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PHASE I GEO-ENVIRONMENTAL APPRAISAL

for

CASTLE STREET BUILDINGS, WATERHOUSE LANE, HULL, HU1 2DA

Project Reference: JMS/AC/42263/Rp-001 Rev A

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Date: 22nd March 2019

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Date: 22nd March 2019

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A	Minor text and formatting amendments	AC	SLR	21.03.19

For the avoidance of doubt, the parties confirm that these conditions of engagement shall not and the parties do not intend that these conditions of engagement shall confer on any party any rights to enforce any term of this Agreement pursuant of the Contracts (Rights of third Parties) Act 1999.

The Appointment of Alan Wood & Partners shall be governed by and construed in all respects in accordance with the laws of England & Wales and each party submits to the exclusive jurisdiction of the Courts of England & Wales

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42263 / 002	GENERAL SITE FEATURES PLAN

PLATES

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APPENDICES

APPENDIX A:	EMAPSITE: GROUNDSURE GEOINSIGHT REPORT
APPENDIX B:	EMAPSITE: GROUNDSURE ENVIROINSIGHT REPORT
APPENDIX C:	COAL AUTHORITY MINING REPORT
APPENDIX D:	EMAPSITE: HISTORICAL ORDNANCE SURVEY PLANS

EXECUTIVE SUMMARY

PHASE I ENVIRONMENTAL ASSESSMENT

UXO	The site is located in an area which is considered to be at moderate to high risk in relation to unexploded ordnance. It is recommended that a specialist Consultant is engaged to carry out a Risk Assessment to determine the risk associated with UXO and advise on any mitigation measures required for intrusive works at the site.
Radon	No Radon protective measures are required.
Ground Gases	Potential sources of hazardous ground gases exist. Monitoring will be required to assess the potential risks and determine whether protection measures will be required in the proposed development.
Invasive Plant Species	None have been observed on site to date, but a specialist survey should be undertaken to confirm the site is not affected.
Sources of Potential Contamination	The site has historical uses which are considered to present significant potential sources of contamination. Investigation and assessment are required.
Groundwater	Groundwater, within the superficial deposits, is likely to be relatively shallow. The historical uses of the site and the surrounding area may have resulted in groundwater contamination. Investigation and assessment are required.
Potable Water Supplies	The potential for organic contaminants within shallow soils is considered to present a potential risk to potable water supply pipes. The results of soil analysis should be provided to the local Water Authority to confirm whether protective measures will be required.
Risk to End Users and Site Workers	There is considered to be a potential risk to end users and construction works during development.
Outline Remediation	There are likely to be remedial measures in order to protect end users and possibly controlled water. Such measures are likely to include the inclusion of gas protection measures within construction to prevent ingress and accumulation of hazardous ground gases, the prevention of end users coming into contact with contaminated soils, possible by way of a capping in soft landscaping areas or enduring all areas are hard standing and possibly protection of water supply pipes. At this stage, given the highly industrial setting of the site, it is considered that the requirement for groundwater treatment is unlikely, but requires assessment following intrusive investigation.

PHASE I GEOTECHNICAL ASSESSMENT

Ground Treatment	None anticipated to be required.
Principal Bearing Strata	Shallow soils are anticipated to be low strength and considered unlikely to be suitable for supporting buildings. Piled foundations are likely to be

	required for the proposed development.
Influence from Trees and Volume Change Potential	Precautions may be required should structures lie within influencing distance when in clay. In addition, precautions may be required where trees are to be removed or where new planting is proposed. All foundations should be constructed in accordance with current guidelines (e.g. NHBC Standards, Chapter 4.2).
Buried Concrete	Sulphate protection is expected to be required in buried structures where made ground is present. Sulphate Class DS-2 will probably be suitable; however, this will need to be confirmed through laboratory testing.
Likely Foundation Types	Piled foundations will be required.
Likely Foundation Depth Range	Nearby BGS boreholes indicate intact Chalk is present at approximately 30m below ground level.
Likely Ground Slab	Suspended ground floor slabs are likely to be required, possibly with ventilated under slab void.
Mining	No potential risk identified to the proposed development.
Soakaways	Not anticipated to be suitable
Obstruction & Excavations	Frequent obstructions are anticipated within the ground due to the previous phases of occupation and development.
Boundary Conditions	The site is bounded by structures and infrastructure. Consideration will need to be given to protecting boundary stability when undertaking development works and in particular during excavation and piling works.
Roads	A preliminary CBR value of <2.5% is currently considered for road and pavement design. It is recommended that <i>in-situ</i> CBR testing is carried out when final site levels will be known.

FURTHER WORKS

	<p>Intrusive investigation including boreholes to inspect soils, determine the thickness of made ground and weak superficial soil, identify the depth to competent founding strata, assess the groundwater beneath the site, assess the contaminant status of the soils and groundwater beneath the site and install ground gas monitoring wells.</p> <p>Undertake risk assessment in relation to the proposed end use and controlled water receptors from identified contamination and determine whether remedial measures are required to mitigate risks.</p> <p>Complete ground gas monitoring over the specified period to assess potential risks from hazardous ground gases to the proposed development.</p> <p>Unexploded ordnance risk assessment will be required prior to undertaking any intrusive works (investigation or development)</p>
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1 INTRODUCTION

1.1 Details of Commission

- 1.1.1 Alan Wood & Partners were appointed by Wykeland Group (the 'Client') to undertake a Phase I Geo-Environmental Assessment. This report covers the proposed development area only.
- 1.1.2 This report provides geotechnical and environmental information in relation to the proposed redevelopment of the site for mixed land-use, assuming that the site is to be redeveloped with a 9 storey hotel, food and beverage and/or office uses, and soft landscaped areas, along with the conversion and extension of the existing Castle Street Buildings. The report also assumes that ground levels will remain similar to present. Interpretation and recommendations should not be assumed valid for adjacent areas of land, or for alternative land uses. Should the proposed site usage change, the recommendations and conclusions presented in this report may need to be re-assessed.
- 1.1.3 The assessment undertaken and presented in this report includes potential sources of historical ground contamination, likely impacts on sensitive receptors and, where necessary, the identification of any remediation and/or subsequent investigative works that may be required.
- 1.1.4 The report has been prepared for the sole use and reliance of the Client. No other third party may rely on, reproduce or redistribute any content of this report without the prior written consent of Alan Wood & Partners. Any unauthorised third parties using the information presented in this report do so entirely at their own risk and are duly excluded from any warranty, duty of care or skill.

1.2 Previous Reports

- 1.2.1 Alan Wood & Partners are not aware of any historical assessment or ground investigation reports, with respect to the site or neighbouring property, which may be used to facilitate the assessment presented herein.

1.3 Scope of Works

- 1.3.1 This report constitutes the findings of the Phase I Geo-Environmental Assessment for the site and is based on a review of available geological, hydrogeological and

environmental records. The scope of works undertaken within the context of this report comprised:

- A site walkover;
- A review of environmental site sensitivity and historical mapping data;
- A review of available British Geological Survey (BGS) records and plans;
- A review of BGS on-shore borehole records (where available);
- A review of Environment Agency information; and the
- Review of Coal Authority data.

1.3.2 The principal objectives of the Phase I assessment was to:

- Obtain information from accessible sources about the soil and groundwater conditions within the area of the site;
- Determine the possible ground related geotechnical and environmental hazards within the site boundaries that may affect the proposed development;
- Develop an initial Conceptual Site Model (CSM) of potential *source-pathway-receptor* contaminant linkages and undertake a preliminary Risk Assessment in accordance with the proposed development end use scenario;
- Outline preliminary development recommendations;
- Provide advice on any additional phases of work that need to be completed to satisfy the regulatory authorities.

2 ENVIRONMENTAL SETTING

2.1 Introduction

2.1.1 Published environmental, geological and historical data relating to the site area has been reviewed, in conjunction with a walkover survey undertaken on the 7th of March 2019, the findings of which are presented below. The principal considerations of immediate relevance are presented in the following sections.

2.2 Site Location & Description

2.2.1 The site is located to the north of the A63 in Hull, east of Waterhouse Lane and is centred at National Grid Reference (NGR) 509512mE, 428484mN. A site location plan is presented as Figure 42263/001.

2.2.2 The site area is approximately 0.28ha and its shape in plan is roughly triangular. A photographic record of the walkover is presented as Plates 1-9. Key site features are shown on Figure 42263/002.

2.2.3 The site is currently being used predominantly as a pay and display car park, with the existing Earl de Grey public house located in the south eastern corner on the southern boundary, and the existing Castle Street Buildings located in the south-western corner on the southern and western boundaries. The predominant surface covering is tarmac.

2.2.4 The Earl de Grey public house is currently fully boarded up, and as it is coated in a cream render, its construction material is not visible. The building is three-stories at the front, with a two storey extension at the back, and the roof of the building is tiled with slates.

2.2.5 The Castle Street Buildings are surrounded by scaffolding and netting, with a temporary roof over it. It is constructed from red brick and comprises three stories. It is currently boarded up around the first floor and was deemed unsafe to enter.

2.2.6 The site boundary is marked to the north and east by an approximately 1m high brick wall, with iron railings to a height of approximately 2.5m. North of the site is the Bonus Arena, on the other side of Waterhouse Lane, and to the immediate east of the site is the Princes Quay multi-storey carpark.

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- 2.2.7 The site boundary is marked to the south and west by a low wooden fence. Immediately south of the site is the A63, and to the west of the site are a number of car parks.
- 2.2.8 One mature tree was present on the southern boundary of the site. This has been tentatively identified as a maple tree.
- 2.2.9 A number of small drain covers were located across the site for surface water drainage. There were a number of cars in the car park therefore there may be more present.
- 2.2.10 No electrical equipment was visible on the site, however some large extraction fans were visible on the western side of the Earl de Grey Public House. It is assumed that these are from the kitchen area of the building.
- 2.2.11 No evidence of storage tanks above or below ground were visible on the site.

3 GEO-ENVIRONMENTAL DATA

3.1 Anticipated Geology, Hydrogeology & Mining

3.1.1 A summary of the available published geological and hydrogeological information is provided in Table 3.1. A review of the following information was undertaken:

- British Geological Survey 1:50,000 scale series, Sheet No. 80 Kingston upon Hull, Solid & Drift Edition;
- Coal Authority online ground stability database, and;
- Emapsite GeolInsight Data Report Ref. EMS-530230_713173 (Appendix A) and EnvirolInsight Report Ref. EMS-530230_713174 (Appendix B).

Table 3.1 - Geological Information

<i>Made Ground and Surface Ground Workings</i>	<p>Information presented in the GeolInsight report indicates that there are no areas of artificial/made ground within 500m of the site.</p> <p>There are numerous entries in the GeolInsight report that refer to historical surface ground working features both on the site and within 250m of the site boundary. The whole of the site feature is shown to be underlain by historical workings, referring to a dock dating from 1890 to 1948. The nearest off-site features lie between 29m and 192m to the south and south-east of the site and relating to a burial ground, docks, a quay, and a pond.</p>
<i>Geology</i>	<p>There are superficial soils shown to be Tidal Flat Deposits present on site. These comprise clay and silt.</p> <p>The solid geology underlying the site area is recorded as being chalk of the Burnham Chalk Formation. This typically comprises white, thinly-bedded chalk with discontinuous flint bands and sporadic marl seams.</p> <p>There are two historical BGS boreholes located on the southern boundary of the site, records of which have been reviewed. There is approximately 2m of made ground recorded which comprises reworked natural material with some anthropogenic content. Below this are tidal flat deposits comprising very soft to stiff clays with some organic content, sands and gravels, and one borehole records firm peat 1.6m thick at 14.8m bgl. Chalk bedrock is present at approximately 26.5m bgl. Penetration of the bedrock is noted to have been to approximately 45m bgl.</p>
<i>Discontinuities</i>	<p>Information presented in the GeolInsight report indicates that there are no linear features within 500m of the site.</p>
<i>Hydrogeology</i>	<p>Aquifer within Superficial Deposits: Unproductive. These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.</p> <p>Aquifer within Bedrock: 'Principal'. Principal aquifers are rock or drift deposits with high intergranular and/or fracture permeability and can provide a high level of water storage. These deposits are capable of supporting water supply and/or base river flow on a strategic scale.</p> <p>Source Protection Zones: The site is classed as a Zone 3. Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source.</p> <p>Source Protection Zones within Confined Aquifer: There are no</p>

	source protection zones within 500m of the site.
<i>Hydrology</i>	<p>There are five reported surface water features within 250m of the site. The nearest is 48m east of the site in the Princes Quay, with the Hull Marina and Railway Dock Marina 76m and 109m to the south east of the site respectively.</p> <p>No biological quality data exists for surface water features around the site. Chemical quality data is available for the Beverley and Barmston Drain 1.2km north of the site. The chemical quality grade has been recorded as E from 2007 to 2009. The results are graded from A ('Very Good') to F ('Bad').</p>
<i>Mining & Ground Stability</i>	<p><u>Historic Underground Working Features</u></p> <p>Information presented in the Geolnsight report indicates there are no historical underground working features within 1000m of the site boundary.</p> <p><u>Coal Mining</u></p> <p>Information presented on the Coal Authority website (www.coal.decc.gov.uk) indicates that the site does not lie within a Development High Risk area or a Coal Mining Reporting area.</p> <p>There are no known mine entries within, or within 20m of, the boundary of the site and there are no reported areas of potential shallow mine workings on the Coal Authority database.</p> <p>On the basis of available information risk associated with shallow coal mining subsidence is considered to be negligible.</p>
<i>Non-coal Mining</i>	Historical information indicates that there are no non-coal mining areas within 1km of the site.
<i>Natural Cavities</i>	The GroundSure data indicates that there are no natural cavities recorded within 1km of the study site.
<i>Radon</i>	The site does not lie within an area where radon protective measures are required in construction.

3.2 Environmental Records

3.2.1 A summary of the available environmental information is presented in Table 3.2.

Table 3.2 - Environmental Data

<i>Potentially Harmful Discharges (Red List) to Controlled Waters</i>	There are no records of red list discharge consents reported to be within 500m of the site.
<i>Licensed Discharge Consents</i>	There are no records of licensed discharge consents reported to be within 500m of the site.
<i>EA Recorded Pollution Incidents to Controlled Waters</i>	There is are no EA recorded pollution incidents within 500m of the site.
<i>Landfill and Other Waste Sites</i>	There is one Environment Agency historic landfill site 956m east of the site at Victoria Dock which accepted inert waste between 1977 and 1985.

	<p>There are BGS/DoE non-operational landfill sites within 500m of the site. There are also no records of Local Authority landfill sites within 1.5km of the site.</p> <p>There are seven entries of waste sites within 500m of the site. All records refer to the same scrap metal works 484m south-west of the site.</p> <p>There are 31 entries of licensed waste sites within 1500m of the site boundary. The closest lies 663m south-west and is a vehicle depollution facility. The next closest is 915m to the west and refers to a household, commercial and industrial waste facility.</p>
<i>Flooding</i>	<p>The EnviroInsight report indicates that the site lies within an Environment Agency Zone 3 floodplain.</p> <p>There are no British Geological Survey groundwater flooding susceptible areas within 50m of the site. The area is not considered prone to groundwater flooding based on the rock type recorded beneath the site.</p>
<i>Abstractions</i>	<p>There is one active groundwater abstraction located within 1km of the site, 882m to the north-west for non-evaporative cooling operations. There are a further 8 historical groundwater abstractions within 2km of the site.</p> <p>There are no potable water abstractions within 2km of the site boundary.</p>
<i>Invasive Plant Species</i>	<p>Japanese Knotweed was not observed during the site walkover.</p>
<i>Public Register of Contaminated Land: Part 2A (EPA 1990)</i>	<p>There are no sites designated as contaminated land under, Section 78R of the EPA 1990, within 500m of the site.</p>
<i>Dangerous or Hazardous Sites</i>	<p>There are no NIHHS or COMAH sites or high pressure underground pipelines within 500m of the site.</p> <p>There are no active petrol or fuel sites within 500m of the site boundary.</p>
<i>Potentially Contaminative Current Land Uses</i>	<p>There are 20 records of potentially contaminative industrial sites located within 250m of the site, although of these are unlikely to have affected the site or its intended redevelopment. These include, for example:</p> <p>Electricity substation, Unspecified Works or Factories, Container and Storage, Marine Equipment, Moorings and Unloading Facilities.</p>

3.3 Historical Land Use

3.3.1 A study of historical Ordnance Survey maps has been undertaken to identify any potentially contaminative former land-uses at the site. The main historical features of the site and surrounding area are summarised in the following table, whilst a copy of the historical maps is presented in Appendix D.

3.3.2 Ordnance Survey map editions may not however be complete and it is possible, therefore, that additional land uses to those presented in the plans have occurred. Alan Wood & Partners have tried to ascertain the complete record of the site's history, but the possibility that other potentially significant land uses may have taken place cannot be ignored.

3.3.3 A summary of the historical land use and surrounding area is presented in Table 3.3 and Table 3.4.

Table 3.3 - Summary of Principal Historical Features (On Site)

Year	Scale(s)	Principal Features
1852-1856	1:10,560	Mapping illegible.
1886		
1886-1890		
1890-1893		
1891	1:500	A public house is one of the buildings present on the southern edge of the site. On the northern boundary of the site is a Junction Foundry and Engine Works.
1893	1:2,500	No significant changes.
1906-1909	1:10,560	Development of a structure along the north-western boundary.
1908	1:10,560	No significant changes.
1910-1911	1:2,500	Structure on the north-western boundary is part of a Timber Yard with a Timber Yard also present on the northern boundary where the Junction Foundry and Engine Works was placed.
1926	1:10,560	Further development has occurred within the north-western half of the site.
1926-1929		No significant changes.
1928	1:2,500*	Incomplete mapping – site not shown.
1938	1:10,560	No significant changes.
		Incomplete mapping – site not shown.
1948	1:10,560	No significant changes.

Year	Scale(s)	Principal Features
1948	1:1,250	Castle Buildings have been constructed in the south-western corner of the site. The timber yard in the north-western half of the site is now a garage. The Timber Yard on the northern boundary is also no longer present.
1948	1:2,500	No significant changes.
1948-1950	1:10,560	
1951-1952	1:1,250*	Incomplete mapping – only northern corner of site shown (garage).
1956	1:10,560*	No significant changes.
		Incomplete mapping – site not shown.
1958	1:2,500	The garages in the north-western half of the site are now Warehouses.
1959	1:1,250	No significant changes.
1968	1:1,250*	Incomplete mapping – only western corner of site shown (Castle Buildings and Warehouse).
1970-1971	1:10,000	No significant changes.
1973-1974	1:1,250*	Incomplete mapping - only western corner of site shown (Castle Buildings and Warehouse).
1979	1:1,250	Buildings present in the eastern half of the site are not also labelled as a Warehouse. Some of the structures present on site previously have been removed along the southern boundary.
1981-1983	1:10,000	No significant changes.
1984-1987	1:1,250	
1988-1991	1:1,250	More structures on the southern boundary of the site have been removed to the east of the Castle Street Buildings.
1988-1993	1:2,500	No significant changes.
1989-1990	1:1,250	
1990-1995	1:1,250	
1991-1993	1:1,250*	Incomplete mapping – northern corner of site omitted. The southern half of the site is now labelled as car park with demolition of previous buildings on the north-western boundary of the site, north of the Castle Street Buildings.
1993	1:1,250*	Incomplete mapping – only south western corner of the site shown.
1992-1994	1:10,000	No significant changes.
2000	1:10,000	
2010	1:10,000	
2014	1:10,000	

* No mapping detail/part mapping detail shown

Table 3.4 - Summary of Principal Historical Features (Off Site)

Year	Scale(s)	Principal Features
1852-1856	1:10,560	Mapping illegible.
1886	1:10,560	Mapping incomplete – no surrounding features shown
1886-1890		
1890-1893	1:10,560	Mapping incomplete – no coverage to the west of the site. Princes Dock is shown approximately 35m east of the site, with Railway Dock, Humber Dock and Queens Dock shown to the south (165m), south east (90m) and north east (380m) respectively. Extensive railway sidings and sheds are shown approximately 220m south of the site.
1891	1:500	The site is shown to be surrounded by various land uses, including the Junction Foundry and Engineering Works immediately adjacent to the north eastern boundary, possibly encroaching into the eastern part of the site. To the south, immediately to the south of Castle Street, is the Humber Brass and Copper Works, with a Saw Mill immediately beyond (south west); Trinity Burial Ground is present immediately to the south of these. A Timber Yard is shown to the north (240m). To the north west and west are Alexander Copper and Brass Works (7m), Chain Cable and Anchor Works (25m), a Smithy (15m) and various Warehouses (c. 35m). Warehouses are also shown to the east (37m) and south east (38m).
1893	1:2,500	Carriage Works and Mat Factory shown 85m north of the site, with an oil mill shown 75m north west. The Princes Dock and Humber Dock are shown to be linked with a Lock, with Mytongate Bridge above. A Timber Yard is shown to flank the Railway Dock on its northern side, with Warehouses and Shipping Offices to the south (fronting Kingston Street). The Timber Yard to the south west of the site is now labelled “Saw Mill”.
1906-1909	1:10,560	Incomplete mapping – no features north of the site shown. No significant changes to the south, east and west.
1908	1:10,560	Incomplete mapping – no features west of the site shown. No significant changes to the north, east or south.
1910-1911	1:2,500	Timber Yards shown immediately to the north and approximately 10m south of the site. Trinity Burial Ground is shown as “disused”. Carriage Works and Mat Factory to the north are no longer shown. Junction Foundry and Engineering Works no longer shown. All of the Copper and Brass Works are no longer shown.
1926	1:10,560	Paragon Station shown approximately 380m north west. No other significant changes evident.
1926-1929		
1928	1:2,500*	Incomplete mapping – limited coverage to the west.
1938	1:10,560	Queens Dock is now longer shown; Queens Gardens .

Year	Scale(s)	Principal Features
1948	1:10,560	Incomplete mapping – no coverage north of the site. No significant changes.
1948	1:1,250	Timber Yards to the north and south of the site no longer shown. Former Timber Yard to the north is shown to have been redeveloped with a Warehouse. Humber Brass and Copper Works to the south of the site is once again identified as being present. The area to the south west of this previously occupied by a Saw Mill is now labelled as Humber Leadworks. The site formerly occupied by the Chain Cable and Anchor works to the north west is now shown to operate as a Garage, with a Timber Yard beyond. The buildings adjacent to the site to the east appear to be commercial premises, although the use is not specified. There are areas where buildings are no longer shown, where previously buildings had been present. Many areas previously occupied by domestic terraced properties are shown to have been cleared or redeveloped with commercial or industrial buildings, including several Paint Works, a Timber Yard, a Chemical Works, a Mineral Water Factory, a Metal Works and various Warehouses.
1948	1:2,500	Several “Ruins” are shown by this mapping in the vicinity of the site, predominantly to the north west. The Oil Mill to the north west is no longer shown
1948-1950	1:10,560	
1951-1952	1:1,250*	Incomplete mapping - no significant change.
1956	1:10,560*	No significant change
1958	1:2,500	Mineral water factory now shown as “Factory”. Brass and Copper works to the south is now shown as a Works, as are many of the Paint Works, Chemical Works and other previously identified works. The majority of Ruins previously shown have now been cleared and/or redeveloped.
1959	1:1,250	No significant changes.
1968	1:1,250*	Incomplete mapping – features only shown to the south west of the site.
1970-1971	1:10,000	No significant change.
1973-1974	1:1,250*	Incomplete mapping – no features shown east of the site. No significant change.
1979	1:1,250	Works to the south of the site no longer shown. Warehouse north of the site no longer shown. The three Docks closest to the site are now shown as “disused”.
1981-1983	1:10,000	No significant change.
1984-1987	1:1,250	Railway Dock and Humber Dock are now shown as Railway Dock Marina and Humber Dock Marina.
1988-1991	1:1,250	Hotel Shown to the south of the site.
1988-1993	1:2,500	
1989-1990	1:1,250	Princes Dock is shown to have been redeveloped, partly covered/infilled with Princes Quay shopping centre. A Hotel is now shown to the south of the site.

Year	Scale(s)	Principal Features
1990-1995	1:1;250	Pontoons now shown in both Railway Dock Marina and Humber Dock Marina.
1991-1993	1:1,250*	
1993	1:1,250*	Incomplete Mapping – only features to the south west shown. No significant change.
1992-1994	1:10,000	Kingston Park Retail Park shown approximately 250m south west of the site. Depot shown approximately 10m west of the site.
2000	1:10,000	No significant change.
2010	1:10,000	
2014	1:10,000	

* No mapping detail/part mapping detail shown

3.3.4 In summary, the site has undergone various stages of redevelopment, with the existing Earl de Grey Public House shown as being present from the earliest mapping reviewed (1891), but dates back 180 years, and the Castle Buildings first shown as such on 1948 mapping, but is understood to have been first built in 1890. Castle Buildings and Earl de Grey are Grade II Listed.

3.3.5 The site itself has been occupied by various uses, including a Timber Yard, part of the Junction Foundry and Engine Works, Warehouses, Domestic properties and Garages. The domestic properties were demolished in the late 1980s and the warehouses were demolished shortly afterwards in the 1990's.

3.3.6 The site is located in an industrial area of the City, which is shown to have been dominated by the four Docks and associated warehousing, manufacturing and infrastructure for the majority of the history reviewed, Of note, Brass and Copper Works, Garages, Warehouses, Engineering Works, Timber Yards and Chemical / Paint Works were present around the site, from as close as 7m to the west.

3.3.7 Two of the four docks were redeveloped (Princes Dock as a shopping centre and Queens Dock as Queens Gardens), while the other two were converted into Marinas for leisure use.

3.4 Unexploded Ordnance

3.4.1 The site is located in an area of Hull which received bomb damage during WWII. The historical information available on line identifies several bomb strikes in the vicinity, both detonated and unexploded and historical mapping appended here shows several ruins in the post WWII mapping.

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- 3.4.2 Given the proximity of the Docks, the Railway infrastructure, the foundries and Engineering Works to the site, it is considered that there is a significant concentration or possible targets for WWII bombing close to the site.
- 3.4.3 The site is considered to be at potential risk from unexploded ordnance. However, it is recommended that a specialist consultant are engaged to provide a Risk Assessment in relation to the proposed development and any associated intrusive works.

4 PHASE I GEOTECHNICAL APPRAISAL

4.1 Made Ground

4.1.1 Given the sites history of development, use and remodelling, it is considered likely that made ground will be present across the site.

4.1.2 The presence, type and extent of any on-site made ground soils will need to be established through ground investigation.

4.2 Natural Strata

4.2.1 Based on the available information, it is anticipated that the natural strata will comprise Tidal Flat Deposits of soft clays, silts, and sands and gravels, with a high likelihood of organic matter being present, potentially as peat.

4.2.2 The solid geology has been proven to be chalk of the Burnham Chalk Formation.

4.3 Groundwater

4.3.1 Groundwater is anticipated to be present at shallow depth beneath the site within made ground and Tidal Flat Deposits.

4.4 Foundations

4.4.1 The most appropriate foundation solution will be confirmed following completion of the ground investigation and receipt of finalised construction proposals/development layout.

4.4.2 At this stage it is considered that piled foundations will be required for proposed new buildings at the site due to the anticipated thickness of low strength (Tidal Flat Deposits) soils. Made ground soils of any type are **not** suitable founding stratum.

4.4.3 There is one tree on the southern boundary of the site, so precautions may be required should structures lie within influencing distance when in clay. In addition, precautions may be required where trees are to be removed or where new planting is proposed. All foundations should be constructed in accordance with current guidelines (e.g. NHBC Standards, Chapter 4.2). If foundations are built off competent bedrock, no precautions are likely to be required.

4.4.4 The widening, strengthening and reinforcement of foundations in accordance with current guidelines would be required where footings are found to straddle strata of different type (e.g. clay and rock) or where soft and/or where locally unstable ground is

encountered at founding depth. With respect to buried sub-structures, it is anticipated that these will need to be broken-out and backfilled in a controlled manner; site-won made ground materials could possibly be used in this instance if the material is of suitable engineering grade and type (subject to testing and design specification).

- 4.4.5 The historical information indicates that the majority of the site has been covered by structures at some point. As such, it is possible that pile positions may need to be pre-drilled to fully penetrate relic structures and other in ground obstructions.

4.5 Coal Mining Induced Subsidence

- 4.5.1 It is considered, on the basis of available information, that foundations will not need to be reinforced / strengthened to accommodate any potential movement associated with historic coal mining activity and any ground instability that may occur post development. Should further information become available this assessment may need to be revised.

4.6 Floor Slabs

- 4.6.1 *In situ* suspended floor slabs are likely to be the most suitable for use at the site, particularly as in excess of 600mm of unsuitable material is anticipated across the majority of the site. Ground bearing slabs are not considered suitable for the proposed development.
- 4.6.2 Old substructures should be removed to at least 1.0m below any new floor slabs to prevent the formation of 'hard spots', subject to agreement with your warranty provider.
- 4.6.3 A suspended floor system incorporating a sub-floor void, such as beam and block, will be required for all properties where the foundations lie within the heave zone of trees as defined by NHBC Standards (Chapter 4.2), or where seasonally desiccated soils are present at the time of construction. Furthermore suspended floor systems, with sub-floor void may also be required should hazardous ground gases be present at the site.

4.7 Non-Coal Mining

- 4.7.1 There is no evidence to suggest that mineral extraction has occurred on site. Should evidence of quarrying be encountered during redevelopment this should be brought to the attention of Alan Wood and Partners. Where this is found to affect construction

appropriate precautions may need to be incorporated in to the design (e.g. deepened foundations, reinforced superstructure).

4.8 Excavation Conditions

4.8.1 Obstructions to excavations should be expected due to the presence of existing buildings and historical information indicating buildings once stood over the majority of the site. Other currently unforeseen obstructions may also be present. Allowance should be made for breaking out obstructions for either foundations or other construction requirements. Excavation of the materials encountered should be easily achieved using conventional hydraulic excavation techniques.

4.8.2 It is likely that excavations will be unstable in the short term, especially where granular soils and made ground are present. These are liable to collapse without warning. This situation is likely to be exacerbated by water ingress. No man entry into unsupported excavations should be allowed without an appropriate risk assessment. Reference to CIRIA report 97 (1983) should be made to establish suitable means of support, or battering of excavation sides.

4.8.3 It is considered unlikely that dewatering will be required for shallow short-term excavations. Anticipated groundwater conditions suggest that simple dewatering techniques (e.g. sump pumping) are likely to prove adequate to control water ingress on a routine basis. However, it is recommended that provision for the drainage of surface water is allowed for to prevent surface water ponding or collection both during and post construction, as this may lead to deterioration of the founding stratum.

4.9 Stability Issues & Retaining Structures

4.9.1 The site is relatively flat and level and the area surrounding the site is similar. No particular risk in relation to slope instability should occur on site. Where excavations are proposed close to site boundaries, properties and/or any other existing retaining structures, a risk assessment of the integrity/stability should be undertaken prior to such works being carried out. Designed and engineered temporary/permanent measures should be adopted to ensure their continued stability.

4.9.2 The proximity of neighbouring structures and existing structures on site, to be retained, will require careful consideration in determining foundation construction techniques as vibration may present issues during piling operations and general development.

4.9.3 Where changes in gradient exist across the site these will be adjusted by minor earthworks. It is anticipated that future ground profiles are unlikely to require earth retaining structures; if this changes, further advice may be required when more information is available.

4.9.4 With respect to natural ground subsidence, the site has been classified as having a 'Negligible' risk rating for ground dissolution and collapsible deposits, a 'Very Low' risk rating for landslides, a 'Low' risk rating for shrink/swell clay and 'Moderate' risk rating for , compressible deposits and running sand hazards.

4.10 Surface Water Drainage

4.10.1 It is considered, at this stage, that soakaways are likely to be unsuitable. Surface water will therefore need to be disposed of to a suitable drainage system (possibly to any existing drains that cross/exit the site), subject to obtaining approvals from regulatory authorities.

4.11 Roads and Pavement

4.11.1 A preliminary CBR value of <2.5% is currently considered for road and pavement design. It is recommended that *in-situ* CBR testing is carried out when final site levels will be known and after construction of the development platform. Highways Agency document HD25 Interim Advice Note 73/06 Revision 1 (2009) states that where a subgrade has a CBR lower than 2.5%, it is considered unsuitable support for a pavement foundation since it would tend to deform under construction traffic and must be improved.

4.11.2 All road design should be discussed with the local authority if highways are to be subject to a Section 38 agreement.

4.12 Concrete

4.12.1 Sulphate protection is expected to the required in buried structures where made ground is present. Sulphate Class DS-2 will probably be suitable; however, this will need to be confirmed through laboratory testing.

5 PHASE I ENVIRONMENTAL APPRAISAL

5.1 Introduction

5.1.1 The following section summaries the Preliminary Phase I Conceptual Site Model (CSM), which has been produced following the review of available pertinent desk study and third party information. The CSM summarises the understanding of surface and sub-surface features, the potential sources of contamination, pathways and receptors in order to support the identification and assessment of plausible pollutant linkages.

5.2 Initial Conceptual Site Model & Risk Assessment

5.2.1 The risk assessment has been carried out to assess the likelihood of risk to human health and the wider environment, on the basis of information reviewed. The risk assessment is a qualitative *source-pathway-receptor* assessment and its function is to assess the likelihood that each possible linkage exists and to decide whether they pose potentially unacceptable risks to identified receptors (i.e. people, structures, water bodies or ecosystems) that may be harmed.

5.2.2 Risk can be defined as the combination of the consequence of a harmful effect and the probability of its occurrence. The existence of a contaminant linkage is dependent on site use, as well as environmental conditions: **if no contaminant linkage(s) can be proven, then the risk(s) may be discounted.**

5.3 Site Summary & Environmental Sensitivity

5.3.1 A review of available desk study information indicates that the proposed development area and the adjacent land has had a variety uses including warehousing, foundry, engine works, various works, metal works, garages, timber yards and docks. Two original buildings dating back to the 19th Century remain on site; the public house in the eastern corner and Castle Buildings in the western corner.

5.3.2 Made ground soils are expected on site, although the extent of such material would need to be confirmed through ground investigation. It is anticipated that the depths will vary significantly across the site and infilled cellars are anticipated where former domestic properties were present.

5.3.3 The underlying geology is indicated to comprise Tidal Flat Deposits over chalk of the Burnham Chalk Formation.

- 5.3.4 Some perched/shallow groundwater may be present within the near surface deposits.
- 5.3.5 It is considered possible that elevated concentrations of CO₂ and CH₄ may be present as a result of organic content within the Tidal Flat Deposits (see BS 8576:2013, 'Guidance on Investigations for Ground Gas - Permanent Gases and Volatile Organic Compounds').
- 5.3.6 On site historical uses are considered to present a significant potential source of contamination, including heavy metals, hydrocarbons, volatile organic compounds and asbestos.
- 5.3.7 The potential leaching of mobile contaminants of concern to the underlying groundwater and aquifer is considered to be moderate given the anticipated shallow water, proximity of surface water features and underlying principal aquifer.
- 5.3.8 In summary, given the site history, the anticipated contaminant load within the on-site soils, its underlying geology, gassing potential and the nature of controlled waters receptors, sensitivity of the site is considered, at this stage, to be **moderate**. The nature and concentration of any contamination will need to be confirmed through testing.

5.4 Potential Sources

- 5.4.1 A potential source is defined as 'a contaminant which is in, or under the land and has the potential to cause harm to human health or to cause pollution of controlled waters'.
- 5.4.2 The following potential contaminants that may be associated with the site are summarised in Table 5.1.

Table 5.1 - Summary of Potential Contaminant Sources

Potential Sources	Associated Potential Contaminants (<i>not limited to</i>)	
	<i>Metals, inorganics and other contaminants</i>	<i>Organics</i>
Made Ground associated with former uses including timber yard, warehouses and domestic properties	Heavy metals, sulphates, asbestos	Petroleum hydrocarbons, volatile organic compounds, phenols, glycols
Organic rich soils within Tidal Flat Deposits	CH ₄ , CO ₂	

* Invasive plant species to be assessed separately if encountered.

5.5 Potential Receptors

5.5.1 A receptor is the potential target of the source pollutant, to which either significant harm or deterioration in quality may be caused.

5.5.2 The potential sensitive receptors with respect to the potential contamination hazards identified above are considered in Table 5.2 below.

Table 5.2 - Summary of Potential Receptors

Potential Receptor	Comment
Human Health	Site end-users Site operatives (during construction phase only)
Construction	Potable water supply pipes Foundations
Underlying natural strata and controlled water	Near surface soils and/or any perched groundwater

5.6 Plausible Pathways

5.6.1 Migration pathways are routes by which contaminant sources may come into contact with receptors. Potential pathways for different types of contaminants vary depending on the properties of the contaminant, the mechanism of its release and the nature of the receptor. The principal potential pollution pathways by which receptors might become exposed to potential contamination at the site are summarised as follows in Table 5.3.

Table 5.3 - Summary of Plausible Pathways

Potential Source	Pathway
Potentially contaminated made ground soils, perched groundwater	Direct ingestion, dermal contact, dust and/or vapour inhalation
	Direct ingestion and/or dermal contact with liquid contaminants
	Leaching and direct migration of liquid contaminants to groundwater and nearby surface waters
	Leaching and direct contact with foundations and potable water supply pipes. Lateral migration of contaminants through preferential pathways
Ground gases	Migration of gases and/or accumulation in void spaces via transport through service conduit, any permeable made ground and/or underlying permeable natural strata

5.7 Risk Assessment

5.7.1 The potential pollutant linkages listed above are based on available data and the features noted during the 'walkover'. Therefore, the linkages identified are tentative in nature and are subject to the following uncertainties (to be followed up through ground investigation):

- Nature and extent of the made ground at the site;
- Nature of the underlying natural strata at the site;
- The actual distribution of contaminants within the made ground and underlying natural soils;
- The hydrogeological regime beneath the site.

5.7.2 The assessment presented herein assumes that the site end-use is to be *commercial*. The assessment is not valid for other land uses. Should the proposed end-use of the site change, the assessment contained herein would need to be revised to accommodate this.

5.7.3 The identified potential contaminants and receptors have been considered in relation to the pathways that may link them. The risk classification has been estimated in accordance with those methods prescribed in CIRIA publication C552 '*Contaminated Land Risk Assessment: A Guide to Good Practice*', 2001.

5.7.4 Risk is regarded as a combination of the likelihood of an 'event' occurring and its severity: both elements must be taken into account when assessing risk. The method for risk assessment, or evaluation, is purely qualitative. As defined in CIRIA C552:2001, the magnitude of the potential 'severity' of risk occurring may be assessed against:

- **Severe:** short term risk to human health likely to result in significant harm as defined under EPA 1990, Part 2A. Short term risk of pollution to sensitive water receptor;
- **Medium:** significant harm to human health, pollution of sensitive water resource or significant change to an ecosystem or specific organism;
- **Mild:** pollution of non-sensitive water resource but significant damage to crops, buildings, structures and services or the environment;
- **Minor:** harm, which may result in financial loss, or expenditure to resolve. Non-

permanent effects to human health. Easily repairable effects of damage to buildings, structures and services.

5.7.5 Similarly, the classification of the magnitude of the 'probability' of the risk occurring may be assessed against:

- **High Likelihood:** a contaminant linkage exists and an event appears very likely in the short term, or almost inevitable in the long term, or pollution is causing harm at the receptor;
- **Likely:** a contaminant linkage exists and it is probable that an event will occur. An event may not occur, but it is possible in the short term and likely over the long term;
- **Low Likelihood:** a contaminant linkage exists and it is possible that an event will occur. It is not certain that an event will occur over time but it is less likely in the short term;
- **Unlikely:** a contaminant linkage exists but it is not possible to say if an event will occur even over a very long time.

5.7.6 Following completion of the severity and probability assessment, classifications can be compared to indicate the actual risk each contaminant linkage presents: this can only be undertaken where there is a possibility of there being an active contaminant linkage.

5.7.7 The risk categories which can be assigned are presented in Table 5.4 and range between 'very high risk' to 'very low risk'. *NB - it is not possible to classify an identified risk as 'no-risk'.*

Table 5.4 - Risk Categories

		Consequence			
		Severe	Medium	Mild	Minor
Probability	Highly Likely	Very High	High	Moderate	Moderate / Low
	Likely	High	Moderate	Moderate / Low	Low
	Low Likelihood	Moderate	Moderate / Low	Low	Very Low
	Unlikely	Moderate / Low	Low	Very Low	Very Low

Reproduced from Table 6.5, CIRIA C552/2001.

- **Very High** – severe harm could arise to a designated receptor or that severe harm is occurring. Urgent investigation and remediation is likely to be required;
- **High** – harm could occur to a designated receptor and that urgent investigation and remediation may be needed in the short term, but are likely over the longer term;
- **Moderate** – harm could occur. It is unlikely to be severe, most probably relatively mild. Investigation is normally required to clarify the risk with some remedial works being required in the longer term;
- **Low** – possible that harm could occur, but if it did, at worst it would be mild;
- **Very Low** – low possibility of harm arising, and that if it does it is not likely to be severe.

5.7.8 The identified potential contaminants and receptors have been considered in relation to the pathways that may link them. The resulting contaminant linkages are presented in Table 5.5.

Table 5.5 - Summary of Phase I Conceptual Site Model & Risk Assessment

Potential Source	Potential Receptor	Plausible Pathway	Probability	Severity	Initial Risk Rating	Solution
Potentially contaminated made ground / perched groundwater	<u>Human Health</u> Site end-users, inc. maintenance and site workers (short term risk during construction)	Direct ingestion or dermal contact with soil, dust and/or vapour inhalation	Likely	Medium	Moderate	Soil capping or treatment / removal of contaminated soils as required
		Direct ingestion and/or dermal contact with liquid contaminants	Low likelihood	Medium	Moderate/Low	
		Inhalation of asbestos fibres	Low likelihood	Severe	Moderate	Appropriate removal and disposal, burial at depth or soil capping where necessary
	<u>Construction</u> (Potable Water Supply Pipes)	Direct contact/leaching (tainting)	Likely	Mild	Moderate/Low	Upgraded water pipes/clean backfill material where necessary
	<u>Construction</u> (Foundations)	Direct contact/leaching	Likely	Mild	Moderate/Low	Appropriate concrete specification
	Controlled Waters	Surface run-off / leaching / lateral migration	Unlikely	Mild	Very Low	No risk anticipated due to low soil leaching potential
Natural organic deposits within the Tidal Flat Deposits	<u>Human Health</u>	Inhalation (via ingress and accumulation)	Likely	Medium	Moderate	Gas monitoring with necessary precautions appropriate to proposed site end use

- 5.7.9 The preliminary conceptual site model (CSM) presented above has indicated that several contaminant linkages may exist on-site.
- 5.7.10 In order to investigate any potential risk presented by these, intrusive investigation is required. The intrusive works will provide information on actual contaminants present on-site and plausible pathways to potentially sensitive receptors.
- 5.7.11 At this stage it is possible that a soil capping layer would be required in soft landscaped areas to break potential direct exposure pathways given the potential for elevated concentrations of inorganic and organic contaminants within any made ground soils (and/or the underlying near surface natural strata) at levels above current guideline values, these being DEFRA Category 4 Screening Levels 2014 (C4SLs), LQM/CIEH 2015 (S4ULs) or other in-house derived organic GAC values calculated by Alan Wood & Partners in CLEA v1.06 for sandy soils. The need for remedial measures to mitigate risk associated with any contamination will be provided following the completion of laboratory analysis and risk assessment.
- 5.7.12 Fugitive ground gases associated with the underlying Tidal Flat Deposits strata and on site made ground may present a risk to development on the basis of available information. In accordance with BS8485:2007, BS8576:2013, NHBC (2007) and CIRIA C665 (2007), a period of ground gas monitoring appropriate for the proposed end use of the site should be undertaken. Although it is considered that the likely generation potential for ground gas at the site will be low, the proposed development case indicates that 6 monitoring visits over a period of 3 months should be undertaken to determine the minimum level of protection required. A minimum of 3 boreholes should be installed. It may be prudent, at this stage, to allow for the provision of gas precautions to Characteristic Situation 2 until proven otherwise.
- 5.7.13 No radon precautions are required in construction.
- 5.7.14 It is considered, at this stage, that some protective measures may be required where potable water supply pipes are to be laid. Confirmation of the need for protective measures will however be given following completion of the ground investigation and laboratory analysis. Analytical work may need to be carried out in accordance with those guidelines prescribed in UKWIR (2010) (Ref. 10/WM/03/21). If the concentrations of contaminants within the soils are found to be below the acceptable levels listed in the UKWIR guidelines, standard PE/PVC pipes should be suitable for the development, these being placed in a clean backfill surround where made ground

soils are present. The local utility provider should be contacted however to determine its exact requirements in respect of the levels of contamination encountered.

5.7.15 Sulphate protection is expected to be required in buried structures where made ground is present. In accordance with Special Digest 1:2005, Sulphate Design class DS2 will most probably be suitable, although this will need to be confirmed by chemical testing.

5.7.16 Other currently unforeseen areas of contaminated soil may be present.

5.7.17 Any materials to be removed from site should be undertaken in accordance with the Duty of Care Regulations 1991. There will also be a requirement to classify the waste in accordance with the European Waste Catalogue, in which case the waste should be subject to Waste Acceptance Criteria (WAC) testing. In light of the new regulations it is recommended that discussion with landfill operators takes place at an early stage if this is to occur.

6 RATIONALE FOR PHASE II GROUND INVESTIGATION

6.1 Introduction

- 6.1.1 The overall objective of this study is to contribute towards the understanding of the ground conditions underlying the proposed development at the site off Castle Street, Hull. Research into the history and evolution of the site up to the present day has been undertaken which allows a fair assessment of the risks posed to the development to be made.
- 6.1.2 The study has provided sufficient background data in terms of the land uses of the site and its surroundings together with details of the general geology, mining and hydrogeology.
- 6.1.3 The preliminary risk assessment, when considered within the context of proposed end-use, indicates that some on-site contaminant linkages may present a potential risk to human health and/or the wider environment and need to be assessed further.
- 6.1.4 It is recommended that a Phase II geo-environmental investigation be carried out so that site-specific data can be obtained with respect to any potential soil and/or groundwater contamination, ground gas risks, sulphate precautions etc, so that risks can be quantified in relation to the *source-pathway-receptor* scenarios and plausible contaminant linkages postulated in the initial conceptual model above.

6.2 Scope of Works

- 6.2.1 The intrusive investigation will provide information to establish the nature, type and condition of the near-surface soils, underlying bedrock and groundwater, thus obtaining an initial understanding of the contamination status and geotechnical properties of the on-site soil and rock conditions. As such, the following should be carried out:
- Ground investigation by advancing boreholes across the site to inspect the underlying made ground and soils, facilitate the collection of samples from within the on-site made ground and the underlying natural strata for chemical and geotechnical laboratory testing;
 - Assess the risk to human health and controlled water from the identified levels of contamination;

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- Assessment of the thickness and nature of the made ground soils;
 - Assessment of the geotechnical properties of the underlying natural strata for foundation design purposes;
 - Report on the presence of likely development abnormalities (e.g. weak shallow soils, organic natural deposits, buried obstructions, soft ground, deep made ground etc), where encountered;
 - Establish the presence of fugitive ground gases over the period of monitoring as outlined above. A minimum of 3 No. ground gas/groundwater monitoring installations would be required;
 - Invasive plant species survey (to be commissioned under separate agreement if necessary).

6.2.2 All ground investigation works and soil descriptions will be undertaken in general accordance with BS EN ISO 14688-1 'Geotechnical Investigation and Testing – Identification and Classification of Soil' (2002), BS10175 (2011), BS 5930 (2010) and/or BS EN 1997-2/2007 (EC7 Part 2).

6.3 Analytical Strategy

6.3.1 The analytical strategy to be adopted for the investigations shall be designed to provide an overall assessment of potential contaminants thought to be associated with the potential pollutant sources identified, once full and proper access to the site is achievable.

6.3.2 In view of the historical uses of the site, the following of concern are anticipated in significant concentrations, it is anticipated that the following analytes should be tested for:

- Heavy metals suite (including As, Cd, Cr(III), Cr(VI), Cu, Hg, Se, Pb, Ni, Zn);
- Speciated Polycyclic Aromatic Hydrocarbons;
- Speciated Total Petroleum Hydrocarbons;
- Volatile Organic Compounds;
- BTEX;
- Cyanide (Free and Total);
- Total phenol;
- Sulphates (Total and Water Soluble);

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- Sulphide;
 - pH;
 - TOC;
 - Asbestos fibres.

6.3.3 Sampling will be undertaken in accordance with those guidelines prescribed in Sections 8.3.2 and 8.6 of BS 10175:2011, whilst the basic engineering properties of soils encountered will be recorded through visual observation.

7 REGULATORY APPROVAL

- 7.1.1 The conclusions and recommendations presented in this report are considered reasonable on the basis of available information and the assessment of the site as carried out by Alan Wood & Partners.
- 7.1.2 It should be noted however that the works undertaken cannot be guaranteed to gain approval by the Regulatory Authorities and your Warranty Provider, so copies of this report should be made available to the relevant organisations (as appropriate) for their comment and approval, prior to undertaking any irrecoverable works associated with the site.

8 INFORMATION SOURCES

In addition to the specific references cited in the text, the following references have been referred to in the production of this report, where relevant to the defined project objectives.

- 1 BRE BR211 (2015) *Radon: guidance on protective measures for new dwellings*;
- 2 British Geological Survey Sheet 80 (1:50,000 scale, solid & drift edition and/or 1:10,000 scale);
- 3 Emapsite GroundSure / Geolnsight Report & EnviroInsight Report: EMS-530230_713173 and EMS-530230_713174, dated 4th March 2019.
- 4 BS5930 (1999), *Code of practice for site investigations*;
- 5 BS:8576 (2013), *Guidance on Investigations for Ground Gas - Permanent Gases and Volatile Organic Compounds (VOCs)*;
- 6 BSEN 1997-2 (2007), *Geotechnical Design Part 2 – Ground investigation and testing*;
- 7 BSEN 1997-1 (2004), *Geotechnical Design Part 1 – General Rules*;
- 8 Chartered Institute of Environmental Health (CIEH): *Professional Practice Note: Reviewing human health risk assessment reports invoking contaminant oral bioavailability measurements or estimates* (2009);
- 9 CIRIA C665 (2007), *Assessing risks posed by hazardous ground gases to buildings*;
- 10 CIRIA C552 (2001), *Contaminated Land Risk Assessment, A Guide to Good Practice*;
- 11 CIRIA SP32 (1984): *Construction over Abandoned Mine Workings*.
- 12 CL:AIRE / EIC / AGS: *Soil Generic Assessment Criteria for Human Health Risk Assessment* (updated January 2010 version);
- 13 Coal Authority, www.coal.decc.gov.uk;
- 14 DEFRA SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - Policy Companion Document*, December 2014;
- 15 DETR Circular 02/2000 (2000). *Environmental Protection Act 1990 Part IIA. Contaminated Land*. Department of the Environment, Transport and the Regions, Circular 02/2000, Dated 20th March 2000;
- 16 Environment Agency, www.environment-agency.org.uk;
- 17 NHBC Chapter 4.2 (2019), *Building near trees*, NHBC Publication, 2019;
- 18 Land Quality Management / CIEH: *The LQM/CIEH S4UL's for Human Health Risk Assessment*, Land Quality Press, Nottingham, 2015. Publication Number S4UL 3286.

9 LIMITATIONS OF STUDY

9.1.1 This document has been prepared by Alan Wood & Partners for the titled project and should not be relied upon or used for any other project without prior written authorization being obtained. Alan Wood & Partners can accept no responsibility or liability for the consequences of the use of this document, wholly or in part, for any other purpose than that for which it was commissioned.

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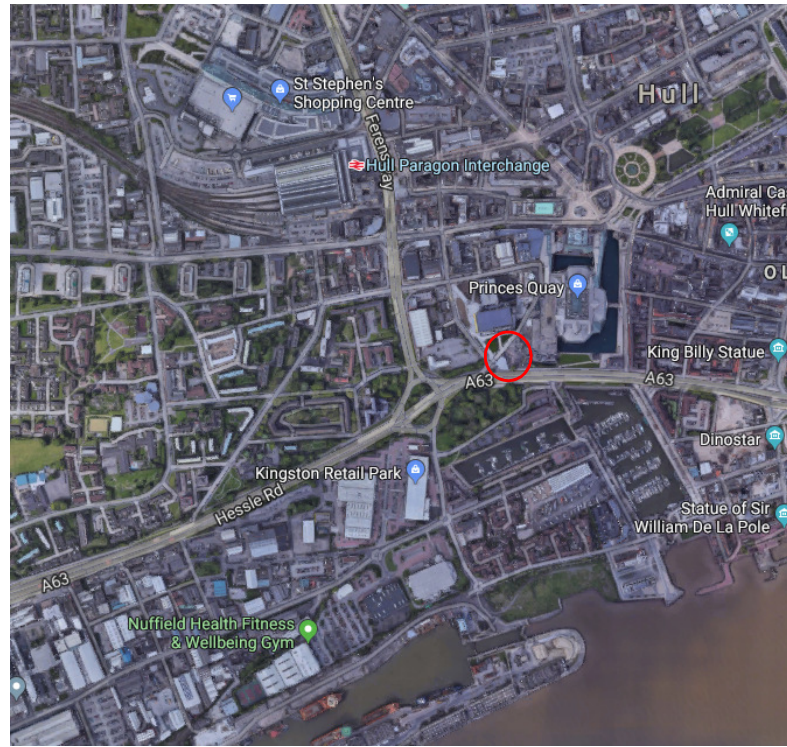
9.1.2 The findings and opinions provided in this document are given in good faith and are subject to the limitations and constraints imposed by the methods and information sources described in this report. Factual information, including, where stated, a visual inspection of the site, has been obtained from a variety of sources. Alan Wood & Partners assumes the third party data to be reliable, but has not independently confirmed this. The validity and accuracy of this information is outside the control of Alan Wood & Partners. No guarantee can therefore be given as to the completeness of the information gathered during the study and no responsibility is accepted for errors or omissions in the third party information used to produce this report. Alan Wood & Partners' professional judgement and experience is however used to ensure that uncertainties are reduced to a level appropriate to the site conditions, the purpose of the investigation and the resources devoted to it by the Client.

9.1.3 The findings and opinions presented in this report are relevant to the dates when the assessment was undertaken, but should not necessarily be relied upon to represent conditions at a substantially later date.


9.1.4 This report provides an assessment of the potential contamination status of the ground below the site, being based only upon information available for review. Where the report refers to the potential presence of invasive plants (such as Japanese Knotweed) or asbestos-containing materials, such observations are for information only and should be verified by a suitably qualified expert.

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- 9.1.5 Whilst every effort has been made to carry out an assessment that enables a realistic initial characterisation of the geotechnical and environmental parameters to be identified, the possibility of significant variation in actual ground and groundwater conditions existing cannot be discounted. Further information, ground investigation, construction activities, change of site use, or the passage of time may reveal conditions that were not indicated in the data presented and therefore could not have been considered in the preparation of this report. Where such information might impact upon stated opinions, Alan Wood & Partners reserve the right to modify the opinions expressed in this report. Where opinions expressed in this report are based on current available guidelines and legislation, no liability can be accepted by Alan Wood & Partners for the effects of any future changes to such guidelines and legislation. New information of improved practices and changes in legislation may require reinterpretation of the report as a whole, or in part.
- 9.1.6 The conclusions and recommendations presented in this report are based on site-specific information obtained during the desk study. They are however limited to those that could be reasonably made at the time the assessment was undertaken. Alan Wood & Partners reserve the right to retract either conclusions or recommendations in light of any further information that may become available.
- 9.1.7 Interpretation and recommendations should not be assumed valid for adjacent areas of land, or for alternate land uses. Where the proposed site usage changes, the findings of this report should be re-assessed to accommodate the change in proposed end-use.
- 9.1.8 The limitations of liability of Alan Wood & Partners for the contents of this document have been agreed with the Client, as set out in the terms and conditions of offer and related contract documentation.

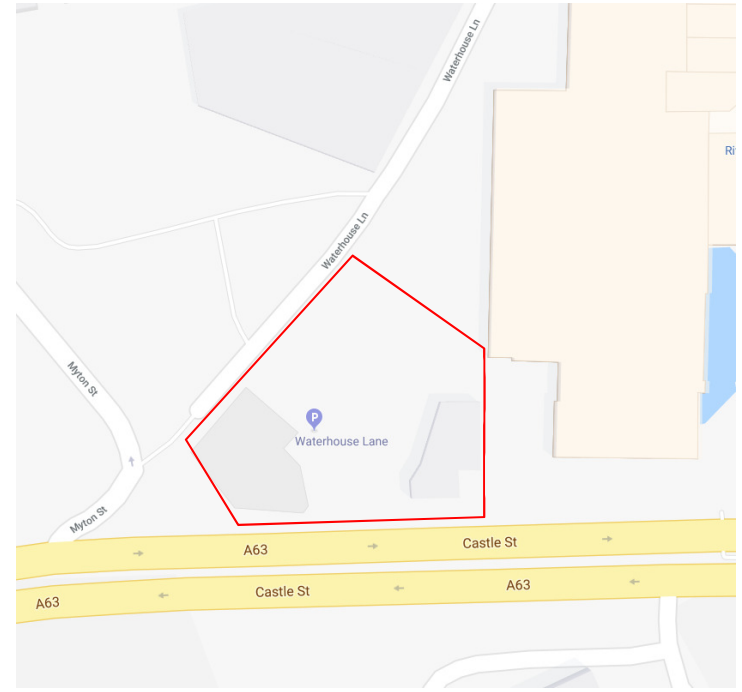
FIGURES



DO NOT SCALE

 Approximate Site Location

 Site Boundary



Client. Wykeland Group		
Project. Castle Street Buildings		
Drawing. Site Location Plan		
Date. 20.03.19	Scale. NTS	
Drawn by. AC	Check by. SLR	Approved by. SLR
Status: FOR INFORMATION		
Job no. 42263	Fig. no. 001	Rev.

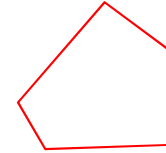
Bonus Arena

Photograph No. 2
(view south)

Photograph No. 1
(view north)

**Princes Quay
multi-storey car
park**

DO NOT SCALE



Site Boundary



Photograph No. 6
(view east)
Photograph No. 7

Photograph No. 9
(view east)

**Earl de Grey Public
House**



**Castle Street
Buildings**

Photograph No. 4
(view north)

Photograph No. 3
(view south)

Photograph No. 5
(view south)

Photograph No. 8
(view east)

Client. Wykeland Group		
Project. Castle Street Buildings		
Drawing. Site Features Plan		
Date. 20.03.19	Scale. NTS	
Drawn by. AC	Check by. SLR	Approved by. SLR
Status: FOR INFORMATION		
Job no. 42263	Fig. no. 002	Rev.

SITE PHOTOGRAPHIC RECORD



Photograph No. 1

View to the north of the site with the Bonus Arena pictured on the left and the Princes Quay multi-storey car park on the right.



Photograph No. 2

View to the south of the existing Castle Street Buildings surrounded by scaffolding.



Photograph No. 3

View looking south of the existing Castle Street Buildings.



Photograph No. 4

View looking north of the existing Castle Street Buildings.



Photograph No. 5

View to the south of the A63. Tree located on the southern boundary tentatively identified as Maple.



Photograph No. 6

View to the east of the existing Earl de Grey Public House.



Photograph No. 7

Western side of the Earl de Grey Public House.



Photograph No. 8

Front of the Earl de Grey Public House currently boarded up.



Photograph No. 9

View to the east over the site, with the Castle Street Buildings on the right hand side and the Princes Quay multi-storey in the background.

APPENDIX A

Groundsure Geo Insight Report