Notting Hill Home Ownership Limited

St Clare Business Park

Geo-environmental Site Appraisal

29701-R02(00)

RSK GEOSCIENCES

June 2022

RSK GENERAL NOTES

Project No.: 29701

Title: Geo-environmental Site Appraisal: St Clare Business Park, Holly Road, Hampton Hill TW12 1PZ

Client: Notting Hill Home Ownership Limited

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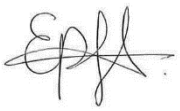
Signature		Signature	

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1 INTRODUCTION

1.1 Commissioning

RSK Environment Limited (RSK) was commissioned by Notting Hill Home Ownership Limited to carry out a geo-environmental site appraisal of the land at St Clare Business Park Holly Road , TowHampton Hill TW12 1PZ.

The project was commissioned in order to review the existing site investigation report (previously prepared by RSK for Notting Hill Housing Trust) in relation to the current development proposal.

RSK's service constraints are shown in Appendix A.

1.2 Background

As highlighted above, the site has been the subject of a previous investigation undertaken by RSK in 2018, namely:

- RSK Environment Ltd: Geo-environmental site assessment of St Clare Business Park, Hampton Hill; Ref 29701-01, dated May 2018.

Pertinent information from the report has been referenced within the subsequent sections.

1.3 Scope of works

The scope of this assessment has been developed in accordance with relevant British Standards and authoritative technical guidance as referenced through the report. The assessment of the contamination status of the site is in line with the technical approach presented in Land Contamination Risk Management (LCRM) (Environment Agency, 2021) – which supersedes CLR11 Model Procedures for Land Contamination – and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017). It is also compliant with relevant planning policy and guidance.

A brief summary of relevant legislation and policy relating to land contamination is given in Appendix C.

The scope of works for the assessment has included the following:

Desk Study:

- review of the history of development on the site and surroundings;
- a site walk-over reconnaissance survey;
- review of the previous site investigation reports carried out by RSK, to include a study of the history of development on the site, local geology, hydrology and hydrogeology of the site;
- a revised Conceptual Site Model (CSM) of contamination, identifying possible pollutant linkages;

- an assessment of the environmental risks and liabilities associated with proposed development; and
- an assessment of previous analytical data in line with the current guidance and identification of outline mitigation measures for complete pollutant linkages or recommendations for further work.

1.4 Limitations

This report is subject to the RSK service constraints given in Appendix A and limitations that may be described through this document.

2 SITE DETAILS

2.1 Site location

Site location details are presented in **Table 1** and a site location plan is provided on Figure 1.

Table 1 Site location details

Site name	St Clare Business Park
Full site address and TW12 1PZ	Holly Road , TowHampton Hill TW12 1PZ
National Grid reference (centre of site)	514170_{E}, 170860_{N}

2.2 Site description

The Site boundary and current site layout are shown on Figure 2.

The Site, covering an area of c. 1 hectare, is currently occupied by St Clare Business Park and 7-11 Windmill Road, which are in use as an assortment of offices, light industrial buildings and storage buildings.

The Business Park is accessed via a single lane from Holly Road to the south. The southern and northern boundaries are formed of the rear gardens of dwellings along Holly and Windmill Roads respectively, whilst to the east are the properties that front onto the High Street, which are in a variety of residential and commercial uses.

The ground level decreases at the western part of the site towards the railway, which forms the western boundary. The railway is in a cutting below the surrounding ground level and a steep vegetated bank separates it from the site, along with a bank of trees.

7-11 Windmill Road backs onto the Business Park, to the south, but there are currently no vehicular or pedestrian access routes between these two properties. On the south side of Holly Road, adjoining the railway line, is a small site currently used by the Business Park as an overflow car park.

The site is comprised of the following properties:

- St Clare House and Holly House: These buildings measure between two to three-storeys in height and used as offices built between 1970s-1980s;
- Lacey House: This is a two-storey building providing office accommodation;
- Units 1-8, St Clare Business Park: Single storey terraced workshop units built in the 1970's and 1980's;
- The Atcost Structure: This is a two bay open sided single storey concrete framed structure, which can only be used for covered storage purposes. It has no offices or services; and

- 7-11, Windmill Road is outside of the Business Park and comprises a car wash and garage.

2.3 Development plans

The proposed development, at the time of preparing this report, is shown in below.

2.3.1 St Clare Business Park

Demolition of existing buildings and erection of 1no. mixed use building between three and five storeys plus basement in height, comprising 98no. residential flats and 1,172sq.m of commercial floorspace. 1no. three storey building comprising 893sq.m of commercial floorspace, 14no. residential houses and associated access, external landscaping and car parking.

2.3.2 7-11 Windmill Road

It is understood this parcel of land is to provide a future access route to The Business Park.

2.3.3 Holly Road, South Side

Not part of the development scheme.

An outline footprint of the proposed development has been presented as Figure 3 of previous report (Appendix C).

3 DESK-BASED ASSESSMENT

The desktop study was designed generally to meet the objectives of a preliminary (phase 1) investigation, as defined by BS 10175:2011 + A2 2017 (BSI, 2017) and this assessment relates to LCRM Stage 1, Tier 1 preliminary risk assessment. The "vicinity" of the site for the purposes of this report is defined as locations situated within an approximate 250 m radius of the site, although certain sources and/ or sensitive targets further than 250 m may also have been considered.

The study aims principally to identify and assess the potential risks and liabilities associated with contamination of the ground, on and in the vicinity of the site. While this includes consideration of current operations and housekeeping on the site, the report does not constitute a comprehensive environmental audit of the site, as covered under ISO 14001.

3.1 History of site and surrounding area

The history of the land-use and development of the site and surrounding area has been assessed based on the following sources:

- historical maps within the environmental database from 1869 to present (2018);
- town plans;
- internet search;
- historical maps of London;
- local archives;
- information from the local planning authority; and,
- aerial photography.

Copies of OS and County Series maps are included in the environmental database report in the previous report (Appendix C). Reference to historical maps provides invaluable information regarding the land use history of the site, but historical evidence may be incomplete for the period pre-dating the first edition and between successive maps.

Planning records held by London Borough of Richmond upon Thames Council pertaining to the site date from 1994 – 2015. Subsequent planning consents of note are referenced in **Table 2**.

Table 2: Planning information

Year	Details
1994	94/2187 – installation of additional windows (Unit 4) – permission granted
1996	96/1322 – change of use to facilitate site access (Business Park)– withdrawn by applicant
1996	96/2437 - change of use to facilitate site access (Business Park)– permission refused
1997	97/1699 – extension of working hours (Unit 6) – withdrawn by applicant

1997	96/3995 - change of use to facilitate site access (Business Park)– permission refused – appealed
1997	96/3994 - change of use to facilitate site access (Business Park)– permission refused – appealed
1998	96/3994 – details of materials pursuant (Business Park) –permission granted
1998	96/3995 - details of materials pursuant (Business Park) –permission granted
1998	96/3994 - details of landscaping (Business Park) –permission granted
1999	99/2846 – installation of two 1st floor windows (Unit 6) –permission granted
1999	98/0786 – redevelopment of part of the site to provide 3 buildings for B1 use and demolition of nos. 9-11 Windmill Road to form new vehicular access to the site
2000	99/3230 – demolition of existing buildings and construction of two and three storey business units (b1).
2001	00/3078 – proposed demolition – with drawn by applicant
2001	00/30177 - demolition of existing buildings and construction of 2 and 3 storey business units and offices (b1) – withdrawn by applicant
2015	15/0621 - The redevelopment of the whole site for a mixed-use scheme comprising demolition and conversion of the St Clare Business Park, Hampton Hill for the erection of up to 116 homes (inclusive of support accommodation) of varying tenure together with up to 1,790 GIA square metres (sq.m) of commercial (Use Class B1) floorspace including care communal accommodation and training, creation of a new vehicular access from Windmill Road, provision of parking and refuse facilities, and associated works – withdrawn by applicant

The development history of the site and surrounding area from the above sources is detailed in **Table 3** and summarised below.

Table 3: Summary of historical development

Date	Land use/features on-site	Land use/features in vicinity of site (of relevance to the assessment)
1866	**The Business Park** – largely unoccupied with the exception of an isolated building and tree-line along the east site boundary. **The Car Wash –** northern extents occupied by a detached building fronting Windmill Lane. **Holly Road, South** – unoccupied greenfield	Largely residential fronting Hampton Hill High Street, Windmill Lane, and Holly Road with interspersed and open greenfield.
1896 – 1915	**The Business Park** – Detached buildings occupying the central eastern site boundary. An old gravel pit is located along the western site boundary.	Residential development throughout fronting surrounding roads. Railway cutting along the western site boundary clearly defined.

Date	Land use/features on-site	Land use/features in vicinity of site (of relevance to the assessment)
	The Car Wash – Detached building north is denoted as a Smithy **Holly Road, South** –unoccupied greenfield	
1915 – Mid - 1960s	**The Business Park** – occupied by a nursery with buildings located within eastern and southern extents. Trees occupied central and western boundaries. **The Car Wash –** Additional buildings noted fronting Windmill Lane **Holly Road, South** – unoccupied with some evidence of ground working	**The Business Park** – continued residential development **The Car Wash –** A fire station is situated adjacent the western site boundary **Holly Road, South** – continued residential development with some encroachment of gardens / possibly buildings into southern extents
Mid-1960s – 1970s	**The Business Park** – Nursery and associated buildings no longer present. Site now occupied by a builders yard (south) and 'works (north). Buildings largely are existing and in present configuration **The Car Wash –** No significant change **Holly Road, South** – terraced garages located along south-eastern boundary. Two detached buildings along western site boundary.	**The Business Park** – No significant change **The Car Wash –** Adjacent fire station now denoted a public library **Holly Road, South** – No significant change
1970s – 1990s	**The Business Park** – No significant change other than electrical substation depicted in southern extents (present today) **The Car Wash –** building fronting Windmill Lane now replaced by garages present today **Holly Road, South ––** No significant change	No significant change
1990s – present (2018)	**The Business Park** – No significant change other than the construction of the centrally located building as present today **The Car Wash –** The garage building has extended southwards occupying the footprint evident today **Holly Road, South** – the terrace garages and western buildings are no longer present	No significant change

3.2 Sensitive land uses

The subject site is located circa 100m southeast of the Bushy Park and Home Park sites of special scientific interest (SSSI).

A comprehensive evaluation of ecological receptors is outside the scope of this report.

3.3 Licences and permissions

There are 3No. active contemporary trade directory entries held for the site including a sheet metal work business unit, car repair business, construction services and an air conditioning equipment supplier.

Inactive/past contemporary trade directory entries for the site include business units for garages services, power transmission equipment, printing, tool design and manufacture.

Off-site, there are 4No. local pollution prevention and control currently in place within 2 km of the subject site including entries for dry cleaners, petrol filling stations, and a vehicle re-spraying business. The closet entry is a dry cleaner located circa 100 m north east of the subject site.

3.4 Local authority environmental health department information

The environmental health department (EHD) of London Borough of Richmond upon Thames has no records of contamination in connection with the site.

Furthermore, the site has not been identified for detailed inspection under Part IIA of the Environmental Protection Act 1990, and the Council is not considering taking any action on a formal or informal basis.

A copy of the response has been included within the previous report (Appendix C).

3.5 Petroleum licensing information

3.5.1 St Clare Business Park

The response from the London Fire Brigade's petroleum environmental search reported two underground fuel storage tanks (USTs) located within The Business Park boundaries. No plans are available to show the locations within the site. However, visual evidence of USTs were identified within the southern extents of The Business Park through the identification of existing vent stacks.

It was reported the tanks held diesel and gas oil with a tank capacity of 4,546 litres and 18,184 litres respectively.

There is currently no licence or Petroleum Storage Certificate in force related to the tanks. It was reported the last licence was issued 1st December 1966 and expired 30th November 1987.

There have been no known records of any leaks or spills relating to the USTs on site. There are no records to indicate the current status of the tanks

3.5.2 7-11 Windmill Road

The response from the London Fire Brigade's petroleum environmental search reported two underground fuel storage tanks (USTs) located within The Car Wash boundaries. No plans are available to show the locations within the site.

The two tanks are reported to be single skin steel petrol tanks, both with a capacity of 22,730.

There is currently no licence or Petroleum Storage Certificate in force related to the tanks. It was reported the last licence was issued 1st September 1966 and expired 31th October 1994.

There have been no known records of any leaks or spills relating to the USTs on site. The tanks are reported to have been filled with water in 1983 before the expiration of the licence. There are no current updates to the status of the tanks.

3.5.3 Off site

Hampton Hill Service Station and Tesco Petrol Filling Station (PFS) are located circa 200m and 300m northeast of the subject site respectively.

With reference to the Envirocheck report (159575380_1_1, 16 March 2018) report, there are two fuel station entries within 2 km of the subject site, the closest of which relates to an obsolete entry located circa 200 m northeast. The second entry is located circa 1 km east however; further information is limited

3.6 Site geology

3.6.1 Anticipated geological sequence

Published records (British Geological Survey, 1998) for the area indicated the geology of the site to be characterised by the succession recorded in **Table 4**.

Table 4: Geology at the site

Geological unit	Description	Estimated thickness (m)
Taplow Gravel Member	Sand and gravel, locally with lenses of silt, clay	Several metres
London Clay Formation	The London Clay mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay.	Up to 150 m
Source: BGS Geology of Britain viewer: http://mapapps.bgs.ac.uk/geologyofbritain/home.html		

Borehole records were downloaded from the British Geological Survey website to provide further information regarding ground conditions in the vicinity of the site.

Taking into consideration findings of previous exploratory works, site topography and development history of the subject site, made ground should be expected beneath the all land parcels.

3.6.2 Radon

The environmental database report (Envirocheck report, 159575380_1_1, 16 March 2018) indicates that the site is not located within an 'Affected Area' as defined by the Documents of the National Radiological Protection Board (Radon Atlas of England and Wales, NRPB-W26-2002).

Therefore, the risk of significant ingress of radon into structures on-site is considered to be low and no radon protective measures are required within new dwellings at the site.

3.6.3 Mining and quarrying

Evidence has been sought to identify any mining and quarrying operations, past and present, which have taken place in the vicinity of the site. The sources of information referenced in this element of the desk study include:

- an environmental database report;
- records held by local authority/EA;
- old Ordnance Survey maps and plans; and,
- geological maps.

With reference to the environmental database, there are four (4No.) historically recorded BGS Mineral Sites within 1 km of the subject site all relating to open cast quarrying of the underlying Taplow Gravel Formation, the closest if which is located circa 400 m north of the subject site (Hampton Hill Gravel Pit).

With reference to available historical mapping data, an old gravel pit is located along the western site boundary of The Business Park presumably open cast and quarrying from the underlying Taplow Gravel Member as elsewhere in the region.

The site is not located within an area affected by coal mining.

3.6.4 Landfilling and land reclamation

Evidence has been sought to identify any landfilling or land reclamation operations, past and present, which have taken place in the vicinity of the site. The sources of information referenced in this element of the desk study include:

- environmental database report;
- records held by local authority/EA;
- old Ordnance Survey maps and plans; and,
- geological maps.

There are no records of landfill sites (former or current) within 250 m of the site (i.e. within the planning consultation zone).

The Envirocheck report (159575380_1_1, 16 March 2018) details three areas of potentially in-filled land within 1/2 km of the site. There is potential of unknown in-filled land 391 m north of site, mapped in 1985 and a second 439 m north west of site, mapped in 1985. Another potentially in-filled ground, detailed as water related, is found 495 m south, mapped in 1899.

Taking into consideration the localised nature of landfilling activities and the anticipated age of deposits the risks posed to any future development of the subject site are considered negligible and therefore omitted from any further assessment as part of this report.

On-site however and with reference to the historical data, there have been several phases of construction and demolition on all land parcels within the subject site and therefore the presence of made ground should be expected.

3.7 Hydrogeology

3.7.1 Aquifer characteristics

Based on the published geological map referred to above, the hydrogeology of the site is likely to be characterised by the presence of an unconfined shallow aquifer comprising the Taplow Gravel Member overlying the London Clay Formation – an aquitard.

Confined by the London Clay Formation is a deep aquifer, comprising a sequence of deposits consisting of the lower part of the Lambeth Group and Thanet Sands (Basal Sands) and the White Chalk. These units are expected to be in hydraulic continuity.

The anticipated depth to the groundwater table is in the order of 2-3 m below ground level coincidental with the occurrence of the granular Taplow Gravel Formation Strata.

Shallow groundwater in the site area is anticipated to flow either westwards toward the unconfined soils of the abounding railway cutting or more regionally southwards towards Longford River (<100 m south) a tributary to the River Thames located ~1.5 km south of the subject site.

Shallow and localised perched water is anticipated to be present in the underlying made ground.

The presence of low permeability clay at relatively shallow depths beneath the site, while restricting downwards migration, may increase the potential for lateral migration of shallow groundwater (and therefore mobile contamination, if present).

3.7.2 Vulnerability of groundwater resources

The site has been classified by the EA website to overlie a:

- Principal Aquifer (Taplow Gravel Member): defined as layers of rock or drift deposit that have high intergranular and/or fracture permeability (usually providing a high level of water storage). They may support water supply and/or river base flow on a strategic scale; and
- ‘Unproductive’ strata (London Clay Formation): defined as low permeability with negligible significance for water supply or river base flow.

The soils beneath the site are classified as having ‘high urban’ (HU) leaching potential.

HU - soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere, so a worst-case vulnerability classification is assumed until proven otherwise.

3.7.3 Risk from rising groundwater levels

Rising groundwater levels can affect foundations and structures, and may result in flooding if not controlled properly. In certain areas, groundwater levels are rising owing to reduced groundwater abstraction by industry. London is at particular risk but the situations in Birmingham, Liverpool, Glasgow and Nottingham are also being monitored.

As defined within CIRIA Special Publication 69 (Simpson et al., 1989) the site does not lie within an area defined as 'critical' in the London basin within which exceptional structures and therefore is not considered at potential at risk from the rising groundwater levels in the deep aquifer.

The rise in groundwater levels started during the mid-1960s as a result of a significant reduction in groundwater abstraction from the Chalk aquifer. Prior to this, the Chalk aquifer had been increasingly exploited as a result of increasing industrialisation throughout the 19th century and early part of the 20th century.

Following the issue of CIRIA Special Publication 69 (Simpson et al., 1989), the Rising Groundwater Level Working Group (GARDIT) was formed in March 1998. This group publicly launched a strategy proposal for controlling rising groundwater beneath London. As a result of the implementation of the GARDIT strategy, groundwater levels are now considered to be stabilising across much of the London Basin and the GARDIT Strategy is considered to have been successful. There will be ongoing monitoring and control of groundwater levels in the London Basin using the abstraction licensing process.

The EA status report issued in 2018 'Management of the London Basin Chalk Aquifer' indicates that the potentiometric surface of the groundwater in the deep aquifer in the site area in January 2015 was at approximately -20 to -30 mAOD, i.e. approximately 40-50 m below ground level.

3.7.4 Licensed groundwater abstraction

The Envirocheck report (159575380_1_1, 16 March 2018) report indicates that there are two current licensed groundwater abstractions within a 2 km radius of the site, details summarised in **Table 5** below.

Table 5: Groundwater abstractions

Reference	Distance and orientation from site	Comment
28/39/31/0172	660m south (down-gradient)	Hampton Pool Ltd – sports ground facilities (general) – single point (anticipated from shallow superficial geology)
Th/039/0031/013	762m west	Hampton School – spray irrigation – single point (anticipated from shallow superficial geology)

In terms of aquifer protection, the EA generally adopts a three-fold classification of source protection zones (SPZ) for public supply abstraction wells.

- Zone 1 or 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time from any point below the water table to the source. 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 2 or 'outer protection zone' is defined by a 400-day travel time from a point below the water table to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants.
- Zone 3 or 'total catchment' is the area around the source within which all groundwater recharge is presumed to be discharged at the source.

Information available on the EA website indicates that the site does not lie within a currently designated groundwater Source Protection Zone.

3.8 Hydrology

3.8.1 Surface watercourses

The nearest identified surface water feature to the site is the Longford River located <100 m southwest of the subject site and a tributary to the River Thames located circa 1.5 km south of the subject site.

The EA classification of the water quality in the stretch of the Longford River nearest to the site is Grade B (good). Chemical analysis of the Longford River, obtained from a sampling point location circa 1/4 km south of the subject site, indicates a Grade A to Grade B (very good to good) river quality chemistry from early 1990's to 2010.

The base flow of the Longford River is likely to be recharged by groundwater in the shallow aquifer in the site area. A linkage between the river and any ground or groundwater contamination beneath the site may therefore exist.

The Envirocheck report (159575380_1_1, 16 March 2018) report does not detail any record of any authorised discharge consents within a 2 km radius of the subject site.

There are two reported pollutant incidents to controlled waters recorded within 2 km of the subject site. Limited information is available however; both are reportedly category 3 minor incidents, the closest and more recent of which is located circa 800 m north-west of the subject site reported in 1998.

3.8.2 Surface water abstractions

The Envirocheck report (159575380_1_1, 16 March 2018) report indicates there is a single licensed surface water abstraction within a 2 km radius of the site, the details of which are summarised in **Table 6** below.

Table 6: Surface water abstractions

Reference	Distance and orientation from site	Comment
28/39/M/0002	1,617 m – southwest (down-gradient)	Thames Water Utilities – potable water single point

3.8.3 Site drainage

Surface drainage from the site appears to be via a series of gullies discharging into the underlying Taplow Gravels via on-site (albeit poorly maintained) soakaways connected via three-stage interceptors.

3.8.4 Preliminary flood risk assessment

The indicative floodplain map for the area, published by the EA, shows that the does not lie within an EA defined at risk from flooding from rivers or sea, nor is it situated within an area benefitting from defences nor is it within an intended water storage area.

This report is not intended to replace a full hydrological study and it is recommended that additional specialist studies be conducted to confirm flood risks at the site.

4 SITE RECONNAISSANCE FINDINGS

The Site was visited on 23rd June 2022. The aim of the survey was to identify any changes to the site (particularly relevant to any new sources or signs of contamination and / or geotechnical hazards) since the previous assessments, which dated from 2018. The characteristics of the site observed during the site reconnaissance visit and obtained from current Ordnance Survey maps are summarised below.

4.1.1 St Clare Business Park

The business park comprises a number of occupied and unoccupied commercial units and offices. The site generally slopes westwards towards the adjacent railway cutting and tree-line defining the western site boundary. The site is almost entirely covered by hardstanding. Underground fuel storage (UST) vent stakes were noted to the south believed to be indicative of a nearby UST/s.

4.1.2 7-11 Windmill Road

The site is located along a predominantly residential street (Windmill Road) and is currently occupied by a car wash and garage. The site generally slopes southwards from road level. The site is entirely covered by hardstanding. A number of manholes were noted on-site potentially relating to underground storage tanks and or interceptor infrastructure.

4.1.3 Holly Road, South Side

The site is located behind a series of terraced residential properties fronting Holly Road and is currently occupied by tarmac hardstanding used to store a number of vehicles. The site is relatively flat. The western site boundary is defined by a railway cutting.

5 INITIAL CONCEPTUAL SITE MODEL

In the UK land contamination is assessed using a risk-based approach taking account of the magnitude (severity of the hazard) and likelihood (probability) of occurrence. A 'receptor' is something that could be adversely affected by contamination (e.g. people, an ecological system, property or a water body). A 'pathway' is a route or means by which a receptor is or could be exposed to or affected by a contaminant. A 'contaminant source' is a hazard but it can only pose a risk to a receptor where a pathway is present. The relationship between sources, pathways and receptors are referred to as a conceptual site model. A risk can only be released where a contaminant source, pathway and receptor are all in place, referred to as a 'pollutant linkage'.

In line with LCRM (Environment Agency, 2021) and BS 10175: 2011 + A2 2017 (BSI, 2017), RSK has used information in the preceding sections to identify hazards (sources of contaminants), receptors that may be impacted and plausible linking pathways. Where all three are present this is termed a potentially complete contaminant linkage and a qualitative risk estimation is made.

5.1 Potential soil, soil vapour, gas and groundwater linkages

5.1.1 Potential sources of contamination

Potential sources of soil and groundwater contamination identified from current activities and the history of the site and surrounding area are presented in **Table 7**.

Table 7 Potential sources of contamination

Potential sources	Contaminants of concern
On-site historical	
Impacted made ground: associated with past development history including: ***St Clare Business Park:*** Backfill material of the former gravel pit, former use as a builders yard and historical commercial site-use. ***7-11 Windmill Road:*** Former buildings fronting Windmill Lane ***Holly Road, South Side***: Former garages and buildings on western site boundary	Unknown fill material potentially containing fuel oils, lubricating oils, heavy metals, ash, clinker, sulphates, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), chlorinated and other organic solvents, sulphates, asbestos containing materials (ACM). Possible soil gases including methane and carbon dioxide.
On-site present day	
Impacted made ground: associated with: ***St Clare Business Park:*** Current commercial site-uses (plant rooms, localised fuel/chemical storage, substations and	Possible localised hydrocarbon (PAH/TPH), heavy metals, PCBs, asbestos containing materials (ACM) impact.

Potential sources	Contaminants of concern
below ground infrastructure of unknown condition and integrity). ***7-11 Windmill Road:*** Current commercial site-uses (fuel/chemical storage, and below ground infrastructure of unknown condition and integrity). ***Holly Road, South Side***: Current vehicular storage (possibility area used for maintenance or storage of vehicles in need of repair)	Possible soil gases including methane and carbon dioxide.
Underground storage tanks and associated infrastructure ***St Clare Business Park:*** Diesel /oil & gas tank on-site of unknown condition/integrity and status ***7-11 Windmill Road:*** Underground storage tanks on-site of unknown condition/integrity and status	Possible localised hydrocarbon (PAH/TPH) impact.
Off-site	
St Clare Business Park and Holly Road South Side: Adjacent railway land defining the western site boundary	Fuel oils, lubricating oils, heavy metals, PAHs, PCBs, ethylene glycol, ash, sulphate, herbicides and asbestos
Petrol filling stations located 200 m east and 300 m north east of the subject site (all sites)	Hydrocarbons, petroleum spirit, ethylene glycol, methyl tertiary butyl ether (MTBE), oil and waste oil, chlorinated and non-chlorinated solvents, asbestos, sulphuric acid, metal and metal compounds
Dry cleaning premises, 100 m east (all sites)	Organic solvents
Gas sources and gas generation potential in line with BS8576	
St Clare Business Park: Landfilling of the former gravel pit on-site onsite (low to moderate gas generation potential but potentially high if disturbed)	Carbon dioxide, methane and trace gases
Impacted made ground: associated with past and present development history (all sites)	Carbon dioxide, methane and trace gases

Note that in the absence of any significant pollutant incidences associated with past/current off-site land uses, the potential for off-site contaminative impact is considered 'low' and therefore omitted from further assessment as part of this report.

5.1.2 Sensitive receptors

Sensitive receptors at this site include:

- future site occupants;

- adjacent site users (local residents and businesses);
- controlled waters:
    - underlying Principal Aquifer (Taplow Gravel Member);
    - nearby surface watercourse (Longford River, <100m south west); and,
- future infrastructure: potable water supply pipes; and
- future vegetation.

Note that given the proximity of the SSSI to the subject site and the residential land use that separates the two, the SSSI is not considered the primary receptor in this instance, and therefore potential for any site derived contaminative to impact on the SSSI are considered negligible.

In addition, construction workers have also not been identified in the conceptual model as receptors because risks are considered to be managed through health and safety procedures including CDM regulations.

5.1.3 Summary of plausible pathways

The plausible pathways are summarised below:

- direct contact (soil, dust and vegetable ingestion, dermal contact, dust and fibre inhalation);
- ground gas and soil gas inhalation;
- vertical and lateral migration including leaching;
- root uptake; and,
- chemical attack of infrastructure (including water supply pipes) and buildings.

5.1.4 Data gaps and uncertainties

- unknown presence/chemical composition of underlying made ground;
- unknown condition/integrity/capacity and decommissioning status of exiting USTs and associate infrastructure;
- depth to groundwater/condition;
- depth/condition of exiting soakaways;
- extents and nature of backfill associated with the historical gravel pit; and presence/absence of historical foundations/obstructions associated with past development.

5.2 Preliminary risk assessment

The preliminary risk assessment findings and potentially complete contaminant linkages are shown in **Table 8** overleaf. The risk classification based on the combination of hazard consequence and probability using a risk matrix from CIRIA C552 (Rudland et al., 2001). This relates to Tier 1 preliminary risk assessment in LCRM (Environment Agency, 2021).

Table 8 Risk estimation for potentially complete contaminant linkages

Potential Contaminant	Potential receptor	Possible pathway	Likelihood	Severity	Risk and justification
Impacted made ground: associated with past development and current commercial site-use including the presence of USTs of unknown condition/integrity and status.	Future site occupants	Direct contact	Likely	Medium	***Moderate*** – future contact *likely* assuming the proposed development incorporates a degree of soft landscaping and open space. *Medium* severity conservatively assigned given unknown chemical composition of any made ground.
	Adjacent site users		Unlikely	Medium	***Low*** – *unlikely* of future contact assuming construction best practice adopted and adhered to. *Medium* severity conservatively assigned given unknown chemical composition of any made ground.
	Controlled waters – Principal Aquifer of the Taplow Gravel Formation	Vertical and lateral migration including leaching	Likely	Mild	***Moderate/Low*** – conservatively assessed as *likely* given unknowns associated with prevailing ground conditions and asset integrity/condition. *Mild* severity assigned given the site is not located within a SPZ, the absence of any potable water abstractions within 2 km and the sensitivity of the nearest abstraction (spray irrigation) located >1/2 km south.
	Controlled waters – surface water course –Longford River		Likely	Medium	***Moderate*** – conservatively assessed as *likely* given unknowns associated with prevailing ground conditions and asset integrity/condition. Medium severity assigned given proximity of the surface water body (<100 m) and the Grade B status and Grade A/B water quality assigned.
	Future infrastructure: potable water supply lines	Chemical attack of infrastructure	Likely	Medium	***Moderate*** – future contact *likely* given nature of the development. *Medium* severity conservatively assigned given unknown chemical composition of any made ground.
	Future vegetation	Root uptake	Likely	Mild	***Moderate/low*** – future contact *likely* assuming the proposed development incorporates a degree of soft landscaping and open space. *Mild* severity conservatively assigned given unknown chemical composition of any made ground.

Potential Contaminant	Potential receptor	Possible pathway	Likelihood	Severity	Risk and justification
Hazardous Ground Gases associated with landfilling of a former gravel pit and any Impacted made ground: associated with past and present development history	Future site occupants	Ground gas and soil gas inhalation	Low-likelihood	Severe	***Moderate*** – *low-likelihood* given the proposed development will incorporate areas of confining atmosphere (most notably the basement). *Severe* assigned given potential for explosive atmospheres and or asphyxiation.
	Adjacent site users		Unlikely	Severe	***Moderate/low*** – *unlikely* given the surrounding residential properties are unlikely to have needed to include ground gas protection measures . *Severe* assigned given potential for explosive atmospheres and or asphyxiation.

Risk matrix		Consequences			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**Highly likely**	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very low	Very low

The potential pollutant linkages with a risk of moderate or above requiring further investigation include:

1. Direct contact of future site occupants with potentially impacted made ground;
2. Vertical/lateral migration of potentially impacted made ground to the underlying Principal Aquifer (Taplow Gravels) and to the proximal surface water course (Longford River);
3. Chemical attack on future infrastructure (potable water supply lines) from potentially impacted soils;
4. Root uptake of contaminants into future vegetation exposed to potentially impacted made ground; and
5. Inhalation hazardous ground gases by future site occupants and adjacent site users.

6 SITE INVESTIGATION STRATEGY & METHODOLOGY

6.1 Introduction

RSK carried out intrusive investigation work on 26th March – 29th March 2018.

6.2 Sampling strategy and methodology

6.2.1 Health, safety and environment considerations

Prior to the intrusive works, the available service plans were consulted and a service clearance engineer carried out a utility clearance survey of the site using a ground penetrating radar. A Cable Avoidance Tool (CAT) scan at the investigation locations was also carried out by the RSK supervising engineer.

Prior to commencement, RSK commissioned a Preliminary UXO Risk Assessment for the subject site. Recommendations of the preliminary assessment included the need for further works in the form a Detailed UXO Risk Assessment.

At the request of the Client, RSK commissioned a detailed assessment within which it a UXO watching brief was recommended as part as part of any intrusive works. The watching brief provided included the use of down-hole magnetometer undertaken on all intrusive exploratory positions.

6.2.2 Investigation locations

The site work comprised the activities summarised in **Table 9** along with a justification for each exploratory hole location.

The investigation and the soil descriptions were carried out in general accordance with BS5930: 2015 - Code of Practice for Ground Investigations.

The exploratory hole logs and other site work records are presented in the previous report (Appendix C). The locations of the intrusive investigations are shown in Figure 4.

Table 9: Exploratory hole and monitoring well location rationale

Investigation Type	Land Parcel	Ref.	Targeted Response zone	Rationale
Deep Borehole (Cable Percussion)	The Business Park	BH4	Shallow – Made Ground Deep – Taplow Gravel	Adjacent 'known' UST/ Adjacent proposed block and basement Shallow: Hazardous ground gases Deep: Groundwater in Aquifer Soil parameters for geotechnical design
Window Sampling (drive-in sampler)	The Car Wash	WS1	None	Adjacent 'known' UST/ Adjacent within proposed access road
		WS2	Shallow – Made Ground	Adjacent 'known' UST/ Adjacent within proposed access road Hazardous ground gases and perched water body
	The Business Park	WS3	None	General site coverage – geotechnical within proposed footprint
		WS4	Shallow – Made Ground	General site coverage – geotechnical within proposed footprint
		WS5	Deep – Taplow Gravels	General site coverage – geotechnical within proposed footprint Deep: Groundwater in Aquifer
		WS6	Shallow – Made Ground	General site coverage – geotechnical within proposed footprint Hazardous ground gases and perched water body
		WS7	None	General site coverage – geotechnical within proposed footprint
		WS8	Shallow – Made Ground	Adjacent existing substation Hazardous ground gases and perched water body
	Holly Road, South	WS9	Shallow – Made Ground	General site coverage – Hazardous ground gases and perched water body
		WS10	None	General site coverage
Hand Excavated Foundation Pit	The Business Park	TP01	None	Foundation pit to confirm profile of existing foundations

Investigation Type	Land Parcel	Ref.	Targeted Response zone	Rationale
Machine excavated Trial Pits		TP02	Taplow Gravels	BRE365 soakage test locations
		TP03		
Note: Boreholes BH1-BH3 and BH5 removed from original scope of works and will be carried out once the site is vacant. TP01 was removed from the scope of works due to inaccessibility of location.				

6.2.3 Soil sampling, in-situ testing and laboratory analysis

Soils collected for laboratory analysis were collected in a variety of containers appropriate to the anticipated testing suite required. Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination.

The samples were transported to the laboratory in chilled cool boxes. Laboratory chain of custody forms can be provided if required. The rationale for soil sample chemical analysis is presented in **Table 10**.

Table 10: Scheduled analysis – soil

Exploratory hole no. and sample depth (m bgl)	Analyte	Rationale
WS2 (0.20-0.80)	Full suite (Heavy metals, hydrocarbons and ACM screen)	Establish prevailing chemistry of underlying Made Ground
WS4 (1.20)	Full suite (Heavy metals, hydrocarbons and ACM screen)	Establish prevailing chemistry of underlying Made Ground
WS5 (0.50 – 1.00)	Full suite (Heavy metals, hydrocarbons and ACM screen)	Establish prevailing chemistry of underlying Made Ground
WS5 (2.80)	Waste classification suite	Establish prevailing chemistry of natural soils within proximity of the proposed basement for future off-site disposal
WS6 (2.50 and 3.50)	Speciated TPH	Location down-gradient of hydrocarbon impacted gravels identified at a similar depth in TP02
WS7 (0.20 – 0.70)	Waste classification suite	Establish prevailing chemistry of made ground within proximity of the proposed basement for future off-site disposal

Exploratory hole no. and sample depth (m bgl)	Analyte	Rationale
WS8 (0.50)	Full suite (Heavy metals, hydrocarbons and ACM screen) plus PCBs	Establish prevailing chemistry of made ground within proximity of existing substation
WS10 (0.45- 1.10)	Full suite (Heavy metals, hydrocarbons and ACM screen)	Establish prevailing chemistry of underlying Made Ground
TP02 (2.90)	Full suite (Heavy metals, hydrocarbons and ACM screen)	Visual / olfactory evidence of hydrocarbon impact
TP02 (3.50)	Speciated TPH	Establish hydrocarbon impact (if any) at greater depth in natural soils
TP02	Asbestos ID	Suspected ACM fragment encountered in made ground
BH4 (0.30)	Full suite (Heavy metals, hydrocarbons and ACM screen)	Establish prevailing chemistry of underlying Made Ground within proximity to 'known' UST
BH4 (1.20 – 1.65) (2.75)	Speciated TPH	Establish hydrocarbon impact (if any) at a depth similar to the anticipated base of the UST and into natural soils at depth
Notes: none		

Standard penetration tests (SPTs) were carried out at regular intervals of approximately 1m, alternated with U100 samples at the same frequency.

Dynamic Cone Penetrometer testing was undertaken in 3No. exploratory locations across the subject site in order to determine CBR values for pavement design. Copies of the in-situ test data are given in the previous report (Appendix C).

Disturbed samples were taken from each stratum encountered for subsequent geotechnical analysis.

6.2.4 Groundwater monitoring and levelling

Depths to groundwater and non-aqueous phase liquid were recorded using an electronic interface probe during return monitoring visits. The monitoring results together with the temporal conditions are discussed in more detail in Section 6 of this report.

6.2.5 Groundwater developing, sampling and analysis

During the ground gas monitoring programme RSK retrieved a total of 4No. groundwater samples from WS2, WS5, WS6 and BH4 on the 10th May 2018 to confirm the absence of contamination within the ground water.

In the absence of any visual/olfactory signs of contaminative impact samples were collected via 'conventional' means using sample bailers without full well development having been achieved due to the slow recharge rate of each exploratory location.

In order to collect more representative groundwater samples, a second round of groundwater sampling was completed on 23rd August 2018 using a United States Environment Protection Agency (USEPA) approved low-flow purging and sampling methodology.

Despite using the low-flow methodology, only a single location (BH4) recharged sufficiently to allow the collection of a representative groundwater sample.

6.2.6 Ground gas monitoring

A total of 6No. monitoring wells were installed across all subject sites with response zones targeted the underlying made ground as detailed in Table 9. A total of 6No. monitoring rounds were completed between 5th April 2018 and 23rd August 2018. An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million.

Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

The atmospheric pressure before and during monitoring, together with the weather conditions, was recorded.

All monitoring results together with the temporal conditions are discussed in further detail within Section 6.

6.2.7 infiltration testing

A trail pit soakage tests in accordance with BRE365 were scheduled to be undertaken within TP02, however due to trail pit instability and the latter identification of potential of hydrocarbon impact, the test was aborted shortly after commencement.

A return site visit was arrange to undertake an additional trial pit (TP03) within an area of potentially more competent ground, however, again due to trail pit instability, the test was aborted shortly after commencement.

An existing soakaway chamber located adjacent TP02 was examined by RSK as a potential location to obtain ground infiltration data, however after filling with a nominal volume of water, no observable infiltration was noted and was attributed to the poor conditions of the silt laden chamber.

Falling head tests were conducted within exploratory locations BH4 (borehole) and WS5 (piezometer), both installed with response zones within the underlying Taplow Gravels.

Results together with the temporal conditions are discussed in further detail within Section 6.

7 SITE INVESTIGATION FACTUAL FINDINGS

The results of the intrusive investigation and subsequent geo-environmental and geotechnical laboratory analysis undertaken are detailed below.

7.1 Ground conditions encountered

The exploratory holes revealed that the site is underlain by a variable thickness of made ground over the Taplow Gravel Member of the River Terrace Deposits, with the London Clay Formation encountered at depth. This appears to confirm the stratigraphical succession described within the initial conceptual model. For the purpose of discussion, the ground conditions are summarised in **Table 11** and the strata discussed in subsequent subsections

Table 11: General succession of strata encountered

Strata	Exploratory holes encountered	Depth to top of stratum m bgl	Thickness (m)
Made ground	All	G.L.	1.50 - 3.50 (not proven in WS1; WS4 and TP03)
Taplow Gravel Member	BH4, WS2, WS3, WS5 to WS9 and TP02	1.50 – 3.50	1.50 - 1.60 (proven only in BH4 and WS5)
London Clay Formation	BH4 and WS5	4.00 – 4.40	proven to 20 mbgl in BH4

7.1.1 Made ground

The made ground (ranging between 1.50 m and 3.50 m in thickness) was variable in nature and comprised of both granular and cohesive portions. The granular portion generally consisted of a very loose to medium dense, dark brown/ greyish in colour, clayey, slightly to very sandy, gravel. The cohesive proportion comprised of stiff to firm, dark brown/ greyish in colour with varying amounts of gravel and sand clays.

Within both the granular and cohesive portions the sand was fine to coarse and the gravel was fine to coarse. The gravel was described as rounded to angular gravel comprising of brick, concrete, flint, clinker, with other anthropogenic material such as glass, oyster shells and a shoe. Occasionally cobbles sized concrete and brick fragments were found within the made ground.

A suspected fragment of asbestos containing cement was identified within TP02 and was confirmed by laboratory testing to contain chrysotile.

Included within the made ground were varying ground level surface conditions. Locations WS1, WS2, WS3, WS9 and WS10 had a thin layer of tarmac (0.05 – 0.20 m) followed by a red brick sub-base (0.80 – 0.20 m). Locations WS6, WS7 and TP03 have concrete at ground level (0.20 – 0.50 m thick), while WS4 and WS5 are in the area of reinforced

concrete surface (0.10 – 0.15 m thick). Locations WS8 and TP02 were located within an area of soft landscaping with vegetation and topsoil found at ground level.

7.1.2 Taplow Gravel Member

This stratum was encountered beneath the made ground at depths of between 1.50 m and 3.50m below ground level and varies between 1.50 m and 1.60 m in thickness. Based on the site descriptions and in-situ tests carried out (SPT 'N' values of 14 to >50), this layer can be described predominately as a medium dense to dense (locally very dense), orangish brown, very gravelly sand.

Sand was described as fine to coarse. The gravel was described as fine to coarse, rounded to angular comprising of flint and sandstone and rare shell fragments.

7.1.3 London Clay Formation

The London Clay was encountered at a depths of 4.00 m to 4.40 m below ground level to the full depth of investigation. Based on the site descriptions and in-situ and laboratory testing carried out this stratum can be described as a stiff to very stiff, high to very high strength, poorly laminated bluish grey clay, with increased silt content towards the base of the borehole.

A summary of the in-situ and laboratory test results in this stratum is presented in **Table 12**.

Table 12: Summary of in-situ and laboratory test results for London Clay

Soil parameters	Range
Liquid limit (%)	61 - 90
Plasticity limit (%)	29 - 43
Plasticity index (%)	32- 47
Plasticity term	High to Very High (CH to MV)
Moisture content (%)	20 - 31
Consistency index	0.94 – 1.49
Consistency term	Stiff to Very Stiff
SPT 'N' values	28 - 32
Undrained shear strength inferred from SPT 'N' values (kN/m^2)	118 to 134
Undrained shear strength measured by triaxial testing (kN/m^2)	81 to 177
Undrained shear strength measured by shear vane testing (kN/m^2)	146 to 236
Strength term	High to Very High

7.1.4 Groundwater

Groundwater was encountered during the investigation as detailed in **Table 13**.

TP03 had a slow water seepage at 2.20 m

Table 13: Groundwater results during investigation

BH/TP	Stratum	Strike (m bgl)	Rise (m)
BH4	Made ground/ Taplow Gravel interface	2.50	2.40
TP02	Taplow Gravel	3.20	NA
TP03	Made Ground	2.20	NA
WS1	Made Ground	1.30	NA
WS2	Made Ground	2.90	2.80
WS3	Made Ground	1.80	2.10
WS4	NA	DRY	NA
WS5	Made Ground	2.30	1.86
WS6	Made Ground	2.00	NA
WS7	Made Ground	2.50	2.50
WS8	NA	DRY	NA
WS9	Taplow Gravel	3.50	NA
WS10	NA	DRY	NA

The minimum and maximum results of the subsequent groundwater monitoring and well surveying exercise are summarised in **Table 14**.

It should be noted that groundwater levels might fluctuate for a number of reasons including seasonal variations.

7.1.5 Results of infiltration tests

The results of the falling head tests are summarised in **Table 14**.

Table 14: Falling head test results

Borehole/ monitoring well	Saturated geological unit	Hydraulic conductivity (m/sec)
BH4	Taplow Gravel	6.20×10^{-5} to 7.06×10^{-5}
WS5		6.20×10^{-5}

7.1.6 Visual/olfactory evidence of soil and groundwater contamination

Visual/olfactory evidence of contaminative impact was identified within TP02. An oily sheen was noted on the water and on the soil at the interface between the made ground and underlying natural Taplow Gravel.

7.2 Ground gas regime

The minimum and maximum results are recorded in **Table 15**.

Table 15: Summary of ground gas monitoring results (5th April 2018 to 23rd August 2018)

Borehole	Response zone	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Flow rate (l/hr)	Atmospheric pressure (mbar)
BH4 (Pipe 1)	3.00 – 4.00	0.0	1.5 – 4.8	13.9 – 20.0	0.0	1011 - 1026
BH4 (Pipe 2)	0.50 – 2.00	0.0	0.8 – 2.4	19.2 - 20.5	0.0	1011 - 1026
WS2	0.65 – 6.35	0.0	4.8 – 15.3	1.5 - 11.8	0.0	1011 - 1026
WS4	0.30 – 1.30	0.0	0.0 – 4.9	14.4 – 19.8	0.0 – 0.1	1011 - 1026
WS5	2.00 – 3.00	0.0	0.6 – 4.2	13.0 – 19.7	0.0	1011 - 1026
WS6	1.00 – 3.00	0.0	0.0 – 1.0	17.9 – 19.2	-0.1 - 0.0	1011 - 1026
WS8	1.00 – 2.50	0.0	0.1 – 2.4	17.8 – 20.7	0.0	1011 - 1026
WS9	0.70 – 4.00	0.0	1.6 – 20.8	0.2 – 18.8	0.0	1011 - 1026

8 GEO-ENVIRONMENTAL ASSESSMENT

8.1 Refinement of initial CSM

The investigation generally confirmed the desk-based assessment and outlined conceptual site model as discussed within the PRA.

Visual evidence of contamination identified during the site work was an oily sheen on the water and on the soil at the interface between the made ground and underlying natural Taplow Gravel at the location of TP02 along with the presence of single a visible asbestos fragment within the Made Ground.

The maximum thickness of the Made Ground was recorded to be 3.5 m, which is considered to be potential generator of ground gas (methane/carbon dioxide).

8.2 Linkages for assessment

As described in LCRM (Environment Agency, 2021), there are two stages of quantitative risk assessment (QRA), Tier 2 generic (GQRA) and Tier 3 detailed (DQRA). The GQRA comprises the comparison of soil, groundwater, soil gas and / or ground gas results with generic assessment criteria (GAC) that are appropriate to the linkage being assessed. This comparison can be undertaken directly against the laboratory results or following statistical analysis depending upon the sampling procedure that was adopted. This assessment relates to LCRM Stage 1, Tier 2 generic quantitative risk assessment

Following the refinement of the CSM, the potentially complete contaminant linkages that require further assessment and the methodology of assessment are presented in **Table 16**.

Table 16 Linkages for GQRA

Potentially relevant pollutant linkage	Assessment method
1. Direct contact with impacted soil by future residents	Human health GAC presented in Appendix E for a proposed residential end use.
2. Inhalation exposure of future residents to asbestos fibres	Qualitative assessment based on the asbestos minerals present, their form, concentration, location and the nature of the proposed development.
3. Uptake of contaminants by vegetation potentially impacting plant growth	Comparison of soil data to phytotoxic GAC presented in Appendix E.
4. Contaminants permeating potable water supply pipes	Comparison of soil data to GAC presented in Appendix E for plastic water supply pipes using UKWIR (2010) guidance.
5. Leaching of soil contaminants and subsequent migration to Principal aquifer (Taplow Gravels) and Longford River	Comparison of groundwater data to GAC for controlled waters Table 1 of Appendix E for secondary aquifer.

Potentially relevant pollutant linkage	Assessment method
	Freshwater EQS were adopted owing to the proximity of the nearest surface water body (<100 m southwest) vs the nearest groundwater abstraction (660 m south) and not located within an EA defined SPZ. Where EQS values are absent more conservative UK DWS were adopted.
6. Concentrations of methane and carbon dioxide in ground gas entering and accumulating in: depressions and excavations that could affect workers enclosed spaces or small rooms in new buildings, which could affect future residents. In the case of methane this could create a potentially explosive atmosphere, while death by asphyxiation could result from carbon dioxide.	Gas screening values (GSV) have been calculated using maximum methane and carbon dioxide concentrations with maximum flow rates recorded at the site. The GSV have been conservatively assessed using generic Traffic Lights, as presented within the NHBC ground gases guide (Boyle and Witherington, 2007) and the aforementioned CIRIA report C665, owing to the development comprising an element of low-rise housing with suspended floors. In addition, the gas regime is considered within the context of a conceptual model as required by both aforementioned guidance documents and BS8576.

8.3 Methodology and assessment of human health and phytotoxic-related linkages

The methodology and results of the GQRA are presented for each relevant pollutant linkage in turn.

8.3.1 Direct contact with impacted soil by future residents

8.3.1.1 St Clare Business Park

Determinants exceeded the adopted GACs for human health have been summarised in **Table 17** below.

Table 17: Soil exceedances of the adopted Human Health GAC: The Business Park

Determinant	GAC (mg/kg)	Exceedances
Lead	200	WS4 at 1.20 m – made ground (537 mg/kg) WS5 at 0.50-1.00 m – made ground (287 mg/kg) WS7 at 0.20-0.70 m – made ground (2014 mg/kg) WS8 at 0.50 m – made ground (662 mg/kg) TP02 at 2.90 m – made ground (237 mg/kg) BH4 at 0.30 m – made ground (311 mg/kg)
Benzo(b)fluoranthene	2.6	BH4 at 0.30 m – made ground (3.17 mg/kg)
Dibenzo(ah)anthracene	0.24	WS4 at 1.20 m – made ground (0.26 mg/kg) BH4 at 0.30 m – made ground (0.48 mg/kg)

Determinant	GAC (mg/kg)	Exceedances
Asbestos	0.001%w/w	WS4 at 1.20 m – made ground (Amosite & Chysotile loose fibres and cement board of 0.053%w/w) TP02 – made ground (Crysotile board – bulk fibre 40%w/w)

8.3.1.2 7-11 Windmill Road

Determinants exceeded the adopted GACs for human health have been summarised in **Table 18** below.

Table 18: Soil exceedances of the adopted Human Health GAC: The Car Wash

Determinant	GAC (mg/kg)	Exceedances
Lead	200	WS2 at 0.20-0.80 m - made ground (446 mg/kg)
Benzo(b)fluoranthene	2.6	WS2 at 0.20-0.80 m - made ground (3.86 mg/kg)
Dibenzo(ah)anthracene	0.24	WS2 at 0.20-0.80 m - made ground (0.50 mg/kg)
Asbestos	0.001%w/w	WS2 at 0.20-0.80 m - made ground (Chysotile loose fibres and cement board of 0.017%w/w)

8.3.1.3 Holly Road, South Side

None of the determinands were detected above the adopted GACs in any of the tested samples.

8.3.1.4 Summary of results

The results of the assessment indicate that this pollutant linkage may exist on both, St Clare Business Park and 7-11 Windmill Road parcels of land however; is likely to be absent on the Holy Road, South Side.

8.3.2 Uptake of contaminants by vegetation potentially inhibiting plant growth

8.3.2.1 St Clare Business Park

Determinants exceeded the adopted GACs for phytotoxicity have been summarised in **Table 19** below.

Table 19: Soil exceedances of the adopted Phytotoxic GAC: The Business Park

Determinant	GAC (mg/kg)*	Exceedances
Lead	300	WS4 at 1.20 m - made ground (537 mg/kg) WS8 at 0.50 m – made ground (662 mg/kg) BH4 at 0.30 m – made ground (311 mg/kg)
Mercury	1	WS8 at 0.50 m – made ground (1.81 mg/kg)
*GAC for pH >8 adopted		

8.3.2.2 *7-1 Windmill Road*

Determinants exceeded the adopted GACs for phytotoxicity have been summarised in **Table 20**.

Table 20: Soil exceedances of the adopted Phytotoxic GAC

Determinant	GAC (mg/kg)*	Exceedances
Lead	300	WS2 at 0.20-0.80 m - made ground (446 mg/kg)
*GAC for pH >8 adopted		

8.3.2.3 *Holly Road, South Side*

None of the determinands were detected above the adopted GACs in any of the tested samples.

8.3.2.4 *Summary of results*

The results of the assessment indicate that this pollutant linkage may exist on both, The Business Park and The Car Wash parcels of land however; is likely to be absent on the Holy Road, South site.

8.3.3 Impact of organic contaminants on potable water supply pipes

For initial assessment purposes, the results of the investigation have been compared with the GAC for this linkage, which are reproduced from *UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (UKWIR, 2010).

8.3.3.1 *Summary of results*

The results indicate that this pollutant linkage may exist on both, St Clare Business Park and 7-11 Windmill Road parcels of land.

Detectable concentrations of TPH were encountered within WS2 (0.20-0.80 m), WS4 (1.20 m), WS5 (2.80 m), WS7 (0.20-0.70 m), TP02 (2.90 m and 3.90 m), and BH4 at 0.30m, and therefore pollutant polyethylene (PE) water supply pipes are expected to be unsuitable for use on the development unless remedial measures are implemented that mitigate the risk. Polyvinyl chloride (PVC) pipes are likely to be suitable for use.

It should be noted that at the time of this investigation the future routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations.

Consequently, a targeted investigation and specific sampling/analytical strategy may be required at a later date once the route(s) of the supply pipe(s) are known. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

8.3.4 Leaching of contaminants to groundwater in principal aquifer and subsequent migration to surface watercourse

8.3.4.1 St Clare Business Park

Determinants exceeded the adopted GACs for controlled waters have been summarised in **Table 21** below.

Table 21: Groundwater exceedances of the adopted Controlled Waters GAC: The Business Park

Determinant	GAC (ug/l)	Exceedances
Aliphatic C8 – C10	300	WS6 – 480 ug/l
Aromatic C10 – C12	90	WS6 – 150 ug/l
Aromatic C12 – C16	90	WS6 – 126 ug/l
Aromatic C16 – C21	90	WS6 – 675 ug/l
Aromatic C21 – C35	90	WS6 – 15,200 ug/l
Anthracene	0.1	WS6 – 0.23 ug/l
Benzo(a)pyrene	0.00017	WS5 – 0.36 ug/l WS6 – 1.04 ug/l
Benzo(b)fluoranthene	0.1	WS5 – 0.45 ug/l WS6 – 1.36 ug/l
Benzo(ghi)perylene	0.1	WS5 – 0.23 ug/l WS6 – 0.88 ug/l
Benzo(k)fluoranthene	0.1	WS5 – 0.18 ug/l WS6 – 0.47 ug/l
Fluoranthene	0.0063	WS5 – 0.78 ug/l WS6 – 1.91 ug/l
Indeno(123-cd)pyrene	0.1	WS5 – 0.24 ug/l WS6 – 0.83 ug/l

8.3.4.2 7-11 Windmill Road

Determinants exceeded the adopted GACs for controlled waters have been summarised in **Table 22** below.

Table 22: Groundwater exceedances of the adopted Controlled Waters GAC: The Car Wash

Determinant	GAC (ug/l)	Exceedances
Lead	10	WS2 – 14 ug/l
Nickel	20	WS2 – 81 ug/l
Aromatic C21-C35	90	WS2 – 281 ug/l
Benzo(a)pyrene	0.00017	WS2 – 0.29 ug/l

Determinant	GAC (ug/l)	Exceedances
Benzo(b)fluoranthene	0.1	WS2 – 0.37 ug/l
Benzo(ghi)perylene	0.1	WS2 – 0.18 ug/l
Benzo(k)fluoranthene	0.1	WS2 – 0.15 ug/l
Fluoranthene	0.0063	WS2 – 0.64 ug/l
Indeno(123-cd)pyrene	0.1	WS2 – 0.19 ug/l

8.3.4.3 Holly Road, South Side

No groundwater samples were taken for subsequent laboratory analysis from the installed exploratory position WS9 as part of this phase of investigation.

8.3.4.4 Summary of results

Elevated concentrations of individual hydrocarbon speciations were identified in exploratory locations WS2 and WS6. Hydrocarbon concentrations within exploratory location BH4 largely remained at or below the laboratory detection limited.

Marginally elevated SVOCs (PAHs) were identified within exploratory locations WS2, WS5 and WS6.

Isolated elevated heavy metal Lead and Nickel was identified within exploratory location WS2.

8.3.4.5 Commentary

Despite the aforementioned exceedances, it is important to note that all samples in exceedance were collected via 'conventional' means using sample bailers without full well development and therefore can often over-estimate the concentrations of contaminants present.

In terms of hydrocarbon impact, visual/olfactory evidence of contaminative impact was limited to TP02 oily sheen noted on the water at the interface between the made ground and underlying natural Taplow Gravels. TP02 is located within close proximity WS6 where elevated hydrocarbon concentrations have been reported. However; collection of a more representative groundwater sample using 'low flow' methodology was not achievable due to insufficient groundwater recharge.

Marginally elevated concentrations of 'heavy-end' aromatics (C21-C35) were recorded within WS2 located south of 'known' underground fuel storage tanks (UST's). Again, collection of a more representative groundwater sample using 'low flow' methodology was not achievable due to insufficient groundwater recharge.

No elevated hydrocarbon concentrations were reported within exploratory location BH4, adjacent to a 'known' UST's. These findings were supported by subsequent 'low-flow' sampling an analysis.

Whilst localised hydrocarbon impact has been identified on-site (notably WS6 and marginally WS2), given the absence of any contaminative impact within any of the surrounding exploratory positions, and the insufficient groundwater recharge rates stifling the collection of more representative groundwater samples, the impact identified is

unlikely to represent a significant contaminative source with the potential to adversely affect any underlying and surrounding Controlled Waters.

Elevated hydrocarbon concentrations or any visual/olfactory signs of contaminative impact were notably absent from soil horizons (2-3mbgl anticipated tank base horizon) within exploratory locations targeting the 'know' USTs and associated infrastructure (BH4).

With reference to the soil chemical analysis completed to date, exceedances of generic assessment criteria are largely limited to heavy metal Lead and rare individual speciations of poly aromatic hydrocarbons (PAHs).

Although localised marginal exceedances of lead, nickel and PAH were recorded within groundwater collected from WS2, they are not considered to represent a significant contaminative source but rather indicative of leachable concentrations within isolated pockets of Made Ground.

Based on the data collected to date, the results of this quantitative assessment indicate that this pollutant linkage is unlikely to exist.

It is important to note however; that whilst hydrocarbon impact is understood to be localised and limited in extent, in pursuance of a Duty of Care and betterment approach the requirement for limited and localised removal of impacted soils/groundwater should be allowed for and in particular within areas around existing infrastructure (USTs, soakaways and associated pipe work).

8.3.5 Ground gas assessment

8.3.5.1 Summary of results

St Clare Business Park

All concentrations of methane (CH4) in all exploratory positions remained below the limit of detection (<0.1%v/v).

Concentrations of carbon dioxide (CO2) in all exploratory positions ranged from 0.3 to 4.9%v/v.

All flow rates in all exploratory positions remained below the limit of detection (<0.1l/hr).

7-11 Windmill Road

All concentrations of methane (CH4) in all exploratory positions remained below the limit of detection (<0.1%v/v).

Elevated concentrations of CO2 (5.5 to 15.3%v/v) were recorded in exploratory location WS2 located within the southern extents of the Car Wash site.

All flow rates in all exploratory positions remained below the limit of detection (<0.1l/hr).

With reference to the exploratory log data, WS2 comprised 3.50 m of varied granular made ground. A slight hydrocarbon odour was noted within the shallow made ground. WS2 is situated adjacent a 'known' underground storage tank within the southern extents.

Holly Road, South Side

All concentrations of methane (CH4) in all exploratory positions remained below the limit of detection (<0.1%v/v).

Elevated concentrations of CO2 (14.4 to 20.8%v/v) were recorded in exploratory location WS9 located within the northern extents of the Holly Road, South site.

With reference to the exploratory log data, WS9 comprised 3.20 m of varied granular made ground however; contaminative impact was limited to anthropogenic inclusions alone.

All flow rates in all exploratory positions remained below the limit of detection (<0.1l/hr).

8.3.5.2 Assessment of data

St Clare Business Park

The site is to be redeveloped with both low and medium-rise residential dwellings/commercial units and therefore falls under both Situation A and B.

- Situation A: Maximum GSVs of <0.01l/hr for both CH4 and CO2 resulting in Characteristic Situation 1 – no ground gas protection measures required; and,
- Situation B: Maximum GSVs of <0.01l/hr for both CH4 and CO2 resulting in Green scenario – no ground gas protection measures required.

7-11 Windmill Road

The site is be redeveloped as an access road to the main development site (The Business Park) only however; owing to its location abound by predominantly residential housing, Situation B assessment has been applied.

- Situation B: Maximum GSVs of <0.01l/hr for both CH4 and CO2 resulting in Green scenario – no ground gas protection measures required. However, given the elevated concentrations of CO2 above the trigger concentration of 5% this portion of the site should be reclassified as Amber 1.

Holly Road, South Side

At present the development proposals are unknown however; owing to its location abound by predominantly residential housing, Situation B assessment has been applied.

- Situation B: Maximum GSVs of <0.01l/hr for both CH4 and CO2 resulting in Green scenario – no ground gas protection measures required. However, given the elevated concentrations of CO2 above the trigger concentration of 10% this portion of the site should be reclassified as Amber 2.

8.3.5.3 Commentary

Based on the monitoring data collected to date indicates that this pollutant linkage is absent on the Business Park site and therefore no ground gas protection measures would be required as part of any future development proposals on this parcel of land.

In view of the elevated concentrations of carbon dioxide in two locations WS9 and WS2 the need for ground gas protection measures (including vapours) should be considered. However, with reference to the proposed development and assuming no buildings are to

be constructed, no ground gas protection measures would be required for the proposed access road on the Windmill Road parcel.

The requirement for ground gas protection measures on the Holly Road, south site would only need to be considered should future development plans include for buildings (be it residential or commercial).

It should be noted that gas monitoring was not undertaken during falling atmospheric pressure conditions to capture worst case conditions for ground gas generation. As sych further monitoring may be required by the local planning authority to confirm the findings to date.

8.4 Summary of findings

8.4.1 St Clare Business Park

The relevant pollutant linkages that will require future mitigation include:

1. Direct contact of future site occupants with impacted made ground; and,
2. Chemical attack on future infrastructure (potable water supply lines) from potentially impacted made ground.

8.4.2 7-11 Windmill Road

The relevant pollutant linkages that will require future mitigation include:

1. Chemical attack of future infrastructure (potable water supply lines) from potentially impacted made ground.
2. Future ground gas protection measures may be required if buildings are included on the proposed development within this parcel of land.

8.4.3 Holly Road, South Side

No potentially complete pollutant linkages were identified as part of this geo-environmental assessment however; the requirement for any future ground gas protection measures may need to assessed once development plans are made available

9 GEOTECHNICAL ASSESSMENT

9.1 Proposed development

It is understood that the proposed development will comprise the demolition of the existing buildings of the Business Park, to provide room for high-density purpose built mixed commercial and residential units, comprising 11No. houses and 100No. flats in blocks up to five-storeys high. A single-storey basement is also understood to be proposed beneath the central building on The Business Park site.

Currently there is no information on the proposals for the Holly Road South site. Furthermore, no specific information relating to the proposed structures and building loads has been provided.

9.2 Geotechnical hazards

A summary of commonly occurring geotechnical hazards is given in **Table 23** together with an assessment of whether the site may be affected by each of the stated hazards.

Table 23: Summary of main potential geotechnical hazards that may affect site

Hazard category (excluding contamination issues)	Hazard status based on investigation findings and proposed development			Engineering considerations if hazard affects site
	Found to be present on site	Could be present but not found	Unlikely to be present and/or affect site	
Sudden lateral changes in ground conditions	✓	Likely to be present given the inherent variability of the made ground, and the depth to the surface of the Taplow Gravel		Likely to affect ground engineering and foundation design and construction
Shrinkable clay soils			✓ London Clay Formation at depths not affecting the proposed development	Design to NHBC Standards Chapter 4 or similar
Highly compressible and low bearing capacity soils, (including peat and soft clay)			✓	Likely to affect ground engineering and foundation design and construction
Silt-rich soils susceptible to loss of strength in wet conditions	✓	London Clay with variable silt content		Likely to affect ground engineering and foundation design and construction
Running sand at and below water table		✓	Likely to be present for excavations below the water table	Likely to affect ground engineering and foundation design and construction

Hazard category (excluding contamination issues)	Hazard status based on investigation findings and proposed development			Engineering considerations if hazard affects site
	Found to be present on site	Could be present but not found	Unlikely to be present and/or affect site	
Karstic dissolution features (including 'swallow holes' in Chalk terrain)			✓	May affect ground engineering and foundation design and construction – refer to Section 4.1.2
Evaporite dissolution features and/or subsidence			✓	May affect ground engineering and foundation design and construction
Ground subject to or at risk from landslides		✓	Railway cutting at the western boundary may be affected by the development	Likely to require special stabilisation measures
Ground subject to peri-glacial valley cambering with gulls possibly present			✓	Likely to affect ground engineering and foundation design and construction
Ground subject to or at risk from coastal or river erosion			✓	Likely to require special protection/stabilisation measures
High groundwater table (including waterlogged ground)			✓	May affect temporary and permanent works
Rising groundwater table due to diminishing abstraction in urban area			✓	May affect deep foundations, basements and tunnels
Underground mining	✓	Great thickness of made ground, possibly due to in-filled gravel pits		Likely to require special stabilisation measures
Existing sub-structures (e.g. tunnels, foundations, basements, and adjacent sub-structures)	✓	Evidence of USTs; possible remains of historic structures on the site		Likely to affect ground engineering and foundation design and construction
Filled and made ground (including embankments, infilled ponds and quarries)	✓	Made ground with variable thickness across the entire site		Likely to affect ground engineering and foundation design and construction
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)	✓	See Section 7.7		May affect ground engineering and foundation design and construction
Note: Seismicity is not included in the above table as this is not normally a design consideration in the UK.				

9.3 Foundations

9.3.1 General suitability

The ground conditions beneath the site comprise variable and locally significant (up to 3.5 m) thickness of made ground, over 1.5 m to 1.6 m thick layer of medium dense to dense, sand and gravel of the Taplow Gravel Member, with high to very high strength, silty clay of the of the London Clay Formation at depth. Groundwater was generally at the interface between the made ground and the Taplow Gravel, with highest recorded 'resting' level at 1.45 mbgl.

Given the significant depth of made ground and the relatively high anticipated loading from the proposed structures, it is considered that traditional spread foundations are unlikely to be appropriate foundation solution, and consideration should be given to piled foundations. Reinforced concrete rafted foundation can also be considered, especially under the proposed basement, transferring anticipated loading over a greater area, thus reducing the risk of potential differential movements.

The sub-structure design and construction will be primarily determined by the proposal to construct a basement beneath the majority of the Business Park area. Given the inherent instability of the granular Taplow Gravel deposits, it will be necessary to form an effective perimeter wall taken sufficiently deep for stability purposes and to control the water ingress in the excavation. Adoption of interlocked sheet piles or secant bored piled wall should overcome this issue.

The excavation of the new basement will be accompanied by immediate elastic and long-term swelling heave of the underlying clay soils. The amount of heave movement will be a function of the depth and breadth of excavation and period of time that elapses between excavation and subsequent construction.

9.3.2 Basement Raft

Based on the ground conditions encountered, the proposed single-storey basement formation level is likely to be at the boundary between the made ground and the Taplow Gravel Member.

For preliminary design purposes, a net safe bearing pressure in the order of 150kN/m^2 (safety factor F_s=3.0) is considered suitable for a raft foundation, although it will be necessary to check that the associated movements related to the removal of overburden to form the basement structure (heave), and subsequent settlements following the construction of the new structure are acceptable to the proposed structure and surrounding buildings.

Based on the groundwater monitoring records, the proposed basement formation level will be below groundwater level, and therefore dewatering will be required during the construction. The falling head test undertaken in BH04 and WS5 indicate a coefficient of permeability 'k' value of approximately 6.20×10^{-5} to 7.06×10^{-5} m/s, however, it should be stressed that the ground conditions within the Taplow Gravel were relatively variable across the site and further, targeted permeability testing should be undertaken to confirm these values. The basement raft should also be deigned to withstand the uplift hydrostatic pressures acting at the underside of the slab.

The basement structure will need to incorporate suitable waterproofing measures and reference should be made to BS 8102:2009 'Code of practice for protection of below ground structures against water from the ground' for further guidance.

9.3.3 Piled foundations

Recommendations for the design and construction of pile foundations in relation to the ground conditions are set out in **Table 24**.

Table 24: Design and construction of piled foundations

Design/construction considerations	Design/construction recommendations	
Pile type and possible constraints	The construction of both bored and driven piles is considered technically feasible at this site. Given the close proximity of the site to a residential area it is considered possible that the vibration/noise associated with pile driving may not be acceptable. Furthermore, driven piles may reach premature set within the locally very dense Taplow Gravel. Given potential for isolated contaminative impact of the made ground at the site it may not be cost effective to adopt bored piles at the site as disposal of arisings will be costly.	
Temporary casing	Given the presence of groundwater strikes within the non-self supporting made ground and Taplow Gravel, bored piles will require temporary casing throughout their depth. Alternatively, the use of continuous-flight-auger (CFA) injected bored piles or driven piles usually overcomes this issue.	
Man-made obstructions	The presence of buried sub-structures or other obstructions within made ground may lead to some difficulty during piling. It is recommended that once the proposed pile layout has been determined, pre-pile probing be carried out at each of the pile positions. Where buried obstructions are encountered, it will be necessary to either relocate the pile(s) or make allowance for removing the obstruction	
Soft superficial deposits	For the purpose of assessing preliminary pile capacities the made ground has been presumed not to contribute to the load-carrying capacity for the piles.	
Hard strata	An allowance should be made for chiselling thin 'rock' bands (claystone, limestone or cemented sandstone) within the London Clay or Reading Formation	
Pile design parameters for Taplow Gravel	Shaft friction factor ($k_s \times \tan \delta$)	0.1
Pile design parameters for London Clay Formation	Undrained shear strength c_u (kN/m^2)	50+9.67z; z – depth of the London Clay
	Adhesion factor α	0.5
	Bearing capacity cactor N_c	9.0
General parameters	Global margin of safety	2.6
	Limiting shaft friction (kN/m^2)	110 kN/m^2

Design/construction considerations	Design/construction recommendations	
	Limiting concrete stress (kN/m^2)	7.5 N/mm^2
Special precautions relating to bored pile shafts and bases	Bored pile concrete should be cast as soon after completion of boring as possible and in any event the same day as boring. Prior to casting the base of the pile bore should be clean, otherwise a reduced safe working load will be required. Similarly, if the pile bore is left open the shaft walls may relax/soften, leading to a reduced safe working load.	

The design procedure for piles varies considerably, depending on the proposed type of pile. However, for illustrative purposes **Table 25** gives likely working pile loads for traditional bored, cast-in-situ concrete piles of various diameters and lengths, based on the design parameters given in **Table 24**.

Table 25: Illustration of typical pile working loads for bored cast-in-situ piles

Typical pile working loads (kN)				
Depth of pile below proposed basement level (m)	Pile diameter			
	300 mm	450 mm	600 mm	750 mm
5.0	74	127	191	266
10.0	188	307	443	595
15.0	346	553	782	1035
20.0[1)]	529	830	1155	1505

[1)] pile toe below final depth of investigation

It should be stressed that the above capacities do not take into consideration pile group effects which is more pronounced for a large number of closely spaced piles.

9.4 Floor slabs

The site is generally underlain by more than 600 mm of existing made ground. National House-Building Council (NHBC) standards require that ground floor slabs should be suspended in areas where made ground is greater than 600 mm in thickness. Alternatively, consideration could be given to removing the made ground and replacing it with well compacted, suitable granular fill.

9.5 Basement retaining wall design parameters

In order to facilitate basement construction it may be necessary to construct some form of retaining wall suitable for the site conditions. On the basis of the ground investigation information the following soil parameters in **Table 26**, are recommended for retaining wall design purposes.

Table 26: Retaining wall design parameters

Soil type	C_U (kN/m^2)	SPT 'N' value	Unit weight (kN/m^3)	Short Term Characteristics		Long Term Characteristics	
				C_U (kN/m^2)	ϕ (°)	c' (kN/m^3)	ϕ' (°)
Made ground	-	1 to 14	18	-	22[1)]	-	22[1)]
Kempton Park Gravel	-	N_{min}=14	20 (moist) 21 (saturated)	-	32	-	32
London Clay Formation	50 at surface; 200 at 20mbgl	12 to 32	19.5	50+9.7z where z-depth into clay	-	2[2)]	23[2)]

[1)] estimated values based on predominantly granular in nature
[2)] presumed values – no drained analysis undertaken

Groundwater was encountered at the interface of the made ground and the Taplow Gravel, with the highest resting level at 1.45mbgl, above the proposed basement formation level, therefore temporary groundwater control will be necessary to allow construction of the basement, and there will be hydrostatic pressures acting behind retaining structures.

The new basement construction must be designed to be fully sealed to prevent any future groundwater ingress unless allowance is made for an effective drainage system.

9.6 Roads, hardstanding and drainage

In the 1 m to 1.5 m below the proposed finished ground level the exploratory holes have revealed a soil profile comprising variable made ground.

In pavement design terms, the groundwater conditions are anticipated to comprise a intermediate water table, i.e. between 300 mm and 1000 mm of the pavement formation level.

The results of in-situ testing on the near surface soils are summarised in **Table 27**.

Table 27: Summary of CBR values derived from in-situ DCP tests

Test location	Material type	Minimum CBR value
WS1	Made ground	2%
WS4		7%
WS9		2%

The sub-grade soils may be susceptible to improvement by rolling with conventional compaction plant.

The recommended sub-grade soil CBR value for road pavement design is therefore 2%. This value assumes that during construction the formation level will be carefully compacted and any soft spots removed and replaced with well-compacted granular fill.

The sub-grade soils can be regarded as non-frost-susceptible, based upon the criteria given in Appendix 1 of TRRL (1970) Report Road Note 29. When the sub-grade is frost-susceptible the thickness of sub-base must be sufficient to give a total thickness of non-frost-susceptible pavement construction over the soil of not less than 450 mm.

9.7 Chemical attack on buried concrete

This assessment of the potential for chemical attack on buried concrete at the site is based on *BRE Special Digest 1: Concrete in aggressive ground*, which represents the most up-to-date guidance on this topic currently available in the UK.

The desk study and site walkover indicate that, for the purposes of assessing the aggressive chemical environment of the site, the site should be considered as comprising natural ground likely to contain pyrite

As the site is considered likely to contain pyrite, the characteristic percentage of oxidisable sulphide (OS) in the soil has been calculated as 1.62%, which is above the 0.3% limit set in *BRE Special Digest 1*. As such, the soil can be considered pyritic.

Based on the characteristic water-soluble sulphate and total potential sulphate concentrations in the soil of 227mg/l (SO_4) and 1.27% (SO_4), the Design Sulphate (DS) Class for the London Clay Formation is DS3, as determined from Table C1 of *BRE Special Digest 1*. However, it is important to note that the sulfide content of the ground depends of the concrete exposure to disturbed ground which might be vulnerable to oxidation. Simply cutting through ground without opening up the ground beyond the cut face (eg. piling operations) does not generally result in disturbed ground. On that basis, a reduced Design Sulphate (DS) Class for the London Clay Formation of DS2 can be adopted.

Based on the mobile groundwater conditions and the characteristic pH values measured in the London Clay Formation, the aggressive chemical environment for concrete (ACEC) is AC-2.

9.8 Soakaways

With reference to the available data, the infiltration rate of the underlying Taplow Gravels ($k=10^{-5}$) is considered representative of low to medium permeability, and good drainage conditions.

However, the occurrence of both significant thickness of unsuitable strata (Made Ground) and the underlying high groundwater table is likely to influence the suitability of pit soakaways.

Whilst it is noted that there are numerous soakaway chambers currently on-site, there number may be indicative of a drainage strategy designed to overcome the aforementioned constraints

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 Environmental

The relevant pollutant linkages that will require future mitigation (based on current development proposals) include:

1. Direct contact of future site occupants with impacted made ground on The Business Park site; and,
2. Chemical attack of on future infrastructure from potentially impacted made ground on both The Business Park site and 7-11 Windmill Road.

10.1.1 Conclusions

With reference to both the aforementioned soil laboratory results there will the requirement for a suitable 'clean' capping layer on the Business Park site to mitigate future risks to human health.

Assuming the Car Wash site remains a future access road, the requirement for suitable capping layer would be omitted through the use of hardstanding however; the appropriate decommissioning of any underground infrastructure (USTs) and removal of any residual/localised impact in accordance with a Duty of Care and betterment approach would still need to be considered. The same would apply for the any underground infrastructure of The Business Park site.

Whilst exceedences are absent on the Holly Road, South site, depending on the intended end-use, the requirement to install a suitable capping layer and or removal of the shallow made ground may be driven by the presence of undesirable anthropogenic inclusions and or future geotechnical considerations.

Elevated hydrocarbon concentrations or any visual/olfactory signs of contaminative impact were notably absent from telltale soil horizons within exploratory locations targeting the 'know' USTs and associate infrastructure however; localised removal of residual soil/groundwater impact cannot be ruled out entirely and should be allowed for.

Whilst phytotoxic exceedences were identified, the risks posed to future vegetation are likely to be mitigated through the importation of a suitable growing medium (including root bowls) as part of the final landscaping solution. Taking this into consideration in addition to the requirement for a suitable 'clean' capping layer to mitigate future risks to human health, this pollutant linkage is considered absent and therefore omitted from any further assessment and or any specific remedial measures.

Isolated/localised detectable concentrations of TPH were encountered on both The Business Park and car Wash sites and therefore pollutant polyethylene (PE) water supply pipes are expected to be unsuitable for use on the development unless remedial measures are implemented that mitigate the risk. Polyvinyl chloride (PVC) pipes are likely to be suitable for use.

Whilst the risks to controlled waters are considered 'low', the occurrence of localised soil/groundwater impact cannot be ruled out entirely.

With reference to the proposed basement – it is anticipated that dewatering activities will be required to some extent. Appropriate management, mitigation and disposal of groundwater (impacted or otherwise) will need to be considered at an early stage and the necessary consents/licenses obtained.

With regards to hazardous ground gases, based on the monitoring data collected to date ground gas protection measures may be required depending upon the future development proposals (if any) for the Car Wash and Holly Road, South.

10.1.2 Recommendations

A site Remediation Strategy will need to need to be drafted and approved by the Local Authority and their statutory consultees at the Environment Agency.

Remedial measures are likely to be limited to the incorporation of a 'clean' cap typically 600 mm in private gardens and 450mm within public open space within The Business Park site.

The Remediation Strategy will also need to provide details on the decommissioning and verification works to be undertaken on existing below ground infrastructure (USTs/soakaways/pipe work); as well as an outline as to the procedures in place should previously unforeseen contaminative impact be discovered during the development phases of works.

Should a piled foundations solution be decided upon, despite the risks to Controlled Waters being considered low, owing to the presence of the shallow Principal Aquifer (Taplow Gravels), it is recommended that a Piling Risk Assessment is completed prior to commencement.

Owing the sites location within a predominately residential area, impacts of any development to adjacent site users will need to closely managed and as such there may be the requirement for a Construction Environmental Management Plan (CEMP).

With reference to the preliminary flood risk assessment (Section 3.5.4) and the identification of potential hydrological constraints, specialist studies may need to be conducted to confirm flood risks at the site.

With reference to potable water supply lines, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment.

Note that the assessment has been conducted with reference to the proposed development and the intended end-use understood at the time of drafting. Should any of the development plans change, it recommended that the assessment is re-visited.

RSK recommends early engagement with the local authority, following issuance of this report.

10.2 Geotechnical

The site investigation has confirmed the site to be underlain by variable thickness of made ground (up to 3.5 m thick), medium dense to dense sand and gravel of the Taplow Gravel, with high to very high strength, silty clay (London Clay Formation) proven to the terminal depth of investigation at 20 mbgl. Groundwater was encountered at the interface between

the made ground and the Taplow Gravel, at the highest level of 1.45 m below ground level.

The formation level of the new basement is estimated to lie at around 3.50 m below existing ground level, within the Kempton Park Gravel and below the current groundwater level.

Piles or reinforced concrete basement raft are considered to be preferred foundation solution for the proposed development.

The presence of buried sub-structures or other obstructions within made ground may lead to some difficulty during piling. It is recommended that once the proposed pile layout has been determined, pre-pile probing be carried out at each of the pile positions.

Given the granular nature of the Taplow Gravel, it will be necessary to form an effective perimeter wall taken sufficiently deep for stability purposes and to control the water ingress in the excavation. Adoption of an interlocked sheet piles or secant bored piled wall should overcome this issue.

Allowance should be made for the resulting hydrostatic pressures acting underneath the raft and behind the basement retaining walls.

The basement structure will need to incorporate suitable waterproofing measures and reference should be made to BS 8102:2009 ‘Code of practice for protection of below ground structures against water from the ground’ for further guidance.

The recommended sub-grade soil CBR value for road pavement design is 2%. This value assumes that during construction the formation level will be carefully compacted and any soft spots removed and replaced with well-compacted granular fill. The sub-grade soils can be regarded as non-frost-susceptible.

Should the ground conditions will not be significantly disturbed during the construction phase of construction, and the concrete is not into contact with the London Clay soils, the Design Sulphate Class for the site DS-2 with an Aggressive Chemical Environment for Concrete classification of AC-2 can be adopted for the proposed development.

Infiltration rates of the underlying Taplow Gravels ($k=10^{-5}$) is considered representative of low to medium permeability, and good drainage conditions however; the presence of a significant thickness of unsuitable strata and a shallow water table are likely constraints to the suitability of pit soakaways.

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FIGURES

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Client: NOTTING HILL HOUSING TRUST

Project Title: ST CLAIR BUSINESS PARK, HAMPTON HILL

Drawing Title: SITE LOCATION MAP

Rev	Drawn	Date	Checked	Date	Approved	Date
00	AP	06.04.18	JG	06.04.18	JG	06.04.18

Dimensions	Scale	Original Size
m	1:50,000	A4

Project Number	Drawing File	Drawing Number
29701 - R01 (00)	29701 - SLP.dwg	FIGURE 1

LEGEND

- Site boundary
- Car Wash
- Business Park
- Holly Road South

N

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P1	09.04.18	FIRST ISSUE	AP	JG	JG

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Client

NOTTING HILL HOUSING TRUST

Project Title

ST CLARE BUSINESS PARK, HAMPTON HILL

Drawing Title

SITE BOUNDARY

Drawn	Date	Checked	Date	Approved	Date
AP	09.04.18	JG	09.04.18	JG	09.04.18

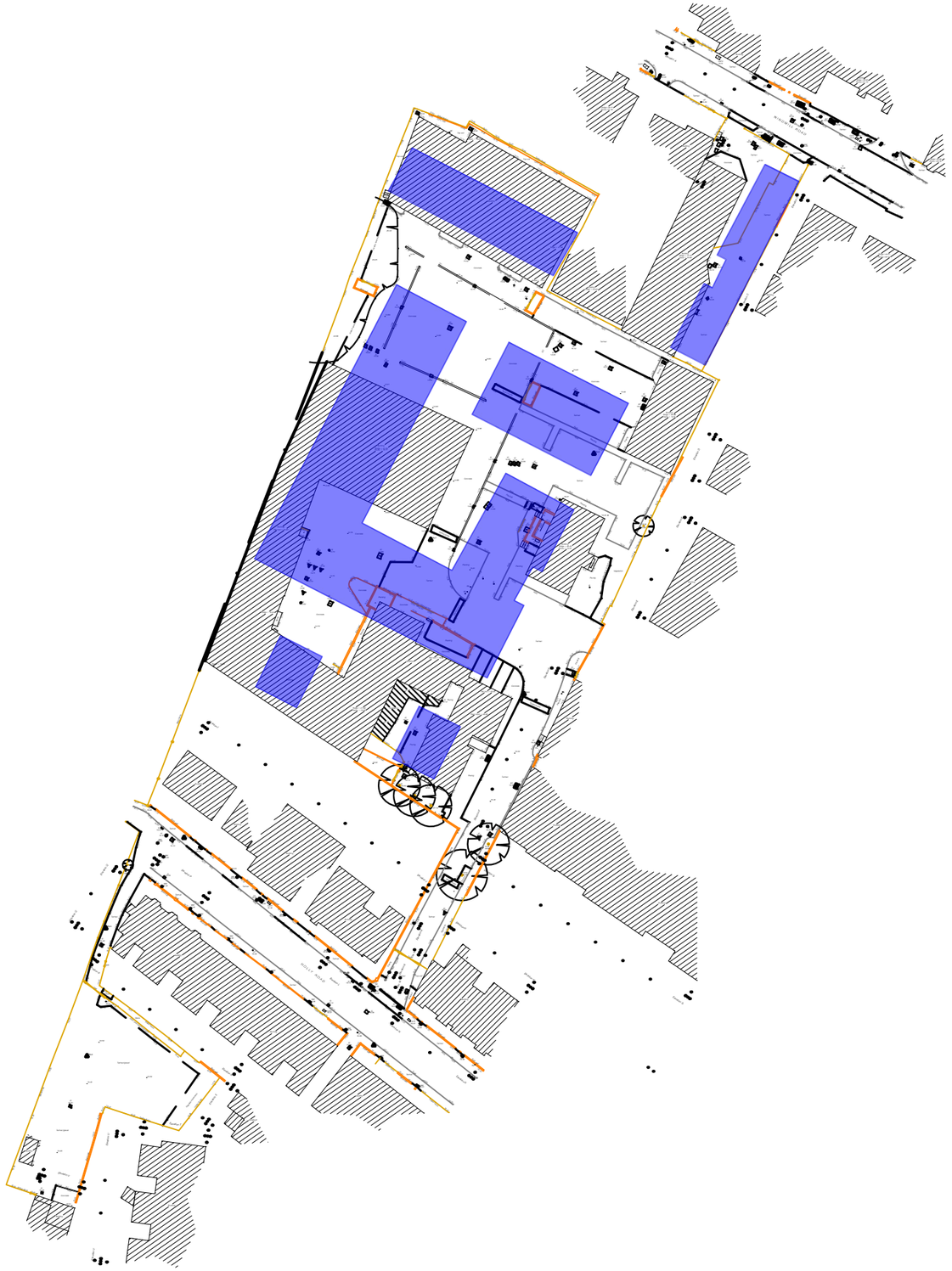
Scale	Orig Size	Dimensions
1:1000	A3	m

Project No.	Drawing File
29701 - R01(00)	29701 - (R01-00).dwg

Drawing No.	Rev.
FIGURE 2	P1

Scale

0 10 20 30 40 50m



LEGEND

Proposed building outline

N

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P1	09.04.18	FIRST ISSUE	AP	JG	JG

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NOTTING HILL HOUSING TRUST

Project Title

ST CLARE BUSINESS PARK, HAMPTON HILL

Drawing Title

PROPOSED DEVELOPMENT PLAN

Drawn	Date	Checked	Date	Approved	Date
AP	09.04.18	JG	09.04.18	JG	09.04.18

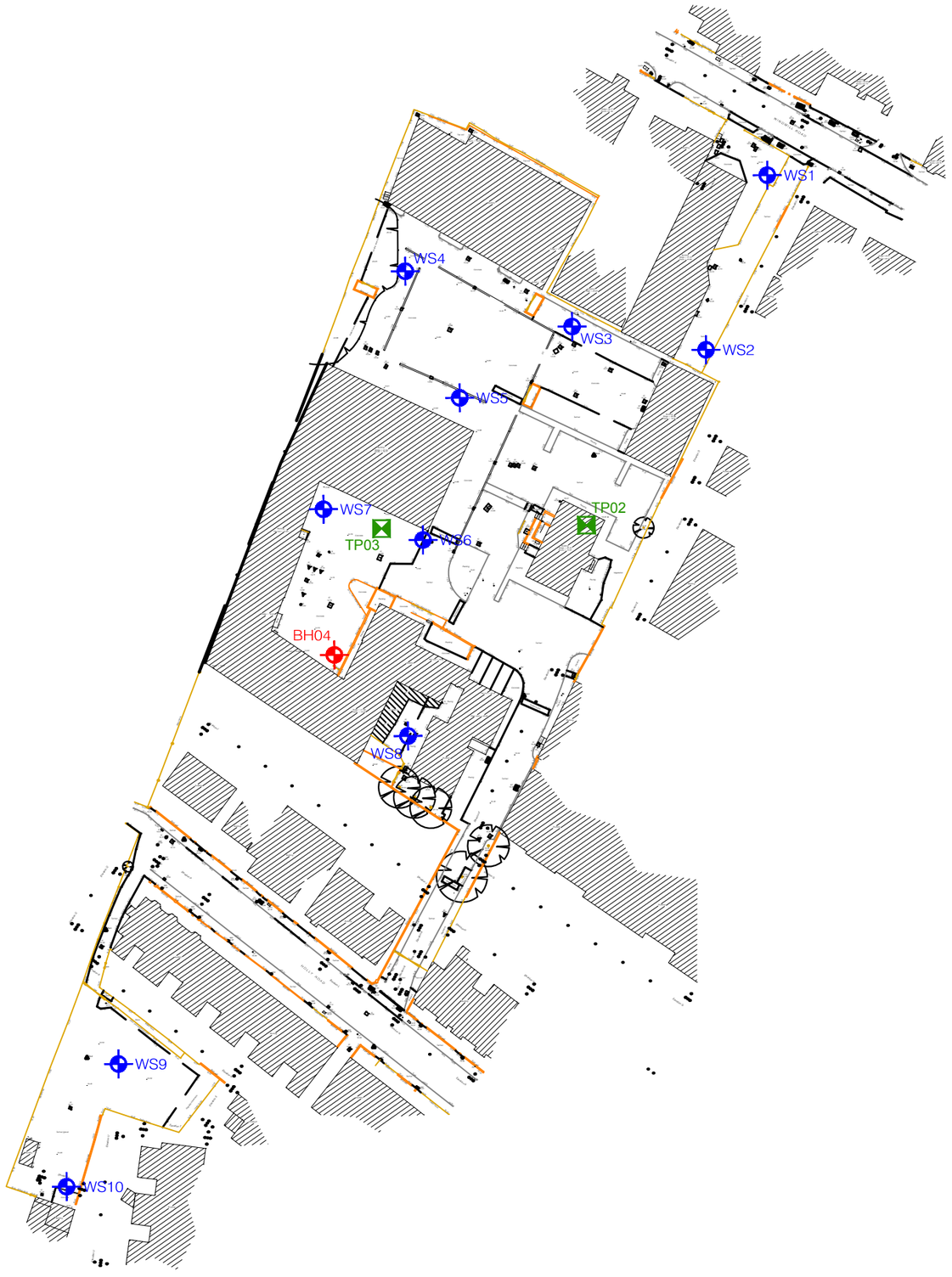
Scale	Orig Size	Dimensions
1:1000	A3	m

Project No.	Drawing File
29701 - R01(00)	29701 - (R01-00).dwg

Drawing No.	Rev.
FIGURE 3	P1

Scale

0 10 20 30 40 50m



LEGEND

- Borehole location
- Window sample location
- Trail pit location

N

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P1	01.05.18	FIRST ISSUE	AP	JG	JG

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NOTTING HILL HOUSING TRUST

Project Title

ST CLARE BUSINESS PARK, HAMPTON HILL

Drawing Title

EXPLORATORY HOLE LOCATION PLAN

Drawn	Date	Checked	Date	Approved	Date
AP	01.05.18	JG	01.05.18	JG	01.05.18

Scale	Orig Size	Dimensions
1:1000	A3	m

Project No.	Drawing File
29701 - R01(00)	29701 - (R01-00).dwg

Drawing No.	Rev.
FIGURE 4	P1

Scale

0 10 20 30 40 50m

APPENDICES

APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Notting Hill Home Ownership Limited (the "Client") in accordance with the terms of a contract [RSK Environment Standard Terms and Conditions] between RSK and the Client.. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.

2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.

6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas, persistent, bioaccumulative or toxic chemicals (including PFAS/ PFOS) or other radioactive or hazardous materials, unless specifically identified in the Services.

7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

    a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.

b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.

c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.

12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

APPENDIX B
SUMMARY OF LEGISLATION AND POLICY RELATING TO LAND CONTAMINATION

Part IIA of the Environmental Protection Act 1990

Part IIA of the Environmental Protection Act 1990 (Part IIA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, formed the basis for the current regulatory framework and the statutory regime for the identification and remediation of contaminated land. Part IIA of the EPA 1990 defines contaminated land as 'any 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 significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters are considered to include all groundwater, inland waters and estuaries.

In August 2006, the Contaminated Land (England) Regulations 2006 (SI 2006/1380) were implemented, which extended the statutory regime to include Part IIA of the EPA as originally introduced on 1 April 2000, together with changes intended chiefly to address land that is contaminated by virtue of radioactivity. These have been replaced subsequently by the Contaminated Land (England) (Amendment) Regulations 2012, which now exclude land that is contaminated by virtue of radioactivity.

The intention of Part IIA is to deal with contaminated land issues that are considered to cause significant harm on land that is not undergoing development (see Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012). This document replaces Annex III of Defra Circular 01/2006, published in September 2006 (the remainder of this document is now obsolete).

Planning Policy

Land contamination is often addressed via the planning process during redevelopment of sites. This approach was documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use. PPS23 was withdrawn early in 2012 and has been replaced by much reduced guidance within the National Planning Policy Framework (NPPF), reference ISBN: 978-1-5286-1033-9, July 2021. For sites in Wales, reference should be made to Planning Policy Wales (Welsh Government. Edition 11, February 2021).

The new framework has limited guidance on contaminated land, as follows:

Chapter 11. Making effective use of land

117 Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.

118. Planning policies and decisions should:

c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land.

Chapter 15. Conserving and enhancing the natural environment

170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

Ground conditions and pollution

178. Planning policies and decisions should ensure that:

a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.

179. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

Water Resources Act (WRA)

The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 updated the Water Resources Act 1991, which introduced the offence of causing or knowingly permitting pollution of controlled waters. The Act provides the Environment Agency with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so.

Water Framework Directive (WFD)

The Water Framework Directive 2000/60/EC is designed to:

- enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands that depend on the aquatic ecosystems
- promote the sustainable use of water
- reduce pollution of water, especially by ‘priority’ and ‘priority hazardous’ substances
- ensure progressive reduction of groundwater pollution.

The WFD requires a management plan for each river basin be developed every six years.

Groundwater Directive (GWD)

The 1980 Groundwater Directive 80/68/EEC and the 2006 Groundwater Daughter Directive 2006/118/EC of the WFD are the main European legislation in place to protect groundwater. The 1980 Directive is due to be repealed in December 2013. The European legislation has been transposed into national legislation by regulations and directions to the Environment Agency.

Priority Substances Directive (PSD)

The Priority Substances Directive 2008/105/EC is a 'Daughter' Directive of the WFD, which sets out a priority list of substances posing a threat to or via the aquatic environment. The PSD establishes environmental quality standards for priority substances, which have been set at concentrations that are safe for the aquatic environment and for human health. In addition, there is a further aim of reducing (or eliminating) pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on the list. The WFD requires that countries establish a list of dangerous substances that are being discharged and EQS for them. In England and Wales, this list is provided in the River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. In order to achieve the objectives of the WFD, classification schemes are used to describe where the water environment is of good quality and where it may require improvement.

Environmental Permitting Regulations (EPR)

The Environmental Permitting (England and Wales) Regulations 2016 (as amended) provide a single regulatory framework that streamlines and integrates waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation. Schedule 22, paragraph 6 of EPR 2016 states: 'the regulator must, in exercising its relevant functions, take all necessary measures - (a) to prevent the input of any hazardous substance to groundwater; and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater.'

Notes:

1. *The above information is provided for background but does not constitute site-specific advice*
2. *The above summary applies to England only. Variations exist within other countries of the United Kingdom*

APPENDIX C
PREVIOUS REPORT

Notting Hill Housing Trust

St Clare Business Park, Hampton Hill

Geo-environmental site assessment

Report No. 29701-R01 (01)

SEPTEMBER 2018

RSK GENERAL NOTES

Project No.: 29701-R01 (01)

Title: Geo-environmental site assessment: St Clare Business Park, Hampton Hill

Client: Notting Hill Housing Trust

Date: 14th September 2018

Office: Anerley Court, Half Moon Lane, Hildenborough, Tonbridge, Kent, TN11 9HU, UK

Status: Final

Author	Niki Dubber/ Julia Griffin	**Technical reviewer**	Niki Dubber / Svetislav Trajkovski
Signature		Signature	
Date:	14th September 2018	Date:	14th September 2018
Project manager	Niki Dubber	**Quality reviewer**	Thomas Payne
Signature		Signature	
Date:	14th September 2018	Date:	14th September 2018

CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

RSK Environment Limited (RSK) was instructed by Tully De'Ath on behalf of Notting Hill Housing Trust (the 'Client') to carry out a geo-environmental assessment of the land at St Clare Business Park, Hampton Hill. It is understood the site is being considered for redevelopment with a mixed residential and commercial end-use.

This report is subject to the RSK service constraints given in **Appendix A**. A summary of legislation and policy relating to contaminated land is given in **Appendix B**.

1.1 Objective

The objective of the work is to evaluate the prevailing ground conditions principally including any associated ground contaminative issues and geotechnical design parameters to inform future foundation design.

1.2 Scope

The scope of the ground investigation was provided/designed by the Clients appointed agent Tully De'Arth Consultants (Reference: 14/12/2-2017 Specification for Desk Study and Site Investigation, dated 15th December 2017).

The layout of this report has been designed with consideration of CLR11 (Environment Agency, 2014) and BS 10175: 2013 (BSI, 2013) and guidance on land contamination reports issued by the Environment Agency (EA) (2010a).

The project was carried out to an agreed brief as set out in RSK's proposal (Reference: 29701-T03 (00), dated; 12th March 2018) and subsequent amendments following discussions with the Client during the intrusive phases of works.

The scope of works for the assessment included:

- a preliminary risk assessment (PRA) to include a review of existing reports, geological, hydrogeological and hydrological information, a commercially available environmental database, and historical plans; correspondence with regulatory authorities; and a site walkover – this information is used to develop an initial conceptual site model to consider any potentially complete pollutant linkages;
- a review of published geological data to assess ground stability;
- an intrusive investigation consisting of a single cable percussive borehole, 10No. window sample boreholes, and 2No. trial pits, with laboratory analysis plus subsequent groundwater and gas monitoring;
- identification of outline mitigation measures for complete pollutant linkages or recommendations for further work;
- interpretation of ground conditions and geotechnical data to provide recommendations with respect to foundations and infrastructure design;
- a factual and interpretative report with recommendations for further works (i.e. undertake a remedial options appraisal to identify appropriate mitigation

measures/produce a remedial implementation and verification plan) and/or remediation as necessary; and

- an assessment of the potential waste classification implications of soil arisings.

1.3 Existing reports

It is understood that there is an existing / historical Geo-environmental Report produced by LBH Wembley (Reference: 2377). Salient findings of the report have been discussed in Section 3.2.

RSK have issued a draft report titled 'Geo-environmental site assessment: St Clare Business Park, Hapmton Hill', report reference 29701-R01 (00) dated May 2018.

The report below is an update of the above stated report, which includes:

- Additional 4No. gas monitoring rounds;
- Chemical analysis of selected groundwater samples from installed boreholes; and,
- Details from the London Fire Brigade giving information of known underground storage tanks on the site.

1.4 Limitations

The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows may vary from those reported due to seasonal, or other, effects.

2 THE SITE

2.1 Site location and description

The site is located at St Clare Business Park, Holly Road, Hampton Hill, TW12 1PZ, at National Grid reference E514170, N170860 as shown on **Figure 1**.

The area around the site consists of mainly residential housing with public open green spaces within the surroundings as detailed in Table 1.

Table 1: Site setting

To the north:	Residential housing
To the east:	Residential housing with public open green beyond, including a cricket ground.
To the south:	Residential housing
To the west:	Residential housing with a recreational green / playground to the south west

The site covers approximately 0.94 hectares at an elevation of approximately 15m above Ordnance Datum (AOD). An existing site layout and redline boundary has been presented as **Figure 2** of this report.

In order to aid orientation, the subject site/s has been split into three (3No.) distinct parcels of land based on their situation and current land-use. These areas include:

- **The Business Park** – centrally located and comprising the majority of the subject site. The site is currently occupied by both occupied and unoccupied commercial units and offices;
- **The Car Wash** – accessed off Windmill Road the site comprises a small rectangular parcel of land currently occupied by an active carwash and garage; and,
- **Holly Road, South** – accessed off Holy Road the site comprises a small irregular shaped parcel of land currently used to store vehicles.

2.2 Proposed development

2.2.1 The Business Park

The project comprises the redevelopment of St Clares Business Park to provide high-density purpose built commercial floor space along with 111No. residential units comprising 11No. houses and 100No. flats in blocks up to five-storeys high.

It is understood that a basement will be incorporated into the proposed central building on The Business Park site.

2.2.2 The Car Wash

It is understood this parcel of land is to provide a future access route to The Business Park.

2.2.3 Holly Road, South

The proposed development plan for this parcel of land was not available at the time of drafting.

An outline footprint of the proposed development has been presented as **Figure 3** of this report.

Note that at the time of drafting the proposed building shown as located on the Car Wash Parcel of land (**Figure 3**) had been omitted from the development plans. The Car Wash land has been assessed as an area of future hardstanding as described in Section 2.2.2.

3 PRELIMINARY RISK ASSESSMENT (PRA)

3.1 Site walkover

The site was visited on 26th March 2018 to undertake a site walkover. Photographs and the site walkover checklist are provided in **Appendix C**.

Salient observations along with potentially significant environmental and geotechnical issues arising from the survey are summarised below.

3.1.1 The Business Park

The site is located within a predominantly residential area and currently occupied by both occupied and unoccupied commercial units and offices. The site generally slopes westwards towards the adjacent railway cutting and tree-line defining the western site boundary. The site is almost entirely covered by hardstanding (tarmac/concrete). Underground fuel storage (UST) vent stakes were noted to the south believed to be indicative of a nearby UST/s.

Potential sources of contaminative activity may include;

- localised above ground and unbunded fuel storage operated by an number of occupied units;
- existing sub-station located south;
- presence/absence of any impacted made ground;
- centrally located building believed to be roofed with asbestos containing materials; and,
- existing underground storage tanks and associated infrastructure of unknown integrity and condition.

Geotechnical considerations include;

- presence of historical/existing buried foundations/substructures;
- proximity of neighbouring properties and associated foundations;
- railway cutting adjacent to the western site boundary;
- tree-line along western site boundary; and,
- deep fill materials around ‘known’ underground storage tanks.

3.1.2 The Car Wash

The site is located along a predominantly residential street (Windmill Road) and is currently occupied by an active car wash and garage. The site generally slopes southwards from road level. The site is entirely covered by hardstanding (tarmac/concrete). A number of manholes were noted on-site potentially relating to underground storage tanks and or interceptor infrastructure.

Potential sources of contaminative activity may include;

- localised above ground and unbunded fuel storage;