

Land to the West of Hatfield

Statement on Ground Conditions, Hydrogeology & Contamination

Project Ref: (I12011)

15th October 2018



Client
Arlington BP Ltd

Baynham Meikle Partnership Ltd
8 Meadow Road
Edgbaston
Birmingham
B17 8BU

Tel: +44 (0)121 434 4100
Fax: +44 (0)121 434 4073

1.0 GROUND CONDITIONS, HYDROGEOLOGY AND CONTAMINATION

Overview of Baseline Site Conditions

- 1.1 A geotechnical and geo-environmental site assessment has not been undertaken on the site at the time of writing, however historic Site Investigation was undertaken on the adjacent land within the Hatfield Business Park. The results of the intrusive investigation and subsequent laboratory analysis undertaken are detailed below. 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 fully in their report.

Soil

- 1.2 The exploratory holes revealed that the site is underlain by variable thicknesses of topsoil over superficial deposits associated with the Lowestoft Formation (Till). Localised made ground soils were encountered within some of the trial holes.

The topsoil materials typically comprised brown to dark brown gravelly sandy clay or gravelly clayey sand, with frequent roots and rootlets, and a gravel content comprising angular to sub-rounded fine to coarse flint. The thickness of topsoil encountered ranged from 0.15m to 0.30m bgl.

Groundwater

- 1.3 Groundwater was encountered during the investigations across the site at varying depths. It should be noted that groundwater levels might fluctuate for a number of reasons including seasonal variations. Ongoing monitoring would be required to establish both the full range of conditions and any trends in groundwater levels.
- 1.4 The findings reflect the general groundwater table in the Lowestoft Formation, which is at an elevation of between 5.0m and 12.80m bql.

Soakaway Testing

- 1.5 Soakaway testing recently undertaken within the Lowestoft Formation achieved infiltration rates of between $5.13 \times 10^{-6} \text{m/s}$ and $2.92 \times 10^{-5} \text{m/s}$.

Hydrogeology

- 1.6 The GroundSure report indicates that the watercourse, identified on the EA website as the Ellenbrook, to the north and east of the site is classified as a Tertiary river and flows off site to the south east along the eastern boundary of the site.
- 1.7 The environmental database has identified surface water features, all of which relate to the Ellenbrook. In addition to these, it is known that a lined pond exists in the south-east corner of the site.
- 1.8 The classification of the water quality in the stretch of the Ellenbrook nearest to the site is unknown at this stage.
- 1.9 The base flow of the Brook is likely to be recharged by surface water run-off from the surrounding fields and shallow soils. A linkage between the Brook and any near surface ground contamination beneath the site may therefore exist.

Site Drainage

- 1.10 Surface drainage in the north and east of the site appears to be discharge directly into the Ellenbrook. Elsewhere at the Site surface water appears to discharge to ground.

Visual/Olfactory Evidence of Soil and Groundwater Contamination

- 1.13 No visual or olfactory evidence of contamination was encountered at any time during the adjacent site's investigation.

Ground Gas

- 1.14 Ground gas monitoring and testing carried out found no elevated concentrations of carbon dioxide or methane in any of the boreholes within the adjacent site. The adjacent site was given a preliminary classification of Characteristic Situation 1 (CS-1); a negligible gas regime.

Contamination

- 1.15 No significant sources of contamination or ground gases have been identified, however, made ground may be present across the site, particularly in areas of previous development.
- 1.16 Groundwater has been encountered at depths of between 5.0m and 12.80m bgl, and during sampling, did not show any signs of contamination such as odour or sheen.

Consultation Undertaken to Date

- 1.17 Consultation with the Local Planning Authority (LPA) has taken place on numerous occasions with respect to the former airfield and ground condition, hydrology and contamination strategy adjacent to which the site falls.

Insignificant Effects

- 1.18 There are no insignificant effects scoped out at this stage.

Sensitive Receptors

- 1.19 Sensitive receptors at this site include:
- Construction workers
 - Future site occupants (residential)
 - Adjacent site users
 - Vegetation
 - Potable water supply pipes
 - Groundwater beneath the site
 - Groundwater in wider aquifer body (including any abstractions in close proximity to the site)
 - Surface watercourses (including the Ellenbrook).
- 1.20 Risk to construction workers should be managed through health and safety procedures including CDM regulations.

Potentially Significant Effects

1.21 Given the above, the potentially significant effects are presented below:

1. Direct contact, ingestion and inhalation of contaminated made ground to proposed site users (adults and children occupying houses),
2. Direct contact, ingestion and inhalation of asbestos fibres from made ground to proposed site users (adults and children occupying houses),
3. Uptake of contaminants through natural absorption by vegetation of contaminated made ground,
4. Chemical attack from contaminants in the made ground affecting potable water supply pipes,
5. Migration and leaching of contaminants and horizontally from the unsaturated made ground and surface water runoff to surface water receptors,
6. Migration and leaching of contaminants both vertically and horizontally from the unsaturated made ground to groundwater receptor, and
7. Migration of contaminated groundwater to wider groundwater body and nearby groundwater abstractions.
8. The accumulation of ground gases generated from made ground and possible tank leakages, as well as offsite sources within buildings posing risks to proposed site users.

Proposed Methodology for further Assessment

1.22 The methodology and results of the assessment are now presented for each relevant pollutant linkages

Direct contact with impacted soil by future residents:

- 1.23 End users of the site are defined as those who are exposed to sources of contamination on a regular and predictable basis. In the case of developments for a commercial end use, the critical receptor is defined within SR3 as a 16 to 65 year old female.
- 1.24 The chemical test results will be compared directly to the appropriate GAC for each contaminant, based upon a conservative Soil Organic Matter (SOM) of 2.5%. The direct comparison table, which presents the chemical laboratory data set compared against the appropriate GAC will be demonstrated.
- 1.25 All samples taken in close proximity to the site were below the GAC and the results of the assessment indicate the strata encountered should be suitable for use.
- 1.26 Based on the above assessment, no potentially significant risks associated with the soil contamination have been identified and it is considered that the site may be regarded as suitable for the proposed end use.

Inhalation exposure of future residents to asbestos fibres:

- 1.27 Asbestos was not identified on the adjacent site during the site investigation and subsequent laboratory analysis.
- 1.28 It is recommended that once development plans are finalised and all areas of the site are accessible, site specific investigation and exploratory holes together with asbestos screening are undertaken in order to confirm any possible extent of potential asbestos contamination.

Uptake of contaminants by vegetation potentially inhibiting plant growth:

- 1.29 The results have been compared with the GAC for this linkage. The results indicate that a relevant pollutant is unlikely to exist associated with phytotoxic effects.

Impact of organic contaminants on potable water supply pipes:

- 1.30 For initial assessment purposes, the results of the investigation have been compared with the GAC 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).
- 1.31 The results indicate that a relevant linkage is unlikely to exist associated with organic contaminants and therefore polyethylene (PE) and/or polyvinyl chloride (PVC) water supply pipes are expected to be suitable for use on the development.
- 1.32 It should be noted that at the time of the adjacent site's 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 will 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.

Leaching of contaminants to surface water receptors and groundwater in principal aquifer:

- 1.33 The leachate results have not indicated any concentrations of contaminants exceeding the relevant GACs.
- 1.34 Soil samples were not analysed for leachable PAH or TPH. However, concentrations at the site are typical of those recorded in natural strata and topsoil. Furthermore, groundwater analysis reports concentrations below the GAC. Therefore, risks associated with the leaching pathway are considered acceptable.

Migration of dissolved phase contaminants to wider principal aquifer body:

- 1.35 Samples of groundwater will be taken and tested for the presence of contaminants across the site.
- 1.36 The analytical results on the adjacent land have indicated that contaminant concentrations are below the GAC indicating any pollutant linkages associated with contaminants in the dissolved phase are incomplete.

Ground gas:

- 1.38 The results have been assessed in accordance with the guidance provided in BS8576 and CIRIA Report C665. In the assessment of risks and selection of appropriate mitigation measures, both reports highlight the importance of a conceptual model.
- 1.39 CIRIA C665 identifies two types of development, termed Situation A (modified Wilson and Card method), appropriate to all development excluding traditional low-rise construction, and Situation B (National House-Building Council, NHBC) only appropriate to traditional low-rise construction with ventilated sub-floor voids.

- 1.40 Both methods are based on calculations of the limiting borehole gas volume flow for methane and carbon dioxide, renamed as the gas screening value (GSV). The GSV (litres of gas per hour) is calculated by multiplying borehole flow rate (litres per hour) and gas concentration (percent by volume).
- 1.41 In both situations the GSV thresholds are guideline values and not absolute. The GSV thresholds may be exceeded in certain circumstances, if the site conceptual model indicates it is safe to do so. Similarly, consideration of additional factors such as very high concentrations of methane, should lead to consideration of the need to adopt a higher risk classification than the GSV threshold indicates.
- 1.42 The site is to be redeveloped with residential properties and therefore falls under Situation B.
- 1.43 Situation B is a characterisation system developed by the NHBC (Boyle and Witherington, 2007), which relates only to low rise housing development constructed with a clear ventilated underfloor void. The system provides a risk-based approach that is designed to allow an identification of the required gas protection measures for low-rise housing by comparing the measured gas emission rates to generic "Traffic Lights". The Traffic Lights include typical maximum concentrations that are provided for initial screening purposes and risk-based GSVs for situations where the typical maximum concentrations are exceeded. Based on the typical maximum gas concentrations and the GSVs, the appropriate Traffic Light, ranging from Green through Amber 1 and Amber 2 to Red, is determined from Table 8.7 of CIRIA C665.
- 1.44 The site is to be redeveloped with residential properties and therefore falls under Situation B. The gas monitoring data on the adjacent land identified a maximum methane concentration of <0.1% and a maximum concentration of carbon dioxide of 1.6%. A maximum gas flow rate of 0.03 l/hr has been recorded. The calculated GSV for methane is 0.0001 l/hr and the GSV for carbon dioxide is 0.00048 l/hr.
- 1.45 For both types of development, CIRIA C665 provides details of the typical scope of protective measures to be adopted for the relevant site characterisation.
- 1.46 On the basis of the calculated GSVs, and the findings of the monitoring programme, the site has been given a preliminary classification of Characteristic Situation 1 (CS-1); a negligible gas regime.
- 1.47 The gas monitoring programme carried out to-date provides some evidence for an initial assessment of redevelopment requirements. However, it is considered that the monitoring undertaken during the adjacent site's investigation may not have established the 'worstcase' scenario and therefore further monitoring is recommended to characterise adequately the ground gas regime. Once development plans have been finalised and all areas of the site are accessible, additional gas monitoring would be recommended in order to establish the 'worst-case' gas regime for the site, and may also allow for and phasing / zoning of the site.