Desk Study

soils LIMITED

Geotechnical & Environmental Consultants

Phase I Desk Study

at

77-79 Charlotte Street, London W1T 4PW

for

Charlotte Street Property Ltd

Soils Limited
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Cross Road
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REPORT 14653/DS

Phase I Desk Study

Job Title: 77-79 Charlotte Street, London W1T 4PW

Client: Charlotte Street Property Ltd

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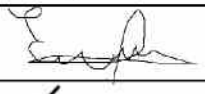
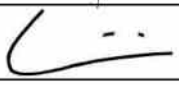
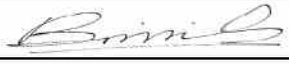
Prepared by:	Eliane S. Foteu Madio *(esfm@soilslimited.co.uk)*	
Checked by:	R. B. Higginson	
	R. Biney	

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

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Report on a Phase I Desk Study

At

77-79 Charlotte Street, London W1T 4PW

For

Charlotte Street Property Ltd

Section 1 Commission

1.1 Commission

Soils Limited was commissioned by MLM acting on behalf of Charlotte Street Property Ltd to carry out a Phase I Desk Study and a Site Walkover on the site located at 77-79 Charlotte Street, London W1T 4PW.

1.2 Caveat

Whilst reasonable skill and care has been taken to determine the site history and the environmental setting within the time constraints applied by the project, it should be appreciated that uncertainties may occur owing to the natural variability of soil material within a defined area or as a result of unknowns that are associated with contaminated land assessment in general. The site conditions may be different from that indicated by this desk study, particularly on a site with a history of past development. No responsibility can be accepted should such conditions alter the recommendations made in this report.

Section 2 Introduction

2.1 Objective

The Phase I Desk Study was undertaken to advise the client on the risk pertaining to the site, with special reference to former and present day potential contaminative uses. This also included their impact on sensitive receptors, such as, human health, controlled waters, ecological features, building structures and services.

2.2 Location

The site area is 0.03ha. It is situated at 77-79 Charlotte Street, London W1T 4PW, at O.S. National Grid Reference of TQ 29354 81787. The site location map is presented in Figure 2.1 and the full Site Walkover discussed in Section 3.1 of this report.

The site is occupied by an existing "L" shaped building; approximately 25m long x 12m wide – to the front entrance (east) and x 6m wide to the rear entrance (west). It was a five storey building with a lower ground level (basement). It was bounded by similar sized building to the north and south. The southern building was under development at the time of the preparation of this report.

The proposed area of the investigation was to be in a light-well (basement level) to the front and rear entrance of the existing buildings (eastern and western side of the building), and within the footprint near the front of the existing building.

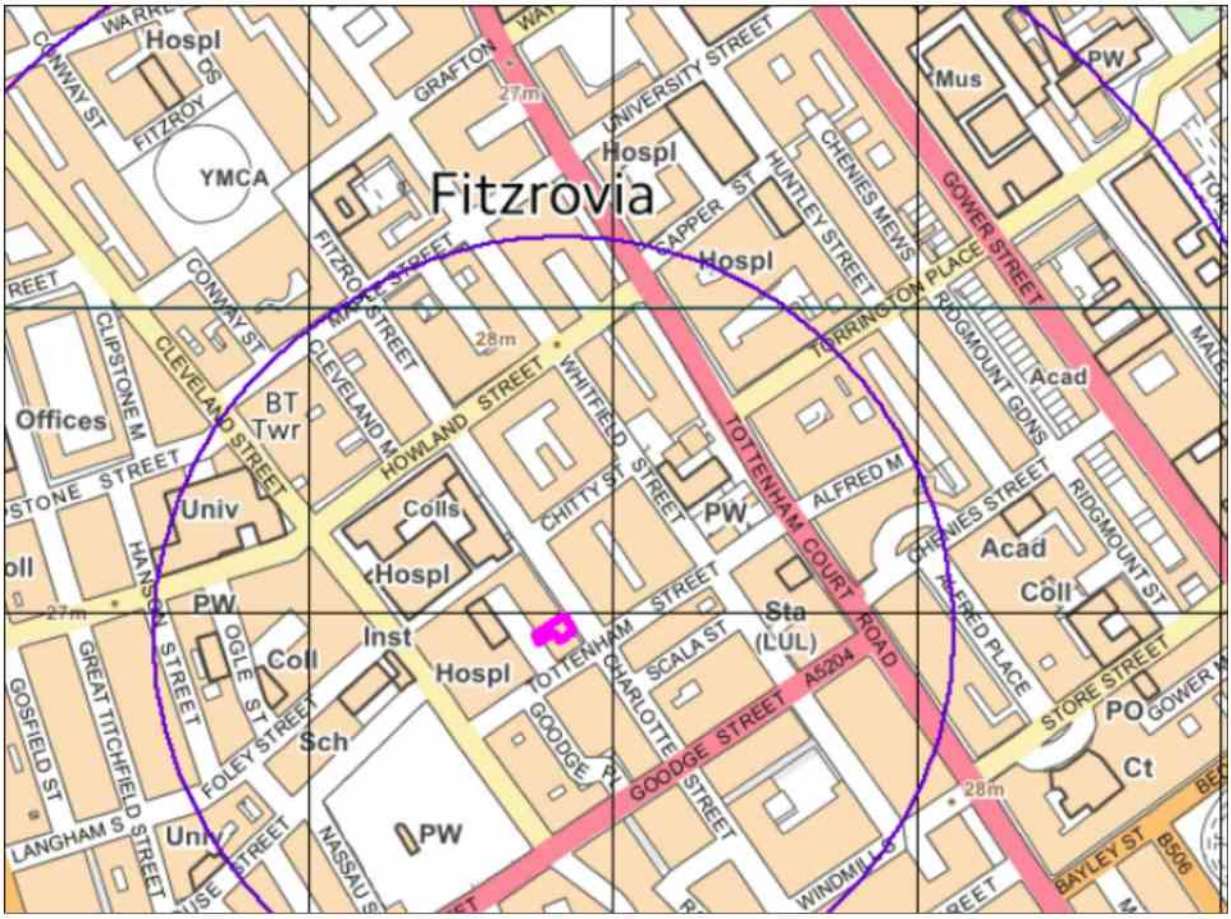


Figure 2.1. Site Location Map (NTS)

2.3 Proposed Redevelopment

The proposal redevelopment is for predominantly residential (houses). The proposed development comprises the demolition of the existing building and construction of a new six storey building with a two level basement. The basement level is to be approximately 8m below existing ground (street) level. The current proposal for the new building is to construct a concrete frame from the first floor slab down to the basement and a lightweight steel framed structure from first to roof level.

The existing layout plan is shown in Figure 2.2 and the detailed proposed layout plan was not available at the time of writing this report.

In compiling this report reliance was placed the Cove Burgess Architects LLP produced in October 2004 that was supplied by Charlotte Street Property Ltd c/o MLM. Any change or deviation from the scheme outlined in the drawing could invalidate the recommendations presented within this report. Soils Limited must be notified about any such changes.

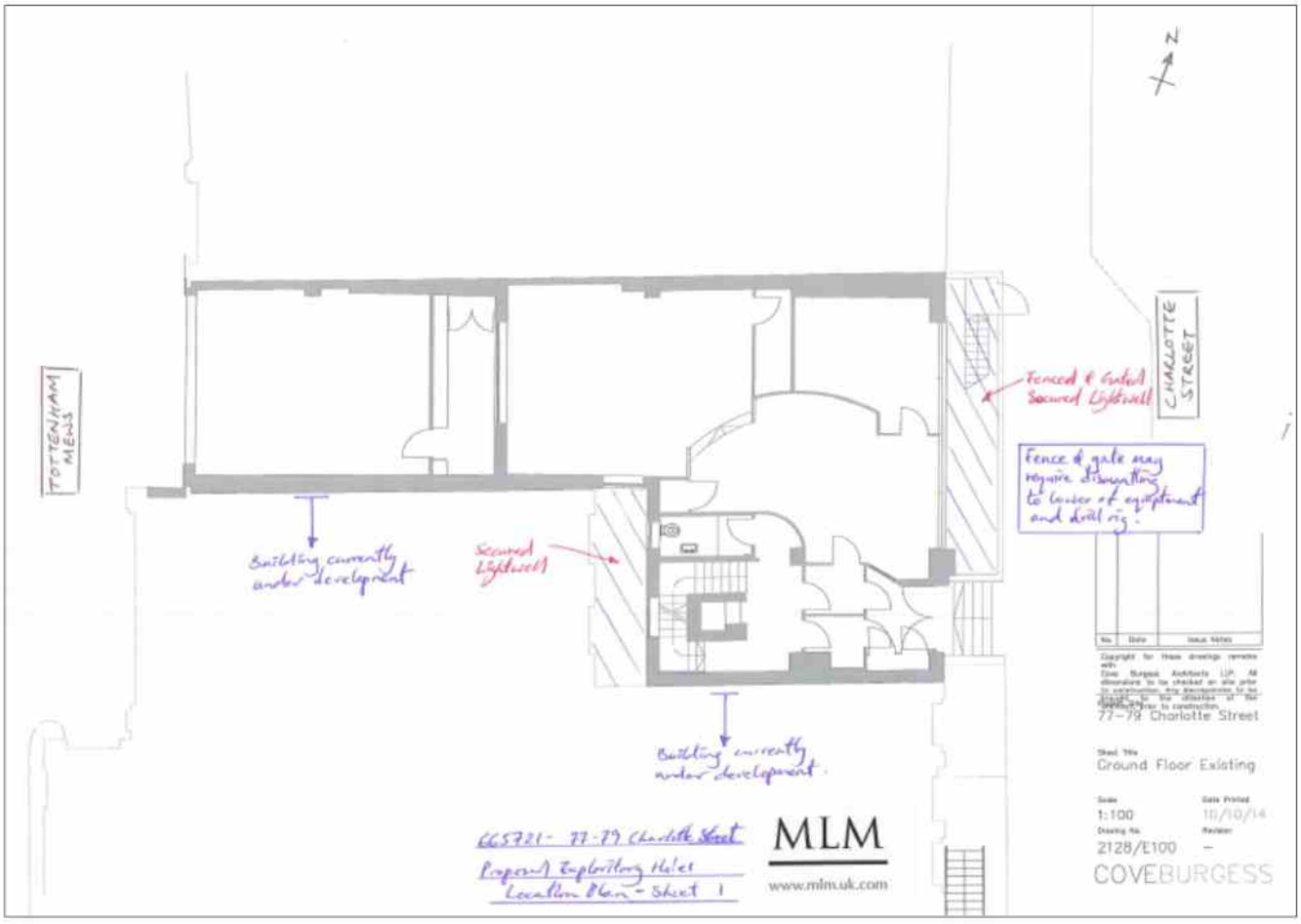


Figure 2.2. Existing Ground Floor Plan

2.4 Legislation and Liability

The primary legislative mechanism for contaminated land management in the UK is Part 2A of the Environmental Protection Act, 1990 (EPA). Part 2A was introduced into the EPA under Section 57 of the Environment Act 1995 to help deal with the substantial legacy of land contamination. The legislation provides powers in relation to the identification, remediation and apportionment of liability for contaminated land. Part 2A applies where there is unacceptable risk, assessed on the basis of the current use and the relevant circumstances of the land. It is not directed to assessing risks in relation

to a future use of the land that would require a specific grant of planning permission.

Under Part IIA of the Environment Act 1995, Local Authorities are required to identify contaminated land and serve on every person who is an appropriate person a remediation notice setting out what is to be done by way of remediation and the period within which it must be done.

If the person who caused, or knowingly permitted the contaminating substance cannot be found, the owner and/or occupier for the time being of the property can be the appropriate person.

Under the legislation, Contaminated Land is defined as: -

> *Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused.*

Where the Act defines harm as: -

> *'harm to the health of living organisms or other interference with the ecological systems of which they form a part and, in the case of man, includes harm to his property.'*

and pollution of controlled waters is defined as: -

> *'the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter.'*

In addition, The Radioactive Contaminated Land (Modification of Enactments) (England) Regulations 2006 introduced the additional definition of harm to include: lasting exposure to any person resulting from the after-effects of a radiological emergency, past practice or past work activity.

With regard to contaminated waters, the Environment Act 1995 amends the Water Resources Act 1991 and provides the Environment Agency with the power to force clean-up of historical contamination by issuing a Works Notice, with remediation paid for by the responsible parties.

The Groundwater Regulations (1998) stated that entry of List 1 substances into groundwater must be prevented, and List II substances must be controlled.

2.5 Planning Policy and Development Act

The objectives of this desk study report was (i) to satisfy any contaminated land condition attached to planning permission from the council stating that a scheme for provision and implementation of contamination investigation and remediation is submitted and agreed between the developer and the Planning Authority; (ii) to assess the likelihood of contamination existing on the site and the potential for it to cause harm and (iii) to assess any potential risk to future site receptors and determine the need for remediation measures.

Part 2A as described focuses on the identification and remediation of land which in its current use poses an unacceptable risk to people or the environment. Current use includes any use that has planning permission but is as yet unimplemented.

The role of the planning system is to control future development and land use. The assessment of risk arising from contamination and remediation requirements is considered on the basis of both the current and proposed use. The underlying approach to identifying and dealing with risk and the broad policy objective of safeguarding human health and the environment are similar for both regimes.

It is considered that after remediation under planning, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990. The developer and the Environment Agency's roles are set in National Planning Policy Framework – planning and contaminated land (EA, 2012) and should be referred to if necessary.

2.6 Limitations and Disclaimers

This Phase I Desk Study Report relates to the site located at 77-79 Charlotte Street, London W1T 4PW and was prepared for the sole benefit of Charlotte Street Property Ltd (the "Client") for the brief described in Section 1.1 of this report.

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the contract with the Client, incorporation of our General Conditions of Contact of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

There may be other sources of information not included in those listed that hold data relevant to the Phase I Desk Study undertaken at the site that could materially affect the conclusions made in this report.

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 as presented in section 2.4 of this report.

Where a contaminative use is identified in the Phase I Desk Study this does not determine whether contamination has actually occurred, or if it has the degree to which it may have taken place. An intrusive investigation(s) and analysis is required to establish the nature and degree of any contamination present.

Section 3 Site Conditions

3.1 Site Walkover

A Site Walkover was undertaken in November 2014 and the details are presented in Tables 3.1 and 3.2.

Table 3.1. Site Walkover Record (On-site)		
On-Site	**Use of site**	Office buildings.
	Structures	Building structures consisting of 6 floors including a light well.
	Site topography	Generally flat and level.
	Site covering	Predominantly concrete.
	Vegetation	None.
	Contamination Sources	None seen.
	Odour	None sensed.
	Drainage	The site drainage is along the front and back of the building.

Table 3.2. Site Walkover Record (Off-site)		
Off-Site	**Use of Land**	North: offices and commercial properties South: offices and commercial properties North east: main Road South west: building site
	Area topography	Generally flat and level.
	Vegetation	Some small trees along the main road. See aerial photograph (Appendix D).
	Potential Contamination Sources	None observed.

3.2 Site Drainage

The drainage was along the front and back of the building. Water drains to the mains.

3.3 Site Photographs

The site aerial photographs are appended to this report (Appendix D).

Section 4 Geology, Hydrogeology, Hydrology and Radon

4.1 Anticipated Geology

The 1:50,000 BGS map showed the site to be located on bedrock of the London Clay Formation with a superficial geology of Lynch Hill Gravel Member.

4.1.1 Lynch Hill Gravel Member

The rivers of the south-east of England, including the River Thames and its tributaries, have been subject to at least three changes of level since Pleistocene times. One result has been the formation of a complex series of River Terrace Gravels. These terraces represent ancient floodplain deposits that became isolated as the river cut downwards to lower levels.

The Lynch Hill Gravel approximates to the third level terrace gravel. The composition of the River Terrace Gravel varies greatly, depending on the source material available in the river's catchment. Deposits generally consist of sand and gravel of roughly bedded flint or chert gravel commonly in a matrix of silt and clay.

4.1.2 London Clay Formation

The London Clay Formation comprises a stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of gypsum (Selenite) are often found within the weathered part of the London Clay, and precautions against sulphate attack to concrete are sometimes required.

The lowest part of the formation is a sandy beds with black rounded gravel and occasional layers of sandstone and is known as the Basement Beds.

In the north London area the upper part of the London Clay Formation has been disturbed by glacial action and may contain pockets of sand and gravel.

4.2 Hydrogeology

To assess the vulnerability of groundwater to contamination, consideration must be given to the leaching characteristics of the overlying soils and the characteristics of the strata in the unsaturated zone. Information on the geological strata, such as lithological type and permeability characteristics, has been combined with the physical properties of the soil to produce varying degrees of vulnerability. Table 4.1 presents the hydrological data that is relevant to the site.

Table 4.1. Hydrogeological Assessment

Hydrogeological Data		Comment	Risk Likely	
			Yes	No
On-site Aquifers	Superficial	Secondary Aquifer - A[1]	√	
	Bedrock	Unproductive Strata		√
Source Protection Zones (SPZ)		None within 2000m		√
Abstraction	Potable	None within 250m		√
	Non-potable	None within 250m		√
Sensitive land uses		None within 2000m		√
Surface Water Features		None within 2000m		√
Flood Risk		No Flooding risk from Rivers or Sea within 2000m		√

Notes: [1] permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The overall groundwater vulnerability of the site was classified as Secondary Aquifer A. The bedrock was the London Clay Formation, which are Soils of High Leaching Potential (U) (i.e. Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. A worst case vulnerability classification (H) assumed, until proved otherwise).

Any works or development, which may have an impact on surface water, aquifer or groundwater quality, must be approved by the Environment Agency prior to implementation.

According to Environment Agency guidance given to Local Authorities, a flood risk assessment is unlikely to be required as a part of the application for planning permission and guidance should be obtained from the Planning Department. Soils Limited can carry out a flood risk assessment if required.

4.3 Hydrology

The approximate elevation of the site was ~24.0m AOD (Above Ordnance Datum). The anticipated groundwater flow direction is given in Table 4.2. The topography in generally flat at the site but regionally, it sloped to the southeast direction. The Groundwater flowed toward the southeast direction in line with the area topography and to the nearest surface water which is located approximately 1000m south of the site.

Table 4.2. Groundwater Flow Direction

Direction	Comment
Toward the southeast direction	Groundwater flows toward the southeast direction in line with the area topography

4.4 Radon Gas

The site was **not situated** within an area where protection or risk assessment against the ingress of radon was required. **No radon protection measures** will need to be installed within the proposed new development. It is not possible in the course of a survey or inspection to determine whether radon gas is present as the gas is colourless and odourless. Tests can be undertaken to assess the concentration of radon in existing structures.

Section 5 Site History

5.1 Historic Map Study

The object of this study was to report on the evidence of site history and redevelopment of the site and its environs from available County Series and Ordnance Survey Maps dating from the mid to late 19th Century to the present day as downloaded from Landmark Environmental in October 2014.

Maps only represent a "snap shot" of the site and its environs at the date of the survey. Changes that had occurred either to the site and/or the environs may well not have been recorded on the maps and could represent a hazard to the site.

Any distances quoted for features remote from the site have been scaled from the maps and are only approximate. Where dates have been noted in brackets, these are the actual dates applicable to the map editions.

The information reported might not represent all pertinent information that could be obtained.

The interpretation of the maps and/or other data commented on in this report is subjective.

In the following sections dealing with individual maps, only features considered to have a potential contaminative impact on the site and usually within a notional 250 m radius are discussed. The north point and approximate extent of the site are indicated on each figure. The historic maps referred to are appended to this report (Appendix A).

A précis of the environs identified, if any from the maps are given in Tables 5.1 and 5.2.

Table 5.1. Source of Potential Pollution Identified from Historic Maps

Environ	Direction	Distance[1] (m)	Date Range	
			From	To
Depot	SW	0-100	1958	1958
Middlesex Hospital	SW	0-100	1875	1896
Garage	SE	0-100	1966	1973
Garage	NE	0-100	1966	1973
Timber	SW	0-100	1953	1958
Ruins	Various	0-250	1953	1958
Workhouse	w	0-100	1872	1875
Chemical works	w	0-100	1895	1921
Electric substation	N	100-250	1953	1954
Depot	SW	100-250	1958	1958
works	N	100-250	1958	1990
Hospital	E	100-250	1875	1953
Factory	S	100-250	1958	1990
Phonic works	SE	100-250	1916	1953
Works	SE	100-250	1954	1958
Mineral works	SE	100-250	1954	1995
Factory	N	100-250	1958	1962
Processing works	N	100-250	1966	1973

[1] Approximate distance to the site boundary

Table 5.2. Historic Development of the Site		
Site Development	Date Range	
	From	To
Building structure onsite	1875	1953
Ruin	1953	1958
77-79 Charlotte Street	1953	2014

Section 6 Environmental Records and Consultation

6.1 Dataset Information

A Landmark Envirocheck Report was obtained for the site by Soils Limited. A copy of the report is appended to this report (Appendix B) and a summary is given in Tables 6.1 and 6.2.

6.2 Site Sensitivity Maps

Tables 6.1 and 6.2 summarises significant potential sources of contamination were shown on the Landmark Envirocheck Site Sensitivity Maps. A copy of the Landmark report has been appended to this report (Appendix C).

Table 6.1. Environmental Significance Of Data

Source	Direction	Distance (m)	Maximum Radius (m)
Contaminated Land Register Entries and Notices	None	na	1000
Discharge Consents	"	"	250
Integrated Pollution Prevention and Control	"	"	250
Local Authority Pollution Prevention and Controls	"	"	1000
Local Authority Pollution Prevention and Control Enforcements	"	"	1000
Nearest Surface Water Feature	"	"	500
Pollution Incidents to Controlled Waters (Significant Incidents only)	"	"	250
Prosecutions Relating to Authorised Processes	**NE**	**185**	**na**
Registered Radioactive Substances	**SW & W**	**38 (X6) & 93 (X6)**	**na**
Substantiated Pollution Incident Register	**SW**	**139**	**na**
Nearest potable abstraction point	None	na	1000
Nearest non-potable abstraction point	"	"	1000
Water Industry Act Referrals	"	"	1000
Source Protection Zones	"	"	1000
Extreme Flooding from Rivers or Sea without Defences	"	"	1000
Flooding from rivers or sea without defences	"	"	1000
Areas benefiting from flood defences	"	"	1000
Flood Water Storage Areas	"	"	1000
Flood Defences	"	"	1000
BGS Recorded Landfill Sites	"	"	1000
Historical Landfill Sites	"	"	1000
Licensed Waste Management Facilities	"	"	1000
Local Authority Recorded Landfill Sites	"	"	1000
Registered Landfill Sites	"	"	1000
Registered Waste Transfer Sites	"	"	1000
Registered Waste Treatment or Disposal Sites	"	"	1000
Control of Major Accident Hazards Sites (COMAH)	"	"	1000
Explosive Sites	"	"	1000
Notification of Installations Handling Hazardous Substances	"	"	1000
Planning Hazardous Substance Consents	"	"	1000
Contemporary Trade Directory within 100m[1]	**Direction**	**Distance (m)**	**Status**
T-Shirts	N	10	Inactive
Textile Manufacturing	NW	16	Inactive
Garage Services	NW	44	Inactive
Commercial Cleaning Services	SE	42	active
Pest & Vermin Control	SE	42	Inactive
Telecommunications Equipment & Systems	S	52	Inactive

Table 6.1. Environmental Significance Of Data			
Printers	S	81	active
Printers	S	81	Inactive
Tool Design, Manufacturers & Makers	N	53	Inactive
Dry Cleaners	NE	56	Inactive
Footwear Manufacturers & Wholesale	W	65	active
Printers	W	65	Inactive

1 Those likely to impact the underlying soil and/or groundwater, date not supplied. Most of these activities either (i) operate according to environmental guidance (i.e. environmental permitting or IPPC) therefore may not be considered as source of contamination, (ii) are remote from the site or (ii) are not located up gradient of the site therefore have not direct impact on identified receptors.2

Table 6.2. Geological Hazards	
Source	**Nearest distance from site/type**
Non Coal Mining Affected Areas	Unlikely
Mining Instability	None
Natural and Mining Cavities	Unlikely
Potential For Collapsible Ground Stability Hazards	On-site: Very Low
Potential For Compressible Ground Stability Hazards	On-site: No Hazard
Potential For Ground Dissolution Stability Hazards	On-site: No Hazard
Potential For Landslide Ground Stability Hazards	On-site: Very Low
Potential For Running Sand Ground Stability Hazards	On-site: Very Low
Potential For Shrinking or Swelling Ground Stability Hazards	On-site: No Hazard
Shallow Mining Hazards	Unknown

6.3 Soil Geochemistry

A potential level of contaminants has not been contoured at the study as presented on the Landmark Environmental check report (Appendix B). Risk to future receptors from these contaminants was assessed against the appropriate environmental quality standards (e.g. SGV) for the sites purposed end use as shown in Table 6.3. The ranges of concentrations of potential contaminants shown in the table revealed lead risk to the receptors identified.

Table 6.3. Soil Geochemistry					
Determinand	**Most Sensitive Proposed Land Use**	**Indicated Soil Geochemistry (mg kg^{-1})**	**Soil Guideline for residential use (mg kg^{-1})**	**Potential Hazard**	
				Yes	**No**
Lead	Residential	600.00-900.00	200.00[1]	√	
Arsenic		25.00-35.00	37.00		√
Cadmium		<1.80	26.00		√
Chromium		60.00-120.00	3000.00		√
Nickel		<15?	130.00		√

Notes: [1]Soil guideline value for 1% and 6% SOM respectively. Other soils guidelines presented in the table are based on soils with 6% SOM.

Please note that there are only a limited number of land uses for which data on determinands have been published or can be readily determined.

Section 7 Discussion and conclusions

The findings of the Phase I Desk Study are summarised below:

1. The 1:50,000 BGS map showed the site to be located on bedrock of the London Clay Formation with a superficial geology of Lynch Hill Gravel Member
2. The historical maps and former research revealed that there may be sources of pollution located at the vicinity of the proposed site that may cause risk to the receptors identified.
3. Examination of the Environment Agency records showed that there is no Groundwater Source Protection Zones (GSPZ) located onsite that could be a risk from any contaminants that may exist within the soil.
4. The Environment Agency hydrogeological maps showed a Secondary Aquifer A with soil of high permeability. The regional groundwater flow toward the southeast in line with the local topography which slopes to the southeast.
5. The Building Research Establishment report BRE 211 (2007) showed that **no radon protection measures** were required.
6. Environment Agency records showed that the **site was not at risk of flooding from rivers or sea.** Soils Limited can carry out a flood risk assessment if required.
7. Any suspicious ground conditions encountered during groundworks should be reported to a competent person for further inspection.

Summary of potential on-site contamination sources identified during the study of the historic maps, the Dataset Information and Landmark Envirocheck Report and the Site Walkover are outlined in Table 7.1.

Table 7.1. Summary of Potential Contamination Sources

	Sources/Environmental Impact	Direction [1]	Distance (m)	Date Range		Source
				From	To	
On site	Ruin with possible Made Ground	na	0	-	-	HM
	Lead	na	0	-	-	EC
Offsite	Depot	SW	0-100	1958	1958	HM
	Middlesex Hospital	SW	0-100	1875	1896	HM
	Garage	SE	0-100	1966	1973	HM
	Garage	NE	0-100	1966	1973	HM
	Timber	SW	0-100	1953	1958	HM
	Ruins	various	0-250	1953	1958	HM
	Workhouse	w	0-100	1872	1875	HM
	Chemical works	w	0-100	1895	1921	HM
	Electric substation	N	100-250	1953	1954	HM
	Depot	SW	100-250	1958	1958	HM
	works	N	100-250	1958	1990	HM
	Hospital	E	100-250	1875	1953	HM
	Factory	S	100-250	1958	1990	HM
	Phonic works	SE	100-250	1916	1953	HM
	Works	SE	100-250	1954	1958	HM
	Mineral works	SE	100-250	1954	1995	HM

Table 7.1. Summary of Potential Contamination Sources

Sources/Environmental Impact	Direction [1]	Distance (m)	Date Range		Source
			From	To	
Factory	N	100-250	1958	1962	HM
Processing works	N	100-250	1966	1973	HM
T-Shirts	N	10	Inactive		EC
Textile Manufacturing	NW	16	Inactive		EC
Garage Services	NW	44	Inactive		EC
Commercial Cleaning Services	SE	42	active		EC
Pest & Vermin Control	SE	42	Inactive		EC
Telecommunications Equipment & Systems	S	52	Inactive		EC
Printers	S	81	active		EC
Printers	S	81	Inactive		EC
Tool Design, Manufacturers & Makers	N	53	Inactive		EC
Dry Cleaners	NE	56	Inactive		EC
Footwear Manufacturers & Wholesale	W	65	active		EC
Printers	W	65	Inactive		EC
Radioactive Substances	SW	38	---		EC
Radioactive Substances	W	93			EC

Notes: **Data Origin:** - HM=Historic Maps and EC=EnvironCheck [1]For on-site relative to the centre of the site. The activities reported in the EnviroCheck report that are not listed in the table are either (i) operating according to environmental guidance (i.e. environmental permitting or IPPC) therefore may not be considered as source of contamination, (ii) remote from the site or (iii) not located up gradient of the site therefore have not direct impact on identified receptors.

Section 8 Preliminary Conceptual Site Model

8.1 General

Environment Agency guidance provided in CLR11 indicates the Conceptual Site Model should identify those contaminants, pathways and receptors which are 'likely' to represent an 'unacceptable' risk either to human health or the surrounding environment. The following sections present potential contaminants and receptors based on this desktop study. Pathways have been established on reasonable scientific knowledge of the behaviour of the contaminants in the ground.

8.2 Sources of Contamination

From the study of the Landmark Envirocheck Report and Site Walkover the Phase I Desk Study has assessed and outlined potential contaminative sources (Table 7.1). The Initial assessment of the likelihood each contaminative source poses a hazard to the site is considered in Sections 8.3.1 - 8.3.3.

8.2.1 On-Site Potential Contamination Sources

Map evidence, study of Landmark Envirocheck Report and Site Walkover showed the following potentially contaminative sources, given in Table 8.1.

Table 8.1. On-Site – Potentially Contaminative Sources

Sources	Direction[1]	Likelihood	
		Likely	Unlikely[2]
Lead	-	√	
Ruin	-	√	

Notes: [1] Relates to the centre of the site. [2] Sources are marked as 'Unlikely' if the hazard to the site was considered negligible. These considerations are based on type of contamination, age of source and anticipated significance.

8.2.2 Off-Site Potential Contamination Sources

Map evidence, study of Landmark Envirocheck Report and Site Walkover showed the following potentially contaminative sources, given in Table 8.2.

Table 8.2. Off-Site – Potentially Contaminative Sources

Sources	Direction	Distance (m)	Likelihood		Reasoning
			Likely	Unlikely[1]	
Depot	SW	0-100		√	Not located in the direction of groundwater flow to the site
Middlesex Hospital	SW	0-100		√	
Garage	SE	0-100		√	
Garage	NE	0-100	√		Located in the direction of groundwater flow to the site
Timber	SW	0-100		√	Not in the direction of groundwater flow to the site or remote to the site or low risk of environmental pollution
Ruins	various	0-250		√	
Workhouse	w	0-100		√	
Chemical works	w	0-100		√	
Electric substation	N	100-250		√	
Depot	SW	100-250		√	
works	N	100-250		√	
Hospital	E	100-250		√	
Factory	S	100-250		√	

Table 8.2. Off-Site – Potentially Contaminative Sources					
Sources	Direction	Distance (m)	Likelihood		Reasoning
			Likely	Unlikely[1]	
Phonic works	SE	100-250		√	
Works	SE	100-250		√	
Mineral works	SE	100-250		√	
Factory	N	100-250		√	
Processing works	N	100-250		√	
T-Shirts	N	10		√	
Textile Manufacturing	NW	16	√		Located near the site and in the direction of groundwater flow to the site
Garage Services	NW	44	√		
Commercial Cleaning Services	SE	42		√	Not in the direction of groundwater flow to the site
Pest & Vermin Control	SE	42		√	
Telecommunications Equipment & Systems	S	52		√	
Printers	S	81		√	
Printers	S	81		√	
Tool Design, Manufacturers & Makers	N	53		√	
Dry Cleaners	NE	56		√	
Footwear Manufacturers & Wholesale	W	65		√	
Printers	W	65		√	
Radioactive Substances	SW	38		√	
Radioactive Substances	W	93		√	

Notes: [1] Sources are marked as 'Unlikely' if the hazard to the site was considered negligible. These considerations are based on type of contamination, age of source, anticipated significance and taking account of the source distance from the site.

8.2.3 Potential Contamination

From the Risk Assessment in Tables 8.1 and 8.2, the main groups of contaminants are presented in Table 8.3. The possibility of hazardous materials within the existing made ground cannot be ruled out. It should be noted however that approximately 8m of soil will be removed from the site and disposed of according to the appropriate waste management guidelines.

Table 8.3. Potential Contaminants or properties			
Contaminants/Chemical Properties For Testing[1]		Potential Contaminative Sources	Hazard
P1	Ammonia		
P2	Asbestos	Ruins	√
P3	De-icing agents, fire-fighting chemical		
P4	Herbicides/pesticides		
P5	Metals and semi-metals (e.g. Arsenic, Chromium)	Made Ground	√
P6	Non-chlorinated solvents		
P7	Organic compounds (e.g. PAHs and TPHs)	Made Ground	√
P8	Organic solvents (e.g. chlorinated solvents)		
P9	Polychlorinated Biphenyl (PCBs)		
P10	Sulphate	Made Ground	√
P11	Pathogens		
P12	Radioactive		

Table 8.3. Potential Contaminants or properties			
Contaminants/Chemical Properties For Testing[1]		Potential Contaminative Sources	Hazard
P13	Soil gas[2]	Made Ground	√

Notes: [1] Based on DOE industrial profiles or on knowledge of the processes involved in the activity carried out on site. [2] all possible made ground will be excavated for the basement construction. P=Properties;

8.2.4 UXO Preliminary Risk Assessment

It is estimated that a percentage (approximately 10%) of bombs dropped on London alone failed to detonate and could therefore pose a threat if unearthed, especially with recent turbulent weather conditions. Several unexploded devices that have been unearthed as a result of the floods. While the probability of detonation may seem a relatively low risk, the potential consequences are extreme. Steps must therefore be taken as part of health and safety risk assessments and the overall planning process to ensure the appropriate due diligence has been undertaken.

Soils Limited carried out a UXO Preliminary Risk Assessment at the Site (Appendix F). This preliminary research for this report identified a potential UXO risk and the need for further research to be carried out on the proposed site. The site was situated in an area of London (Metropolitan Borough of St. Pancras) which sustained a high density of bombing throughout WWII. Mapping and bombing records available for this preliminary investigation highlighted signs of substantial bomb damage and destruction within the site boundary. Further research would be required in order to confirm the exact location and scale of damage, the calibre of the bomb strikes and whether or not they exploded. Cross referencing the written records, photography and mapping should allow confirmation of the actual locations of the strikes.

The research recommended that a detailed UXO Threat Assessment is carried out for the proposed site. The proposed site area sustained bombing and associated damage; much of the site appears to have been subject to 'total destruction' however an area in the western section of the boundary may have sustained less severe damage. It would be recommended to make reference to relevant incident records and account for bomb damage to locations bounding the site of proposed works. The acquisition of high resolution aerial reconnaissance imagery can further highlight the conditions present within the site boundary with reference to the assessed threat for UXO encounter. It is may be possible to reduce the perceived risk on site depending on the quantity / quality of information obtained and the conclusions formed in a full investigation. It is understood that works are imminent at the site. This preliminary investigation has highlighted a potential threat from German Air-Delivered Ordnance and as a consequence it would be recommended to undertake appropriate on-site UXO support measures prior to or in lieu of a Detailed Assessment.

8.3 Potential Pathways

A pathway is a route or routes by which a receptor is exposed to a contamination source. Pathways can also determine the likelihood of the contamination source contacting a receptor.

Anthropogenic (or artificial) pathways for contaminant migration can be present in the form of land drains etc. Leaking sewage supply pipes and site drainage could also provide pathways for potential contaminant migration. Granular backfill to trenches for cables, gas pipes, water pipes etc. can also provide pathways for movement of mobile contaminants and contaminated groundwater.

The 1:50,000 BGS map showed the site to be located on bedrock of the London Clay Formation with a superficial geology of Lynch Hill Gravel Member. The groundwater vulnerability of the site was classified as Secondary Aquifer A. Groundwater was considered vulnerable to potential contaminants that may exist within the ground.

The Lynch Hill Gravel Member will act as pathway of pollutant to groundwater.

Table 8.4. On-Site Potential Pathway

Routes / Attack Type	Exposure pathways	Site Settings			Risk To Potential Receptors			
		Anticipated onsite	Likely	Unlikely	HH	BS	EF	Controlled water SW, GW, SPZ & A)
Oral	Direct soil and dust ingestion	Contaminants & gardens		x				
	Consumption of home-grown produce	Contaminants & gardens		x				
Dermal	Dermal contact	Contaminants & gardens		x				
Inhalation	Inhalation of dust (indoor and outdoor)	Contaminants		x				
	Inhalation of vapours (indoor and outdoor)	Volatile compounds		x				
	Inhalation of soil Gases	Soil Gases (e.g. CH_4 and CO_2)		x				
Physical	Fire and explosion [1]	UXO (e.g. Bombs or projectile sites) (0-250m)[2]	√		√	√		
		Combustible material in soil		x				
		Soil Gases		x				
	Via anthropogenic pathways (services trenches)	Contaminants & Trenches		x				
	Others physical pathways[3]	Degradation of fills, blast... etc...		x				
Chemical	Location of service supply pipes in contaminated soils			x				
	Direct contact of concrete to high-sulphate soils	Sulphate, Acids & Concrete		x				
Others	Irradiation [4]	Radon		x				
		Radioactive materials		x				
		UXO within 0-250m	√		√	√		
	Via surface water runoff	Gradient (Area)		x				
	Migration downwards via granular soils	Drift or superficial: Principal/secondary		x				
	Migration downwards via permeable soils and bedrock	Bedrock: Principal/secondary		x				
		Groundwater vulnerability: Principal/secondary		x				
	Plant uptake and phytotoxicity [5]	Heavy metals		x				
		Soil Gases		x				
	Plant uptake and ecotoxological effects [6]	Contaminants		x				

Notes:

BS= Building Structures. **EF**= Ecological Features, Controlled water (**SW**= Surface Water, **GW**=Groundwater, **SPZ**=Source Protection Zone and **A**= Abstractions within 250m to the site), **HH**=Human Health,. √ = Likely and **x**=Unlikely.

[1] Both underground fires and biodegradable may produce toxic or flammable gases;

[2] UXO= Unexploded Ordnance: Although risk is generally low in the UK, a risk assessment (i.e. using Find map for example) may be needed if an UXO is found onsite,

[3] Blast-furnace and steel-making slag may expand. Degradation of fills may cause settlement and voids in buried tanks and drums may collapse as corrosion occurs or under loading;

[4] Radioactive materials emitting gamma rays that can be inhaled and absorbed through the skin and also cause a radiation response;

[5] Prevention or inhibition of plant growth

[6] Contaminants in soil may affect microbial, animal and plant populations. Ecosystems or individual species on the site, in surface waters or areas affected by migration from the site may be affected.

[7] Unlikely although unexplored

Table 8.5. Off-Site Potential Pathways			
Receptors	**Off-Site Potential Pathways**	**Likely**	**Unlikely**
Human Health Building Materials	Migration via surface water runoff (Surface flow)		√
Human Health Building Materials	Migration via air	√	
Groundwater Human Health Building Materials	Migration via groundwater flows	√	

8.4 Potential Receptors

With respect to land contamination, potential receptors include human health, ecological features, controlled waters, and buildings and materials.

The presence of potential receptors has been evaluated from our understanding of the current and future land use of the site, an assessment of surrounding land uses and currently available information pertaining to the site.

The assessment for potential receptors at the site is shown in Table 8.6.

Table 8.6. Potential Receptors			
Potential Receptor		**Present**	
		Likely	**Unlikely**
Human Health	Future users of the site	√	
	Visitors to the site	√	
	Construction workers on site	√	
	Service and maintenance workers	√	
	Site neighbours and wider public	√	
Groundwater/Controlled Waters	Groundwater/Future Potable Water Supply	√	
	Surface Water		√
Buildings & Materials	Construction materials	√	
	Buildings and confined spaces	√	
Ecosystems	Flora and fauna in surface water		√

8.5 Preliminary Risk Assessment

A preliminary risk assessment has been undertaken relating to the potential proposed development based on a qualitative assessment of the likely presence of a pollutant linkage. A pollutant linkage is the relationship between a contaminant source, a pathway and a receptor. Unless all three elements of a pollutant linkage are present, a risk is not considered to exist. Each of the three elements was considered in Sections 8.3, 8.4 and 8.5.

The approach adopted was to screen the site based on assigning a risk category. The preliminary risk assessment is presented in Table 8.7 with the risk assessment criteria attached to this report (Appendix E).

Table 8.7. Risk Assessment					
Environs	**Direction**	**Distance (m)[1]**	**Pathway**	**Receptor**	**Risk[1]**
Ruin	-	0		√	None
Lead	-	0		√	None
Depot	SW	0-100		√	None
Middlesex Hospital	SW	0-100		√	None
Garage	SE	0-100		√	None
Garage	NE	0-100		√	None
Timber	SW	0-100		√	None
Ruins	various	0-250		√	None
Workhouse	w	0-100		√	None
Chemical works	w	0-100		√	None
Electric substation	N	100-250		√	None
Depot	SW	100-250		√	None
works	N	100-250		√	None
Hospital	E	100-250		√	None
Factory	S	100-250		√	None
Phonic works	SE	100-250		√	None
Works	SE	100-250		√	None
Mineral works	SE	100-250		√	None
Factory	N	100-250		√	None
Processing works	N	100-250		√	None
T-Shirts	N	10		√	None
Textile Manufacturing	NW	16		√	None
Garage Services	NW	44		√	None
Commercial Cleaning Services	SE	42		√	None
Pest & Vermin Control	SE	42		√	None
Telecommunications Equipment & Systems	S	52		√	None
Printers	S	81		√	None
Printers	S	81		√	None
Tool Design, Manufacturers & Makers	N	53		√	None
Dry Cleaners	NE	56		√	None
Footwear Manufacturers & Wholesale	W	65		√	None
Printers	W	65		√	None
Radioactive Substances	SW	38		√	None
Radioactive Substances	W	93		√	None

Note: [1] approximately from boundary of the site.

The classifications tables are presented in Appendix E are modified from, 'contaminated land risk assessment: A guide to good practice, 2001, CIRIA C552'.

8.6 Preliminary Conceptual Site Model

The preliminary conceptual site model, including linkages that require further actions is presented in Table 8.8 and the reasoning behind the decision taken shown in Table 8.9.

Table 8.8. Preliminary Conceptual Site Model and Risk Assessment Methodology

Linkage No	Potential Contaminants Identified (Table 8.3)	Pathway (See Tables 8.4 & 8.5)	Receptor (See Table 8.6)	Risk Assessment Methodology (plus anticipated quantitative risk assessment methods)	Site specific settings	Risk Classification: Based on Desk Study	Pollutant Linkage & Action Required
1	P2, P5, P7, P10 & P13	None	Ecological features (i.e. Flora and Fauna)	Presence of SSSI, Museum, Natural reserves and others within 0- 250m to the site. Use EA Science Report	No significant ecological feature within 250m of the site.	Likely to be none	**The view of the local council must be sought.**
2	P2, P5, P7, P10	None	Building structures/services	Soil testing & use BRE 2005 for risk assessment. Water UK (2014) for pipes. Use Anglian Water trigger for services risk assessment	Proposed foundations and services pipes	Likely to be medium	**No further actions needed**
3	P2, P5, P7-P10	e.g. Inhalation, ingestion and dermal contact	Human health Site users	Use CLEA for human risk assessment	Residential	Likely to be medium	**No further actions needed**
			Human Health Workers	Assessment not within the scope of this Desk study (responsibility of building contractor). Ground workers should follow regulations on health and safety during development (HSE, 1991)	Workers and the general public should follow regulation on health and safety during development (HSE, 1991)	Likely to be low	Follow HSE procedures
4	P2, P5, P7,P10	None	Shallow groundwater/ Surface Water	Assessment to be carried out based on distance from watercourse and direction of flow – Consider use of R&D 20 publication for risk assessment	There is no surface water within 250m of the site. There is no GSPZ on the site. The site is on secondary aquifer A therefore pollutant linkage exists.	Likely to be low	**No further actions needed**
5	P2, P5, P7,P10	None	Deep groundwater	Undertake groundwater or leachate testing depending on site specific ground conditions. – Consider use of R&D 20 publication for risk assessment if contamination is identified.	There is no GSPZ on the site. Site is on an Aquifer with soils of low permeability.	Likely to be very low	**No further actions needed**
6	None	None	Human, building Structures and the atmosphere	Current or former Landfill sites within 0-250m to the site. Assess nature/age/size of site for Risk Assessment. Use CIRIA 149 & 665 to assess need for gas protection measures where necessary following ground gas testing	No landfill site within 250m of the site. Very Low gas risk from potential infilled ground located onsite and within 250m of the site.	Likely to be very low	**No further actions needed**

Note: HSE= Health and Safety Executive, SPZ= Source Protection Zone and P=Property. P2= asbestos which is included anyway, P5=Metals and semi-metals (e.g. Arsenic, Chromium), P7=Organic compounds (e.g. PAHs and TPHs) and P10=Sulphate

Table 8.9.Reasoning Behind Risk Assessment		
Linkage No	**Receptor**	**Reasonning**
1	Ecological Features (i.e. Flora and Fauna)	There are no significant ecological features within 250m to the site therefore, no pollutant linkages exist. The view of the local council must be sought regarding any conservation areas that may exist at the vicinity of the site.
2	Building Structures/Services	There are no contaminants risks to proposed foundations and services pipes therefore further actions are required. Approximately 8m of soil/Made ground will be excavated for the basement construction
3	Human Health Site users Human Health workers	All site works must be carried out according to Health and Safety Executive (HSE) procedures.
4	Surface Water	There is no surface water located within 250m of the site. However, the site is underlain by a secondary aquifer with soils of high permeability. The potential source will be removed therefore further actions are not warranted.
5	Groundwater	The site was underlain by an Aquifer with soils of low permeability therefore risk to deep groundwater may be considered unlikely.
6	Human and Building Structures: Possible soil gas	No significant infilled ground are been found onsite or within 0-250m of the site therefore gas monitoring is not considered necessary

The intrusive investigation may reveal on site sources of contamination that were not established by the Phase I Desk Study and Site Walkover that could modify the Conceptual Site Model.

Section 9 Recommendations

9.1 General

Based on the information obtained during the desk study and the preliminary conceptual site model derived for the site, an intrusive contaminated land investigation is not required because no actual pollution linkages exist. An intrusive site investigation is only needed in order to characterise the waste soil for disposal purposes.

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

9.2 Impact of Construction Activities on Controlled Waters and Site Neighbours

A demolition and construction risk assessment must be undertaken and appropriate measures taken to mitigate against mobilisation and to monitor impact to groundwater and surface waters.

9.3 Proposed Further Site Works

The proposal is a combined geotechnical and Phase II Intrusive Investigation (Table 9.1) in order to obtain further information as follows

9.3.1 Phase II Intrusive Investigation

The Preliminary CSM allows for the identification of the test parameters relevant to the investigation, though this may require modification or addition from the findings of the intrusive investigation. Phase II intrusive site investigation will be carried out in order to investigate and assess pollutant linkages specified in the preliminary Conceptual Site Model presented in Table 8.8.

The works to be undertaken on the site would comprise (i) soil sampling that is appropriate to the potential sources and (ii) testing for the potential contaminants given in the CSM or other sources identified during the intrusive investigation for waste assessment purposes only.

Significant made ground or asbestos material may be encountered during site works. If encountered on site, this should be reported to a competent person for an appropriate assessment.

9.3.2 Geotechnical Site Investigation

The purpose of the geotechnical investigation will be to obtain data regarding engineering properties of the soils to enable the design of foundations, concrete, pavements and drainage.

The works to be undertaken on the site would comprise (i) soil sampling, (ii) drilling boreholes with window sampler and percussion drilling rig at selected locations within the site and (iii) probing using either DPH or DPSH in order to permit the establishment of the engineering parameters for foundation design.

Following a preliminary Assessment it was recommended to undertake appropriate on-site UXO support measures prior to or in lieu of a detailed assessment. Steps must be

taken as part of health and safety risk assessments of the development plan and the overall planning process to ensure the appropriate due diligence has been undertaken.

Table 9. 1. Standard Further Works

Further works	Environmental Phase II intrusive site investigation	Geotechnical site investigation	General Purpose
Soil sampling	√	√	Take sampling for laboratory testing across the site
In situ or laboratory soils testing	√		Determine the nature and extent of contamination across the site
		√	Engineering parameters for foundation design
Generic and/ or site specific risk assessment	√		Assess pollutant Linkages (Table 8.8) based on current contaminated land guidance if any
Drilling boreholes with window sampler across the site	√	√	Determine the nature of the ground
Boreholes installation	√	√	**1.** If Tier 1 risk assessment for groundwater only shows unacceptable levels of contamination in groundwater, further groundwater testing and monitoring may be necessary. **2.** If soil gas monitoring was considered.
Remediation	√		If intrusive investigation and site specific risk assessment reveal that the site was contaminated
Soils testing for validation	√		If remediation was carried out on site
Probing using either DPH or DPSH		√	Establish foundation design and engineering parameters for foundation design

9.4 Discovery Strategy

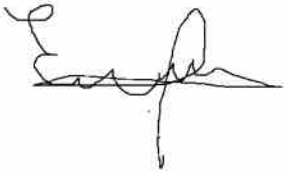
There may be areas of contamination not identified during the course of the intrusive investigation. Such occurrences may also be discovered during the demolition and construction phases for the redevelopment of the site.

Groundworkers should be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil; discolouration, or odours and emission. Upon discovery, advice must be taken from a suitably qualified person before proceeding, such that appropriate remedial measures and health and safety protection may be applied.

Should a new source of contamination be suspected or identified then the Engineer and if appropriate the Local Authority must be informed.

The following appendices complete this report:

- Appendix A- County Series and Ordnance Survey Maps
- Appendix B-Landmark Envirocheck Report
- Appendix C-Site Sensitivity Maps
- Appendix D-Site Photographs
- Appendix E-Risk Assessment Criteria
- Appendix F-UXO Report



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