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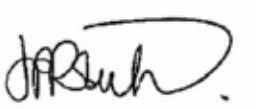
PHASE 1: DESKTOP STUDY AND PRELIMINARY RISK ASSESSMENT REPORT FOR 3 MALTING LANE, DONINGTON, SPALDING, PE11 4XA

For JJ and J Hartley

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Appendices

Appendix A - Proposed Redevelopment and Location Plans
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Executive Summary

Summary of Contamination Recommendations

The below table shows a snapshot of the recommendations concerning ground contamination within this report. It is advised that the report is read in its entirety to gain a better understanding of our findings and recommendations. This section is relevant to Contamination ONLY and further recommendations concerning other aspects may be presented later in this report.

Potential Linkage	No Investigation Recommended	Investigation Recommended
Soil Contamination		✓
Ground Gas	✓	

Investigation Recommended

We have identified one or more potential material sources of contamination within the site itself or in the surrounding area that may, if present, represent a risk of harm to users of the development. Investigation of the site is recommended to enable a robust assessment of this risk to be made, and we would further recommend that further development works on the site do not take place until this investigation has been completed and reported.

1.0 Introduction

*Your*Environment (YE) was instructed by JJ and J Hartley to produce a Phase 1: Desktop Study and Preliminary Risk Assessment Report for the site located at 3 Malting Lane, Donington, Spaling, PE11 4XA (grid ref: 520503 335508; area: 0.4ha).

We understand current plans for the redevelopment of the site comprise:

- Demolition of former British Legion club building
- Erection of six (6no) detached bungalows

The purpose of this report is to support the planning application submitted to South Holland District Council ref: H04-0905-20. In particular the report is to satisfy condition 8 of the decision notice set out by the local authority.

A proposed site plan provided to YE, at the time of issuing this report can be reviewed within **Appendix A.**

Objectives

The objectives of this Phase 1 report are to:

- Establish the environmental setting, including sensitivity in relation to human health, surface water, groundwater and ecological receptors
- Review historical and recent uses to assess the potential for contamination to be present from past and current land-use
- Assess by qualitative means the potential nature and extent of contamination from those uses and the environmental risk and liabilities which may affect the site redevelopment
- Identify the prevalent source-pathway-receptor linkages present on site by means of a Tier 1 contamination risk assessment which incorporates the formulation of a Conceptual Site Model

Information Sources

During the production of this report the following primary information sources have been utilised:

- Enviro + Geo Insight data obtained from Groundsure
- Historical Ordnance Survey mapping at scales ranging from 1:1,250 to 1:10,560, obtained from Groundsure

The full information from these sources can be reviewed within **Appendices B & C.**

2.0 Environmental and Geological Setting

Information on the environmental and geological setting of the site is presented in a Groundsure Enviro + Geo Insight Report prepared for the site, a copy of this report is reproduced in **Appendix B.**

2.1 Site Geology

Site geology has been assessed by reference to information from British Geological Survey mapping summarised in the Groundsure Enviro + Geo Insight data. Information from these sources referenced in this report has been predominantly limited to that identified within

50m of the site (underlying geology) or 250m of the site (structural features, borehole records), in order to focus on the information directly relevant to the site. Information from outside these radii will be referenced when deemed relevant.

Superficial Ground and Drift Deposits

The superficial ground deposits underlying the study site comprise of tidal flat deposits (clay and silt).

Bedrock Geology

Underlying the superficial drift deposits is bedrock comprised the Oxford Clay Formation (mudstone).

Landslips

There are no records within 250m.

Linear Features

There are no records within 250m.

Natural Ground Subsidence

The following hazard ratings applicable to the site and land within 50m are presented in the Enviro + Geo Insight Report:

Shrink swell clays	Low
Running sands	Moderate
Compressible deposits	Moderate
Collapsible deposits	Negligible
Landslides	Very low
Ground dissolution	Negligible

Table 2.1: Natural Ground Subsidence

2.2 Site Hydrogeology and Hydrology

These records are derived by Groundsure from Environment Agency and British Geological Survey data. Details of the source and coverage of specific records are provided in the Enviro + Geo Insight Report. Information from these sources referenced in this report has been predominantly limited to that identified within 250m of the site (aquifers, surface water) or 1000m of the site (abstractions), in order to focus on the information directly relevant to the site. Information from outside these radii will be referenced when deemed relevant.

Table 2.2 presents Environment Agency aquifer designations:

Principal Aquifer	Layers with high intergranular and/or secondary permeability capable of supporting water supplies at strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Major Aquifers.
Secondary (A) Aquifer	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers.
Secondary (B) Aquifer	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water bearing parts of former Non-Aquifers.
Secondary Undifferentiated Aquifer	Layers that cannot be attributed to a category A or B rock type. These layers could have previously been described as a minor or a non-aquifer due to their variable characteristics.

Unproductive strata	Rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Table 2.2: Aquifer Designations

Aquifer within Superficial Deposits

Because of the superficial geology on site, the tidal flat deposits are designated as an Unproductive aquifer.

Permeability of Superficial Deposits

The minimum permeability is recorded as being very low with the maximum permeability recorded as being low.

Aquifer within Bedrock Geology

As a result of the bedrock geology on site, the Oxford Clay Formation is designated as being an Unproductive aquifer.

Water Framework Directive Groundwater Bodies

The site is not within any groundwater water bodies.

Permeability of Bedrock Deposits

The minimum permeability is recorded as being very low with the maximum permeability recorded as being low.

Groundwater Vulnerability

Table 2.3 presents Environment Agency groundwater vulnerability definitions:

High Vulnerability	Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.
Medium Vulnerability	Intermediate between high and low vulnerability.
Low Vulnerability	Areas that provide the greatest protection from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability.

Table 2.3: Groundwater Vulnerability Definitions

Groundwater vulnerability has been classified as low due to unproductive aquifers underneath the site.

Groundwater Abstraction Licences

There are no groundwater abstraction licences within 1000m.

Surface Water Abstraction Licences

There are no active licensed surface water abstractions within 1000m.

Potable Water Abstraction Licences

There are no potable abstraction licences within 1000m.

Source Protection Zones

The study site is not located within a Source Protection Zone.

Ordnance Survey Water Network

There are eighteen (18no) records of inland rivers (non-tidally influenced) that were identified within 250m of the site, the nearest of which are 1m west, 49m northwest and 74m north. All further records are over 95m from the study site.

Surface Water Features

There are six (6no) records of surface water features within 250m of the study site, the nearest of which include surface water body catchment boundaries, lake and surface water bodies and narrow transfer water bodies.

Water Framework Directive Surface Water Bodies and Catchments

The site is within the Black Sluice IDB (draining in to the South Forty Foot Drain) river water body catchment.

2.3 Environmentally Sensitive Areas

These records are derived by Groundsure from Environment Agency, Natural England, Historic England, English Heritage, Forestry Commission and UK Government data. Details of the source and coverage of specific records are provided in the Enviro + Geo Insight Report. Information from these sources referenced in this report has been predominantly limited to that identified within 500m of the site (environmental designations) or 250m of the site (habitat, visual and cultural designations), in order to focus on the information directly relevant to the site. Information from outside these radii will be referenced when deemed relevant.

Environmental and Habitat Designations

The site is within a nitrate vulnerable zone, designated for surface water (Black Sluice IDB-draining into the South Forty Foot Drain NVZ).

There are three (3no) records of priority habitat inventories within 250m of the site, located 49m north for additional habitat areas and 88m and 106m north for deciduous woodland areas.

Visual and Cultural Designations

A record of the Donington conservation area was identified 13m northeast of the study site. In addition, there are four (4no) grade II listed buildings within 250m of the study site, located 151m northeast, 195m northwest and 199m and 229m northeast.

3.0 Past Land Use and Potential Contaminant Sources

Information on past land use and potential contaminant sources is presented in a Groundsure Enviro + Geo Insight Report prepared for the site, a copy of this report is reproduced in **Appendix B.**

3.1 Land Use Records

These records are derived by Groundsure from historical mapping and each record corresponds to a particular map revision date. Thus, several records may refer to the same feature where it is present over time. Groundsure has in some cases grouped such records in the Enviro + Geo Insight report. Differences in distances quoted from the study site may be due to expansion of the feature over time or geolocation errors.

Information from these sources referenced in this report has been predominantly limited to that identified within 250m of the site, in order to focus on the information directly relevant to the site. Information from outside this radius will be referenced when deemed relevant.

Historical Industrial Land Uses

There are three (3no) records of historical land use onsite, two (2no) of which relate to police stations, the other refers to a windmill. There are thirteen (13no) additional land use records within 250m of the site, referring to which are two (2no) records of unspecified

works 0m west, two (2no) windmills located 6m west, an additional windmill 7m west, three (3no) malthouses 15m north, and a brewery 139m east. Other notable records include three (3no) Smithies located 174m, 181m and 184m northeast, respectively.

Historical Tanks
There are no records of historical tanks within 250m.

Historical Energy Features
There are eleven (11no) electrical substations within 250m of the study site. The closest of which are 71m and 88m north. All other records are over 140m from site.

Historical Petrol Stations
There are no records of historical petrol stations within 250m.

Historical Garages
A record of a garage was identified onsite, present between 1981-1988. There are also three (3no) additional records of garages within 250m of the study site, located 2m, 11m and 18m north of the study site.

Historical Military Land
There are no records of historical military land within 250m.

Current or Recent Industrial Land Uses
There are ten (10no) records of historical industrial land use within 250m of the site, the nearest of which are a vehicle repairs and servicing site 24m north, unspecified works 50m west and a waste storage and disposal site 60m west.

Further records within 250m include an electrical substation 62m north, a vehicle hire and rental site 65m southwest, a water pumping station 139m south, and three (3no) further electrical substations located 142 and 156m southeast, as well as 228m south.

Current or Recent Petrol Stations
A single record pertaining to an obsolete Murco site, was identified 39m north.

Electricity Cables
There are no records of high voltage underground electricity cables within 250m.

Gas Pipelines
There are no records of high pressure underground gas pipelines within 250m.

Railway Infrastructure
There are no records of historical or current railway infrastructure or projects within 250m.

3.2 Environmental Permits, Incidents and Registers
These records are derived by Groundsure from local authority, Health and Safety Executive and Environment Agency data. Details of the source and coverage of specific records are provided in the Enviro + Geo Insight Report. Information from these sources referenced in this report has been predominantly limited to that identified within 250m of the site, in order to focus on the information directly relevant to the site. Information from outside this radius will be referenced when deemed relevant.

Sites Determined as Contaminated Land
There are no records of sites determined as contaminated land under Part 2A of the Environmental Protection Act 1990 within 250m.

Control of Major Accident Hazards (COMAH)
There are no records within 250m.

Regulated Explosive Sites
There are no records within 250m. Note that details of some sites may be redacted for security reasons.

Planning Hazardous Substances Consents
There are no records within 250m.

Records of Historic IPC Licensed Activities
There are no records within 250m.

Records of Part A (1) Licensed Activities
There are no records within 250m.

Records of Part A (2)/B Licensed Activities and Pollutant Release
There are two (2no) records pertaining to a site 25m north for the unloading of petrol into storage at service stations, undertaken with permit type B.

Records of Radioactive Substance Authorisations
There are no records within 250m.

Licensed Discharges to Controlled Waters
There are no records within 250m.

Further afield, a record of miscellaneous discharges was identified 442m east, relating to Mill Lane Factory.

Pollutant release to Surface Waters (Red List)
There are no records within 250m.

Pollutant Release to Public Sewer
There are no records within 250m.

List 1 and List 2 Dangerous Substances
There are no records within 250m.

Substantiated Pollution Incidents
There are no records within 250m.

Further afield, there were two (2no) records identified. The first of which is located 404m south and is dated 2009 for an incident involving gas and fuel oils, which was recorded to have had a significant impact to water, but no impact to land or air. The other is for a 2002 incident located 410m northeast for smoke pollution, which had minor impact to air, but not impact to water or land.

Pollution Inventory Substances
There are no records within 250m.

Pollution Inventory Waste transfers
There are no records within 250m.

Pollution Inventory Radioactive Waste
There are no records within 250m.

3.3 Waste and Landfill

These records are derived by Groundsure from Environment Agency, British Geological Survey, Ordnance Survey (interpreted by Groundsure) and local authority data. Details of the source and coverage of specific records are provided in the Enviro + Geo Insight Report.

Information from these sources referenced in this report has been predominantly limited to that identified within 500m of the site (landfills) or 250m of the site (non-landfill waste operations), in order to focus on the information directly relevant to the site. Information from outside these radii will be referenced when deemed relevant.

Active or Recent Landfill

There are no records of active or recent landfill within 500m of the study site.

Historical Landfill

There are no records of historical landfill within 500m of the study site.

Non-Landfill Waste Records

There are no records of non-landfill waste within 500m of the study site.

3.4 Mining, Ground Workings and Natural Cavities

These records are derived by Groundsure from British Geological Survey, Ordnance Survey (interpreted by Groundsure), Coal Authority, Peter Brett Associates, Johnson Poole and Bloomer, Cheshire Brine Subsidence Compensation Board, British Gypsum, Mining Searches UK, Kaolin and Ball Clay Association and local authority data. Details of the source and coverage of specific records are provided in the Enviro + Geo Insight Report.

Information from these sources referenced in this report has been predominantly limited to that identified within 250m of the site, in order to focus on the information directly relevant to the site. Information from outside these radii will be referenced when deemed relevant.

Natural Cavities

There are no records within 250m.

Mining Cavities

There are no records within 250m.

BritPits Data (Surface and Underground Mineral Workings)

There are no records within 250m.

Historical Mineral Planning Areas

There are no records within 250m.

Surface Ground Workings

There are four (4no) ponds within 250m, one of which is located 143m west, two (2no) were identified 145m west, and the other was identified 148m west. It is likely these are all referring to the same body of water.

Underground Workings

There are no records within 250m.

Coal Mining

There are no records held by the Coal Authority or by Johnson Poole and Bloomer within 250m.

Non-Coal Mining

There are no records within 250m for brine extraction or gypsum, tin or clay mining.

3.5 Radon and Background Soil Chemistry

These records are derived by Groundsure from British Geological Survey and Public Health England data. Details of the source and coverage of specific records are provided in the Enviro + Geo Insight Report. Information from these sources referenced in this report has been predominantly limited to that identified on or within 50m of the site.

Radon

The study site is not located within a Radon Affected Area, as less than 1% of properties are above the Radon Action Level. No radon protective measures are necessary for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment.

Background Soil Chemistry

Values estimated by BGS for background concentrations of five potentially harmful elements are provided as follows:

Arsenic	15 mg/kg
Bio-accessible arsenic	No data
Lead	100 mg/kg
Bio-accessible lead	60 mg/kg
Cadmium	1.8 mg/kg
Chromium	60-90 mg/kg
Nickel	15-30 mg/kg

Table 3:1 Background Soil Chemistry

These values are not considered to be elevated with respect to guideline values for residential end-uses.

4.0 Historical Mapping Study

The object of this search was to report on the evidence of site history and redevelopment of the site and its environs from available County Series and Ordnance Survey Maps at scales ranging from 1:1,250 to 1:10,560 dating from the mid to late 19th Century to the present day, and Getmapping PLC aerial photography dating from the late 1990s to the recent past, as provided by Groundsure.

Information in the historical mapping study has been predominantly limited to that identified on the site or within 100m of the site, in order to focus on the information directly relevant to the site. Information from outside this radius will be referenced when deemed relevant.

Each map or photographs only represents a "snap-shot" of the site and its environs at the date of the survey. Changes that had occurred at other times may not have been recorded on the maps and could represent an unidentified hazard to the site.

The information reported might not represent all pertinent information that could be obtained. The interpretation of the maps and/or other data commented on in this report is subjective.

Year	On site	Off site
1889	Site is largely undeveloped, in assumed agricultural use.	The surrounding area is undeveloped and in assumed agricultural use. Corn windmill 10m west Malthouse 25m north Unspecified buildings 50m northeast, assumed residential use. Pump 200m southwest Brewery 225m east
1887	Partial map- no discernible changes	Partial map- no relevant changes
1903-1906	No discernible changes	No relevant changes
1938	Partial map- no discernible changes	Partial map- no relevant changes
1946-1948	Partial map- no discernible changes	Partial map- no relevant changes
1956	No discernible changes	No relevant changes
1972	Hall	Police station 10m north Garage 25m north Unspecified works 50m west Sewage pumping station 125m south Engineering works 200m east
1975	Partial map- no discernible changes	Partial map- no relevant changes
1977	Police station (map shifted - not deemed to be on site)	Partial map- no relevant changes
1978	Partial map- Garage (map shifted - not deemed to be on site)	Partial map- no relevant changes
1981-1988	Royal British Legion Social Centre Bowling Green Drain	Police station 10m north Garage 25m north Pumping station 150m south Works 200m east
1995	No discernible changes	No relevant changes
1999	Unspecified building onsite, likely the hall illustrated in historical maps	No relevant changes
2001	No discernible changes	Works 450m southwest Depot 475m southwest Depot 500m southwest
2003	No discernible changes	No relevant changes
2007	No discernible changes	No relevant changes
2010	No discernible changes	No relevant changes
2015	No discernible changes	No relevant changes
2018	No discernible changes	No relevant changes
2020	No discernible changes	No relevant changes

Table 4.1: Historical Mapping Review

The Historical Ordnance Survey Maps were obtained from Groundsure and are available for review within **Appendix C.** The aerial photographs are included in the Groundsure Enviro + Geo Insight Report and are available for review within **Appendix B.**

Photographs taken during the walkover of the site and surrounds, can be reviewed within **Appendix D.**

5.0 Framework for Assessment of Contamination

Environmental risks are assessed within the risk management framework established in Part IIA of the Environmental Protection Act (EPA) 1990 introduced by Section 57 of the Environment Act 1995 which provides a statutory definition of contaminated land. To fall within this definition it is necessary that, as a result of the condition of the land, substances may be present on or under the land such that:

(a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
(b) Pollution of controlled water is being or is likely to be caused.

Risk from contamination is assessed by consideration of possible linkages between contaminant sources and potential receptors which could be harmed or polluted.

The key aspect of the framework is the development of a Conceptual Site Model (CSM) which illustrates the spatial interaction between the potential sources and receptors on site.

The information presented in this report was collated and evaluated to develop an initial CSM to assess ground contamination issues at the site.

For a risk of pollution or environmental harm to occur as a result of ground contamination, ***all*** of the following elements must be present:

- A source - a substance that is capable of causing pollution or harm
- A receptor - something which could be adversely affected by the contaminant
- A pathway - a route by which the contaminant can reach the receptor

If one of these elements is absent there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

Potential sources, pathways and receptors are identified in the sections below and the risks associated with possible pollutant linkages outlined.

6.0 Possible Contaminant Sources

On Site Sources

The following possible on site sources have been identified from the historical study:

- Made ground associated with historical on site development.

The following possible on site sources have been identified from the Enviro + Geo Insight data:

- None identified.

Off Site Sources

The following off site sources have been identified from the historical study:

- Police station - 10m north
- Garage - 25m north
- Malthouse - 25m north
- Sewage - 125m south
- Pumping Station - 150m south
- Pump - 200m south west
- Engineering works - 200m east
- Works - 200m east
- Brewery - 225m east

There are further entries present but these are considered far enough from the site to pose no risk.

The following possible off site sources have been identified from the Enviro + Geo Insight data:

- Unspecified works - adjacent west and 50m west
- Garage - 2m, 11m and 18m and 24m north
- Malthouse - 15m north
- Obsolete petrol station - 39m north
- Wate storage and disposal site - 60m west
- Brewery - 139m east
- Smithy's - 174m, 181m and 184m north east.

Sources Summary

The *main* **sources** of potential contamination that have been identified at the site or in the vicinity of the site are summarised below:

Source	Location	Description
Made ground associated with historical onsite development	On site	Historical development identified on site may create small amounts of made ground on site. Made ground has the potential to contain a variety of contaminants including, heavy metal, PAH, TPH and asbestos. Made ground may also generate ground gas.
Surrounding commercial uses, including; garages, works, Police station, malthouse and Pumping station.	Off site	A variety of commercial uses surrounding the site have a broad spectrum of associated contaminants including PAH, TPH, VOCs, SVOCs, herbicides, and pesticides.

Table 7.1: Sources Summary

The following contaminants are potentially associated with the on-site sources:

- Heavy Metals
- TPH
- PAH
- Asbestos
- Ground gas

The following contaminants are potentially associated with the off-site sources:

- Heavy Metals
- PAH
- TPH
- VOCs
- SVOCs
- Herbicides
- Pesticides
- Ground gas – from decomposition of organic carbon in infilled material, leading to generation of methane and carbon dioxide

In practice, a broad contaminant screen should be analysed for in any intrusive investigation recommended to ensure that potential contaminants are not omitted.

7.0 Possible Pathways and Receptors

Pathways

In order for contaminants to reach potential receptors, there has to be a viable **pathway** for the contaminant. Potential pathways that may affect the migration of contaminants are listed below:

Pathway	Medium	Properties
Direct Contact	Dust, solid and liquid phase	There may be direct contact with potentially impacted soil and Made Ground across the site. There is a possibility of dust fumes being produced during earthworks in the construction phase. Dermal contact and ingestion of potentially contaminated soils during construction or operational phase of the site.
Leaching through Made Ground	Unsaturated flow	Potential for leaching and migration of potential contaminants along preferential flow paths in the ground.
Foundations and Underground Infrastructure and Obstructions	Preferential flow	Contaminants will flow the path of least resistance which can be gaps around foundations, services, and floor construction
Migration of Ground Gas	Gaseous flow	Infilled land material is likely to be variable in composition. Migration through granular material within superficial deposits is possible.

Table 8.1: Pathways

Receptors

The site specific **receptors** that could be potentially affected by the contamination hazards identified during this preliminary appraisal are summarised below:

Category	Receptor	Properties
Humans	End users (such as residents and visitors)	Potential contact with contaminated soils in existing/proposed soft landscaping areas, however it is understood that the site will be asphalt surfaced. Potential contact with ground gas within enclosed buildings
	Construction workers	Reworking of contaminant impacted materials in underlying soil during construction works can expose workers to contamination.
Property	Materials and site structures	Foundations and site services may be damaged by potentially aggressive compounds present in soils.
Controlled Waters	Underlying superficial / bedrock Aquifer and surface water	The site is recorded as having a Unproductive aquifers in both superficial and bedrock deposits.
Plant (species and uptake) and Wildlife	Various	Attributes will be influenced by factors such as relative quality, scale, rarity and substitutability; however it is understood that the site is proposed to be asphalt surfaced.

Table 8.2: Receptors

8.0 Qualitative Risk Assessment

Potential pollutant linkages are identified using the source-pathway-receptor framework detailed above. An assessment of the potential significance of each linkage is then made by consideration of the likely magnitude and mobility of the source, the sensitivity of the receptor and nature of the migration/exposure pathways.

This qualitative risk assessment has been undertaken in accordance with Annex 4 of the National House Building Council/Environment Agency/Chartered Institute of Environmental Health R&D publication 66, Guidance for the Safe Development of Housing on Land Affected by Contamination (NHBC/EA/CIEH, 2008) which updates and supersedes CIRIA C552: Contaminated Land Risk Assessment, A Guide to Good Practice (Rudland et al., 2001).

An assessment of the likelihood of the risk being realised and the magnitude of potential risk is presented below to give an estimation of the significance of each potential pollutant linkage identified. Where it is considered that there is no credible linkage, this is indicated in the table. In accordance with the R&D66 guidance, if there is no pollution linkage then there is no need to apply tests for probability and consequence.

The assessment is undertaken based on the current proposals for the site, at the time of issuing this report, which would be classed as a generic end land use of 'residential (with consumption of homegrown produce)'. Any change in the development proposals for the site involving a change in end use class may result in a requirement for this assessment to be revised.

9.0 Preliminary Conceptual Site Model

Contaminant Source	Pathways	Receptor	Potential Severity	Probability of Risk	Level of Risk	Justification
On Site: Made Ground soils on site possibly containing elevated metals, other organics such as TPH, PAH, and Phenols.	Ingestion, dermal contact, inhalation of dusts/vapours	Future end users and site visitors	Mild	Low Likelihood	Low ●	A low risk has been assessed due to the absence of any contaminative past land uses identified on site. However, a pathway is present through garden areas.
		Construction Workers	Mild	Likely	Moderate/ Low ●●	Construction workers are likely to come into direct contact with soils during groundworks. Safe working practices should be implemented and appropriate personal protective equipment (PPE) should be used to mitigate any potential risk from contact with soils and shallow/perched groundwater.
	Leaching through soils and migration via groundwater or soil pore moisture	Controlled Waters	Mild	Unlikely	Very Low ●●	A very ow risk rating has been assessed due to the absence of potentially contaminative sources on site and the presence of Unproductive aquifers in the underlying geology. There are no abstraction licenses within 1000m of the site.
	Permeation of water pipes	Construction materials, future end users and site visitors	Medium	Low Likelihood	Moderate/ Low ●●	Hydrocarbons, especially aromatics are known to permeate plastic pipes. Provision of water supply pipes and connectors formed from proprietary "barrier pipe" materials (eg polyethylene-aluminium-polyethylene) may be required by the water supply company.
	Uptake	Plant and Wildlife	Minor	Low Likelihood	Very Low ●●	A low risk has been assessed due to the absence of any contaminative past land uses identified on site. However, a pathway is present through garden areas.
On Site: Asbestos at/near ground surface in Made Ground soils.	Inhalation of fibres in airborne dust	Future end users and site visitors	Medium	Low Likelihood	Moderate/ Low ●●	A moderate/low risk rating has been assessed due to the commercial history of the site creates potential for asbestos.
		Construction Workers	Medium	Low Likelihood	Moderate/ Low ●●	Construction workers are likely to come into direct contact with soils during groundworks. Safe working practices should be implemented and appropriate personal protective equipment (PPE) should be used to mitigate any potential risk from contact with soils and shallow/perched groundwater.
On Site: Ground Gases (CH_4, CO_2) from	Gas migration and build up within buildings	Future end users and building structures.	Mild	Unlikely	Very Low ●●	A very low risk rating has been assessed due to the limited thickness and lack of organic and/or degradable content assumed to be present in the made ground. Such made ground is generally classified as very low risk in terms of potential for gas generation.

on site Made Ground.	(explosion/ asphyxiation risk)					
Off Site: Historical land uses and activities, Made Ground/infilled material possibly containing elevated metals, other inorganics, TPH, PAH, phenols, VOC and SVOCs.	Leaching through soils and migration via groundwater or soil pore moisture	Future end users and site visitors	Medium	Low likelihood	Moderate/ Low ●●	Given the low permeability of underlying deposits, it is considered a low likelihood of contaminant migration to site. However, given the presence of sources within a close proximity of the site, there is some potential of migration.
	Ingestion, dermal contact, inhalation of dusts/vapours	Future end users and site visitors	Medium	Low likelihood	Moderate/ Low ●●	Given the low permeability of underlying deposits, it is considered a low likelihood of contaminant migration to site. However, given the presence of sources within a close proximity of the site, there is some potential of migration and the proposed garden areas are a potential pathway.
Off Site: Ground Gases (CH_4, CO_2, H_2S) from off site historical landfilling activities.	Gas migration and build up within buildings (explosion/ asphyxiation risk)	Future end users and building structures.	Mild	Unlikely	Very Low ●●	No significant landfilling activities have been identified. Therefore, the chance of ground gas generation and migration from offsite sources is considered unlikely.

Table 10.1: Preliminary Conceptual Site Model

10.0 Recommendations

10.1 Proposed Site Investigation

Based on the information obtained for formation of this report, we would recommend that an intrusive contaminated land investigation is undertaken to determine the actual pollution linkages and to quantify the risk to the receptors as outlined with the Preliminary Conceptual Site Model.

The intrusive investigation may reveal on-site sources of contamination that were not established by the Phase I Desk Study and Site Walkover and thus require modification of the conceptual site model.

The proposed scope of investigation is outlined below.

Scope of Proposed Investigation

Testing Regime

The testing regime has been devised in accordance with BS10175:2017 Guidelines for the Code of Practice for Contaminated Land and CLR Report No. 4 Sampling Strategies. The objective at this stage of the report is to attempt to identify the extent of any possible contamination that may exist at the site by using intrusive soil sampling and testing techniques.

Sampling Strategy

A service search should be completed prior to any subsequent investigation to determine the service locations by lifting up any manhole/drain covers; therefore, locations may be subject to change depending upon these results.

The SI should incorporate excavation of six (6no.) machine dug trial pits, one in each proposed dwelling, in order to gain a suitable spread of the site and enable adequate analysis of the soil conditions. This will be completed to a maximum depth of 2 metres below ground level (mbgl) or refusal or where groundwater is encountered.

All positions should be logged, and samples removed in accordance with current protocol. In addition, groundwater conditions, if encountered, shall be logged and visual/olfactory observations noted.

We would recommend that the test locations be based on the findings contained with this report, to enable a broad coverage of the site.

Laboratory Analysis

An appropriate and consistent analytical suite of contaminants should be applied to any soil samples retrieved from the site.

Based on the findings contained within this report, we would recommend that a comprehensive range of testing should be undertaken to comprise of heavy metals, speciated Total Petroleum Hydrocarbons (TPH CWG Aromatic/aliphatic split) and speciated Polycyclic Aromatic Hydrocarbons (PAH) including the more carcinogenic benzo(a)pyrene

(BaP) and naphthalene, soil organic matter (SOM) content, VOCs, SVOCs, pH, VOCs, SVOCs and sulphates.

In addition, selected samples retrieved from the Made Ground, if encountered, will also be submitted for a screen to determine the presence, or otherwise, of asbestos.

It should be noted that not all samples retrieved from the proposed investigative works will be laboratory analysed and a UKAS and MCERTS accredited laboratory testing organisation should carry out all analysis.

Guidance

The results from the proposed SI shall be compared against standards, such as the revised LQM/CIEH S4UL criteria[1] where available.

Results from gas monitoring shall be used to calculate a Gas Screening Value (GSV) in accordance with BS8485: 2015.

10.2 Consultees

It is highly recommended that this report be forwarded to the relevant Local Authority Environmental Health and Planning Departments to seek their comments and subsequent approval, otherwise further works may be required.

10.3 Groundworks Watching Brief

If during construction works any material is noted to show visual and/or olfactory signs of contamination an environmental consultant should be contacted to supervise/guide further works.

If any landscaping materials are to be imported on site they should be tested to check that they are suitable for the intended use.

10.4 Flood Risk Assessment

This report does not replace a full hydrogeological survey and specialist studies may need to be undertaken to ascertain the risks posed from flooding. Further details on site flood information can be found within the appendices.

11.0 Limitations and Uncertainties

This report has been prepared by YE with all reasonable skill, care and diligence. The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources, together with a site walkover inspection of the site.

The opinions given in this report have been dictated by the finite data on which are they based and are relevant only to the purpose for which the report was commissioned.

[1] Nathanail et al. (2015) The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, 2015. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3495

Information reviewed should not be considered exhaustive and accepted in good faith as providing true and representative data with respect to site conditions. Should additional information become available which may influence the opinion expressed in this report, YE reserves the right to review such information and, if warranted, to alter the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site. This report is an environmental phase 1 report and does not consider the geotechnical implications for the site, its redevelopment and proposed future use. Further advice should be sought on geotechnical investigation requirements for the proposed development.