LAGAN HOMES LIMITED

WEST RATBY, BURROUGHS ROAD, RATBY

DESK STUDY AND PRELIMINARY RISK ASSESSMENT

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CONTENTS

APPENDICES

DRAWINGS

1.0 INTRODUCTION

1.1 Introduction

1.1.1 This report has been prepared in accordance with instructions received 4 October 2023 from Laraine Southwood (Head of Planning, Lagan Homes Ltd). This commission has been undertaken in accordance with proposals detailed within an email dated 20 September 2023 from Lindsey Geddes of Travis Baker Ltd (TB).

1.1.2 This report has been prepared to provide an appraisal of ground conditions and identify potential development constraints in respect of a proposed development at situated to the west of Ratby surrounding Burroughs Road in Ratby, Leicestershire (approximately centred at National Grid Reference 450745, 306000), herein referred to as 'the site'. It is understood that development proposals for the site include the erection of new homes alongside access, landscaping, drainage and other associated development works.

1.1.3 The contamination assessment has been undertaken in accordance with the risk assessment framework presented in 'Land Contamination Risk Management (LCRM)' (Environment Agency, 2020). LCRM requires that a phased approach be followed to assess the risk of ground contamination. This phased approach involves the production of an initial 'preliminary risk assessment' (PRA). If necessary, the PRA would be followed by an intrusive investigation and quantitative risk assessment, followed in turn by the design, implementation and verification of remedial works should any contaminants be found in unacceptable concentrations.

1.1.4 The report has been compiled using readily available sources of information from local archives and relevant websites, and supplemented by a site walkover and by the procurement of a site-specific Groundsure Report. A list of information sources used within this report is provided in Appendix 1. A complete copy of the Groundsure Report is attached as Appendix 2.

1.1.5 We understand that this report is to be submitted in support of a planning application for the development of residential properties with associated gardens, landscaping, infrastructure and areas of public open space.

1.1.6 This report has been prepared for the sole internal use and reliance of Lagan Homes Limited. This report shall not be relied upon or transferred to other parties without the written authorisation of Travis Baker Ltd (TB).

1.1.7 Some of the information referenced and included in this report has been provided by third parties. These include records readily available in local archives, which are continually changing and sometimes incomplete. TBGE have carried out reasonable care in examining and interpreting this information to confirm its reliability, however, we cannot guarantee the authenticity of this information.

2.0 SITE SETTING AND SITE HISTORY

2.1 Site Location and Description

2.1.1 The site is located immediately west of the village of Ratby and is divided into two by east – west traversing Burroughs Road. The site is approximately centred at National Grid reference 450745, 306000 and is shown on Drawing No. 23120-GE01. Hereafter in this report, 'the site' refers to the area within the red line boundary indicated in the aforementioned drawing.

2.1.2 A Travi Baker Engineer conducted a site walkover on 12 October 2023. The main site features observed are outlined in the following paragraphs. Due to the size of the site and for ease of reference, we have assigned numbers to each of the fields, as illustrated on Drawing No. 23120-GE02. The pertinent site features are recorded on Drawing No. 23120-GE03 and are summarised in the following sections. A selection of photographs obtained during the site walkover is included as Appendix 3.

Overview

2.1.3 The site generally forms an undulating topography comprising thirteen fields of undeveloped agricultural land primarily comprising grassland and are bound by a combination of broad-leaf trees and hedgerows. For ease of reference the fields have been numbered 1 to 13, as illustrated on Drawing No. 23120-GE02. Generally, the site slopes downwards to the south west with levels varying between approximately 112m above ordnance datum (AOD) in the north east and 83m AOD in the south west.

Field 1

2.1.4 Field 1 is located in the south west of the site. The eastern boundary of field 1 comprises a dry drainage ditch adjacent to a hedgerow. The remaining boundaries comprise a combination of post and rail / post and wire fencing with woodland beyond along the southern boundary and southern extent of the western boundary. Part of a tributary to Rothley Brook is present to the south west forming a bank that is approximately 2m vertical at its peak. Burroughs Road is present beyond the northern boundary; a gap in the hedgerow off Burroughs Road provides access into the field.

2.1.5 A small stockpile of soil is present in the north of field 1 near the entrance. A public footpath crosses the south east corner with notably softer ground in the south. The highest point of Field 1 lies in the north eastern area and the site slopes downwards towards the south, east and west. There are a few steep sections of the slope, particularly in the south of the site (up to 7o). The bank of Rothly Brook, immediately adjacent to part of the southwestern boundary shows signs of bank erosion with exposed soil evident beneath the tree line.

Field 2

2.1.6 Field 2 is the southern-most field and is currently used as grazing land. Field 2 is bound by a tributary of Rothley Brook to the south that is cut into the hillside with areas by rush grass which may be indicative of potentially long-term boggy / wet ground. The east of field 2 is typically hummocky showing evidence of ridge and furrow farming (also be seen in fields 3, 6 and in the east of field 5). Overhead electricity cables cross the far east of Field 2 trending approximately north/south.

Field 3

2.1.7 Field 3 consists of a ridge and furrow grass-covered field. A steep gradient is present in the south of field 3 with a drainage ditch present along the west boundary. This is connected to a small ditch overlapping fields 3 and 4. Overhead electricity cables cross Field 3 trending approximately north/south approximately central to the field.

Field 4

2.1.8 Field 4 comprises grassland sloping from north to south. A number of trees are recorded in the west of Field 4 with evidence of a couple stumps remaining from felled trees. An area of boggy ground was observed adjacent to the drainage ditch along the eastern boundary. A public right of way crosses Field 4 trending approximately north east / south west.

Field 5

2.1.9 Field 5 consists of grass; parts of the eastern field area consist of ridge and furrow although the majority is slopes at a gentle gradient downwards to the south. Field 5 includes a stockpile of cattle manure in the centre that is being added to and a small linear dry ditch crossing the north west of the field. A further dry ditch is located along the southern boundary which appears to coincide with a former pond on the historic mapping.

2.1.10 The field is bound by a dry drainage ditch and hedgerow along the western boundary and hedgerows along the northern, southern and eastern boundaries. Burroughs Road is present beyond the northern boundary; a gap in the hedgerow off Burroughs Road provides access into the field.

Field 6

2.1.11 Field 6 comprises a grassed ridge and furrow field sloping downwards to the south. A small ditch is present in the south east of field 6 which appears to coincide with a former pond. The field boundaries are marked by hedgerows. Burroughs Road is present beyond the northern boundary.

Field 7

2.1.12 Field 7 comprises grass and slopes gently from north to south. An area of dense vegetation is present in the south eastern corner. Overhead electricity cables pass over the east of the field trending approximately north / south. There was no current evidence of the former structure or allotment use observed during the walkover.

Field 8

2.1.13 Field eight lies in the far east of the site and comprises soft landscaped grassland (marked as a recreation ground on the plan provided). Two separate areas of play equipment are visible in the north west and east of the site. A path is present adjacent to the eastern boundary which enters the field in the north eastern corner and joins Burroughs Road in the south; the road passes through the south of area 8; the small area to the south of the road comprises woodland. The far south western corner of the field has dense vegetation. A circular service cover was recorded in the south of the site, adjacent to Burroughs Road. A gated vehicular entrance is present off Burroughs Road in the south. The western boundary is marked by paladin fencing.

Field 9

2.1.14 Field 9 is grassed with a path crossing the north of the field, trending approximately east / west. The field is at a topographic high of c. 109m AOD falling towards the south east at c. 101m AOD. Overhead electricity cables pass over the east of the field trending approximately north / south. A series of manhole covers were observed in the south of the site which suggest the presence of an underground service, possibly crossing the south western corner of Field 9.

Field 10

2.1.15 Field 10 is characterised by undulating ground. The southern boundary is marked by Burroughs Road; a public right of way passes through field 10 connecting the central southern area and the central eastern boundary (to field 9). A series of inspection chambers were observed which suggests perhaps two linear services within the area (central and eastern area). An area of boggy ground was observed in the south of field (at the topographical lowest point); a 1m deep drainage ditch was present immediately south of the boggy area, adjacent to Burroughs Road. Residential development is taking place immediately north of field 10.

Field 11

2.1.16 Field 11 is split into two sections by a gravel public footpath denoted by a wooden fence. The larger northern area consists of grassed ridge and furrow and has a Nissen style hut in the north consisting of corrugated metal sheets. The western area of Field 11 appears to be in use as a compound area including site offices and materials storage for the adjacent development. Overhead electricity cables are recorded to cross the central northern area, trending approximately north / south.

2.1.17 The southern area of field 11 comprises grass and includes a small stockpile of vegetated soil and a small dilapidated wooden shed adjacent to the southern boundary. The roofing of the wooden shed was suspected to contain possible asbestos containing materials (corrugated cement sheeting).

Field 12

2.1.18 Field 12 consists of a woodland which appears to be managed by the Woodland Trust. There are a series of paths through the woodland. A public footpath forms the southern field boundary, parts of which were notably boggy. The northern, eastern and western boundaries formed by a combination of post and wire fence and hedgerow.

Field 13

2.1.19 Field 13 is characterised by arable farm land with a strip of woodland in the eastern field area. A tributary of Rothley Brook forms the northern boundary and passes through the east of the site; a ford is present on Burroughs Road immediately south of the site. Two vegetated stockpiles are present in the far east of the site; a path passes between the woodland and the aforementioned stockpiles.

2.1.20 No significant evidence of fly-tipping, or visual or olfactory evidence of any gross contamination was identified during the site walkover.

2.2 Surrounding Area

2.2.1 Agricultural fields continue beyond the site boundaries to the south and west. Modern residential homes, comprising two-storey buildings with associated driveways and private gardens are located adjacent to the east of the site.

2.3 Site History

2.3.1 The history of the site is shown on successive editions of Ordnance Survey County Series and National Grid maps, as well as aerial photography, provided in the Groundsure report. Copies of the maps consulted are included in Appendix 1. Satellite photography, accessed via Google Earth Pro, has also been reviewed where available. For ease of reference, the pertinent changes shown between successive maps have been summarised in the following paragraphs.

2.3.2 The earliest available historical mapping dated 1885 shows the site as a series of fields. The stream is present which appears to follow the same approximate route as current day. There are a series of footpaths which cross the site and a few ponds are recorded locally. There are no significant changes until the 1928-1931 mapping which records part of the eastern site as being used as allotment gardens. Some of the ponds that were previously recorded are no longer shown. The 1968 edition of the mapping shows a ford located in the south west of the site on the recorded stream. There are no significant changes until the 1973 mapping which no longer shows the southern allotment garden area. The 1989-90 map indicates the far east of the site as a recreation ground. The historic maps from 2001 onwards do not appear to show the allotment gardens; Google Earth also suggests that the allotment field had been converted to agricultural use.

2.3.3 The first available mapping dated 1885 shows the majority of the surrounding area to be occupied by agricultural fields. The village of Ratby is shown to the east for the site; Martinshaw Woods is shown to the north. An unnamed stream is recorded south of the site. A 'Supposed Encampment' is recorded approximately 500m to the west. The West Bridge Branch of the Midland Railway passes to the south of the site, located approximately 600m to the south east at its closest point.

2.3.4 The 1901 edition of the mapping shows the encampment to the south west to be a Roman Camp. Immediately to the north east of the site, a Hosiery Manufactory is located with several associated pumps. The 1928 edition shows little change with the exception that the camp to the south west is called Bury Camp and a stone works is shown approximately 600m to the south of the site adjacent to the railway.

2.3.5 The 1964-1968 mapping shows the M1 to be under construction approximately 500m to the north of the site. The hosiery manufactory is no longer marked however the buildings are in similar configuration. The 1968 edition of the mapping shows the construction of the M1 to have been completed and significant expansion of Ratby to the east and south east of the site which continues until the most recent mapping of 2023.

3.0 RECORDED GEOLOGY, MINING, HYDROGEOLOGY, HYDROLOGY AND RADON

3.1 Recorded Geology

3.1.1 We have consulted published geological mapping for the area via the online British Geological Survey (BGS) 'Geology of Britain Viewer', 'GeoIndex', 'Lexicon of Named Rock Units' and 'Borehole Scans' database. The results of our research are described below.

3.2 Superficial Deposits

3.2.1 The 'Geo-index' mapping does not record the presence of any artificial or worked ground. Localised areas in the north of the site are recorded to be overlain by superficial materials consisting of diamicton of the Thrussington Member. These deposits are variable in nature but typically comprise brown to reddish-brown gravelly clay with sand and silt. These deposits are recorded to be present in the northern and eastern parts of the site.

3.3.2 A narrow band area of alluvium, comprising clay, silt, sand and gravel, is recorded in the west of the site associated with the stream. To the east and west of the alluvium and the southern extent of the site are river terrace deposits, recorded to consist of sand and gravel.

3.3 Recorded Bedrock

3.3.1 The BGS Geology of Britain online mapper and GeoIndex indicates that site is underlain by three geological units. The north and eastern portions of the site are recorded to be underlain by the Edwalton Member with the material comprising red brown and greenish grey mudstone and siltstone with beds of dolomitic siltstone and fine grained sandstone.

3.3.2 The southern and western extents of the site are recorded to be underlain by the Gunthorpe Member which comprises red brown mudstone with dolomitic siltstone and fine grained sandstone with gypsum veins and nodules.

3.3.3 A thin band of the Cotgrave Sandstone Member is recorded between the Edwalton Member and the Gunthorpe Member which is recorded to comprise fine to medium grained pale greenish grey sandstone interbedded with mudstone and siltstone with gypsum nodules.

3.3.4 There are no BGS borehole records available for the site itself. There are boreholes available local area, however, there are none within the immediate vicinity of the site of similar geology. Boreholes to the west of the site shows rubble and fill material overlying stiff red brown clay with mudstone bands overlying sandstone. Boreholes to the north east of the site show a series of red brown gravelly clay with sandy bands, and mudstone, siltstone and sandstone gravel.

3.4 Mining

3.4.1 The Coal Authority's on-line Interactive Map (consulted September 2023) indicates that the site and surrounding area are not located within an area for which a coal mining reporting is required. Furthermore, BGS mapping for the area does not indicate the presence of shallow coal bearing strata below or with the general vicinity of the site.

3.4.2 Based on the underlying geology, the site is not considered to be at risk as a result of past underground coal mining.

3.4.3 Furthermore, the historical maps and Groundsure report show no evidence of either below-ground or open-cast mining for clay, sand, gravel or other minerals.

3.5 Radon

3.5.1 Reference has been made to UK Radon (part of the UK Health Security Agency). Based on the mapping, the maximum radon potential for the grid square where the site lies is 1-3%. On this basis, new properties constructed on the site will not require radon protective measures.

3.6 Hydrogeology

3.6.1 Data from the 'Magic' Map Application (managed by Natural England) and the Groundsure Report have been consulted to provide details on aquifer designation and Groundwater Source Protection Zones for the site area.

3.6.2 Where present, the Thrussington Member recorded to overlie parts of the northern site area are classified as a Secondary Undifferentiated aquifer. The alluvium and river terrace deposits recorded in the west of the site are classified as a Secondary A aquifer. The underlying Edwalton Member and Gunthorpe Member are classified as Secondary B aquifers. The Cotgrave Member is classified as a Secondary A aquifer.

3.6.3 The site is not recorded to be within a groundwater source protection zone.

3.7 Hydrology

3.7.1 There is a stream recorded within the site which intersects the western fields. The stream flows in a south easterly direction to the west of the site and joins another stream along the southern boundary.

3.8 Flood Risk

3.8.1 The Flood Map for Planning, produced by DEFRA and the Environment Agency and consulted November 2023 states that the majority of the site lies within 'Flood Zone 1'. However, the far south of the site lies within 'Flood Zone 2' and Flood Zone 3'. Flood Zone 2 indicates a 'medium' risk of with an annual probability of fluvial flooding of between 1% and 0.1%. Flood Zone 3 indicates a 'high' probability of flooding with greater than 1% chance of flooding from fluvial sources.

3.8.2 A Flood Risk Assessment (FRA) is recommended to assess the risk from fluvial flooding.

4.0 ENVIRONMENTAL SETTING

4.1 Groundsure Report

4.1.1 Information from the Environment Agency (EA) and other statutory authorities has been obtained via a site-specific Groundsure report, dated 27 October 2023. The report provides environmental information for the site and up to 2km around the site boundary. The report includes details of nearby abstraction and discharge consents, recorded pollution incidents, licensed waste sites, and sites that have, or historically have had, potentially contaminative uses or related issues. A copy of the Groundsure Report is included as Appendix 2.

4.2 Discharge Consents

4.2.1 There is 1 recorded discharge consent within 500m of the site which relates to 'miscellaneous' surface water entering Rothley Brook approximately 150m south east of the site.

4.3 Licensed Pollutant Release (Part A(2)/B)

4.3.1 The Groundsure Report indicates there are no records of licensed pollutant releases within 500m of the site.

4.4 Recorded Pollution Incidents

4.4.1 There are no records included in the Groundsure report relating to pollution incidents within 500m of the site.

4.5 Abstraction Licences

4.5.1 There are no recorded groundwater abstractions within 250m of the site. However, there are seven records listed within 2km of the site associated with spray irrigation or general farming and domestic use, all of which are listed as 'historical', suggesting that they are no longer in use.

4.5.2 The Groundsure report states that there are no surface water abstractions within 1km of the site. However, there are two records of surface wate abstractions approximately 1.5km north of the site, both of which are listed as 'active'. Records suggest that water can be used from a lake fir spray irrigation and general farming & domestic purposes.

4.6 Historical Landfill Sites and Registered Landfill Sites

4.6.1 There are no recorded historical or registered landfill sites on or within 500m of the site.

4.7 Waste Exemptions

4.7.1 There are fifteen recorded waste permitting exemptions within 500m of the site at various locations around the site. The closest permit exemption relates to a property approximately 130m south east of the site. None of the waste permit exemption activities listed are considered to affect the site.

4.8 Licensed Waste Sites

4.8.1 The Groundsure Report does not hold any details of any licensed waste treatment sites within 500m of the site.

4.9 Historical Potentially Contaminative Uses

4.9.1 The Groundsure has fifteen entries for historical potentially contaminative land uses recorded within 500m of the site based on historic mapping. These appear to relate to eight locations (shown over successive mappings). The closest potentially contaminative site is associated with a hosiery manufacturers adjacent to the site. Other uses include a smithy, cuttings, unspecified pits, stone works, bus depot and other unspecified works.

4.10 Recent Potentially Contaminative Uses

4.10.1 The Groundsure has six entries for recent potentially contaminative land uses recorded within 250m of the site. The features include electricity substations (6m east, 30m south east and 143m north east), gas governor and business park (both 18m south east) and a garage (90m east).

4.10.2 There are no current or recent petrol filling stations within 500m of the site.

4.10.3 Based on the features and their relative locations, the aforementioned land uses are considered unlikely to significantly impact the site.

4.11 Historical Tank Database

4.11.1 There are records of nine unspecified tanks within 500m of the site, the closest of which is 130m north east of the site. These are considered unlikely to affect the site due to the stated distances.

4.12 Energy Features

4.12.1 There are nine historical electricity sub-stations listed within 500m of the site which appear to relate to four features over several map editions. The closest sub-station is approximately 140m north east of the site.

4.12.2 The Groundsure report holds records of 3 current electricity sub-stations with 250m of the site, two of which lie within 30m of the site. The closest electricity sub-station is approximately 6m east of the site.

4.13 Historical Military Sites

4.13.1 There are no historic military sites recorded within 500m of the site.

4.14 Historical Garages

4.14.1 There are three records of historical garages within 500m of the site relating to two locations to the east. The closest site is located approximately 28m east of the site. Given the proximity of the garages to the site, it is possible that contamination may have potentially migrated on to site.

4.15 Control of Major Accident Hazard Sites (COMAH)

4.15.1 There are no Control of Major Accident Hazard Sites within 500m of the site.

4.16 Notification of Installations Handling Hazardous Substances (NIHHS)

4.16.1 There are no Notifications of Installations Handling Hazardous Substances within 500m of the site.

4.17 Sites Determined as 'Contaminated Land'

4.17.1 No areas have been designated as contaminated land within 500m of the site.

4.18 Environmental Designations

4.18.1 There is one Site of Special Scientific Interest (SSSI) within 2km of the site. Groby Pool and Woods are situated approximately 1.7km north east of the site (separated into Slate Wood East and slate Wood West). As a consequence, the site lies within two SSSI impact risk zones but residential developments do not appear to be listed as a type of development that would require further consultation. On this basis, the proximity of the SSSIs would not appear to affect the site or future development. We note that if the land use changes, the requirement for additional consultation should be reviewed.

4.19 Services

4.19.1 A full services survey is beyond the scope of this report. Overhead electricity cables were noted crossing the east of the site, trending approximately north / south. Several manhole covers were also noted during the walkover; based on the position of the covers, the possible indicative route of the manholes is marked on the site features plan (see Drawing No. 23120-GE02).

4.19.2 A full-service search should be undertaken prior to any intrusive works / development.

4.20 Unexploded Ordnance (UXO) Risk

4.20.1 Reference has been made to Zetica UXO Ltd's website. A risk map provided by Zetica UXO indicates that the site lies within an area of 'low risk' from unexploded World War II bombs. Given the general lack of military presence or major targets in the local area, the risk of encountering UXOs is not considered to be elevated when compared to similar UK sites.

4.20.2 For completeness, a UXO Pre-Desk Study Assessment (PDSA) Report has been requested from Zetica UXO. The report is awaited at the time of report issue.

4.21 Summary

4.21.1 The information included in the Groundsure Report indicates that there are no landfill sites or other licensed waste sites in the locality, and that the proposed development is generally unlikely to be affected by authorised discharges or geological constraints.

4.21.2 The possibility of contamination from existing or historic land uses on site are generally restricted to agricultural use including localised areas of former allotments. Potential off-site sources include other allotments / agricultural usage, nearby garage and made ground associated with local development etc.

5.0 CONCEPTUAL SITE MODEL AND PRELIMINARY RISK ASSESSMENT

5.1 Initial Conceptual Site Model

5.1.1 An initial Conceptual Site Model (CSM) has been developed based on the findings of the desk study researches described in the preceding sections of this report, and incorporating the accepted 'Source-Pathway-Receptor' linkage ('contaminant linkage') approach outlined in Part 2A of the Environmental Protection Act 1990. In order for a contaminant linkage to exist, a source, pathway and receptor must all be present. Land Contamination Risk Management (LCRM) (Environment Agency, 2020) defines these elements as follows:

- **Source** – A contaminant or pollutant that is in, on or under the land and has the potential to cause harm or pollution
- **Pathway** – A route by which a receptor is, or could be affected by a contaminant
- **Receptor** – Something that could be adversely affected by a contaminant. Examples include humans, controlled waters, ecosystems and Part 2A receptors such as buildings, crops or animals.

5.1.2 LCRM expressly states that "without a contaminant linkage, there is not a risk – even if a contaminant is present".

5.1.3 The aim of the CSM is therefore to provide a qualitative assessment of the risk posed to both human health and environmental receptors from potential on-site and off-site sources of ground contamination. Sections 5.2 to 5.4 below summarise the potential sources, pathways and receptors identified.

5.2 Potential Sources

5.2.1 Table 1 lists the potential sources of ground contamination identified at the site and in the surrounding area, together with the contaminants that have the potential to have been generated. Contaminants arising from both current and historical land uses have been considered, and have been separated according to whether they are likely to have originated from within the development area, or from other on-site or off-site source activities.

Table 1 – Potential Contamination Sources

	Potential Sources	**Potential Contaminant(s)**
On-Site		
1	Possible historic agricultural application of pesticides / insecticides to agricultural land, potentially including lead arsenate	Lead, arsenic, organophosphorus and organochlorine insecticides
2	Possible made ground associated with infilling of natural hollows, former ponds, stockpiles etc	Total petroleum hydrocarbons (TPH), metals/ metalloids, polyaromatic hydrocarbons (PAHs), sulphate, asbestos, acidity/alkalinity (low/high pH)
Off-Site		
3	Possible historic agricultural application of pesticides / insecticides (potentially including lead arsenate) to surrounding agricultural land	Lead, arsenic, organophosphorus and organochlorine insecticides

	Potential Sources	**Potential Contaminant(s)**
4	Recorded electricity substations located c.6m to 140m from site	Polychlorinated biphenyls (PCBs), petroleum, hydrocarbons.
5	Recorded gas governor located c.18m south east from site	Total petroleum hydrocarbons (TPH), metals / metalloids, polyaromatic hydrocarbons (PAHs), asbestos, VOCs / SVOCs
6	Former hosiery manufacturers	Total petroleum hydrocarbons (TPH), metals / metalloids, polyaromatic hydrocarbons (PAHs), asbestos, VOCs / SVOCs
7	Garage located approximately 90m east of the site	Total petroleum hydrocarbons (TPH), metals / metalloids, polyaromatic hydrocarbons (PAHs), asbestos

5.3 Potential Pathways

5.3.1 The list below summarises possible pathways which could allow potential receptors to be exposed to any contamination present at the site:

- Dermal contact, ingestion or inhalation of contaminated soil and soil-derived dust by humans;
- Migration of contaminants via proposed service routes and foundations;
- Leachate migration into pore water from soil contamination, dilution and dispersion into groundwater;
- Direct contact between contaminated soils and building substructures;
- Migration of naturally occurring radon gas into proposed buildings.

5.4 Potential Receptors

5.4.1 Potential receptors to any contamination identified at the site include:

- Humans – construction workers, future site residents and off-site residents/occupiers;
- Proposed development end use – buildings, gardens, and services/utilities;
- Controlled waters – tributaries of Rothley Brook, underlying 'Secondary A', 'Secondary B' and Secondary (undifferentiated)' aquifers.

5.5 Preliminary Risk Assessment

5.5.1 The site will be developed for residential housing with associated domestic gardens, landscaping, and infrastructure. We have therefore broadly utilised the methodology presented in the EA/NHBC document 'Guidance for the Safe Development of Housing on Land Affected by Contamination' (R&D Publication 66, 2008), which has been used to evaluate a level of risk for each contaminant linkage identified in the conceptual model. This is a qualitative approach based upon the classification of the probability of occurrence and the potential consequence (severity). It is considered that this approach should provide a conservative view of any potential risks identified at the site.

5.5.2 The degree of risk is based on an assessment of consequence of an event occurring and the probability of a pollutant linkage. Table 2 is the Categorisation of Risk table from R&D 66, in which the likelihood of each pollutant linkage being realised is compared with the severity of the consequence. This provides a qualitative assessment of potentially unacceptable risks.

Table 2 – Categorisation of Risk

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability of Pollutant Linkage	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate to Low Risk
	Likely	High Risk	Moderate Risk	Moderate to Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate to Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate to Low Risk	Low Risk	Very Low Risk	Very Low Risk

5.5.3 The definitions of the risk terms used in describing the risk levels in Table 2 above are based on those provided in CIRIA 552, Contaminated Land Risk Assessment, A Guide to Good Practice 2001a.

- Very High Risk - There is a probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action.
- High Risk - Harm is likely to arise to the designated receptor from an identified hazard at the site without appropriate action.
- Moderate Risk - It is possible that without appropriate remediation action harm could arise to the designated receptor. It is relatively unlikely that such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild.
- Low Risk - It is possible that harm could arise to a designated receptor from an identified hazard. It is likely that, at worst if any harm was realised, any effects would be mild.
- Very Low Risk - The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

5.5.4 We understand that the site will be developed with residential dwellings with associated gardens, landscaping and infrastructure.

5.5.5 This assessment of the potential harm to either human health or the local environment is based on our experience and judgement.

5.6 Pollutant Linkages

5.6.1 Possible 'contaminant linkages' from each of the potential sources of contamination described above have been identified, and a risk classification assigned with respect to each. These are presented in Appendix 5. Sections 5.7 to 5.9 below summarise the level of risk identified with respect to each of the receptors.

5.7 Risk to Human Health

5.7.1 The potential risk to human health from on-site sources of ground contamination is generally considered low or moderate / low, potentially increasing to moderate if any credible ground gas sources are identified. A ground investigation, including chemical laboratory testing of the existing

topsoil and shallow subsoil is recommended to enable a quantitative assessment of the levels of contamination and the potential 'contaminant linkages' identified. Intrusive investigation will also allow the nature of the soils to be assessed and determine whether ground gas production is likely.

5.7.2 The risk to human health from off-site sources is generally considered low or very low rising to moderate / low locally. Off-site sources of contaminants should also be considered when planning any future site investigation.

5.8 Risk to Proposed Development

5.8.1 The potential risk to the proposed development is generally considered low.

5.9 Risk to Controlled Waters

5.9.1 The potential risk to controlled waters from ground contamination arising from both on-site and off-site sources is considered low or very low, taking account of the underlying low-permeability clay soil / weathered mudstone identified by the geological mapping data.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Potential Development Constraints

The desk study research undertaken has identified the following potential ground-related development constraints which will require further consideration prior to the development of the site for residential housing:

- The possible potential for ground contamination associated with agricultural / allotment use of the site and surrounding areas;
- The likely presence of clay based soils beneath the site, with the potential to heave or shrink due to tree influence and associated changes in moisture content;
- The presence of established trees and hedgerows at the site boundaries;
- The possible risk of ground gas sources (such as localised alluvium, made ground etc) which may pose a risk to future site users;
- Localised risk of flooding;
- Topography which may require regrading to form suitable development platforms;
- Presence of a watercourse passing through parts of the site which will require consideration as part of the layout / infrastructure proposals;
- The site's location within an 'SSSI Impact Risk Zone';
- Possible suspected asbestos sheeting associated with dilapidated shed;
- The presence of existing services within the site boundary.

6.1.2 Each of these points is discussed further below.

6.2 Ground Contamination

6.2.1 Other than localised suspected asbestos sheeting on the dilapidated shed in Field 11, there is no other significant visual or olfactory evidence of contamination at the site. There were a number of small localised stockpiles observed, however, it is considered unlikely that these pose a significant risk. These features will need to be investigated as part of any future site investigations.

6.2.2 The lack of previous development across the vast majority of the site suggests that the likelihood of encountering ground contamination is generally low. However, it is possible that pesticides have historically been applied to the agricultural fields (both on and off site), and these could potentially have accumulated in the topsoil and underlying shallow subsoil beneath the site. The primary risk receptors from these contaminants (if present) would be future site residents, particularly in areas of proposed gardens and landscaping. Localised fields in the east of the site have also been used as allotment gardens which may have had imported soils (such as ash-based products) added to improve drainage properties etc. It is unlikely that the sources identified would present a significant risk to controlled waters, major ecological receptors or proposed buildings and services but investigation is recommended to confirm potential contaminant linkages.

6.2.3 There are a number of off-site sources which have been identified within the local area including former hosiery manufacturers, garage, sub-stations, gas governor etc. It is unlikely that these contaminants, if present, would have migrated to the site in sufficient quantities to pose a risk to future occupiers of the site. Furthermore, given that the hosiery factory has been redeveloped with residential housing, it is assumed that any risk that may have been present previously has been

addressed and is unlikely a pose a risk to future users of the site. The likelihood of impact to controlled waters also appears low given the prevailing low-permeability clay soils.

6.2.4 A ground investigation is recommended at the site which would include chemical laboratory testing of the underlying shallow soils to enable a quantitative assessment of the levels of contamination (including by lead, arsenic and insecticides) and the associated risk to human health.

6.3 Ground Gas

6.3.1 Based on the general absence of significant gas generating sources, ground gases are not generally considered to pose a significant risk to future users of the site. However, there are a number of possible sources which may require further investigation as part of the intrusive works including possible presence of organic-based clays associated with the mapped alluvium around the southern and western periphery of the site. Although there are a number of old ponds mapped on the historic maps, the majority of these features have been observed as dry depressions. Whilst it is unlikely that these features will have been infilled, the ponds may still have organic-based soils. However, given the size of the former ponds, the volume and impact of any organic soils is likely to be low.

6.3.2 As part of any future investigation, it would be prudent to place a series of exploratory holes within the areas of possibly elevated gas risk to assess the nature of the soils and any perceived gas risk. Following the initial intrusive investigation, an assessment should be made to whether a ground gas monitoring exercise is required.

6.4 Foundations

6.4.1 The geological map of the area indicates that the ground conditions beneath the site are likely to be consistent with those previously encountered beneath the adjacent land to the north. These comprised firm to stiff naturally occurring clay soils at shallow depth, which are likely to provide a suitable bearing stratum for the proposed lightly-loaded residential buildings.

6.4.2 The minimum founding depth will need to be confirmed following geotechnical laboratory testing including plasticity index testing.

6.4.3 Given the likely presence of clay-based soils and trees / hedgerows around the field boundaries, the soils may be susceptible to volume change. Laboratory testing should be carried out to confirm the volume change potential of the clay to determine what effect, if any, the trees may have on the soils. A specialist arboricultural survey should also be undertaken to determine the species of trees at the site boundaries and enable an assessment of their likely water demand. This information should in turn be used to establish the minimum foundation level and potential heave protection measures within influencing distance of the trees and hedgerows in accordance with NHBC guidance.

6.4.4 If the assessment shows that the minimum foundation level within influencing distance of trees is greater than 2.5m, the use of conventional strip or trench fill foundations is not generally considered acceptable. Consideration would therefore need to be given to an alternative foundation solution (most likely piled foundations) in this instance.

6.5 Ecological Considerations

6.5.1 No invasive plant species (e.g. Japanese Knotweed, Giant Hogweed) or evidence of significant animal burrowing were observed within or immediately adjacent the site during the walkover. However, it should be noted that TBGE are not ecological specialists. Specialist surveys are therefore

recommended to confirm the ecological status of the site and the presence or otherwise of invasive weeds.

6.5.2 The site lies within a defined SSSI Impact Risk Zone although there do not appear to be any specific requirements for residential developments in this regard.

6.6 Topography

6.6.1 Although a topographic survey has been provided, we have not been provided with any proposed site levels. Based on existing ground levels, localised regrading is likely to be required.

6.7 Other Considerations

Soakaway Drainage

6.7.1 Based on the recorded geology of the site together with the findings of the previous ground investigation on the adjacent land to the north, it is likely that the underlying near-surface soils will be fine-grained and of low permeability. On this basis, it is considered that soakaway drainage is unlikely to be suitable for the proposed development. However, this should be reviewed following the completion of a ground investigation on the site. It may be appropriate to undertake soakaway testing in the event that any substantial horizons of coarse-grained sand or gravel-sized materials are encountered beneath any part of the site. Other considerations will also include groundwater levels, proposed levels, depth of made ground, etc.

Topsoil Strip

6.7.2 Existing topsoil across the site should be stripped and stockpiled separately as part of the site preparation works. Chemical testing will be required to ascertain the levels of contamination and confirm whether the soils are suitable for re-use at the site.

Services

6.7.3 A full service search is outside the scope of this report. However, overhead electricity cables were noted crossing the east of the site, trending approximately north / south. Several manhole covers were also noted during the walkover. Consultation with the utility providers will be required to confirm the presence or otherwise of easements/standoff zones and the possibility of diversion if needed.

Flood Risk

6.7.4 Although the majority of the site lies within Flood Zone 1 (low risk), part of the southern site area is shown to lie within 'Flood Zone 2' and 'Flood Zone 3'. A Flood Risk Assessment (FRA) is recommended to assess the risk from fluvial flooding.