GEOENVIRONMENTAL SITE INVESTIGATION REPORT
PHASE I PRELIMINARY RISK ASSESSMENT
ON LAND AT
MOSS LANE
STOCKTON BROOK

Prepared for: -

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LIST OF ACRONYMS

Acronym	Meaning
BGS	British Geological Survey
BH	Borehole
CDM	Construction Design and Management
CL:AIRE	Contaminated Land: Applications In Real Environments
CLR	Contaminated Land Report
COSHH	Control Of Substances Hazardous to Health
CSM	Conceptual Site Model
DCP	Dynamic Cone Penetrometer
DEFRA	Department for Environment Foods and Rural Affairs
DP	Dynamic Probe
DoE	Department of Environment
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	Generic Acceptance Criteria
HP	Hand Pit
HA	Hand Auger
LQM	Land Quality Management
mbgl	Meters Below Ground Level
MP	Mackintosh Probe
NGR	National Grid Reference
OS	Ordnance Survey
SGV	Soil Guideline Value
SSV	Soil Screening Value
WSV	Water Screening Value
SPOSH	Significant Possibility of Significant Harm
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
TP	Trial Pit
TT	Trial Trench
WS	Windowless Sample / Window Sample

1.0 INTRODUCTION

1.1 Instruction

1.1.1 GeoCon Site Investigations Ltd (GeoCon) have been commissioned by Mr A Grocott (AG) to undertake a Phase I Preliminary Risk Assessment on Land at Moss Lane, Stockton Brook.

1.1.2 It is understood that a Phase I Preliminary Risk Assessment is required to assist with a planning application for a proposed residential development at the site.

1.1.3 This report is therefore provided to establish the potential for contamination at the site, to assist with a planning application for a proposed new residential development at the site, and to identify the indicative ground conditions for geotechnical purposes.

1.2 Scope of Works

- To appraise the land use history of the site by the examination of available historical plans.
- To assess the environmental setting of the site with specific reference to geology, mining & quarrying, hydrogeology and hydrology.
- To gain an understanding of any concerns of the regulatory authorities (Local Authority Planning, Building Control and Environmental Health departments and the Environment Agency) regarding local land filling, flooding, mining, quarrying and other concerns.
- To produce a Preliminary Conceptual Site Model (CSM).

1.3 Limitations

1.3.1 The assessment and interpretation of the factual data obtained as part of this Phase I Preliminary Risk Assessment has been undertaken in accordance with standard consulting practise and with current national and international guidance.

1.3.2 This report presents the observations made during the Phase I Preliminary Risk Assessment and the factual data obtained. The conclusions and recommendations in this report are limited to those which can be made based on the findings of the survey and information provided by third parties. GeoCon assumes all third party data to be true and correct. No responsibility can be accepted by GeoCon for inaccuracies in the information provided by any other party.

1.3.3 This report is written in the context of an agreed scope of works and should not be used in a different context. Furthermore, new information, improved practises, and changes in legislation may require the reinterpretation of the report in whole or in part after its original issue. GeoCon reserve the right to alter their conclusions and recommendations in the light of further information that may become available. This report is provided for the sole use of the client and their professional advisors and is confidential to them unless agreed otherwise in writing.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Location

2.1.1 The site is located on land at Moss Lane, Stockton Brook, at approximate National Grid Reference NGR: 392740:352230 (centre of the site).

2.1.2 A site location plan is presented as Drawing No. GSI 1159/01 in Appendix A.

2.2 Site Description

2.2.1 The site is an irregular shaped piece of land, with an approximate area of 0.18Ha.

2.2.3 It should be noted that the site description has been taken in part from google earth and Google Street View imagery and site photographs, if provided by AG, at this stage.

2.2.4 The site is currently occupied by derelict land and grass land, the only use currently being a car park.

2.2.5 The site is bounded by residential and industrial/commercial properties to the West and East, open grassland to the North, Stanley Moss Lane to the South West and Stanley Road to the South East.

2.2.6 Access to the site is via Stanley Moss Lane to the South West.

2.2.7 The topography of the site is generally flat.

2.3 Current Site Usage

2.3.1 The site is currently derelict.

2.4 Future Site Usage

2.4.1 A proposed development plan is presented as an un-numbered, un-dated drawing as drawn by Architectural and Associated Services in Appendix A.

2.5 Surrounding Area

2.5.1 The current surrounding land use to the site is generally within a rural setting comprising mixed residential and industrial/commercial properties and grassland in all directions.

2.5.2 The topography of the surrounding area is generally flat.

2.6 Statutory Services

2.6.1 GeoCon have not been provided with buried service location plans at this stage.

2.7 Site Reconnaissance

2.7.1 At this stage, a site walkover has not been carried out. A site walkover may be carried out either prior to or during any Phase II investigation and this will be reported accordingly.

3.0 SITE HISTORY

3.1 Site History

3.1.1 The history of the site has been determined from available historical maps obtained as part of the Envirocheck Report and via the Envirocheck Analysis online historical mapping tool. The history of the site and of the surrounding area is summarised overleaf in Table 3.1: Site History. It should be noted that some of the maps come with little to no coverage.

3.1.2 The information presented overleaf in Table 3.1: Site History, is given based on the distance and direction from the closest point of each feature to the site. The table presents the data broken down into the following categories: - feature; the potential use of each feature where applicable; the date each particular feature is first observed; the direction of each feature from the site; the approximate distance of each feature from the site; the approximate area of each feature; and any other relevant information regarding the site and surrounding area in general.

3.2 Aerial Photography

2000 Aerial Photo:

3.2.1 The 2000 aerial photo is generally unclear; however, the site appears to be occupied by derelict land and grassland. The surrounding area occupied with residential and industrial/commercial properties.

Recent Aerial Photograph:

3.2.2 Recent aerial photography shows the site is undeveloped and covered by grass and trees. The surrounding area is within a rural setting comprising mixed residential and industrial/commercial properties and grassland in all directions.

Table 3.1: Site History

Feature	Date first observed	Date no longer shown	Direction from site centre	Distance (m) from site centre	Area (m2)	General notes
Building	1879	Current	W	On Site	91	Unknown use
River	1879	Current	NW	12	NA	River running north-west to south east, due north of the site.
Hercules Mill	1899	Current	E	47	298	Flint
Pond	2019	Current	SE	59	262	
Stanley Mill	1879	1888	E	94	90	Corn
Mill Pond	1879	Current	E	100	2912	
Smithy	1879	1924	SW	165	174	
Quarry	1879	Current	SE	174	7245	
Pond	2019	Current	S	185	231	
Victoria Mill	1879	1962	NW	251	750	
Mill Pond	1879	Current	SE	257	1535	
Stanley Old Mill	1879	1924	SE	268	130	Flint/Gelatine Works
Stanley Pool	1879	Current	SE	317	24453	

Site and surrounding area in general	In general the site has remained rural with buildings/sites of industrial use, and some residential housing.

4.0 ENVIRONMENTAL SETTING

4.1 General

4.1.1 A number of third parties have been approached to collate information relating to the site, its environmental setting, and any issues pertaining. The following third party sources have been utilised which are outlined in Table 4.1: Sources of Information:

Table 4.1: Sources of Information

Source	Information
Landmark	Envirocheck Report Geology Report
British Geological Survey (BGS)	The BGS Geological Map Sheet 123 Stoke-On-Trent BGS Open Geoscience online geological mapping tool
Ordnance Survey	OS Open Data online mapping tool
Coal Authority	Online Gazetteer of England and Wales
Environment Agency (EA) Online	Water Quality Data and Aquifer designation

4.1.2 The Landmark Envirocheck report is provided in Appendix B and all relevant parts of other third party responses, where available, are presented within the indicated appendices.

4.2 Published Geology

4.2.1 The British Geological Survey shows the site to be underlain by the geological succession outlined below Table 4.2: Published Geology.

Table 4.2: Published Geology

Geology	Description /strata
Artificial	None recorded
Superficial	Till
Bedrock	Morridge Formation

4.2.2 There are no known artificial deposits recorded underlying the site.

4.2.3 The superficial geology recorded underlying the site is shown to be Till. Till deposits are generally gravelly clay with cobbles and varying silt sand and gravel content.(No BGS description available)

4.2.4 The bedrock geology beneath the site is shown to be the Morridge Formation which is generally described as *'Interbedded dark grey, shaley mudstones and pale grey protoquartzitic siltstones and sandstones*' (BGS general description).

4.3 Hydrogeology

Superficial Deposits

4.3.1 The Environment Agency aquifer classification scheme indicates that the superficial aquifer designation for the site is classed as Secondary Undifferentiated aquifer which are generally described as having been '*assigned in cases where it has not been possible to attribute either category A or B to a rock type. In*

most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.' (EA general description).

Bedrock

4.3.2 The Environment Agency aquifer classification scheme indicates that the bedrock aquifer designation for the site is classed as Secondary A aquifer which are generally described as *'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'* (EA general description).

Groundwater Abstractions

4.3.3 There are no licensed groundwater abstraction points within 1000m of the site.

4.3.4 There are no public drinking water abstractions within 2000m of the site.

4.3.5 It is possible that there may be private unlicensed water abstractions that exist locally in the area.

4.3.6 There are no Source Protection Zones (SPZ) within 2000m of the site.

4.4 Hydrology

4.4.1 The nearest surface watercourse to the site is an unnamed river located approximately 13m to the north east.

4.4.2 There is no EA General Quality Assessment (GQA) data available within relevant distance to the site.

4.4.3 There are two discharge consents within 250m of the site. The nearest being approximately 19m south west of site and is listed as sewage effluent. The final one is listed as Trade Discharge – Processed Water, however this consent was revoked on 1st July 1991.

4.4.4 There are no pollution incidents to controlled waters within 250m of the site.

Surface Water Abstractions

4.4.5 There are no licensed surface water abstraction points within 1000m of the site.

4.4.6 It is possible that there may be private unlicensed water abstractions that exist locally in the area.

4.5 Flooding

4.5.1 Envirocheck indicates that the site is located within an area at risk of flooding or within 250m of an area at risk of flooding from rivers or sea.

4.5.2 Envirocheck indicates that the site is not located within an area at risk of flooding or within 250m of an area at risk of flooding from surface waters (i.e. pluvial – rainfall, sewers, drains etc.).

4.5.3 The site lies within an area that may be affected by flooding from groundwater at the surface.

4.6 Radon

4.6.1 The site is within a lower probability radon area, as less than 1% of homes are above the action level. Therefore, no radon protection measures are necessary in the construction of new dwellings or extensions.

4.7 Mining, Subsidence and Foundations

4.7.1 There is one BGS recorded mineral site within 250m for Opencast Sandstone mining, however the status of this is ceased.

4.7.2 The Coal Authority indicates that the site is located within a coal mining area and that a Coal Authority mining report is required for the site. However, GeoCon have reviewed the BGS geological maps of the

area and the Coal Authority interactive maps and advise that it is not required to commission a Coal Authority Mining Report.

4.7.3 The Coal Authority indicates that the site not located within a brine extraction area.

4.7.4 Landmark indicates that the risk from non-coal mining is rare.

4.7.5 The British Geological Survey provide risk ratings for the potential geological hazards outlined below in Table 4.3: Potential Geological Hazards.

Table 4.3: Potential Geological Hazards

Potential Geological Hazard	Hazard Potential
Compressible Ground	No hazard
Collapsible Ground	Very low
Ground Dissolution	No hazard
Running Sands	Very low
Shrinking or Swelling Clay	Very low
Landslides	Low

4.8 Landfills and Waste

4.8.1 There is one historical landfill site within 250 m of the site boundary.

4.8.2 There is one area where the potential for infilling is possible that have been identified by Landmark that they may have been infilled within unknown materials. This is approximately 183 m west of site and is listed as Deposited Waste included Household Waste.

4.8.3 Made ground may also be present on the site with unknown thickness and composition.

4.9 Fuel Storage

4.9.1 There are no fuel station entries within 500 m of the site.

4.10 Potentially Contaminative Uses

4.10.1 There is one contemporary trade directory within 250 m of the site. This is located approximately 68m to the East for Corinthian Stone Ltd (Concrete Products).

4.11 Hazardous Substances

4.11.1 There are no hazardous substance uses recorded within 500 m of the site.

4.12 Environmentally Sensitive Sites

4.12.1 There are two significant environmentally sensitive site within 250 m of the site.

4.12.2 There are two environmentally sensitivity site recorded with 250 m of the site, located onsite, of adopted Green Belt and a Nitrate Vulnerability Zone.

5.0 PRELIMINARY GEOTECHNICAL ASSESSMENT

5.1 General

5.1.1 The underlying shallow geology is likely to consist of Till overlying Morridge Formation which generally comprises gravelly clay with cobbles and varying silt sand and gravel content, and interbedded dark grey, shaly mudstones and pale grey protoquartzitic siltstones and sandstones respectively.

5.1.2 Made Ground may also be present on site.

5.1.3 Based upon the information reviewed, a list of potential geotechnical risks has been outlined below in Table 5.1: Potential Geotechnical Risks, which presents a summary of the likely geotechnical risks potentially present at the site.

Table 5.1: Potential Geotechnical Risks

Existing or Potential Features of Concern	Geotechnical Consideration	Geotechnical Risk to Proposed Development
Made Ground	Any potential made ground beneath the site.	Made ground can cause total and differential settlement of any new structures.
Trees and vegetation	Large mature trees surrounding the site boundaries.	Tree roots have the potential to cause clay soils to shrink causing settlement of new structures.
Shrinkage and expansion of clay soils	Clay soils beneath the site.	Potential for shrinkage and/or heave of clay soils causing damage to new structures.
Groundwater ingress	Shallow groundwater beneath the site.	Shallow ground water can have an impact on construction and foundation excavations. Pumping and/or dewatering may be required.
Existing / former foundations and underground structures	New buildings may be situated upon the sites of former demolished buildings or buildings that will be demolished as part of the proposed development.	Uneven founding, inconsistent ground conditions, and unsuitable bearing capacity for new structures.
Aggressive ground	Chemical content of the soils beneath the site.	Chemically aggressive ground may have the potential to attack buried concrete.
Soft / loose / weak soils and / or rock beneath the site	Unsuitable founding strata beneath the site.	Soft and lose soils or weak rock may be in adequate to found on. A suitable foundation option should be selected based on the actual ground conditions beneath the site.
Embankments	Unstable slopes and embankments.	Collapse onto or into any new developments
Shallow mine workings beneath the site	Any coal seams present beneath the site may have been worked in the past.	Worked mine seams leave voids underground that have the potential to settle when new loads are placed above them.

5.2 Discussion

Structures

5.2.1 The nature and distribution of geotechnical properties of the near surface strata have not been fully identified within this study, therefore it is not possible at this stage, to give meaningful advice as to the type, nature, and construction of any foundations for the proposed development.

5.2.2 The site is not considered to be affected by shallow coal mining.

5.2.3 The site is not considered or could be to be affected by brine extraction.

Sustainable Drainage

5.2.4 In accordance with National and Local Planning Guidance, the Planning Authority will insist surface water drainage from the proposed development complies with current design practices for Sustainable Urban Drainage (SUD's) construction of separate drainage systems for foul and surface water. Surface water shall be required to be attenuated to Greenfield runoff rates or better and attenuation up to the 1 in 100 year storm event plus 40% for climate change will be required on site.

5.2.5 Based on the indicative ground conditions encountered it is unlikely that sustainable drainage would be suitable at the site, however the presence and thickness (if present) of made ground at the site may result in sustainable drainage not be practical or feasible. If sustainable drainage is to be considered, it is recommended that soak-away testing is carried out in accordance with BRE 365 at the site to establish the sites suitability for sustainable drainage.

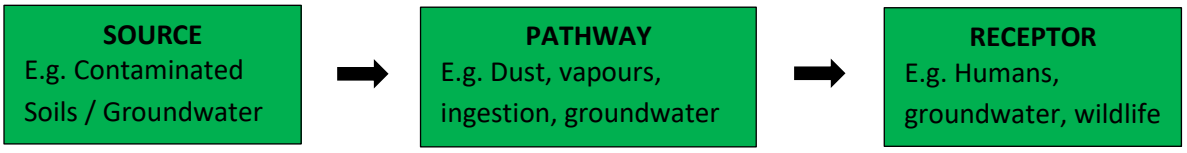
6.0 PRELIMINARY RISK ASSESSMENT

6.1 Introduction

6.1.1 In statutory guidance regarding potentially contaminated land, risk assessments are used as a technique on a site-specific basis to identify potential environmental issues. As recommended by BS 10175 an Initial Conceptual Generic Model has been formulated which defines the 'pollutant linkage' through source, pathway and receptor methodology. All three must be present in order to pose a risk to the end users and to the environment; i.e. if there is no pathway between the source and the receptor, then there is no 'pollutant linkage' and hence negligible risk to the receptor.

6.2 Risk Assessment Methodology

6.2.1 The purpose of a Phase I Preliminary Risk Assessment (Desk Study) is to obtain information regarding the site or property to gain a preliminary understanding of potential environmental issues. This information includes existing and proposed use, site history, and environmental setting. The information obtained is used to develop a Conceptual Site Model (CSM), which describes potential hazards (sources), pathways, and receptors, which may be relevant to a property or site. The following definitions have been adapted from Part IIA of the Environmental Protection Act (EPA) 1990:



6.2.2 **Source** – A source can be defined as a potential contaminant, substance, or condition that has the potential to cause harm to the environment, humans or other flora and fauna.

6.2.3 **Pathway** – A pathway is defined as the route by which a source is brought into contact with a receptor. This can include the transport of contamination via groundwater, wind borne dust, vapours, excavation and deposition, dermal contact, ingestion and inhalation.

6.2.4 **Receptor** – Receptors are defined as anything that can be affected by a source such as human beings, flora and fauna, other living organisms, groundwater and surface water, physical systems and built structures.

6.2.5 Some of the above such as groundwater, surface water, flora, and fauna can be considered as both pathways and receptors.

6.2.6 A risk may be considered significant if all three of the above stages are present and thereby forming a pollutant linkage.

6.3 Outline Conceptual Site Model

6.3.1 The potential risks based on the collated information gathered as part of this Phase I Preliminary Risk Assessment are discussed below.

Potential Sources (on and off site):

6.3.2 The following potential sources of contamination have been identified:-

- Reworked / made ground beneath the site associated with construction and demolition on site and of the surrounding area.
- Potential for contamination to have occurred at the site as a result of historical and contemporary industrial processes at the site.

- Potential for mobile hydrocarbon contamination at the site associated with historical and contemporary industrial uses / processes within influencing distance.
- Potential for hazardous ground gasses associated with any made ground beneath the site, and areas of potentially infilled land within influencing distance of the site.
- Potential for PCB's from nearby electrical substations.

Potential Pathways

6.3.3 The following potential pathways have been identified at the site:

- Ingestion and inhalation of site generated dust.
- Ingestion of vegetables produced on site.
- Dermal contact with contaminated materials.
- Inhalation, suffocation, and potential of explosion from hazardous ground gasses from off-site sources.
- Leaching of contaminants present in any made ground beneath the site into underlying soils, nearby surface waters and groundwater beneath the site.

Potential Receptors

6.3.4 The following potential receptors have been identified:

- Site end users and construction workers could be at risk from exposure to contaminated soils/materials at the site via ingestion, direct contact, and inhalation of contaminated dust/vapours. Members of the public off-site could also be at risk from inhalation of contaminated dust.
- End users of the site could be at risk from hazardous concentrations of ground gases via inhalation.
- Aquifer and drinking water beneath the site could be at risk from potential leachable and/or mobile contaminants at the site.
- Nearby surface water courses could be at risk from potential leachable and/or mobile contaminants at the site.
- Other ecosystems could also be at risk from potential contamination at the site.
- Any effluent 'aggressive' groundwater leaching contaminating substances from the made ground across the site has the potential to attack below ground structures and services.

6.3.5 Table 6.1: Outline Conceptual Site Model overleaf shows the outline conceptual site model with generic potential pollutant linkages.

Table 6.1: Outline Conceptual Site Model

Source of Contamination	Pathway	Receptor
Metals and metalloids (possibly contained within any Made Ground beneath the site) Asbestos fibres (possibly contained within any made ground beneath the site)	Ingestion of soil Inhalation of dust Dermal contact Consumption of home grown vegetables	Current and future site users Neighbouring residents Construction workers
	Plant Uptake	Plants within landscaping
	Leaching from contaminated soils into groundwater with vertical and lateral migration	Groundwater within Aquifer Local water courses
Any Organic Contamination (possibly contained within any made ground beneath the site or from off-site sources)	Ingestion of soil Inhalation of dust & vapours Dermal contact Consumption of home grown vegetables	Current and future site users Neighbouring residents Construction workers
	Reaction	Below ground service and structures
	Leaching from contaminated soils into groundwater or direct contact with groundwater followed by vertical and lateral migration	Groundwater within Aquifer Local water courses
Off-site contaminated groundwater migrating beneath this site from nearby sites	Inhalation of vapours Dermal contact	Current and future site users Construction workers
	Reaction	Below ground services
Hazardous ground gases (from any made ground present on site, local infilling, mine shafts, gases migrating up from Coal Seams beneath the site through minor faults/joints/fissures and through the drift, degradation of any organic contamination/matter (e.g. within Relict Topsoil horizons beneath the site)	Migration into buildings followed by build-up in poorly ventilated confined areas and inhalation Asphyxiation Explosion	Current and future site users Neighbouring residents Construction workers

6.4 Preliminary Risk Assessment

6.4.1 The Preliminary Risk Assessment has been evaluated using a probability / consequence matrix, which is provided in Appendix C.

6.4.2 Based on the site history and the environmental information available, potential contaminants identified on this site may include heavy metals metalloids and inorganics, organic and hydrocarbons, PCB's, and asbestos. The discussion below assesses the risk from these potential contaminants with a justification on whether they would likely be present and have the potential to cause significant harm, and provides a risk rating for the site.

6.4.3 The proposed development comprises of residential housing at the site.

6.4.4 The underlying superficial geology of the site and surrounding area is indicated to be Till which is of low permeability.

6.4.5 The underlying bedrock geology of the site and surrounding area is indicated to be Morridge Formation which is of high permeability.

Human Health

6.4.6 The potential for heavy metals, metalloids and inorganics to be present on or beneath the site is considered to be low. From the information available, the site itself has had limited historical use. Therefore, there it is possible that made ground will be present beneath the site associated with the past construction and demolition at the site and the surrounding neighbourhood, however it is not expected to be present in any significant thickness. Therefore, the risk from heavy metals, metalloids and inorganic contamination is considered to be **low**.

6.4.7 The potential for mobile, organic and leachable contamination to be present from historical and contemporary land uses on land within influencing distance of the site is considered to be very low. The likelihood for this contamination to have migrated onto the site the site is considered to be low based on the distances between the features and the site, and the generally impermeable geology beneath the site. Therefore, the risk from mobile, organic and leachable contamination is considered to be **very low.**

6.4.8 The potential for volatile (VOC's & SVOC's) contamination to be present from historical and contemporary land uses on land within influencing distance of the site is considered to be low. The likelihood for this contamination to have migrated onto the site the site is considered to be low based on the distances between the features and the site, and the generally impermeable geology beneath the site. Therefore, the risk from volatile (VOC's & SVOC's) contamination **very low**.

6.4.9 There are no known electric substations within 250m of the site.

6.4.10 It is possible that further electric substations or former electric substations are present within influencing distance to the site associated with the surrounding area that have not been identified on the historical maps.

6.4.11 Therefore, considering the above and the underlying geology, the risks from PCB's are considered to be **very low**.

6.4.12 Asbestos fibres could be present within any made ground shallow soils beneath the site from past site uses and phase of construction and demolition. Therefore, risks from asbestos are considered to be **low.**

Ground Gasses

6.4.13 There is one historical landfill site within 250 m of the site boundary where the potential for infilling is possible that have been identified by Landmark that they may have been infilled within unknown materials. This is approximately 183 m west of site and is listed as Deposited Waste included Household Waste.

6.4.14 Therefore, the risks to future end users and buildings are considered to be **low to moderate**; the risks to construction workers from the site are considered to be **low to moderate**; and the risks to neighbouring residents from the site are considered to be **low to moderate** at this stage.

6.4.15 Landmark indicates that the site is within a lower probability radon area, as less than 1% of homes are above the action level. Therefore, no radon protection measures are necessary in the construction of new dwellings or extensions.

Plants and Native Grasses

6.4.16 Any plants that may be grown at the site in areas of landscaping may potentially be at risk from phytotoxic elements in any artificial soils beneath the site.

6.4.17 Based on the above and the sites low potential for contamination, the risks to plants and native grasses are considered to be **low** at this stage.

Groundwater

6.4.18 The Environment Agency aquifer classification scheme indicates that the superficial aquifer designation for the site is classed as Secondary Undifferentiated aquifer and the bedrock aquifer designation for the site is classed as Secondary A Aquifer.

6.4.19 There are no licensed groundwater abstraction points within 1000 m of the site. There are no public drinking water abstractions within 2000 m of the site. It is possible that there may be private unlicensed water abstractions that exist locally in the area. There are no Source Protection Zones (SPZ) within 2000 m of the site.

6.4.20 Therefore, based on the above and the sites low potential for contamination, the risks to drinking water and groundwater are considered to be **very low** at this stage.

Surface Water

6.4.21 The nearest surface watercourse to the site is an unnamed river located approximately 13 m to the north east.

6.4.22 There are no licensed surface water abstraction points within 1000 m of the site. It is possible that there may be private unlicensed water abstractions that exist locally in the area.

6.4.23 Therefore, based on the above and the sites low potential for contamination, the risks to surface waters are considered to be **very low** at this stage.

Flooding

6.4.24 Envirocheck indicates that the site is located within an area at risk of flooding or within 250m of an area at risk of flooding from rivers or sea, but is not located within an area at risk of flooding or within 250m of an area at risk of flooding from surface waters (i.e. pluvial – rainfall, sewers, drains etc.).

6.4.25 The site lies within an area that may be affected by flooding from groundwater at the surface

6.4.26 Therefore, based on the above and the sites low potential for contamination, the risks to flooding are considered to be **low** at this stage.

Water Supply/Plastic Pipes

6.4.27 Any organic contamination present in the soils or groundwater beneath the site would pose a risk of premature failure to below ground services via chemical reaction. The risk of this are considered to be low at this stage.

Preliminary Conceptual Site Model

6.4.28 Table 6.2: Preliminary Conceptual Site Model and Potential Pollutant Linkages overleaf shows the preliminary conceptual model and potential pollutant linkages for the site which have been identified from the information above. Potential contaminants of concern (COC's) have been identified based on information provided within the Department of Environment (DoE) Industry Profiles (where available) for specific land uses and from a general range of contamination common to land uses not published by the DoE.

Table 6.2: Preliminary Conceptual Site Model and Potential Pollutant Linkages

Potential Sources	Contaminants of Concern	Potential Receptor	Potential Pathway	Likelihood	Severity	Pollutant Linkage	Risk Classification	Action / Mitigation
Made ground beneath the site Current and former site uses Current and former land uses within influencing distance to the site (on site and off site sources)	Heavy metals, sulphates and inorganics PAH's Asbestos Mobile organic contamination PCB's Leachable contamination (off site and on-site sources)	Human health animals and plants: Including current site users, future site users, neighbouring residents and constructions workers	Ingestion Inhalation Dermal Contact	Possible	High	Considered potentially active	**Low**	Site investigation to confirm presence, type and extent of any contamination beneath the site. Consult specialist asbestos contractor, if required.
		Local water courses and associated Flora and fauna	Contaminants leaching into water bodies, downward and lateral migration via permeable strata and features.	Possible	High	Considered inactive	**Very Low**	No further action, however, if made ground or any visual or olfactory evidence of contamination is encountered on site then this risk will need to be reassessed.
		Aquifer (Drinking water)	Contaminants leaching into water bodies, downward and lateral migration via permeable strata and features	Unlikely	High	Considered inactive	**Very Low**	No further action, however, if made ground or any visual or olfactory evidence of contamination is encountered on site then this risk will need to be reassessed.
Made ground beneath the site Current and former site uses	Phytotoxic elements	Plants and vegetation	Plant uptake	Possible	High	Considered inactive	**Low**	Site investigation to confirm presence, type and extent of any contamination beneath the site.

Potential Sources	Contaminants of Concern	Potential Receptor	Potential Pathway	Likelihood	Severity	Pollutant Linkage	Risk Classification	Action / Mitigation
Hazardous ground gases and vapours (on site and off site sources)	CO2, CH4 CO, H2S	Human health animals and plants: Including current site users, future site users, neighbouring residents and constructions workers Building	Inhalation Explosion	Possible	High	Considered potentially active	**Low to Moderate**	Site investigation to install gas monitoring wells with subsequent monitoring in accordance with CIRIA 665 is carried out at the site.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Geoenvironmental

7.1.1 A review of the preliminary information reveals that future end users of the site are potentially at **low** risk of being affected by contamination in soils and / or groundwater beneath this site.

7.1.2 Risks to neighbouring residents from the site are considered to be **low** at this stage.

7.1.3 Risks to construction workers from the site are considered to be **low** at this stage.

7.1.4 The risks of hazardous ground gasses affecting the site are considered to be **low to moderate** at this stage.

7.1.5 No radon protection measures are necessary in the construction of new dwellings or extensions.

7.1.6 The risks to surface waters are considered to be **very low** at this stage.

7.1.7 The risks to drinking water and groundwater are considered to be **very low** at this stage.

7.1.8 Risks to plants and native grasses are considered to be **low** at this stage.

Geotechnical

7.1.9 The nature and distribution of geotechnical properties of the near surface strata have not been fully identified within this study, therefore it is not possible at this stage, to give meaningful advice as to the type, nature, and construction of any foundations for the proposed development.

7.1.10 Inadequately designed buried concrete may be at risk from potentially elevated sulphates and low pH in the soils and groundwater beneath the site.

7.1.11 The site is not considered to be affected shallow coal mining. Therefore, risks from shallow coal mining are considered to be **very low** at this stage.

7.1.12 The site is not considered to be affected by brine extraction. Therefore, risks from brine extraction are considered to be **very low** at this stage.

7.1.13 Based on the indicative ground conditions encountered it is unlikely that sustainable drainage would be suitable at the site.

7.2 Recommendations

7.2.1 It is recommended that a suitable combined phase II geoenvironmental and geotechnical site investigation is carried out at the site to establish the presence of any contamination at the site, and to identify the ground conditions and provide details of their engineering properties in order to facilitate foundation design for the proposed development.

7.2.2 A recommended scope of works for the intrusive site investigation would be as follows:

- Windowless sample boreholes across the site to a nominal depth of up to 5.00 mbgl or refusal to facilitate geoenvironmental sampling; and to facilitate the installation of ground gas monitoring wells.
- Full supervision of all works by engineering geologist including sampling and detailed geotechnical descriptions to BS5930, EN ISO 14688-1 EN ISO 14688-2 and EN ISO 14689 of all strata types encountered within the exploratory holes.

- The installation of three combined gas and groundwater monitoring standpipes.
- Subsequent gas monitoring on six occasions over a three month period, commencing approximately one week after the completion of the ground investigation field work.
- A suitable suite of chemical testing, for determinants identified within the Preliminary Conceptual Model.
- A suitable suite of geotechnical testing.
- Provision of interpretative report to undertake a Generic Quantitative Risk Assessment (GQRA) and to provide details of the engineering properties of the underlying soils and rocks encountered with subsequent recommendations on suitable foundation solutions.

7.2.3 It is recommended that the above conclusions and recommendations are agreed in principle with the Local Authority and the Environment Agency to gain their approval prior to commencement of the development to avoid unnecessary complications or delays at a later stage.

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