

STAGE 1 DESK STUDY ENVIRONMENTAL RISK ASSESSMENT

At

Hill View/Wayside, Eastergate Lane,
Chichester PO20 3SJ

On behalf of

Eastmere Paddocks Ltd

PROJECT REFERENCE: CE25.1749

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constructiveevaluation
site investigation • building pathology



Stage 1 Environmental Risk Assessment Desk Study

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Foreword

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Appendix A – Site Walkover Photographs

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Executive Summary

Site Address	Hill View, Eastergate Lane, Eastergate, Chichester PO20 3SJ
Site Description	Grassland and garden of a residential plot, alongside a workshop garage and storage buildings.
Proposed Development	Redevelopment of the existing site for the development of nine new detached two-storey residential properties with private gardens, associated access roads and car parking areas.
Geology	Superficial: Head – gravel, sand, silt and clay Bedrock: London Clay Formation – clay, silt and sand
Hydrology	A small river named Lidsey Rife is located 589m southwest of the site and is part of the Arun and Western Streams management catchment. The site lies within the catchment zone for Lidsey Rife and the groundwater body labelled Sussex Lambeth Group.
Hydrogeology	Secondary A superficial aquifer on the site and secondary undifferentiated off site within the Head Deposits. The site lies over an unproductive aquifer within the London Clay Formation.
Topography	Based on Ordnance Survey 1:25000 maps of the area, the subject site is at an approximate elevation of 17m AOD. Local topography on site is relatively level.
Site History	The historical maps date back to 1876 showing a section of land within a larger field associated with other potentially agricultural fields within the area. The construction of a new building on the site and the neighbouring properties (Wayside and Hill View) are observed between 1937 to 1939. Additional buildings are constructed within 1974-1979 with the previous buildings being modified in 1991-1994.
Potential Areas of Concern	On Site: • Imported Made Ground • Waste, construction and builders' materials (skip and stockpiled) • Potential Asbestos Containing Material (ACM) • Potential chemical spillages from fuels and maintenance of vehicles, plant and equipment (Garage/workshop, warehouses and parked vehicles on the site) • Burnt remnants of unknown materials • Historic Nursery Complex – pesticide/fertiliser chemicals

	Off Site • Car Breakers Yard Potential chemical spillages from fuels and maintenance of vehicles (282m west) • Landfill inert/commercial/household waste (136m east & 184m north) Unspecified pits, sand pits and gravel pits within 500m north, east, south and west.
Conceptual Site Model	• Human Health - Moderate • Controlled Waters - Low/Moderate • Ground Gas - Moderate • Geological Hazard - Low
Ground Engineering	Potentially good foundation conditions, dependent on the nature and variability of the Head Deposits. According to the Groundsure report database search, the southern half of the site is within a radon affected area (between 3% and 5%).
Conclusions and Recommendations	Investigation for refinement of the potential risks identified within the Preliminary Conceptual Site Model and determine the geotechnical properties of the soil on the site.

1 Introduction

On 11th June 2025 Constructive Evaluation (CE) was commissioned by Eastmere Paddocks Ltd (the Client) to undertake a Stage 1 Desk Study Environmental Risk Assessment at Hill View/Wayside, Eastergate Lane, Eastergate, Chichester PO20 3SJ, hereafter referred to as the “site”. The site is located at Hill View, Eastergate Lane, Eastergate, Chichester PO20 3SJ, and National Grid Reference SU 94825 06003. The Site Location Plan is provided in **Figure 1**.

It is understood that the proposed development consists of the redevelopment of the existing site through building nine new detached two-storey residential properties with private gardens, associated access roads and car parking areas. A Proposed Development Plan is presented as **Figure 2**.

In accordance with BS5930:2015 the intent of this desk study is to:

- To provide information on the anticipated geology, hydrology, and hydrogeology of the subject site.
- Investigate the development history and most recent uses of the subject site.
- To identify whether there is any contamination on site which is likely to cause significant harm to human health, the environment, or other sensitive receptors.

To achieve these aims CE undertook:

- A site walkover to assess existing site conditions.
- A comprehensive assessment of Geo Insight data as acquired from Groundsure.
- A review of publicly available data including those published by British Geological Survey and Ordnance Survey.
- A Conceptual Site Model (CSM) based on environmental database information.

The works described in this report are subject to the Service Constraints presented in **Appendix C**. This report was finalised in June 2025 and should be read considering any subsequent changes in legislation, statutory requirements, statutory guidance, non-statutory guidance, relevant research, and industry practices. This report is currently assigned to the Client for their sole reliance.

2 The Site

2.1 Site Location

The site can be found in an area of residential and commercial land-use. A summary of the site surroundings is as follows;

- Northern boundary – Main gate entrance from Eastergate Lane. Vegetation and deciduous trees. A residential two-storey building with boundary defined with fence line.
- Eastern boundary – Detached two-storey residential properties.
- Southern boundary – Woodland and arable grassland with residential properties associated with Eastergate beyond.
- Western boundary – Arable grassland/agricultural land with sparse structure and Fontwell Avenue beyond.

The site is U-shaped with maximum dimensions of approximately ~85m east to west by ~140m north to south, covering an area of 0.77ha. Based on Ordnance Survey 1:25000 maps of the area, the subject site is at an approximate elevation of 17m AOD. Local topography across the site is level.

Access to the site is gained via the northern boundary from Eastergate Lane. The eastern half of the site is mostly surfaced by concrete, with an ~0.06ha area of grass towards the centre, whilst the western half of the site is entirely grass covered soft standing. The centreline of the site is marked by the boundary between two properties (Hill View & Wayside) and by a ~2m tall hedge. Several semi-mature apple trees are located in the northwest corner of the site, with mature oak trees bordering the southern boundary. Semi-mature and mature deciduous trees were noted along the eastern boundary with a single semi-mature silver birch in the rear garden of Wayside, near the centre of the site.

Several stockpiles were located across the site including construction material, building debris, wooden pallets, metal fencing and disused vehicles most notably in the northeast corner and southern boundary. Stockpiles of mostly wood and grass trimmings were noted in the western half of the site south of Wayside.

Multiple building structures were concentrated along the eastern boundary of the site including warehouses, garage/workshop buildings and stores. The building structures are constructed of wood, concrete and metal with corrugated metal sheet and corrugated cement roofing possibly containing asbestos. A small worn down green house and shipping container was noted close to the southern boundary just south of the grassy area in the eastern half of the site. Gas canisters, rusty metal drums, paint/oil containers, old equipment/plant, rubber tyres, burnt debris from a bonfire, several shipping/storage containers were all observed within the eastern area of the site.

The Site Walkover Plan is provided in **Figure 3**.

2.2 Site Walkover Observations

A site walkover was undertaken on 16th June 2025 with the aim of identifying any potential areas of concern that may be present on site prior to the commencement of any intrusive works.

The following areas of concern were observed:

- Potential Imported Made Ground beneath existing concrete hardstanding.
- Potential Asbestos Containing Material (ACM), within corrugated roofing.

- Potential chemical spillages from maintenance and storage of vehicles (oil, diesel, petrol).
- Construction and builders' materials (skip and stockpiled)
- Bonfire remains

Site Photographs are presented within **Appendix A**.

2.3 Aerial Photographs

Available aerial photographs of the site date back to 1999. From 1999 the photography highlights an area of grass/subsoil, approximately 400m² in the centre of the site has been stripped away and the western half is being used as a potential tree nursery in conjunction with the neighbouring land to the west. Between 2005 and 2012 the land to the west of the site has been cleared of any trees and a clear boundary is set between the site that still contains rows of trees. By 2023 the trees within the western half of the site have become more sparse and sporadic, and by 2024 the stripped turf in the centre and the southwest corner of field has been left to grow wild, whilst the northwest corner still has sporadic trees.

2.4 Historical Maps

A site history of the site was undertaken through the review of available historical map extracts within 250m of the site and are summarised in Table 1.

Table 1: Summary of Historical Maps

Date	Map Scale	On Site	Off Site
1876	1:2,500 & 1:10,560	Two sections of land with a boundary line down the centre of the site.	Gravel pit ~190m north of the site. Unnamed road (later Eastergate Lane) running east-west north of the site. Northfields farm ~200-300m to the west of the site. Eastergate village ~750m south of the site.
1896	1:10,560	No significant change.	No significant change.
1897	1:1,2500	No significant change.	No significant change.
1910	1:10,560	The site is shown to have an orchard/nursery layout with trees planted across the site.	The newly planted trees and grids extend in all directions around the site ~100m. New structures have been built ~100m southwest and west. An unnamed pit is located ~200m east of the site. Mass residential expansion of Eastergate, with a new village labelled West Barnham shown >1km southeast of the site.
1912	1:2,500	No significant change.	Unnamed pit ~150m to the east.
1937-1939	1:2,500	The eastern half of the site has been cleared of trees with a small rectangular building along the eastern side having been constructed.	Hill View and Wayside detached residential properties have been constructed adjacent to the centre of

			the site. Old Gravel Pits ~150m to the east have expanded. Additional structures associated with the tree nursey have been built ~150m southwest with mass expansion of the planting areas surrounding the site beyond the limit of the map.
1940	1:10,560	No significant change.	Gravel pit ~150m east of the site extends to the north of Walberton Lane (later Eastergate Lane). Nursery fields extend up to 750m southeast and northeast of the site. Further residential properties and commercial structures built around Eastergate to the south of the site, with the Fontwell Racecourse ~400m northwest of the site.
1961	1:10,560	No significant change.	No significant change.
1966 – 1969	1:10,560	No significant change.	No significant change.
1974 – 1979	1:2,500	Three rectangular structures have been built in the southeast corner of the site with an access road leading to a wider area from the north.	Grinstead Nursery ~100m to the northeast. The Gravel Pit ~150m east of the site has vegetation and labelled as disused Pits. Several detached residential properties have been built along the road to the north, to the east and greater than ~100m west of the site.
1979-1980	1:10,000	No significant change.	Much of the nursery has been returned to grassland. Further expansion from the southeast and northeast. New nursery and cattle grid constructed ~700m southeast of the site.
1991 – 1994	1:2,500	Eastern structure has been replaced with a larger rectangular structure. The western half is shown as a clear plot of land.	No significant change.
2001	1:10,000	No significant change.	No significant change.
2003	1:1,250	No significant change.	No significant change.
2010	1:10,000	No significant change.	A school and recreation ground has been built ~800m southwest of the site.
2025	1:10,000	The site and surrounding area are now present in their current condition.	

The historical maps date back to 1876 showing a section of land within a larger field associated with other potentially agricultural fields within the area. The construction of a new building on the site and the neighbouring properties

(Wayside and Hill View) are observed between 1937 to 1939. Additional buildings are constructed within 1974-1979 with the previous buildings being modified in 1991-1994.

The complete site history is provided in **Appendix B**.

2.5 UXO

The risk of UXO has been assessed by reference to the unexploded WWII aerial delivered bomb (UXB) regional risk maps produced by Zetica.

The Zetica risk maps indicate a low risk, and there is no known history of military activity in the area. However, a Luftwaffe target is indicated west of Fontwell Avenue approximately 900m west of the site. Overall risk of UXO is rated as low.

3 Physical Site Setting

Published geological information as available from the British Geological Survey and included within the Geo Insight data provided by Groundsure, and presented in **Appendix B** was reviewed to assess probable geological conditions.

3.1 Geology

Reference to the publications of the British Geological Survey (BGS), indicate that the site has a superficial cover of Head Deposits. Sedimentary bedrock of the London Clay Formation is indicated to underlie the site. The following sections summarise the anticipated geological strata as described in “The BGS Lexicon of Named Rock Units”.

3.1.1 Head Deposits

The Head Deposits formed between 2.588 million years ago (Ma) to the present, during the Quaternary Period. The deposits consist of clay, silt, sand, and gravel; and are poorly sorted and poorly stratified, angular rock debris and/or clayey hill wash and soil creep, mantling a hillslope and deposited by solifluction and gelifluction processes.

3.1.2 River Terrace Deposits

The River Terrace Deposits formed between 2.588 million years ago and the present during the Quaternary period. The deposits consist of sand and gravel, locally with lenses of silt, clay or peat.

3.1.3 London Clay Formation

The underlying bedrock is indicated to be of the London Clay Formation, deposited within the Ypresian Age (56Ma to 47.8Ma). The London Clay mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay.

3.2 Historical Boreholes

No historical boreholes are indicated to lie within the site boundaries. However, two historical boreholes were indicated to lie within 500m of the site.

The BGS ref. SU90NE49 was located 440m southeast of the site. The stratigraphic log described topsoil overlying white wall ballast over ballast to a depth of ~6.0mbgl. Groundwater was struck at ~3.0mbgl.

The BGS ref. SU90NW6/A was located 500m north-northwest of the site but was marked as confidential and could not be assessed.

A deep borehole located 750m east of the site (BGS ref. SU90NE32) recorded Head deposits to 5.8m, LC to 26m, Lambeth below to 56m over Chalk to at least 76m, with groundwater at 55.16m bgl.

3.3 Geological Hazards

3.3.1 Natural Hazards

Natural hazards identified on the site are summarised in Table 2.

Table 2: Summary of Potential Natural Hazards

Natural Hazard	Risk Rating
Shrink Swell	Low
Running Sands	Low
Compressible Deposits	Negligible
Collapsible Deposits	Low
Landslides	Very Low
Ground Dissolution of Soluble Rocks	Negligible

3.3.2 Ground Cavities and Sinkholes

There are no records of ground cavities and sinkholes within 500m of the site. These include natural cavities, mining cavities, and the national karst database.

3.3.3 Radon

According to the Groundsure report database search, the southern half of the site is within a radon affected area (between 3% and 5%).

3.3.4 Soil Chemistry

Reference to BGS estimated and measured soil chemistry indicates the likely background concentration of potentially harmful elements in and around the site. A summary of expected on-site soil chemistry concentration values is presented in Table 3.

Table 3: Summary of Expected Soil Chemistry Average Concentration Values

Element	Concentration (mg/kg)
Arsenic	15
Bio-accessible Arsenic	No Data
Lead	100
Bio-accessible Lead	60
Cadmium	1.8
Chromium	60 – 90
Nickel	15 - 30

3.4 Land Use Designations

The site lies within:

- A nitrate vulnerable zone, the Aldingbourne Rife NVZ Surface Water
- A Site of Special Scientific Interest (SSSI) Impact Risk Zone
- Grade 1 Agricultural Land Classification
- Traditional Orchards

Within 250m of the site lies:

- Two nitrate vulnerable zones, the continuation of the Aldingbourne Rife NVZ Surface Water and Sussex Chalk Groundwater
- Grade 3a Agricultural Land Classification (242m SW)
- Grade 2 Agricultural Land Classification (30m NW)
- Grade 1 Agricultural Land Classification (233m NW)
- Priority Habitats – Deciduous woodland and traditional orchards (38-153m from site)

3.5 Hydrology

A small river named Lidsey Rife is located 589m southwest of the site and is part of the Arun and Western Streams management catchment. The site lies within the catchment zone for Lidsey Rife and the groundwater body labelled Sussex Lambeth Group.

The site is indicated to have a limited chance of surface water flooding, with a small section at the centre of the site with the highest risk on site of a 1 in 30 year risk of 0.1-0.3m. The highest risk within 50m of the site is indicated to be a 1 in 30 year risk of 0.1-0.3m.

There is a Moderate-High risk of groundwater flooding on site, and a Moderate-High risk within 50m of the site.

3.6 Risk of Flooding from Rivers and the Sea

The site has no risk of flooding from Rivers and the Sea (RoFRaS) on site and within 50m of the site.

There are no recorded historical flood events within 250m of the site.

There are no recorded flood defences within 250m of the site.

There are no recorded flood storage areas within 250m of the site.

The site has not been identified as being within any Flood Zone of the Environment Agency floodplains, which include fluvial and tidal models.

3.7 Hydrogeology

The Head Deposits covering the site have been classified as a Secondary A aquifer. These consist of 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. Approximately 68m northwest of the site a secondary undifferentiated aquifer has been assigned to a narrow stretch of the superficial deposits. Secondary undifferentiated aquifers are assigned where it is

not possible to assign category A or B to a rock type. An additional secondary A aquifer is identified 110m east of the site.

The London Clay Formation is classed as Unproductive. These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. Secondary A aquifer is located 80m northwest of the site within the Lambeth Group.

3.8 Controlled Waters

There are no licensed discharges to controlled water within 500m of the site.

3.8.1 Groundwater Abstractions

There are two groundwater abstraction licences within 500m of the site. One is labelled as active, and one is labelled as historical, all located off the subject site. These are:

- Potable Water Supply – Direct (428m N) – Portsmouth Water Ltd
- Potable Water Supply – Direct (436m N) – Portsmouth Water Ltd

These wells are likely to be at depth below the London Clay Formation.

3.8.2 Surface Water Abstractions

There are no surface water abstraction licences within 500m of the site.

3.8.3 Potable Water Abstractions

There are two potable water abstractions within 500m of the site.

There is an active potable water abstraction for Eastergate Pumping Station located 428m north of the site and commenced on 31/03/1974.

There is a historic potable water abstraction for Eastergate Pumping Station located 436m north of the site and commenced on 31/03/1974.

3.8.4 Source Protection Zones

There are two Source Protection Zones (confined aquifer) within the site. They are:

- 1c – Inner catchment within confined aquifer
- 2c – Outer catchment within confined aquifer

These are likely to be focussed at depth below the London Clay Formation.

3.8.5 Groundwater Vulnerability

The on-site Secondary A superficial aquifer is identified as being of medium vulnerability, with an intermediate infiltration value of >70% and a dilution value of 300-550mm/year. The northern half of the site has been identified as having a very significant soluble rock risk with a moderate possibility of localised natural subsidence.

4 Desk Study

4.1 Information Sources

Information used to compile this desk study includes;

- Site walkover – photographs presented in **Appendix A**
- Environmental Database Information – presented in **Appendix B**

4.2 Historical Land Uses

The following assessment of the historical land uses adjacent to site summarises land uses and features land uses up to 500m from the site boundary, unless stated otherwise.

4.2.1 Historical Potentially Contaminative Industrial Sites

- Nursery, present in 1979; 13m NE, 268m S, 313m SW, 361m SW
- Old gravel pit, present in 1896 and 1910; 105m W
- Unspecified disused pits, present between 1940 and 1990; 139m E, 150m E, 217m N, 242m E
- Sand Pit, present in 1910; 147m E
- Garage/car breakers yard, present between 179 and 1984; 282m W
- Gravel pit, present in 1910; 225m N, 348m N
- Pumping Station, present between 1896 and 1940; 374-385m N
- Pumping Station, present between 1969 and 1940; 398-404m N

4.2.2 Historic Landfill

Records indicate two historical landfill sites within 250m of the site. These include:

- Eastergate Lane, 136m E. Waste type: inert, commercial and household. Recorded to be operational between 1949 to 1963.
- Wandley's Lane, 184m N. Waste type: inert. Recorded to be operational between 1979 and 1981.

4.2.3 Historic Waste Sites

Records indicate three historical waste sites within 500m of the site. These include:

- Ground workings and refuse heap, 228m N (1912)
- Car breakers yard/Scrap Yard, 282-285m W (1979 – 1994)
- Ground workings and refuse heap, 355m N (1912)

4.2.4 Historical Tank Database

Records indicate eight individual historical tanks within 500m of the site, split across two locations. These include:

- Unspecified tank (1974-1994), 299m W
- Tank/unspecified tank (1939-1974), 405-453m N

4.3 Contemporary Land Uses Adjacent to Site

The following potentially contaminative industrial sites are within 250m of the site boundary, unless stated otherwise.

4.3.1 Industrial Land Use

Records indicate four recent industrial land uses within 250m of the site:

- Electrical substation, 133m W
- SPR Centre (animal feeds, pet foods, hay and straw), 170m W
- JBS (Wood products including charcoal, paper, card and board), 179m NE
- Hidden Hearing (disability and mobility equipment), 189m W

4.3.2 Electricity Features

Records indicate one electricity feature within 250m of the site:

- Electricity substation, 133m W

4.3.3 Dangerous or Hazardous Sites

There are no dangerous or hazardous sites recorded within 250m of the site.

4.3.4 Part A(2) and Part B Activities and Enforcements

There are no Part A(2) and Part B Activities and Enforcements within 500m of the site.

4.3.5 Petrol and Fuel Sites

There are no recorded petrol or fuel sites within 500m of the site.

4.3.6 Potentially Infilled Land

- Old gravel pit, present in 1896 and 1910; 105m W
- Unspecified disused pits, present between 1940 and 1990; 139m E, 150m E, 217m N, 242m E
- Sand Pit, present in 1910; 147m E

4.3.7 Pollution Incidents

- Pollutant type: other – noise. (2002). Water impact: Category 4 (no impact), Land impact: Category 4 (no impact), Air impact: Category 3 (minor) – 259m W
- Pollutant type: Agricultural materials and wastes – solid manure. (2003). Water impact: Category 4 (no impact), Land impact: Category 3 (minor), Air impact: Category 3 (minor) – 423m NW

4.3.8 Licensed Discharge Consents

There are no licensed discharge consents recorded within 250m of the site. The closest recorded licensed discharge consent is 251m west and was active between 1994 and 1997.

4.4 Licensed Waste Sites

Records indicate three recent licensed waste sites within 250m of the site:

- On Site:
 - Sussex Recovery, metal recycling site (vehicle dismantler), issue date 1994
 - SRC Recycling Ltd, metal recycling site (vehicle dismantler), issue date 1994 modified in 2006
- Off Site:
 - SRC Recycling Ltd, metal recycling site (vehicle dismantler), issue date 1994 – 340m SW

4.5 Potential Areas of Concern

Potential areas of concern were identified during the undertaking of the desk study; these are summarised in Table 4 and shown in Figure 4.

Table 4: Summary of Potential Areas of Concern

Reference	On Site
A	Imported Made Ground
B	Waste, construction and builders' materials (skip and stockpiled)
C	Potential Asbestos Containing Material (ACM)
D	Potential chemical spillages from fuels and maintenance of vehicles (Garage/ workshop and parked vehicles on the site)
E	Burnt remnants of unknown materials
F	Historic Nursery Complex – pesticide/fertiliser chemicals
Reference	Off Site
G	Car Breakers Yard Potential chemical spillages from fuels and maintenance of vehicles (282m west)
H	Landfill inert/commercial/household waste (136m east & 184m north)
I	Unspecified pits, sand pits and gravel pits within 500m north, east, south and west.

4 Preliminary Risk Assessment

To assess the potential for risk, the Source-Pathway-Receptor relationships have been evaluated to determine whether there are potentially active pollutant linkages between sources and receptors. It is only when there is an active pollutant linkage, can there be a potential risk to a receptor from a source via a particular pathway. Each active pathway has been assigned a qualitative assessment as to the level of risk explained in Table 5 as per R&D 66⁴.

Table 5: Qualitative Risk Classification Scheme

		Consequence			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High	Very High risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate/Low risk	Low risk
	Low	Moderate risk	Moderate/Low risk	Low risk	Very low risk
	Unlikely	Moderate/Low risk	Low risk	Very low risk	Very low risk

4.6 Identification of Contaminant Sources

The potential sources of contamination on site and in the surrounding areas are summarised in Table 6.

Table 6: Identification of Potential Sources of Contamination

Potential Source	Location (distance m)	Potential Contaminants
Asbestos Containing Material (ACM) on stable roofing	On site	Asbestos
Chemical spillages from vehicles (oils and fuels)	On site/Off site	Hydrocarbons (TPH, BTEX, PAH), Heavy Metals, Phenols, Inorganics
Construction and builders' materials (skip and stockpiled)	On site	Hydrocarbons (TPH, BTEX, PAH), Heavy Metals, Phenols, Inorganics, Asbestos, Acids, Alkaline
Historic Gravel Pit and backfilled ground	Off site	Hydrocarbons (TPH, BTEX, PAH), Heavy Metals, Phenols, Inorganics, Asbestos, Acids, Alkaline
Animal Waste	On site	Organics, micro-organisms
Made Ground Soils	On site	Hydrocarbons (TPH, BTEX, PAH), Heavy Metals, Organics, In-organics, Acids, Asbestos
Imported Made Ground Hardstanding	On site	Hydrocarbons (TPH, BTEX, PAH), Heavy Metals, Organics, In-organics, Acids, Asbestos
Historic Landfill	Off site	Hydrocarbons (TPH, BTEX, PAH), Heavy Metals, Phenols, Inorganics, Asbestos, Acids, Alkaline.
Nursery Complex	On site/Off site	Organic solvents, Organic acids, Mineral acids, Heavy Metals, pesticides and herbicides

The initial CSM has identified a number of potential contaminant sources associated with the site's recent and former use as a nursery complex.

4.7 Pathways

4.7.1 Human Health Pathways

The potential human health exposure pathways, based on the relevant guidance¹, for a residential receptor are indicated in Table 7.

Table 7: Potentially Active Human Health Exposure Pathways

Potential Pathway	Active/ Inactive	Comments
<i>Ingestion of soil and dusts</i>	<i>Active</i>	<i>Qualitative Risk Assessment required</i>
<i>Dermal contact with soils and dusts</i>	<i>Active</i>	<i>Qualitative Risk Assessment required</i>
<i>Inhalation of dusts</i>	<i>Active</i>	<i>Qualitative Risk Assessment required</i>
<i>Inhalation of asbestos</i>	<i>Active</i>	<i>Qualitative Risk Assessment required</i>
<i>Inhalation of organic vapours (generated by shallow soils) in external areas or inside buildings</i>	<i>Active</i>	<i>Qualitative Risk Assessment required</i>
<i>Inhalation of organic vapours generated by dissolved phase surface water migrating onto site</i>	<i>Active</i>	<i>Qualitative Risk Assessment required</i>
<i>Inhalation of organic vapours generated by dissolved phase surface water migrating onto site from offsite sources</i>	<i>Active</i>	<i>Qualitative Risk Assessment required</i>

4.7.2 Controlled Water Pathways

The potentially active controlled waters migration pathways are indicated in Table 8.

Table 8: Potentially Active Controlled Water Pathways

Potential Pathway	Active/Inactive	Comments
<i>Impacted soils leaching to groundwater</i>	<i>Active</i>	<i>Qualitative Risk Assessment required</i>
<i>Impacted soils leaching to groundwater and migration to adjacent surface water</i>	<i>Inactive</i>	<i>Qualitative Risk Assessment required</i>

4.7.3 Ground Gas Pathways

¹ Environment Agency, August 2008. Updated technical background to the CLEA model. Science Report – SC050021/SR3

The potentially active migration pathways for ground gas are indicated in Table 9.

Table 9: Potentially Active Ground Gas Pathways

Potential Pathway	Active/Inactive	Comments
<i>Ground gas generated from current/historical landfills within 500m radius</i>	<i>Active</i>	<i>Historic landfill ~136m east of the site.</i>
<i>Ground gas generated from historical infilled land within 500m radius</i>	<i>Active</i>	<i>Potential backfilled historic gravel pit (Brit pit). Historic landfill ~136m east of the site.</i>
<i>Ground gas generated from disturbed made ground soils capped within hardstanding concrete</i>	<i>Active*</i>	<i>Qualitative Risk Assessment required</i>

*To be proven by site investigation.

4.8 Receptors

Based on future residential land use, the potentially sensitive receptors are considered as the following.

4.8.1 Human Health

- Site users
- Construction workers*

*The risks to on-site workers (during development) can be minimised by following appropriate health and safety guidance on site (i.e. wearing protective clothing, respiratory equipment and washing).

4.8.2 Controlled Waters

- Superficial Head Deposits (Secondary A and Secondary Undifferentiated).

The following have been discounted as they are anticipated to be below the London Clay Formation which would prevent any downward migration of contaminants:

Two Source Protection Zones are located within the site. Inner catchment 1c and Outer catchment 2c within a confined aquifer. Two Groundwater Abstractions within 500m of the site. Both direct sources from the Southern Region Groundwater.

4.8.3 Others

- Material construction of building and infrastructure

4.9 Qualitative Risk Assessment

A summary of the relevant pollutant linkages based on a Source-Pathway-Receptor analysis is provided in Table 10.

Table 10: Summary of Potentially Active Source-Pathway-Receptor Assessment

Source	Location (On/Off Site)	Contaminant	Potential Pathway	Potential Receptor	Probability	Consequence	Risk Classification	Notes
Potential chemical spillages from fuels and maintenance of vehicles	On-site Sources	Hydrocarbons (PAH, BTEX, TPH)	Inhalation of organic vapours generated by dissolved phase groundwater migrating from site to neighbouring properties	Human Health (On-site Residential)	Likely	Mild	Moderate/Low	Spillages from vehicles would be at small volumes and low occurrence rate.
Potential chemical spillages from fuels and maintenance of vehicles	Off-site Sources	Hydrocarbons (PAH, BTEX, TPH)	Inhalation of organic vapours generated by dissolved phase groundwater migrating from neighbouring properties to site	Human Health (Off-site Residential)	Low	Mild	Low	
Potential chemical spillages from fuels and maintenance of vehicles	On-site Sources	Hydrocarbons (PAH, BTEX, TPH)	Impacted soils leaching to groundwater and migrating towards surface water	Controlled Waters (On-site Residential)	Unlikely	Mild	Very Low	Spillages from vehicles would be at small volumes and low occurrence rate. Impermeable nature of the bedrock geology would make migration to groundwater unlikely.
Asbestos Containing Material (ACM)	On-site Sources	Asbestos fibres	Inhalation of asbestos	Human Health (Onsite Residential)	Likely	Severe	High	Potential ACM's in the form of cement bound roofing tiles on the warehouses. Testing of the roofing tiles for ACM would be advised prior to demolition.

Source	Location (On/Off Site)	Contaminant	Potential Pathway	Potential Receptor	Probability	Consequence	Risk Classification	Notes
Construction and builders' materials (skip and stockpiled)	On-site Sources	Hydrocarbons (PAH), Heavy Metals, Phenols, Inorganics, Asbestos, Acids, Alkaline	Inhalation of dusts and dermal contact	Human Health (Onsite Residential)	Low	Medium	Low/Moderate	The onsite soils are likely to contain elevated PAH and contaminants. However, given the current proposals for site, it is considered that the risk to the identified receptors is low as the material will be removed from site during the development.
Construction and builders' materials (skip and stockpiled)	On-site Sources	Hydrocarbons (PAH), Heavy Metals, Phenols, Inorganics, Asbestos, Acids, Alkaline	Impacted soils leaching to groundwater and migrating to surface water	Controlled Waters (Onsite Residential)	Low	Medium	Low/Moderate	
Made Ground soils	On-site Sources	Ground gases and vapours	Inhalation of organic vapours and ground gas	Human Health (Onsite Residential)	Low	Medium	Low/Moderate	Without knowing the gas/vapour regime, proposed new concrete flooring alone may not block the pathway.
Made Ground soils	Off-site Sources	Ground gases and vapours	Inhalation of organic vapours and ground gas	Human Health (Onsite Residential)	Low	Medium	Low/Moderate	Historic gravel pit (Brit pit) east of the site. Gas monitoring required.
Historic Landfill	Off-site Sources	Ground gases and vapours	Inhalation of organic vapours and ground gas	Human Health (Offsite Residential)	Low	Severe	Moderate	Offsite landfill to the east and north of the site could produce harmful gases that migrate on to site.
Nursery Complex	Off-site Sources	Organic solvents, Organic acids, Mineral acids, Heavy Metals	Impacted soils leaching to groundwater and migrating to surface water	Controlled Waters (Surface Water)	Low	Mild	Low	Impacted soils leaching is more likely from the soft-standing surface cover west of the site.
Nursery Complex	Off-site Sources	Organic solvents, Organic acids, Mineral acids, Heavy Metals	Vapour inhalation from dissolved phase migration from offsite sources	Human Health (Offsite Residential)	Unlikely	Medium	Low	Inclusion of gas/vapour protection (upgrading of DPC to vapour, sub floor ventilation and/or re-

Source	Location (On/Off Site)	Contaminant	Potential Pathway	Potential Receptor	Probability	Consequence	Risk Classification	Notes
Historic Nursery Complex	On-site Sources	Organic solvents, Organic acids, Mineral acids, Heavy Metals	Vapour inhalation from dissolved phase migration from offsite sources	Human Health (Onsite Residential)	Unlikely	Medium	Low	enforced concrete) would block this potential pathway. Without knowing the gas/vapour regime, proposed new concrete flooring alone may not block the pathway. Hardstanding ground within warehouses would block this potential pathway.

5 Ground Engineering Assessment

The following is summarised from the BGS 1:1M Superficial Engineering Geology map, and the 1:1M Bedrock Engineering Geology map.

There are superficial Head deposits identified on the site. They consist of very soft to very stiff sometimes sandy clay or silt. Desiccation of top few metres may result in firm to stiff material overlying soft to very soft deposits at depth. They have a low to moderate permeability flow dominantly through fissures.

Typically, easy digging. Excavations usually require immediate support, but stiff clays may be stable in short-term where groundwater ingress is controlled or absent.

Important to determine lithological variability and the presence, depth and extent of any soft compressible zones (and depth to sound strata). Assessment of shrink-swell potential and sulphate/sulphide contents in clay deposits and the potential for rapid collapse settlement in loessic deposits is advisable.

The bedrock geology of the London Clay Formation consists of firm to very stiff sometimes sandy clay or silt. It is effectively impermeable, however low permeability flow is dominantly through fissures.

Potentially good foundation conditions, dependent on the nature and thickness of the weathered zone, and the presence of marl bands and beds of flint nodules. Soakaways near structures are not advised.

Typically, easy digging to hard digging. Excavations usually require rapid support but stiff clays may be stable in short-term.

During the site investigation it is important to determine in situ variability in lithology and properties, including depth and nature of the weathered zone. In situ loading tests advisable to assess bearing strength at selected sites. Assessment of shrink-swell potential, sulphate/sulphide contents and running sand potential is highly advisable.

An assessment of the ground engineering parameters is provided in Table 11.

Table 11: Qualitative Ground Engineering Assessment

Category	Parameter	Potential Issue	Likelihood/Consequence
Foundations	<i>Fine Soil</i>	<i>Generally, not considered good for foundation conditions, dependent on shear strength and consolidation characteristics. Susceptibility to frost.</i>	<i>Moderate</i>
	<i>Coarse Soil</i>	<i>Generally good foundation conditions. Possible susceptibility to frost.</i>	<i>Low</i>
Drainage	<i>Fine Soil</i>	<i>Effectively impermeable to low permeability flow through fissures.</i>	<i>Low</i>
	<i>Coarse Soil</i>	<i>High to very high permeability flow through matrix.</i>	<i>Moderate</i>
Excavations	<i>Fine Soil</i>	<i>Easy digging to hard digging. Excavations require rapid support, though stiff clay may be stable in short-term.</i>	<i>Moderate</i>
	<i>Coarse Soil</i>	<i>Easy digging to hard digging. Immediate trench support required. May be water-bearing with running sands. Susceptible to collapses in the short-term.</i>	<i>Moderate</i>
Groundwater	<i>Shallow Groundwater</i>	<i>Control measures will be necessary where deposits are below the water table.</i>	<i>Low</i>

6 Conclusions and Recommendations

Based on the information provided within this Stage 1 Desk Study Environmental Risk Assessment Report, the conceptual site model and qualitative risk assessment has identified the following risk shown in Table 12.

Table 12: Summary of Qualitative Risk Assessment

Category	Risk Classification
Human Health	<i>Moderate</i>
Controlled Waters	<i>Low/Moderate</i>
Ground Gas	<i>Moderate</i>
Geological Hazard	<i>Low</i>

An intrusive investigation is recommended to confirm the conceptual site model and to determine the geotechnical properties on the site. CE recommends:

- 1) Shallow boreholes and/or trial pits to assess the composition and depth of any Made Ground and any field evidence of contamination into underlying soils.
- 2) Installation of three shallow standpipes to assess the potential for ground gas and vapour generation on site and from off site landfill, along with return monitoring.
- 3) Selected soil samples (including materials bearing field evidence of contamination) should be sent for laboratory analysis (identified below).
- 4) Soil samples should be screened for vapours using a Photoionisation Detector (PID).
- 5) If perched water is encountered, it should be sampled and tested. However, it is not considered necessary to investigate aquifer water quality at this stage.

Positions should be located in areas of concern: targeted to specific points of potential contamination such as historic gravel pit in southwestern area of site, below the footprint of proposed dwellings and in the location of buried services.

Monitoring for ground gases; three preliminary return visits at different weather/pressure conditions to record levels of common ground gases (carbon dioxide, methane, oxygen, VOC's) gas flow rates, and water levels.

The analytical suite, based on the known site history and walkover survey, should include:

- General parameters: Acidity (pH), fraction of organic carbon.
- A selection of shallow samples should be screened for pesticides and herbicides.
- Metals; Arsenic, Cadmium, Chromium (total), Lead, Mercury, Selenium, Boron, Copper, Nickel and Zinc.
- Non-metals: water soluble Sulphate, Sulphide, total Cyanide.
- Targeted organic parameters; TPH, BTEX, Speciated PAHs, VOCs and SVOCs, scheduled based on PID screening and field evidence etc.
- Visual asbestos screening of all Made Ground samples. Where possible asbestos fibres or ACMs are identified, these should be examined under a microscope to determine type.

Once the above have been undertaken the preliminary Conceptual Site Model can be refined. Further investigation or remediation may be recommended.

Further positions may be required, additional samples analysed, or additional determinants added to the analysis, as appropriate, based on any field evidence of possible contamination encountered.

Onsite and laboratory testing could also be undertaken to determine the geotechnical properties of the soil and/or rock conditions encountered on site.

In addition, the requirement for Waste Acceptance Criteria (WAC) testing should be considered to categorise soils in terms of disposal.

It would be prudent to confirm the scope of ground investigation works with the Local Authority and other stakeholders before carrying out these works.

7 Relevant Guidance

Constructive Evaluation has duly taken account of the recommendations contained within the following current and historical guidance documents during the preparation of this report.

1. Land Contamination Risk Management (LCRM) produced by DEFRA and the Environment Agency²
2. Environment Agency Soil Science Report SR3³.
3. Safe Development of Housing on Land Affected by Contamination⁴.
4. British Standards guidance for the Investigation of Potentially Contaminated Sites⁵ and for undertaking of Site Investigations⁶
5. Environment Agency Updated Technical Background to the CLEA Model⁷
6. Sampling Strategies for Contaminated Land⁸

The above documents produced by DEFRA, the Environment Agency, the National House-Building Council (NHBC) and the Chartered Institute of Environmental Health (CIEH) outline structured mechanisms to identify potential risk issues and, where necessary, provide a way forward to develop a robust risk management strategy to address potentially unacceptable risks in an appropriate manner.

The National Planning Policy Framework⁹ has also been considered. This document states that, prior to development, a site must meet the following criteria;

- The site is made suitable for its intended use, taking account of all ground conditions arising from natural and former activities, pollution arising from previous uses and proposals for mitigation including land remediation.
- After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990.
- Adequate site investigation information, prepared by a competent person, is presented.

² Environment Agency. October 2020. Land Contamination Risk Management.

³ Environment Agency. 2009. Science Report SC050021/SR3

⁴ Environment Agency. 2008. Guidance for the Safe Development of Housing on Land Affected by Contamination. R&D 66.

⁵ British Standards. 2011. Investigation of Potentially Contaminated Sites – Codes of Practice. BS5930: 2011.

⁶ British Standards. 2015. Code of Practice for Site Investigations. BS5930: 2015.

⁷ Environment Agency. August 2008. Updated Technical Background to the CLEA Model. Science Report – SC050021/SR3.

⁸ DOE. 1994. Sampling Strategies for Contaminated Land. CLR Report No 4.

⁹ Department of Communities and Local Government. March 2012.

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The recommendations made and opinions expressed in the report are based on the conditions revealed by the site works together with an assessment of the data from the insitu and laboratory testing or in respect of the desktop reports. No responsibility can be accepted for conditions that have not been revealed by the research, site works and testing.

The Client is advised that the conditions observed on site by Constructive Evaluation Limited at the time of any site survey may be subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance and they may subsequently have become evident. It is not possible to assess areas which are inaccessible or where access is not granted and CE accept no liability for risks subsequently identified therein.

The conceptual model, Risk assessment and sampling regime has been formulated in accordance with current UK guidance at time of production based upon the relevant information gained from Phase 1 and Phase 2 investigations. While the model and assessment offer opinions and interpretations of these guidelines, the comments made are for guidance only and no liability can be accepted for their accuracy. It is possible that aspects of desktop study may need to be altered to conform to the requirements of the statutory regulatory bodies.

Intrusive Field Operations

The data collected through direct operations in the production of this report has been so obtained, unless directly otherwise stated, in accordance with current UK guidance, law or accepted industry practice, including but not limited to: BS.5930: 1990 Code of Practice for Site Investigations (Amendment 2: 2010), BS 10175:2011+A1:2013 Investigations into Potentially Contaminated Sites, and BS.8576:2013 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds. Exact exploratory locations will depend upon access conditions, site use and plant capability, CE do not accept liability for issues arising from material identified between or outside of the area of exploratory locations.

Laboratory Testing

Unless stated otherwise within the text, all geotechnical and material laboratory tests have been performed in accordance with the relevant British Standard Documents. Laboratory testing for contaminated land assessment is completed under the UKAS / MCERTS accreditation schemes, unless identified as otherwise in the report.

Human Health Risk Assessment Criteria

The Environment Agency has recently undertaken revision of the Soil Guideline Values (SGVs) which are partially complete. Where standards are available using the "new" approach, these have been utilised for correlative purposes. Where standards have not yet been revised, guidance following the "old" approach has been utilised. Please note that upon release of the remaining guidelines, the standards contained within this report may be subject to change. In addition, the second edition of the LQM CIEH guidance has now been released and will be utilised in favour of previously published guideline values.

Third Parties

The findings and opinions conveyed in this report are based on information obtained from a variety of sources, including that from previous Site investigations and chemical testing laboratories. Constructive Evaluation Limited has assumed that such information is correct. Constructive Evaluation Limited cannot and does not guarantee the authenticity or reliability of the information it has relied upon and can accept no responsibility for inaccuracies with the data supplied by other parties.

The accuracy of the historical map extracts supplied cannot be guaranteed and it should be noted that different conditions may have existed between mapping sheet editions. Therefore, there can be no certainty that all areas of contamination have been identified during the Phase 1 investigation.

Definitions

Reference to the word "contamination" in this report does not relate to the statutory definition of contaminated land under 1990 Environmental Protection Act unless otherwise stated. The definition used in this report is: "Land that contains substances that, when present in sufficient quantities or concentrations, are likely to cause harm, directly or indirectly, to man, to the environment, or on occasion to other targets" (NATO CCMS, 1985).

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