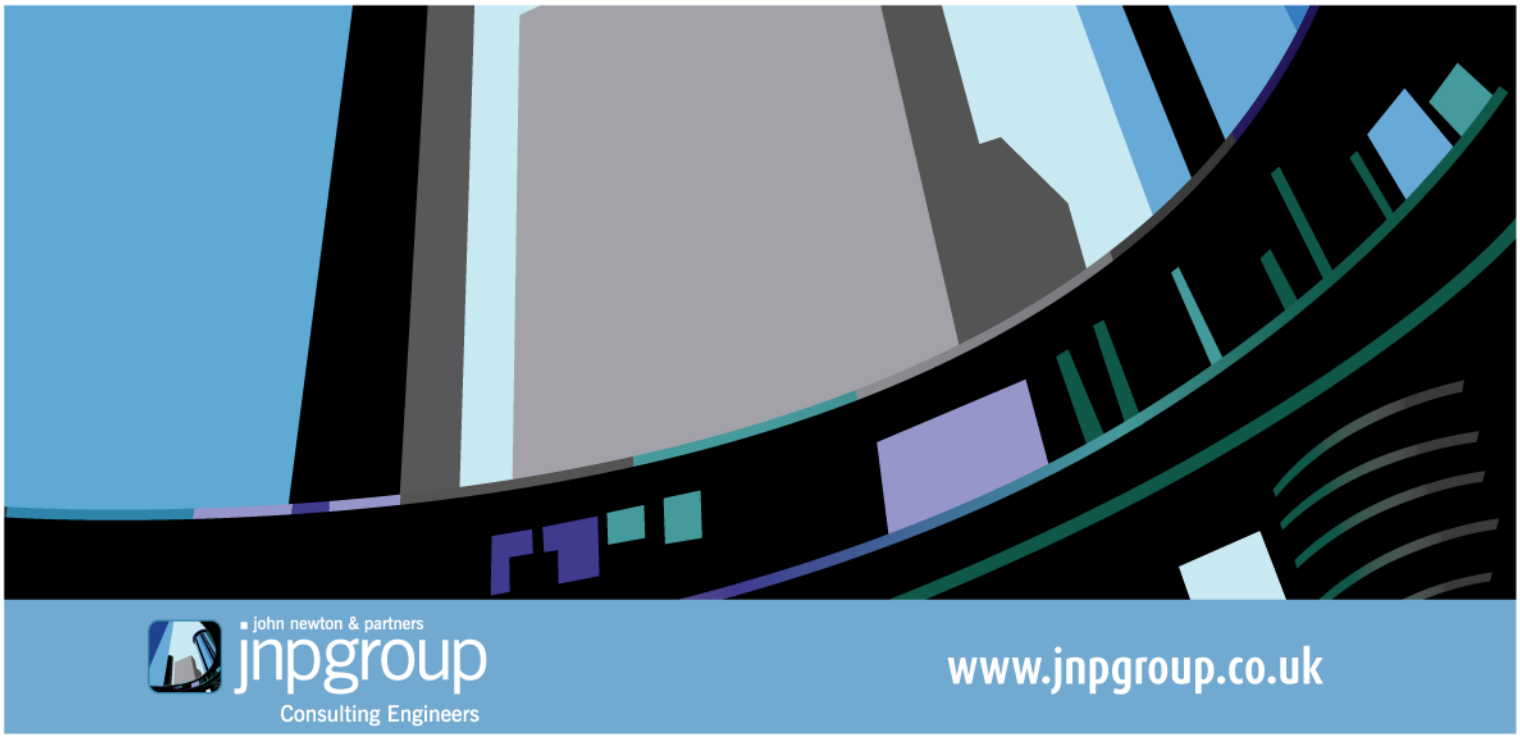

Phase 1 Geo-environmental Desk Study

Project: Dukesbridge House, Reading

Client: Lipman Properties

Reference: C86080-JNP-XX-XX-RP-C-1001-S2 P06

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1 INTRODUCTION

1.1.1 jnpgroup was instructed by the client, Lipman Properties, to undertake a Phase I Geo-environmental Desk Study of Dukesbridge House, Reading (hereafter referred to as 'the site'). This report is subject to the limitations presented in Appendix A.

1.1.2 It is understood that the proposed works comprises a change of use of the building from Class B1(a) (offices) to Class C3 (dwelling houses) to comprise 76 dwellings. Prior Notification under Class O, Part 3 of Schedule 2 of the Town and Country Planning (General Permitted Development) Order 2015.

1.1.3 All comments given are based on the understanding that the proposed redevelopment will be as detailed above.

1.2 Objectives

1.2.1 The purpose of the investigation was to address geotechnical and geo-environmental issues relating to a proposed residential end-use of the site. The scope of work comprised desk study research. This report contains details of the site, development of an initial conceptual model, and a preliminary risk assessment with regard to contaminated land issues.

1.3 Methodology

1.3.1 This report has been compiled in accordance with the guidance given in the Environment Agency / Department of Environment, Food, and Rural Affairs (DEFRA) Contaminated Land Report 11 'Model Procedures for the Management of Land Contamination' (Environment Agency. 2004) and the Environment Agency's three reports entitled 'Guiding Principles for Land Contamination' (Environment Agency. 2010).

2 SITE DESCRIPTION

2.1.1 The site is located between Duke Street and Highbridge Wharf near the centre of Reading as shown in Figure 1. The centre of the site is located at National Grid Reference 471785, 173341. The site covers an area of approximately 0.34 hectares.

2.1.2 The site is situated in the centre of Reading and is bounded to the west by Duke Street to the north by commercial properties which are bounded by Kings Road, and to the east and south by Highbridge Wharf. The River Kennet is present to the south immediately beyond Highbridge Wharf. A range of commercial and retail properties are present beyond the site boundaries in all directions.

2.1.3 The site is currently occupied by Dukesbridge House, a large brick built building up to five stories high which surrounds a paved parking area which is accessed off Highbridge Wharf. Occasional trees and bushes are present around the periphery of the parking areas.

3 GEOLOGY, HYDROLOGY AND HYDROGEOLOGY

3.1 Geology

3.1.1 The geology of the site has been determined by reference to the 1:50,000 scale British Geological Survey (BGS) online Geoindex Tool (http://mapapps2.bgs.ac.uk/geoindex/home.html).

3.1.2 No BGS recorded artificial or Made Ground is indicated to be underlying the site, however, from the aerial imagery viewed hardstanding or buildings are present across the entire site and Made Ground is anticipated to be present.

3.1.3 The superficial geology of the site to be is indicated to be Alluvium, which is described by the BGS as "*Normally soft to firm, consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present*".

3.1.4 The underlying geology is indicated to be the Seaford and Newhaven Chalk Formation, which is described by the BGS as Chalk with flints.

3.1.5 There are no faults denoted within 500 m of the site.

3.1.6 The following table details the risk of geological hazard potential on or underlying the site as identified in the Groundsure Report (included in Appendix B).

Table 3.1: Geological Hazards

Hazard	Risk
Shrinking or swelling clay	Very Low
Landslide ground	Very Low
Ground dissolution	Very Low
Compressible soils	Moderate
Collapsible soils	Negligible
Running sand	Low

3.1.7 Based upon the above, geological hazards are not considered to present a constraint to development.

3.2 BGS Borehole Records

3.2.1 jnpgroup has consulted online borehole records held by the BGS. Numerous borehole records are present within 250m of the site however three boreholes exist within 100m. These boreholes encountered between 1.8m and 3.2m of Made Ground, consisting of brick, glass, tarmac, wood and flint. Underlying the Made Ground in borehole SU77SW342, which is the closest to the river and which is most likely to represent the onsite conditions, Alluvium of silty and sandy clay were recorded to a depth of 4.60m below ground level (bgl). Underlying Alluvium, a chalk and flint gravel and slightly sandy clay, noted as Valley Gravel deposits, are recorded to 6.70m bgl. Underlying the Valley Gravel, Chalk was proven to a depth of 30.0m.

3.3 Background Soil Chemical Concentrations

3.3.1 The Groundsure Report (Appendix B) provides an indication to the background concentrations of a number of metallic contaminants commonly recorded in soils:

- arsenic 15 – 25 mg/kg;
- cadmium < 1.8 mg/kg;
- chromium 60 - 90 mg/kg;
- lead <100 mg/kg;
- nickel 15 – 30 mg/kg

3.3.2 In addition, the UK Soil Observatory map viewer (http://www.ukso.org/mapViewer.html) provides an indication to the background concentrations of a number of metallic contaminants commonly recorded in soils:

- arsenic 20 mg/kg;
- cadmium 0.5 mg/kg;
- chromium 69 mg/kg;
- copper 37 mg/kg
- lead 128 mg/kg;
- nickel 27 mg/kg;
- zinc 140 mg/kg

3.3.3 Therefore, naturally elevated concentrations of metals are not anticipated at the site or in close proximity.

3.4 Ground Workings, Mining History and Natural Cavities

- There are 8 No records of historic surface ground workings within 100m of the site and these are all related to the construction of the adjacent canal and associated Wharfs.
- No historical underground workings have been identified within 1 km of the site;
- No current ground workings have been identified within 750m of the site;
- No coal mining has bene identified within 1 km of the site;
- Non-coal mining for chalk may have occurred within 20m to 260m of the site. These occurrences are reported to be either localised (unlikely) or infrequent (rare).
- There are three non-coal mining cavities located within 500m of the site, the nearest of which is 413m to the south in the Taplow Gravel;
- There are three natural cavities located within 250m of the site with the nearest recorded 191m to the west of the site and are recorded as a solution pipe;
- No brine or gypsum extraction has been identified within 1 km of the site;
- No tin or clay mining areas have been identified within 1 km of the site.

3.5 Hydrology

3.5.1 The nearest surface water features to the site are the Holy Brook, which is situated 6m to the north of the site, and the River Kennet, which is situated 6m to the south of the site; both flow to the east. The Holy Brook appears to be culverted at this location and is not visible on aerial imagery.

3.5.2 River quality data indicates that the nearest section of the River Kennet recorded a chemical General Quality Assessment (GQA) of B (Good) in 2005, and a chemical GQA of A (Very Good) from 2006 to 2009.

3.5.3 The site lies in an area considered by the Environment Agency to be at a medium risk of fluvial flooding.

3.5.4 There are two current surface water abstraction licences with 1km of the site the nearest of which is situated 236m south west (upstream) of the site and is associated with the Oracle Shopping Centre.

3.6 Hydrogeology

3.6.1 The Aquifer Maps contained in the Groundsure Report indicates that the Alluvium underlying the site are recorded as a Secondary A Aquifer. The underlying Chalk is recorded as a Principal Aquifer.

3.6.2 The Environment Agency define a Principal Aquifer as:

"These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer."

3.6.3 The Environment Agency define a Secondary-A Aquifer as:

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

3.6.4 The overlying soils are classified as having a high leaching potential, although this is uncertain, as a worst-case vulnerability classification is assumed by the Environment Agency (EA) for urban areas.

3.6.5 The Groundsure Report lists three groundwater water abstractions within 1km of the site. The nearest current groundwater abstraction is located 554m to the south of the site and is registered to the Primark Store.

3.6.6 There are two current potable water abstraction licences within 1km of the site, the nearest of which is located 554m to the south of the site and is registered to the Primark Store.

3.6.7 The site's proximity to groundwater Source Protection Zones (SPZs) was determined by reference to the Environment Agency's website. These zones show the risk of contamination from any activities that might cause pollution in the area, with the closer the activity, the greater the associated risk. The maps show three main zones (inner, outer and total catchment) to a groundwater source.

3.6.8 The site lies approximately 325 m to the south west of a Zone III (Total Catchment) Source Protection Zone.

3.6.9 The definition of a SPZ III is:

'The area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is > 0.75.'

4 SITE HISTORY

4.1.1 The history of the site and the surrounding area has been determined from historical map extracts. Copies of these extracts are included in Appendix C. The historical land uses on site and in close proximity to the site are summarised in the following table:

Table 4.1: Site History Summary

Date	On-site Historical Land Use	Off-site Historical Land Use
1879	The site is shown to be occupied by a number of different buildings which cover the majority of the site.	The River Kennet is shown directly to the south of the site. Beyond the site, in all directions, numerous roads and buildings are present. The building usage is varied and includes a mix of residential, commercial and industrial premises. A steam saw mill is present 90m to the south east with a Lead and Zinc Works and Brewery shown beyond. 160m to the south west, a gas works and an Iron and Brass foundry are recorded. 150m to the north east, a saw mill and timber yard are also recorded.
1900	Site buildings remain the same as previously, however the fire insurance plans from 1895 indicates that the buildings on site are recorded as the following uses: Cabinet Factory, Stables, Smithy, Stores (various) and a Tallow Chandlers.	The saw mill with the Lead and Zinc Works 90m to the south east are no longer recorded.
1912	No changes.	Tramway shown along Duke Street and King Street.
1931	No changes.	Gas works and foundry to the south west no-longer shown.
1956	Building layout remains the same however a Dance Hall is labelled on the site.	There is continued re-development of the buildings beyond the site boundary.
1962	A building on the southern boundary of the site, adjacent to Highbridge Wharf, is no-longer shown.	As above
1979	Buildings on the northern third of the site are no longer shown.	As above
1986 to Present	The buildings on site have been altered to meet the current configuration, with Dukesbridge Court labelled in the centre of the site. An electric substation is labelled on the south east corner of the site.	As above

4.2 Site History Summary

4.2.1 The site and surrounds were shown to be heavily developed on the earliest available maps. The site usage appeared to have been mainly commercial and small industrial works until 1986 when the site was redeveloped with commercial and office units in its current configuration.

4.2.2 The surrounding area was heavily urbanised and appears to have undergone continuous redevelopment up until the present day. Historically the surrounding area was a mix of commercial, residential and industrial properties with a Gas Works, Iron and Brass Foundry, numerous Saw Mills and a Lead and Zinc works shown within 250m of the site.

5 INFORMATION HELD BY STATUTORY AUTHORITIES

5.1.1 This section details any relevant information held in the registers maintained by statutory bodies as identified in the Groundsure Report (Appendix B).

5.2 Waste Management Facilities

5.2.1 The Groundsure Report identifies one licensed waste management facilities located within 1 km of the site as follow:

- Hopkins Recycling Limited located approximately 564 m to the east of the site. The site is used for recycling household, commercial and industrial waste.

5.2.2 There are no landfills recorded within 1km of the site.

5.3 Historic IPC, IPPC Part A and B Activities and Enforcements

5.3.1 The Groundsure Report indicates that:

- There are no historic IPC authorisations within 500 m of the study site;
- There are no Part A (1) and IPPC authorised activities within 1 km of the site;
- There are no Part A (2) and Part B activity and enforcements within 500 m of the site.

5.4 Pollution Incidents to Controlled Waters

5.4.1 Records held by the Environment Agency identified twelve pollution incidents to controlled waters within 500m of the site. With the exception of one incident recorded 44m to the north east of the site, which was recorded as a Category 2 significant water impact due to diesel, all the rest were recorded as minor or no impact.

5.5 Discharge Consents

5.5.1 The Groundsure Report identifies sixteen licensed discharge consents within 500m of the site however the status for all is recorded as revoked.

5.6 Fuel Sites

5.6.1 The Groundsure Report identifies no active fuel station entries within 500 m of the site.

5.7 Historical and Contemporary Industrial Data

5.7.1 The Groundsure Report identifies twenty-three potentially contaminative industrial sites within 250 m of the site. The nearest are summarised as follows:

- An electricity substation located on site and a further four present within 100m of the site.
- Lincoln Maritime Ltd located at 21 Duke Street and noted as on site, categorised as transport storage and delivery.
- Biotechnica Services Ltd recorded 4m north of the site and categorised as industrial products.

5.8 Radon

5.8.1 The Groundsure Report states that the Health Protection Agency identified less than 1% of homes above the action level. The British Geological Survey Information Services Group indicates that no radon protection measures are necessary.

5.8.2 Reference to BRE211 'Radon: guidance on protective measures for new dwellings' indicates that the site does not lie within an area where geological information indicates that basic radon protection may be required. Therefore no radon protection measures are considered necessary.

5.9 Environmentally Sensitive Areas

5.9.1 The sensitive land use map within the Groundsure Report indicates that the site is not within any environmentally sensitive areas.

6 UK CONTAMINATED LAND LEGISLATIVE FRAMEWORK

6.1 Legislation on Contaminated Land

6.1.1 Given that the site is being assessed with the potential for future development, the most applicable appraisal relates to the requirements of the Planning Regime as described in the National Planning Policy Framework. In order to proceed with an assessment of contamination issues it is essential that there is compliance with UK guidance as detailed within reports published by the Environment Agency 'Model Procedures for the Management of Land Contamination' (Environment Agency, 2004), and 'Guiding Principles for Land Contamination' (Environment Agency, 2010).

6.1.2 Part IIA of the Environmental Protection Act, 1990, which was enacted by Section 57 of the Environment Act 1995, and the associated Contaminated Land (England) Regulations 2000 (SI 2000/227), was introduced on 1 April 2000. It created a new statutory regime for the identification and remediation of land where contamination poses an unacceptable risk to human health and the environment. The guidance was subject to a review by DEFRA in 2012, and a revision was published.

6.1.3 Part IIA provides a statutory definition of contaminated land:

"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 a significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused".

6.1.4 Controlled waters are considered to be all groundwaters, inland surface waters, and estuarine and coastal waters.

6.1.5 To determine whether land falls under the Part IIA definition of contaminated land, the site should be evaluated in the context of a risk based framework. The assessment of contaminated land is typically a two-phase process, which is initially based on a qualitative assessment of the likelihood of complete pollution linkages, with a quantitative element that seeks to determine the degree and the significance of the harm. Land is only defined as 'Contaminated Land' if a "significant pollutant linkage" is present.

6.1.6 A pollutant linkage must comprise the following:

Source - a contaminant at a concentration capable of causing adverse health or environmental effects.

Receptor - there must be a receptor (e.g. human, controlled waters, ecological, or property) present, which may be at risk of harm or impact from the source.

Pathway - there must be an exposure pathway through which the receptor comes into contact with the contamination source.

6.1.7 Each of these elements can exist independently, but they create risk only when they are linked together, so that a particular contaminant affects a particular receptor, through a particular pathway.

6.1.8 The responsible authority then needs to consider whether the identified pollution linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage;
- presents a significant possibility of significant harm being caused to that receptor;
- is resulting in the pollution of controlled waters, which constitute the receptor; or is likely to result in such pollution.

6.1.9 If a pollutant linkage is demonstrated, then the Part IIA legislation provides powers for remedial action to be enforced by the Local Authority in whose area the contaminated land is situated.

6.1.10 In addition, jnpgroup has undertaken a preliminary risk assessment based on the **probability** of receptor exposure to the identified source and the **consequences** of such exposure.

6.1.11 **Risk management**, which can include site surfacing, formal management systems, legal requirements; is then considered to provide an overall residual risk. The categories of environmental risk used by jnpgroup are given in Table 6.1 that follows.

Table 6.1: Risk Matrix

Environmental Risks		
HIGH		Issues within this category likely to provide a significant cost or liability. Further detailed investigation may be required to clarify the risk.
MEDIUM		It is possible that issues within this category may provide a cost or liability. Further investigation may be required to clarify the risk.
LOW		It is unlikely that issues within this category will provide a significant cost or liability. Basic investigation may be required to clarify the risk.
NONE		No source – pathway – receptor linkage present.

7 CONCEPTUAL MODEL AND PRELIMINARY RISK ASSESSMENT

7.1 General

7.1.1 This section uses information from desk-based sources to provide a conceptual model and qualitative assessment of the potential risks posed to human health and environmental receptors from potential on-site and off-site sources of contamination. The assessment is presented as a 'source-pathway-receptor' model in accordance with Part IIA of the Environmental Protection Act 1990.

7.1.2 The conceptual model has been developed assuming the site development comprises a change of use of the building from Class B1(a) (offices) to Class C3 (dwelling houses) to comprise 76 dwellings. It is assumed that there will not be private residential gardens at this stage.

7.2 Potential Sources of Contamination

Potential On-site Sources of Contamination

- The site is shown as developed on the earliest available map with a number of buildings shown across the site. The historical fire insurance plans show that in 1895, the buildings on site had a range of uses including a factory, stables, smithy and candle makers. More recently the site was utilised as commercial cabinet and office premises.
- Heavy metals, Volatile Organic Compounds, Semi Volatile Organic Compounds hydrocarbons, asbestos and soil gas associated with a potentially significant depth of Made Ground may be present as a result of previous phases of development including imported and site generated fill materials.
- In accordance with C733 guidance, any structure built, refurbished or modified during the Twentieth Century has the potential to contain asbestos containing materials (ACM). In addition, any demolition material either stockpiled or used as backfill on site also has the potential to contain asbestos containing materials (intact or broken up).

Potential Off-Site Sources of Contamination

- Historical land use within 200m of the site included residential, commercial and industrial premises. The industrial processes include a Gas Works, Timber Yard, Iron and Brass Foundry and a Lead and Zinc works. The closest of these industries is 90mto the south east and is unlikely to have led to significant contamination of the site.

7.3 Receptors

7.3.1 The site development comprises a change of use of the building from Class B1(a) (offices) to Class C3 (dwelling houses) to comprise 76 dwellings. Based on the current proposals, the primary receptors considered to be potentially at risk from any identified contamination are as follows:

Human Health

- Construction workers during the redevelopment phase;
- Residential end users.

Controlled Waters

- The Alluvium beneath the site is classified as a Secondary-A Aquifer overlying a Principal Chalk aquifer. Jnpgroup consider groundwater to be a sensitive receptor;
- The nearest controlled surface waters are the Holy Brook and the River Kennet which are situated 6m to the north and south respectively. jnpgroup consider these both to be sensitive receptors.

Ecological

- The site is not located within an environmentally designated sensitive area;
- Given the site setting, sensitive species are considered unlikely to be present at the site (subject to any ecological survey undertaken).

Property

- Concrete sulphate attack;
- Build-up of gases with potential for explosion.

7.4 Pathways

7.4.1 Potential contaminant migration pathways considered relevant to the site are:

Human Health

- Ingestion of contaminated soils and dust particles;
- Direct physical contact with near surface soils and contaminated dust particles;
- Inhalation of wind-blown contaminated dust;
- Inhalation of vapours and gases, migrating vertically into the atmosphere;
- Inhalation of vapours and gases, migrating into buildings and confined spaces;

Infrastructure

- Water supply pipework.

Controlled Waters

- Leaching of contaminants in Made Ground;
- Lateral migration of contaminated groundwater into the River Kennet or Holy Brook.
- Vertical migration of contaminated shallow groundwater impacting deeper groundwater in the aquifer sequence;
- Run-off of site-derived contamination into the River Kennet and Holy Brook during construction.

Ecological

- Migration of contamination through groundwater and subsequent uptake by plant roots;
- Direct contact between ecological receptors and contaminated surface water;
- Direct contact between ecological receptors and contaminated soils;
- Ingestion of contaminated soils/surface waters by ecological receptors;
- Inhalation of vapours or wind-blown dust by ecological receptors.

7.5 Pollutant Linkages

7.5.1 A 'pollutant linkage' describes the relationship between a contaminant, a pathway and a receptor, a 'pollutant' being the contaminant in a pollutant linkage. A contaminant, pathway and receptor must all be present for a pollutant linkage to exist, which forms the basis for determination that a piece of land is Contaminated Land. Potential sources, pathways and receptors have been assessed. The following table summarises the significant pollutant linkages potentially active at the site.

Table 7.1: Potential Source-Pathway-Receptor Linkages for Human Health Risk Assessment

Source	Pathway	Receptor
Contaminated soils	Dermal contact	On site female child: 0 - 6 yrs old
		On site construction worker
	Dermal contact with household dust	On site female child: 0 - 6 yrs old
	Inhalation of fugitive soil dust	On site construction worker
		On site female child: 0 - 6 yrs old
	Inhalation of fugitive household dust	On site female child: 0 - 6 yrs old
	Inhalation of vapours in outdoor air	On site female child: 0 - 6 yrs old
		On site construction worker
	Inhalation of vapours in indoor air	On site female child: 0 - 6 yrs old
	Contact with contaminated soils	Water supply pipework
Ground Gas	Vertical and Lateral Migration	End Users
		Residential Housing
		Services and Infrastructure

Table 7.2: Source Pathway Receptor Linkages for Controlled Waters Risk Assessment

Source	Pathway	Receptor
Contaminated soils	Leaching Mechanisms	Groundwater stored in the Alluvium and Seaford and Newhaven Chalk Formation
	Runoff during construction works	River Kennett and Holy Brook
Contaminated groundwater	Vertical migration	Groundwater stored in the Alluvium Seaford and Newhaven Chalk Formation
Contaminated groundwater	Lateral and vertical migration (baseflow)	River Kennett and Holy Brook

7.6 Preliminary Risk Assessment

7.6.1 From the information obtained from the desk study jnpgroup has undertaken a preliminary risk assessment.

Table 7.3: Preliminary Risk Assessment

Issue	Risk		Justification
HUMAN HEALTH	MEDIUM		Historic land use (various commercial and light industrial units) suggests potential sources of contamination present on site. Potential for direct contact / inhalation of vapours or gases with residential receptors.
GROUNDWATER	HIGH		The site is located on productive strata (Secondary A and Principal Aquifer)
SURFACE WATER	HIGH		The nearest surface watercourses are adjacent to the northern and southern boundary.
ECOLOGY	NONE		Based on the assumption that there are no sensitive/ protected species on site (subject to any ecological survey undertaken).

7.6.2 The conceptual model has been refined and the plausible pollutant linkages evaluated against generic criteria in accordance with joint DEFRA / Environment Agency publication 'Model Procedures for the Management of Land Contamination' (Environment Agency. 2004).

8 PRELIMINARY ENGINEERING ASSESSMENT

8.1 General

8.1.1 The following assessment of the ground conditions expected on site is based solely on the desk study information. It is, therefore, subject to confirmation or otherwise through appropriate intrusive ground investigation.

- Made Ground anticipated to depths of 3 – 5 m metres;
- Alluvium anticipated beneath the Made Ground consisting of soft to firm silt and clay;
- Chalk is anticipated to be encountered at depth of 5 – 10 m bgl;

8.2 Earthworks and Excavations

8.2.1 It is anticipated that excavations should be readily achieved using conventional plant, such as a wheeled backhoe excavator. Pits will likely require shoring to maintain stability due to indicative near-surface ground conditions. All excavations should be carried out in accordance with CIRIA Report 97 "Trenching Practice", 2001. Shallow groundwater is anticipated due to the close proximity of the River Kennett and Holy Brook, therefore it is likely that groundwater may pose an issue for shallow excavations.

8.3 Foundations

8.3.1 The following assessment of the likely foundation types is based solely on the desk study and is therefore subject to confirmation or otherwise through appropriate intrusive ground investigation techniques. The assessment also assumes that ground levels will remain similar to those at present. If this is not the case then some amendments to the recommendations given may be required.

8.3.2 Historical borehole records adjacent to the site indicate that deep Made Ground may be present beneath the site. In addition, it is anticipated that shallow groundwater will be encountered beneath the site. The proposed development comprises modification of the existing building. Should such modifications result in additional loads being applied to the existing foundations, assessment will be required as to the impact of such in terms of bearing capacity and/or settlement. Details of the existing foundations (type, depths, dimensions) and site ground condition may be required, possibly via ground investigation.

8.4 Geotechnical Considerations & Risks

8.4.1 From the desk study review, the geotechnical risks that may affect the final development are considered to be:

- Made Ground anticipated to depths of 3- 5 m bgl across the site.

Due to the variable nature and quality of such ground, it is likely to generate difficulties for excavation, earthworks and foundation construction. The depths and characteristics of Made Ground should be determined and understood to develop suitable foundations and assess any disposal / treatment requirements.

- Instability during excavation

Due to the potential variable nature and quality of Made Ground on site and also the potential for water-bearing granular soils, there is the potential for instability during construction. Support systems during temporary works may be required to prevent collapse of excavations.

- Ground movement resulting from excavation

It is possible that some ground movement could result from excavations representing a risk to the stability of surrounding infrastructure and structures. Consultations with the relevant third parties should be undertaken to ensure an appropriate methodology is adopted which complies with relevant standards and asset owners requirements.

- Chemical attack on structures.

Chemical composition of Made Ground deposits at the site may result in thaumasite attack and degradation of buried concrete at the site. Appropriate soil and groundwater chemical testing should be undertaken to allow determination of an appropriate class of concrete in accordance with the guidance set out in BRE Concrete in Aggressive Ground (2005).

- Buried private and public utilities.

Where utilities are present at the site there remains a risk of damage through utility strikes and the possible requirement to realign utilities to satisfy statutory authority providers. Utilities' information to be obtained prior to the commencement of any ground investigation works followed by appropriate clearance prior to breaking ground.

9 CONCLUSIONS

9.1 Conclusions

9.1.1 The desk study has identified that the geological succession below the site is likely to comprise Made Ground overlying Alluvium with the Seaford and Newhaven Chalk Formation encountered beneath. The site is recorded as occupied from at least the 1870's and is likely to have had a number of contaminative uses as detailed below:

- The historical fire insurance plans show that in 1895 the buildings on site had a range of uses including a cabinet factory, stables, smithy and candle makers. More recently the site was utilised as commercial and office premises.
- Heavy metals, Volatile Organic Compounds, Semi Volatile Organic Compounds, hydrocarbons, asbestos and soil gas associated with a potentially significant depth of Made Ground may be present as a result of previous phases of development including imported and site generated fill materials.

9.1.2 Based on information contained within the desk study, it is the opinion of jnpgroup that the potential site conditions provide a **MEDIUM** environmental risk and dependent on the final development proposal for the site, further investigation and assessment are likely to be required.

9.1.3 In consideration of the existing building and the proposed change of use from offices to residential, given the building is already constructed, the main issue is likely to relate to the potential for generation of hazardous ground gas due to the anticipated presence of deep Made Ground. It is unknown if the existing building has sufficient gas protection measures installed to protect a residential development. Should the ground investigation confirm the presence of ground gas then retro-fitting of gas protection measures are likely to be required.

9.1.4 The nature of the existing foundations also needs to be determined, to enable assessment of the impact of the proposed modifications in terms of bearing capacity and settlement, particularly if any additional loads were to be applied.

9.1.5 For areas of proposed new development, a Phase 2 ground investigation would be required in order to confirm the underlying ground conditions.

9.2 Recommendations

9.2.1 Based on the conclusions from the desk study and the intended redevelopment of the site, jnpgroup recommend that the following intrusive works are undertaken initially:

<u>Change of use only</u>

- Installation of ground gas monitoring wells and a phase of ground gas monitoring for a very low gas generation source with a moderate sensitivity for flats. This would require a minimum of six monitoring visits over a two month period.
- Assessment of additional loads with recommendations for further works (such as investigations to determine existing foundations and ground conditions) if appropriate.

9.2.2 jnpgroup recommend that the scope of the intrusive works is agreed with the Regulatory Authorities as they may have particular requirements that need to be taken into account.

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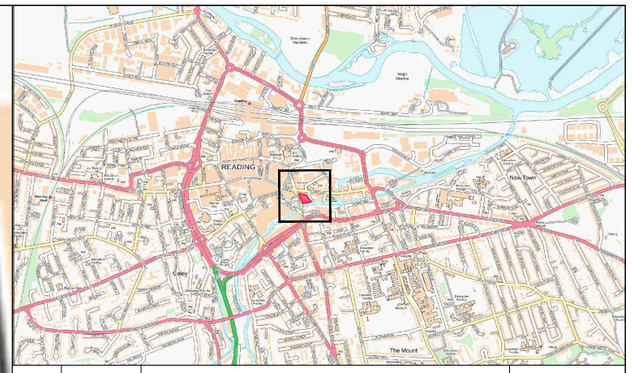
Figures / Drawings



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Appendix A

Limitations

Introduction

This report is confidential and has been prepared solely for the benefit of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from jnpgroup; a charge may be levied against such approval. jnpgroup accepts no responsibility or liability for the consequences of this document being used for any purpose or project other than for which it was commissioned, and: this document to any third party with whom and agreement has not been executed.

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Any deviation from the recommendations or conclusions contained in this report should be referred to jnpgroup in writing for comment and jnpgroup reserve the right to reconsider their recommendations and conclusions contained within. jnpgroup will not accept any liability or responsibility for any changes or deviations from the recommendations noted in this report without prior consultation and our full approval.

The details contained within this report reflect the site conditions prevailing at the time of investigation. jnpgroup warrants the accuracy of this report up to and including that date. Additional information, improved practice or changes in legislation may necessitate this report having to be reviewed in whole or in part after that date. If necessary, this report should be referred back to jnpgroup for re-assessment and, if necessary, re-appraisal.

This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report. Whilst this report and the opinion made herein are correct to the best of jnpgroups' belief, jnpgroup cannot guarantee the accuracy or completeness of any information provided by third parties.

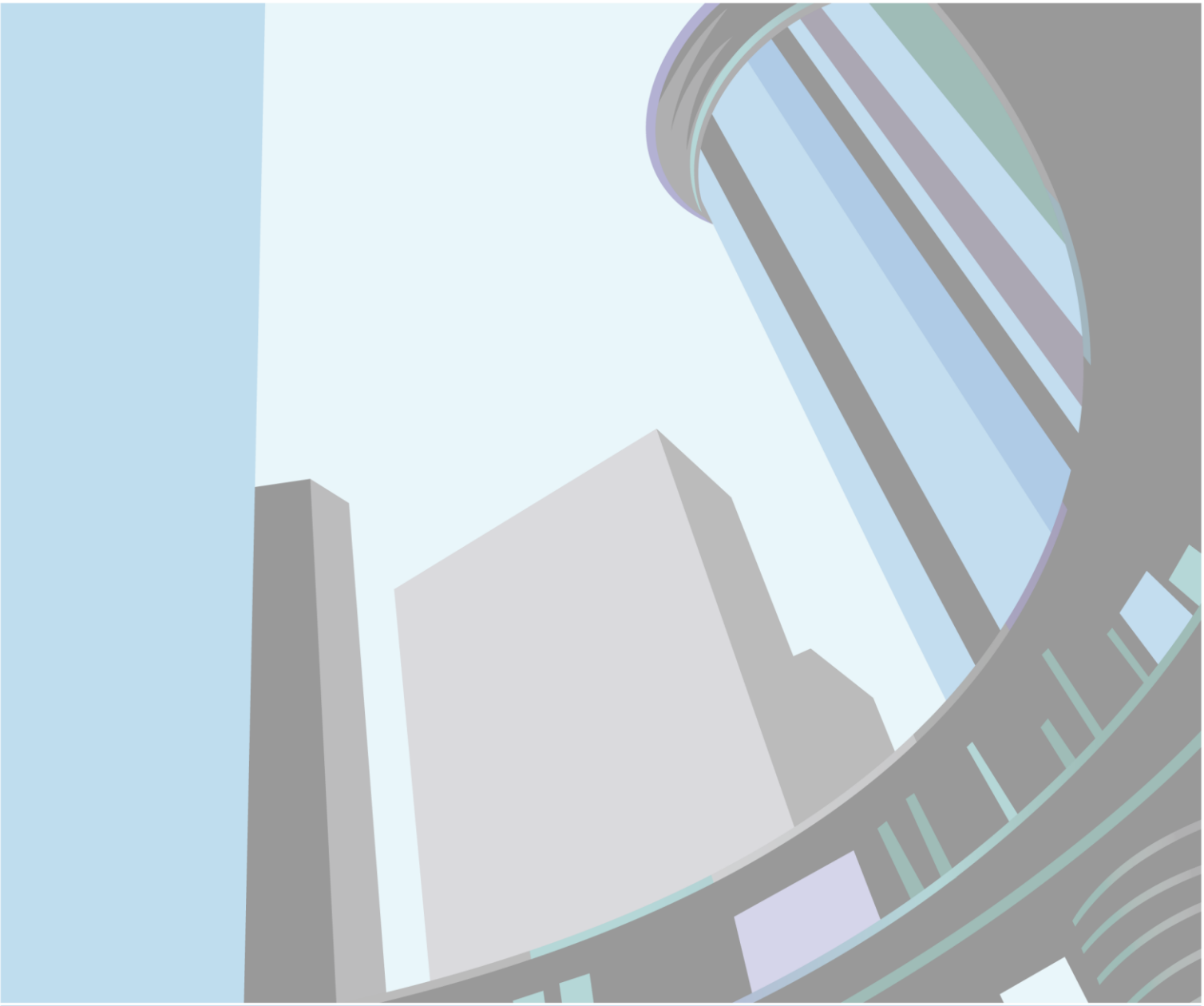
The report represents the finding and opinions of experience geotechnical and geo-environmental engineers. jnpgroup does not provide legal advice and the advice of lawyers may also be required.

It should be noted that the following were not included as part of the agreed scope of works with the client: detailed ecological surveys and assessment; groundwater monitoring and sampling; geotechnical requirements etc.

jnpgroup has provided advice and made recommendations based on the findings of the work undertaken, however this is subject to the approval / acceptance by the relevant Regulatory Authorities.

Objectives

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, jnpgroup reserves the right to review such information and, if warranted, to modify the opinions accordingly. It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.



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