

AGAR GROVE

CONTAMINATION REPORT

DECEMBER 2013



**Document prepared on behalf of the London
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**Proposed Residential Development,
Agar Grove Estate, Camden, London NW1**
Phase 1 Ground Condition Assessment



On behalf of: **London Borough of Camden**



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Summary

This report presents the findings of a Phase 1 Ground Condition Assessment to support a planning application for a residential development at Agar Grove Estate, Camden.

Site Description The Site is located on the northwest slope of the valley of the former River Fleet. The natural ground conditions comprise the London Clay Formation with the Lambeth Group at depth. Historically the Site was initially developed for residential housing in the 1850-60s and redeveloped again as residential housing in the mid-1960s.

Ground Stability Risk Assessment A review of potential geological hazards has identified the risk for potentially adverse foundation conditions to be present, in general, to be **Very Low**. The exception relates to a **Moderate** potential risk for volume change owing to the presence of shrinking/swelling clays in the London Clay Formation.

Tier 2 Geoenvironmental Risk Assessment The findings of a qualitative risk assessment carried out to assess hazards and constraints posed by the existing site conditions to the proposed development are summarised in the following table.

Potential Receptor	Risk Assessment	Description
Site Workers	Low	The risk to site workers is expected to be Low provided appropriate protective clothing and equipment are worn, and good standards of hygiene are adopted to prevent prolonged skin contact, inhalation and ingestion of soils.
Future Site Users	Very Low	The proposed buildings and hard surfaces, together with the provision of a layer of topsoil/subsoil in areas of soft landscaping will effectively mitigate the exposure of future site occupiers and users to any potential contaminants.
Ground and Surface Waters	Very Low	Given the nature of the proposed development, the potential for any mobile contaminants to adversely affect the quality of ground and surface waters is considered to be Very Low.
Ecology and Wildlife	Very Low	Owing to the potential for contaminants to be present in the ground and the distance to the nearest ecological receptor the risk to ecology and wildlife is expected to be Very Low.

The geoenvironmental risk assessment indicates that any potential contaminants and hazardous ground gases do not by themselves represent an unacceptable risk to the human health, controlled waters or ecology and wildlife associated with the development of the Site as currently proposed. On this basis, there is no reason that the site would be designated as Contaminated Land under Part IIa of the Environmental Protection Act 1990.

The summary contains an overview of the key findings and conclusions. However no reliance should be placed on any part of the summary until the whole of the report has been read.

1.0 Introduction

Peter Brett Associates LLP (PBA) has been commissioned by London Borough of Camden (the Client) to carry out a Phase 1 Ground Condition Assessment to support a planning application for a residential development at Agar Grove Estate, Camden.

The object of the study is to review readily available information to assess the likely ground conditions at the Site and immediate surrounding land, thereby to identify potential geoenvironmental and geological hazards and constraints to the proposed redevelopment.

In accordance with the requirements of the National Planning Policy Framework (DCLoG, 2012), the assessment has been carried out in accordance with "established procedures" using current UK best practice and guidance as given in British Standard 10175 (2001), Contaminated Land Report 11 (EA, 2004) and NHBC Standards Chapter 4.1 (NHBC, 2011a). The study also follows the general guidelines outlined by the London Borough of Camden Planning Guidance (LBC, 2011).

The scope of work performed by PBA comprises:

- i) A review of readily available geological, hydrogeological and aquifer vulnerability maps; and historical Ordnance Survey maps; together with any ground investigation data; and construction drawings and reports.
- ii) A qualitative assessment of geological hazards and ground stability risk to identify the potential risk arising from artificial cavities; natural cavities; and other potential adverse foundation conditions.
- iii) A qualitative Tier 1 contamination risk assessment utilising a Conceptual Site Model to identify 'source-pathway-receptor' linkages to assess the potential risk and hazards, if any, associated with existing or potential future contamination in the ground.

This report presents the findings of the study together with a qualitative assessment of any hazards and constraints posed by the existing ground conditions to the proposed development. This report also comments on any mitigation measures that may be required as part of the proposed redevelopment.

Guidance on the context of this report and any general limitations or constraints on its content and usage are given in a guidance note included after the text of this report.

2.0 The Site

2.1 Site Location

The Agar Grove Estate is centred at National Grid Reference TQ 295 842 about 0.7 km northeast of the historical centre of Camden Town. The location of the estate is shown on a Site Location Plan presented as **Figure 1**.

The Agar Grove Estate is largely trapezoidal in shape with overall plan dimensions of about 180 by 220 m and a plan area of about 2.8 Ha. The estate is bounded to the west by Agar Place, to the northwest by Agar Grove road, to the east by Camley Street, and to the south by an elevated railway of the London Overground network (formerly denoted the North London Line). The proposed redevelopment site comprises the area of the existing estate with the exception of the area occupied by two residential blocks (denoted Cranbourne and Ferndown) on the eastern part of the estate. The layout of the Site is shown on a Site Layout Plan presented as **Figure 2** of this report.

The Site is located on the northwest slope of the valley of the River Fleet which formerly flowed to the southeast about 0.4 km southwest of the Site. Existing ground levels fall from northeast to southwest from about 33.5 m OD to about 28.5 m OD.

2.2 Site History

Information on the history of the Site and surrounding area has been determined by reference to a number of readily available historical and current Ordnance Survey (OS) maps, supplemented where possible by reference to early maps and other historical records. Copies of the extracts from the historical and current OS maps are presented in **Appendix 1**; for ease of presentation the OS maps are presented at a reduced scale (from A3 to A4) with duplicate and blank maps omitted.

Up to the early-1850s, the Site and surrounding area was largely undeveloped agricultural land. The area of the Site was initially developed in the 1850s and 1860s associated with the construction of the East & West India Docks & Birmingham Junction Railway (now a London Overground line) along the southern boundary of the Site and later the Midland Mainline Railway along the eastern boundary.

The earliest detailed OS maps available date from the early-1870s and show the initial development consisted of large semi-detached houses fronting onto St Paul's Road (now Agar Grove) to the northwest, a mix of semi-detached and terraced houses with a church (St Thomas's Church) fronting onto Elm Road on the central part of the Site and terraced houses fronting onto Wrotham Road and backing onto the elevated London Overground line on the southern part. Also by this date, the area to the north and west of the Site had largely been developed primarily with residential properties, whilst the land to the south and east was largely given over to railway sidings and associated goods sheds and cattle and coal depots.

Between the mid-1870s and the mid-1960s, the available maps indicate no significant change took place to the size and layout of the buildings on the Site or the adjacent area. The Bomb Damage Maps (LTS, 2005) indicate the houses and buildings on the Site suffered general blast damage as a result of German bombing during World War II.

By the late-1960s, the Site had been redeveloped into the configuration in-situ today with a single high-rise residential block (Lulworth House) surrounded by a series of low/medium rise residential blocks with associated access roads, car parking and areas of soft landscaping. By the late-1980s, the area of railway sidings to the east of the Site had been redeveloped by the construction of a series of light industrial units and an access road (denoted Camley Street) from the south via an existing brick arch under the elevated London Overground line.

Since the early-2000s, a children's nursery (denoted Agar Children's Centre) has been constructed on the southern part of the estate, and two residential blocks (denoted Cranbourne and Ferndown) on the eastern part of the estate.

2.3 Current Site Use

The Site is currently occupied a mixture of blocks of flats, maisonettes and terraced houses, together with associated vehicle access, car parking, pedestrian walkways and areas of soft landscaping that comprise the Agar Grove residential estate.

The central part of the Site is occupied by a single high-rise residential block, namely Lulworth House, which comprises a 19-storey structure of reinforced concrete construction that forms a block of 137 flats. The building comprises two conjoined and offset rectangular wings, on a north-south orientation. Centrally a circulation and services core links the two wings. A plant room is located on the roof of the central core. Communal and concierge facilities are located at ground floor level. A single level basement is currently closed off to public access but was previously used as stores.

Other residential blocks include Broadstone on the southwest part of the Site which comprises a terrace of two storey houses; Abbotsbury, Ashmore, Frampton, Manston and Nettlecombe on the northern and southeast parts of the Site that comprise 3-4 storey high blocks of apartments; and Sherborne and Sturminster on the northern part of the Site that comprise two storey blocks of maisonettes. The Agar Children's Centre is present on the southern part of the Site.

Frاندown and Cranbourne residential blocks on the eastern part are present on the southern part of the Estate.

The buildings are surrounded by landscaped areas of grass with a boundary wall to the east, and a boundary fence to the northwest. Vehicular access is via an access road from Agar Grove and Agar Place, with additional pedestrian access via a number of gates and footpaths along these roads.

The Site is bordered to the northwest by Agar Grove road beyond which sits an area of mid-to-late 19th century high-quality terraces and villas focused around Camden Square. To the east lies Camley Street which is occupied by low rise light-industrial units. Beyond Camley Street lies the mainline railway into St Pancras and then the 1960s Benson and Forsyth Maiden Lane Estate which is also undergoing refurbishment as part of Camden's estate programme. To the south is the elevated railway of the London Overground line beyond which sits a pocket of low rise late 20th century housing. To the west is a predominantly residential area.

The layout of the Site is shown on the Site Layout Plan presented as **Figure 2**.

2.4 Environmental and Industrial Setting

Information on the environmental and industrial setting of the Site is presented in an EnviroInsight Report (Emap, 2013a) prepared for the Site, a copy of this report is reproduced in **Appendix 2**. The results of the database search are summarised on the following table and discussed in the following sections.

Summary of Environmental and Industrial Setting

Data Type	Number on Site ⁽¹⁾	Number within 250 m of Site ⁽¹⁾
Waste Regulation		
Landfill Sites	0 (0)	0 (0)
Licensed Waste Management Facilities	0 (0)	0 (0)
Statutory Permits/Authorisations		
Part A(1) and IPPC Permitted Activities ⁽²⁾	0 (0)	0 (0)

Data Type	Number on Site ⁽¹⁾	Number within 250 m of Site ⁽¹⁾
Part A(2) and Part B Permitted Activities	0 (0)	0 (0)
Radioactive Substance Authorisations	0 (0)	0 (0)
Planning Hazardous Substances ⁽³⁾	0 (0)	0 (0)
Potential Contaminative Uses		
Fuel Stations	0	1
Trade Directory	0	~50

Note: 1) Numbers in brackets denotes number of authorisations, licences or permits that are lapsed, revoked, cancelled, superseded, defunct, surrendered, not applicable, withdrawn or not yet started.
2) Includes historic Integrated Pollution Controls, Integrated Pollution Prevention and Control, Local Authority Integrated Pollution Prevention and Control and Local Authority Pollution Prevention and Control permits.
3) Includes COMAH (Control of Major Accident Hazards) and NIHHS (Notification of Installations Handling Hazardous Substances) sites.

Statutory Permits/Authorisations/Potential Contaminative Uses The trade directory entries identified in the vicinity of the Site typically relate to local light industrial and commercial activities. The closest activities relate to the repair, testing and servicing of motor vehicles at number of units within the industrial units off Camley Road located immediately east of the Site.

Given their nature, size and/or distance from the Site, none of these activities listed are considered to represent a particular risk of environmental hazard to the Site or the proposed development.

Areas of Environmental Sensitivity The closest area of environmental sensitivity to the Site is Camley Street Nature Park located approximately 0.6 km south of the Site. Camley Street Nature Park is Local Nature Reserve comprising 0.8 hectares of land on the banks of the Regent's Canal by St Pancras Lock and adjoining St Pancras Basin. The park contains a variety of habitats including wetlands, meadow and woodland.

2.5 Proposed Development

The Agar Estate development forms part of Camden's 'Community Investment Programme' which aims to generate investment, deliver new homes and regenerate neighbourhoods.

The current proposal is to demolish the low/medium rise residential blocks on the Site followed by the phased redevelopment of the Site with a number of new-build residential blocks and the refurbishment of the Lulworth Tower positioned centrally on the Site. The proposed development also includes replacement local convenience retail and cafe; community facilities and a new small-scale business space together with areas of open space, parking and associated infrastructure to support the development and contribute towards the creation of a high-quality environment. The existing children's nursery on the southern part of the estate is to be retained.

3.0 Geology, Hydrogeology and Hydrology

3.1 Geology

3.1.1 Published Geology

The 1:50 000 scale geological map of the area (BGS, 2006) and the geological memoir (BGS, 2004) indicate the solid geology in the area of the Site comprises the London Clay Formation with the Lambeth Group (formerly denoted the Woolwich and Reading Beds) at depth. Historical borehole and well records held by the BGS archive indicate the London Clay is about 40 m thick in the area of the Site.

Superficial deposits are not shown to be present in the area of the Site however, it is possible that Head Deposits formed by natural geomorphological processes are present over the London Clay Formation. Made Ground associated with the previous development of the Site is expected to be present overlying the natural strata.

3.2 Geological Hazards

3.2.1 Radon

Radon is a naturally occurring radioactive gas and emanates from geological formations to varying degrees, depending on the type, porosity and permeability. An assessment of potential for radon gas to be present is given in a GeolInsight Report (Emap, 2013b) and reproduced in [Appendix 3](#). This assessment indicates that Site is situated in area where protection measures are currently not required for radon gas.

3.3 Hydrogeology

The published groundwater vulnerability map of the area (NRA, 1995) indicates the London Clay Formation is classified as Unproductive Strata (formerly non-aquifer), these are rock layers or drift deposits with low permeability and have negligible significance for water supply or river base flow. However, groundwater flow through such formations, although imperceptible, does take place and needs to be considered in assessing the risk associated with persistent pollutants.

The leaching potential of the soils on the Site has not been determined as the potential mobility of non-absorbed diffuse source pollutants and liquid discharges will be determined by the properties of the underlying strata.

The latest indicative maps included in the EnviroInsight Report (Emap, 2013a) indicate that the Site is not located in any groundwater source protection zone. Groundwater source protection zones are defined as the groundwater catchment zones for significant public water supply and private wells or boreholes that supply water to potable or equivalent standards.

3.4 Hydrology

The nearest surface water body is the Regent's Canal that runs southeast-northwest about 150 m southwest of the Site.

The site is located within a Critical Drainage Area owing to the flat gradient and amount of impermeable surfacing (PBA, 2013).

3.5 Groundwater and Surface Water Control

Information on ground and surface water controls is presented in the EnviroInsight Report (Emap, 2013a) reproduced in **Appendix 2**. The results of the database search are summarised on the following table.

Summary of Groundwater and Surface Water Control

Groundwater and Surface Water Controls	Number on Site ⁽¹⁾	Number within 1.0 km of Site ⁽¹⁾
Abstractions	0 (0)	4 (0)
Discharge Consents	0 (0)	0 (0)
Pollution Incidents to Controlled Waters	0	0
Prosecutions Relating to Controlled Waters	0	0

Notes: 1) Numbers in brackets denotes number of authorisations, licences or permits that are lapsed, revoked, cancelled, superseded, defunct, surrendered, not applicable or not yet started.

Abstractions The closest licence relates to the abstraction of groundwater from a well in the deep chalk aquifer located approximately 0.3 km east of the Site with the abstracted water used to supply a concrete batching plant. The closest licence for potable water relates to the abstraction of groundwater from a well in the deep chalk aquifer located approximately 0.8 km northwest at the Kentish Town Sports Centre.

4.0 Ground Stability Risk Assessment

4.1 Introduction

In accordance with the requirements of the National Planning Policy Framework (DCLoG, 2012), the potential for the proposed development to contribute to or to be adversely affected by land instability has been assessed. Accordingly, consideration is given below to the potential risk of subsidence arising from Artificial Cavities; Natural Cavities; and Potential Adverse Foundation Conditions arising from existing ground conditions across the Site, as identified by the desk study.

4.2 Artificial and Natural Cavities

The Natural and National Mining Cavities Database maintained and updated by PBA has been searched for relevant natural and mining cavity records. No record was found of natural and mining cavities within a 1.0 km radius of the Site. Whilst the absence of existing records does not, in itself, demonstrate that natural or mining cavities are not present on the Site, the geology and geomorphological setting of the Site is such that the potential for such features to be present is considered to be **Very Low**.

4.3 Potential Adverse Foundation Conditions

An assessment of potential geological hazards that may give rise to adverse foundation or construction conditions as supplied by the British Geological Society from their National Geoscience Information Service are presented in a GeoInsight Report (Emap, 2013b) and reproduced in **Appendix 3**. The assessment is generated automatically based on digital geological maps and the scope and the accuracy is limited by the methods used to create the dataset and is therefore only indicative for the search area.

The information contained in the GeoInsight Report has been reassessed by PBA considering the specific information available for the Site. The modified assessment of the potential for geological hazards to be present on the Site is summarised below.

Summary of the Geological Hazards

Stability Hazard	Hazard Potential	Comment
Shrinking or Swelling Clay	Moderate	The London Clay Formation is expected to have a high volume change potential (NHBC, 2011b). Due allowance will need to be made for the presence of the trees and shrubs in the design of foundations, floor slabs and infrastructure founded on this strata.
Landslide	Very Low	The gradient of the Site is significantly flatter than the expected maximum safe gradient of the ground.
Ground Dissolution	Very Low	The ground conditions are not considered to be susceptible to the development of natural cavities as a result of dissolution
Compressible Ground	Very Low	The ground conditions are such that layers of very soft compressible materials such as organic clay or peat are not expected to be present
Collapsible Ground	Very Low	The ground conditions are such that a rapid reduction in volume is not expected to occur when they are loaded and saturated with water.
Running Sand	Very Low	The ground conditions are such that there is expected to be no significant potential for internal erosion associated with groundwater flows into excavations below the water table.

4.4 Surface Working

The historical OS maps do not indicate any surface workings on or in the immediate vicinity of the Site.

5.0 Tier 2 Geoenvironmental Risk Assessment

5.1 Risk Assessment Strategy

To assess the potential risk to the proposed residential development in relation to the quality of the ground and groundwaters, a qualitative risk assessment has been carried out utilising a Conceptual Site Model to identify 'source-pathway-receptor' linkages. This assessment has been made from consideration of the information currently available.

For the purposes of this study the potential for a significant source, pathway or receptor being present have been assessed in terms of their magnitude and extent as being very low, low, moderate, high or very high. The environmental risk is determined by the interrelationship between the potential for a source of contamination to be present, the potential for migration of the contaminant along a given pathway, and the significance of potential receptors for any identified source-pathway-receptor linkage. This approach allows the magnitude and probability of the possible consequences that may arise as a result of a hazard to be assessed and possible unacceptable risks to be identified. Details of the methodology used are given in the guidance notes included after the text of this report.

5.2 Potential Sources

Historically the Site was undeveloped agricultural land until the early-1850s. The area of the Site together with the areas to the north and west were then developed primarily as residential housing, whilst the areas to the south and east were developed as railway infrastructure including areas of goods yards and coal and cattle depots. The Site was redeveloped in the mid-1960s with the construction of a series of residential blocks with associated access roads, car parking and areas of soft landscaping.

There are no known major sources of contamination within the Site and the historic and the current use of the Site makes the presence of significant concentrations of potential contaminants unlikely. Any contamination is expected to comprise scattered marginally elevated concentrations from isolated point sources and overall the potential for contamination to be present on the Site is considered to be **Low**. Based on the available information on ground conditions, the potential for any deleterious material producing hazardous ground gases to be present is considered to be **Very Low**. The presence of localised areas of significant contamination or hazardous ground gases associated with, for example, the disposal of debris during demolition of the previous development cannot at this time be discounted.

The area surrounding the Site typically comprises areas of residential development and local commercial and light industrial activity. Overall the potential for significant contamination to be present in the area around the Site is considered to be **Low** for areas of residential use. The light industrial and commercial properties located to the east of the Site and railway land to the south represent potential sources of contamination. Considering the number and age of these properties the potential for significant contamination to be present in these areas is considered to be **Moderate**.

5.3 Potential Exposure Pathways

Potential pathways for the uptake of contaminants by potential receptors include skin contact, inhalation and ingestion of soils and dust by site workers and after users; absorption by crops and other vegetation; and indirectly associated with leaching of potential contaminants by infiltrating ground and surface waters.

Contact, Uptake and Leaching During the construction works, the clearance of the Site and the excavation of the near-surface soils associated with, for example, construction of foundations will result in a significant potential for skin contact, inhalation and ingestion of any potential contaminants in the

Made Ground and underlying natural soils. As such, the potential for the uptake of contaminants by those workers involved in earthworks or ground works is considered to be **High**.

With regard to the proposed development, the presence of buildings and hard surfaces will limit the potential for skin contact, inhalation and ingestion of any potential contaminants in the Made Ground or underlying natural soils. Similarly the buildings and hard surfaces will limit surface water infiltration and the potential for leaching of potential contaminants from the near-surface soils on the site. In the areas of the site covered by buildings or hard surfacing, the potential for significant contact, uptake or leaching of any potential contaminants in the near-surface soils is considered to be **Very Low**. With regard to areas of proposed soft landscaping, it is expected that the layer of topsoil/subsoil to be provided in these areas will be sufficient to limit the potential for significant contact, uptake or leaching of any potential contaminants in the near-surface soils to **Low**.

Site Drainage It is expected that disused drains associated with the historical development of the Site are likely to be present across the Site, whilst the existing drainage infrastructure on the Site is expected to be largely intact. On this basis, there is a plausible pathway for migration of potential contaminants through the pipe surround and trench backfill associated with leaks in the existing surface and foul water drainage system, however, given that there are expected to be limited number of discharge points the potential for significant migration of contaminants associated with site drainage is considered to be **Low**.

Groundwater Flow The Site is expected to be underlain by Made Ground overlying the London Clay Formation with the Lambeth Group at depth. The ground conditions below the Site represent a plausible pathway for potential contaminants to enter or leave the Site, however, owing to the expected low permeability of the soils the potential for significant migration of contaminants associated with groundwater flow is considered to be **Very Low**.

5.4 Potential Receptors

Potential receptors include site workers and future site users, ground and surface waters, and ecology and wildlife. With regard to site workers and future site users, their potential significance is related directly to the cumulative length of time they will be on or in the immediate vicinity of the Site. With regard to ground and surface waters, and ecology and wildlife, their potential significance is based on the value of the attributes of the receptor and will be influenced by a number of factors such as the relative quality, scale, rarity and substitutability.

Site Workers The construction of the proposed development will require an increase in the number and length of time that workers are present on the Site. Considering the number and length of time they are likely to be on the Site, the potential significance of site workers involved in earthworks or ground works as a receptor is expected to be **High**.

With regard to future site works, this is expected to be limited to maintenance work with little if any additional construction works. Considering the length of time they are likely to be on the Site and the nature of the required work, the potential significance of future site workers as a receptor is expected to be **Low**.

Future Site Users The proposed redevelopment of the Site for residential use will result in unrestricted access to the Site by future site users such that they may be exposed to any potential contaminants present on the Site. The potential significance of future site users as a receptor is considered to be **High** given the cumulative length of time they are likely to be on the Site.

Ground and Surface Waters Given that the London Clay Formation is classified as Unproductive Strata and considering the number of and distance to the abstraction points from groundwater in the vicinity of the Site, the relative importance of the groundwaters as a receptor is considered to be **Very Low**.

With regard to the surface water resources, considering the distance to surface waters from the Site, the relative importance of the surface waters as a receptor is considered to be **Very Low**.

Ecology and Wildlife Considering the nature of and distance to the areas of environmental sensitivity in the vicinity of the Site, the relative importance of the local ecology and wildlife is considered to be **Low**.

5.5 Risk Assessment

Based on the Conceptual Ground Model the assessed environmental risks, associated with the Site and proposed residential development, are discussed in this section with respect to the identified potential receptors.

5.5.1 Site Workers

The impact on site workers relates to the risk of ingestion, inhalation or prolonged skin contact of contaminated material on the Site. Considering the low potential for sources of contamination to be present on Site, the potential risk to site workers is, assessed to be **Low** during construction works and future maintenance works. With regard to potential sources of contamination in the areas surrounding the Site, given the distance to, the nature of and potential for migration from these sources, the associated potential risk to site workers is assessed to be **Very Low** both during construction and future maintenance works.

To mitigate the potential risk during construction works, appropriate protective clothing and equipment should be worn by site workers; and good standards of hygiene adopted to prevent prolonged skin contact, inhalation and ingestion of soils during construction. In addition, the methods of working should be selected to limit the potential for air-borne dust to arise associated with the excavation and disturbance of the soils present on the Site. Although the provision of appropriate protective clothing and adoption of good standards of hygiene and appropriate methods of working will mitigate many of the significant effects, the potential risk to site workers during the construction works will remain as **Low**.

With regard to the risk associated with the inhalation of potentially hazardous ground gases, given the very low potential for such gases to be present on the Site and surrounding areas, the potential risk to site workers is expected to be **Very Low**. Notwithstanding this assessment, appropriate ventilation should be provided to all confined spaces and appropriate procedures adopted to ensure they are checked for hazardous gases prior to man-entry to ensure any potential risk associated with ground gases does not occur.

5.5.2 Future Site Users

The impact on future site users relates to the risk of ingestion, inhalation or prolonged skin contact of contaminated material on the site and inhalation of any potentially hazardous ground gases.

In the areas of the buildings and hard surfaces of the proposed development, the potential risk to future site users associated with contaminated material is expected to be **Very Low** owing to the very low potential for skin contact, inhalation and ingestion of any potential contaminants. In areas of proposed soft landscaping, considering the low potential for sources of contamination to be present, it is expected that the layer of clean topsoil/subsoil to be provided in these areas will be sufficient to ensure the potential risk to future site users associated with contaminated material is **Very Low**. On this basis, no specific measures will be required to limit the risk of ingestion, inhalation or prolonged skin contact of the soils on the Site.

With regard to potential sources of contamination in the areas surrounding the Site, given the distance to, the nature of and potential for migration from these sources, the associated potential risk to future site users is assessed to be **Very Low**.

With regard to the risk associated with the inhalation of potentially hazardous ground gases, given the very low potential for such gases to be present on site, the potential risk to future site users associated with the build up of any such gases within confined spaces is expected to be **Very Low**.

5.5.3 Ground and Surface Water Resources

The impact on groundwater relates to the movement of potential contaminants by surface water infiltration and drainage and the leaching of any such contaminants from the near-surface soils on the Site. The impact on surface waters relates to the risk of movement of potential contaminants by groundwater flows and surface water drainage into adjacent watercourses.

Groundwaters Given the low potential for contaminants to be present and the very low relative importance of the groundwaters as a resource, the potential risk of any mobile contaminants present within the ground below the Site adversely affecting the quality of groundwater is currently assessed to be **Very Low** and is expected to remain at this level both during the construction works and on completion of the scheme.

Surface Waters Considering the distance to surface waters the potential risk to these waters is considered to be **Very Low** and is expected to remain at this level both during the construction works and on completion of the scheme.

5.5.4 Ecology and Wildlife

The impact on ecology and wildlife relates, primarily, to the risk of potentially mobile contaminants being present within the ground and surface waters on and adjacent to the Site. Considering the low potential for mobile contaminants to be present and the distance to the identified site of ecological and wildlife interest, the risk to the ecology and wildlife in the vicinity of the Site is considered to be **Very Low** and is expected to remain at this level both during the construction works and on completion of the scheme.

5.6 Assessment Geoenvironmental Risk

The results of this Geoenvironmental Risk Assessment indicate that the potential risk to sensitive receptors is, in general, **Very Low**. The exception relates to the risk to site workers during the proposed construction works for which the potential risk is assessed to be **Low**. On this basis, any potential contaminants and hazardous ground gases do not by themselves represent an unacceptable risk to the human health, controlled waters or ecology and wildlife associated with the development of the Site as currently proposed.

On this basis, there is no reason that the Site would be designated as Contaminated Land under Part IIa of the Environmental Protection Act 1990.

6.0 Mitigation

6.1 Required Mitigation Measures

The geoenvironmental risk assessment presented in **Section 5.0** indicates that any potential contaminants in the ground or groundwater do not by themselves represent an unacceptable risk to human health, controlled waters or ecology and wildlife, associated with the development of the Site as currently proposed. On this basis, no specific remediation and/or mitigation measures will, in general, be required to limit the potential risks associated with land contamination.

The exception relates the risks to site workers associated with ingestion, inhalation or prolonged skin contact of contaminated material during the construction works. Measures to be adopted to mitigate the risk to site workers will include (i) informing the site workers of any potential contamination on the site and the potential health effects from exposure through site induction and 'tool box talks'; (ii) the provision of appropriate protective clothing and equipment to be worn by site workers; (iii) the adoption of good standards of hygiene to prevent prolonged skin contact, inhalation and ingestion of soils during construction; and (iv) selection of appropriate methods of working to limit disturbance to the contaminated materials and the potential for air-borne dust to arise associated with the excavation and disturbance of the soils present on the site.

6.2 Management of Unidentified Sources of Contamination

There is a possibility that sources of contamination may be encountered during the site clearance or ground works. Should visual and olfactory examination of any unusual solid materials or liquids encountered during the construction works identify areas of contamination specific management procedures will be adopted. These procedures will allow for the short-term storage of the suspected material in stockpiles and/or storage tanks while verification testing for potential contamination is carried out. The storage area will be contained to ensure that contamination does not migrate and affect other areas of the site.

Once the nature, location and extent of the unexpected contamination have been identified appropriate remediation or mitigation measures will be adopted. Although these cannot be identified at this time the main emphasis will be on methods of isolating or treating the affected materials. If such measures are unlikely to be practical or effective in mitigating the risk from the identified contamination, consideration will be given to excavating and removing the contaminated material from site for disposal or treatment at a suitably licensed facility.

Where remediation of unexpected contaminants is required, an implementation and verification process will be established to identify the remediation activities required and to confirm that the remediation has been undertaken correctly. As part of this process, remediation objectives will be identified and remediation criteria selected for measuring compliance against these objectives in consultation with the Local Authority and other statutory consultees. Once any remediation of unexpected contaminants is complete, a verification report will be prepared demonstrating that the remediation objectives and criteria have been achieved. The report will provide a full record of all remediation activities carried out and data collected in accordance with the requirements of the verification plan and any monitoring and maintenance plan.

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Methodology for Ground Condition Assessments

1 Objective

The objective of the Phase 1 Preliminary Risk Assessment is to identify the existing ground conditions and environmental setting of a defined site using readily available published information. The aim is to identify the potential presence of ground contamination which might have associated environmental liabilities or which may affect the site redevelopment. A combined assessment including geotechnical information will also appraise the likely foundation requirements and geotechnical constraints at the site.

2 Introduction

The statutory definition of contaminated land is given in Part IIA of the Environmental Protection Act as "land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land that (i) significant harm is being caused to people, ecosystems or infrastructure, or there is a significant possibility that such harm could be caused, or (ii) pollution of controlled waters is being, or likely to be, caused"

Situations where harm is to be regarded as significant are (i) chronic or acute toxic effect, serious injury or death to humans, (ii) irreversible or other adverse harm to the ecological system, (iii) substantial damage to, or failure of buildings, (iv) disease, other physical damage or death of livestock or crops, and (v) pollution of controlled waters

The definition of "pollution of controlled water" has been amended by the introduction of Section 86 of the Water Act 2003 and makes clear that, for the purposes of Part IIA only, groundwater does not include waters above the saturated zone.

3 Approach

UK policy and legislation promote the use of a risk based approach to the assessment of ground quality/conditions. Risk is defined the probability or frequency of exposure to a substance with the potential to cause harm, and the seriousness of the consequence.

The technical guidance supporting the legislation is presented in a series of documents known as the Contaminated Land Reports (CLRs 1 to 11). The guidance proposes a four-stage approach to the assessment of contamination and associated risks.

The four stages are:-

- i) Hazard Identification – identifying potential contaminant sources on and off site
- ii) Hazard Assessment – analysing the potential for unacceptable risks by identifying what linkages could be present and what could be affected (Conceptual Model)
- iii) Risk Estimation – establish the magnitude and probability of the possible consequences (what degree of harm might result to defined receptors and how likely)
- iv) Risk Evaluation – deciding whether the risk is unacceptable.

The underlying principle is the evaluation of pollutant linkages for assessing whether the presence of a source of contamination could potentially lead to harmful consequences. A pollutant linkage consists of the following three elements:-

- i) A Source/Hazard (chemical or geotechnical) which has the potential to cause harm or pollution;
- ii) A Pathway for the hazard to move along / generate exposure; and
- iii) A Receptor that is affected by the Source/Hazard.

The Source may be an identified leak of oil, an area of radioactive contamination or a former landfill for example. Pathways include transport by groundwater, surface water, windblown dust, vapours etc, and for humans will include the means by which contaminants enter the body, for example dermal contact, ingestion, inhalation etc.

Receptors include people, other living organisms and the built environment. Groundwater and surface waters are receptors as well as being contaminant pathways.

4 Risk Assessment Strategy

To assess the potential risk related to the quality of the ground and groundwaters, a qualitative risk assessment is carried out utilising a Conceptual Site Model to identify 'source-pathway-receptor' linkages. This assessment is made from consideration of the information currently available and the findings of any ground investigations.

In the conceptual model the potential environmental risk is related to the potential for a source of contamination to be present, the potential for migration of the contaminant along a given pathway, and the significance of potential receptors. A significant environmental risk occurs only when there is significant migration along a

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pathway connecting a significant contamination source to a significant receptor. If either the potential for a source, pathway or receptor being present is not significant, then the risk is also not significant. For the purposes of the assessment, the potential for a significant source, pathway or receptor being present is assessed in terms of their magnitude and extent as being very low, low, moderate, high or very high. The criteria used to assess the significance of the identified sources, pathways and receptors are given in the following sections.

4.1 Potential Sources

The significance of potential sources of contamination has been determined from consideration of the previous or ongoing activities on or near to the site and any available results of contamination analyses in general accordance with the criteria presented in the **Table 1**.

4.2 Potential Pathways

The significance of potential pathways for the migration of contamination has been determined from consideration of the nature of the ground conditions on the site and the current use of the site in general accordance with the criteria presented in the **Table 2**.

4.3 Potential Receptors

The significance of potential receptors is based on the value of the attributes of the receptor and will be influenced by a number of factors such as the relative quality, scale, rarity and substitutability of the receptor. The determination of the

significance of the potential receptors is based mainly on existing designations but allows for professional judgement where receptors are found that do not have any formal national or local designation.

The significance of potential receptors has been determined in general accordance with the criteria presented in **Table 3**.

5 Risk Estimation and Evaluation

The environmental risk is related to the potential for a significant source of contamination to be present, the potential for significant migration of the contaminant along a given pathway, and the potential for significant harm to sensitive receptors. A significant environmental risk occurs only when there is significant migration along a pathway connecting a significant contamination source to a significant receptor. If either the potential for a source, pathway or receptor being present is not significant, then the environmental risk is also not significant.

The environmental risk is determined by the interrelationship between the potential for a source of contamination to be present, the potential for migration of the contaminant along a given pathway, and the significance of potential receptors for any identified source-pathway-receptor' linkage. This approach allows the magnitude and probability of the possible consequences that may arise as a result of a hazard to be assessed and possible unacceptable risks to be identified.

Table 1: Criteria for Determining the Significance of Potential Sources of Contamination

Potential Significance	Typical Land Use/ Sources of Gas Generation/ Concentrations of Potential Contaminants
Very Low	Land Use: Greenfield site. Gas Source: Soils with low organic content. Contamination: No significant contamination.
Low	Land Use: Residential, retail or office use. Gas Source: Soils with high organic content. Contamination: Locally slightly elevated concentrations of limited number of contaminants.
Moderate	Land Use: Railway land, collieries, scrap yards, light industry, inert landfills. Gas Source: Old landfills, inert waste. Contamination: Locally elevated concentrations of a number of contaminants.
High	Land Use: Gas works, chemical works, heavy industry, non-hazardous landfills. Gas Source: Shallow mine workings. Contamination: Widespread elevated concentrations of a number of contaminants.
Very High	Land Use: Hazardous landfills. Gas Source: Recent landfills. Contamination: Widespread highly elevated concentrations of a number of contaminants.

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Table 2: Criteria for Determining the Significance of Potential Pathways

Significance	Typical Example
Very Low	Contact, uptake or leaching: Hard surfaces Absorption: Hard surfaces Infiltration: Hard surfaces Ground and surface water flow: Unproductive strata, strata with no significant groundwater flow
Low	Contact, uptake or leaching: Established surface vegetation, significant surface cover Absorption: Non-agricultural land, well established surface vegetation Infiltration: Soils of low leaching potential Ground and surface water flow: Secondary aquifers, materials with low mass permeability
Moderate	Contact, uptake or leaching: Limited surface vegetation or surface cover Absorption: Non-agricultural land, poorly established surface vegetation Infiltration: Soils of intermediate leaching potential Ground and surface water flow: Secondary aquifers, materials with moderate mass permeability
High	Contact, uptake or leaching: Exposed surface soils, areas with no significant surface cover Absorption: Cultivated arable land, grazing land Infiltration: Soils of high leaching potential Ground and surface water flow: Principle aquifer, materials with high mass permeability
Very High	Contact, uptake or leaching: Excavation or disturbance of surface soils Absorption: Land cultivated for fruit and vegetables Infiltration: Direct contact with mobile ground or surface waters Ground and surface water flow: Surface water flow

Table 3: Criteria for Determining the Significance of Potential Receptors

Potential Significance	Criteria	Typical Example
Very Low	Receptor of no significant importance.	Groundwater: Unproductive Strata Surface Water: CQA Grade F Ecology: No significant value Built Environment: No significant value
Low	Receptor of local or county importance with potential for replacement.	Groundwater: Secondary Aquifer Surface Water: CQA Grade D/E Ecology: Local habitat resources Built Environment: Sites of local value
Moderate	Receptor of local or county importance with limited potential for replacement.	Groundwater: Principle Aquifer Surface Water: CQA Grade B/C Ecology: County Wildlife Sites Built Environment: Areas of Historic Character
High	Receptor of county or regional importance with limited potential for replacement.	Groundwater: Source Protection Zone 2 Surface Water: CQA Grade A providing potable water to a small population Ecology: SSSI, NNR or MNR sites Built Environment: Conservation Area
Very High	Receptor of national or international importance with limited potential for replacement.	Groundwater: Source Protection Zone 1 Surface Water: CQA Grade A providing potable water to a large population Ecology: SPA, SAC or Ramsar sites Built Environment: World Heritage Sites

Note: The potential for significant harm to site workers, site users and site neighbours is related directly to the cumulative length of time people will be on or in the vicinity of the site.

To tie in with the established best practice used in environmental impact assessments, whereby the impact is determined from consideration of the magnitude of change and the sensitivity of the receptor, a two-stage assessment is adopted to determine the environmental risk associated with land contamination. Firstly the potential for a source of contamination to be present and the potential for migration of the contaminant along a

given pathway are used to determine the potential for a contaminant to impact a sensitive receptor using the matrix presented in **Table 4**.

Secondly the potential for a contaminant to impact a sensitive receptor and the significance of potential receptors are used to determine the consequent environmental risk using the matrix presented in **Table 5**.

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Risk classifications are then referenced to the following descriptions.

Very Low Risk – It is unlikely that harm will arise to a designated receptor and there is unlikely to be a liability/cost for the owner of the business/land.

Low Risk – It is possible that harm could arise to a designated receptor however, the consequences are likely to be limited and it is considered unlikely that the issue will represent a liability/cost for the owner of the business/land.

Moderate Risk – It is possible that harm could arise to a designated receptor but is unlikely that the harm will be significant or permanent. Remedial action may be necessary and therefore the issue could arise as a liability/cost for the

owner/occupier whilst retained in the current use. Development/change of use will require further assessment and is likely to incur additional costs.

High Risk – It is likely that significant harm to a designated receptor will occur and therefore it is likely that the issue will represent a liability/cost for the owner of the business/land.

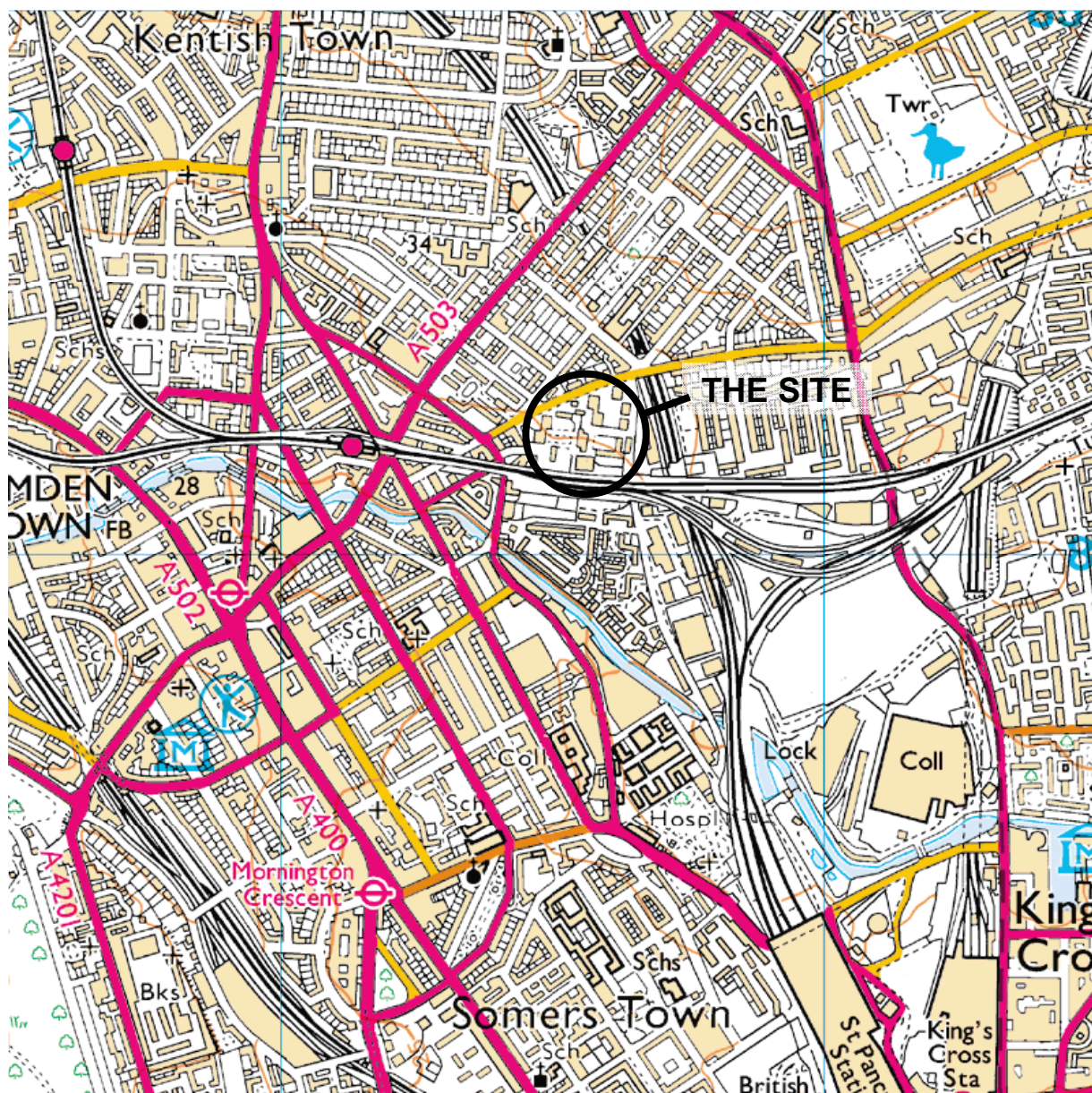
Very High Risk – It is likely that irreversible harm to or loss of a designated receptor will occur and therefore it is likely that the issue will represent a significant liability/cost for the owner of the business/land.

Table 4: Assessed Potential for a Contaminant to Impact a Sensitive Receptor

		Potential for Migration of the Contaminant along a given Pathway				
		Very Low	Low	Moderate	High	Very High
Potential for a Contaminant to be Present	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
	Low	Very Low	Low	Low	Low	Moderate
	Moderate	Very Low	Low	Moderate	Moderate	High
	High	Very Low	Low	Moderate	High	Very High
	Very High	Very Low	Moderate	High	Very High	Very High

Table 5: Assessed Environmental Risk

		Significance of Potential Receptors				
		Very Low	Low	Moderate	High	Very High
Potential for a Contaminant to Impact a Sensitive Receptor	Very Low	Very Low	Very Low	Very Low	Very Low	Low
	Low	Very Low	Low	Low	Low	Moderate
	Moderate	Very Low	Low	Moderate	Moderate	High
	High	Very Low	Low	Moderate	High	Very High
	Very High	Low	Moderate	High	Very High	Very High



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Coordinates N51:32:31 W0:07:60
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Client



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SITE LOCATION PLAN

AGAR GROVE ESTATE, CAMDEN

Date	Sep 2013
A4 Scale	1:12 500
Drawn	mdh
Checked	mdh
Figure	1

