



EARTH ENVIRONMENTAL
& GEOTECHNICAL

Phase 1 GeoEnvironmental Desk Study

1 Douglas Crescent

Bonnyrigg

Midlothian

February 2024

On behalf of

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PHASE I GEOENVIRONMENTAL DESK STUDY

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Report No. A5838/23

FEBRUARY 2024

Report Title:	1 Douglas Crescent, Bonnyrigg, Midlothian Phase I GeoEnvironmental Desk Study
Report Reference:	A5838/24/BDS
Client:	Esk Homes
Issue Date:	23rd February 2024
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1.0 INTRODUCTION

Appointment

- 1.1 Earth Environmental & Geotechnical Ltd has been commissioned by Lothian Built Environmental Services on behalf of Esk Homes Ltd (the Client) to undertake a Phase I GeoEnvironmental Desk Study for the proposed development at The Orchard Centre, 1 Douglas Crescent, Bonnyrigg, Midlothian.
- 1.2 It is understood that the Client intends to convert an existing structure and construct six 1 no. bed flats with associated car spacing pedestrian access and landscaping.
- 1.3 A communal bin store and communal garden have also been proposed.
- 1.4 Vehicle access will be gained from Douglas Crescent and/or Lothian Street, Bonnyrigg.
- 1.5 A proposed development plan has been provided and is shown in Figure 1.

Figure 1 Proposed Development Plan



Objective

- 1.6 The purpose of the Desk Study is to collate available geological and environmental data for the site (and its environment) and provide a preliminary geotechnical and geo-environmental appraisal, with a site-specific conceptual model. This enables a preliminary assessment of geo-environmental risks to be undertaken and, if necessary, provides information for the design of a Phase 2 Ground Investigation.

Scope

- 1.7 The Phase I Environmental Desk Study comprises of a review of the following information sources, some of which was provided by the client.
- British Geological Survey online maps.
 - Google Earth imagery.
 - Environment Agency online mapping data.
 - Historical Ordnance Survey maps.
 - The site and surrounding areas environmental, geological, and mining data presented in the site specific GroundSure Reports (Appendix 1).
 - Coal Authority Interactive Viewer.
 - Midlothian Council Planning portal.

2.0 SITE LOCATION AND DESCRIPTION

- 2.1 The site (0.05 hectares) is located on the corner of Douglas Crescent and Lothian Street, Bonnyrigg, Midlothian, EH19 2DF. The site is situated approximately 80m northwest of Bonnyrigg Rose Football Club.
- 2.2 The approximate National Grid Reference for the centre of the site is NT 30985 65251 (X:330985 Y: 665251).
- 2.3 The site is a rectangular shaped parcel of land which comprises of an existing structure (The Orchard Centre) and soft landscaped areas. The maximum dimensions of the site are 24m east to west and 25m north to south.
- 2.4 The Orchard Centre is a resource centre which provides community-based support across Midlothian, the building also includes a cafe.
- 2.5 The west of the site is adjacent to Douglas Crescent, the south of the site is adjacent to Lothian Street.
- 2.6 The northern and eastern boundaries are adjacent to residential dwellings which are demarcated by a wooden fence.
- 2.7 The general surrounding area comprises of residential dwellings within an urban setting. Bonnyrigg Rose Football Club is 80m southeast of the southern boundary of the site.
- 2.8 A location plan is shown below as Figure 2.

Figure 2 Site Location Plan



Figure 3 Site Photograph



Site Utility Services

- 2.9 Site service plans are yet to be obtained by the client. The status of all services should be checked prior to any development (including site investigation) commencing.

3.0 ENVIRONMENTAL SETTING

- 3.1 The geology of the site is covered by British Geological Survey (BGS) online data and the site specific GroundSure Enviro+Geo Insight report (Appendix 1).
- 3.2 Environmental conditions are covered by Environment Agency (EA) and British Geological Survey (BGS) online data, and the site specific GroundSure Enviro+Geo Insight report (Appendix 1).

Geology

- 3.3 The BGS states that the site is not underlain by artificial deposits.
- 3.4 The BGS states there are superficial underlying the site consisting of Devensian Till, commonly known as Boulder Clay.
- 3.5 The solid geology beneath the site is shown to be the Scottish Lower Coal Measures Formation, comprising sedimentary rock cycles, coal measures type.
- 3.6 There are 7 records of linear features within 500m of the site boundary. The closest record, 42m west refers to an inferred coal seam.
- 3.7 There are no records of landslips within 500m of the site boundary.
- 3.8 There are 17 BGS borehole records within 250m of the site. The closest available borehole log, which allows for further assessment of the local geology or shallow coal mining regime, is located 61m northwest of the site.
- 3.9 BGS borehole records (NT36NW1028 and NT36NW7467) shows sandy clay underlain by a sandstone rockhead at 1.65m bgl. A coal seam and fireclay were recorded at 5m - 6.7m bgl and 11.75m bgl.
- 3.10 The site is in an area where the hazard rating is very low with regards to shrink well clays, running sands, collapsable deposits, and landslides.
- 3.11 The hazard rating is negligible with regards to compressible deposits and soluble rocks.

Ground Workings

- 3.12 There are 2 records of historical surface ground working features identified within 250m of the site boundary. The closest record refers to a Sandstone Quarry located 141m north of the site dated 1852. The other record also refers to a Sandstone Quarry.
- 3.13 According to the BGS, there are 14 records of a British Pits within 500m of the site. The closest record refers to a sandstone quarry located 49m southeast of the site.

Mining and Other Underground Workings

- 3.14 Reference to the Coal Authority Interactive viewer shows the site is located within a Coal Authority risk area and within a High Development Risk Area.
- 3.15 There are 33 records of underground working identified within 1km of the site boundary. The closest record refers to an unspecified old shaft 54m southeast dated 1938.
- 3.16 There are no records for historical mineral planning areas located within 500m of the site.
- 3.17 There are 3 records for non-coal mining areas located within 1km of the site. The closest record refers to a Mineral Vein located 495m northwest of the site.
- 3.18 There are no records for researched mining located within 500m of the site.
- 3.19 There are no areas of brine extraction, gypsum extraction, tin mining, or clay mining within 1km of the site.
- 3.20 There are no records for natural cavities identified within 1km of the site.
- 3.21 There are no records for mining cavities identified within 1km of the site.

Radon Potential

- 3.22 The property is not located in a Radon Affected Area, as less than 1% of the properties are above the Action Level. Therefore, radon protection measures are not required.

Hydrogeology and Hydrology

- 3.23 The Scottish Lower Coal Measures Formation is classified by the Environmental Agency (EA) as a Moderately productive aquifer with a fracture flow type and a high to low permeability.
- 3.24 The groundwater vulnerability and soil leaching potential of the site have both been classified as low. The BGS states:

'Low Vulnerability -Areas that provide the greatest protection from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by low permeability.'
- 3.25 There are no groundwater abstraction licence records within 2km of the site.
- 3.26 There are no surface water abstraction licence records within 2km of the site.
- 3.27 There are no potable abstraction licence records within 2km of the site.
- 3.28 The site is not located within 500m of a Source Protection Zone or a Source Protection Zone within a confined aquifer.
- 3.29 There are no water network entries within 250m of the site.
- 3.30 There are no surface water features identified within 250m of the site.

3.31 There are no records of a Water Framework Directive (WFD) surface water body located within 250m of the site.

3.32 There are no records of a Water Framework Directive (WFD) groundwater body located on-site.

Landfill & Waste Management Activity

3.33 There are no records for current Environment Agency/Natural Resource Wales landfill records within 500m of the site.

3.34 There are no records of historic Environment Agency/Natural Resource Wales landfill sites within 500m of the site.

3.35 There are no records of BGS/DoE non-operational landfill sites within 500m of the study site.

3.36 There are no records of a historical landfill site from the Local Authority and Historical Mapping Records within 500m of the site.

3.37 There are no records of a historical waste site from the Local Authority and Historical Mapping Records within 500m of the site.

3.38 There is 1 record of a Licensed waste site within 500m of the site. This refers to Midlothian Council Bonnyrigg Civic Amenity Site located 326m northeast of the site.

3.39 There are no records of a waste treatment, transfer, or disposal site within 500m of the study site.

Industrial Land Use Information

3.40 There are 9 records of current potentially contaminative land uses identified within 250m of the site. The closest record refers to an Electricity Sub-Station located 42m north of the site.

3.41 There are 131 records of potentially contaminative historical land uses identified within 500m of the site. The closest record refers to a shaft located 19m east of the site dated 1854. Other records refer to Unspecified Shaft, Sawmill, Shaft and Unspecified Old Shafts.

3.42 There are 26 records of historical tanks identified within 500m of the site. The closest record refers to an Unspecified Tank located 159m northeast of the site dated 1952-1988.

3.43 There are 58 historical energy features identified within 500m of the site. The closest record refers to an Electricity Sub Station located 39m north of the site dated 1975.

3.44 There is 1 record for current petrol or fuel sites within 500m of the site. This refers to an Obsolete petrol station on Polton Street, Bonnyrigg located 358m southwest of the site.

3.45 There are no records of historical petrol or fuel sites within 500m of the site.

3.46 There are 27 historical garage and motor vehicle repair site records identified within 500m of the site. The closest record refers to a Garage located 124m southwest of the site.

- 3.47 There are no National Grid high voltage underground electricity transmission cables within 500m of the site.
- 3.48 There are no National Grid high-pressure gas transmission pipelines within 500m of the site.
- 3.49 There are no historical railway and tunnel features identified within 250m of the site.
- 3.50 There are no historical railway lines identified within 250m of the site.
- 3.51 There are no current active railway line records identified within 250m of the site.
- 3.52 There are no underground railway lines or tunnels identified within 250m of the site.
- 3.53 The site is not within 5km of the route of the High Speed 2 rail project.
- 3.54 The site is not within 500m of the route of the Crossrail 1 rail project.

Environmental Permits, Incidents and Registers

- 3.55 The Groundsure Report includes records of environmental permits, incidents, and registers within 500m of the site, which are summarised in Table 1 overleaf.

Table 1: Environmental Permits, Incidents and Registers within 500m of the Site

Permit/Incident/Register	Number
Historical Licensed Industrial Activities (IPC)	0
Part A (1) and IPPC Authorised Activities	0
Pollutant Release to Surface Waters (Red List)	0
List 1 Dangerous Substances Inventory Sites	0
List 2 Dangerous Substances Inventory Sites	0
Part A (2) and Part B Activities and Enforcements	2
Category 3 or 4 Radioactive Substance Authorisations	0
Licensed Discharge Consents	0
Planning Hazardous Substance Consents and Enforcements	0
Dangerous or Hazardous (COMAH and NIHHS) Sites	0
Sites Determined as Contaminated Land under Part 2A EPA 1990	0
Regulated Explosive Sites	0
Pollutant Release to Public Sewer	0
Substantiated Pollution Incidents (Category 1 and 2)	0
Pollution Inventory Substances, Wastes and Radioactive Wastes	0

- 3.56 There are 2 records of Licensed pollutant release (Part A (2)/B) located within 500m of the site. The closest record refers to a Part B Permit at Crawford, Drycleaning Services located 57m southwest of the site.

- 3.57 There are no records of Pollution Incidents (EA/NRW) located within 500m of the site.
- 3.58 There are no records of a Licensed Discharge to Controlled Waters located within 500m of the site.
- 3.59 There are no further Environmental Permits, Incidents and Registers within 500m of the site.

Environmentally Sensitive Sites

- 3.60 There are no Sites of Special Scientific Interest (SSSI) within 2km of the study site.
- 3.61 There are no Special Areas of Conservation (SAC) within 2km of the study site.
- 3.62 There are no Special Protection Areas within 2km of the study site.
- 3.63 There are no records of listed Ramsar sites within 2km of the study site.
- 3.64 There are 16 records of Ancient Woodland within 2km of the study site. The closest record refers to an Unknown (Ancient of semi-natural origin) woodland located 1056m north of the site.
- 3.65 There are no records of a Local Nature Reserve (LNR) within 2km of the study site.
- 3.66 There are no records of Nitrate Vulnerable Zones records located on-site.
- 3.67 There are no records of Nitrate Sensitive Areas located within 2km of the study site.
- 3.68 There are no records of National Parks (NP) within 2km of the study site.
- 3.69 There are no records of Greenbelt land within 2km of the study site.

Ecology

- 3.70 An ecological assessment of the site falls outside the brief of this report. Where considered necessary, advice should be sought from an ecological specialist in this respect.

Archaeology

- 3.71 An archaeological assessment falls outside the brief of this report. Where considered necessary, advice should be sought from an archaeological specialist in this respect.
- 3.72 There are no records of Scheduled Ancient Monuments, National Parks, Registered Parks and Gardens or Conservational Areas within 250m of the site.
- 3.73 There are 5 records of Listed Buildings within 250m of the site, including 1 directly on site. The on-site record refers to the Orchard Centre which is a Grade B listed building.

Potential Flood Risks

- 3.74 Detailed assessment of flood risks is outside the scope of this report. However, an Environment Agency Flood Zone 2 and 3 are not located on site.
- 3.75 There are no records of flooding from rivers and sea (RoFRaS) on site.

- 3.76 There are no records of flood defences within 250m of the site.
- 3.77 There are no records of areas benefitting from flood defences within 250m of the site.
- 3.78 There are no records of areas used for flood storage within 250m of the site.
- 3.79 The highest risk of surface water flooding occurring on-site is negligible.
- 3.80 The highest risk of groundwater flooding occurring on-site is low.

Previous Site Investigations

- 3.81 Earth Environmental & Geotechnical Ltd conducted a coal mining risk assessment at this site.
- 3.82 Although Earth Environmental & Geotechnical Ltd are not aware of any other previous site investigations carried out for the site.

4.0 SITE HISTORY

- 4.1 The historical development of the site has been determined by reference historical plans and Google Earth imagery. The reviewed historical plans comprise only readily available records and are limited; however, the information available to date indicates that additional searches are unlikely to add to our understanding of the site.
- 4.2 The site history is summarised in Table 2, below, followed by selected extracts from maps and aerial photographs.

Table 2: Summary of Site History

Date	On-Site History	Surrounding Land Use History
1854, 1:10,560 1885, 1:63,360	There are structures located on site.	<p>There is a school located 195m north of the site.</p> <p>There is a sawmill located 90m southwest of the site.</p> <p>There is a church located 215m north of the site.</p> <p>There are shafts located 39m south of the site and several more shafts within 500m of the site.</p> <p>There is a sandstone quarry located 286m northeast of the site.</p> <p>There are several other quarries located within 750m of the site.</p> <p>There is a railway line located 400m north of the site.</p> <p>There are several refuse heaps within 500m south of the site.</p> <p>The surrounding area generally comprises of agricultural land.</p>
1894 1:25,000 1895, 1906 1:10,560	Structures have been demolished; site is now unoccupied.	<p>A quarry is located 270m northwest of the site.</p> <p>There is a police station located 250m west of the site.</p> <p>There has been increased residential development within 250m of the site.</p> <p>There has been significant infrastructural change such as roads around the area.</p>
1947, 1953, 1955, 1968 1:25,000 1950 1:2,500	Structure has been erected. Extension to structure in approx. 1960's	<p>There has been significant residential development within the immediate vicinity of the site and between 500-750m.</p> <p>Bonnyrigg football ground is located 80 south of the site.</p> <p>A library is located 18m west of the site.</p> <p>Douglas crescent road constructed.</p>
Google Earth 2006-2024	No significant changes	Further retail and residential development of surrounding area.

Figure 4 OS Map Extract 1854



Figure 5 OS Map Extract 1909

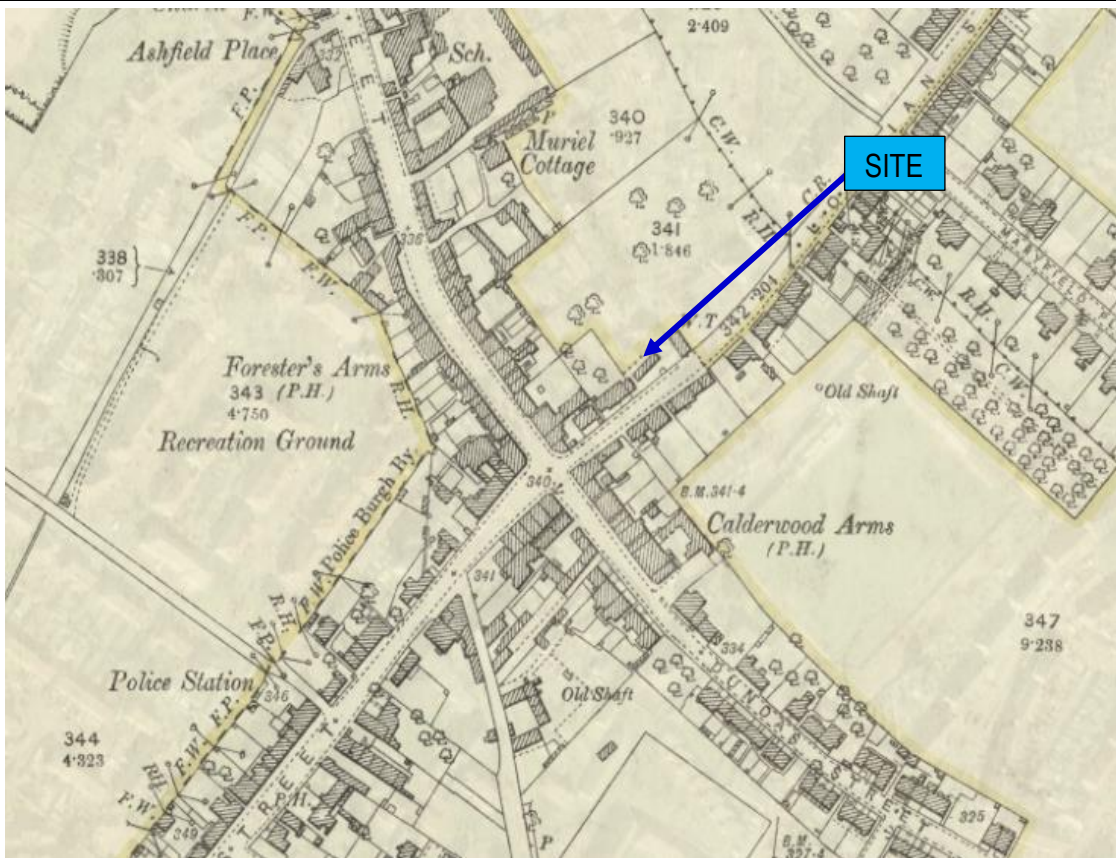


Figure 6 OS Map Extract 1949

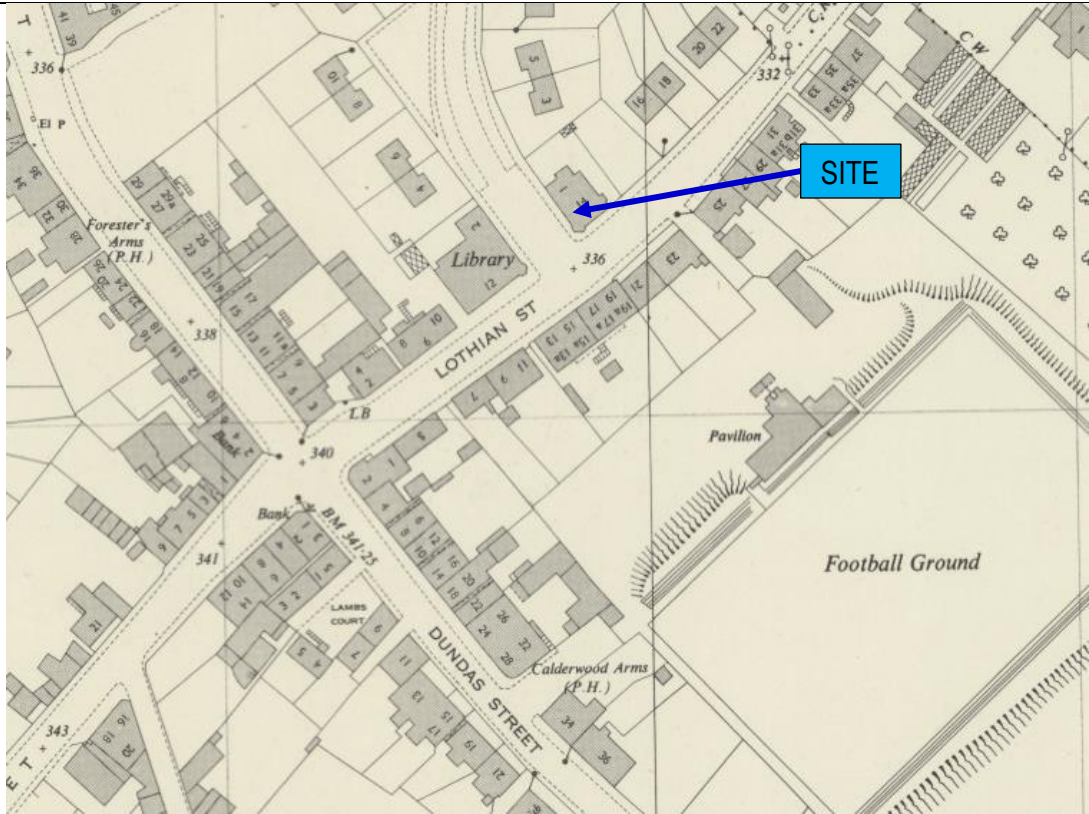


Figure 7 Aerial Image 2024



5.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

Introduction

- 5.1 The following paragraphs outline a Preliminary Risk Assessment (PRA) for the site based on the above desk study information as defined by DEFRA and the EA Model Procedures for the Management of Land Contamination, CLR11⁽²⁰⁰⁴⁾.
- 5.2 Table 5 provides a Preliminary Conceptual Model (PCM) which considers the source-pathway-receptor linkages present alongside the likelihood, severity and risk level as defined within Table 3 and Table 4 below. The assessment of probability, a modified risk table, and certain consequence definitions are based on CIRIA C552 and CLR11.
- 5.3 Table 5 considers whether a pollution linkage is potentially present and provides a preliminary qualitative assessment of risk based on the information currently available. Where a possible linkage is identified, it does not necessarily mean that a significant risk exists but indicates that further information is required through appropriate site investigation to substantiate the conceptual model.
- 5.4 The PCM/PRA is based on a proposed residential end use.

Table 3: Consequence, Probability and Risk

Probability	Consequence,	Risk
High Likelihood- There is a pollution linkage and an event either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution	Very High – acute risk to the human health likely to result in significant harm. Risk of severe or irreversible effect on ground/surface water quality. Catastrophic damage to buildings / property.	Very High – there is a high potential that the source-pathway-receptor scenarios may give rise to harm to human health, or the environment and remedial action is likely to be required.
Likely – there is a pollution linkage, and all the elements are present, which means that it is probable an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.	High – Severe or irreversible effect on human health. Temporary severe or irreversible effect on ground/surface water quality. Reduction of water quality rendering groundwater or surface water unfit to drink and/or substantial adverse impact on groundwater dependant environmental receptors.	High – it is likely that the source-pathway-receptor scenarios may give rise to an impact on human health or the environment, which may require remediation and/or control measures to mitigate risks
Low likelihood– there is a pollutant linkage and circumstances are possible for an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term	Moderate – Long term or short-term moderate effect on human health. Moderate effect on ground/surface water quality, reversible with time. Reduced reliability of a supply at a groundwater or surface water abstraction source	Moderate – it is possible that the source-pathway-receptor scenarios may give rise to an impact on human health or the environment, however it is either relatively unlikely that such would be severe, or if any harm were to occur it is more likely that harm would be mild.
Unlikely – there is a pollution linkage, but circumstances are such that it is doubtful that an event would occur even in the very long term.	Low – Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.) Slight effect on ground/surface water quality, reversible with time. Marginal reduced reliability of a supply at a groundwater or surface water abstraction source.	Low – it is possible that harm could arise at the source, however it is likely that this would at worst be mild.
		Very Low – it is unlikely that the source-pathway-receptor scenarios will give rise to an impact on human health or the environment.

Table 4: Estimation of Level of Risk by Comparison of Consequence and Probability

		Consequence			
		High	Moderate	Low	Very low
Probability	High Likelihood	Very High	High risk	Moderate risk	Moderate to low risk
	Likely	High risk	Moderate risk	Moderate to low risk	Low risk
	Low Likelihood	Moderate risk	Moderate to low risk	Low risk	Very low risk
	Unlikely	Moderate to low risk	Low risk	Very low risk	Very low risk

Potential Sources

- 5.5 Historically the site has seen structures present on the site from historical records dating back to 1854.
- 5.6 The site appears to have been a government building since its construction in the early 1900's with the plot lying empty until they added the prefabricated timber clad flat roofed extension on.
- 5.7 The immediate surrounding area in 1940's seen significant infrastructure change comprising new roads, including Douglas Crescent and part of the current existing structure. The date of the extension to The Orchard centre is unknown however it can be approximated at around the 1960's.

Potential Receptors

- 5.8 The following receptors have been considered for the construction and operational stages of the proposed redevelopment.
- Current site users;
 - Adjacent land users;
 - Future land users;
 - Construction workers during site development works;
 - Groundwater within the underlying aquifer

Potential Pathways

- 5.9 The following pathways have been considered for the construction and operational stages of the proposed redevelopment.
- Dermal contact, ingestion, inhalation pathways of potentially contaminated soils;
 - Downward vertical migration of leachate to shallow groundwater;
 - Vertical or lateral migration of ground gas.

Table 5: Preliminary Conceptual Model

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
<p>Potential ground contamination</p> <p>E.g., Heavy Metals, PAH, TPH, ground gas, PCBs.</p>	<p>Dermal contact, ingestion, and inhalation of soils dust</p>	Current Site Users	Unlikely	Moderate	Low	The site is currently used as the orchard centre. Most of the outdoor space is surfaced in hard standing. There is therefore limited potential for direct contact between contaminated soils and receptors. The risk is therefore considered to be LOW .
		Adjacent land users	Unlikely	Moderate	Low	Residential structures are adjacent to the site. The risk is considered LOW and usual dust control measures should be implemented as part of good site working practices during construction to reduce dust generation.
		Future land users	Unlikely	Moderate	Low	The proposed development is to convert an existing structure and construct six 1no. bed flats with associated car spacing pedestrian access and landscaping. Areas of soft landscaping have been proposed which will increase exposure to contaminated soils. The risk to future site users via direct exposure is considered to be LOW . This assessment is based on the sensitivity of the receptor. A contamination assessment of the existing on-site soils and appropriate remediation will reduce any risk.
		Construction Workers	Low Likelihood	Moderate	Moderate to Low	Construction workers may be exposed to potentially contaminated made ground materials during construction works, however exposure duration will be short term only. Assuming appropriate health and safety measures are adopted (in line with CDM and other relevant health and safety guidance) a MODERATE to LOW risk to construction workers is anticipated.
	Downward vertical migration of leachate to shallow groundwater	Groundwater within the Underlying Aquifer	Unlikely	Moderate	Low	The bedrock aquifer below the site is a Moderately productive Aquifer and the groundwater vulnerability is low. There is no identified source of contamination. The risk is therefore considered LOW .
	Lateral migration in surface waters	Surface water	Unlikely	Moderate	Low	There are no surface features within 250m of the site. There is limited potential for contamination. Therefore, the perceived risk to surface waters is LOW .
	Vertical or lateral migration of ground gas	Current Site Users	Unlikely	Moderate	Low	There are no potential sources of ground gas identified. Radon is less than 1% of the action level. Therefore, the risk to current site users from ground gas is considered LOW .

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
		Adjacent land users	Unlikely	Moderate	Low	The underlying soils are anticipated to be cohesive. The risk to adjacent land users from ground gas is therefore considered LOW .
		Future land users	Unlikely	Moderate	Low	There are no potential sources of ground gas identified. Radon is less than 1% of the action level. Therefore, the risk to current site users from ground gas is considered LOW .
		Construction Workers	Low Likelihood	Moderate	Low	Construction workers may be exposed to ground gas/depleted oxygen conditions in confined spaces and excavations; however, the duration will be short term. The risk to construction workers from ground gas is considered LOW .
Potential Asbestos Containing Material (ACM)		Current Site Users	Low Likelihood	Moderate	Moderate to Low	Asbestos may be present in the building or in the made ground soils beneath the site associated with the former structures. The risk to construction workers from ACMs is considered MODERATE to LOW .
		Adjacent land users	Low Likelihood	Moderate	Moderate to Low	Asbestos may be present in the building or in the made ground soils beneath the site associated with the former structures. Construction and disturbance of soil during the construction phase may allow fibres to become airborne. The risk is therefore considered MODERATE to LOW . Dust control measures (dampening down) should be implemented as part of good site working
		Future land users	Low Likelihood	Moderate	Low	The proposed development is to convert an existing structure and construct six 1no. bed flats with associated car spacing pedestrian access and landscaping. Areas of soft landscaping have been proposed which will increase exposure to any ACM in soils. The risk is therefore considered LOW .
		Construction Workers	Low Likelihood	High	Low	Construction workers may be exposed to potential asbestos in made ground soils during construction, however the made ground is not proposed to be disturbed. The risk is considered LOW .

6.0 GEOTECHNICAL HAZARDS ASSOCIATED WITH THE DEVELOPMENT

6.1 In addition to the environmental hazards there are also geotechnical hazards associated with the stability of the ground including load bearing capacity, slope stability and effects of ground mining activities. Local Authorities follow NPPF (2012) which requires that a site be suitable for its new use considering of ground conditions and land instability, including from natural hazards to former activities such as mining.

6.2 A summary of the geotechnical considerations is provided below in Table 6.

Table 6: Summary of Geotechnical Hazards

Geohazards:	
Highly Compressible Ground	Negligible risk
Collapsible Soils	Very low risk
Swelling Clay	Very low risk.
Running Sand	Very low risk.
Ground Dissolution	Negligible risk.
Landslip	Very low risk.
Mining & Quarrying	The site is located within a Coal Mining Reporting Area and within a Development High Risk Area. A Coal Mining Risk Assessment would need to be developed for this site.
Geotechnical Design Considerations	
Site Clearance	The site is currently clear.
Trees	There are no trees on site.
Existing Buildings/Obstructions	The site is currently occupied by the Orchard Centre.
Foundations	<p>The depth and type of proposed foundations would depend on the ground conditions present on site. The site is underlain by Till Devensian superficial deposits.</p> <p>An intrusive ground investigation is recommended prior to any construction works taking place to discover the most suitable foundation options for the site and to make sure the ground conditions are the same across the entire site.</p> <p>Shallow foundations are feasible.</p>

Geotechnical Design Considerations	
Floor Slabs	Again, an intrusive geotechnical investigation is recommended prior to any construction works to discover the most suitable floor slab design for the on-site ground conditions.
Groundwater	Exact groundwater conditions are not known at this stage. For more detailed knowledge of the groundwater regime, an intrusive investigation would be needed. However, it is recorded that the site is underlain by a Moderately productive aquifer bedrock aquifer. The highest risk of groundwater flooding occurring on-site is low.
Earthworks	Earthworks are unlikely to be required for the proposed development.
Slopes	The site is generally flat.
Retaining Walls	There are no retaining walls present on site.
Chemically aggressive ground conditions	Chemically aggressive ground conditions are not expected at this site. An intrusive geotechnical investigation would be necessary to confirm chemically aggressive ground.

7.0 CONCLUSIONS & RECOMMENDATIONS

Conclusions

- 7.1 It is understood that the Client intends to convert an existing structure and construct six 1no. bed flats with associated car spacing pedestrian access and landscaping.
- 7.2 The site is a rectangular shaped parcel of land which comprises of an existing structure (The Orchard Centre) and soft landscaped areas.
- 7.3 There is limited potential for the presence of contamination on the site.
- 7.4 Reference to the Coal Authority Interactive viewer shows the site is located within a Coal Authority risk area and within a Development High Risk Area.
- 7.5 The property is not located in a Radon Affected Area, as less than 1% of the properties are above the Action Level. Therefore, radon protection measures are not required.
- 7.6 The BGS states there are superficial underlying the site consisting of Devensian Till, commonly known as Boulder Clay.
- 7.7 The solid geology beneath the site is shown to be the Scottish Lower Coal Measures Formation, comprising sedimentary rock cycles, coal measures type (Moderately productive aquifer).
- 7.8 The overall risk from contamination to end users is **LOW** due to limited potential sources.
- 7.9 The overall risk to controlled waters is concluded to be **LOW** based on limited potential for sources of contamination.
- 7.10 The risk from ground gas to end users and construction workers is **LOW** due to limited potential sources.
- 7.11 The overall risk from asbestos to end users is considered **MODERATE to LOW** due to the potential for ACM in the existing structure and made ground soils associated with former structures.
- 7.12 The site is not located in an Environment Agency Flood Zone 2 or 3 and the highest risk of groundwater flooding is **LOW**.

Recommendations

- 7.13 An intrusive investigation should be undertaken to establish geotechnical parameters for the design of foundations, floor slabs and pavement construction for the proposed new structures and surrounding area.

APPENDIX 1

GROUNDSURE REPORTS

APPENDIX 2

REPORT LIMITATIONS

LIMITATIONS

This contract was completed by Earth Environmental & Geotechnical Ltd based on a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill, and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget, and staff resources allocated to the project.

Other than that, expressly contained in the above paragraph, Earth Environmental & Geotechnical Ltd provides no other representation or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Earth Environmental & Geotechnical Ltd.

If a third party relies on this report, it does so wholly at its own and sole risk and Earth Environmental & Geotechnical Ltd disclaims any liability to such parties.

It is Earth Environmental & Geotechnical Ltd understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was an important factor in determining the scope and level of the services. Should the purpose for which the report is used, or the proposed use of the site change, this report will no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without Earth Environmental & Geotechnical Ltd review and advice shall be at the client's sole and own risk.

The report was written in 2024 and should be read considering any subsequent changes in legislation, statutory requirements, and industry best practices. Ground conditions can also change over time and further investigations, or assessment should be made if there is any significant delay in acting on the findings of this report. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of Earth Environmental & Geotechnical Ltd. In the absence of such written advice of Earth Environmental & Geotechnical Ltd, reliance on the report in the future shall be at the client's own and sole risk. Should Earth Environmental & Geotechnical Ltd be requested to review the report in the future, Earth Environmental & Geotechnical Ltd shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between Earth Environmental & Geotechnical Ltd and the client.

The observations and conclusions described in this report are based solely upon the services that were provided pursuant to the agreement between the client and Earth Environmental & Geotechnical Ltd. Earth Environmental & Geotechnical Ltd has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report.

Earth Environmental & Geotechnical Ltd is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, Earth Environmental & Geotechnical Ltd did not seek to evaluate the presence on or off the site of electromagnetic fields, lead paint, radon gas or other radioactive materials.

The services are based upon Earth Environmental & Geotechnical Ltd observations of existing physical conditions at the site gained from a walkover survey of the site together with Earth Environmental & Geotechnical Ltd interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and whilst Earth Environmental & Geotechnical Ltd have no reason to doubt the accuracy and that it has been provided in full of those it was requested from, the items relied on have not been verified.

No responsibility can be accepted for errors within third party items presented in this report. Further Earth Environmental & Geotechnical Ltd was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the services. Earth Environmental & Geotechnical Ltd is not liable for any inaccurate information, misrepresentation of data or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to Earth Environmental & Geotechnical Ltd and including the doing of any independent investigation of the information provided to Earth Environmental & Geotechnical Ltd save as otherwise provided in the terms of the contract between the client and Earth Environmental & Geotechnical Ltd.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable and as investigation excavations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this report. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and Earth Environmental & Geotechnical Ltd] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site.