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DESK STUDY / PRELIMINARY RISK ASSESSMENT REPORT

WARWICK PLACE, UXBRIDGE, UB8 1JT

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Report Title: **Desk Study/Preliminary Risk Assessment Report for Warwick Place, Uxbridge, UB8 1JT**

Report Status: **Final v1.0**

Job No: **P2337J1759/TE**

Date: **23/08/2019**

Quality Control: Previous Release

Version	Date	Issued By

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EXECUTIVE SUMMARY

Palace Capital Ltd ('The client') commissioned Jomas Associates Ltd to undertake a desk study and preliminary risk assessment at Warwick Place, Uxbridge, UB8 1PE. The principal objectives of the study were as follows:

- To determine the nature and where possible the extent of contaminants potentially present at the site;
- To establish the presence of significant contaminant linkages, in accordance with the procedures set out within the Environment Agency (EA) report R&D CLR11 and relevant guidance within the National Planning Policy Framework (NPPF);
- To assess whether the site is safe and suitable for the purpose for which it is intended, or can be made so by remedial action.

It should be noted that the table below is an executive summary of the findings of this report and is for briefing purposes only. Reference should be made to the main report for detailed information and analysis.

Desk Study	
Current Site Use	Vacant car showroom with asphalt car park.
Proposed Site Use	The proposed development includes the demolition of the existing single storey car showroom and construction of 3 storey building to provide 7No new residential units. Private amenity spaces in the form of decked terraces and small areas of communal soft landscaping are anticipated.
Site History	A review of earliest available (1865) historical maps indicates that the site had rectangular structures in the central and northern corner, and was likely to comprise part of "Murrays Yard", in the north, and parts of ornamental gardens associated with adjacent residential properties, in the south. By 1914 the building formerly located in the northern corner of site is no longer present. By 1934 the site has been redeveloped with former buildings no longer present, part of a large building appears to intrude into the site from the northern corner, and a rectangular structure is now present in the southern half of the study site, which is labelled "Garage" by 1962. By 1978 the building formerly located encroaching into site from the northern corner is no longer present. Few changes then occur on site up to present day. The area has exhibited a mix of industrial, commercial and residential zoning, historically. Earliest maps indicate light residential with an iron works located within close proximity to the east of the site. Residential development occurs within the wider area up to the mid 1900's when further industrial development appears. Of note includes increased railway infrastructure and a number of unspecified works and a builder's yard developed within 100m of the study site. By the 1970's some of these areas have been developed into engineering works and motor works, however industry appears to decrease up to present day.

Site Setting	The British Geological Survey indicates that the site is directly underlain by superficial deposits of the Lynch Hill Gravel Member. These superficial deposits are underlain by solid deposits of the London Clay Formation. No artificial deposits are reported within the site. Borehole records from approximately 43m west of the site indicated gravels extending to approximately 3.90mbgl, underlain by the London Clay Formation to the terminal depth of the borehole 6.0m bgl. The superficial deposits underlying the site are identified as a Principal Aquifer with the underlying solid deposits identified as Unproductive. A review of the EnviroInsight Report indicates that there are no source protection zones within 500m of the site. There are no groundwater, surface water or potable water abstractions reported within 1km of the site. The nearest surface water feature is reported 138m north west of the site, identified as a Frays River. The site is not located within Environment Agency Zone 2 or 3 floodplains.
Potential Sources	• Potential for contaminated ground associated with previous site use – on site (S1) - Potential builders' yard - Garage • Potential for Made Ground associated with previous development operations – on site (S2) • Current and previous industrial use – off site (S3) - Builders' yard 25m N - Iron Works 30m NE - Unspecified Yards 30m SE - Unspecified works 30m E, 60m SE - Motor repair works 44m SE - Engineering works 60m SE - Tan yard 125m W • Potential asbestos containing materials within existing buildings – on site (S4) • Potential asbestos impacted soils from demolition of previous buildings – on site (S5)
Potential Receptors	• Construction and maintenance workers • Neighbouring and future site users • Buried foundations and services • Controlled waters – Principal aquifer, Secondary A aquifer, Frays River
Preliminary Risk Assessment	The risk estimation matrix generally indicates a moderate risk. Due to the potential presence of asbestos containing materials, an asbestos survey should be undertaken, with any asbestos containing materials found, removed under suitably controlled conditions.

	There should be no risk to end users from asbestos if the potential asbestos containing materials are removed by suitably qualified and experienced specialists under controlled conditions. It is recommended that an intrusive investigation is undertaken to clarify potential risks to the identified receptors. The investigation should assess the thickness of any Made Ground, and allow samples of Made Ground and natural soils to be taken for laboratory analysis. A potential source of ground gas has not yet been identified. Should a significant thickness of Made Ground by encountered on site, a programme of soil gas monitoring may be required. This would also be recommended to determine the risk of vapour ingress from hydrocarbon-impacted soils, if found.
Potential Geological Hazards	The Groundsure data identifies only very low to negligible risks. The potential impacts of shallow groundwater should be considered during foundation design. The clearance of the site, including removal of foundations and services is likely to increase the depth of Made Ground on the site. Foundations should not be formed within Made Ground or organic rich material (e.g. Topsoil) due to the unacceptable risk of total and differential settlement.The presence of Made Ground derived from demolition material or disseminated pyrite within the London Clay Formation may be a source of elevated sulphate results. If such levels are noted then sulphate resistant concrete may be required. The resultant thickness of Made Ground and the potential for clays beneath the proposed footprint may mean that a suspended floor slab would be required.A geotechnical investigation is recommended to inform foundation design.

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 Palace Capital Ltd ("The Client") has commissioned Jomas Associates Ltd, to assess the risk of contamination posed by the ground conditions at a site referred to as Warwick Place, Uxbridge, UB8 1PE, prior to redevelopment.

1.1.2 To this end a desk based assessment has been undertaken in accordance with Jomas Associates Limited's proposal dated 6th August 2019.

1.2 Proposed Development

1.2.1 The proposed development includes the demolition of the existing single storey car showroom and construction of 3 storey building to provide 7No new residential units. Private amenity spaces in the form of decked terraces and small areas of communal soft landscaping are anticipated.

1.2.2 A plan of the proposed development is included in Figure 3.

1.2.3 For the purposes of the contamination risk assessment, the proposed development is classified as 'Residential without plant uptake'.

1.2.4 For the purpose of geotechnical assessment, it is considered that the project could be classified as a Geotechnical Category (GC) 2 site in accordance with BS EN 1997 Part 1. GC 2 projects are defined as involving:

- Conventional structures.
- Quantitative investigation and analysis.
- Normal risk.
- No difficult soil and site conditions.
- No difficult loading conditions.
- Routine design and construction methods.

1.2.5 This will be reviewed at each stage of the project.

1.3 Objectives

1.3.1 The objectives of Jomas Associates Limited's investigation were as follows:

- To present a description of the present site status, based upon the published geology, hydrogeology and hydrology of the site and surrounding area;
- To review readily available historical information (i.e., Ordnance Survey maps and database search information) for the site and surrounding areas, with respect to potentially contaminative land uses;

- To provide an assessment of the environmental sensitivity at the site and the surrounding area, in relation to any suspected or known contamination which may significantly affect the site and the proposed development;
- To assess the potential presence of significant pollutant linkages, in accordance with the procedures set out within Part IIA of the Environmental Protection Act 1990, associated statutory guidance and current best practice including the EA report R&D CLR 11;
- To identify and assess geotechnical issues that may affect the site.

1.4 Scope of Works

1.4.1 The following tasks were undertaken to achieve the objectives listed above:

- A walkover survey of the site;
- A desk study, which included the review of third party environmental database reports (attached in Appendix 2 and Appendix 3);
- The compilation of this report, which collects and discusses the above data, and presents an assessment of the site conditions, conclusions and recommendations.

1.5 Supplied Documentation

1.5.1 Jomas Associates have not been supplied with any previously produced reports at the time of writing this report.

1.6 Limitations

1.6.1 Jomas Associates Ltd has prepared this report for the sole use of Palace Capital Ltd in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas Associates Limited. No other third-party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.

1.6.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless Jomas Associates Limited has actual knowledge to the contrary, information obtained from public sources or provided to Jomas Associates Limited by site personnel and other information sources, have been assumed to be correct. Jomas Associates Limited does not assume any liability for the misinterpretation of information or for items not visible, accessible or present on the subject property at the time of this study.

1.6.3 Whilst effort has been made to ensure the accuracy of the data supplied, and analysis derived from it, there may be conditions at the site that have not been disclosed by the investigation, and could not therefore be taken into account. As with any site, there may be differences in soil conditions between exploratory hole positions.

Furthermore, it should be noted that groundwater conditions may vary due to seasonal and other effects and may at times be significantly different from those measured by the investigation. No liability can be accepted for any such variations in these conditions.

1.6.4 Any reports provided to Jomas Associates Limited have been reviewed in good faith. Jomas Associates Limited cannot be held liable for any errors or omissions in these reports, or for any incorrect interpretation contained within them.

1.6.5 This investigation and report has been carried out in accordance with the relevant standards and guidance in place at the time of the works. Future changes to these may require a re-assessment of the recommendations made within this report.

1.6.6 *Our investigations exclude surveys to identify the presence of injurious and invasive weeds.*

1.6.7 ***This report is not an engineering design and the figures and calculations contained in the report should be used by the Structural Engineer, taking note that variations may apply, depending on variations in design loading, in techniques used, and in site conditions. Our recommendations should therefore not supersede the Engineer's design.***

2 SITE SETTING

2.1 Site Information

2.1.1 The site location plan is appended to this report in Figure 1, Appendix 1.

Table 2.1: Site Information

Name of Site	-
Address of Site	Warwick Place Uxbridge UB8 1JT
Approx. National Grid Ref.	505430 184388
Site Area (Approx)	0.0604ha
Site Occupation	Vacant car showroom with asphalt car park
Local Authority	London Borough of Hillingdon

2.2 Walkover Survey

2.2.1 A site walkover survey was undertaken by Jomas Associates on 15th August 2019.

Table 2.2: Site Description

Area	Item	Details
On-site:	**Current Uses:**	The site is occupied by 1No. single storey commercial unit previously used to display cars. The remainder of the site is asphalt car parking.
	Evidence of historic uses:	Scarring within asphalt located within car park, potentially infilled drainage.
	Surfaces:	Much of the site is hard cover either by the buildings or by car parking areas. A small area of gravel is located in the northern corner of the site.
	Vegetation:	Small patch of overgrown weeds in south west corner, medium sized deciduous tree located in the south eastern corner.
	Topography/Slope Stability:	Gentle downward slope noted running north east to south west within car park.
	Drainage:	The site appears to be connected to normal drainage facilities. Drain covers are situated around the site.
	Services:	The site is assumed to be connected to standard electrical, gas and telecommunication services.
	Controlled waters:	No controlled waters were noted on site.
	Tanks:	No tanks were noted on site.
	North:	Public house, restaurant.

Area	Item	Details
Neighbouring land:	**East:**	Police station, commercial units, Wickes and Halfords Church.
	South:	Carers centre, nail shop, general commercial and restaurants. Fast food outlets.
	West:	Commercial, main road (high street).

2.2.2 Key features noted during the walkover are shown on a site walkover plan in Figure 2, together with site photos, in Figure 4.

2.3 Historical Mapping Information

2.3.1 The historical development of the site and its surrounding areas was evaluated following the review of a number of Ordnance Survey historic maps, procured from GroundSure, and provided in Appendix 3 of this report.

2.3.2 A summary produced from the review of the historical map is given in Table 2.3 below. Distances are taken from the site boundary.

Table 2.3: Historical Development

Dates and Scale of Map	Relevant Historical Information	
	On Site	**Off Site**
1865/66/68 1:2,500 1:10,560	The site has rectangular structures in the central and northern corner, and is likely to comprise part of **"Murrays Yard"**, in the north, and parts of ornamental gardens associated with adjacent residential properties, in the south.	**"Murrays Yard"** extends off-site to the northeast. **Albert Iron Works** located 30m northeast. **Unspecified yards** located 30m and 70m south east and 100m south west. Ground workings located 150m north. Steam saw mill located 250m west. Pond located 220m east. Fray River 175m west, canal located 400m west and unspecified river located 450m west. Tileworks and gravel pit located 850m north east.
1877 1:2,500	Incomplete mapping.	Incomplete mapping
1881 1:10,560	No significant change.	Gravel pit located 400m north. Railway station located 500m south. Water works located 625m south west. Gravel pits located 800m south
1895/97 1:10,560	No significant change.	No significant change.

Dates and Scale of Map	Relevant Historical Information	
	On Site	**Off Site**
1899/1900 1:2,500 1:10,560	No significant change.	The pond formerly located 220m east is no longer present. **Tan yard** found 125m west. Brewery located 150m west. Osbourne's Wharf, Crown Wharf and Buckingham Wharf located 250m west. Ways Wharf found 250m north west.
1912 1:10,560	Incomplete mapping.	Previously reported river located 450m west is now named River Colne and runs north to south.
1914 1:2,500	Building formerly located in the northern corner of site is no longer present.	Railway line with terminus section present 225m north west.
1920 1:10,560	No significant change.	Railway line with terminus and goods shed present 300m east. Timber yard located 300m west. Steel barrel works and iron works located 500m south west. Printing works located 500m south east.
1932 1:10,560	No significant change.	Fabric works located 750m north.
1934/35 1:2,500 1:10,560	Site has been redeveloped with former buildings no longer present. Part of a large building appears to intrude into the site from the northern corner, and a rectangular structure is now present in the southern half.	Laundry located 260m south. Bell punch ticket works located 750m south west.
1938 1:10,560	No significant change.	No significant change.
1960 1:10,560	No significant change.	Redevelopment of Albert Iron works located 100m north east of the study site. Now labelled **unspecified works**.
1962 1:1,250	Rectangular structure present in the southern half of the study site is now labelled "**garag**e".	**Builder yard** located 25m north. Unspecified works located 60m south east and 175m west.
1967/70 1:10,560	No significant change.	Works located 500m south east.
1972/73/74/75 1:2,500 1:10,000	No significant change.	Unspecified works located 60m south east now labelled **engineering works**. Motor works located 100m east. Works located 100m north east now labelled engineering works and builders merchants Garage and forge located 200m north west.
1978/80/81 1:1,250	Building formerly located encroaching into site from the northern corner is no longer present.	No significant change.

Dates and Scale of Map	Relevant Historical Information	
	On Site	Off Site
1986/87/88/90 1:1,250 1:10,000	The site appears to be in its current configuration.	Bus station located 250m south east. Builders merchants formerly located 100m north east now labelled depot. Further development of works located 750m south west.
1992 1:1,250	No significant change.	Police station now located 40m north. Tank and unspecified works found 130m north east.
1993 1:1,250	Incomplete mapping.	No significant change.
2001 1:10,000	No significant change.	No significant change.
2010 1:10,000	No significant change.	No significant change.
2019 1:10,000	No significant change.	No significant change.

Potentially polluting/contaminating uses/activities shown in **bold**

2.3.3 An aerial photograph supplied as part of the GroundSure EnviroInsight report and taken in 2015 generally shows a broad agreement with the most up to date OS mapping data.

2.4 Historical Industrial Sites

2.4.1 Groundsure have provided some information on historical industrial sites on and in the vicinity of the site. Table 2.4 below summarises the information provided, which is presented in further detail in the Enviroinsight in Appendix 2. Where the identified features have appeared on more than one map they have been counted multiple times and therefore the reported numbers are higher than the actual count.

Table 2.4: Industrial and Statutory Consents

Type of Consent/Authorisation	On site	Off-site (within 500m of site, unless stated otherwise)	Potential to Impact Site*
Potentially Contaminative Uses identified from 1:10,000 scale mapping	Iron Works and unspecified works (1885-1959)	214No reported, inclusive of Iron Works 12m NE (1968)	✓
Historical Tank Database	None reported	42No reported, closest identified as Unspecified tank 80m E (1914)	X
Historical Energy Features Database	None reported	42No reported, closest identified as Electricity Substation 59 NE (1975)	X
Historical Petrol & Fuel Site Database	None reported	None reported	X
Historical Garage & Motor Vehicle Repair Database	Garage (1962-72)	20No reported, closest identified as Motor Repair Works 44m SE (1975 – 88)	✓

Type of Consent/Authorisation	On site	Off-site (within 500m of site, unless stated otherwise)	Potential to Impact Site*
Potentially infilled land	None reported	60No reported, closest identified as Fish Pond 144m SW (1868 – 82)	X
Tunnels	None reported	6No reported, closes identified as Railway 199m NW (1914)	X

2.5 Industrial and Statutory Consents

2.5.1 The Groundsure EnviroInsight Report also provides information on various statutory and industrial consents on and in the vicinity of the site. The following section summarises the information collected from the available sources.

Table 2.5: Industrial and Statutory Consents

Type of Consent/Authorisation	On site	Off-site (within 500m of site, unless stated otherwise)	Potential to Impact Site*
Discharge Consents	None reported	8No. reported, closest identified as Sewage Discharges - Pumping Station 312m NW (1989 – 2010)	X
Water Industry Act Referrals	None reported	None reported	X
Red List Discharges	None reported	None reported	X
List 1 and List 2 Dangerous Substances	None reported	None reported	X
Control of Major Accident Hazards (COMAH) and Notification of Installations Handling Hazardous Substances (NIHHS) Sites	None reported	None reported	X
Planning Hazardous Substance Consents	None reported	None reported	X
Category 3 or 4 Radioactive substances Authorisations	None reported	None reported	X
Pollution Incidents (List 2)	None reported	8No. reported, closest identified as Contaminated Water Cat 3 Minor water impact 291m NW (2001)	X
Pollution Incidents (List 1)	None reported	None reported	X
Contaminated Land Register Entries and Notices	None reported	None reported	X
Registered Landfill Sites	None reported	3No. reported, closest identified 1235m SW	X
Waste Treatment and/or Transfer Sites	None reported	4No. reported, closest identified Landfill taking Non-Biodegradeable Wastes, 1200m W (2019)	X
Fuel Station Entries	None reported	None reported	X
Current Industrial Site Data	None reported	20No. including Office and Shop Equipment, 47m E, Distribution and	X

Type of Consent/Authorisation	On site	Off-site (within 500m of site, unless stated otherwise)	Potential to Impact Site*
		Haulage, 47m E Vehicle Hire and Rental 48m E.	

* *From a land contamination perspective*

2.6 Previous Site Investigations

2.6.1 Jomas Associates are not aware of any previous site investigations undertaken at the site prior to the writing of this report.

2.7 Local Authority Information

2.7.1 Jomas have made a request to London Borough of Hillingdon for information relating to contamination on the site and surrounding areas. A copy of the correspondence is included in Appendix 6.

2.7.2 A response was received on 22nd August 2019 from the London Borough of Hillingdon Contaminated Land Officer. A summary is presented below.

"The records do not show evidence of any site investigation or remedial reports pertaining to the site or the immediate site vicinity."

"The records do not show evidence relating to any potential landfilling in the site vicinity."

"The Council's land contamination records do not include any current private water supplies in the Borough."

"The records do not show evidence of any anecdotal information or specific local concerns that the local authority is aware of with regards land contamination in the site vicinity."

"The records do not show evidence of tanks or fuel storage at the site."

2.8 Planning Information

2.8.1 A review of the local authority's planning portal was undertaken on 21st August 2019 at https://planning.hillingdon.gov.uk/OcellaWeb/planningSearch

2.8.2 A search was undertaken within the vicinity of the given address including Warwick Place and Redford Way. Despite a number of planning applications identified that were linked to medium sized developments, no pertinent geotechnical or environmental reports were provided under the search results.

2.9 Unexploded Ordnance

2.9.1 The initial data indicates that there is a low risk.

2.9.2 Low-risk regions are those that show a bomb density of up to 10 bombs per 1km^2 and that may contain potential WWII targets.

2.9.3 A watching brief should be maintained during below ground works, with site personnel made aware that there remains a potential, if negligible, risk of unexploded ordnance. Any suspicious item uncovered during site works should be reported immediately.

2.9.4 This does not comprise a full UXO risk assessment. A UXO threat assessment is recommended.

3 GEOLOGICAL & ENVIRONMENTAL SETTING

3.1.1 The following section summarises the principal environmental resources (geological, hydrogeological and hydrological) of the site and its surroundings.

3.1.2 The data discussed herein is generally based on the information given within the EnviroInsight Report and published information provided by the Environment Agency and British Geological Survey.

3.2 Solid and Drift Geology

3.2.1 Information provided by the British Geological Survey indicates that the site is directly underlain by superficial deposits of Lynch Hill Gravel Member deposits.

3.2.2 The Lynch Hill Gravel Member deposits have an average thickness of 7m, but range between approximately 1 – 12m in depth and are described as:

> *"Sand and gravel, locally with lenses of silt, clay or peat "*

3.2.3 These superficial deposits overlie solid deposits of the London Clay Formation which can have a depth of up to 150m in eastern part of the London Basin. These are indicated by the BGS to consist of

> *"bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite."*

3.2.4 Although artificial deposits are not reported 50m of the study site. Given the identified site history a thickness of Made Ground should be expected.

3.3 British Geological Survey (BGS) Borehole Data

3.3.1 As part of the assessment, publicly available BGS borehole records were obtained and reviewed from the surrounding area. The local records obtained are presented in Appendix 5.

3.3.2 The nearest such record was located approximately 43m west of the site, in August 1978.

3.3.3 This showed the underlying ground conditions to comprise very dense coarse to medium gravel with trace amounts of sand to a depth of 4.40m bgl. SPT N-values within this deposit ranged between 57 and 69. The gravel was overlying London Clay to the base of the borehole, at approximately 6.00m bgl.

3.4 Hydrogeology & Hydrology

3.4.1 General information about the hydrogeology of the site was obtained from the EnviroInsight and / or the DEFRA "MAGIC" website.

Groundwater Vulnerability

3.4.2 The EA operates a classification system to categorise the importance of groundwater resources (aquifers) and their sensitivity to contamination. Aquifers were formerly classified as major, minor and non-aquifers, based on the amenity value of the resource. A major aquifer is a significant resource capable of producing large quantities of water suitable for potable supply. Minor aquifers produce water in varying quantities or qualities, and if utilised are of local importance. Non aquifers are low permeability strata, which contain no significant exploitable groundwater and have very limited capacity to transmit contaminants.

3.4.3 Since 1 April 2010, the EA's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. This comprises;

- **Secondary A** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers;
- **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
- **Secondary Undifferentiated** - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
- **Principal Aquifer** – this is a formation with a high primary permeability, supplying large quantities of water for public supply abstraction.
- **Unproductive Strata -** These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Source Protection Zones (SPZ)

3.4.4 In terms of aquifer protection, the EA generally adopts a three-fold classification of SPZs for public water supply abstraction wells.

- Zone I - or 'Inner Protection Zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source.
- Zone II - or 'Outer Protection Zone' is defined by a 400-day travel time to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants.
- Zone III - or 'Total Catchment' is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.

Hydrology

3.4.5 The hydrology of the site and the area covers water abstractions, rivers, streams, other water bodies and flooding.

3.4.6 The Environment Agency defines a floodplain as the area that would naturally be affected by flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas.

3.4.7 There are two different kinds of area shown on the Flood Map for Planning. They can be described as follows:

Areas that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening each year;
- or from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.

(For planning and development purposes, this is the same as Flood Zone 3, in England only.)

- The additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.

(For planning and development purposes, this is the same as Flood Zone 2, in England only.)

3.4.8 These two areas show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

3.4.9 Outside of these areas flooding from rivers and the sea is very unlikely. There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year. The majority of England and Wales falls within this area. (For planning and development purposes, this is the same as Flood Zone 1, in England only.)

3.4.10 Some areas benefit from flood defences and these are detailed on Environment Agency mapping.

3.4.11 Flood defences do not completely remove the chance of flooding, however, and can be overtopped or fail in extreme weather conditions.

Table 3.1: Summary of Hydrogeology & Hydrology

Feature		On Site	Off Site	Potential Receptor?
Aquifer	**Superficial:**	Principal	Principal Secondary A – 132m NW Unproductive – 314m SE	✓
	Solid:	Unproductive	Unproductive Secondary A – 103m W	✓
Source Protection Zone		None	None within 500m of study site	**X**
Abstractions	**Ground water**	None	31No. reported within 2km of study site closest identified as a historical General Washing/Process Washing 659m N of site. Nearest Active abstraction is Spray Irrigation 1019m NW	**X**
	Surface water	None	2No. reported within 2km of study site closest identified as historical Spray Irrigation - Direct 1248m W of site.	**X**
	Potable	None	1No. reported within 2km of study site identified as historical Spray Irrigation - Direct Drinking, Cooking, Sanitary, Washing, (Small garden) 1248m W of site.	**X**
Surface Waters and Ordnance Survey MasterMap Water Network entries		None	43No entries reported, closest identified as Frays River located 138m NW	**X**
Flood Risk	**EA Flood Zone 2**	No	-	-
	EA Flood Zone 3	No	-	-
	RoFRaS	Very low	-	-

Feature		On Site	Off Site	Potential Receptor?
	Flood Defences	There are no areas benefiting from Flood Defences within 250m of the study site.		-
	BGS	BGS has a "High" confidence that there is the potential for below surface "Superficial Deposits" flooding.		-

3.5 Sensitive Land Uses

3.5.1 The London Area Greenbelt is located 371m north west of the site.

3.5.2 No other sensitive land use was identified within 1km of the site.

3.6 Radon

3.6.1 As reported, the site is not within a Radon affected area, as less than 1% of properties are above the action level.

3.6.2 Consequently, no radon protective measures are necessary in the construction of new dwellings or extensions as described in publication BR211 (BRE, 2007).

4 POSSIBLE GEOLOGICAL HAZARDS

4.1 Database Information Review

4.1.1 The following are brief findings extracted from the GroundSure GeoInsight Report, that relate to factors that may have a potential impact upon the engineering of the proposed development.

Table 4.1: Geological Hazards

Potential Hazard	Site check Hazard Rating	Details	Further Action Required?
Shrink swell	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays.	No
Landslides	Very low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.	No
Ground dissolution soluble rocks	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.	No
Compressible deposits	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.	No
Collapsible Rock	Very low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.	No
Running sand	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.	No
Coal mining	None	The study site is not located within 1km of an identified coal mining area.	No
Shallow mine workings	None	The study site is not located within 1km of an identified shallow mine workings area.	No

Potential Hazard	Site check Hazard Rating	Details	Further Action Required?
Brine affected areas	None	The study site is not located not located within 1km of an identified brine affected area.	No

4.1.2 In addition, the GeoInsight report notes the following:

- 12No. historical surface ground working features are reported within 250m of the site. Nearest reported 144m south west of the site for a Fish Pond.
- No historical underground working features are reported within 1km of the site.
- 5No. BGS Current Ground Working Features are reported within 1km of the site. The nearest is reported 781m south of the site, identified as producing Sand and Gravel. The operational status is given as Ceased.

4.1.3 A relatively shallow groundwater table may be present.

The potential impacts of shallow groundwater should be considered during foundation design. The affects that this may have include (but are not limited to):

- Permanent excavations – i.e. for items such as basements and drainage. This is likely to need waterproofing / tanking and may have flotation issues.
- Temporary excavations – likely to affect side stability especially where the excavations are formed in granular materials.
- Soakaways – likely to affect the permeability and therefore the effective use of soak-away drainage.
- Concrete classification on the site (in accordance with BRE SD-1) due to the potential for a mobile groundwater table.
- May require dewatering or groundwater exclusion techniques to be used.
- Foundation design – likely to reduce the allowable bearing capacity that could be achieved in the superficial deposits.

4.1.4 The clearance of the site, including removal of foundations and services is likely to increase the depth of Made Ground on the site.

4.1.5 Foundations should not be formed within Made Ground or organic rich material (e.g. Topsoil) due to the unacceptable risk of total and differential settlement.

4.1.6 The presence of Made Ground derived from demolition material or disseminated pyrite within the London Clay Formation may be a source of elevated sulphate results. If such levels are noted then sulphate resistant concrete may be required.

4.1.7 The resultant thickness of Made Ground and the potential for clays beneath the proposed footprint may mean that a suspended floor slab would be required.

4.1.8 A geotechnical investigation is recommended to inform foundation design.

5 QUALITATIVE RISK ASSESSMENT

5.1 Legislative Framework

5.1.1 A qualitative risk assessment has been prepared for the site, based on the information collated. This highlights the potential sources, pathways and receptors. Intrusive investigations will be required to confirm the actual site conditions and risks.

5.1.2 Under Part IIA of the Environmental Protection Act 1990, the statutory definition of contaminated land is:

"*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:*

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or
(b) significant pollution of controlled waters is being caused, or there is significant possibility of such pollution being caused."

5.1.3 The Statutory Guidance provided in the DEFRA Circular 04/2012 lists the following categories of significant harm to **human health**:

- death; life threatening diseases (e.g. cancers); other diseases likely to have serious impacts on health; serious injury; birth defects; and impairment of reproductive functions.

5.1.4 Other health effects may also be considered by the local authority to constitute significant harm with a wide range of conditions that may or may not constitute significant harm (alone or in combination) including: physical injury; gastrointestinal disturbances; respiratory tract effects; cardio-vascular effects; central nervous system effects; skin ailments; effects on organs such as the liver or kidneys; or a wide range of other health impacts.

5.1.5 In deciding whether or not land is contaminated land on grounds of significant possibility of significant harm to human health there are four categories to be considered. Categories 1 and 2 would encompass land which is capable of being determined as contaminated land on grounds of significant possibility of significant harm to human health. Categories 3 and 4 would encompass land which is not capable of being determined on such grounds.

5.1.6 For non-human receptors the following types of harm should be considered to be significant harm:

Ecological System Effects

- Harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or
- Harm which significantly affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location.

- In the case of European sites, harm should also be considered to be significant harm if it endangers the favourable conservation status of natural habitats at such locations or species typically found there. In deciding what constitutes such harm, the local authority should have regard to the advice of Natural England and to the requirements of the Conservation of Habitats and Species Regulations 2010.

Property Effects

- Crops: A substantial diminution in yield or other substantial loss in their value resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage.
- Buildings: Structural failure, substantial damage or substantial interference with any right of occupation. The local authority should regard substantial damage or substantial interference as occurring when any part of the building ceases to be capable of being used for the purpose for which it is or was intended. In the case of a scheduled Ancient Monument, substantial damage should also be regarded as occurring when the damage significantly impairs the historic, architectural, traditional, artistic or archaeological interest by reason of which the monument was scheduled.

5.1.7 Contaminated land will only be identified when a 'pollutant linkage' has been established.

5.1.8 A 'pollutant linkage' is defined in Part IIA as:

"A linkage between a contaminant Source and a Receptor by means of a Pathway".

5.1.9 Therefore, this report presents an assessment of the potential pollutant linkages that may be associated with the site, in order to determine whether additional investigations are required to assess their significance.

5.1.10 In accordance with the National Planning Policy Framework, where development is proposed, the developer is responsible for ensuring that the development is safe and suitable for use for the purpose for which it is intended, or can be made so by remedial action. In particular, the developer should carry out an adequate investigation to inform a risk assessment to determine:

- whether the land in question is already affected by contamination through source – pathway – receptor pollutant linkages and how those linkages are represented in a conceptual model;
- whether the development proposed will create new linkages, e.g. new pathways by which existing contaminants might reach existing or proposed receptors and whether it will introduce new vulnerable receptors; and
- what action is needed to break those linkages and avoid new ones, deal with any unacceptable risks and enable development and future occupancy of the site and neighbouring land.

5.1.11 A potential developer will need to satisfy the Local Authority that unacceptable risk from contamination will be successfully addressed through remediation without undue environmental impact during and following the development.

5.2 Conceptual Site Model

5.2.1 On the basis of the information summarised above, a conceptual site model (CSM) has been developed for the site. The CSM is used to guide the investigation activities at the site and identifies potential contamination sources, receptors (both on and off-site) and exposure pathways that may be present. The identification of such potential "pollutant linkages" is a key aspect of the evaluation of potentially contaminated land.

5.2.2 The site investigation is then undertaken in order to prove or disprove the presence of these potential source-pathway-receptor linkages. Under current legislation an environmental risk is only deemed to exist if there are proven linkages between all three elements (source, pathway and receptor).

5.2.3 This part of the report lists the potential sources, pathways and receptors at the site, and assesses based on current and future land use, whether pollution linkages are possible.

5.2.4 Potential pollutant linkages identified at the site are detailed below:

Table 5.1: Potential Sources, Pathways and Receptors

Source(s)	Pathway(s)	Receptor(s)
• Potential for contaminated ground associated with previous site use – on site (S1) - Potential builders' yard - Garage • Potential for Made Ground associated with previous development operations – on site (S2) • Current and previous industrial use – off site (S3) - Builders' yard 25m N - Iron Works 30m NE - Unspecified Yards 30m SE - Unspecified works 30m E, 60m SE - Motor repair works 44m SE - Engineering works 60m SE - Tan yard 125m W • Potential asbestos containing materials within existing buildings – on site (S4) • Potential asbestos impacted soils from demolition of previous buildings – on site (S5)	• Ingestion and dermal contact with contaminated soil (P1) • Inhalation or contact with potentially contaminated dust and vapours (P2) • Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3) • Horizontal and vertical migration of contaminants within groundwater (P4) • Accumulation and Migration of Soil Gases (P5) • Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)	• Construction workers (R1) • Maintenance workers (R2) • Neighbouring site users (R3) • Future site users (R4) • Building foundations and on site buried services (water mains, electricity and sewer) (R5) • Controlled waters – Principal aquifer, Secondary A aquifer, Frays River (R6)

5.3 Qualitative Risk Estimation

5.3.1 Based on information previously presented in this report, a qualitative risk estimation was undertaken.

5.3.2 For each potential pollutant linkage identified in the conceptual model, the potential risk can be evaluated, based on the following principle:

Overall contamination risk = Probability of event occurring x Consequence of event occurring

5.3.3 In accordance with CIRIA C552, the consequence of a risk occurring has been classified into the following categories:

- Severe
- Medium
- Mild
- Minor

5.3.4 The probability of a risk occurring has been classified into the following categories:

- High Likelihood
- Likely
- Low Likelihood
- Unlikely

5.3.5 This relationship can be represented graphically as a matrix (Table 5.2).

Table 5.2: Overall Contamination Risk Matrix

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Low Risk
	Likely	High Risk	Moderate Risk	Moderate Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate Risk	Low Risk	Very Low Risk
	Unlikely	Low Risk	Low Risk	Very Low Risk	Very Low Risk

5.3.6 The risk assessment process is based on guidance provided in CIRIA C552 (2001) *Contaminated Land Risk Assessment – A Guide to Good Practice*. Further information including definitions of descriptive terms used in the risk assessment process is included in Appendix 4.

5.3.7 The degree of risk is based on a combination of the potential sources and the sensitivity of the environment. The risk classifications can be cross checked with reference to Table A4.4 in Appendix 4.

5.3.8 Hazard assessment was also carried out, the outcome of which could be:

- Urgent Action (UA) required to break existing source-pathway-receptor link.
- Ground Investigation (GI) required to gather more information

- Watching Brief there is no evidence of potential contamination but the possibility of it exists and so the site should be monitored for local and olfactory evidence of contamination.
- No action required (NA)

5.3.9 The preliminary risk assessment for the site is presented in Table 5.3 below.

Table 5.3: Preliminary Risk Assessment for the Site

Sources	Pathways (P)	Receptors	Consequence of Impact	Probability of Impact	Risk Estimation	Hazard Assessment
• Potential for contaminated ground associated with previous site use – on site (S1) - Potential builders' yard - Garage • Potential for Made Ground associated with previous development operations – on site (S2) • Current and previous industrial use – off site (S3) - Builders' yard 25m N - Iron Works 30m E - Unspecified Yards 30m SE - Unspecified works 30m E, 60m SE - Motor repair works 44m SE - Engineering works 60m SE - Tan yard 125m W • Potential asbestos containing materials within existing buildings – on site (S4) • Potential asbestos impacted soils from demolition of previous buildings – on site (S5)	• Ingestion and dermal contact with contaminated soil (P1) • Inhalation or contact with potentially contaminated dust and vapours (P2) • Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6)	• Construction workers (R1) • Maintenance workers (R2) • Neighbouring site users (R3) • Future site users (R4) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Medium	Likely	Moderate	GI – Ground Investigation
			Severe for Asbestos	Likely	High for Asbestos	
	• Accumulation and migration of soil gases (P5)		Severe	Low	Moderate	
	• Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3) • Horizontal and vertical migration of contaminants within groundwater (P4)	• Neighbouring site users (R3) • Controlled waters – Principal aquifer, Secondary A aquifer, Frays River (R6) • Building foundations and on site buried services (water mains, electricity and sewer) (R5)	Medium	Unlikely	Low	

5.3.10 It should be noted that the identification of potential pollutant linkages does not necessarily signify that the site is unsuitable for its current or proposed land use. It does however act as a way of focussing data collection at the site in accordance with regulatory guidance in CLR 11.

5.4 Outcome of Risk Assessment

5.4.1 The risk estimation matrix generally indicates a moderate risk as defined above.

5.4.2 The proposed demolition of the existing single storey rear car showroom extension and construction of 3 storey building to provide 7No new residential units and landscaping. Private amenity spaces in the form of decked terraces and small areas of communal soft landscaping are anticipated.

5.4.3 Due to the potential presence of asbestos containing materials within the existing buildings on site, an asbestos survey should be undertaken, with any asbestos containing materials found, and removed under suitably controlled conditions. There should be no risk to end users from asbestos within the fabric of the existing building if the potential asbestos containing materials are removed by suitably qualified and experienced specialists under controlled conditions.

5.4.4 A review of earliest available (1865) historical maps indicates that the site had rectangular structures in the central and northern corner, and was likely to comprise part of “Murrays Yard”, in the north, and parts of ornamental gardens associated with adjacent residential properties, in the south. By 1914 the building formerly located in the northern corner of site is no longer present. By 1934 the site has been redeveloped with former buildings no longer present, part of a large building appears to intrude into the site from the northern corner, and a rectangular structure is now present in the southern half of the study site, which is labelled “Garage” by 1962. By 1978 the building formerly located encroaching into site from the northern corner is no longer present. Few changes then occur on site up to present day.

5.4.5 The area has exhibited a mix of industrial, commercial and residential zoning historically. Earlies maps indicate light residential with an iron works located within close proximity to the east of the site. Residential development occurs within the wider area up to the mid 1900’s when further industrial development appears. Of note includes increased railway infrastructure and a number of unspecified works and a builder’s yard developed within 100m of the study site. By the 1970’s some of these areas have been developed into engineering works and motor works, however industry appears to decrease up to present day.

5.4.6 It is recommended that an intrusive investigation is undertaken to clarify potential risks to the identified receptors, and assess the extent of made ground soils present at the site.

5.4.7 A preliminary investigation may comprise a series of window sampler and/or cable percussive boreholes.

5.4.8 A potential source of ground gas has not yet been identified. Should a significant thickness of Made Ground by encountered on site, a programme of soil gas monitoring may be required. This would also be recommended to determine the risk of vapour ingress from hydrocarbon-impacted soils, if found. Any monitoring should be undertaken in accordance with CIRIA C665.

5.5 List of Key Contaminants

5.5.1 The possible contamination implications for both on-site and off-site sources have been assessed based on the information presented in the report. This has been achieved using guidance publications by the Environment Agency, together with other sources.

5.5.2 In the case of the site uses identified as part of the desk study research, reference to DoE industry profiles would not indicate a specific use reference, although reference has been made to the miscellaneous industries profile.

5.5.3 Based on recommendations within the guidance publications, an initial soil and water chemical testing suite would need to consider a range of contaminants as follows:

- *Metals*: cadmium, chromium, copper, lead, mercury, nickel, zinc;
- *Semi-metals and non-metals*: arsenic, boron, sulphur;
- *Inorganic chemicals*: cyanide, nitrate, sulphate and sulphide;
- *Organic chemicals*: aromatic hydrocarbons, aliphatic hydrocarbons, petroleum hydrocarbons, phenol, polyaromatic hydrocarbon; volatile organic compounds (VOCs)/semi-volatile organic compounds (SVOCs);
- *Others*: pH, Asbestos.

6 REFERENCES

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APPENDICES

APPENDIX 1 – FIGURES

APPENDIX 2 – GROUNDSURE REPORTS

APPENDIX 3 – OS HISTORICAL MAPS

APPENDIX 4 – QUALITATIVE RISK ASSESSMENT METHODOLOGY

APPENDIX 5 – BGS BOREHOLE RECORDS

APPENDIX 6 – LOCAL AUTHORITY CORRESPONDENCE

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