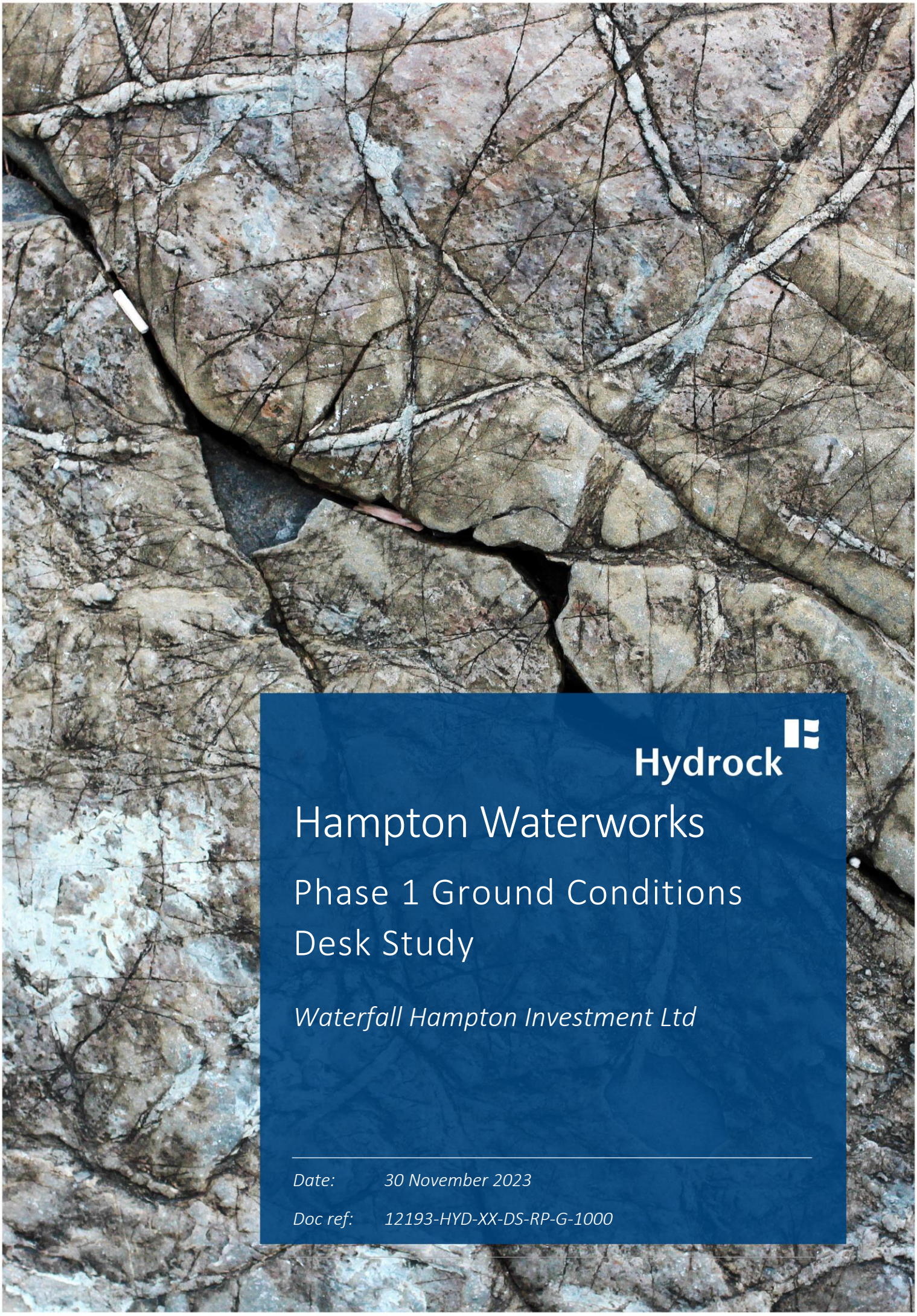

Hydrock

Hampton Waterworks

Phase 1 Ground Conditions Desk Study

Waterfall Hampton Investment Ltd

Date: *30 November 2023*

Doc ref: *12193-HYD-XX-DS-RP-G-1000*

DOCUMENT CONTROL SHEET

Issued by	Hydrock Consultants Limited Over Court Barns Over Lane Almondsbury Bristol BS32 4DF	Tel: 01454 619533 E-mail: bristol@hydrock.com www.hydrock.com
Client	Waterfall Hampton Investment Ltd	
Project name	Hampton Waterworks	
Title	Phase 1 Ground Conditions Desk Study	
BIM reference	12193-HYD-XX-DS-RP-G-1000	
Project reference	C-12193-C	
Date	30/11/2023	

Document Production Record		
Status and Revision	P2 S2	Name
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Document Revision Record			
Status	Revision	Date	Revision Details
S2	P1	04/07/2019	Original issue.
S2	P2	08/09/2022	Draft for comment
S2	P3	14/02/2023	Proposed development plans updated
S2	P4	30/11/2023	Date updated

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EXECUTIVE SUMMARY

SITE INFORMATION AND SETTING	
Objectives	Phase 1 Desk Study to formulate a Preliminary Conceptual Ground Model of the site to identify key geo-environmental and geotechnical risks to the proposed development.
Client	Waterfall Hampton Investment Ltd
Site name and location	Hampton Waterworks, Upper Sunbury Road, Hampton, TW12 2DL. Located to the immediate south of Upper Sunbury Road and to the west of Lower Sunbury Road and approximately 180m north of the River Thames.
Proposed development	Understood to comprise refurbishment and extension of the existing buildings for use as residential apartments and workspace along with revised hard and soft landscaping surrounding the buildings.
PHASE 1 (DESK STUDY AND SITE RECONNIASANCE)	
Ground Model	The site is currently occupied by the historical Victorian water works buildings and a mixture of hardstanding and soft landscaping. The site is rectangular in shape (approximately 145m long E-W and 40m wide N-S) and has an area of approximately 0.6Ha. The site is set at an elevation of around 11m OD on generally level ground. There are slopes to the south and west suggesting that the ground may have been artificially raised prior to construction of the water works in the 19th century. Also, areas of elevated ground in the eastern and western ends of the site respectively. The raised ground in the eastern part of the site may be indicative of underground tanks associated with the former use as a water works as there are a many manholes present. Slopes down to filtration beds to the south. Review of historical Ordnance Survey data indicates: • The site has comprised buildings (engine houses) associated with water works in various configurations since before the earliest mapping (1869). Many of these buildings still remain. • The current layout of buildings is indicated since the 1957 map. • The wider waterworks comprised engine houses (on site) filter beds and reservoirs and a narrow-gauge railway from 1915. This tramway connected the riverside Coal Wharf (located approximately 300m south of the site) to the pumping stations/engine houses on site. • The operations onsite included coal fired steam engine pumps and filtration along with chemical treatment of water for drinking purification. A non-specialist UXO assessment indicates a high bomb risk and that a UXO desk study is required for GI and construction works. Whilst superficial deposits are not mapped in the north of the site, it is possible that either Kempton Park Gravel Member and/or Taplow Gravel Member overlie the London Clay which extends beneath the whole site. Given that the site has been subjected to past development some Made Ground is also anticipated. The superficial deposits comprise a Principal Aquifer and the London Clay Formation is an Unproductive Aquifer. The site is not a Source Protection Zone and there are no groundwater abstractions within 500m of the site. The River Thames is located approximately 180 south of the site and there are filter beds associated with the existing water works extending from approximately 10m south of the site to the River Thames. The desk study information indicates that there is potential for groundwater flooding at the site.

ASSESSMENT AND CONCLUSIONS

Preliminary Geotechnical Hazards

The following plausible geotechnical risks are identified.

- Uncontrolled Made Ground (variable strength and compressibility).
- Soft / loose compressible ground (e.g. Alluvium - low strength and high settlement potential).
- Insufficient bearing capacity of ground for existing foundations after additional loading by construction of new storeys on top of existing buildings, leading to the potential for new settlement (where applicable).
- Shrink swell of the clay fraction of soils (e.g. London Clay) under the influence of vegetation.
- Variable lateral and vertical changes in ground conditions.
- Attack of buried concrete by aggressive ground conditions (e.g. sulphates in London Clay).
- Obstructions and services (including potential underground tanks and pipework).
- Existing below ground structures to remain (gantry rails, foundations, buried slabs, and/or infilled cellars)).
- High / shallow groundwater.
- Changing groundwater conditions.
- Loose Made Ground and shallow groundwater, leading to difficulty with excavation due to trench instability.
- Running sand from excavations into sand and gravels with shallow groundwater.

Preliminary Geo-environmental Conclusions

Based on historical land uses and its current operational use, the overall risk from land contamination at the site is considered to be moderate, but would need to be confirmed by appropriate intrusive investigation, testing and assessment of the results of the investigation.

It is considered that it is unlikely that the site would be classified as Contaminated Land under Part 2A of the EPA 1990.

The possible pollutant linkages on an un-remediated site determined by desk study and walk-over are summarised below for risk levels of moderate or greater.

Source(s)	◄ potential Impact on ►	Receptor(s)
Hydrocarbon fuels, lubricants and solvents (metals, hydrocarbons, solvents, degreasers, etc.) from the operation of the historic plant on the site including leakages from the steam engines, pipework between tanks, underground storage tanks and pumps, and general spillage, together with uncontrolled disposal and spillage from waste receptacles (oil drums and chemical containers).		Site users Neighbours Groundwater
Metals, metalloids, PAH, petroleum hydrocarbons and asbestos in Made Ground below the site.		
Ground gases (carbon dioxide and methane) from Made Ground and peat within the natural ground beneath the site and possibly migrating from nearby alluvial deposits.		Site Users Buildings
Hydrocarbon vapours from potential VOC and petroleum hydrocarbon spillages/leaks.		Site users Neighbours Groundwater
Buildings (asbestos). Asbestos / ACM in the ground		Site Users
The historic use of chemicals such as chlorine and flocculating agents (generally aluminium sulphate of iron sulphate), the use of acids and alkali (sulphuric acid and sodium hydroxide).		Site users Neighbours Groundwater

FUTURE CONSIDERATIONS	
Further work	In order to confirm the actual risks to receptors and confirm the ground conditions with respect to potential geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken. This investigation will need to: • undertake a UXO desk study prior to any ground investigation or breaking ground. • undertake appropriate services searches (potentially including GPR services survey) prior to any ground investigation or breaking ground. • determine the depth and distribution of Made Ground and natural strata across the site; • determine the design of the foundations to the existing buildings (depths / widths / type), so that an assessment can be made of their ability to carry new loads without unacceptable settlement, and to assist in design of remedial measures or new foundations where necessary. • If new loads cannot be carried on the old foundations, it may be necessary to undertake deeper investigation to allow design of piled foundations. • determine the soil strength/density profile beneath the site; • determine the depth/level of groundwater beneath the site; • determine the ground gas concentrations and generation rates beneath the site; • determine CBRs to assist with pavement design; • assess trench stability, over break potential and 'diggability'; • allow soil infiltration rate testing for feasibility of sustainable drainage including soakaways; • allow sampling for chemical and geotechnical laboratory testing; • allow soil classification to allow geotechnical characterisation and determine suitability for reuse of soils within earthworks; • obtain information in terms of Aggressive Chemical Environment for Concrete Class (ACEC Class). Following investigation, assessment will be required to: • update the Ground Model; • update the Geotechnical Risk Register; • provide Geotechnical Design recommendations; • update the Conceptual Site Model (CSM), including identification of plausible pollution linkages; • undertake generic quantitative risk assessment of potential chemical contaminants to establish 'suitability for use' under the current planning regime; • discuss potential environmental liabilities associated with land contamination (soil, water and gas); and • provide outline mitigation recommendations to ensure the site is 'suitable for use'. • If ground source heating is proposed, a new scope of desk study and intrusive investigation and monitoring will be required.

This Executive Summary forms part of Hydrock Consultants Limited report number 12193-HYD-XX-DS-RP-G-1000 and should not be used as a separate document.

1. INTRODUCTION

1.1 Terms of reference

Hydrock Consultants Limited (Hydrock) was commissioned by Waterfall Hampton Investment Ltd (the Client) to undertake a ground conditions desk study at Hampton Waterworks, Upper Sunbury Road, Hampton, TW12 2DL.

The site is currently a disused historical part of Hampton Water Treatment works consisting of a series of 1 to 3 storey Grade 2 listed buildings with surrounding hardstanding and soft landscaping.

The remaining operational parts of Hampton Water Treatment works located to the south and west of the site provides about 30 per cent of London's mains water. Over the last five years, it has had significant investment, including a new disinfection dosing plant and high lift pumping station to feed the water distribution network.

Hydrock understands that the proposed development is to comprise the refurbishment and extension of the existing buildings for conversion to residential apartments and workspace along with revised hard and soft landscaping surrounding the buildings. A proposed development plan is included in the LOM architecture and design document (Design Review Panel - Submission II dated September 2022) presented in Appendix A.

1.2 Objectives

The works have been commissioned to support the planning application.

The objective of the Phase 1 Desk Study is to formulate a Preliminary Conceptual Ground Model of the site to identify key geo-environmental and geotechnical risks to the proposed development.

1.3 Scope

The scope of the Phase 1 Desk Study comprises:

- a field reconnaissance (walkover) to determine the nature of the site and its surroundings including current and former land uses, topography, geology and hydrology;
- acquisition and review of:
  - historical Ordnance Survey maps, to identify former potentially contaminative uses at the site and immediately surrounding it, and an assessment of the associated contamination risks;
  - a third party environmental database search to identify flooding warning areas, local landfills, pollution incidents, abstractions, environmental permits etc. which may have had the potential to have environmental impact on the site;
  - topographical, geological and hydrogeological maps;
  - British Geological Survey (BGS) archive records;
  - regional UXB risk maps;
- development of a preliminary Conceptual Site Model (CSM), including identification of potential pollution linkages;
- a qualitative assessment of any risks identified; and
- identification of plausible geotechnical hazards.

1.4 Available information

The following have been provided to Hydrock for use in the preparation of this report:

- LOM Architecture and Design. Hampton Waterworks – Design Review Panel – Submission II. Dated September 2022.

1.5 Regulatory context and guidance

The geo-environmental section of this report is written in broad agreement with BS 10175:2011+ A2:2017, the CLR 11 Model Procedures (Environment Agency 2004) and the AGS (2006) Good Practice Guidelines for Site Investigations. The methods used follow a risk-based approach, with the first stage being a Phase 1 desk study and field reconnaissance (this report), with the potential geo-environmental risk assessed qualitatively in future report(s) using the 'source-pathway-receptor contaminant linkage' concept to assess risk as introduced in the Environmental Protection Act 1990 (EPA, 1990).

The geotechnical section of this report is undertaken in general accordance with BS EN 1997 (EC7). This report forms the Preliminary Sources Study Report (PSSR) as defined by DMRB HD22/08.

Remaining uncertainties and recommendations for further work are listed in Section 5 and Section 6.

Reference to the technical details of the approach and the methodologies adopted are provided in Appendix G.

2. PHASE 1 STUDY (DESK STUDY AND FIELD RECONNAISSANCE)

2.1 Data

A number of desk study sources have been used to assemble the following information. These are presented in Appendix D and include:

- Third party environmental database search (Envirocheck report, reference 207351560_1_1);
- Historical Ordnance Survey mapping;
- BGS Archive Records; and
- Zetica UXB Risk Maps (https://zeticauxo.com/downloads-and-resources/risk-maps/).

2.2 Site referencing

The site is referenced in Table 2.1 and the location is indicated in Figure 2.1 and Figure 2.2.

Table 2.1: Site referencing information

Item	Brief Description
Site name	Hampton Waterworks
Site address	Upper Sunbury Road, Hampton, TW12 2DL
Site location and grid reference	The site is located alongside the southern side of Upper Sunbury Road, to the west of Lower Sunbury Road and approximately 180m north of the River Thames.

Figure 2.1: Site location

(Reproduced with permission from Envirocheck)

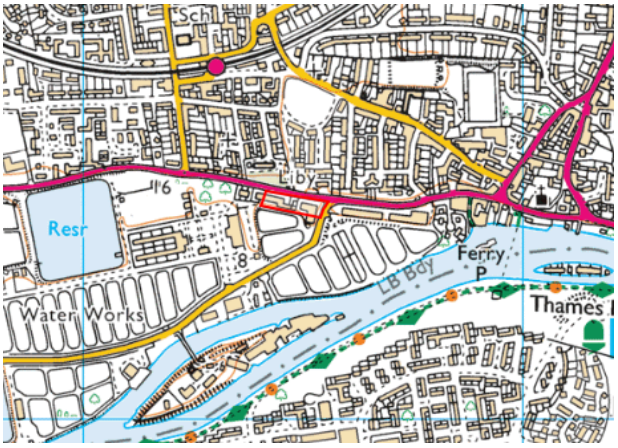

Figure 2.2: Extract from the Ordnance Survey Map.

(OS licence 100023353).

A site location plan (Hydrock Drawing 12193-HYD-XX-XX-DR-G-1000) is presented in Appendix A.

2.3 Site description and field reconnaissance survey

A field reconnaissance survey was undertaken on 21st June 2019 to visually assess potential geotechnical hazards, contaminant sources and receptors. The site walkover was restricted to an external inspection only as access to the buildings was not available. The weather during the field reconnaissance survey was warm and dry.

A site description is presented in Table 2.2 and selected photographs are presented in Figure 2.3 to Figure 2.6. Additional photographs are presented in Appendix B.

Table 2.2: Site description

Item	Brief Description
Site access	Via Gate B in the active water works site in the south western corner of the site.
Site area	The site is broadly rectangular in shape and has an area of approximately 0.6Ha, measuring approximately 145m long from west to east and 40m wide from north to south.
Elevation, topography and any geomorphic features	The site is set at an elevation of around 11m OD on generally level ground on the northern side of the River Thames. There are slopes to the south and west down from the built areas, suggesting that the ground may have been artificially raised prior to construction of the water works in the 19th century. Also, there are areas of elevated ground in the eastern and western ends of the site. The raised ground in the eastern part of the site may be indicative of underground tanks associated with the former use as a water works as there are a many manholes present. The raised ground in the west is potentially indicative of deeper Made Ground.
Present land use	The existing buildings on site were constructed in the late 19th century, comprising two engine houses, two chimneys and waterworks offices which later changed to waterworks cottages. The existing buildings form a currently disused part of the wider water treatment works together with a mixture of hardstanding and soft landscaping. The buildings which are to be converted are mostly of early Victorian brick construction with slate / tile pitched roofs and appear in good condition with no external sign of cracking or other instability. At the south eastern corner of the western engine house, the brick walls were externally covered in rendering suggesting that some past wings have likely been demolished and therefore remnant foundations may be present in the ground. No details of the foundations of the existing buildings are available. There are areas of hardstanding across the site which comprise a mixture of concrete and cobblestones. Disused tram tracks were noted in a number of locations, which are likely to have been associated with a former crane gantry in the north western part of the site and also tramway was noted on the historic mapping along the southern edge of the site (likely used for transportation of coal from the historic dock site 300m south of the site). Areas of soft landscaping and uncontrolled undergrowth were observed in the gardens of the cottages in the centre of the site. Mature trees were noted in the north eastern and western corners of the site and a line of conifer trees were noted against the eastern wall of the eastern engine house. Metal oil drums and plastic chemical containers were noted around the outside of the buildings, discarded in an uncontrolled way in several locations with some evidence of hydrocarbon staining around the base of the drums. It is considered that the lack of control of discarded drums and chemical containers may not have been isolated to those observed during the site walkover and that there could have been generally poor historical control and storage of chemical and oil containers across the site. It was not possible to make a detailed record of this, and over the history of the site's operation, methods of control and disposal of solid and liquid chemicals are likely to have changed considerably. Large numbers of metal service covers were noted across the site in hardstanding and soft landscaped / grassed areas.
Vegetation	There are a number of mature trees of various species in the northern part of the site alongside Upper Sunbury Road. A series of conifer trees were noted against the eastern wall of the eastern engine house. A number of shrubs, mostly buddleia, were noted around the western engine house including some growing out of the building itself.

Item	Brief Description
General site sensitivity	The site is in an urban area with residential properties to the north and filter beds associated with the currently active waterworks to the south. The northern limb of a large meander of the River Thames is located around 200m to the south of the site flowing from west to east (non-tidal). The site is considered to be of moderate to high sensitivity given the potential sources of contamination at the site, the proposed residential end use and the proximity of the River Thames, together with the surrounding area land uses.
Site boundaries and surrounding land	The southern, eastern and western boundaries of the site are elevated above the surrounding area by a slope approximately 1m high which is likely to have been created to raise the site during the construction of the waterworks in the late 19th century. There are a series of filter beds from approximately 10m to the south of the site extending to the northern bank of the River Thames. The remaining operational water treatment works is present from approximately 50m to the southwest, extending to the west.

A topographical and buried services plan by M.J. Rees and Company Ltd and a site features plan (Hydrock Drawing 12193-HYD-XX-XX-DR-G-1001) are presented in Appendix A.

Figure 2.3: Looking east along northern site boundary.

Figure 2.4: taken from the operational waterworks towards the site, showing the southern edge of the site in the background.

Figure 2.5: Raised ground and manholes (potential underground tank) in the north east corner of the site.

Figure 2.6: Chemical containers in central southern part of site.

2.4 Site history

A study of historical Ordnance Survey maps (Appendix C) has been undertaken to identify former land uses at the site and surrounding areas which may have geotechnical or geo-environmental implications for the proposed development. The key findings are summarised in Table 2.3.

Table 2.3: Site history review

Reference	Key Features on Site	Key Features off Site
1866 – 1:2,500 1869 - 1:10,650	Three buildings associated with the Grand Junction Waterworks are present on site. The buildings appear to correspond with those currently present on the site.	Four filter beds, that are part of the Grand Junction / Southwark and Vauxhall Water Works, are located immediately south of the site. There are sloping embankments along each edge of the filter beds. Buildings marked as West Middlesex Water Works are located immediately west of the site. The River Thames is located approximately 180m south of the site. Hampton railway station is located approximately 280m north of the site.
1895 – 1896 1:2,500 1896 – 1:10,560 1897 – 1898 1:10,560	The three existing buildings on site have been extended.	A well is indicated approximately 20m south of the site. The Southwark and Vauxhall Water Works comprises 7 filter beds. The West Middlesex and Grand Junction Water Works comprise 6 reservoirs and 5 filter beds. Electric Launch Works are located on an island (Platt's Eyot) on the River Thames approximately 250m south of the site.
1914 – 1915 1:2,500	The two larger buildings on site are labelled as engine houses.	No significant changes.
1919 – 1920 1:10,560 1934 1:10,560 1934 1:2,500	A tramway linking to the river Thames 300m south of the site is indicated along the southern boundary of the site likely used for	The West Middlesex, Southwark and Great Junction Water Works are now recorded as Water Works (Metropolitan Water Board) and have been extended to 300m east and 1100m west of the site and 200m south extending to the bank of the River Thames. The

Reference	Key Features on Site	Key Features off Site
1938 1:10,560	transportation of coal and other materials to the engine houses.	infrastructure of the water works now comprises over 40 filter beds, four reservoirs and four engine houses. Several buildings are located to the west and east of the site along Upper Sunbury Road. Tanks (unknown contents – probably water) are marked approximately 50m east and 20m north of the site. A tramway is located approximately 200m west of the site trending in a north south direction and terminating at the River Thames where there is a network of tramlines and travelling cranes. Three intake locations are recorded south of the site along the River Thames. A goods shed associated with the railway line is located approximately 290m northwest of the site.
1957 1:2,500	A building has been removed and replaced with a travelling gantry in the northwest of the site. There are two warehouse cottages in the centre of the site and two chimneys to the northeast and east of the site.	A well is located on the southern wall of a building that extends south beyond the site boundary
1999 1:10,000	No significant changes.	The five filter beds between approximately 70m and 250m north of the site are no longer in use.
2006 – 1:10,000	No significant changes.	Residential houses are in the location of the former filter beds to the north of the site.
2019 – 1:10,000	No significant changes.	The waste water infrastructure between approximately 70m and 200m to the west of the site boundary have been extended and now include a road and several small buildings.

The site is historically industrial in nature comprising the following and depending on the various treatment stages employed by the water treatment works historically:

- two engine houses with chimneys;
- tramways/crane gantry's;
- coal fired plant (steam driven pumps and engines);
- the use of chemicals such as chlorine and flocculating agents (generally aluminium sulphate of iron sulphate);
- the use of acids and alkali (sulphuric acid and sodium hydroxide)

2.5 Unexploded ordnance (UXO)

In general accordance with CIRIA Report C681 (Stone et al 2009) a non-specialist UXO screening exercise has been undertaken for the purposes of ground investigation and is presented in Table 2.4.

Table 2.4: Non-specialist UXO screening (for the purposes of ground investigation)

Data	Comment	Further Assessment Required
Site History	The site was a water works during WW2 with the same building footprint as the present-day disused water works.	No
Post War Development	There is no evidence of bomb damage either on site or in the surrounding area.	No
Geology Type	The geology comprises London Clay overlain by Kempton Park Gravel Member in the south. It is possible that UXO could have penetrated into this material and remain undetected.	Yes
Surface Cover during WWI	The site was occupied by the Water Works during WW2 with hardstanding across most of the open areas of the site and the surrounding areas were residential. It is therefore unlikely that UXO could have penetrated through this material and not been noticed.	No
Indicator of Aerial Delivered UXO	Zetica's UXO risk mapping indicates that the site is located within a high-risk area. Further review of http://bombsight.org indicates the nearest bomb recorded approximately 400m north of the site.	Yes

The non-specialist UXO screening exercise has indicated that there is the potential for UXO to remain undetected due to the site having been in a high-risk area during WW2 and bombs are recorded within 400m of the site. As a result, a UXO desk study is recommended prior to ground investigation and construction works involving excavation.

2.6 Geology

The general geology of the site area is shown on the British Geological Survey (BGS) 1:50,000 geological map of South London (Sheet 270) and reproduced as part of the Envirocheck report and is summarised in Table 2.5. Extracts from the map are shown in Figure 2.7 and Figure 2.8.

Table 2.5: Geology

Ref. for Figures	Location	Stratigraphic Name	Description
Superficial Deposits (Figure 2.7)			
KPGR	On site (southern half)	Kempton Park Gravel Member	Sand and gravel, locally with lenses of peat.
TPGR	20m north	Taplow Gravel Member	Sand and gravel, locally with lenses of silt, clay or peat.
ALV	100m south	Alluvium	Clay, silt, sand and gravel deposited by the River Thames.
Solid Geology (Figure 2.8)			
LC	On site.	London Clay Formation	Mainly 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.

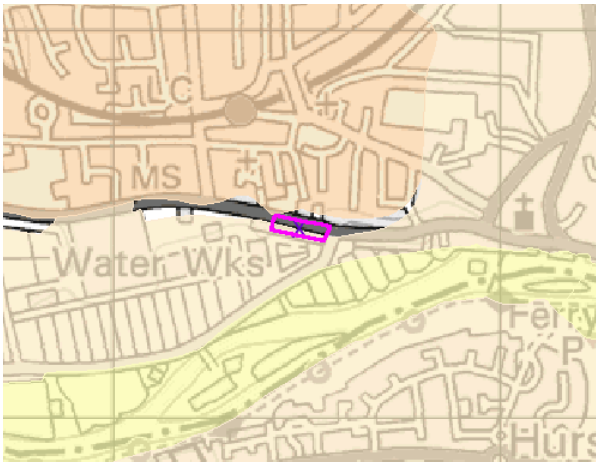

Figure 2.7: Superficial deposits.

(Reproduced with permission from Envirocheck)

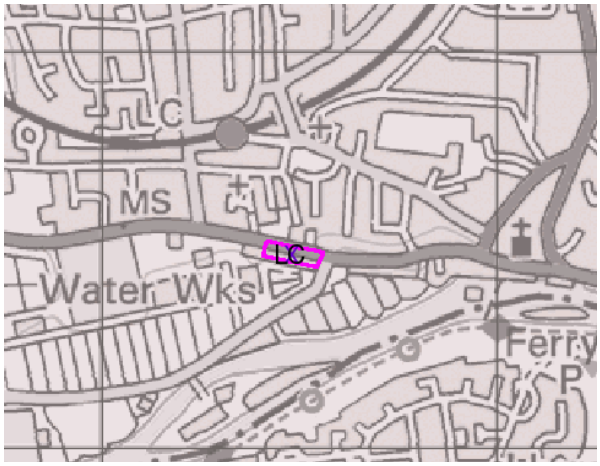

Figure 2.8: Solid geology.

(Reproduced with permission from Envirocheck)

Whilst superficial deposits are not mapped in the north of the site, it is still possible that either Kempton Park Gravel Member and/or Taplow Gravel Member overlie the London Clay beneath the whole site. Given that the site has been subjected to past development some Made Ground is also anticipated.

A number of borehole logs from the BGS archive have been reviewed. Selected records are summarised below:

- TQ16NW64, located 40m to the northeast of the site (NGR 513600E, 169500N), drilled to a depth of 12.00m and recorded:
  - gravelly topsoil between ground level and 0.50m below ground level (bgl);
  - Made Ground between 0.50m and 1.45m bgl;
  - firm to stiff brown silty clay between 1.45m and 5.40m bgl (probable London Clay); and
  - firm grey silty clay between 5.40m and 12.00m bgl (probable London Clay).
- TQ16NW62, located 10m to the north of the site (NGR 513510E, 169520N), drilled to a depth of 6.00m and recorded:
  - topsoil between ground level and 0.25m bgl;
  - Made Ground between 0.25m and 1.40m bgl;
  - concrete between 1.40m and 1.85m bgl;
  - medium dense brown gravelly sand between 1.85 m and 5.20m bgl (probable Taplow Gravel Member); and
  - soft to firm brown sandy gravelly clay between 5.20m and 6.00m bgl.
- TQ16NW60, located 30m to the northwest of the site (NGR 513390E, 169540N), drilled to a depth of 6.00m and recorded:
  - topsoil between ground level and 0.30m bgl;
  - Made Ground between 0.30m and 0.80m bgl;

- very dense brown sand and gravel between 0.80m and 3.15m bgl (probable Taplow Gravel Member); and
- firm to stiff grey silty clay between 3.15m and 6.00m bgl (probable London Clay Formation).

2.7 Groundwater system

2.7.1 Aquifer designations

Based on the inferred geological sequence presented in Section 2.6 and the Environment Agency's interactive aquifer designation map, the aquifer system presented in Table 2.6 applies.

Table 2.6: Aquifer system

Stratum	Aquifer Designation	Hydraulic Characteristics
Kempton Park Gravel Member	Principal Aquifer	Intergranular permeability. Dominated by moderate to high permeability layers of sand and gravel.
London Clay Formation	Unproductive Aquifer	Dominated by low permeability and low porosity clay.

2.7.2 Groundwater abstraction

There are no active licensed groundwater abstractions within 500m of the site. However, a well is indicated on the OS maps approximately 20m south of the site.

2.7.3 Groundwater source protection zones and groundwater vulnerability

The site is not within a groundwater Source Protection Zone (SPZ).

2.7.4 Groundwater quality

The groundwater body beneath the site (Thames) is currently (2016 Cycle 2) classified under the Water Framework Directive as ‘good’.

2.7.5 Groundwater levels, recharge, and flow

Shallow groundwater is likely to be present within the Kempton Park Gravel Member. The desk study information has highlighted the potential for groundwater flooding on site.

Groundwater below the site is likely to drain towards the River Thames, some 180m south of the site.

2.8 Surface Water System

2.8.1 Hydrology and drainage

The surface water features in the vicinity of the site are listed in Table 2.7.

Table 2.7: Surface water features

Feature	Location Relative to Site
River Thames	Approximately 180m south.
Filter beds	Approximately 10m south of the site.
Several Reservoirs	Between approximately 300m and 100m west and southwest.

The site is located approximately 7km upstream of Teddington Lock, and is therefore not now in the tidal zone of the River Thames, although historically, it is likely to have been tidal where it is closest to the site.

2.8.2 Surface water abstractions and discharges

There is one active licensed surface water abstraction within 500m of the site from the River Thames

Table 2.8: Surface water abstractions

Location Relative to Site	Purpose of Abstraction
184m southwest	Public Water Supply – Potable Water Supply, Storage Start date: 18th September 1987

There are no active licensed surface water discharges within 500m of the site.

2.8.3 Surface water quality

Reference to the Environment Agency web site shows the site is located within the catchment of the Lower Thames Basin District, with the specific river water body being the Thames River. The current (2016 cycle 2) overall status under the Water Framework Directive is 'poor'.

The water body is currently 'poor' status due to biological quality elements, moderate supporting elements and physio-chemical quality elements and high specific pollutants. The objective is for supporting elements (surface water) to be 'good' by 2027.

2.8.4 Surface water flooding

The desk study information indicates the proposed development is in Flood Zone 1 (with a low probability of flooding from rivers or the sea). The desk study information indicates that there is a potential for groundwater flooding to occur at surface and the potential for groundwater flooding of property situated below ground level.

Immediately south and east of the site is a Flood Zone 2 (with a medium/moderate probability of flooding from rivers or the sea) extending to a Flood Zone 3 (with a high/significant probability of flooding from rivers or the sea) near the River Thames.

No further consideration of flood risk is undertaken in this report. Specialist flood risk advice should be sought with regard to drainage and flooding.

2.9 Waste management

There are no current or historical waste management sites recorded within 250m of the site.

2.10 Regulatory consultation

Information in the Envirocheck Report (Appendix D), relating to various active regulatory controls has been reviewed, with a summary presented below in Table 2.9.

Table 2.9: Regulatory information within 500m of the site

Regulatory Data	Distance from Site	Details	Potential Risk	Comment
Discharge Consents	85m southwest	Thames Water Utilities Ltd Process effluent discharged to the River Thames.	No	Due to being down gradient of the site.
	172m southeast			
	264m south	Mr. C. Marryat Process effluent discharged to the River Thames.		
Local Authority Pollution Prevention and Controls	258m northeast	Local Authority Air Pollution Control, PG6/46 Dry cleaning, Permitted.	No	Due to small volume of waste and distance from the site.
Pollution Incidents	86m southwest	June 1990, oils, Category 3 – minor incident	No	Due to the date of the incident.
	91m southwest	December 1993, oils, Category 2 – Significant incident	No	Due to the date of the incident.
	164m south	August 1993, oils, Category 3 – minor incident	No	Due to the date of the incident and distance from site.
	168m south	January 1997, unknown, Category 3 – minor incident	No	Due to the date of the incident and distance from site.
	169m south	December 1993, oils, Category 3 – minor incident	No	Due to the date of the incident and distance from site.
	184m southwest	November 1990, oils, Category 3 – minor incident	No	Due to the date of the incident and distance from site.
	279m southwest	Date no supplied, oils, Category 2 – Significant incident	No	Due to the distance from site.
	306m southwest	April 1993, oils, Category 2 – Significant incident	No	Due to the distance from site.
	311m southwest	September 1997, general pollutant, Category 2 – Significant incident	No	Due to the distance from site.
	372m southwest	October 1997, oils, Category 3 – minor incident	No	Due to the distance from site.
	441m east	June 1989, unknown sewage, Category 2 – Significant incident	No	Due to the distance and being down gradient from site.
	446m east	November 1989, unknown sewage, Category 3 – minor incident	No	Due to the distance and being down gradient from site.
	491m east	December 1998, general pollutant, Category 3 – minor incident	No	Due to the distance and being down gradient from site.

Regulatory Data	Distance from Site	Details	Potential Risk	Comment
	450m east	April 1992, unknown sewage, Category 3 – minor incident	No	Due to the distance and being down gradient from site.
Trade Directory Entries	There are a number of industrial processes operating within 500m of the surrounding area, however, as long as these have been operated in accordance with any applicable licence, no impact on the site is envisaged.			
Control of major accident hazards sites (COMAH)	234m southwest	Thames Water Utilities Limited Lower Sunbury Road, Hampton, Middlesex	No	Due to the distance and being down gradient from site.

2.11 Natural soil chemistry

Information contained within the environmental data report (Appendix D) gives indicative natural concentration values (estimated) for the natural soils at the site for a selection of Contaminants of Potential Concern (CoPC). These have been reproduced in Table 2.10.

Table 2.10: Natural soil chemistry

Element	Arsenic	Cadmium	Chromium	Lead	Nickel
Concentration (mg/kg)	No data	<1.8	No data	100 - 200	No data

2.12 Radon

The radon risk is reported in the environmental data report which indicates that the site is in a lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). Therefore, radon protection measures are not required for new buildings at this location in line with current guidance.

3. PRELIMINARY CONCEPTUAL SITE MODEL

3.1 Ground model

The preliminary ground model is presented in Section 2 which forms the understanding of the ground conditions that inform the preliminary geotechnical hazard assessment (Section 3.2) and the preliminary geo-environmental exposure model (Section 3.3).

3.2 Geotechnical hazard identification

The preliminary geotechnical hazard identification has been undertaken in accordance with the general requirements of ICE/DETR Document 'Managing Geotechnical Risk' and the HE documents HD 41/15 and HD 22/08.

The following section sets out the identified geotechnical hazards and the development elements potentially affected (see Table E.1 in Appendix E for further detail).

3.2.1 Plausible geotechnical hazards

Plausible geotechnical hazards identified at the site are:

- Uncontrolled Made Ground (variable strength and compressibility).
- Soft / loose compressible ground (e.g. Alluvium - low strength and high settlement potential).
- Insufficient bearing capacity of ground for existing foundations after additional loading by construction of new storeys on top of existing buildings, leading to the potential for new settlement (where applicable).
- Shrink swell of the clay fraction of soils (e.g. London Clay) under the influence of vegetation.
- Variable lateral and vertical changes in ground conditions.
- Attack of buried concrete by aggressive ground conditions (e.g. sulphates in London Clay).
- Obstructions and services (including potential underground tanks and pipework).
- Existing below ground structures to remain (gantry rails, foundations, buried slabs, and/or infilled cellars)).
- High / shallow groundwater.
- Changing groundwater conditions.
- Loose Made Ground and shallow groundwater, leading to difficulty with excavation due to trench instability.
- Running sand from excavations into sand and gravels with shallow groundwater.

3.2.2 Potential development elements affected

Development elements affected by potential geotechnical hazards are:

- Buildings – foundations for new buildings and existing buildings with changed loading configurations.
- Buildings – floor slabs.
- Roads and pavements.

- Services.
- Construction staff, vehicles and plant operators.
- Concrete below ground.

Health and safety risks to site Contractors and maintenance workers have not been assessed during these works and will need to be considered separately during design.

The above plausible geotechnical hazards and development elements affected will need to be carried forward for investigation and assessment.

3.3 Geo-environmental exposure model

The preliminary exposure model is based on information presented in Section 2 and is used for geo-environmental hazard identification and establishing potential contaminant linkages based on the contaminant-pathway-receptor approach.

A pollutant linkage requires all the elements (S-P-R) to be present. If only one or two are present, there is likely to be no linkage and further assessment is not required.

3.3.1 Potential contaminants

For the purpose of this assessment the potential contaminants have been separated according to whether they are likely to have originated from on-site or off-site sources.

Potential on-site sources of contamination

S 1. Hydrocarbon fuels, chlorine, flocculating agents, acid's, alkali's, lubricants and solvents (metals, hydrocarbons, solvents, degreasers, etc.) from the operation of the historic plant on the site including leakages from the steam engines, pipework between tanks, underground storage tanks and pumps, and general spillage, together with uncontrolled disposal and spillage from waste receptacles (oil drums and chemical containers). Contamination from stored coal, and ash from furnaces of steam-driven pumps and other machinery.

S 2. Made Ground due to past site development – contamination may include metals, metalloids, asbestos, PAH and petroleum hydrocarbons.

S 3. Ground gases (carbon dioxide and methane) from biodegradable materials within Made Ground (if found to be significantly thick) and/or peat within the superficial geology.

S 4. Hydrocarbon vapours from potential VOC and petroleum hydrocarbon spillages/leaks.

S 5. Buildings – construction materials, pipe insulation, heat protection from steam boilers (free and bound asbestos).

Potential off-site sources of contamination

S 6. Residual contamination from content in the filter beds, which were historically present 100m to the north of the site and are present directly to the south of the site (elevated concentrations of metals, metalloids, inorganic and organic contaminants, micro-organisms

such as faecal coliforms and ground gases (carbon dioxide, methane and/or hydrogen sulphide);

S 7. Storage, spillage, leakage and disposal of chemicals used in water treatment works (chlorine and flocculating agents (generally aluminium sulphate of iron sulphate), acids and alkali (sulphuric acid and sodium hydroxide))

S 8. Migratory ground gases (carbon dioxide and methane) from alluvium south of the site.

3.3.2 Potential pathways

The following potential pathways have been identified.

P 1. Humans: ingestion, skin contact, inhalation of dust and outdoor air.

P 2. Buildings: methane ingress via permeable gravels and/or construction gaps.

P 3. Buildings: VOC and petroleum hydrocarbon vapour ingress via permeable soils and/or construction gaps.

P 4. Plant life: root uptake.

P 5. Underlying groundwater: migration of contaminant into the Kempton Park Gravel Member principal aquifer.

P 6. Surface water: overland flow.

3.3.3 Potential receptors

The following potential receptors in relation to the proposed land use have been identified.

R 1. Humans (neighbours, site end users).

R 2. Development end use (buildings, utilities and landscaping).

R 3. Groundwater: Principal aquifer status of the Kempton Park Gravel Member.

R 4. Surface Water: filter beds, water reservoir and the River Thames south of the site.

An assessment of the Source-Pathway-Receptor linkages has been undertaken and is presented in Appendix F (Table F.2) and the conclusions of the assessment are discussed in Section 4.

Health and safety risks to site Contractors and maintenance workers have not been assessed during these works and will need to be considered separately.

A summary of the plausible linkages is presented on the Preliminary Conceptual Site Model provided in Appendix A (Hydrock Drawing 12193-HYD-XX-XX-DR-G-1002).

4. DESK STUDY CONCLUSIONS

4.1 Geotechnical conclusions

The following plausible geotechnical risks are identified.

- Variable Made Ground - settlement or differential settlement of foundations, floor slabs, roads and infrastructure elements.
- Low strength, compressible ground – risk of shear failure and excessive settlement of foundations, roads and infrastructure elements.
- Excessive loading of existing foundations by adding new storeys to current buildings - risk of shear failure and unacceptable settlement of foundations.
- Attack of buried concrete by aggressive ground conditions – the development site may contain Made Ground and potentially sulfate bearing soils.
- Shrinkage/swelling of clay – settlement/heave of foundations, especially where located within the influence of trees and vegetation.
- Loose Made Ground and shallow groundwater, leading to difficulty with excavation due to trench instability.
- Potential for buried obstructions from former buildings, and buried water pipes, tanks, drains, and other pipes and culverts– risk of unacceptable total/differential settlements due to voiding or hard spots and risk of instability of excavations with the impact on construction staff, vehicles and plant operators.
- Potential for unforeseen ground conditions and the risks associated with limited data.

These plausible risks require further investigation and assessment (see Section 6).

4.2 Geo-environmental conclusions

Based on historical and current land uses and in accordance with the processes set out in Appendix G:

- It is considered that it is unlikely that the site would be classified as Contaminated Land under Part 2A of the EPA 1990.
- The overall risk from land contamination at the site is considered to be low for the current development, as it is covered by hard standing or buildings limiting the possibility of contact with the soils, as well as the risk of significant rainwater infiltration leading to leaching.
- The overall risk for a redeveloped site (based on a residential with or without plant uptake) is assessed to be moderate, but this would need to be confirmed by appropriate intrusive investigation, testing and assessment of the results of the investigation.

The possible pollutant linkages (for risk levels of moderate or greater) on an un-remediated redeveloped site, as determined by the desk study and walk-over, are summarised in Table 4.1:

Table 4.1: Possible Pollutant Linkages (for Risk Levels of Moderate or Greater)

Source(s)	◄ potential Impact on ►	Receptor(s)
Hydrocarbon fuels, lubricants and solvents (metals, hydrocarbons, solvents, degreasers, etc.) from the operation of the historic plant on the site including leakages from the steam engines, pipework between tanks, underground storage tanks and pumps, and general spillage, together with uncontrolled disposal and spillage from waste receptacles (oil drums and chemical containers).		Site users Neighbours Groundwater
Metals, metalloids, PAH, petroleum hydrocarbons and asbestos in Made Ground below the site.		
Ground gases (carbon dioxide and methane) from Made Ground and peat within the natural ground beneath the site and possibly migrating from nearby alluvial deposits.		Site Users Buildings
Hydrocarbon vapours from potential VOC and petroleum hydrocarbon spillages/leaks.		Site users Neighbours Groundwater
Buildings (asbestos). Asbestos / ACM in the ground		Contractors and end Site Users
The historic use of chemicals such as chlorine and flocculating agents (generally aluminium sulphate of iron sulphate), the use of acids and alkali (sulphuric acid and sodium hydroxide).		Site users Neighbours Groundwater

These possible pollutant linkages require further investigation and assessment (see Section 6).

5. UNCERTAINTIES AND LIMITATIONS

5.1 Site-specific comments

Access to internal parts of the existing buildings was not possible. An updated walkover will be required when access is possible to determine if there are any additional potential contaminant sources inside buildings that have not been identified to date.

5.2 General comments

Hydrock Consultants Limited (Hydrock) has prepared this report under the terms of appointment for Hydrock. Hydrock shall not be responsible for any use of the report or its contents for any purpose other than that for which it was prepared and provided.

This report details the findings of work carried out in June 2019. The report has been prepared by Hydrock on the basis of available information obtained during the study period. Although every reasonable effort has been made to gather all relevant information, not all potential environmental constraints or liabilities associated with the site may have been revealed.

Information provided by third parties has been used in good faith and is taken at face value. However, Hydrock cannot guarantee its accuracy or completeness.

Where the existing report(s) prepared by others have been provided by the Client, it is assumed that these have been either commissioned by the Client, or can be assigned to the Client, and can be relied upon by Hydrock. Should this not be the case Hydrock should be informed immediately as additional work may be required. Hydrock is not responsible for any factual errors or omissions in the supplied data, or for the opinions and recommendations of others. It is possible that the conditions described may have since changed through natural processes or recent activities.

The work has been carried out in general accordance with recognised best practice. The various methodologies used are referenced in Appendix G.

Where the phrase 'suitable for use' is used in this report, it is in keeping with the terminology used in planning control and does not imply any specific warranty or guarantee offered by Hydrock.

Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance.

Please note that notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials or invasive weeds, this report does not constitute a formal survey of these potential hazards and specialist advice should be sought.

Whilst the preliminary risk assessment process has identified potential risks to construction workers, consideration of occupational health and safety issues is beyond the scope of this report.

Any site boundary line depicted on plans does not imply legal ownership of land.

6. RECOMMENDATIONS FOR FURTHER WORK

6.1 Ground investigation objectives

In order to confirm the actual risks to receptors and confirm the ground conditions with respect to potential geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken. This investigation will need to:

- undertake a UXO desk study prior to any ground investigation or breaking ground.
- undertake appropriate services searches (potentially including GPR services survey) prior to any ground investigation or breaking ground.
- determine the depth and distribution of Made Ground and natural strata across the site;
- determine the design of the foundations to the existing buildings (depths / widths / type), so that an assessment can be made of their ability to carry new loads without unacceptable settlement, and to assist in design of remedial measures or new foundations where necessary.
- If new loads cannot be carried on the old foundations, it may be necessary to undertake deeper investigation to allow design of piled foundations.
- determine the soil strength/density profile beneath the site;
- determine the depth/level of groundwater beneath the site;
- determine the ground gas concentrations and generation rates beneath the site;
- determine CBRs to assist with pavement design;
- assess trench stability, over break potential and 'diggability';
- allow soil infiltration rate testing for feasibility of sustainable drainage including soakaways;
- allow sampling for chemical and geotechnical laboratory testing;
- allow soil classification to allow geotechnical characterisation and determine suitability for reuse of soils within earthworks;
- obtain information in terms of Aggressive Chemical Environment for Concrete Class (ACEC Class).

Following investigation, assessment will be required to:

- update the Ground Model;
- update the Geotechnical Risk Register;
- provide Geotechnical Design recommendations;
- update the Conceptual Site Model (CSM), including identification of plausible pollution linkages;
- undertake generic quantitative risk assessment of potential chemical contaminants to establish 'suitability for use' under the current planning regime;
- discuss potential environmental liabilities associated with land contamination (soil, water and gas); and
- provide outline mitigation recommendations to ensure the site is 'suitable for use'.
- If ground source heating is proposed, a new scope of desk study and intrusive investigation and monitoring will be required.

6.2 Proposed scope and rationale for Phase 2 investigation works

Based on the current data, and subject to constraints from limited access and buried services, preliminary Phase 2 intrusive site investigation is recommended to comprise the following as a minimum:

- the excavation of 7 trial pits to allow collection of samples for geotechnical and chemical analysis, to assess trench stability, over break potential and 'diggability' and allow soil infiltration rate testing to be undertaken;
- the undertaking of soil infiltration rate tests at an appropriate location to be agreed with the project designer;
- 3 cable percussive boreholes to allow collection of samples for geotechnical and chemical analysis of deeper soils (up to approximately 20m bgl), and allow *In situ* testing (SPTs) to be undertaken to determine the strength of the clay and assess density of the sands and gravel, and allow the installation of gas and groundwater monitoring wells;
- If piling is required, further boreholes to 30m or more may be required.
- 6 TRL Dynamic Cone Penetration tests to determine CBRs for pavement design;
- gas and groundwater monitoring installations to allow gas concentrations and groundwater levels to be monitored;
- 9 rounds of gas concentration and groundwater level monitoring over a minimum 6-month period in accordance with CIRIA C655 (as the development is considered to be of moderate sensitivity with a moderate gas generation potential);
- geotechnical testing of soils; and
- contamination analyses of soil and groundwater.

Access to the site will be restricted by the existing buildings and infrastructure. Therefore, a phased investigation may be required.

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Appendix A

Drawings

Appendix B

Field Reconnaissance Photographs

Appendix C

Historical Ordnance Survey Maps

Appendix D

Desk Study Research Information

Envirocheck

Database Report

Zetica UXB Risk Map

Appendix E

Preliminary Geotechnical Risk Register

Geotechnical Hazard Identification – Desk Study Stage

Potential geotechnical hazards have been assessed in accordance with the general requirements of ICE/DETR Document 'Managing Geotechnical Risk' and the HE documents HD 41/15 and HD 22/08. The following pages set out the identified geotechnical risks and hazards which are associated with the proposed development and establish the approach which is to be taken to manage the risks including the geotechnical input and analysis.

Table E.1 is a preliminary assessment of possible geotechnical hazards at the site at Desk Study stage. This information is used to assist with site investigation design.

Table E.1: Possible geotechnical hazards

Hazard	Comment	Hazard status based on desk study (subject to final proposals)	
		Could be present and / or affect site (i.e. Plausible)	Unlikely to be present and/or affect site
Uncontrolled Made Ground (variable strength and compressibility).	Made Ground expected on site.	✓	-
Soft / loose compressible ground (low strength and high settlement potential).	Variable Made Ground expected on site.	✓	
Insufficient bearing capacity of ground for existing foundations after additional loading by construction of new storeys on top of existing buildings (where applicable)	-	✓	
Shrink swell of the clay fraction of soils under the influence of vegetation.	London Clay expected below Made Ground and superficial sands and gravels.	✓	
Variable lateral and vertical changes in ground conditions.	Variable thickness of Made Ground expected on site.	✓	
Elevated sulfates present in the soils.	Potential for sulphates in Made Ground and natural soils.	✓	
Adverse chemical ground conditions, (e.g. expansive slag).	-	✓	
Obstructions.	Risk of unacceptable total/differential settlements due to voiding or hard spots and risk of instability of excavations with the impact on construction staff, vehicles and plant operators.	✓	
Existing below ground structures to remain (gantry rails, foundations, buried slabs, and/or infilled cellars).		✓	
High groundwater.	Potential for groundwater flooding on site.	✓	
Changing groundwater conditions.		✓	
Risk from erosion.	-		✓
Risk from flooding.	Potential for groundwater flooding on site.	✓	
Loose Made Ground, leading to difficulty with excavation and collapse of side walls.	Associated with the presence of Made Ground	✓	

Hazard	Comment	Hazard status based on desk study (subject to final proposals)	
		Could be present and / or affect site (i.e. Plausible)	Unlikely to be present and/or affect site
	and natural sands and gravels.		
Slope stability issues – general slopes.	-		✓
Slope stability issues – retaining walls.	-		✓
Slope stability issues – to adjacent filter beds.		✓	
Earthworks – settlement (due to placement of fill on soft / loose ground).	-		✓
Earthworks – poor bearing capacity of new fill.	-		✓
Earthworks – unsuitability of site won material to be reused as fill.	-		✓
Solution features in Chalk.	-		✓
Cavities in the Superficial Deposits due to solution features.	-		✓
Dissolution (associated with “wet rock head”).	-		✓
Brine extraction.	-		✓
Mining.	-		✓
Cambered ground with gulls possibly present.	-		✓
Relict Slip Surfaces.	-		✓
Solifluction.	-		✓
Problematic soils (silts and rewetting etc.).	-		✓

Appendix F

Plausible Source-Pathway-Receptor Contaminant Linkages

Summary of Potential Contaminant Linkages

Table F.2 lists the plausible contaminant linkages which have been identified. These are considered as potentially unacceptable risks in line with guidelines published in CLR 11 and additional risk assessment is required.

Source – Pathway – Receptor Linkages have been assessed in general accordance with guidance in CIRIA Report C552 (Rudland et al 2001) but with the addition of a 'no linkage' category (See Table F.1). More details are given in the relevant Hydrock methodology, referenced in Appendix G, including descriptions of typical examples of probability and consequences.

It should be noted that whilst the risk assessment process undertaken in this report may identify potential risks to site demolition and redevelopment workers, consideration of occupational health and safety issues is beyond the scope of this report and need to be considered separately in the Construction Phase Health and Safety Plan.

Table F.1: Consequence versus probability assessment.

		Consequence			
Probability		Severe	Medium	Mild	Minor
	High Likelihood	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Low risk	Very low risk
	Low Likelihood	Moderate risk	Low risk	Low risk	Very low risk
	Unlikely	Low risk	Very low risk	Very low risk	Very low risk
	No Linkage	No risk			

Table F.2: Exposure model – preliminary risk assessment of source-pathway-receptor contaminant linkages

Sources	Possible Pathways	Receptors	Probability	Consequence	Risk Level	Comments
Made Ground material due to former use of buildings – contamination may include metals, metalloids, asbestos, PAH, petroleum hydrocarbons, chlorine, flocculating agents, acid's, alkali's.	Ingestion, inhalation or direct contact.	Site users.	Likely	Severe	High	There is potentially variable Made Ground below the entire site. Further intrusive investigation is required to categorise the potential risks.
	Inhalation of fugitive dust.	Neighbours.	Low likelihood	Severe	Moderate	
	Leaching through unsaturated zone.	Groundwater.	Likely	Medium	Moderate	
	Surface run-off.	Aquatic ecosystems. Surface water and possible abstractors.	Likely	Medium	Moderate	
	Base flow from contaminated groundwater.		Likely	Medium	Moderate	
	Root uptake.	Landscape planting	Likely	Minor	Very Low	Private gardens are not proposed.

Sources	Possible Pathways	Receptors	Probability	Consequence	Risk Level	Comments
Hydrocarbon fuels, chlorine, flocculating agents, acid's, alkali's, lubricants and solvents (metals, hydrocarbons, solvents, degreasers, etc.) from the operation of the historic plant on the site including leakages from the steam engines, pipework between tanks, underground storage tanks and pumps, and general spillage, together with uncontrolled disposal and spillage from waste receptacles (oil drums and chemical containers). Contamination from stored coal, and ash from furnaces of steam-driven pumps and other machinery.	Ingestion, inhalation or direct contact.	Site users.	Likely	Medium	Moderate	In addition to the industrial nature of the site which includes plant and rail lines chemical storage, there is visual evidence of contamination staining on site along with waste barrels and containers. Further intrusive investigation is recommended.
	Vapours.	Neighbours.				
	Leaching through unsaturated zone.	Groundwater and possible abstractors.	Likely	Medium	Moderate	
	Direct contact	Water supply pipes.				
Ground gases (carbon dioxide and methane) from organic materials in the Made Ground and natural ground beneath the site and possibly migrating from nearby alluvial deposits.	Migration, build up and asphyxiation.	Site users.	Likely	Medium to Severe	Moderate to High	There is potentially variable Made Ground and the potential for organic material within the natural deposits below the entire site. Gas monitoring is required to categorise the potential risks.
		Neighbours.				
		Buildings on site.				
		Buildings on adjacent sites.				

Sources	Possible Pathways	Receptors	Probability	Consequence	Risk Level	Comments
Asbestos fibres within soils from insulation or asbestos-containing materials in the buildings.	Fugitive dust.	Site users.	Likely	Severe	High	Asbestos may be present in Made Ground. Further assessment is required to quantify the long-term risk to future site users.
		Neighbours.	Unlikely	Severe	Low	Dust suppression can limit exposure to neighbours during construction.

Appendix G

Hydrock Methodologies

This report has utilised Hydrock Desk Study Template V12.1.

This appendix provides additional background information on certain approaches and methods used by Hydrock Consultants Limited in the preparation of this report.

The following Hydrock Methodologies apply to this report. These are not included, but are available on request by quoting the methodology reference, revision and date.

Reference	Name	Revision	Date
001	Desk Study	001	30/07/2018