

DESK STUDY REPORT FOR BIRCH INDUSTRIAL ESTATE, HEYWOOD



REPORT STATUS SHEET

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APPENDIX A

DRAWINGS & FIGURES

- Site Location Plan
- Existing Masterplan (Drawing No PR821_SK01, dated 13th November 2015 by Fletcher Rae)
- Proposed Masterplan Enlarged (Drawing No PR821_SK03, Rev B, dated 15th July 2016 by Fletcher Rae)
- Conceptual Site Model (AG2536-16-01)

APPENDIX B

DESK STUDY DATA

1.0 INTRODUCTION

An area of land in the southeast of Birch Industrial Estate in Heywood is being considered for redevelopment by Scott Hughes Design (the Client). The proposals for the site comprise the demolition of the existing industrial units and the construction of four new industrial units. This report presents the results of a desk study/Phase I Geoenvironmental Risk Assessment undertaken on behalf of the Client.

The desk study/Phase I assessment was undertaken to:

- Permit formulation of an opinion, as to the potential for hazardous substances or conditions to exist on or near the site likely to warrant mitigation or consideration appropriate to the intended end use proposed by the Client and as stated above.
- Establish anticipated geological conditions.
- Support a Planning Application.

The terms of reference/brief for the works were mutually developed between the Client and Applied Geology Ltd and are outlined in our proposal and estimate [ref AG16-5412let001] of the 20th July 2016. Limitations and Exceptions of the report are presented in Section 8.

More specifically, the services provided are summarised below and detailed in the following Sections.

- A site inspection and walkover survey to identify indicators (as defined in later sections) of the existence of hazardous substances or conditions on and in the vicinity of the site.
- A review of previous desk study and ground investigation reports by others and provided by the Client for information:
 - ❑ 'Phase I Geo-Environmental Desk Based Study' by Clancy Consulting dated February 2011 (Ref. 10/0340/001);
 - ❑ 'Geo-Environmental Appraisal Report' by Clancy Consulting dated May 2011 (Ref. 10/0340/002);
 - ❑ 'Geo-Environmental Desk Study' by Scott Hughes Design, dated 16th July 2012 (Ref. 2514, Rev 2);
 - ❑ 'Phase 2 (Ground Investigation) Report' by Sub Soil Surveys Ltd, dated 29th October 2012 (Ref. 2012/80-001-CON-Rev 0).
- A review of the following sources to provide data on likely ground conditions, geohazards and features which may affect development and to obtain information about the potential for hazardous substances to exist at and in the vicinity of the site:
 - ❑ GroundSure Report
 - ❑ BGS - Published Information & Borehole Database
 - ❑ Historical Maps

- ❑ The Coal Authority Web Site
- ❑ Environment Agency Web Site
- ❑ MAGIC Web Site

- Inspection of on-line Planning records.
- Reporting.

2.0 SITE LOCATION AND DESCRIPTION

2.1 General

The site is located in the southeast of the Birch Industrial Estate, located off Moss Hall Road in Heywood. Bury town centre is approximately 4km northwest of the site and the junction where the M62 and M66 join the M60 is 2.5km to the southwest. The Ordnance Survey grid reference for the centre of the site is 384193, 408235 as shown on the Site Location Plan in Appendix A.

The site is irregular in shape and covers an area of approximately 4.6ha. It generally slopes down to the northwest.

2.2 Walkover Survey

A site walkover survey was carried out by Applied Geology on the 15th September 2016.

The site comprised industrial premises Units B, D and G, which were steel framed warehouses, brick buildings and portacabins, surrounded by hardstanding with some landscaped areas. A raised grassed area was present between Unit B in the south and the perimeter access road. The use of each area of the site was discussed with Steve Simpson on site, who oversees the running of the Birch Industrial Estate, and is presented in a list included in Appendix B, together with a plan showing the location of each unit.

The area surrounding Unit G in the south of the site was noted to be unkempt, with rubbish, empty and full pallets and evidence of fires present. Land adjacent to the north of Unit B was used for storage of scaffolding poles. The northern part of the site was also a storage area, with some parked cars noted and a stockpile of crushed hardcore and soil in the east. It was understood from Steve that this stockpile had been on site for around 10 years and belonged to the person renting the yard.



Unit B on right with scaffolding poles stored to the north and Unit A (off site) in background



Unit B on left with raised grassed area in foreground and Unit G in background and pallets on far right



Evidence of bonfires and rubbish in southern corner of site, by Unit G



Northeastern part of site with soil and hardcore mound on right

Steve advised us of several former and current fuel tanks on site, comprising an LPG tank by Unit G, a former heating oil tank adjacent to Unit D, and a former above ground heating oil tank adjacent to the southwest of Unit B. It is understood that the latter was removed around three years ago and that surrounding soils were removed and replaced. A diesel tank and containers were noted off site at Unit L, to the west of the northern part of the site, and a diesel tank to the northwest of the site next to Unit H.

Three electricity substations are present within the Birch Industrial Estate, the closest being adjacent to the west of the site (off site).

Immediately north of the site were redundant sewage settlement tanks for the Birch Industrial Estate. Beyond that was an attenuation pond for surface water from the Birch Industrial Estate. It is understood that there is a brick interceptor for outflow water from the pond, which then flows in a culvert towards the Lady Brook (location unknown). Steve advised us that the Environment Agency sample the outflow water before it enters the culvert.



Redundant sewage settlement tanks (off site), looking northeast away from the site



Attenuation pond (off site), looking southwest towards the site

Fields were to the east and southeast of the site. Whittle Lane formed the southern site boundary and Moss Hall Road the western-most site boundary. Other premises within Birch Industrial Estate were located adjacent to the west of the central and northern parts of the site.

Trees were located along the southeastern, southern and far western site boundaries.

Several fuel tanks on and off site, electricity substations off site, ash from bonfires on site and former and current land usages on and off site are potentially contaminative sources. Given their age, the buildings may contain asbestos.

It should be noted that Applied Geology Limited does not provide arboricultural surveys or specialist surveys for the detection of invasive plant species (such as Japanese Knotweed) or protected species of wildlife. Whilst no Japanese Knotweed or other controlled or invasive species was noted, it is recommended that if required, separate investigation by specialists be undertaken to confirm this.

2.3 Proposed Development

The proposals for the site comprise the demolition of the existing industrial units and the construction of four new industrial units, as shown on the Proposed Masterplan Enlarged (Drawing No PR821_SK03, Rev B) dated 15th July 2016 by Fletcher Rae, a copy of which is included in Appendix A.

3.0 DESK STUDY INFORMATION

3.1 Site History

Historical maps were obtained in order to determine any significant past activity or land usage. Copies of these maps are presented in Appendix B of this report and are described below.

Table 1 – Site History Summary

Map Date	On The Site	In The Vicinity Of The Site
1848-1851	The site is part of several fields.	The surrounding area is agricultural, with several excavations/ponds within fields, the closest being 45m northeast of the site. A road is adjacent to the south and west of the site. A stream issues approximately 80m southeast of the site, flowing in an easterly then southerly direction to the Whittle Brook 850m southeast of the site. The Whittle Brook flows in a westerly direction. A sand pit is approximately 580m east of the site, old sandstone quarries 550m north and 580m northwest of the site and Barlow's Coal Pits 650m northwest of the site.
1890-1893	No significant changes.	The sand pit is marked as old quarries. Some former excavations/ponds north and northwest of the site appear to have been infilled, although the closest remains.
1907-1910	No significant changes.	An unmarked excavation is approximately 85m south of the site.
1928-1932	No significant changes.	No significant changes.
1938-1939	By 1939, the site is part of one large field.	No significant changes.
1955-1956	No significant changes.	The excavation 45m northeast of the site appears to have been infilled. A gravel pit is marked 400m southeast of the site.
1965	No significant changes.	The gravel pit has enlarged and is now marked as Whittle Fold Sand Quarry.
1974-1975	No significant changes.	Whittle Fold Sand Quarry is not marked, presumably infilled, with the M62 constructed over part of it, in a cutting.
1980-	The site is part of Birch	Birch Industrial Estate extends off site to the northwest.

Map Date	On The Site	In The Vicinity Of The Site
1992	Industrial Estate, with several buildings on site, including part of a depot in the north.	A 'D' shaped pond is located 60m northeast of the site, in a similar location to the former excavation. Between the northern site boundary and the pond are tanks, understood to be sewage settlement tanks.
2002-2014	The building in the northern part of the site has been demolished by 2002.	By 2002, the coal pits are no longer marked. There are many streams marked within fields, beyond 250m of the site.

Summary: the site comprised fields until Birch Industrial Estate was constructed between 1975 and 1980. A depot was formerly located in the north of the site and to the west of the site, with sewage settlement tanks off site to the north.

Anecdotal evidence included within previous Desk Study reports by Scott Hughes Design and Clancy Consulting suggests that the site was part of an RAF premises, with a maintenance unit present between 1939 and 1967 and an RAF instructors school between 1944 and 1946. Military installations are often not shown on historical maps of this age. The exact locations of these in relation to the site are not known.

The Desk Study report by Scott Hughes Design identified an old demolished boiler house and chimney within the former Depot, adjacent to the west of the northern part of the site, during their walkover survey in 2012.

The surrounding area has and remains predominantly agricultural, with many historical excavations shown, associated with sand, gravel and sandstone extraction. The Desk Study Report by Scott Hughes Design also suggests historical extraction of clay. Some excavations appear to have been infilled. Coal pits were located northwest of the site until between 1982 and 2002.

3.2 Anticipated Geology

Reference to the published 1:50,000 scale British Geological Survey (BGS) map, Sheet '85' [solid and drift edition], indicates the site to be directly underlain by drift deposits of Glacial Till, typically sandy gravelly clay, with Glaciofluvial Ice Contact Deposits, generally sand with some gravel, in the southern-most part of the site. Solid deposits comprise the Pennine Lower Coal Measures Formation, described as interbedded mudstone, siltstone and sandstone with coal seams, which become more numerous and thicker in the upper part.

Inferred coal seams are identified within the Groundsure report 340m northwest of the site and beyond. The Desk Study Report by Clancy Consulting identifies three coal seams north and northwest of the site, the closest being the Lower Mountain Mine seam around 340m northwest of the site, dipping to the southeast by around 5 degrees. This would suggest that the shallowest coal seam beneath the site is in excess of 40m below ground level (bgl).

A geological fault is located 95m north of the site, orientated east-west and downthrown to the south, but does not affect the geology on site.

Two ground investigations, by Sub Soils Surveys adjacent to the west of the northern part of the site (Ref. 2012/80-001-CON-Rev 0), and by Clancy Consulting in the western part of the Birch Industrial Estate (Ref. 10/0340/002), identified Made

Ground comprising topsoil, mixed granular and cohesive fill with brick and concrete fragments, clinker, slag, ash, coal, limestone, sandstone and quartzite gravel and occasional cobbles and asbestos cement fragments to depths of between 0.2m and 3.0m bgl.

Alluvium was present across most of the sites, typically comprising very soft to firm silt/slightly gravelly sandy organic-rich clay to depths of between 2.6m and 3.9m bgl. Glacial Till and Glaciofluvial Ice Contact Deposits appear to be interbedded below, comprising medium dense sand, sand and gravel and firm to very stiff slightly gravelly slightly sandy clay.

Solid deposits comprising sandstone, mudstone and shale were encountered at depths of between 7.0m and 13.3m bgl, shallowest in the north.

Perched groundwater was struck locally, within the Made Ground and drift deposits at depths of between 1.7m and 12.9m bgl as slow and fast inflows. Subsequent monitoring recorded groundwater to be standing at depths of between 0.7m and 1.6m bgl.

3.3 Mining History/Geological Cavities

Historical maps show many excavations in the surrounding area, which are marked as former sand and gravel pits, sandstone quarries and coal pits.

The site is within a coal mining reporting area. The Coal Authority web site identifies coal mine entries not only in the location of the former coal pits shown on historical maps 650m northwest of the site but also approximately 550m northwest of the site. The site is outside of a development high risk area. The northwestern-most part of the Birch Industrial Estate (off site) is shown as an area of probable shallow coal mine workings.

A Coal Mining Report was obtained by Applied Geology on the 8th September 2016 (ref. 51001247491001). It states that the site is not within a past, present or future designated underground or opencast coal mining area and that there are no known mine entries within 20m of the site. There are no reports of any damage or preventative works within 50m of the site due to subsidence from coal mining. There is no known mine gas emission requiring action.

A review of the DoE regional reports for Natural Underground Cavities in Great Britain (1993) indicates the site is not located in an area of recorded natural cavity formation.

3.4 Radon

Reference to the BRE document 211:2007, (Radon: guidance on protective measures for new buildings) and the Groundsure Report indicates that the site does not lie in an area where the geological strata may be susceptible to radon emissions. Hence, no precautions against ingress of radon into buildings are necessary.

3.5 Hydrology

The closest recorded surface watercourses are the culverted watercourse around 70m northeast of the site and the stream 80m southeast of the site. However, the Desk Study report by Clancy Consulting states that there are field drains and streams around the periphery of the industrial estate, which are tributaries to the Whittle Brook.

The closest surface water feature is the attenuation pond 60m north of the site.

There are no current surface water abstractions within 2km of the site. There is one current licensed discharge consent within 500m of the site, 30m north of the site for sewage from Birch Industrial Estate.

The Environment Agency web site indicates that the site lies outside of any fluvial flood zone. However this report is not intended to be a full hydrological study and if a flood risk assessment is needed, additional analysis by others is recommended to confirm this aspect of the development.

3.6 Hydrogeology

The Environment Agency classifies the Glacial Till as a Secondary (undifferentiated) Aquifer and the Alluvium, Glaciofluvial Ice Contact Deposits and Pennine Lower Coal Measures Formation as Secondary A Aquifers.

There are no current groundwater abstractions within 2km of the site. The site is not located within a groundwater Source Protection Zone.

3.7 Ecology

Information from environmental and ecological datasets was obtained from a review of the MAGIC (Multi-Agency Geographic Information for the Countryside) web site undertaken on the 14th September 2016 and the GroundSure Report, there are several deciduous woodlands within 2km of the site, the closest being 230m south of the site. A Local Nature Reserve, Hollins Vale, is 1.9km west of the site. The site and surrounding area is a recorded breeding area for arable assemblage farmland birds.

The site is within the Liverpool, Manchester and West Yorkshire Greenbelt.

If a full assessment of Environmental or Ecological aspects is required, it is recommended that other specialists are consulted.

3.8 Environmental Searches

Information pertaining to environmental issues was obtained from an emapsite Groundsure report, commissioned by Applied Geology Limited, dated 8th September 2016. This database contains sets of data corresponding to the databases held by a number of sources including the Environment Agency, British Geological Survey, Public Health England and The Coal Authority. A copy of the report is included in Appendix B.

Whilst there are no recorded landfill sites within 250m of the site, some historical excavations near the site appear to have been infilled. In addition, an area of infilled ground is identified on the geological map and the Groundsure report 230m southeast of the site. This is near the location of the Whittle Fold Sand Quarry shown on historical maps and may indicate backfill to the quarry.

There are two recorded pollution incidents within 250m of the site, both having minor (Category 3) impacts on land and water. One occurred on site in 2002 and was associated with gas and fuel oils. The second occurred 165m north of the site in 2003 and was associated with dyes and inks.

There are no recorded environmental permits, hazardous substance consents or enforcements or polluting emissions within the Birch Industrial Estate.

There are no current fuel stations within 250m of the site. The walkover survey identified several current and former gas, diesel and heating oil tanks on and off site within the Birch Industrial Estate.

3.9 Current Land Uses

Within the Birch Industrial Estate there are several distribution and haulage companies, tanks and electricity substations that could be potential sources of contamination.

3.10 Contamination and Ground Gas Data from Previous Ground Investigation Reports

The two ground investigations off site within the Birch Industrial Estate, by Sub Soils Surveys (Ref. 2012/80-001-CON-Rev 0) and by Clancy Consulting (Ref. 10/0340/002) identified all concentrations of contaminants tested in Made Ground and natural strata below the relevant commercial/industrial screening values. It has been noted that several samples in the vicinity of former or current fuel tanks identified petroleum hydrocarbons, with concentrations of total TPH between 13mg/kg and 153mg/kg adjacent to the west of the northern part of the site and one concentration of 113,000mg/kg in the northwest of the Birch Industrial Estate. However, all concentrations of TPH were below human health screening values. Limited leachate testing identified elevated concentrations of some PAH's and TPH and high pH values. Groundwater testing was not undertaken.

Ground gas monitoring was undertaken by both Sub Soils Surveys and Clancy Consulting. However, the ground investigation report by Sub Soils Surveys was issued before the gas monitoring was undertaken and the data has not been reviewed. The investigation by Clancy Consulting included monitoring standpipes within three cable percussive boreholes, with response zones within the Alluvium and shallow Glacial Till and Glaciofluvial Ice Contact Deposits. Four visits during high and steady atmospheric pressure recorded no methane above detection limits and carbon dioxide upto 4.1%vol. No flows were recorded. These results suggested that no special gas protection measures would be required for the new builds. Whilst hydrogen sulphide, a mine gas, was monitored and none was recorded above detection limits, carbon monoxide, another mine gas, and hydrocarbon vapours were not monitored.

3.11 Unexploded Ordnance

The Phase 2 report by Sub Soil Surveys (Ref. 2012/80-001-CON-Rev 0) states that the Zetica 'Regional Unexploded Bomb Risk' maps identify the Birch Industrial Estate to be at low risk of encountering unexploded ordnance. However, it is recommended that a UXO risk assessment be undertaken by a specialist prior to construction, given the possible historical use as RAF premises.

3.12 Planning Searches

Rochdale Council's online Planning Records were reviewed on the 19th September 2016. Nine new planning applications have been made for the Birch Industrial Estate within the last five years, although none appear to be on the site itself. They comprise various alterations to existing buildings, a new storage building and a 45m high wind turbine.

4.0 CONCEPTUAL MODEL

In developing a Conceptual Model for the site, pollutant linkages are determined by identifying likely sources of contamination from previous and current site uses, possible targets such as site users, neighbouring site users and Controlled Waters and linkages between them. These are discussed below.

4.1 Summary of Site History

The site comprised fields until it possibly became part of an RAF site in the late 1930's. Birch Industrial Estate was constructed between 1975 and 1980. A depot was formerly located in the north of the site and to the west of the site.

The surrounding area has and remains predominantly agricultural, with many historical excavations shown, associated with sand, gravel, sandstone and possible clay extraction. Some appear to have been infilled. Coal pits were located northwest of the site.

4.2 Summary of Anticipated Geology

Ground conditions on site are anticipated to comprise Made Ground, associated with the former and current site usages, underlain by possible localised Alluvium and interbedded cohesive Glacial Till and granular Glaciofluvial Ice Contact Deposits to depths of between around 7.0m and 13m bgl. Beneath the drift deposits, solid deposits of the Pennine Lower Coal Measures Formation are anticipated, comprising interbedded mudstone, shale, sandstone and coal seams. Perched groundwater may be present within the Made Ground and granular drift deposits.

4.3 Potential Source - Pathway – Receptor Pollutant Linkages

4.3.1 Sources

On-site

Made Ground on site may be a potential source of contamination and/or ground gas.

The former and current land uses, including the former RAF site and depot, may be potential sources of contamination, including asbestos.

The former and current fuel tanks and the historical pollution incident on site may be potential sources of hydrocarbons and hydrocarbon vapours.

Ash from bonfires around Unit G may be sources of heavy metals and polyaromatic hydrocarbons.

Alluvium on site may be a potential source of ground gas.

Mine gas may be present, associated with the coal seams at depth beneath the site.

Elevated sulphates may be present in any Made Ground and/or underlying natural strata.

Off-site - off site sources are generally similar to the on site sources, due to the similar site history and land uses.

Made Ground off site, including within backfilled excavations, may be a potential source of contamination and/or ground gas.

The former and current land uses, including the former RAF site and depot, may be potential sources of contamination.

The former and current fuel tanks off site may be potential sources of hydrocarbons and hydrocarbon vapours.

The electricity substations off site may be potential sources of PCB's.

The sewage treatment area north of the site may be a potential sources of organic contaminants.

Any remnant ash from the former chimney off site may be a potential source of heavy metals and polyaromatic hydrocarbons.

Alluvium off site may be a potential source of ground gas.

Mine gas may be present, associated with the coal seams at depth.

Elevated sulphates may be present in any Made Ground and/or underlying natural strata.

4.3.2 Pathways

Human dermal contact, ingestion via soil directly and inhalation of dust or volatile vapours.

Leaching and/or migration through permeable soils (any granular Made Ground and Glaciofluvial Ice Contact Deposits).

Direct contact with buried concrete and water supply services.

4.3.3 Receptors

End Users and Neighbours

The proposed end users and current and future neighbours may be receptors to any contamination or ground gas on or off site.

Controlled Waters

The field drains/streams around the periphery of the site, the culverted watercourse northeast of the site and stream southeast of the site are potential receptors to any contamination on or off site.

The drift and solid deposits on site are classified as a Secondary Aquifers and are a potential receptors to any contamination on or off site.

Buried Concrete and Water Supply Pipes

Buried concrete may be chemically attacked by elevated sulphates in the soil, if present.

Any hydrocarbons present may affect potable water in plastic water supply pipes.

Construction Workers

The risk to construction workers is not included here due to the short-term exposure times that they will be subject to and the assumption that good hygiene practices will be adopted on site and the appropriate use of relevant PPE/RPE will be adhered to when exposed to potentially contaminated soils.

4.3.4 Summary

The Conceptual Model described above is summarised below, together with a diagrammatic representation of the potential pollutant linkages in Appendix A as Drawing No AG2536-16-01.

Table 2 – Initial Conceptual Site Model

Source	Pathway	Receptor	Risk*
Potential contaminants in any Made Ground (on and off site)	Dermal contact, ingestion and inhalation of dust	End users and neighbours	Low-medium
	Migration and leaching	Culverted watercourse, streams, field drains and aquifers	Low-medium
Potential contaminants from former and current land uses (on and off site)	Dermal contact, ingestion and inhalation of dust	End users and neighbours	Low-medium
	Migration and leaching	Culverted watercourse, streams, field drains and aquifers	Low-medium

Source	Pathway	Receptor	Risk*
	Direct contact	Water supply pipes	Low-medium
Former and current fuel tanks and containers (on and off site), the historical pollution incident (on site) and PCBs (off site)	Dermal contact, ingestion and inhalation of dust	End users and neighbours	Medium
	Migration and leaching	Culverted watercourse, streams, field drains and aquifers	Medium
	Direct contact	Water supply pipes	Medium
Ash from bonfires around Unit G (on site) and the former chimney (off site)	Dermal contact, ingestion and inhalation of dust	End users and neighbours	Low
	Migration and leaching	Culverted watercourse, streams, field drains and aquifers	Low
Potential organic contaminants from sewage treatment area (off site)	Migration and leaching	End users and neighbours	Low
		Culverted watercourse, streams, field drains and aquifers	Low
Ground gas from Made Ground (methane & carbon dioxide), mine gas from coal seams (hydrogen sulphide and carbon monoxide) and hydrocarbon vapours (on and off site)	Migration into buildings, service ducts etc.(inhalation)	End users and neighbours	Low - medium
Elevated sulphates in any Made Ground and/or natural soils	Direct contact	Buried concrete	Low - medium

*** Definition of Risk Categories**

Negligible - Contaminants that might have unacceptable impact on key receptors, are unlikely to be present, or, no pathway is envisaged.

Low Risk: Contaminants may be present but are unlikely to be at levels to have unacceptable impact on key receptors, or pathways are likely to be minimal.

Medium Risk: Contaminants are probably present and might have an unacceptable impact on key receptors. Pathways may also be present therefore remedial measures may be necessary to reduce the risks.

High Risk – Contaminants probably or certainly present and pathways are probably also present. Therefore, contaminants are likely to have an unacceptable impact on key receptors and remedial measures are likely to be necessary to reduce the risks to acceptable levels.

5.0 GEOENVIRONMENTAL ASSESSMENT

Based on the available information, there is considered to be a low to medium risk of contamination and ground gas, mine gas and hydrocarbon vapours from on and off site sources that may affect human health or controlled waters. A ground investigation is recommended and remedial measures may be required.

6.0 GEOTECHNICAL ASSESSMENT

Made Ground is anticipated across the site, associated with the various phases of development, underlain by localised very soft to firm Alluvium. These would not be suitable as founding strata. Foundations would need to be extended into the more competent Glacial Till and/or Glaciofluvial Ice Contact Deposits.

Therefore, conventional spread/trench fill foundations may be suitable if the Made Ground and Alluvium do not exceed around 2.5m bgl. If the Made Ground and Alluvium are thicker than this, the new buildings will probably need to be founded on ground that has been improved (eg. by vibro) or on piled foundations. Due to the Made Ground and Alluvium, ground bearing floor slabs may not be feasible, depending on loadings and settlement tolerances.

Shallow perched groundwater may be present in the Made Ground and/or near surface granular drift deposits.

Soakaway drainage is unlikely to be a viable option, given the predominantly cohesive nature of the drift deposits and since surface water from the Birch Industrial Estate currently flows into an attenuation pond north of the site.

7.0 RECOMMENDATIONS

It is recommended that a Phase II Ground Investigation be undertaken to inform foundation design and to investigate the validity of the conceptual site model.

The ground investigation should comprise driven continuous sampling boreholes and cable percussion boreholes. Selected boreholes should be installed with standpipes in the Made Ground and natural strata to enable monitoring for ground gases, mine gases and hydrocarbon vapours and groundwater level. Geotechnical testing would be carried out in the exploratory holes to obtain soil parameters for foundation design and concrete classification. Chemical testing on soils and leachate and/or groundwater would be undertaken alongside geotechnical testing to determine whether any contamination is present on site and to assess the soils for waste disposal, buried concrete design and any special requirements for water supply pipes.

It is recommended that a UXO risk assessment be undertaken by a specialist prior to the ground investigation and construction.

8.0 LIMITATIONS AND EXCEPTIONS OF ASSESSMENT

Scott Hughes Design (the Client) has requested that a Phase I Geoenvironmental Risk Assessment be performed to support a planning application. The report is not a comprehensive site characterisation and should not be construed as such.

The investigation was conducted and this report has been prepared for the sole internal use and reliance of Scott Hughes Design. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Applied Geology limited. If any unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The findings and opinions conveyed via this report are based on information obtained from a variety of sources as detailed within this report, and which Applied Geology Limited believes are reliable. Nevertheless, Applied Geology Limited cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

The report represents the findings and opinions of experienced geoenvironmental consultants. Applied Geology Limited does not provide legal advice and the advice of lawyers may also be required.

The opinions presented in this report are based on findings derived from a site inspection and walkover and offsite surveys, a review of records, historical sources and on-site interviews. Applied Geology Limited has found indicators that suggest that hazardous substances exist at the site at levels likely to warrant mitigation or consideration appropriate to the end use stated by Scott Hughes Design.

The most recent site inspection/walkover survey was performed on 15th September 2016. Scott Hughes Design is advised that the conditions observed by Applied Geology Limited are subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance and may subsequently have become observable.

It is possible that Applied Geology Limited's researches, while fully appropriate for a Phase I Geoenvironmental Risk Assessment, failed to indicate the existence of important information sources. Assuming such sources actually exist, their information could not have been considered in the formulation of Applied Geology Limited's findings and opinions.

Applied Geology Limited believes that providing information about limitations is essential to help Scott Hughes Design identify and thereby manage its risks. These risks can be mitigated - but they cannot be eliminated, through additional research. Applied Geology Limited will on request advise Scott Hughes Design of the additional research opportunities available, their impact on risk, and their cost.

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GENERAL NOTES

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