



GEOTECHNICAL
ENGINEERS

Delivering Innovative Solutions

Geo-environmental Assessment

Davidsons Developments

Lutterworth Road, Burbage

25th March 2022

Ref: PJSG21-58-DOC-01

Executive Summary

Environmental Risk Assessment Summary

Human Health Risk Assessment	Based on the contamination testing that has been carried out on the site, the risk assessment has indicated that the site poses a negligible risk to Human Health receptors. The natural topsoil and subsoils are considered to be suitable for retention / re-use on site if geo-technically suitable, subject to compliance with a Materials Management Plan (MMP).
Controlled Waters Risk Assessment	During the investigation, no significant evidence of contamination was identified below the site and no evidence of Made Ground was identified. The risk to groundwater / surface water associated with the site is considered very low to negligible and no further risk assessment considered to be warranted in that regard.
Ground Gas / Vapour Risk	Based on encountered ground conditions, gas protection measures are not considered to be required for the site. This recommendation should be confirmed with the relevant authorities prior to construction. No evidence vapours have been identified on site; no further assessment or mitigation is therefore required in that regard.
Ecological Risk	Potential impacts from contamination sources is considered negligible. However, the impact to ecological receptors from proposed construction activities should always be considered.

Geotechnical Assessment Summary

Foundations	Traditional strip / trenchfill foundations are generally considered appropriate for the proposed development bearing within firm to stiff cohesive and medium dense to dense granular deposits encountered beneath the site, subject to consideration of the loads imposed. An allowable design bearing pressure of 100kN/m² is recommended for trenchfill foundations (up to 1m wide), bearing uniformly in the firm cohesive deposits at a depth of 1m. An allowable design bearing pressure of 125kN/m² is recommended for trenchfill foundations (up to 1m wide), bearing uniformly in the firm to stiff cohesive deposits and/or the medium dense to dense granular deposits at a depth of 2m. At this stage, based on the illustrative site layout a significant number of plots are situated in close proximity to the site boundaries / on-site hedgerows and therefore foundation depths are likely to exceed 2.5m due to tree influence. In addition, unstable and /or low strength strata have been encountered within the southeast of the site. It is considered likely that plots coinciding with these areas will likely require a piled foundation solution.
Floor Slabs	At this stage it is anticipated that both ground bearing and suspended floor slabs may be suitable for the site, subject to developer preference and further assessment of proposed ground levels / tree influence.
Drainage	The cohesive geology encountered across the site would suggest that soakaway drainage is not considered feasible; an alternative drainage solution is therefore likely to be required. The advice of a Drainage Engineer should however be sought to confirm this preliminary assessment prior to construction.

Concrete	Soil results indicate Design Sulphate Class DS-1 and Aggressive Chemical Environment for Concrete Class AC-1 should be used for design purposes on all shallow foundations across the site.
Roads & Hardstanding	Based on the ground conditions identified and testing undertaken, it is considered that a preliminary CBR design values of 2 - 5% should be achieved for road construction design purposes for near surface deposits underlying the site.
Recommendations	
Delineation of any soft cohesive deposits and / or loose granular deposits identified within which coincide with proposed plots. [REDACTED]	
Limited SI was undertaken within the northern field (WS04 – WS06) and within the southern central portion of the site. It is recommended that further SI is undertaken in these locations to obtain further ground data.	
Detailed foundation design. [REDACTED]	
Further in-situ CBR testing is recommended at formation level once development proposals have been established.	
The drilling of deeper boreholes may be required to aid the design of piled foundations.	
Re-use of materials on-site should be controlled by a CL:AIRE approved Materials Management Plan (MMP).	



Document Issue Record

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Status	Revision	Date of Issue	Author	Checked	Approved
Final	-	25/03/22	Nicholas Brown MSc AMIEnvSc	Vinny Hallifield (BSc Hons)	Martin Parker BSc (Hons) ICIQB

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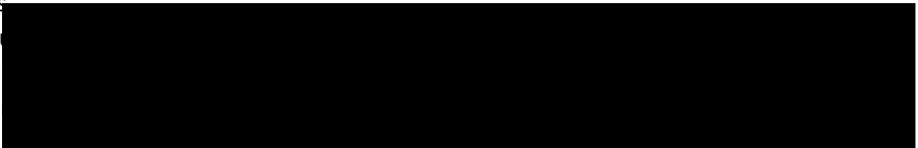


Drawings

PJSG21-58-DR-001 –Site Location Plan
P17-1701_96-1 Rev. C – Illustrative Masterplan
PJSG21-58-DR-002 – Site Features Plan
PJSG21-58-DR-003-A – Exploratory Hole Location Plan

Appendices

Appendix A: Site Photographs
Appendix B: Exploratory Hole Logs
Appendix C: Chemical Testing Results
Appendix D: Geotechnical Testing
Appendix E: Gas and Groundwater



1. Introduction

1.1 Instruction

In December 2021, PJS Geotechnical Engineers Limited (PJSG) were instructed by Davidsons Developments (the Client) to undertake a Geo-environmental Assessment at land off Lutterworth Road, Burbage, Leicestershire, LE10 2DW (the site).

A Site Location Plan (PJSG21-58-DR-001) is included within the Drawings Section of this report.

1.2 Proposed Development

Redevelopment proposals for the site are understood to comprise a residential development with gardens and areas of soft landscaping used as Public Open Space (POS).

An Illustrative Masterplan (P17-1701_96-1 Rev. C) has been provided by the client and is presented within the Drawings Section.

1.3 Objectives

The objectives of this assessment are detailed below:

Table 1-1 Objectives

Objectives
Confirm the suitability of the site for the proposed residential development, taking into account the ground conditions and contaminative status of the site.
Undertake a generic quantitative risk assessment to confirm the findings of the Initial Conceptual Site Model (ICSM).
Revision and update of the ICSM.
Identify suitable foundation depths and sub-structure design solutions.
Identify any potential geo-environmental issues that may cause abnormal development costs.
Make recommendations for any further investigation / remediation deemed necessary.

1.4 Previous Reports

The table below provides details of the relevant information sources which have been made available to PJSG for review in preparation of this report:

Table 1-2 Information Sources

Report Reference	Produced By	Report Name	Date
P9034	GRM	Phase 1 Site Appraisal (Desk Study)	August 2019

2. The Site

This section provides a brief overview of the site in its present condition, including the site's existing layout, general location and near surrounding land use.

A brief summary of the site's description is presented below in Table 2-1. The full details of the site are presented in the Phase 1 Desk Study Report referenced in Table 1-2.

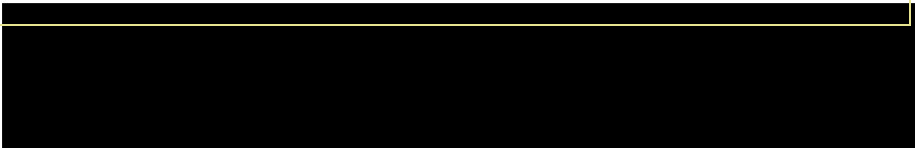
A Site Features Plan (PJSG21-58-DR-002) is presented in the Drawings Section of this report. Photographs of the site are presented in Appendix A.

Table 2-1 Summary of Site Info

Specifics	Details
<i>Location</i>	Lutterworth Road, Burbage, Leicestershire, LE10 2DW
<i>National Grid Reference</i>	444698E, 291962N.
<i>Approximate Site Area</i>	8.6 Hectares (Ha).
<i>Topography</i>	The topography of the site generally slopes down from the northwest (~118m AOD) to the southeast corner (~106m AOD).
<i>Current Land Use</i>	Agricultural grass land comprising 7 No. separate fields. A number of fields comprise visible evidence of historic ridge and furrow farming techniques. It is understood that certain areas of the site are to be left undeveloped in order to preserve the ridge and furrow land. In addition, an area of land within the north has been designated as being 'species rich grassland' and 'of the highest conservation value.' It is therefore proposed that the grasses / topsoil within this area, is relocated to an adjacent field (not within this study site) prior to the development commencing.
<i>Existing Buildings / Retaining Structures</i>	None observed.
<i>Services / Utilities</i>	Overhead electric cables and a sewer are present in the north of the site, running parallel (west to east) with an existing hedgerow which divides the central and northern fields. An underground foul rising main is recorded in the southern portion of the site, running in a north easterly to south westerly direction. In addition, an unknown service has been identified during a geophysical survey, the service is approximately located in the centre of the site, running in north easterly to south westerly direction.
<i>Identified Potential Contamination Sources from Reconnaissance</i>	No significant sources were identified during on-site reconnaissance, as detailed within the Phase 1 Desk Study report.
<i>Vegetation / Invasive Plants</i>	Assessment of invasive plant species is beyond the scope of this report.
<i>Site Boundaries</i>	The site is bounded by mature trees and hedgerows on all sides.



Specifics	Details
<i>Surrounding Land Use</i>	North –Residential properties. East – Agricultural land. South – Transport Depot / M69. West – Lutterworth Road / Residential properties.
<i>Surface Water Features (Site & Vicinity)</i>	Several ditches are present on-site running alongside hedgerows, significant water was noted in the ditch located between the western and central field, flowing in a south easterly direction. The remaining ditches were noted to be dry.



3. Site Setting

3.1 Summary of Desk Study Information

The Desk Study report (referenced in Table 1-2) has been reviewed to provide a summary of the sites setting as detailed in Table 3-1 below.

It should be noted that the Desk Study undertaken by GRM comprised a larger site area and included the field directly to the east of this study site. Only pertinent information to the study site will be included in the below summary.

Table 3-1 Summary of Site Info

Historical Summary	
<i>Site</i>	The land [REDACTED] the present day. Several ponds have been identified on historical maps, however are no longer present on-site indicating that the ponds have been backfilled.
<i>Surrounding area</i>	The surrounding area of the site has also comprised predominantly agricultural land. Residential development has occurred directly to the north and west of the site. Features of note in close vicinity to the site include a derelict building adjacent to the northeast, a former hosiery factory located to the north west, a motorway cutting is located directly to the south of the site. A former sewage works was present ~250m to the east of the site. It is considered that all identified historical features are localised in extents and do not represent a significant risk to the site.
Geological Summary	
<i>Made Ground</i>	None recorded.
<i>Superficial Geology</i>	The majority of the site is shown to be underlain by Oadby Member deposits comprising Diamicton. Wolston sand and gravel deposits are recorded on the extreme western extents of the site. Bosworth Clay Member comprising clay and silt are recorded in the northeast and southeast of the site.
<i>Bedrock Geology</i>	Mercia Mudstone Group (Mudstone).
<i>Faults</i>	None recorded.
Hydrogeology	
<i>Aquifers</i>	• Unproductive (Bosworth Clay) • Secondary Undifferentiated (Oadby Member) • Secondary A (Wolston Sand and Gravel) • Secondary B (Mercia Mudstone Group)



<i>Source Protection Zones (SPZ)</i>	None recorded.
<i>Potable Abstractions</i>	None recorded.
<i>Groundwater Flow</i>	Groundwater is likely to flow towards the east / southeast taking into consideration the local topography.
Hydrology	
<i>Surface Water Features</i>	Several field drainage ditches are located on-site. A pond is recorded ~200m east of the site.
<i>Surface water flow</i>	Water flow recorded [REDACTED]
Mining & Ground Constraints	
<i>Mining</i>	The site is at negligible risk from coal mining / non-coal mining activities.
<i>Potential for Natural Ground Subsidence</i>	A moderate risk rating has been identified for compressible deposits likely to be associated with the Bosworth Clay Member. Compressibility and uneven settlement hazards may be present. Very low to negligible remaining ground stability hazards have been identified on-site.
<i>Radon</i>	The site is not within a radon affected area as less than 1% of properties are above the action level. Therefore, no radon protection measures are required within new dwellings.
<i>UXO</i>	The site has a low risk in regard to UXO. No further assessment required.
Environmental Records	
<i>Regulatory Records</i>	No significant environmental hazards, that are considered likely to pose a potential risk to the site have been identified.
<i>Landfills / waste sites</i>	No landfills or waste sites are recorded within 250m of site.



4. Preliminary Contamination Risk Assessment

In accordance with CLR11, a preliminary risk assessment (PRA) was completed for the site as detailed in the Phase 1 Desk Study report referenced in Table 1-2. The PRA is the first tier of risk assessment that develops the Initial Conceptual Site Model (ICSM) to establish whether there are any potentially unacceptable risks associated with the site.

The ICSM was developed based on the commonly adopted source-pathway-receptor (S-P-R) model as detailed within ICRM 2020. This was carried out in the context of the proposed development and potential contaminant linkages which may represent a risk to identified receptors. The ICSM was refined within the Phase 1 Desk Study report and reproduced and refined for the purpose of this assessment.

4.1 Potential Sources of Contamination

Sources (S); These are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g. fuel storage tanks). Sources relevant to the site identified within the Phase 1 Desk Study report are detailed in Table 4-1.

Table 4-1 Potential Sources of Contamination

Source Number (S)	Potential Sources	Inorganic Contaminants	Organic Contaminants
S1	On-Site: Potential for localised made ground from former backfilled ponds / vicinity of the site.	Naturally occurring metals, pH and possible asbestos fibres / fragments.	-
S2	On-Site: Potential for localised spills of fuels / oils from farm machinery using the land.	-	Poly-Aromatic Hydrocarbons (PAH), Total Petroleum Hydrocarbons (TPH), BTEX and Volatile Organic Compounds (VOCs).
S3	On-site: Agricultural Soils	Naturally occurring metals, pH and possible asbestos fibres / fragments.	-
S4	On-site: Natural Subsoils	Potentially elevated sulphates	-
S5	Off-site: ACMs falling onto site associated with disused building/s adjacent to the northeast boundary.	Asbestos fibres / fragments.	-

An off-site hosiery factory (to the northwest) and sewage treatment works (~250m east) were identified in the Phase 1 Desk Study. It is considered that these features will have no impact to site associated with the previous land uses and will therefore not be discussed further.



4.2 Potential Sources of Ground Gas & Vapours

It is considered that the following potential sources of ground gas / vapours may be present on site and in the surrounding area as detailed in Table 4-2.

Table 4-2 Potential Sources of Contamination

Source Number (S)	Location	Details	Source Generation Potential (CIRIA C665)
S1	On-site & off-site: Potential for localised made ground from former backfilled ponds / vicinity of the site.	Any Made Ground has the potential to generate elevated ground gas at the site. Particularly if any putrescible material is present.	Generally, very low but would be dependent on nature of any materials identified. Source is likely to be very localised
S3	On-site: Spills / leaks of fuels / oils from the various sources identified in Table 7-3.	The potential exists for localised VOCs to be present within any soils and / or groundwater below the site from localised spills of fuels / oils from farm machinery using the land.	Generally, very low and localised.
S6	On-site & off-site: Possible peat stratum in Wolston Sand and Gravel.	Peat has the potential to generate elevated ground gas.	Generally, very low and localised.

4.3 Potential Contaminant Linkages

In conclusion, it was considered that the site represents a low Environmental Risk for future residential redevelopment from an environmental perspective.

All plausible pathways (P) between the potential contaminant sources (S) and the receptors (R), i.e. S-P-R linkages, have been identified and are outlined in the ICSM presented in Table 4-3 overleaf using the information gathered within the Phase 1 Desk Study report.

Specific contaminants relevant to the identified source are listed in Table 4-1 and potential sources of ground gas are listed in Table 4-2 above.

Based on the identified sources of contamination and ground gas, the ICSM detailed in Table 4-3 (tabular form) provides details of the potential contaminant linkages that were identified during the PRA.

It was considered that the proposed development presented a **low** risk to Human Health and **very low** risk to Controlled Waters receptors. It is recommended that a ground investigation is undertaken to quantify the contaminant linkages and identify appropriate mitigation measures should they be required.