relevant planning conditions; and
- to identify the need for any additional investigation or remediation works to demonstrate that the site is suitable for its proposed use.

1.3 Scope of works

The scope of this assessment has been developed in accordance with relevant British Standards and authoritative technical guidance as referenced through the report. The assessment of the contamination status of the site is in line with the technical approach presented in Land Contamination Risk Management (LCRM) (Environment Agency, 2020) – which supersedes CLR11 Model Procedures for Land Contamination – and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017). It is also compliant with relevant planning policy and guidance.

The scope of the intrusive investigation has been designed in line with the recommendations of BS5930:2015+A1:2020 Code of practice for ground investigations (BSI, 2020), which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. It has also been developed in general accordance with BS 10175: 2011 + A2 2017. Ground gas assessment has been undertaken in general accordance with BS8576: 2013 and BS 8485:2015+A1:2019.

A brief summary of relevant legislation and policy relating to land contamination is given in **Appendix C**.

The scope of works for the assessment has included the following:

- a review of previous site investigation reports made available;
- development of an initial conceptual site model (ICSM);

Intrusive Investigation

- design and implementation of an intrusive investigation, soil sampling, laboratory geo-environmental and ground gas monitoring of installed boreholes;
- interpretation of data to develop a refined conceptual site model (CSM);
- generic quantitative risk assessment (GQRA) of relevant contaminant linkages; and
- preparation of this interpretative report.

1.4 Existing reports

The following reports detailing previous works at the site were made available for review:

- Idom Merebrook Ltd. (May 2017). Geo-Environmental Assessment, report ref: GEA-19495-16-306REVB;
- Idom Merebrook Ltd. (December 2018) Supplementary site investigation (SI), report ref: L-19495-2.4.2-18-S432-DCE Rev.A;
- Idom Merebrook Ltd. (May 2017) Water level monitoring – November 2016 to March 2017 report ref: L-19459-2.4.2-17-S256-SMJ;
- Idom Merebrook Ltd. (December 2018) Soakage Tests, report ref: L-19495-2.4.2-18-S698-RMH;
- Idom Merebrook Ltd. (August 2018) Supplementary ground gas assessment, report ref: L-19495-2.4.2-18-S455-LMH; and,
- RSK. (March 2020) Soakaway Testing, report ref: 305145 L01 (00).

Pertinent information from these reports has been summarised in Section 3.

1.5 Limitations

This report is subject to the RSK service constraints given in **Appendix A** and limitations that may be described through this document.

2 SITE DETAILS

2.1 Site location

Site location details are presented in **Table 1** and a site location plan is provided as Figure 1.

Table 1 Site location details

Site name	Water Lane, Angmering
Full site address and postcode	Land at Water Lane, Angmering, West Sussex, BN16 4AW

2.2 Site description

The site boundary and current site layout are shown on Figure 2. The site covers an area of circa 9 hectares and currently comprises of two agricultural fields with the field to the west accessed via Weavers Hill and the other field accessed via High Street to the south.

2.3 Surrounding land uses

The site is located in Angmering, within a predominantly residential setting. Immediate surrounding land uses are described in **Table 2**.

Table 2 Surrounding land uses

North	Water Lane and agricultural fields
East	A280 and agricultural fields beyond
South	High Street with residential properties and The Spotted Cow (public house)
West	Weavers Hill with residential properties beyond

2.4 Development plans

Residential development comprising residential housing with private gardens, areas of communal soft landscaping and associated infrastructure. The proposed layout of the site, at the time of preparing this report, is shown in **Appendix B**.

3 PREVIOUS REPORTS

3.1 Summary of previous investigations

A summary of pertinent information from previous investigations is included below:

Table 3 Summary of previous investigation reports

Report Details	1. Idom Merebrook Ltd. (May 2017). Geo-Environmental Assessment, report ref: GEA-19495-16-306REVB
Site coverage	Eastern field off A280 only
Summary scope of works	Preliminary risk assessment, 4 No. window sample boreholes (MWS116 – MWS119) to 3.00 m below ground level (bgl), 7 No. trial pits (MTP118 – MTP124) to a maximum depth of 3.10 m bgl and 2 No. soakaway tests (MSA103 and MSA104). A single gas and groundwater monitoring well was installed within location MWS118 to a depth of 3.00 m bgl. A total of 9 soil samples were submitted for laboratory testing, 5 samples from the made ground and 4 samples from natural ground. A single groundwater sample was also collected from MWS118 for laboratory analysis.
Does the client have reliance upon the report?	Yes
Key factual findings	The site has remained as undeveloped agricultural land. Historical development of the surrounding area indicated gravel pits 75 m west and 100 m north west and plant nurseries adjacent to the west and south of the site from 1897 – 1970. The geological records of the site indicated it is underlain by Superficial Alluvium deposits, in the northernmost tip, Head Deposits across the north of the site and River Terrace Deposits to the south of the site. The bedrock geology is London Clay Formation within the north and the Lambeth Group within the south. The site is located within a radon affected area as between 5% and 10% of the houses are above the action level and as such basic radon protection measures are required. The superficial Head and River Terrace Deposits are designated as Secondary Undifferentiated and Secondary A Aquifers respectively. The London Clay Formation is designated as Unproductive Strata and the Lambeth Group is designated as a Secondary A Aquifer. The site is not located within a groundwater source protection zone and there are no active groundwater abstractions within a 1 km radius of the site. The nearest surface water feature to the site is a partially culverted watercourse which flows alongside Water Lane on the northers section of the site.

Key Factual findings continued	Made ground was encountered within 7 locations (MTP118, MTP120, MTP121, MTP123, MTP124, MSA103, MSA104). The thickness of made ground in MTP120 was not proven, with this location terminated at 2.9 m bgl. It is noted that anthropogenic materials noted on the log for MTP120 comprised brick and concrete. The made ground observations in the other locations were restricted to fragments of brick identified within the topsoil layer. All soil and groundwater samples recorded concentrations below generic assessment criteria (GAC) suitable for residential end use and protection of controlled waters respectively. No testing was undertaken for asbestos. 3 no. gas monitoring visits were undertaken within monitoring well MWS118. Steady flow rates were recorded at <0.1 l/hr, methane was not recorded above the instrument detection limit (<0.1 %) and carbon dioxide was recorded at a maximum level of 7.0 %. Basic radon protection was recommended for all properties.
Report Details	2. Idom Merebrook Ltd. (May 2017) Water level monitoring – November 2016 to March 2017, report ref: 2016 L-19459-2.4.2-17-S256-SMJ
Site coverage	Entire site
Summary scope of works	7 no. cable percussive boreholes to depths of 10.00 m bgl and to install groundwater monitoring wells. Groundwater level monitoring was undertaken on 4 occasions between November 2016 and March 2017.
Does the client have reliance upon the report?	Yes
Key factual findings	Groundwater found to be resting at depths between 2.83 m and below 10.00 m bgl.
Report Details	3. Idom Merebrook Ltd. (December 2018) Supplementary site investigation (SI), report ref: L-19495-2.4.2-18-S432-DCE Rev.A
Site coverage	Eastern field off A280 only
Summary scope of works	A supplementary site investigation was undertaken by Idom Merebrook Ltd in 2018, which comprised 12 No. windowless sample boreholes (MWS201 – MWS212) drilled to a maximum depth of 4.45 m bgl, 19 No. trial pits (MTP1 – MTP6, MTP201-MTP209 and CBR1 – CBR4). No additional soil samples were collected for environmental laboratory analysis. The supplementary site investigation was primarily undertaken for geotechnical purposes.
Does the client have reliance upon the report?	Yes
Key factual findings	No made ground and groundwater was noted during the investigation. Topsoil was encountered in the majority of locations to depths ranging between 0.15 m to 0.38 m bgl, underlain by River Terrace Deposits and locally by superficial head deposits, followed by the Lambeth Group.

Report Details	4. Idom Merebrook Ltd. (December 2018) Soakage Tests, report ref: L-19495-2.4.2-18-S698-RMH
Site coverage	South eastern corner of eastern field off A280
Summary scope of works	Supplementary soakage testing was also undertaken at the site in 2018 by Idom Merebrook Ltd in two locations (MSA1 and MSA2).
Does the client have reliance upon the report?	Yes
Key factual findings	Ground conditions were found to comprise up to 0.4 m of topsoil underlain by superficial deposits consisting of brown very sandy gravelly clay (0.9-1.0 m thick), with a layer of brown clayey sandy cobble gravel below (0.6 -0.7 m thick).
Report Details	5. Idom Merebrook Ltd. (August 2018) Supplementary ground gas assessment
Site coverage	Entire site
Summary scope of works	Three rounds of supplementary gas monitoring completed between July 2018 and August 2018.
Does the client have reliance upon the report?	Yes
Key factual findings	Idom Merebrook characterised the site as an Amber 1/ CS2. This conclusion was based largely on the 2015 monitoring completed in one monitoring well location only, whereby carbon dioxide in excess of 5 % was recorded. The monitoring of the wells in 2018 found levels of CO2 below 5 %.
Report Details	6. RSK. (March 2020) Soakaway Testing, report ref: 305145 L01 (00)
Site coverage	Entire site
Summary scope of works	16 No. soakaway tests (SA1 and SA19).
Does the client have reliance upon the report?	Yes
Key factual findings	Ground conditions encountered during the investigation comprised topsoil in all locations to a maximum depth of 0.2 m bgl overlying superficial deposits to a maximum depth of 2.3 m bgl. The superficial deposits varied in composition but generally comprised variable sand, gravel and silt. No groundwater was encountered during the investigation.

Based on the review of the Idom Merebrook Ltd reports to date, the following has been considered for the initial conceptual site model.

4 INITIAL CONCEPTUAL SITE MODEL

In the UK land contamination is assessed using a risk-based approach taking account of the magnitude (severity of the hazard) and likelihood (probability) of occurrence. A 'receptor' is something that could be adversely affected by contamination (e.g. people, an ecological system, property or a water body). A 'pathway' is a route or means by which a receptor is or could be exposed to or affected by a contaminant. A 'contaminant source' is a hazard but it can only pose a risk to a receptor where a pathway is present. The relationship between sources, pathways and receptors are referred to as a conceptual site model. A risk can only be released where a contaminant source, pathway and receptor are all in place, referred to as a 'pollutant linkage'.

In line with LCRM (Environment Agency, 2020) and BS 10175: 2011 + A2 2017 (BSI, 2017), RSK has used information in the preceding sections to identify hazards (sources of contaminants), receptors that may be impacted and plausible linking pathways. Where all three are present this is termed a potentially complete contaminant linkage and a qualitative risk estimation is made.

4.1 Potential soil, soil vapour and groundwater linkages

4.1.1 Potential sources of contamination

Potential sources of soil and groundwater contamination identified from current activities and the history of the site and surrounding area are presented in **Table 4**. Ground gas sources are addressed in the next section.

Table 4 Potential sources of soil and groundwater contamination

Potential sources	Contaminants of potential concern
On-site	
Made ground (i.e. fill material) (eastern field only)	Unknown fill material but potentially including brick, ash and clinker and containing toxic and phytotoxic metals, inorganics, polycyclic aromatic hydrocarbons (PAHs), asbestos
Off-site	
Plant Nursey (adjacent west)	Fuels (hydrocarbons), fertilisers and pesticides

The assessments undertaken by Idom Merebrook previously considered potential pollutant linkages associated with made ground encountered onsite and the adjacent nursery. At the preliminary risk assessment phase, the off-site plant nursey to the west was concluded to pose a low risk and as such further assessment was not deemed necessary. The onsite made ground however was assessed via laboratory analysis of five soil samples and one groundwater sample. The soil laboratory analysis results were below GAC relating to a residential end use with gardens with a soil organic matter (SOM) of 2.5% and the groundwater analysis results were below GAC protective of controlled waters.

RSK concur with the Idom Merebrook assessments in regard to potential contaminants in soil and groundwater relating to these potential sources. As such, further assessment of these sources in regard to contaminants in soil and groundwater is not considered necessary and therefore they have been omitted from the conceptual site model.

4.2 Potential ground gas linkages

4.2.1 Ground gas generation potential

Potential ground gas sources identified for the site and surrounding are shown in **Table 5**.

Table 5 Potential ground gas sources

Potential sources	Indicative ground gas generation potential (CIEH, 2008)	Additional information
On-site		
Made ground with low degradable organic content primarily in the vicinity of location MTP120 (e.g. up to 5% organic material and no easily degradable waste)	Very low	Made ground was encountered within the Idom Merebrook site investigation within MTP118, MTP120, MTP121, MTP123, MTP124, MSA103 and MSA104. All these exploratory locations are sited in the eastern part of the site. It is noted that the anthropogenic materials recorded on the borehole logs for these locations pertain to brick and concrete fragments only.
Off-site		
Infilled gravel pits	Very low	75 m west and 100 m north west

Given the anticipated ground conditions set out above, very low potential sources of ground gas generation have been identified associated with made ground and infilled gravel pits.

4.2.2 Preferential pathways for ground gas migration

Credible preferential pathways potentially connecting the source and receptor through vertical and lateral migration are:

- geology of the River Terrace Deposits which is likely to be permeable;
- building foundations, piled foundations and vibro-stone columns;
- construction joints and cracks within building structure; and

- future utility routes and service penetrations into buildings (existing services do not traverse the site as shown on the plans included in **Appendix D**).

4.2.3 Sensitive receptors and linking pathways

Sensitive receptors identified at or in the vicinity of the site that could be affected by the potential ground gas sources identified above comprise:

- future site users – residential users [migration and ingress of ground gases into buildings, build-up in confined spaces and explosion/ asphyxiation];
- current/ adjacent site users – residential users [migration and ingress of ground gases into buildings, build-up in confined spaces and explosion/ asphyxiation]; and
- future buildings and services [migration and ingress of ground gases into buildings, build-up in confined spaces and explosion].

The assessment has identified receptors to include building structures and current/ proposed end-users.

Construction workers have not been identified as receptors for the purposes of this assessment. Risks may still be present to construction workers especially where works include the entry into excavations within the ground. Construction workers should undertake appropriate risk assessments and risks should be managed through health and safety procedures and the use of PPE.

4.3 Preliminary risk assessment

The preliminary risk assessment findings and potentially complete contaminant linkages are shown in **Table 6** overleaf. The risk classification based on the combination of hazard consequence and probability using a risk matrix from CIRIA C552 (Rudland et al., 2001), a summary of which is included in **Appendix E**. This relates to Tier 1 preliminary risk assessment in LCRM (Environment Agency, 2020).

Table 6 Risk estimation for potentially complete contaminant linkages

Potential source	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
Made Ground	Onsite human health (future residents), future buildings/ services and off-site residents	Migration and ingress of ground gases into buildings, build-up in confined spaces and explosion/ asphyxiation	Low likelihood	Severe	Moderate	Made ground deposits have been encountered on the site, which are a potential source of ground gases. These materials in accordance with CIEH, 2008 are classed as very low ground gas generation potential materials. Based on this it would be considered unlikely that these materials shall pose a risk to future residents. However, existing gas monitoring results for the site have recorded carbon dioxide concentrations in excess of 5% in one location and as such further monitoring has been recommended to further characterise the ground gas regime at the site.
Off site						
Ground gases emanating from the infilled gravel pits (from 75m off-site)	Human health (future residents) and future buildings/services	Migration and ingress of ground gases into buildings, build-up in confined spaces and explosion/ asphyxiation	Unlikely	Severe	Moderate/low	The infilled gravel pits in accordance with CIEH, 2008 are classed with a very low ground gas generation potential. Therefore, it is considered unlikely that ground gases emanating from these features shall pose a risk to the identified receptors.



Risk matrix		Consequences			
		Severe	Medium	Minor	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very low	Very low

Potentially complete contaminant linkages with a potential risk of moderate to low or higher identified in **Table 6** comprise:

- ground gases emanating from the made ground onsite – via migration and ingress of ground gases into future buildings and existing off-site buildings, build-up in confined spaces and explosion/ asphyxiation; and
- ground gases emanating from the infilled gravel pits off-site– via migration and ingress of ground gases into future buildings, build-up in confined spaces and explosion/ asphyxiation.

These potentially complete contaminant linkages need to be assessed further through appropriate site investigation and gas monitoring to target the identified sources of potential contamination and assess the feasibility of identified pathways.

5 SITE INVESTIGATION STRATEGY & METHODOLOGY

5.1 Introduction

RSK carried out intrusive investigation works on the 2nd November 2020. Subsequent ground gas monitoring was undertaken between 5th November and 15th December 2020.

5.2 Objectives

The specific objectives of the investigation were as follows:

- to further establish ground conditions underlying the site;
- to investigate specific potential sources of contamination identified in initial CSM; and
- to determine the ground gas regime underlying the site.

5.3 Selection of investigation methods

The techniques adopted for the investigation were chosen with consideration of the objectives and site constraints, which are described below.

Window sampling drilling was chosen based on the targeted drill depth, the opportunity to collect contamination samples for laboratory testing and install monitoring wells.

Prior to conducting intrusive works, utility service plans were obtained, and buried service clearance undertaken in line with RSK's health and safety procedures. Copies of statutory service records obtained by RSK as part of the agreed scope of works are contained in Appendix D.

5.4 Investigation strategy

The ground investigation was carried out using intrusive ground investigation techniques in general accordance with the recommendations of BS5930:2015+A1:2020, which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. Whilst every attempt was made to record full details of the strata encountered in the boreholes, techniques of hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

Details of the investigation locations, installations and rationale are presented in **Table 7**. Window sample boreholes were drilled in 7 locations to a maximum depth of 3 m bgl and were all installed with combined gas and groundwater monitoring wells.

Table 7 Exploratory hole and monitoring well location rationale

Investigation Type	Number	Designation	Monitoring well installation	Rationale Examples below
Boreholes by windowless sampling methods	7	WS1 to WS7	Gas/ groundwater	To further determine the contamination status of the ground beneath the site and to install additional dual purpose groundwater and gas monitoring wells

5.4.1 Implementation of investigation works

The exploratory holes were logged by an engineer in general accordance with the recommendations of BS5930:2015+A1:2020 (which incorporates the requirements of BS EN ISO 14688-1, 14688-2 and 14689-1).

Photographs taken during the intrusive investigation works are presented in **Appendix F**.

The monitoring well construction and associated response zones are detailed on the exploratory hole records in **Appendix G**. The response zones were installed to target identified gas generation sources or migration pathways detailed in the initial preliminary CSM.

The soil sampling and analysis strategy was designed to further characterise ground conditions at the site and permit an assessment of the potential contaminant linkages identified. In addition, samples were taken to allow for environmental testing to supplement the existing data for the site.

Soils collected for laboratory analysis were placed in a variety of containers appropriate to the anticipated testing suite required. They were dispatched to the laboratory in cool boxes under chain of custody documentation. Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination.

5.5 Monitoring programme

5.5.1 Ground gas monitoring

In line with the initial CSM, response zones were installed to target the sources or pathways as detailed in **Table 6**.

Given that Idom Merebrook undertook three monitoring rounds in July and August 2018, RSK will undertake a further three monitoring rounds over the course of six weeks to provide additional data to support refining of the initial CSM presented in Section 4.

The number of monitoring rounds undertaken is in general accordance with the decision matrix presented as Figure 6 of BS8576 for a very low source generation potential.

A calibrated infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO₂), methane (CH₄) and oxygen (O₂) in percentage by volume.

Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a photo ionisation device (PID) to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

The atmospheric pressure before and during monitoring, together with the weather conditions, were recorded. The monitoring included periods of falling atmospheric pressures and after/during rainfall.

During the intrusive investigation it was noted that historic monitoring well MBH01 remained in-situ within the western parcel of the site. As such, this monitoring well has been included within the RSK monitoring to provide further information in this area of the site.

All RSK ground gas monitoring results together with the temporal conditions are contained within **Appendix I**. Equipment calibration certificates are available on request.

5.6 Laboratory testing

Laboratory testing was undertaken at a UKAS accredited laboratory with ISO17025 and MCERTS accredited test methods were specified where applicable for contamination testing and as shown in the laboratory test certificates appended.

5.6.1 Chemical analysis of soil samples

The programme of chemical tests undertaken on soil samples obtained from the intrusive investigation is presented in **Table 8** with the laboratory testing results contained in **Appendix H**.

Table 8 Summary of chemical testing of soil samples

Stratum	Tests undertaken	No. of tests
Topsoil	Metals, PAHs and TPHs CWG	6
	Asbestos	6
	TOC	2
Head deposits	Metals, PAHs and TPHs CWG	1
	Asbestos	1

6 SITE INVESTIGATION FACTUAL FINDINGS

The results of the intrusive investigation and subsequent environmental laboratory analysis undertaken are detailed below.

6.1 Ground conditions encountered

The descriptions of the strata encountered, notes regarding visual or olfactory evidence of contamination, list of samples taken, field observations of soil and groundwater, in-situ testing and details of monitoring well installations are included on the exploratory hole records presented in **Appendix G**.

For the purpose of discussion, the ground conditions encountered during the fieldworks are summarised in **Table 9** with the strata discussed in subsequent subsections.

Table 9 General succession of strata encountered

Stratum	Exploratory holes encountered	Depth to top of stratum m bgl	Proven thickness (m)
Topsoil	All	GL	0.20 – 0.60
Head Deposits	All	0.20 – 1.10	0.40 – >2.00
River Terrace Deposits	WS1, WS4, WS6 & WS7	1.10 - 2.10	>0.90 - >1.90
Lambeth Group	WS3	1.70	>1.30

6.1.1 Topsoil

Topsoil was encountered within all exploratory hole locations down to a maximum depth of 0.60 m bgl and generally comprised grass over dark brown slightly gravelly slightly sandy clay. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint.

6.1.2 Head Deposits

Head deposits were encountered beneath the topsoil within all locations and comprised of brown gravelly clay. Gravel is angular to subrounded fine to coarse flint.

6.1.3 River Terrace Deposits

River Terrace Deposits were encountered beneath the head deposits within four locations (WS1, WS4, WS6 & WS7). This stratum consisted of brown slightly clayey sandy gravel. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse flint.

6.1.4 Lambeth Group

The Lambeth Group was only encountered within WS3 in the north east of the site beneath the head deposits at a depth of 1.70 m bgl to the base of the borehole. The stratum comprised of soft brown sandy clay. Sand is fine to coarse.

6.1.5 Visual/olfactory evidence of soil contamination

No visual or olfactory evidence of soil contamination was identified.

6.2 Groundwater

6.2.1 Groundwater encountered during intrusive works

Groundwater was not encountered during the investigation works.

6.2.2 Groundwater encountered during monitoring

Groundwater levels were recorded within two exploratory hole locations during the 5th November 2020 visit and in three locations during the 4th and 15th December 2020 visits, which suggests that a continuous shallow groundwater body beneath the site is absent. The monitoring programme are summarised in **Table 10** based on the data provided in **Appendix H**. Field data measurements are also shown in **Appendix I**.

Table 10 Summary of groundwater monitoring results

Monitoring well	Response zone stratum	05/11/20 m bgl	03/12/20 m bgl	15/12/20 m bgl
WS2	Head deposits	Dry	2.73	2.52
WS3	Head deposits/ Lambeth Group	2.49	0.805	0.57
MBH01	Head deposits/ Lambeth Group	9.85	10.07	9.98

It should be noted that groundwater levels might fluctuate for a number of reasons including seasonal variations.

The groundwater monitoring concurs with the previous groundwater monitoring undertaken by Idom Merebrook between November 2016 and March 2017 with resting depths between 2.83 m and below 10.00 m bgl.

6.3 Chemical laboratory results

The soil testing results are presented in **Appendix I**.

6.4 Ground gas monitoring

The results of the ground gas monitoring and testing carried out are given in **Appendix H** and discussed in Section 7.

7 ENVIRONMENTAL ASSESSMENT

7.1 Refinement of initial CSM

The ground investigation did not identify the presence of unexpected sources of contamination and no visual or olfactory evidence of contamination was identified.

Ground conditions identified were as anticipated from the published geology and the previous ground investigations. It is noted that all borehole locations were terminated in the superficial Head and River Terrace Deposits, with exception to WS3 which was terminated in the Lambeth Group.

7.2 Linkages for assessment

As described in LCRM (Environment Agency, 2020), there are two stages of quantitative risk assessment (QRA), Tier 2 generic (GQRA) and Tier 3 detailed (DQRA). The GQRA comprises the comparison of soil, groundwater, soil gas and ground gas results with GAC that are appropriate to the linkage being assessed. This comparison can be undertaken directly against the laboratory results or following statistical analysis depending upon the sampling procedure that was adopted.

All potentially complete pollutant linkages pertaining to contaminant of potential concern in soil and groundwater were concluded to be low, (refer to Section 4) and have been addressed by the previous ground investigations undertaken by Idom Merebrook. However, to provide further indication of the chemical status of shallow soils beneath the site the soil sample laboratory analysis results have been conservatively compared to the RSK GAC based on a residential end use with gardens. The RSK residential GAC are presented in Appendix J and the results of the assessment are presented in Section 7.3.1.

Following the refinement of the CSM, the potentially complete contaminant linkages that require further assessment and the methodology of assessment are presented in **Table 11**.

Table 11 Linkages for GQRA

Potentially relevant contaminant linkage	Assessment method
Ground Gas	
1. Concentrations of methane and carbon dioxide in ground gas entering and accumulating in enclosed spaces or small rooms in new buildings, which could affect future site users. For methane this could create a potentially explosive atmosphere, while death by asphyxiation could result from carbon dioxide.	Borehole hazardous gas flow rates (Qhg) have been calculated using maximum (peak) methane and carbon dioxide concentrations and steady state flow rates in accordance with BS8485. This is subject to interpretation and use of professional judgement to designate the site or zones of the site characteristic situation by comparison to a Gas Screening Value (GSV) as appropriate and in line with the CSM. For applicable low-rise residential developments reference to NHBC guidance has also been considered.

7.3 Methodology and assessment of soil results

The analysis of laboratory results relating to soil samples submitted for testing, including leachate analysis, is included in the following sections.

7.3.1 Oral, dermal and inhalation exposure with impacted soil by future occupants/site users

As already mentioned, all potentially complete pollutant linkages relating to the development proposals and pertaining to potential contaminants of concern in soil and groundwater are considered to be low. However, to further support this conclusion the chemical status of shallow soils beneath the site have been further assessed by comparison of soil laboratory analyses results to RSK's GAC based on a residential end use, which include consideration of oral, dermal and inhalation exposure pathways.

All soil results have been directly compared against the GAC for a residential end use with gardens, based on a soil organic matter (SOM) of 2.5%, as shown in the screening table presented in **Appendix K**.

None of the measured concentrations of COPC in soil were detected in excess of the residential GAC. This supports the conclusions drawn in the initial CSM that potential risks to human health receptors from onsite and off-site sources of contamination relating to soils are low and do not warrant further assessment.

7.3.2 Inhalation exposure of future occupants/site users to asbestos fibres

During the historic and recent RSK intrusive investigations conducted at the site no visually identifiable asbestos containing materials (ACM) were observed. Further to this the visual inspection at the laboratory identified no materials suspected of potentially containing asbestos and the scheduled laboratory screening for asbestos to date has found no detectable asbestos fibres within the samples collected.

7.3.3 Uptake of contaminants by vegetation potentially inhibiting plant growth (phytotoxicity)

The results have been compared with the GAC presented in **Appendix L** for this linkage.

The results indicate that a relevant contaminant linkage is unlikely to exist associated with phytotoxic effects.

7.3.4 Impact of organic contaminants on potable water supply pipes

For initial assessment purposes, the results of the investigation have been compared with the GAC presented in M for this linkage, which are reproduced from *UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (UKWIR, 2010).

The results indicate that a relevant linkage is unlikely to exist associated with organic contaminants and therefore pollutant polyethylene (PE) and/or polyvinyl chloride (PVC) water supply pipes are expected to be suitable for use on the development.

It should be noted that at the time of this investigation the future routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling/analytical strategy may be required at a later date once the route(s) of the supply pipe(s) are known. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

7.4 Ground gas risk assessment – bulk gases

7.4.1 Appropriate guidance

The risks to development from ground gases have been assessed in accordance with BS8485:2015+A1:2019 (BS8485), which provides guidance on ground gas (methane and carbon dioxide) characterisation and hazard assessment, as well as providing a framework for the prescription of protection measures within new buildings.

The process involves characterising the gas hazard from combining the qualitative assessment of risk (using the CSM) with ground investigation data so that a 'characteristic situation' (CS) can be derived for the site or zones within the site. Characteristic situations range from CS1 to CS6, the higher the CS, the higher the hazard potential. Gas protection measures within new buildings can be prescribed using a point scoring system, taking into consideration the CS and the proposed building type.

BS8485 indicates that the gas hazard can be characterised using the following methods:

- an empirical semi-quantitative approach using gas monitoring data to determine the 'characteristic situation' of the site (or zones of the site) and subsequent protective measures (Wilson and Card approach);
- an empirical semi-quantitative approach using TOC data to determine the 'characteristic situation' of the site (or zones of the site) and subsequent protective measures (CL:AIRE RB17 approach); or
- detailed quantitative assessment methodologies.

For the purpose of this assessment, the empirical semi-quantitative approach above has been used to characterise the gas hazard and provide advice on the protective measures likely to be required within new buildings at the site (if deemed necessary).

For low rise residential developments an alternative assessment method can be adopted as per NHBC guidance (Boyle & Witherington, 2007) commonly known as the 'NHBC Traffic Light' guidance. The NHBC support the use of a standardised UK approach to demonstrate compliance with Building Regulations (NHBC, 2016). However, the NHBC state that the NHBC Traffic Light Guidance can still be used where development proposals are based on a 'typical house' comprising of up to three stories of <100 m² footprint and with a minimum 150 mm sub-floor ventilated void that achieves one air change per day. As the proposed development meets these criteria, consideration with respect to NHBC guidance is provided in Section 7.4.5.

7.4.2 Summary of the refined CSM for ground gas

In the assessment of risks and selection of appropriate mitigation measures, BS8485 highlights the importance of the conceptual model. In summary, potential sources of ground gas within influencing distance of the site identified in Section 4.2 comprise:

- made ground identified in the eastern portion of the site with low degradable organic content primarily in the vicinity of MTP120; and,
- infilled gravel pits located 75 m west and 110 m north west.

This assessment has been undertaken to assess risks to building structures and proposed end users. The assessment has not taken into consideration the health and safety of construction workers. Risks may still be present to construction workers especially where works include the entry into excavations within the ground. Construction workers should undertake appropriate risk assessments and risks should be managed through health and safety procedures and safe systems of work.

The risk assessment has been undertaken based on the current understanding of the CSM.

7.4.3 Empirical semi-quantitative approach using borehole monitoring data (Wilson and Card approach, BS8485)

7.4.3.1 Background

The empirical semi quantitative approach using gas monitoring data requires the designation of a gas screening value (GSV) for the entire site or zones within the site, which informs the hazard potential and associated prescribed ground gas protection measures within new buildings (where necessary). BS8485 defines the GSV as the *'flow rate (l/hr) of a specific hazardous gas **representative of a site or zone**, derived from assessment of borehole concentration and flow rate measurements and taking account of all other influencing factors, in accordance with a conceptual site model'*.

BS8485 Section 6.3.1 outlines the process for developing a GSV for the site or a zone as follows:

- borehole hazardous gas flow rate (Q_{hg}) is calculated for each borehole standpipe for each monitoring event. The borehole hazardous gas flow rate is defined in BS8485 as the *'flow rate of a specific hazardous gas, either methane or carbon dioxide, from a borehole standpipe'*. The Q_{hg} is calculated from individual borehole measurements of total gas flow and the concentration of the specific hazardous gas. BS8485 states in Section 6.3.4 that the **maximum** gas concentration recorded during the monitoring event should be used, together with **steady-state** values of gas flows;
- the reliability of the measured gas flow rates and concentrations are assessed taking into account borehole construction;
- decisions are made about how to deal with any temporal or spatial shortages in the data; and

- judgements are made about what GSV to designate for use for design purposes taking all relevant information and the conceptual site model into account.

Once the Q_{hg} has been calculated for methane and carbon dioxide, individual borehole measurements are compared to the thresholds presented in Table 2 of BS8485 which inform the CS that directly relates to each individual measurement. Taking into account the site data (i.e. borehole gas concentration and flow rate to calculate the Q_{hg}) and all other influencing factors in accordance with the CSM, a decision can then be made regarding the GSV that is considered to be representative of the site or a zone within it.

Typical threshold concentrations of methane (1% v/v) and carbon dioxide (5% v/v), and flow rates (>70 l/h), are also considered when designating the GSV for the site or zone, which in turn dictates the hazard potential and CS. It is important to note that the site or zone characteristic GSV and maximum concentration or flow thresholds are guideline values and not absolute. The thresholds may be exceeded in certain circumstances, if the CSM indicates it is safe to do so.

7.4.3.2 *Designation of a GSV for the site or zone*

The results of the ground gas monitoring and testing undertaken, alongside site conditions at the time of monitoring, are given in **Appendix H**.

A summary of the maximum recorded concentrations per borehole (or minimum for oxygen) is presented in **Table 12** overleaf. This table also presents details of the response zone, maximum recorded initial and steady state flow rates and minimum recorded depth to water across all monitoring rounds.

The range of atmospheric pressure during the three monitoring rounds completed by RSK was 993 - 1032 mbar.


Table 12 Summary of RSK ground gas monitoring results

Exploratory position ID	Response zone top (mbgl)	Response zone base (mbgl)	Response zone geological unit*	No. of monitoring rounds	Peak CH ₄ max. (%/vol)	Steady-state CH ₄ max. (%/vol)	Peak CO ₂ max. (%/vol)	Steady-state CO ₂ max. (%/vol)	Oxygen min. (%/vol)	Peak gas flow max. (l/hr)	Steady-state gas flow max. (l/hr)	Depth to water min. (m)	Depth to water max. (m)	Atm pressure min. (mb)	Atm pressure max. (mb)
WS1	1.00	3.00	HD	3	<0.1	<0.1	2.1	2.1	16.6	0.1	0.1	n/a	n/a	995	1031
WS2	1.00	3.00	HD	3	<0.1	<0.1	2.5	2.5	15.9	0.1	0.1	2.52	dry	996	1032
WS3	1.00	3.00	HD/LG	3	<0.1	<0.1	2.1	2.1	18.6	0.1	0.1	0.57	2.49	996	1032
WS4	1.00	3.00	HD / RTD	3	<0.1	<0.1	2.2	2.2	17.5	0.1	0.1	n/a	n/a	996	1032
WS5	1.00	3.00	HD	3	<0.1	<0.1	3.6	3.6	13.4	0.1	0.1	n/a	n/a	995	1031
WS6	1.00	3.00	HD / RTD	3	<0.1	<0.1	2.0	2.0	16.5	0.1	0.1	n/a	n/a	993	1031
WS7	1.00	3.00	HD / RTD	3	<0.1	<0.1	3.5	3.5	16.4	0.1	0.1	n/a	n/a	993	1031
MBH01	1.00	10.00	RTD / LG	3	<0.1	<0.1	2.6	2.6	17.8	0.1	0.1	9.85	10.07	994	1031

Notes:

*It is noted that no made ground was encountered during the RSK intrusive investigation works, however the response zones at 1-3 m correspond with the made ground encountered in MTP120 by Idom Merebrook up to >2.9 m bgl (contained brick and concrete) as well as targeting more permeable strata within which ground gases from potential off-site sources are more likely to migrate through. It is noted that the occasional fragments of brick identified within the topsoil layer by Idom Merebrook have not been targeted by the monitoring well response zones as these fragments are considered likely to have been entrained within the topsoil via ploughing rather than being a 'made ground deposit' and therefore are not considered a potential ground gas source.

Key HD = Head deposits, LG = Lambeth Group, RTD = River Terrace deposits

7.4.3.3 Summary of borehole hazardous gas flow rates

Borehole hazardous gas flow rates (Q_{hg}) have been calculated for each borehole standpipe, for each monitoring round and are presented, alongside two 'worst case' checks in **Appendix N** comprising a probable 'worst case' and potential 'worst case' from the available monitoring data. Within this data gas concentrations exceeding the thresholds presented in Table 2 of BS8485 are identified, alongside the CS that could be associated with each individual borehole monitoring event.

7.4.3.4 Worst case check

In accordance with BS8485, a 'worst case' Q_{hg} has been calculated per borehole by multiplying the maximum recorded flow from any monitoring round for that borehole by the maximum recorded methane or carbon dioxide concentration in that borehole. A further worst-case Q_{hg} check across all data collected is presented in **Appendix N** for the entire site which has been calculated by multiplying the maximum recorded flow by the maximum recorded methane or carbon dioxide concentration.

7.4.3.5 Designation of site gas screening value (GSV)

Considering the calculated Q_{hg} , the CSM, monitoring conditions and response zone construction, **Table 13** presents the GSVs designated for the site.

Table 13 Summary of RSK ground gas monitoring results

Hazardous gas	GSV (l/h)	Justification for the GSV
Methane	0.0001	Methane not recorded in excess of the instrument detection limit <0.1
Carbon dioxide	0.0036	Based on maximum carbon dioxide concentration recorded in WS5 on 15/12/2020 (3.6%v/v) and maximum flow rate of 0.1 l/hr

Based on the Q_{hg} , the maximum concentrations and flows recorded during the monitoring visits conducted in November and December 2020, the CSM and the method for determining the CS presented within Table 2 of BS8485, the site has been characterised as CS1.

Table 14 and **15** presents the summary of GSVs for the previous Idom Merebrook gas monitoring visits in 2015 and 2018.

Table 14 Summary of Idom Merebrook ground gas monitoring results 2015

Hazardous gas	GSV (l/h)	Justification for the GSV
Methane	0.0007	Methane not recorded in excess of the instrument detection limit <0.1 maximum flow rate of 0.7 l/hr
Carbon dioxide	0.0070	Based on maximum carbon dioxide concentration recorded in MWS110 on 02/10/2015 (7.0%v/v) and maximum flow rate of 0.1 l/hr

Table 15 Summary of Idom Merebrook ground gas monitoring results 2018

Hazardous gas	GSV (l/h)	Justification for the GSV
Methane	0.0001	Methane not recorded in excess of the instrument detection limit <0.1
Carbon dioxide	0.0025	Based on maximum carbon dioxide concentration recorded in MBH04 on 21/08/2018 (2.5%v/v) and maximum flow rate of 0.1 l/hr

Based on the Q_{hg} calculated from the maximum concentrations and flows recorded during the monitoring visits undertaken by Idom Merebrook 2018, the site would have been characterised as CS1, however based on carbon dioxide recorded above 5% within the 2015 monitoring, Idom Merebrook characterised the site as CS2. RSK consider this to be overly conservative based on the sites ground gas CSM, the results of the Idom Merebrook 2018 data and the three recent RSK monitoring visits.

7.4.3.6 Data Limitations

It should be noted that there are inherent limitations in ground gas monitoring including spatial adequacy of monitoring locations, changes in groundwater levels, variation in temporal or atmospheric conditions.

The previous gas monitoring undertaken by Idom Merebrook in 2015 was only undertaken within a single borehole location (MWS118) located in the eastern field. In addition, the further ground gas monitoring undertaken in 2018 was only undertaken over the summer months in periods of high pressure and therefore may have not been represent the "worst case".

The RSK site investigation and subsequent gas monitoring programme was designed to supplement the previous gas monitoring undertaken by Idom Merebrook and provide additional evidence to justify downgrading the site from a CS2 classification (proposed by



Idom Merebrook based on monitoring data from a single monitoring well in 2015) to a CS1 classification.

Two of the three RSK gas monitoring visits coincided with low/falling atmospheric pressure, therefore the results are considered to represent worst-case conditions at the site. This data along with the Idom Merebrook 2018 data is therefore considered suitable to represent the current ground gas regime beneath the site.

7.4.4 BS8485 recommended ground gas protection measures

Case 1: CS1 classification

Based on the understanding of the ground gas CSM and the assessment undertaken, the site has been classified as CS1. Considering the foregoing and in accordance with BS8485, ground gas protective measures are not considered necessary within proposed buildings.

7.4.5 Application of NHBC Guidance

The NHBC guidance (Boyle & Witherington, 2007) provides alternative gas screening values based on calculated maximum gas concentrations within a 'typical house' allowing for potential hazardous gas dilution within a sub-floor void and accumulation within a small room for carbon dioxide and methane. The NHBC therefore derive separate GSV criteria for methane and carbon dioxide due to the different hazards posed by each gas.

The method for derivation of the GSV adopted by NHBC (2007) is based on the Wilson and Card Methodology and is subsequently broadly similar to that set out⁷ in BS8485 (BSI, 2015). However, for carbon dioxide the NHBC guidance recommend the use of a steady-state concentration due to the hazard posed by this substance. Therefore, the GSV for carbon dioxide has been adjusted based on a recorded maximum steady-state concentration of 3.6%v/v.

The respective GSV and typical maximum concentrations as set out in NHBC Guidance is presented in **Table 16**.

Table 16 NHBC Traffic Light Classification System (as per NHBC, 2007)

Traffic Light Classification	Methane ¹		Carbon Dioxide ¹	
	Typical Maximum Concentration ³ (%v/v)	Gas Screening Value ^{2,4} (l/hr)	Typical Maximum Concentration ³ (%v/v)	Gas Screening Value ^{2,4} (l/hr)
Green	1	0.16	5	0.78
Amber 1	5	0.83	10	1.56
Amber 2	20	1.56	30	3.10
Red				

Notes:

1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated.
2. Gas Screening Value is the Borehole Gas Volume Flow Rate, in litres per hour, as defined in Wilson and Card (1999), which is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered.
3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so.
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

The derived GSV for carbon dioxide and methane is based on the three RSK monitoring visits in November and December 2020 and subsequent NHBC classification are as follows:

Methane: A GSV of 0.1 l/hr indicates a Green Classification. Based on the site data (<0.1% v/v), the typical maximum concentration for methane of 1 %v/v is not exceeded. Therefore, a traffic light classification of Green for low rise housing is considered appropriate based on the November and December 2020 data.

Carbon Dioxide: A GSV of 0.1 l/hr indicates a Green Classification. Based on the site data (3.6% v/v), the typical maximum concentration for carbon dioxide of 5 %v/v is not exceeded. Therefore, a traffic light classification of Green for low rise housing is considered appropriate based on the November and December 2020 data.

Based on the November and December 2020 data, a NHBC Traffic Light classification of Green recommendations for gas protection measures within low rise housing are as follows:

Green: No protection measures are required.

7.4.6 Implications of ground improvement or foundation design

Shallow foundation types are being considered for the development. Where such works may create preferential pathways for ground gas migration to the surface, this needs to be considered through the design process, such as through a foundation works risk assessment.

Should foundation solutions or building design change within the design process, then this gas risk assessment and mitigation should be reviewed and where applicable updated.

7.5 Radon

Idom Merebrook reported the site to be located within a radon affected area with between 5% and 10% of the houses above the action level and as such recommended basic radon protection measures to be incorporated into the proposed development.

The Client has subsequently provided a site-specific Radon Report, which is presented in Appendix O. This report demonstrates that the western portion of the site and the central eastern portion of the site falls within a radon affected area, with between 5% and 10% of the houses above the action level.

The classification of the northern and southern parts of the eastern portion of the site is unclear from the Radon Report, RSK are in the process of seeking clarification from the British Geological Survey (BGS). If these areas of the site fall within the category - 1% to 3% of homes estimated to be at or above the radon action level, it may be possible for the site to be zoned in regard to radon protection measures.

Should clarification from the BGS confirm the northern and southern parts of the site fall within an area with 1% to 3% of homes estimated to be at or above the radon action level, the National House Building Council's (NHBC) Building Control Officer for the site would need to be consulted to discuss whether they will permit the site to be zoned in regards to radon protection measures.

At this time, it is recommended that basic radon protection measures need to be incorporated into the entire proposed development unless further information requested from BGS and NHBC deems this not to be required.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Geo-environmental assessment

RSK were commissioned to undertake a review of the previous reports undertaken by Idom Merebrook to identify any gaps or limitations in the reports to help support discharge the planning conditions associated with the site.

Based on a review of the reports it was noted that Idom Merebrook characterised the site as Amber 1/ CS2. This conclusion was based largely on the 2015 data collected from one monitoring well location only, whereby carbon dioxide in excess of 5 %v/v was recorded. The monitoring of the wells in 2018 found lower levels of CO₂, which suggests that the Amber 1 /CS2 classification may be overly conservative. As such, RSK recommended undertaking additional monitoring to provide additional evidence to justify downgrading the site from a CS2/Amber 2 classification to a CS1/Green classification.

Seven window sample boreholes were undertaken across the site and installed with monitoring wells. In addition, a monitoring well from the Idom Merebrook monitoring in 2018 remained in-situ in the western parcel and was included within the monitoring schedule to provide further information in this area of the site.

All potentially complete pollutant linkages pertaining to on and off-site human health receptors, were concluded to be low, and were addressed by the previous ground investigations undertaken by Idom Merebrook. However, to supplement the Idom Merebrook data and further characterise the chemical status of shallow soils beneath the site additional soil samples were collected for laboratory analysis. The soil analysis results have been conservatively compared to RSK human health GAC based on a residential end use with gardens.

None of the measured concentrations of COPC in soil were detected in excess of the GAC. This supports the conclusions drawn in the initial CSM that potential risks to human health receptors from on-site and off-site sources of contamination identified in soils are low and do not warrant further assessment.

The results also indicate that a relevant contaminant linkage is unlikely to exist associated with phytotoxic effects and that a relevant linkage is unlikely to exist associated with organic contaminants and therefore PE and/or PVC water supply pipes are expected to be suitable for use on the development.

Based on the data obtained from three monitoring visits undertaken over the course of six weeks within November and December 2020, the RSK results agree with the gas monitoring undertaken within 2018 by Idom Merebrook and hence provides further evidence to justify downgrading the ground gas classification for the site from CS2/Amber 1 to CS1/Green.

Two of the three RSK gas monitoring visits coincided with low/falling atmospheric pressure, therefore the results are considered to represent worst-case conditions at the site. This data along with the Idom Merebrook 2018 data is therefore considered suitable to represent the current ground gas regime beneath the site. As such it is recommended that the site is downgraded from a CS2/ Amber to CS1/Green and no ground gas protection measures are required for future buildings.



As confirmed within the Radon Report presented in Appendix O, at least part of the site is located within a radon affected area, with between 5% and 10% of the houses above the action level. Therefore, basic radon protection measures need to be incorporated into the proposed development unless further information requested from BGS and National House Building Council (NHBC) deems this not to be required.

REFERENCES

Previous SI reports and other site related information

- Idom Merebrook Ltd. (May 2017). Geo-Environmental Assessment, report ref: GEA-19495-16-306REVB;
- Idom Merebrook Ltd. (December 2018) Supplementary site investigation (SI), report ref: L-19495-2.4.2-18-S432-DCE Rev.A;
- Idom Merebrook Ltd. (May 2017) Water level monitoring – November 2016 to March 2017 report ref: L-19459-2.4.2-17-S256-SMJ;
- Idom Merebrook Ltd. (December 2018) Soakage Tests, report ref: L-19495-2.4.2-18-S698-RMH;
- Idom Merebrook Ltd. (August 2018) Supplementary ground gas assessment, report ref: L-19495-2.4.2-18-S455-LMH; and,
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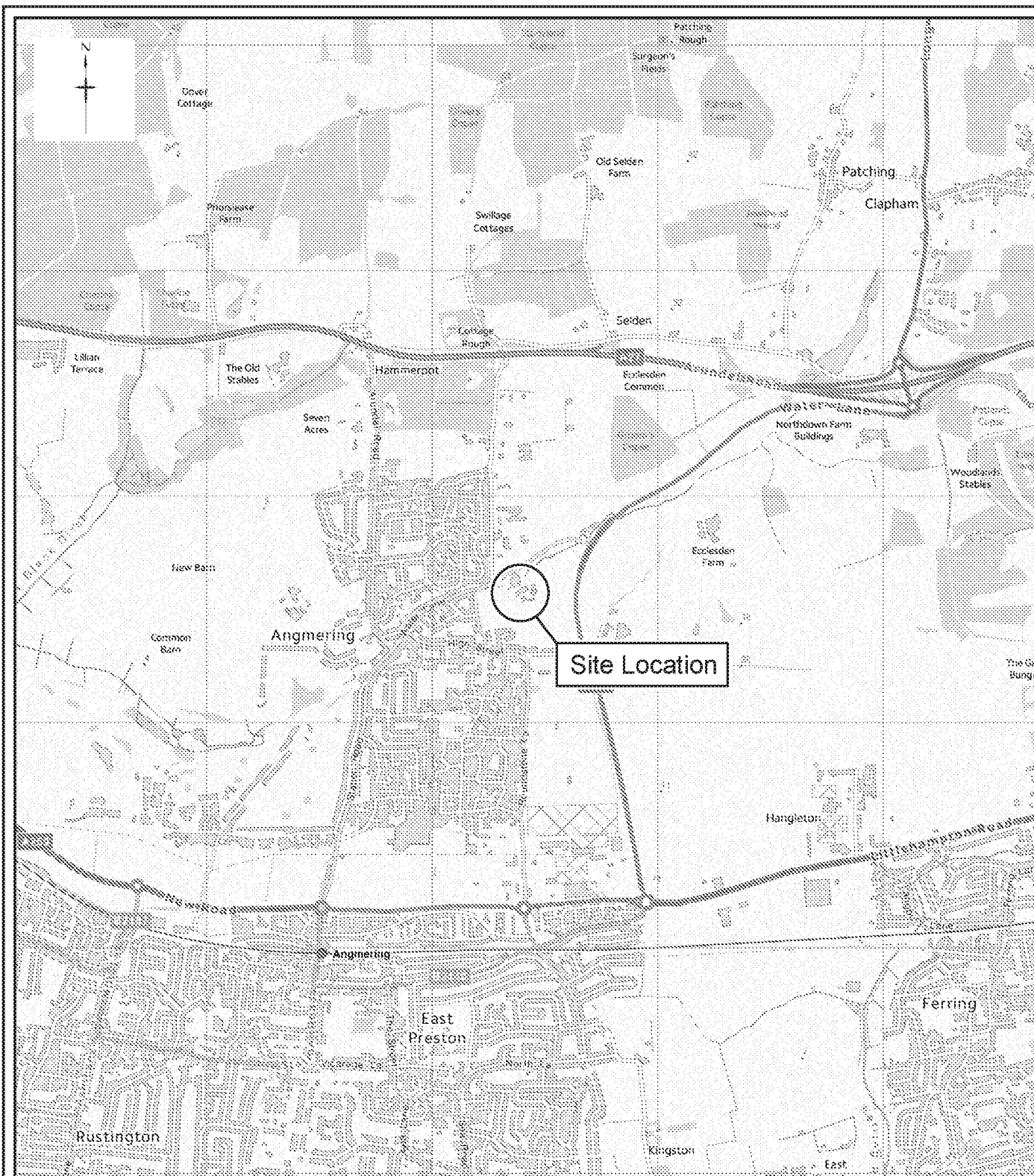
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FIGURES



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Tel: +44 (0) 1442 437500
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Web: www.rsk.co.uk

Client

BARRATT DAVID WILSON SOUTHERN COUNTIES

Project Title

WATER LANE, ANGMERING

Drawing Title

SITE LOCATION PLAN

Rev	Drawn	Date	Checked	Date	Approved	Date
01	LN	01.12.20	MFP	01.12.20	CC	01.12.20
Dimensions		Scale		Original Size		
m		1:25,000		A4		

Project Number

305145 - R01 (00)

Drawing File

305145 (R01-00) Figure 1.dwg

Drawing Number

FIGURE 1



LEGEND

- Site Boundary
- Window Sample Location
- Historic Monitoring Well Location

P1	01.12.20	First Issue	LN	MFP	CC
Rev.	Date	Amendment	Drawn	Chkd.	Appd.



12 Fingernore Road
Horseshoe Lane
Horseshoe Lane
Horseshoe Lane
Horseshoe Lane
United Kingdom

Tel: +44 (0) 1442 457500
Fax: +44 (0) 1442 457500
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client
**BARRATT DAVID WILSON
SOUTHERN COUNTIES**

Project Title
**WATER LANE,
ANGMERING**

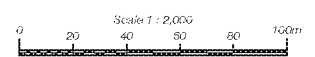
Drawing Title
**EXPLORATORY HOLE
LOCATION PLAN**

Drawn	Date	Checked	Date	Approved	Date
LN	01.12.20	MFP	01.12.20	CC	01.12.20

Scale	Orig Size	Dimensions
1:2000	A3	M

Project No.	Drawing File
305145 - R01 (00)	305145 (R01-00) Figure 2.dwg

Drawing No.	Rev.
FIGURE 2	P1



APPENDIX A

SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for BDW Southern Counties (the "Client") in accordance with the terms of a contract [RSK Environment Standard Terms and Conditions] between RSK and the Client, dated 16th October 2020.. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.
2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials, unless specifically identified in the Services.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):



- a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.
- b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.
- c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.
10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.
11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.
12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

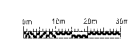
APPENDIX B

DEVELOPMENT DRAWINGS

	SINGLE STOREY BUILDINGS
	TWO STOREY UNITS
	TWO & HALF STOREY UNITS



Rev.	Date	Description	Drawn	Checked
1	15-10-20	Revised to suit amended planning layout.	BAC	DGP
2	20-10-20	Revised to suit amended planning layout.	BAC	DGP
3	20-10-20	Revised to suit client comments.	BAC	DGP
4	20-10-20	Revised to suit client comments.	BAC	DGP
5	15-06-20	Revised to suit amended planning layout.	BAC	DGP
6	09-06-20	Revised to suit amended planning layout.	BAC	DGP
7	01-05-20	Revised to suit amended planning layout.	BAC	DGP
8	16-04-20	Revised to suit amended planning layout.	BAC	DGP
9	24-02-20	Revised to suit amended planning layout.	BAC	DGP
10			BAC	DGP



Client:
Project: Land at Water Lane, Angmering, West Sussex.
Drawing Title: Heights Layout
Scale: N.T.S. @ A1
Date: January 2020
Dwg No: PLN-1-1103

Drawn: DGP
File: P1320 Layout
Rev: J

Checked: DGP
Drawing Status: PLANNING

aap architecture Ltd
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APPENDIX C

SUMMARY OF LEGISLATION AND POLICY RELATING TO LAND CONTAMINATION

Part IIA of the Environmental Protection Act 1990

Part IIA of the Environmental Protection Act 1990 (Part IIA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, formed the basis for the current regulatory framework and the statutory regime for the identification and remediation of contaminated land. Part IIA of the EPA 1990 defines contaminated land as 'any land which appears to the Local Authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters are considered to include all groundwater, inland waters and estuaries.

In August 2006, the Contaminated Land (England) Regulations 2006 (SI 2006/1380) were implemented, which extended the statutory regime to include Part IIA of the EPA as originally introduced on 1 April 2000, together with changes intended chiefly to address land that is contaminated by virtue of radioactivity. These have been replaced subsequently by the Contaminated Land (England) (Amendment) Regulations 2012, which now exclude land that is contaminated by virtue of radioactivity.

The intention of Part IIA is to deal with contaminated land issues that are considered to cause significant harm on land that is not undergoing development (see Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012). This document replaces Annex III of Defra Circular 01/2006, published in September 2006 (the remainder of this document is now obsolete).

Planning Policy

Contaminated land is often dealt with through planning because of land redevelopment. This approach was documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use. PPS23 was withdrawn early in 2012 and has been replaced by much reduced guidance within the National Planning Policy Framework (NPPF), reference ISBN: 978-1-5286-1033-9, February 2019.

The new framework has only limited guidance on contaminated land, as follows:

Chapter 11. Making effective use of land

- 117 Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.
118. Planning policies and decisions should:

- c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land.

Chapter 15. Conserving and enhancing the natural environment

- 170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

- e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

- f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

Ground conditions and pollution

- 178. Planning policies and decisions should ensure that:

- a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

- b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and

- c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.

- 179. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

Water Resources Act (WRA)

The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 updated the Water Resources Act 1991, which introduced the offence of causing or knowingly permitting pollution of controlled waters. The Act provides the Environment Agency with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so.

Water Framework Directive (WFD)

The Water Framework Directive 2000/60/EC is designed to:

- enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands that depend on the aquatic ecosystems
- promote the sustainable use of water
- reduce pollution of water, especially by 'priority' and 'priority hazardous' substances
- ensure progressive reduction of groundwater pollution.

The WFD requires a management plan for each river basin be developed every six years.

Groundwater Directive (GWD)

The 1980 Groundwater Directive 80/68/EEC and the 2006 Groundwater Daughter Directive 2006/118/EC of the WFD are the main European legislation in place to protect groundwater. The 1980 Directive is due to be repealed in December 2013. The European legislation has been transposed into national legislation by regulations and directions to the Environment Agency.

Priority Substances Directive (PSD)

The Priority Substances Directive 2008/105/EC is a 'Daughter' Directive of the WFD, which sets out a priority list of substances posing a threat to or via the aquatic environment. The PSD establishes environmental quality standards for priority substances, which have been set at concentrations that are safe for the aquatic environment and for human health. In addition, there is a further aim of reducing (or eliminating) pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on the list. The WFD requires that countries establish a list of dangerous substances that are being discharged and EQS for them. In England and Wales, this list is provided in the River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. In order to achieve the objectives of the WFD, classification schemes are used to describe where the water environment is of good quality and where it may require improvement.

Environmental Permitting Regulations (EPR)

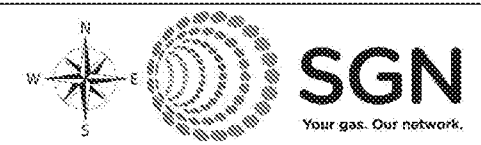
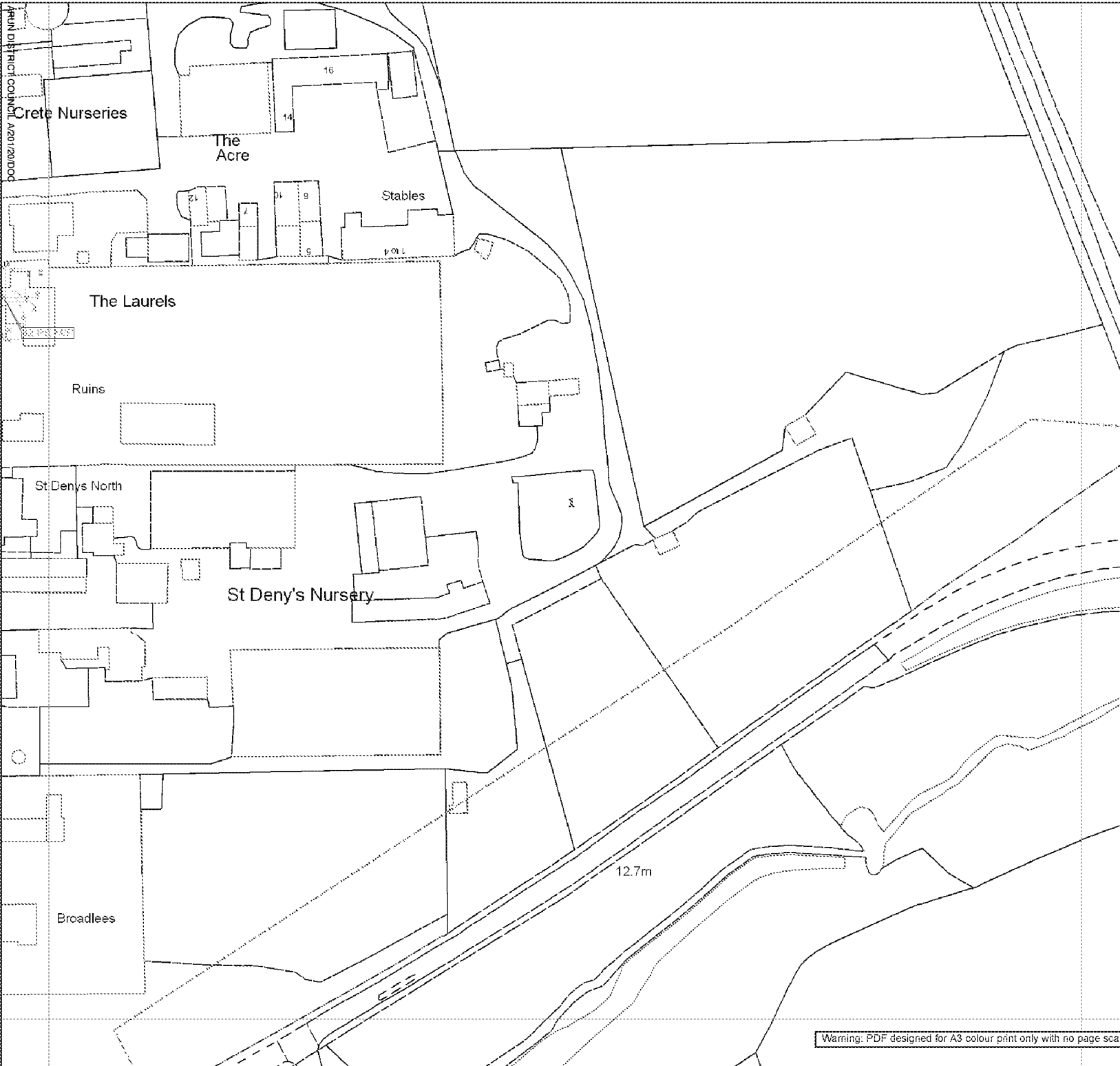
The Environmental Permitting (England and Wales) Regulations 2016 (as amended) provide a single regulatory framework that streamlines and integrates waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation. Schedule 22, paragraph 6 of EPR 2016 states: 'the regulator must, in exercising its relevant functions, take all necessary measures - (a) to prevent the input of any hazardous substance to groundwater; and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater.'

Notes:

- 1. The above information is provided for background but does not constitute site-specific advice*
- 2. The above summary applies to England only. Variations exist within other countries of the United Kingdom*

APPENDIX D

UTILITY SERVICE PLANS



Contact Us
Mapping Enquiries: All areas
General Enquiries: All areas

Date Requested: 20/10/2020
 Job Reference: 20265560
 Site Location: 507447 104541
 Requested by:
 Miss Monique Elsom
 Your Scheme/Reference:
 305145
 Exact Scales:
 1:1000 Area or Circle dig site
 1:1000 Line dig site

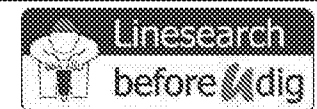
This plan shows the location of those pipes owned by Scotia Gas Networks (SGN) by virtue of being a licensed Gas Transporter (GT). Gas pipes owned by other GTs or third parties may also be present in this area but are not shown on this plan. Information with regard to such pipes should be obtained from the relevant owners. No warranties are given with regard to the accuracy of the information shown on this plan. Service pipes, valves, siphons, sub-connections etc. are not shown but their presence should be anticipated. You should be aware that a small percentage of our pipes/assets may be undergoing review and will temporarily be highlighted in yellow. If your proposed works are close to one of these pipes, you should contact the SGN Safety Admin Team on 0800 912 1722 for advice. No liability of any kind whatsoever is accepted by SGN or its agents, servants or sub-contractors for any error or omission contained herein. Safe digging practices, in accordance with HS (G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that plant location information is provided to all persons (whether direct labour or sub-contractors) working for you on or near gas apparatus. Information included on this plan should not be referred to beyond a period of 28 days from the date of issue.

Report damage immediately - KEEP EVERYONE AWAY FROM THE AREA
 0800 113 999

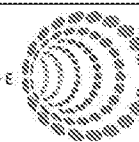
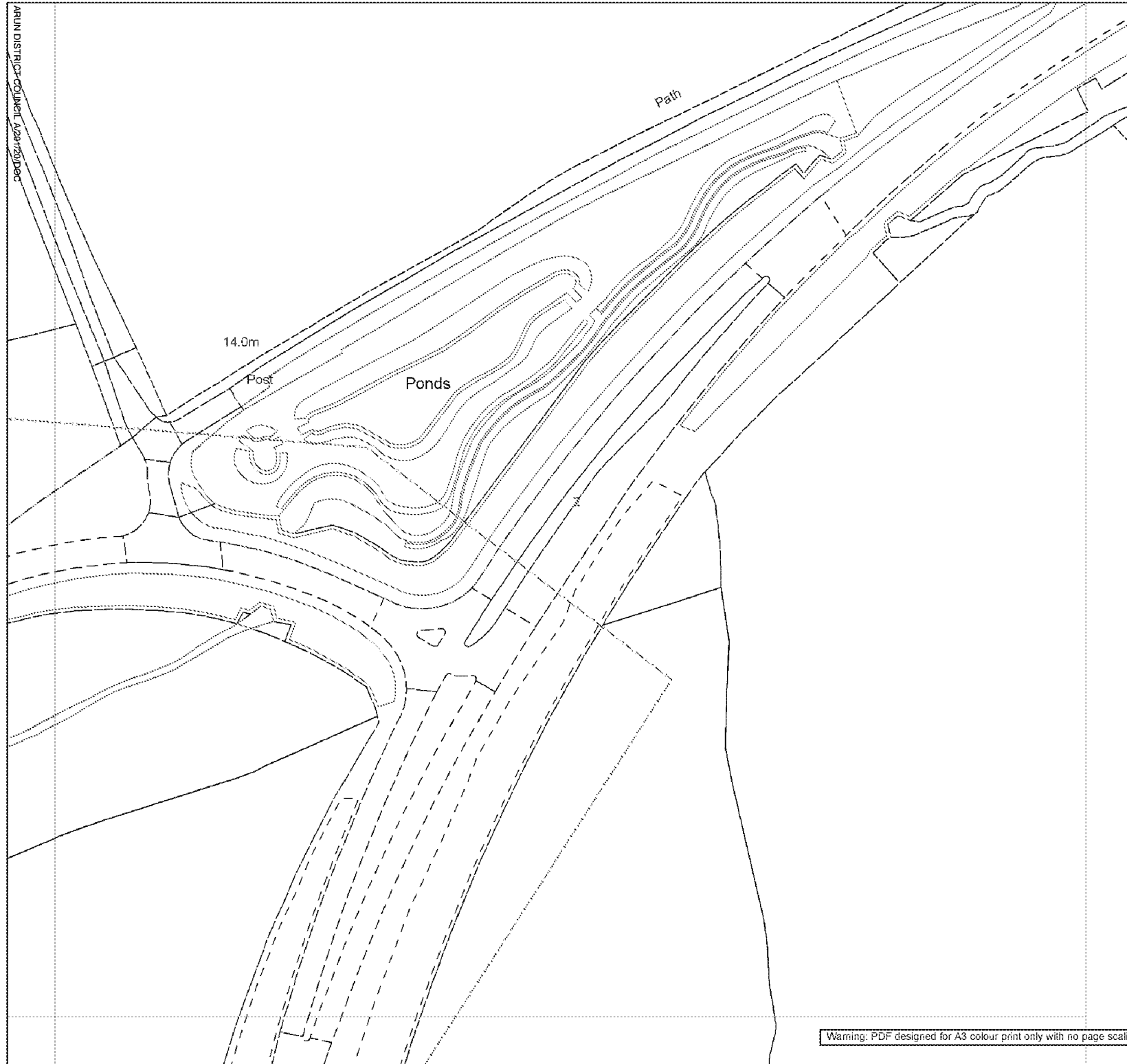
Low Pressure Mains
 Medium Pressure Mains
 Intermediate Pressure Mains
 High Pressure Mains
 LAs
 GTs SSSIs

Some Examples Of Plant Items
 Valve: <> Siphon: O Depth of Cover: V Diameter Change: T Material Change: I

Digsite: Line: Area:



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SGN
Your gas. Our network.

Contact Us

Mapping Enquiries:
All areas

General Enquiries:
All areas

Date Requested: 20/10/2020
Job Reference: 20265560
Site Location: 507447 104541
Requested by:
Miss Monique Elsom
Your Scheme/Reference:
305145
Exact Scales:
1:1000 Area or Circle dig site
1:1000 Line dig site

This plan shows the location of those pipes owned by Scotia Gas Networks (SGN) by virtue of being a licensed Gas Transporter (GT). Gas pipes owned by other GTs or third parties may also be present in this area but are not shown on this plan. Information with regard to such pipes should be obtained from the relevant owners. No warranties are given with regard to the accuracy of the information shown on this plan. Service pipes, valves, siphons, sub-connections etc. are not shown but their presence should be anticipated. You should be aware that a small percentage of our pipes/assets may be undergoing review and will temporarily be highlighted in yellow. If your proposed works are close to one of these pipes, you should contact the SGN Safety Admin Team on 0800 912 1722 for advice. No liability of any kind whatsoever is accepted by SGN or its agents, servants or sub-contractors for any error or omission contained herein. Safe digging practices, in accordance with HS (G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that plant location information is provided to all persons (whether direct labour or sub-contractors) working for you on or near gas apparatus. Information included on this plan should not be referred to beyond a period of 28 days from the date of issue.

Report damage immediately - KEEP EVERYONE AWAY FROM THE AREA
0800 113 898

Low Pressure Mains

Medium Pressure Mains

Intermediate Pressure Mains

High Pressure Mains

LAS

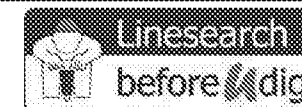
GTs

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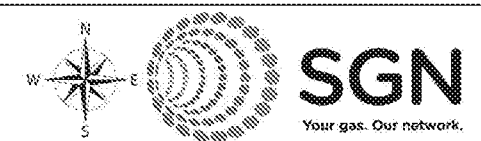
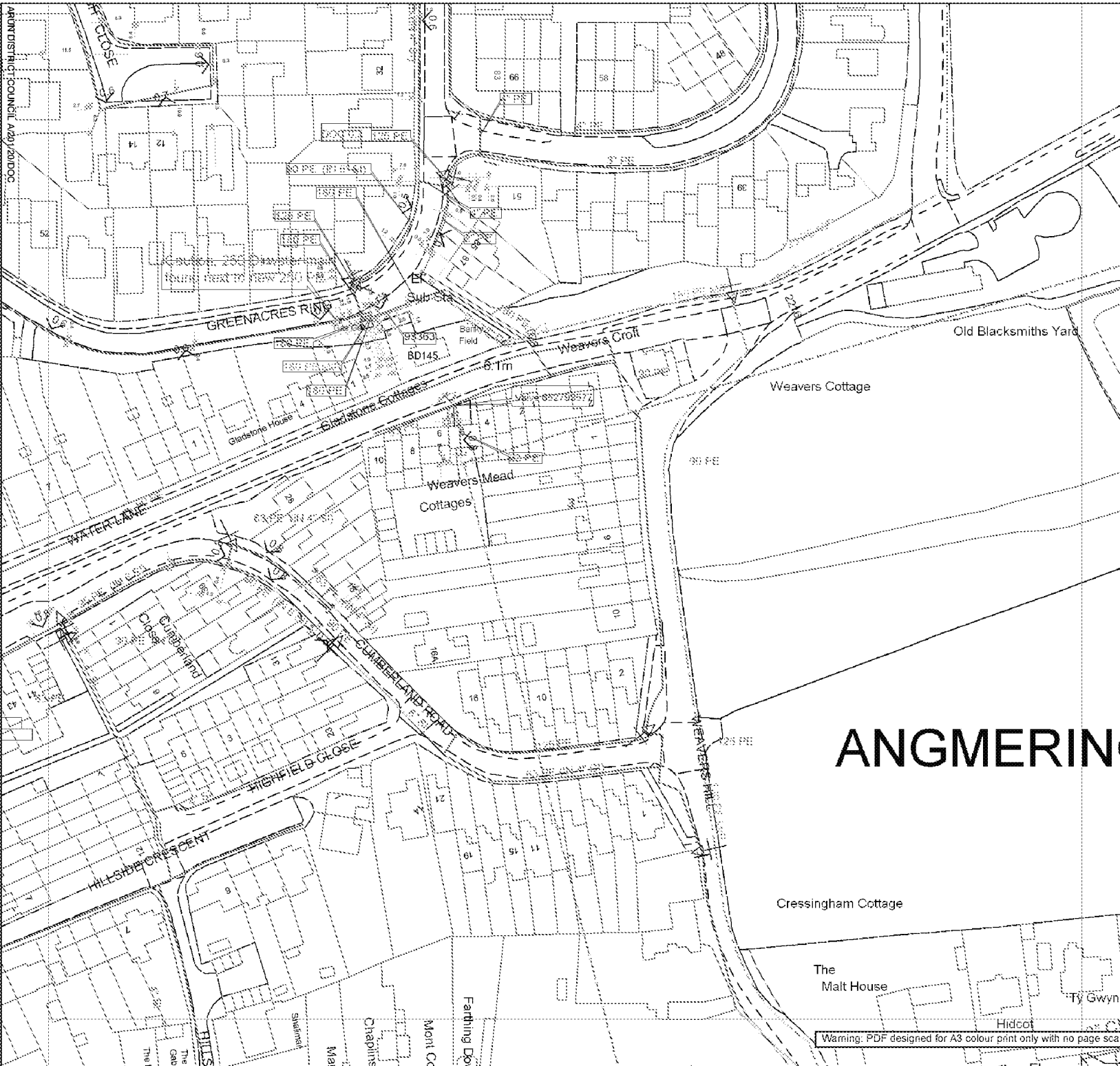
Some Examples Of Plant Items

Valve: Siphon: Depth of Cover: Diameter Change: Material Change:

Digsite: Line: Area:



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Contact Us
Mapping Enquiries: All areas
General Enquiries: All areas

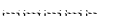
Date Requested: 20/10/2020
 Job Reference: 20265560
 Site Location: 507447 104541
 Requested by:
 Miss Monique Elsom
 Your Scheme/Reference:
 305145
 Exact Scales:
 1:1000 Area or Circle dig site
 1:1000 Line dig site

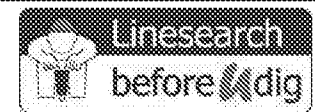
This plan shows the location of those pipes owned by Scotia Gas Networks (SGN) by virtue of being a licensed Gas Transporter (GT). Gas pipes owned by other GTs or third parties may also be present in this area but are not shown on this plan. Information with regard to such pipes should be obtained from the relevant owners. No warranties are given with regard to the accuracy of the information shown on this plan. Service pipes, valves, siphons, sub-connections etc. are not shown but their presence should be anticipated. You should be aware that a small percentage of our pipes/assets may be undergoing review and will temporarily be highlighted in yellow. If your proposed works are close to one of these pipes, you should contact the SGN Safety Admin Team on 0800 912 1722 for advice. No liability of any kind whatsoever is accepted by SGN or its agents, servants or sub-contractors for any error or omission contained herein. Safe digging practices, in accordance with HS (G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that plant location information is provided to all persons (whether direct labour or sub-contractors) working for you on or near gas apparatus. Information included on this plan should not be referred to beyond a period of 28 days from the date of issue.

Report damage immediately - KEEP EVERYONE AWAY FROM THE AREA
 0800 113 898

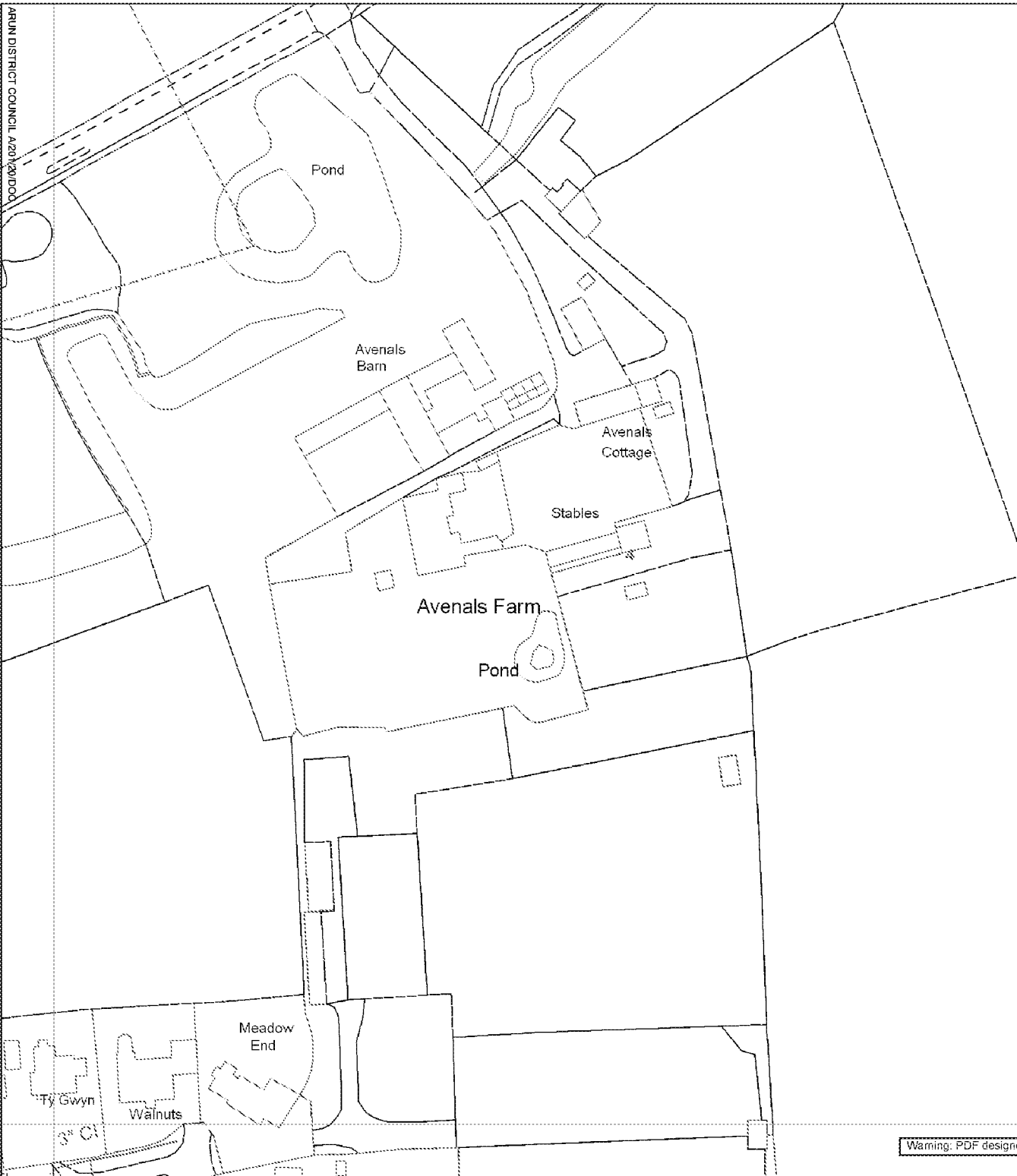
Low Pressure Mains
 Medium Pressure Mains
 Intermediate Pressure Mains
 High Pressure Mains
 LAS
 GTs  SSSIs 

Some Examples Of Plant Items
 Valve  Siphon  Depth of Cover  Diameter Change  Material Change 

Digsite: Line:  Area: 



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SGN
Your gas. Our network.

Contact Us

Mapping Enquiries:
All areas

General Enquiries:
All areas

Date Requested: 20/10/2020
Job Reference: 20265560
Site Location: 507447 104541
Requested by:
Miss Monique Elsom
Your Scheme/Reference:
305145
Exact Scales:
1:1000 Area or Circle dig site
1:1000 Line dig site

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0800 111 999

Low Pressure Mains

Medium Pressure Mains

Intermediate Pressure Mains

High Pressure Mains

LAS

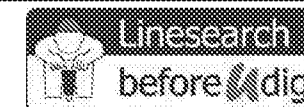
GTs

SSSIs

Some Examples Of Plant Items

Valve: Siphon: Depth of Cover: Diameter Change: Material Change:

Digsite: Line: Area:



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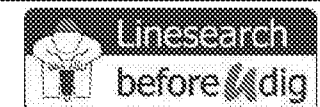
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