T J Morris Ltd.

Former Carcraft Site

Phase I Desk Study Report

112768/01

December 2015



CONTROL SHEET

PROJECT TITLE: Former Carcraft Site

REPORT TITLE: Phase I Desk Study Report

PROJECT REFERENCE: 112768/01

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Issue & Approval Schedul	Prepared by		Chris Sordy		<u></u>	11.12.2015			
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	Rev. Dat		ite	Status	D	escription	Signature		
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This document has been prepared in accordance with procedure OP/P02 of the Fairhurst Quality and Environmental Management System

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1.0 INTRODUCTION

Fairhurst have been instructed by T J Morris Ltd (The Client) to carry out a Phase I Desk Study for a proposed commercial development at land off Portal Way, Liverpool.

The aim of the Phase I Desk Study is to provide geotechnical and environmental information to assist the client in the assessment of abnormal costs associated with the development, and to provide information in support of a planning application.

The desk study includes a review of the available geological, historical and environmental information in order to establish the likely ground conditions at the site.

This report provides the following information;

- A review of the desk study information and development of a preliminary conceptual model.
- Summary of the environmental and geotechnical site conditions.
- Qualitative environmental risk assessment relating to the site conditions and proposed development.
- Outline remediation strategy, which should be implemented during development to mitigate the environmental risks identified by the qualitative risk assessment.
- Preliminary geotechnical engineering recommendations for the development; foundations, pavement design, earthworks and temporary works design.

1.1 Development Proposals

The proposed development is shown on AJA Architects Plan, **Appendix A**. The development comprises;

- Conversion of the existing disused commercial unit to:
 - o Training Centre
 - o 2 No. Commercial Units
 - o Garden Centre
 - o Service Area
- Conversion of the existing Home Bargains Training Centre to Offices
- New access road
- White line alterations to car parking
- Landscaping
- An area for future development

1.2 Sources of Information

Information has been obtained from the following sources in order to provide a desk study review of the site. The information is included in **Appendices A & B**;

- Landmark Envirocheck Report
- Ordnance Survey Historical plans
- British Geological Survey data

Liverpool City Council

The following historical reports have been reviewed as part of the desk study:

- Fairhurst Desk Study and Geo-Environmental Site Investigation Report (DIL/93015/03A), dated October 2013
- Fairhurst Phase I Desk Study (DIL/104979/01), dated January 2015
- Fairhurst Phase II Site Investigation Report (DIL/104979/02), dated April 2015

2.0 SITE DESCRIPTION

2.1 Location

The site, at National Grid Reference 340610, 396740 is located off Portal Way, Liverpool as shown on Figures 1 and 2, **Appendix A**. The site covers an area of approximately 6.47 Hectares.

The site comprises the following:

- Disused commercial unit (former Carcraft building)
- A commercial unit containing a discount supermarket and a training centre
- Car Parking
- Access routes & service areas
- Localised landscaping

Land adjacent to the development comprises:

- North: Warehouse, beyond which is Knowsley Brook
- East: Croxteth Brook, beyond which are open fields
- South: A580 (East Lancashire Road), beyond which are Residential Dwellings
- West: Warehouses

2.2 Topography

The topography of the site is shown on the Topographic Survey, **Appendix A**, and is summarised below:

- Site elevation generally falls gently to the south; with minor level variations throughout the car park
- Levels range from 17.47m AOD in the north to 15.289m AOD in the south of the site.
- A pond is present in the densely vegetated area in the east of the site adjacent to Croxteth Brook
- Adjacent site levels to the north, west, and south are generally higher than the site.
- Croxteth Brook on the eastern site boundary is approximately 3.00m lower than site levels.

2.2 Site History

The site's historical land uses have been identified based on a review of the historical plans included within the Landmark Envirocheck report, **Appendix B**. Significant features, changes, and associated dates are summarised in Table 1 & 2.

Table 1 - Current Land Use

Date	On Site	Adjacent Land
Present	 Disused commercial unit (former Carcraft building) A commercial unit containing a discount supermarket and a training centre Car Parking 	 N – Warehouse E – Open Fields S – Residential Dwellings WEST – Warehouses

Table 2 - Historical Land Use

Date	On Site	Adjacent Land
1850	 Open Fields Trees Pond Croxteth Brook 	 N – Farm SE – Gravel Pit
1891 - 1894	As Above	 N – Farm now a Sewage Farm S - Farm W - Tank
1908 - 1909	As Above	SE – Gravel Pit no longer indicated
1927 - 1928	As Above	 S – Unidentified Buildings
1938	As Above	 S – Unidentified Buildings removed, replaced with East Lancashire Road
1956 - 1961	 Pond shown as infilled on 1:1250 map, but present on 1:10000 map 	 S – Tramlines on East Lancashire Road W – Electrical Works
1962 - 1974	 Sewage Farm (no identifiable features) 	 N – M57 Motorway W – Omnibus Depot W – Electrical Works extended and now listed as Works
1990 - 1993	 Sewage Farm no longer present Croxteth Brook realigned along site boundary 	As Above
2006	Commercial Unit	 W – Works replaced with smaller depot and works

2.3 Geology

2.3.1 Artificial Ground

The historical plans indicate the presence of a former sewage works on site prior to the site being redeveloped to its current commercial end use. As such, deep made ground associated with infilled settling beds may be present in the site area.

The BGS data does not indicate the presence of made ground on site.

The site investigations for the G Park development (Ref. 8 & 9) located approximately 300m to the north of the site identified localised Made Ground to depths of 3.90m – 6.10m bgl. Made ground consisted of fine to coarse sand (of Ash) with gravel sized fragments of clinker, glass, brick, and Wood.

FAIRHURST

2.3.2 Superficial Deposits;

Geological maps (from BGS website www.bgs.ac.uk/opengeoscience/) indicate that the superficial deposits under the site comprise Sands (Shirdley Hill Sand Formation).

Historical on site boreholes (Appendix B) indicated the following ground profile:

- Topsoil to 0.30 -0.40m
- Loose Sand to 2.80m (South of site) 5.25m (North of site)
- Medium Dense Gravel to 5.65m (North of site only)
- Firm to Stiff Clay to >6.40m 11.90m
- Dense Sand (possibly weathered bedrock) to 12.40m (North of site only)

Site investigations for G Park development (Refs. 8 & 9) located approximately 300m to the north of the site identified the following ground profile:

- Localised Made Ground to 3.90m 6.10m
- Very Loose & Loose Sand to 5.20m 8.30m bgl
- Localised Medium Dense Gravel to 8.30m bgl
- Firm Clay (becoming Stiff with depth) with bands of sand to 9.50m 13.50m bgl.

2.3.3 Bedrock Geology

Geological maps (from BGS website www.bgs.ac.uk/opengeoscience/) indicate the site is underlain by Sandstone Bedrock (Sherwood Sandstone Group).

A historical borehole in the north of the site identified bedrock at 12.40m bgl. The historical borehole in the south of the site did not identify bedrock.

The site investigation for the G Park development (Ref. 8) identified Sandstone below the superficial deposits.

2.3.4 Geotechnical Hazards

The Envirocheck Report (Appendix B) indicates:

Low potential for Running Sand hazards

2.4 Mining and Mineral Extraction

Information on mining and mineral extraction in the area has been obtained from Envirocheck Report, Historical Plans, and the BGS GeoIndex.

2.4.1 Mining

Envirocheck Report

The Envirocheck Report does not indicate that the site is in an area which was affected by coal mining.

Historical Plans

The Historical Plans do not indicate the presence of mining activities on or adjacent to the site.

BGS GeoIndex

The BGS GeoIndex (extracts included in **Appendix B**) does not indicate the presence of any active mines or any opencast coal prospecting sites within or adjacent to the site area.

2.4.2 Mineral Extraction

A Gravel pit is indicated on historical plans (1850-1908) located 674m to the east of the site.

The Envirocheck report indicates that the gravel pit was the Radshaw Nook Gravel pit - an Opencast Sand & Gravel Pit which is no longer operational. No further mineral sites are identified.

2.5 Landfilling and Soil Gas

2.5.1 Onsite

There are no recorded landfills within the site area.

Localised infilling of ground may have been undertaken in the area of the pond (in the west of the site) and if filter beds were present on site associated with the on site historical sewage works.

2.5.2 Adjacent Land

A historical landfill is indicated 248m to the North-West of the site and is shown to have accepted industrial and household waste and is likely to have been associated with the infilling of filter beds associated with the historical sewage works. No information is supplied on operational dates. The landfill, along with three further landfills located 499m to the west, 554m to the north-west, and 653m to the north may represent a ground gas risk to the site.

Gas monitoring of the landfill 248m to the North-West was undertaken as part of the G Park development (Refs. 8 & 9) and identified the following:

Table 3 - Ground Gas Monitoring Results from the G Park Development

	Maximum (Worst Case) Result	Mean Result
CH4 (% v/v)	4.4	0.3
CO ₂ (% v/v)	13.5	2.4
Flow Rate (Ih ⁻¹)	0.6	0.25
Q _{hgs} (lh ⁻¹)	0.081	0.006

Based on these results and in accordance with BS8485:2015 (Ref. 2) the site was classified as soil gas Characteristic Situation 2.



2.6 Controlled Waters

2.6.1 Surface Water

A review of the desk study information has identified the following;

- There are no surface water features on site
- Croxteth Brook is located on the site boundary
- The River Alt is located 530m to the west of the site
- There are no surface water abstractions within 1km of the site
- The Landmark Envirocheck Report indicates that there have been 7 Category 2 (Significant) pollution incidents and 21 Category 3 (Minor) pollution incidents to controlled waters within 1km of the site.

The closest incident to the site was located on the site boundary when oils entered Croxteth Brook.

2.6.2 Groundwater

Information on groundwaters obtained from the desk study enquiries (**Appendix B**), historical boreholes, and the site investigation from the G Park Development (Ref. 8 & 9) is summarised below:

- The historical on site boreholes indicate that the site is underlain by Sand to 2.80m 5.25m over Clay to >6.40m 11.90m.
- The bedrock stratum (Sandstone (Sherwood Sandstone)) beneath the site is classified as a Principle Aquifer. Superficial deposits (Sand (Shirdley Hill Sand)) are classified as a Secondary A Aquifer.
- There is one groundwater abstraction within 1km of the site, situated 129m to the south east for potable water supply.
- During the site investigation for the G Park site (located approximately 300m north of the site) superficial groundwater was encountered between 1.20m 6.30m bgl. The main groundwater body was encountered between 5.00m 13.50m (under artesian pressure at rockhead).

2.6.3 Pollution Incidents

The Landmark Envirocheck Report indicates that there have been 7 Category 2 (Significant) pollution incidents and 21 Category 3 (Minor) pollution incidents to controlled waters within 1km of the site.

The closest incident to the site was located on the site boundary when oils entered Croxteth Brook.

2.6.4 Flood Risk

The majority of the site is indicated to be within Environment Agency Flood Zone 1 (<0.1% chance of flooding per annum). The eastern area of the site is indicated to be within Environment Agency Flood Zone 2 (between 0.1% and 1% chance of flooding per annum).

2.7 Radon

Information on radon obtained from the desk study enquiries is presented within the Envirocheck Report in **Appendix B** and summarised below:

- The site has been identified to be located within a lower probability Radon area (less than 1% chance of being above the action level for radon)
- Basic radon protective measures are not necessary in the construction of new buildings

2.8 Regulatory Review

2.8.1 Permits Consents and Authorisations

The factors that could influence the environmental status of the site are described below in Table 4. A full listing of these factors including discharge consents, pollution incidents and other environmental information is included in the Envirocheck Report, **Appendix B**.

Feature	No. within 1km of site boundary	Closest to site	Comments
Local Authority PPC	4	On Site	Carcraft Ltd. Respraying of Road Vehicles Status - Permitted
Contemporary Trade Directory Entries	33	152m (W)	Webuyanycar.com Used Car Dealer Status - Active
Registered Fuel Stations	1	655m (W)	Former Garage, East Lancashire Road Status - Obsolete

Table 4 – Regulatory Review

2.8.2 Landfilling and Waste Management

Details of the landfill sites and waste management facilities located within 1km of the site are summarised in Table 5.

Table 5 – Landfill and Waste Management Sites

Feature	No. within 1km of site boundary	Closest to site	Comments
Historical Landfill	4	248m (NW)	Gilmoss B Industrial & Household Waste No Input Dates Given
Licensed Waste Management Facilities	3	431m (W)	Gilmoss Waste Transfer Station Household, Commercial, and Industrial Licence: Modified (June 2013)
BGS Recorded Landfill Sites	0	-	-
Registered Landfill Sites	1	775m (N)	Brookfield School, Kirkby No Restriction on Waste Source Licence Cancelled (August 1990)
Registered Waste Transfer Sites	3	354m (SW)	P.D.C Fuels Limited Oils & Oil Tanks Status: Licence Surrendered

2.8.3 Summary

The majority of consents and permits discussed are not considered to have a detrimental impact on the site. The identified landfill sites have the potential to negatively impact the site.

2.9 Ecological Receptors

Croxteth Brook is located on the site boundary. An ecological survey may be required.

2.10 Invasive Species

It is recommended that an invasive species survey is undertaken to confirm the absence of any invasive species within the site boundary.

2.11 Archaeology

The English heritage website Pastscape (<u>www.pastscape.co.uk</u>) does not indicate the presence of any on site or adjacent archaeological features. This should be confirmed by a specialist.

2.13 Historical Site Investigations

The site investigations from the G Park Development (Ref. 8 & 9) situated approximately 300m to the north have been reviewed and summarised below:

- The 2013 investigation comprised 7 cable percussion boreholes and 15 Trial Pits, together with the installation of 6 monitoring wells.
- The 2015 investigation comprised 6 cable percussion boreholes and 10 Trial Pits, together with the installation of 5 monitoring wells.
- The identified soil profile comprised:
 - Localised Made Ground to 3.90m 6.10m
 - Very Loose & Loose Sand to 5.20m 8.30m bgl
 - Localised Medium Dense Gravel to 8.30m bgl
 - Firm Clay (becoming Stiff with depth) with bands of sand to 9.50m 13.50m bgl.
 - Sandstone Bedrock
- Superficial Groundwater was identified between 1.20m 6.30m bgl. The main groundwater body was encountered between 5.00m – 13.50m at rockhead.
- Ground gas monitoring identified CO₂ at elevated concentration concentrations and flow rates. CH₄ was identified at very low concentrations.
- Geotechnical testing indicates that the strength of the superficial soils is variable, with recorded SPT 'N' values between 4-26 within the Sand (indicating loose to medium dense Sand) and 15-31 within the Clay (indicating Firm to Stiff Clay).
- Chemical testing indicated that the soils tested contained determinands at concentrations below assessment criteria. Localised marginally elevated

leachable contaminants were identified within soil, and elevated levels of contaminants were identified within superficial groundwater.

Chemical testing also indicated that concrete resistant to aggressive ground conditions may be required.

• Asbestos was not identified in tested samples.

2.14 Site Walkover

A site walkover was undertaken on the 17th November 2015 and identified the following:

- A number of barrels of automotive oils and cleaning products were stored in the car park area
 - Anecdotal evidence indicates that these had only been in place for a short period of time as the building had been partially cleared and cleaned the previous week
- Building products (Pallets, fencing, streetlights, bags of rock salt) were also stored in the car park area
- Electricity and Gas infrastructure were present adjacent to the south-east corner of the building. Future Gas infrastructure is present adjacent to Portal Way.
- A number of storage boxes containing cartons of motor oil were located to the rear of the building
- Localised surface water ponding was noted through the car park area
- Large machinery remains in the service area of the building
- A number of inspection pits are present in the floor slab in the service area of the building

3.0 PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT

3.1 Qualitative Risk Assessment Methodology

Land contamination is a material consideration under the planning regime and a local planning authority has a duty to consider the potential implications of contamination under the following circumstances;

- when it is developing a Local Development Frameworks
- when it is considering applications for planning permission

The National Planning Policy Framework (NPPF) paragraph 122 states that planning policies and decisions should ensure that;

• the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;

• after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990

In order to establish whether there are potentially unacceptable risks associated with contaminant sources a conceptual Site Model has been developed and a Qualitative Risk Assessment has been undertaken in accordance with the requirements of the 'Model Procedures for the management of land contaminated' – CLR11 (Ref 6). The assessment has been undertaken with regard to the following proposed land use;

• Retail Stores and Offices.

The following sections discuss the identified potential on and off site contamination sources, migration pathways and environmental receptors in the context of the proposed development. The plausible pollutant linkages, which may represent a risk to receptors, such as human health and controlled waters, are identified via the conceptual site model and risk assessment based on the data collected during the desk study.

3.2 Potential Sources of Contamination

3.2.1 Historical Land Uses

The site has been developed with a number of potentially contaminative land uses since the 1960's. Adjacent land has also been developed with a number of potentially contaminative land uses since the 1890's.

The following potential contaminant hazards may be present based on site history, industry profiles, and available site investigation data.

<u>Onsite</u>

Historical land use as Sewage Works; Contaminants associated with the former sewage filter beds may include Heavy Metals, Inorganics, Organics (PAH, EPH), Pathogens, and Soil Gas.

Current Land Use as a Used Car Showroom and MOT Centre; widespread contamination at significant levels is unlikely; however localised contaminant hotspots may be present. Localised contaminants may heavy metals, inorganics (sulphur), organics (PAH, TPH, glycol, BTEX, MTBE), and soil gas.

Made Ground as Pond Infill; contaminants associated with made ground may include heavy metals, inorganics, organics, Asbestos, soil gas, and Tin Slag.

* The existing development was constructed in 2006 and it is considered likely that remediation works to any contamination associated with historical land use will have been undertaken on site as part of the development

Adjacent Land

General Made Ground; Localised contaminants associated with made ground may include heavy metals, inorganics, organics, Asbestos, and soil gas.

Historical land use as a Sewage Farm, Sewage Tank, and Settling Beds; widespread contamination at significant levels is unlikely; however localised

contaminant hotspots may be present. Localised contaminants may heavy metals, inorganics, organics (PAH, EPH), pathogens, and soil gas.

Historical land use as Landfill; widespread contamination at significant levels is unlikely; however localised contaminant hotspots may be present. Localised contaminants may include Heavy Metals, Organics (PAH, VOCs), Inorganics (Sulphates, Ammonia), Soil Gas, and Radiation.

Historical and Present land use as Works (including Electrical); widespread contamination at significant levels is unlikely; however localised contaminant hotspots may be present. Localised contaminants may include Heavy Metals, Organics (TPH, PAH, BTEX, VOC's, PCB's), Inorganics (Chloride, Sulphate), and Asbestos.

Present land use as Depots; widespread contamination at significant levels is unlikely; however localised hotspots may be present. Localised contaminants may include organics, inorganics and heavy metals.

Adjacent historical land uses such as Residential dwellings and the Motorway are unlikely to contribute to any contamination on site.

3.3 Pathways

A pathway is defined as a mechanism or route by which a contaminant comes into contact with, or otherwise affects a receptor. Pathways by which the identified receptors may be impacted on in the context of the proposed development are identified as follows;

- Ingestion
- Skin contact
- Inhalation
- Direct contact by buried structures
- Leaching of soluble contamination into groundwater
- Saturated zone flow through Aquifer
- Accumulation of potentially explosive gases within confined spaces
- Construction pathways.
- Radiation

3.4 Receptors

3.4.1 Human Health

Human receptors that are potentially at risk from identified sources include;

- Human health end users
- Human health construction workers
- Human health adjacent site users

3.4.2 Controlled Waters

Controlled waters that are potentially at risk from identified sources include;

- Main Groundwater (Primary Aquifer)
- Croxteth Brook

3.4.3 Structures

Migration of potential pollutants on site may present a risk to the following structures:

- Buried concrete foundations
- Services.
- Archaeological Sites

3.4.4 Ecological Receptors

Ecological receptors that are potentially at risk from identified sources include;

- Croxteth Brook
- Vegetation as landscaping (existing and proposed).

3.5 Preliminary Conceptual Site Model

Based on the preliminary Conceptual Site Model (CSM) an Environmental Risk Assessment (ERA) has been undertaken. The Environmental Risk Assessment is based on a simple matrix taken from CIRIA C552 (Rudland et al., 2001) 'Contaminated Land Risk Assessment – A Guide to Good Practice' and provides a consistent basis for decision-making. The probability and consequences of complete pollution pathways are defined according to parameters relevant to the situation and risk assessment.

The following Pollution Linkages Tables (Table 6 and 7) indicates the level of risk associated with the identified contaminant source and is based on the combination of consequence and probability. Tables 8, 9, 10 and 11 in **Appendix C** provide a Risk Matrix, together with a Classification of Consequence, Probability and Risk.

Table 6 – Summary	/ of	plausible source	 pathway 	/ – recep	otor p	ollutant	linkage -	Onsite	sources
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Source	Pathway	Receptor	Con.	Prob.	Risk
Historical use of the site as	Ingestion, Inhalation, Dermal Contact	Future Site Users	Md	UI	L
Sewage works		Construction Workers	Md	Lw	M/L
		Adjacent Land Users	Md	UI	L
	Leaching, Migration and Surface run-off	Groundwaters (Primary Aquifer)	Md	UI	L
		Adjacent Watercourses	Md	Hi	н
	Direct contact	Buried Concrete Foundations	Mi	Li	M/L
		Underground Services	Mi	Li	M/L
		Archaeological Sites	Mi	UI	VL
	Direct contact and Root Uptakes	Landscaped Areas	Mr	Li	L
Current Land Use as a Car Showroom and Repair Centre	Ingestion, Inhalation, Dermal Contact	Future Site Users	Md	UI	L
		Construction Workers	Md	Lw	M/L
		Adjacent Land Users	Md	UI	L
	Leaching, Migration and Surface run-off	Groundwaters (Primary Aquifer)	Md	UI	L
		Adjacent Watercourses	Md	Lw	M/L
	Direct contact	Buried Concrete Foundations	Mi	Li	M/L
		Underground Services	Mi	Li	M/L
		Archaeological Sites	Mi	UI	VL
	Direct contact and Root Uptakes	Landscaped Areas	Mr	Li	L
Made Ground associated with	Ingestion, Inhalation, Dermal Contact	Future Site Users	Md	UI	L
Pond Infill		Construction Workers	Md	Lw	M/L
		Adjacent Land Users	Md	UI	L
	Leaching, Migration and Surface run-off	Groundwaters (Primary Aquifer)	Md	UI	L
	Direct contact	Adjacent Watercourses	Md	UI	L

Table 6 (continued)

Source	Pathway	Receptor	Con.	Prob.	Risk
Made Ground associated with	Direct contact	Buried Concrete Foundations	Mi	Lw	L
Pond Infili		Underground Services	Mi	Lw	L
		Archaeological Sites	Mi	UI	VL
	Direct contact and Root Uptakes	Landscaped Areas	Mr	Lw	VL
Potential Tin Slag within the	Radiation	Future Site Users	Sv	UI	M/L
Made Ground		Construction Workers	Sv	UI	M/L
Ground gases associated with	Inhalation	Future Site Users	Sv	UI	M/L
made ground deposits		Construction Workers	Sv	UI	M/L

Table 7 – Summary of plausible source - pathway – receptor pollutant linkage – Offsite sources

Source	Pathway	Receptor	Con.	Prob.	Risk
General Made Ground	Ingestion, Inhalation, Dermal Contact	Future Site Users	Md	UI	L
		Construction Workers	Md	UI	L
	Leaching, Migration and Surface run-off	Groundwaters (Primary Aquifer)	Md	UI	L
		Adjacent Watercourses	Md	Lw	M/L
	Direct contact	Buried Concrete Foundations	Mi	UI	VL
		Underground Services	Mi	UI	VL
		Archaeological Sites	Mi	UI	VL
	Direct contact and Root Uptakes	Landscaped Areas	Mr	Lw	VL
Ground gases associated off site land use	Inhalation	Future Site Users	Sv	Lw	М
		Construction Workers	Sv	Lw	М
Historical Land use as Sewage Filter Beds, Tanks and Sewage Tanks	Ingestion, Inhalation, Dermal Contact	Future Site Users	Md	UI	L
		Construction Workers	Md	UI	L
	Leaching, Migration and Surface run-off	Groundwaters (Primary Aquifer)	Md	UI	L
		Adjacent Watercourses	Md	Hi	Н

Table 7 (continued)

Source	Pathway	Receptor	Con.	Prob.	Risk
Historical Land use as Sewage Filter Beds, Tanks and Sewage Tanks	Direct contact	Buried Concrete Foundations	Mi	UI	VL
		Underground Services	Mi	UI	VL
		Archaeological Sites	Mi	UI	VL
	Direct contact and Root Uptakes	Landscaped Areas	Mr	UI	VL
Historical land use as a Landfill	Ingestion, Inhalation, Dermal Contact	Future Site Users	Md	UI	L
		Construction Workers	Md	UI	L
	Leaching, Migration and Surface run-off	Groundwaters (Primary Aquifer)	Md	UI	L
		Adjacent Watercourses	Md	Hi	Н
	Direct contact	Buried Concrete Foundations	Mi	UI	VL
		Underground Services	Mi	UI	VL
		Archaeological Sites	Mi	UI	VL
	Direct contact and Root Uptakes	Landscaped Areas	Mr	UI	VL
Historical land use as a Works (including Electrical)	Ingestion, Inhalation, Dermal Contact	Future Site Users	Md	UI	L
		Construction Workers	Md	UI	L
	Leaching, Migration and Surface run-off	Groundwaters (Primary Aquifer)	Md	UI	L
		Adjacent Watercourses	Md	Lw	M/L
	Direct contact	Buried Concrete Foundations	Mi	UI	VL
		Underground Services	Mi	UI	VL
		Archaeological Sites	Mi	UI	VL
	Direct contact and Root Uptakes	Landscaped Areas	Mr	UI	VL

Table 7 (continued)

Source	Pathway	Receptor	Con.	Prob.	Risk
Present Land use as Depots	Ingestion, Inhalation, Dermal Contact	Future Site Users	Mr	Lw	VL
		Construction Workers	Mr	Lw	VL
	Leaching, Migration and Surface run-off	Groundwaters (Primary Aquifer)	Md	UI	L
		Adjacent Watercourses	Md	Lw	M/L
	Direct contact	Buried Concrete Foundations	Mi	Lw	VL
		Underground Services	Mi	Lw	VL
		Archaeological Sites	Mi	UI	VL
	Direct contact and Root Uptakes	Landscaped Areas	Mr	Lw	VL

After CIRIA Report C552, Contaminated Land Risk Assessment A Guide to Good Practice, 2001.

Where Con = Consequence and Prob = Probability. Consequence: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor. Probability: Hi = High likelihood, Li = Likely, Lw = Low Likelihood, UI = Unlikely. Risk: VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low.

Based on previous activities in the surrounding area, the pollution linkage assessment, and the geological setting of the site, the risk assessment has indicated the following for the majority of the site;

- The site represents a LOW risk to future site users set in the context of the proposed development, apart from the risk from ground gas which is considered MODERATE, and the risk from Tin Slag which is considered MODERATE/LOW.
- The site represents a **MODERATE/LOW** risk to construction workers set in the context of the proposed development works apart from the risk from ground gas which is considered **MODERATE**.
- The site represents a **LOW** risk to the main groundwater body
- The site represents a **HIGH** risk to the adjacent watercourses
- The site represents a **MODERATE/LOW** risk to buried structures and services in the context of the proposed development, and a **VERY LOW** risk to Archaeological sites.
- The site represents a **LOW** risk to landscaping within the development.

3.6 Preliminary Remediation Options and Mitigation Measures

The proposed development is for conversion of existing buildings to end use as commercial units and offices. Partial demolition of the existing buildings and alterations to the external hardstanding areas will be required.

The site and adjacent land have been developed with a number of potentially contaminative land uses. Historical site investigations (Ref. 8) on adjacent land with similar historical land use identified localised hotspots of leachable contaminants within near surface soils and elevated concentrations of contaminants within superficial groundwater.

The following precautionary measures may be required (subject to confirmation by site investigation) to ensure a low risk to receptors is maintained during development.

General Measures Implemented During Construction

The following measures may be required:

- Construction workers should adopt appropriate health and safety measures during construction works.
- Construction workers should undertake soil gas and VOC monitoring prior to and during man entry of below ground voids.
- Surface water control measures should be adopted during construction to limit runoff and infiltration.
- Dust suppression measures should be adopted during all earthworks.

<u>Asbestos</u>

Due to the age of the existing buildings, the presence of Asbestos within the building fabric is considered unlikely but should be confirmed by survey. However, the presence of Asbestos within made ground materials cannot be ruled out.

If encountered Asbestos materials will need to be subject to risk assessment to identify any appropriate remedial action, removal, or burial.

<u>Tin Slag</u>

During the site strip a visual assessment for slag debris should be undertaken. If slag debris is identified during site works then the following method for radiological assessment is proposed;

- A non-intrusive walkover survey based on a 2m grid, involving the use of a sensitive hand-held scintillation detector (Georadis RT-30) to detect photon radiation.
- Any materials that record elevated photon radiation levels are to be excavated and disposed of to landfill.
- If materials are identified that emit elevated photon levels then a gamma survey meter will be used during any further site works to screen excavated materials for emissions.

Minimum Measures to Remediate Pathways

The following measures may be required to remediate pathways:

• Locate and seal any monitoring wells from site investigations.

Minimum Measures to Mitigate Risk to End Users

The following measures may be required to mitigate risk to end users:

- If encountered contaminant hotspots will need to be subject to risk assessment to identify any appropriate remedial action.
- Installation of a clean cover to new landscaping areas.

Minimum Measures to Mitigate Risk to Controlled Waters

The following measures may be required to mitigate risk to controlled waters:

- If encountered leachable contaminant hotspots will need to be subject to risk assessment to identify any appropriate remedial action.
- Limit infiltration of surface water through soils containing elevated concentrations of contaminants.

Minimum Measures to Mitigate Risk to Ecological Receptors

The following measures may be required to mitigate risk to ecological receptors:

Installation of a clean rooting zone to new landscaping areas.

Mitigation Measures within the Built Development

The following mitigation measures may be required in the built development:

• Buried concrete and services should be designed in accordance with the guidance given in BRE Special Digest No. 1 (Ref. 3). Based on the test results from the historical Site Investigations (Ref. 8 & 9) on adjacent land, classifications of DS3 and AC3 are considered appropriate. This should be confirmed by on site investigation.

- The advice of service providers should be obtained to ensure that appropriate measures are taken to protect new services from contamination and aggressive ground conditions.
- Soil gas monitoring from the historical investigations on adjacent land (Ref. 8 & 9) indicated the site as Characteristic Situation 2. This should be confirmed by on site monitoring.

Based on these results ground gas mitigation measures for extensions to the existing building are likely to comprise a reinforced ground slab and a proprietary gas resistant membrane.

The existing building is considered likely to have been constructed with ground gas protective measures. If development works affect these protective measures repair works should be undertaken (i.e. if new foundations are required that will be installed through a gas membrane, the membrane should be sealed to the new foundation).

4.0 PRELIMINARY GEOTECHNICAL ASSESSMENT

4.1 Geotechnical Hazards/Constraints

Based on the desk study information obtained the following geotechnical constraints are anticipated on the site:

- Potential for localised deep made ground
- Localised very loose sand deposits
- Potential for Asbestos within Made Ground Deposits
- Excavations within the made ground and superficial soils may be unstable
- Ground conditions are indicated by historical site investigations on adjacent land to be aggressive to concrete. This may require an upgraded specification concrete within the development.
- Levels fall sharply down to the adjacent watercourses at the north-eastern site boundary

4.2 Demolitions

Development will require partial demolition of the existing disused commercial unit. A section of the existing car park will also require demolition where the new access road is planned.

An asbestos survey should be undertaken prior to demolition.

4.3 Foundation Design Considerations

The only new build areas within the development are two stairwells to be constructed on the southern face of the existing disused commercial unit and an internal extension to the first floor.

It is considered likely that piled foundations will be required due to the loose nature of the near surface soil and the proximity of new foundations to existing building foundations. Required pile depths should be confirmed by site investigation, but are likely to be in the range of 12.50m - 15.00m bgl.

4.4 Pavement Design

As part of the development a new access road and service yard will be constructed. Based on the available information the following sub-grades and indicative design CBR values are considered appropriate:

<u>Subgrade</u>	Design CBR
Made Ground	<2%
Sand	3 - 5%

Prior to development all subgrades should be proof rolled and visually inspected. Any materials with a CBR of < 2.5% should be removed and replaced with compacted granular fill to a minimum depth of 0.50m below the proposed pavement design.

4.5 Mining

Based on the information obtained from the Coal Authority the site is not considered to be at risk from mining activities.

4.6 Earthworks

As part of the development a new access road will be constructed through the existing car parking. Localised earthworks will be required in this area during removal of the car park and construction of the access road.

Where localised earthworks are proposed these should be undertaken in accordance with an appropriate specification.

4.7 Temporary Works

The following temporary works are anticipated for the proposed development;

- The use of traditional plant is expected to be feasible.
- Breakers may be required where the floor slab of the existing disused commercial unit needs to be removed.
- Excavation side support is likely to be required as the subsoils are expected to comprise granular materials.
- Pumping from sumps to control groundwater within excavations may be required.

4.8 Services

Statutory services plans should be reviewed in order to ensure no impact on the proposed development or associated site works.

REFERENCES

- 1. BS10175; 2011. Investigation of potentially contaminated sites. Code of practice
- 2. BS8485:2007. Code of practice for the characterisation and remediation from ground gas in affected developments.
- 3. Building Research Management. Concrete in Aggressive Ground Special Digest 1 (2005)
- 4. Definition of Waste: Development Industry Code of Practice (the code of practice) v.2
- 5. IAN 73/06 Design Guidance for Road Pavement Foundations (February 2009).
- 6. Environment Agency, 2004, Model Procedures for Management of Contaminated Land (CLR11)
- 7. NHBC Standards Chapter 4.2 Building Near Trees (2007)
- 8. Fairhurst Report D/I/L/93015/03A Desk Study and Geo-Environmental Site Investigation Report, dated October 2013
- 9. Fairhurst Report D/I/L/104979/02 Phase II Site Investigation Report, dated April 2015