



EARTH ENVIRONMENTAL
& GEOTECHNICAL

Phase 1 GeoEnvironmental Desk Study

Former Waterfold Mill

Waterfold Lane

Heywood

July 2022

On behalf of

David Gibbons

Earth Environmental & Geotechnical Ltd
Houldsworth Mill Business Centre
Houldsworth Street
Stockport
SK5 6DA

Tel : 01619756088

Email
headoffice@earthenvironmental.co.uk

www.earthenvironmental.co.uk



PHASE I GEOENVIRONMENTAL DESK STUDY

FORMER WATERFOLD MILL

WATERFOLD LANE

HEYWOOD

FOR

MR. DAVID GIBBONS

Earth Environmental & Geotechnical Ltd
Houldsworth Mill Business & Arts Centre
Houldsworth Street
Stockport
SK5 6DA

www.earthenvironmental.co.uk

Tel: 0161 975 6088

Report No. A4301/21

JULY 2022

Report Title:	Former Waterfold Mill, Waterfold Lane, Heywood Phase I GeoEnvironmental Desk Study
Report Reference:	A4301/21
Client:	David Gibbons
Issue Date:	15 th July 2022
Drafted By:	B Garratty
Reviewed By:	A Czarnecki
Authorised By:	A Czarnecki

This document has been prepared for the titled project (or named part thereof) and should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authorisation being obtained from Earth Environmental & Geotechnical. Earth Environmental & Geotechnical accepts no responsibility or liability for the consequences of the use of this document, wholly or in part, for any other purpose than that for which it was commissioned. Any persons so using or relying upon this document for such other purpose do so at their own risk.

This report was prepared for the sole use of the Client and shall not be relied upon or transferred to any other party without the express written authorisation of Earth Environmental & Geotechnical. It may contain material subject to copyright or obtained subject to license; unauthorised copying of this report will be in breach of copyright/license.

The findings and opinions provided in this document are given in good faith and are subject to the limitations imposed by employing site assessment methods and techniques, appropriate to the time of investigation and within the limitations and constraints defined within this document. The findings and opinions are relevant to the dates when the assessment was undertaken but should not necessarily be relied upon to represent conditions at a substantially later date.

The findings and opinions conveyed in this report are based on information obtained from a variety of sources as detailed and which Earth Environmental & Geotechnical assumes to be reliable but have not been independently confirmed. Therefore, Earth Environmental & Geotechnical cannot and does not guarantee the authenticity or reliability of third-party information it has relied upon.

Where opinions expressed in this report are based on current available guidelines and legislation, no liability can be accepted by Earth Environmental & Geotechnical for the effects of any future changes to such guidelines and legislation.

The limitations of liability of Earth Environmental & Geotechnical for the contents of this document have been agreed with the Client, as set out in the terms and conditions of offer and related contract documentation.

CONTENTS

1.0	INTRODUCTION	1
	Appointment	1
	Objective	2
	Scope	2
2.0	SITE LOCATION AND DESCRIPTION.....	3
	Site Utility Services.....	4
3.0	ENVIRONMENTAL SETTING.....	5
	Geology.....	5
	Ground Workings	5
	Mining and Other Underground Workings	6
	Radon Potential.....	6
	Hydrogeology and Hydrology	6
	Landfill & Waste Management Activity	7
	Industrial Land Use Information.....	8
	Environmental Permits, Incidents and Registers	9
	Environmentally Sensitive Sites	10
	Ecology	10
	Archaeology	10
	Potential Flood Risks.....	10
	Previous Site Investigations	11
4.0	SITE HISTORY	12
5.0	WALKOVER SURVEY.....	18
6.0	PRELIMINARY CONTAMINATION RISK ASSESSMENT	20
	Introduction	20
	Potential Sources	21
	Potential Receptors	21
	Potential Pathways.....	22
7.0	GEOTECHNICAL HAZARDS ASSOCIATED WITH THE DEVELOPMENT	25
8.0	CONCLUSIONS & RECOMMENDATIONS.....	27
	Conclusions.....	27
	Recommendations	27

FIGURES

Figure 1	Proposed Development Plan
Figure 2	Site Location Plan
Figure 3	Site Photograph
Figure 4	OS Map Extract: 1851
Figure 5	OS Map Extract: 1890-1891
Figure 6	OS Map Extract: 1957
Figure 7	OS Map Extract: 1990-1992
Figure 8	Aerial Photograph 2021
Figure 9	Site Features Plan
Figure 10	Site Walkover Photo Locations

TABLES

Table 1	Environmental Permits, Incidents and Registers within 500m of the Site
Table 2	Summary of Site History
Table 3	Consequence, Probability and Risk
Table 4	Estimation of Level of Risk by Comparison of Consequence and Probability
Table 5	Preliminary Conceptual Model
Table 6	Summary of Geotechnical Hazards

APPENDICES

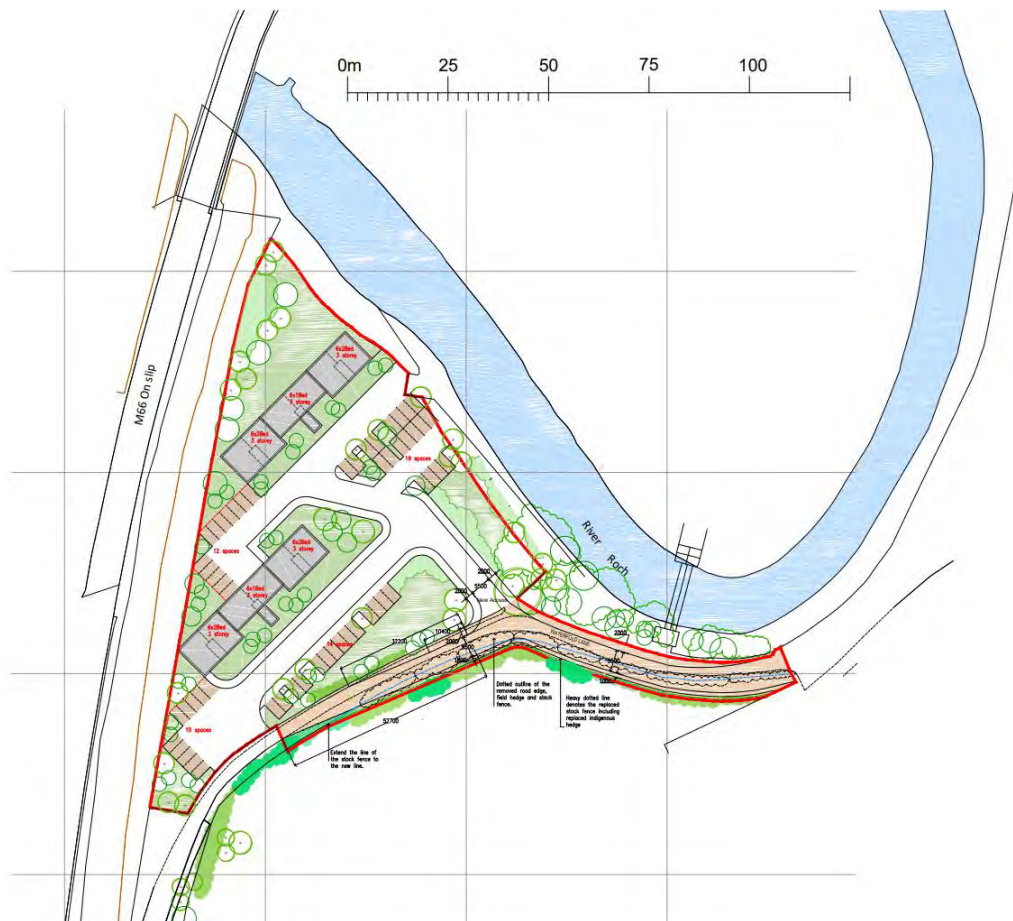
Appendix 1	GroundSure Reports
Appendix 2	Site Photographs
Appendix 3	Site Walkover Notes
Appendix 4	Report Limitations

1.0 INTRODUCTION

Appointment

- 1.1 Earth Environmental & Geotechnical Ltd has been commissioned by Pullman Associates Ltd on behalf of David Gibbons (the Client) to undertake a Phase I GeoEnvironmental Desk Study for the proposed development on the land at Waterfold Lane, Heywood.
- 1.2 It is understood that the Client wishes to construct residential dwellings with associated car parking spaces and soft landscaping.
- 1.3 Vehicle access will be gained from Waterfold Lane to the south of the site.
- 1.4 A proposed development plan for the site is shown in Figure 1 below.

Figure 1 Proposed Development Plan



Objective

- 1.5 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

- 1.6 The Phase I Environmental Desk Study comprises of a site reconnaissance visit and 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.
 - Rochdale Borough Council Planning Portal.

2.0 SITE LOCATION AND DESCRIPTION

- 2.1 The site is located in Heywood, Greater Manchester approximately 3km from Heywood Town Centre. The approximate National Grid Reference for the centre of the site is SD 82106 10335 (X: 382106, Y: 410335) with the closest postcode being BL9 7JY.
- 2.2 The site is an irregular shaped parcel of land with current access via Waterfold Lane to the south of the site. The maximum dimensions of the proposed site are 168m north to south and 88m west to east. The site occupies an area of approximately 1.11 hectares.
- 2.3 The site is currently vacant with an access road to the south of the site.
- 2.4 The general surrounding area comprises predominantly of agricultural fields, with residential dwellings located 130m east of the site and the River Roch running parallel to the northern boundary.
- 2.5 A location plan is shown below as Figure 2, together with a recent site photograph as Figure 3 (overleaf).

Figure 2 Site Location Plan



Figure 3 Site Photograph



Site Utility Services

- 2.6 Site service plans have not been obtained for the site on behalf of 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 underlain by artificial deposit of Made Ground along the western boundary of the site.
- 3.4 The site is predominantly underlain by superficial deposits of River Terrace Deposits, comprising sand and gravel and Alluvium comprising clay, silt, sand, and gravel along with along the northern boundary of the site.
- 3.5 The solid geology beneath the site is shown to be the Pennine Lower Coal Measures Formation, comprising coal seams, mudstone, siltstone, and sandstone.
- 3.6 There are 4 records of linear features within 500m of the site boundary. The closest record refers to an inferred normal fault located 90m southwest of the site.
- 3.7 There is 1 landslide record identified within 500m of the site. This record refers to an unclassified entry of landslide deposits located 282m south of the site.
- 3.8 There are 14 borehole records identified within 250m of the site. The closest accessible record is located 201m northeast of the site (BGS Reference; SD81SW186) and records:
- Made Ground – clay, silt and sand with gravel and brick fragments to 1.30m
 - Made Ground- Concrete to 1.70m
 - Made Ground- Firm orange mottled grey very silty, gravelly, clay to 3.95m
 - Dense, grey, silty, sandy, silt to 4.90m
 - Stiff, grey, silty, sandy, gravelly, clay to 6.80m
 - Very stiff, grey, silty clay with mudstone fragments to 8.40m
 - Weathered, orange-grey, sandy mudstone to 10.00m
- 3.9 The site is in an area where the hazard rating is moderate with regard to highly compressible deposits. The hazard rating is very low with regard to collapsible deposits and shrink swell clays. The hazard rating is low with regard to running sands and landslips. The hazard rating is negligible with regard to the dissolution of soluble rocks.

Ground Workings

- 3.10 There are 21 records of historical surface ground working features identified within 250m of the site boundary. There are 9 onsite record which refer to an unspecified pit, filter beds, ponds, and reservoirs.

- 3.11 The closest offsite record refers to cuttings located 150m southeast of the site and further records in the vicinity refer to further cuttings, unspecified ground workings and an unspecified pit.
- 3.12 According to the BGS, there is 1 record of a British Pit within 500m of the site. This record refers to a ceased surface mineral working for the commodity sand at Peacock Hall Sand Pit, Bury located 499m south of the site.

Mining and Other Underground Workings

- 3.13 The site is located within an identified coal mining area. Reference to the Coal Authority Interactive viewer shows the site is not located within a Development High Risk Area.
- 3.14 There are no records of non-coal mining areas located within 1km of the site.
- 3.15 There are no areas of brine extraction, gypsum extraction, tin mining or clay mining on the site.
- 3.16 There are no records of natural cavities within 500m of the site.
- 3.17 There are no records for non-coal cavities identified within 1km of the site.
- 3.18 There are no records for historical underground working features identified within 1km of the site.

Radon Potential

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

Hydrogeology and Hydrology

- 3.20 The superficial deposits are classified by the Environment Agency (EA) as a Secondary A Aquifer. The River Terrace Deposits of sand and gravel have an intergranular flow type and a very high to high permeability. The Alluvium Deposits have an intergranular flow type and a high to very low permeability. The BGS states the following:

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

- 3.21 The Pennine Lower Coal Formation is classified by the Environment Agency (EA) as a Secondary A Aquifer with a fracture flow type and a high to low permeability. The BGS states the following:

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

- 3.22 The groundwater vulnerability and soil leaching potential of the site has been classified as low vulnerability. The BGS states:

'Low - 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 a low permeability.'

- 3.23 There are 11 ground water abstraction licence records within 2km of the site. The closest record refers to a historical ground water source at Waterfold Farm, Bury located 113m southwest of the site.
- 3.24 There are 7 surface water abstraction licence records within 2km of the site. The closest record refers to active non-tidal hydroelectric power generation located 392m northeast of the site.
- 3.25 There are 2 potable water abstraction licence records within 2km of the site. The closest record refers to a historical ground water source at Castlebrook Water Ltd located 1.54km south of the site.
- 3.26 The site is not located within 500m of a Source Protection Zone or Source Protection Zone within a confined aquifer.
- 3.27 There are 11 water network entries within 250m of the site. The closest record refers to an inland river, not influenced by normal tide action, located 8m northeast of the site.
- 3.28 There are 10 surface water features identified within 250m of the site. The closest record refers to an on-ground surface river located 8m northeast of the site.
- 3.29 There is 1 record of a Water Framework Directive (WDF) surface water body located on site. The record refers to a River catchment in the Roch (Spodden to Irwell). The water body was a good chemical rating and moderate ecological rating in 2016.
- 3.30 There is 1 record of a Water Framework Directive (WDF) groundwater body located on-site. The record refers to Northern Manchester Carboniferous Aquifers which were a poor chemical rating in 2015.

Landfill & Waste Management Activity

- 3.31 There is 1 record for current Environment Agency/Natural Resource Wales landfill records within 500m of the site. This record refers to Viridor Waste Management Ltd for waste landfilling located 316m southeast of the site.
- 3.32 There are no records of historic Environment Agency/Natural Resource Wales landfill sites within 500m of the site.
- 3.33 There are no records of BGS/DoE non-operational landfill sites within 500m of the site.
- 3.34 There are no records of a historical landfill from the Local Authority and Historical Mapping records within 500m of the site.
- 3.35 There are no records of a waste treatment, transfer, or disposal site within 500m of the site.

- 3.36 There are no records of historical waste sites within 500m of the site.
- 3.37 There are no records of current Environment Agency/Natural Resources Wales licensed waste sites within 500m of the site.

Industrial Land Use Information

- 3.38 There are 72 records of potentially contaminative historical land uses identified within 500m of the site. There are 9 onsite records which refer to an unspecified pit, unspecified mills, unspecified works, filter beds, a woollen mill, and unspecified disused mills. The closest record off site refers to an unspecified tank located 81m southwest of the site, dated 1983. Other records in the vicinity refer to other unspecified tanks, railway sidings, cuttings, unspecified pits, unspecified heaps, unspecified ground workings, pumps, paper mills, a dye mill, dye works, sewage works etc.
- 3.39 There are 13 records of current potentially contaminative land uses identified within 250m of the site. The closest record refers to electrical features located 98m west of the site. The other record in the vicinity refers to distribution and haulage, tanks, engineering services and second-hand vehicles.
- 3.40 There are 60 records of historical tanks identified within 500m of the site. The closest record refers to tanks located 5m west of the site, dated 1910.
- 3.41 There are 3 records of historical energy features identified within 500m of the site. The closest record refers to an electricity substation, located 395m northeast of the site, dated 1996-1997.
- 3.42 There are 2 records for current petrol or fuel sites within 500m of the site. The closest record refers to an open ESSO garage located 342m northwest of the site on Rochdale Road.
- 3.43 There are no records of historical petrol or fuel sites within 500m of the site.
- 3.44 There are 5 historical garage and motor vehicle repair site records identified within 500m of the site. The closest record refers to a garage located 304m northwest of the site, dated 1982-1984.
- 3.45 There are no National Grid high voltage underground electricity transmission cables within 500m of the site.
- 3.46 There are no National Grid high-pressure gas transmission pipelines within 500m of the site.
- 3.47 There are 21 historical railway and tunnel features identified within 250m of the site. The closest record refers to railway sidings located 85m south of the site, dated 1938.
- 3.48 There is 1 historical railway line identified within 250m of the site. This record refers to an abandoned line located 135m south of the site.
- 3.49 There are 9 current active railway line records identified within 250m of the site. The closest record refers to an unnamed preserved railway located 119m south of the site.
- 3.50 There are no underground railway lines or tunnels identified within 250m of the site.

3.51 The site is not within 500m of the route of the High Speed 2 rail project.

3.52 The site is not within 500m of the route of the Crossrail 1 rail project.

Environmental Permits, Incidents and Registers

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

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	12
Planning Hazardous Substance Consents and Enforcements	0
Dangerous or Hazardous (COMAH and NIHHS) Sites	1
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)	3
Pollution Inventory Substances, Wastes and Radioactive Wastes	0

3.54 There are 2 records of Part (2) and Part B Activities and Enforcements within 500m of the site. The closest record refers to a current Part B Permit for unloading of petrol into storage at service stations, located 354m northwest of the site at a motorway filling station.

3.55 There are 12 records of Licensed Discharge Consents within 500m of the site. The closest record refers to sewage discharges with the receive water of the River Roch, located 152m northeast of the site.

3.56 There is 1 record of a Dangerous or Hazardous (COMAH and NIHHA) sites within 500m of the site. This record refers to a current COMAH site for a lower tier operation at Tetrosyl Ltd located 277m northeast of the site.

3.57 There are 3 records of Substantiated Pollution Incidents within 500m of the site. The closest record refers to oils and fuels. The incident had a category 2 impact (significant) on water, a category 3 impact (minor) on land and a category 4 impact (no impact) on air.

- 3.58 There are no other records of Environmental Permits, Incident or Registers within 500m of the site.

Environmentally Sensitive Sites

- 3.59 There are no records of Sites of Special Scientific Interest (SSSI) within 2km of the site.
- 3.60 There are 5 records of Greenbelt land within 2km of the site. There is 1 onsite record referring to Merseyside and Greater Manchester. The closest offsite record also refers to Merseyside and Greater Manchester located 4m northeast of the site.

Ecology

- 3.61 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.
- 3.62 However, the site is classified as Good to Moderate Quality Agricultural Land (Grade 3).

Archaeology

- 3.63 An archaeological assessment falls outside the brief of this report. Where considered necessary, advice should be sought from an archaeological specialist in this respect.
- 3.64 However, there are no records of a Listed Building within 250m of the site.
- 3.65 There are no records of World Heritage Sites or Scheduled Ancient Monuments with 250m of the site.

Potential Flood Risks

- 3.66 Detailed assessment of flood risks is outside the scope of this report. However, the site lies within 50m of an Environment Agency Zone 2 and Zone 3 floodplain.
- 3.67 The northern boundary of the site lies within a Flood Zone 2 and 3.
- 3.68 There are 23 records of risk of flooding from rivers and sea (RoFRaS) within 50m of the site. The onsite flood risk category is high.
- 3.69 There are no records of flood defences located within 250m of the site.
- 3.70 There are no records of areas benefitting from flood defences within 250m of the site.
- 3.71 There are no records of areas used for flood storage within 250m of the site.
- 3.72 The highest risk of surface water flooding occurring on-site is 1 in 30 year, 0.3-1.0m.
- 3.73 The highest risk of groundwater flooding occurring on-site is moderate.

Previous Site Investigations

- 3.74 A planning application (reference: 88/D21806) was submitted to Rochdale Borough Council in April 1988 for the erection of the use of land as civil engineering contractor's depot. The application was refused in June 1988.

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 may be limited; however, the information available to date indicates that additional searches are unlikely to add to our understanding of the site. The earliest available historical mapping covering the site dates back to 1851.
- 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
1851 1:10,560	A woollen mill is located in the northwest corner of the site with associated buildings in the centre of the site. A track runs east to west across the centre of the site.	The River Roch runs parallel to the northern boundary with associated footbridges and a weir located to the north. Water Fold residential dwelling with associated well is located 100m south of the site. Lancashire railway line is located 150m south of the site with associated viaduct located 200m southwest of the site. Ash Meadows residential dwelling is located 200m north of the site. Little Bridge residential dwelling is located 200m north of the site. A road running east to west is located 200m north of the site. Spout Bank residential dwelling is located 250m southeast of the site. Heap Bridge residential dwellings are located 300m northeast of the site. A paper mill is located 450m northeast of the site. Old Bridge Hall residential dwelling is located 450m northeast of the site. A sand pit is located 500m south of the site. Peacock Lane runs south to north located 500m south of the site. Peacock Hall is located 510m south of the site. A ballast pit is located 550m east of the site. A cotton mill is located 550m west of the site. A well is located 700m northeast of the site. A woollen mill is located 725m west of the site. An unspecified mill is located 750m south of the site.

Date	On-Site History	Surrounding Land Use History
		A sand pit is located 750 southeast of the site.
1891 1:10,560 1890-1891 1:2,500	The onsite mill is expanded with tenters (for making of woollen cloth) constructed on the south of the site. A reservoir is constructed onsite located in the centre of the site.	A well is constructed located on the eastern boundary of the site. A sluice is installed on the northern boundary of the site running into the river. Residential properties are constructed along Waterfold Lane, located 100m east of the site. A school is constructed located 250m northeast of the site. Further residential developments are constructed located 300m northeast of the site. The railway line is expanded, and large embankments are established. Residential dwellings are constructed located 400m northwest of the site. A reservoir is constructed next to the mill located 700m west of the site. A reservoir is constructed located 700m southwest of the site. A school is constructed located 725m west of the site. A school is constructed located 725m west of the site. A reservoir is constructed located 750m northwest of the site.
1908 1:10,560 1910 1:2,500	The onsite mill is expanded, and tanks are constructed onsite. A chimney is constructed on the mill. The tenters are removed from the site and a cricket/tennis ground are developed on the south of the site. Filter beds are developed on the mill.	Residential buildings located 100m south of the site are converted into a farm. A church is constructed located 150m east of the site. The railway line is expanded towards the northeast with associated embankments located 200m east of the site. A public house is constructed located 400m northwest of the site. A sewage works is constructed located 450m southwest of the site. A football ground is developed located 475m northwest of the site. A recreational ground is developed located 500m west of the site.
1928 1:10,560 1930 1:2,500	The mill is now disused, although the buildings are still present onsite.	A band stand is constructed on the recreational ground located 500m west of the site. A sewage tank is constructed located 550m southeast of the site.

Date	On-Site History	Surrounding Land Use History
		Buildings located 650m west of the site are converted into an unspecified mill.
1938 1:10,560 1937 1:2,500	No significant change.	A pavilion is constructed on the cricket ground located 25m west of the site. An allotment garden is developed located 250m east of the site.
1955-1956 1:10,560 1957 1:2,500	An onsite building is converted in a works. The woollen mill building is demolished.	A dye works is developed located 400m northeast of the site.
1981-1983 1:10,560 1980-1982 1:2,500	All buildings onsite are demolished, and the reservoir is infilled/disused.	The M66 motorway is constructed running parallel to the western boundary of the site. The railway line running towards the northeast is dismantled. A school with associated playing fields is constructed located 450m north of the site. A school is constructed located 525m west of the site. A sports ground is developed located 600m northeast of the site. An allotment gardens is developed located 700m north of the site. A subway is constructed under the M66, located 750m north of the site.
1990-1992 1:1,250	A fenced barrier in constructed running parallel to the western boundary onsite.	No significant change.
2001 1:10,000 2003 1:2,500	No significant change.	A sand quarry is developed located 450m southeast of the site.
2010 1:10,000 2011 Aerial	Trees and vegetation are present onsite.	A sand quarry is developed located 700m southeast of the site.
2021 1:10,000 2020 Aerial	No significant change.	No significant change.

Figure 4 OS Map Extract 1851

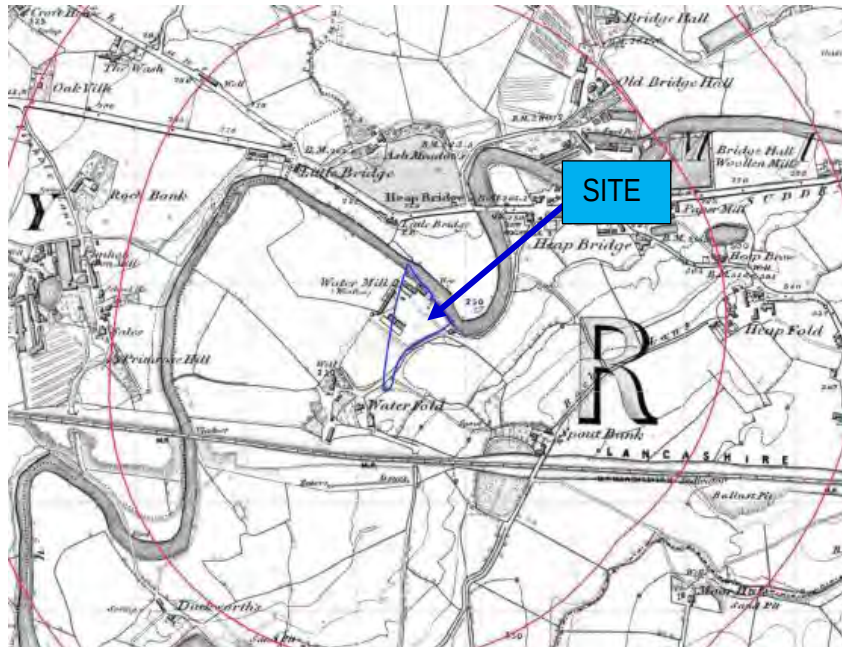


Figure 5 OS Map Extract 1890-1891

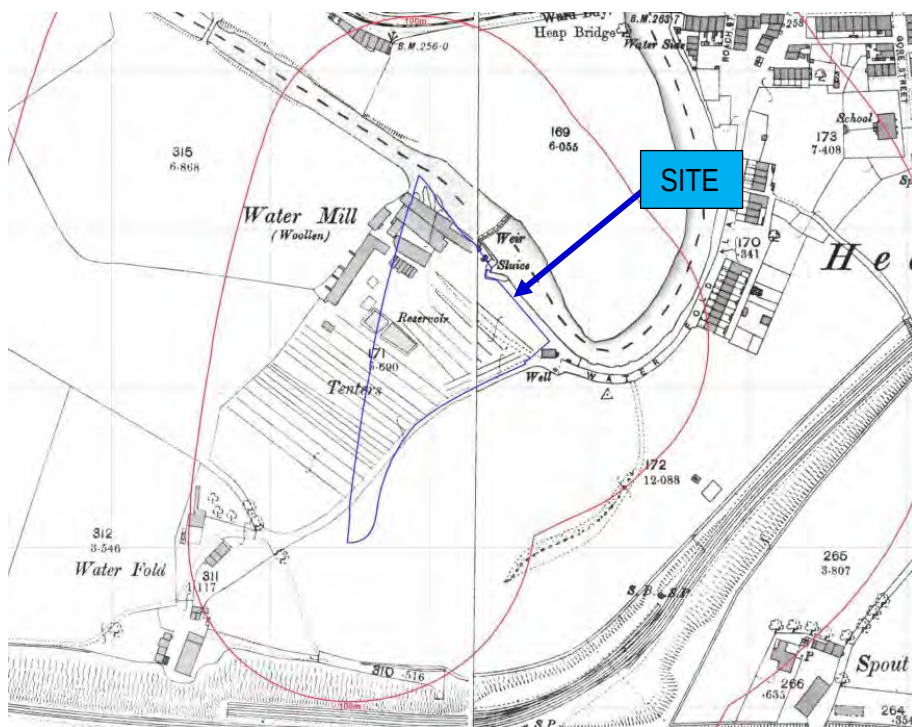


Figure 6 OS Map Extract 1957

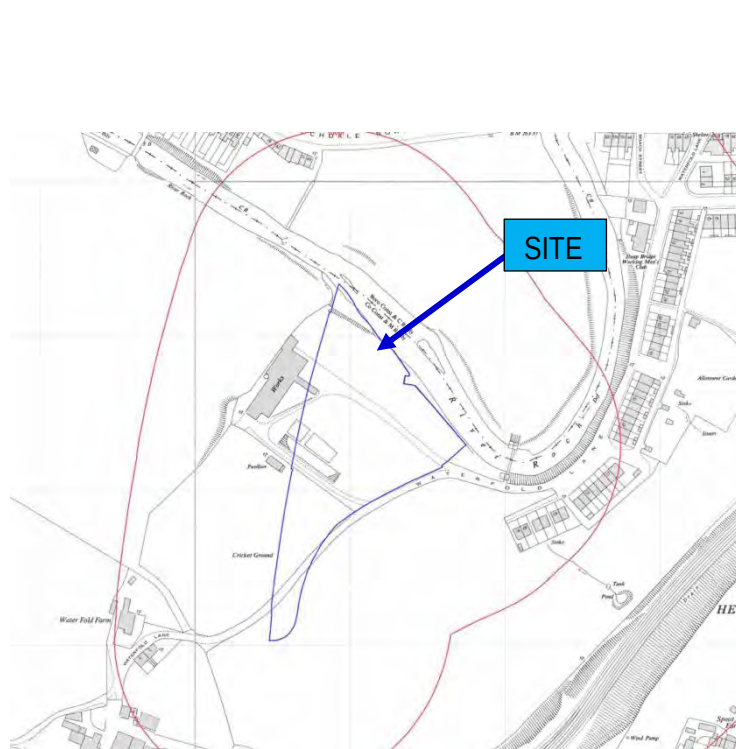


Figure 7 OS Map Extract 1990-1992

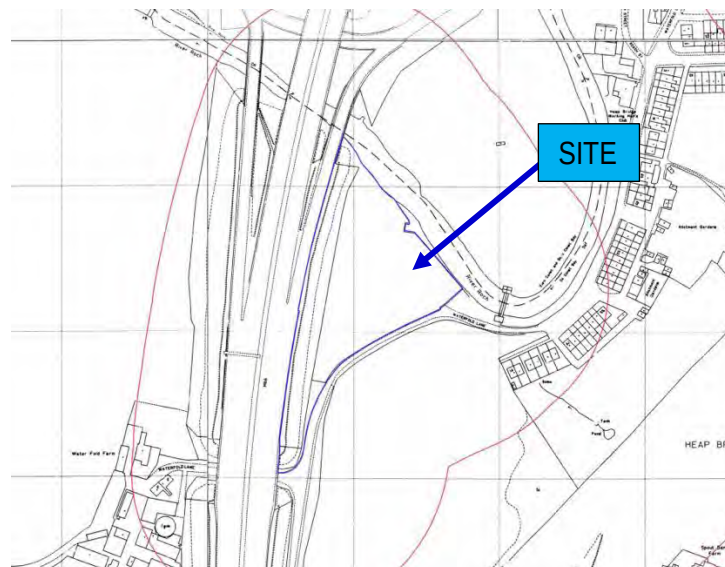


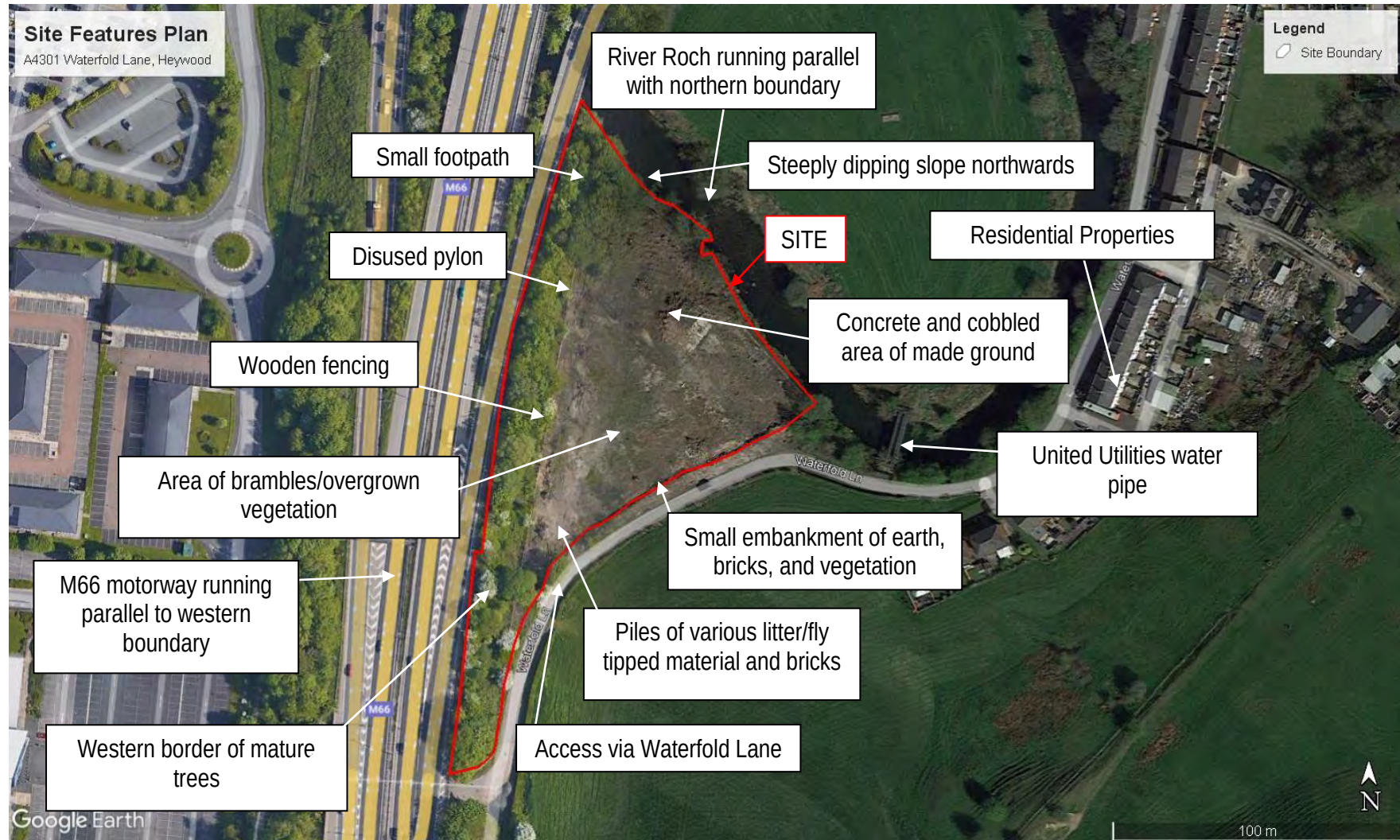
Figure 8 Aerial Photograph 2021



5.0 WALKOVER SURVEY

- 5.1 A walkover survey was completed on 25th October 2021. The photographs and notes from this survey are appended to this report as Appendix 2 and Appendix 3, respectively.
- 5.2 The site is currently accessed via Waterfold Lane to the south of the site.
- 5.3 The site is currently vacant land with minimal vegetation and areas of made ground present on the northern boundary.
- 5.4 The site is generally flat lying with small uneven areas, however the northern boundary has a steep gradient northward towards the River Roch.
- 5.5 There are no overhead cables on the site, although a disused pylon is present on the western boundary.
- 5.6 The site is surrounded by agricultural fields, with the M66 motorway running parallel with the western boundary. There are also residential properties located 100m east of the site.
- 5.7 A site features plan is presented as Figure 9 overleaf.

Figure 9 Site Features Plan



6.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

Introduction

- 6.1 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⁾.
- 6.2 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.
- 6.3 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.
- 6.4 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

- 6.5 Historically the site was occupied by a woollen mill with associated reservoir and tenters. By 1930 the mill was disused, and the majority of buildings were demolished by 1957. Although, one onsite building was converted into an unspecified works and was demolished by 1980. The reservoir was also removed by 1980.
- 6.6 Potential sources of onsite contamination may come from the construction, operation and demolition of the mills and unspecified works, filter beds and unspecified pits related to onsite surface ground workings.
- 6.7 Potential off-site sources of contamination include offsite developments, railway sidings from nearby railway lines, surface ground workings within the vicinity of the site and unspecified tanks within close proximity.
- 6.8 There is potential for the presence of contamination associated with the following:
- Areas of Made Ground from on and off-site developments
 - Ground gas associated with Made Ground
 - Leaks and spillages of fuels and oils associated with on site development.
- 6.9 Contaminants may therefore include heavy metals, asbestos, and ground gases.

Potential Receptors

- 6.10 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;
 - Surface water and Groundwater within the underlying aquifer

Potential Pathways

6.11 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 surface waters and shallow groundwater;
- Vertical or lateral migration of ground gas.

Table 5: Preliminary Conceptual Model

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
Potential soil contamination E.g., Heavy Metals, PAH, TPH, BTEX and ground gases.	Dermal contact, ingestion, and inhalation of soils dust	Current Site Users	Unlikely	Moderate	Low	The site is currently vacant. The risk is therefore considered to be LOW.
		Adjacent land users	Unlikely	Moderate	Low	The site is located next to the M66 motorway and various residential properties are situated within close proximity of the site. Usual dust control measures should be implemented as part of good site working practices during construction to reduce dust generation. Therefore, the risk is considered LOW.
		Future land users	Likely	Moderate	Moderate	The proposed development consists of constructing a new residential development. Some of the site will be surfaced in hardstanding. The risk to future site users via direct exposure is considered to be MODERATE. This assessment is based on the potential for contamination to be present beneath the site.
		Construction Workers	Low Likelihood	Moderate	Moderate to Low	Construction workers may be exposed to potentially contaminated soils during construction works, however exposure duration will be short-term only. The risk to construction workers is considered MODERATE. Appropriate health and safety measures (in line with CDM and other relevant health and safety guidance) will reduce the risk to MODERATE TO LOW.
	Downward vertical migration of leachate to shallow groundwater	Groundwater within the Underlying Aquifer	Likely	Moderate	Moderate	The underlying superficial soils are anticipated to be sandy gravel with a high to very high permeability. There are 11 abstraction licences within 2km. The groundwater vulnerability is considered to be high. The risk to groundwater is therefore considered MODERATE.
	Lateral migration in surface waters	Surface water	Likely	Moderate	Moderate	The River Roch runs parallel to the norther site boundary and is at high risk of contamination, therefore the risk to lateral migration in surface waters is HIGH.

	Vertical or lateral migration of ground gas	Current Site Users	Likely	Moderate	Moderate	The site is currently vacant and large areas of made ground are anticipated. A woollen mill and unspecified works with associated reservoir were historically situated on site suggesting ground gas may be present. This risk to current site users is therefore MODERATE.
		Adjacent land users	Low Likelihood	Moderate	Moderate to Low	Agricultural fields with various residential properties are located within the vicinity of the site. Areas of Made Ground are anticipated. The risk to adjacent site users from ground gas is therefore considered MODERATE TO LOW.
		Future land users	Low Likelihood	Moderate	Moderate	The proposed development consists of constructing a new residential development. The site lies on the site of a disused mill and unspecified works suggesting a high probability of made ground, therefore the risk is considered MODERATE.
		Construction Workers	Low Likelihood	Moderate	Moderate to 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 MODERATE TO LOW.
Asbestos Containing Material (ACM)		Current Site Users	Unlikely	Moderate	Low	The site is currently unoccupied. Asbestos may be present in small areas of the site, albeit unlikely. Asbestos is only harmful when disturbed. The risk to current site users is considered to be LOW.
		Adjacent land users	Unlikely	Moderate	Low	Vacant fields predominantly surround the site including residential dwellings located to the east of the site. Asbestos may be present in small areas of the site, albeit unlikely. Disturbance of soil during the construction phase may allow fibres to become airborne. Dust control measures (dampening down) should be implemented as part of good site working practices. Therefore, the risk is considered LOW.
		Future land users	Low Likelihood	Moderate	Moderate to Low	The proposed development consists of constructing a new residential development. Some of the site will be surfaced in hardstanding. The risk is therefore considered MODERATE TO LOW. A contamination assessment of the existing on-site soils would be required to determine the level of risk and necessary mitigation measures.

		Construction Workers	Low Likelihood	Moderate	Moderate to Low	Construction workers may be exposed to potential asbestos in Made Ground soils. However, this potential area is small. The risk is considered MODERATE TO LOW. A contamination assessment of the existing on-site soils would be required to determine the level of risk and necessary mitigation measures.
--	--	-------------------------	-------------------	----------	--------------------	---

7.0 GEOTECHNICAL HAZARDS ASSOCIATED WITH THE DEVELOPMENT

7.1 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 taking into account of ground conditions and land instability, including from natural hazards to former activities such as mining. A summary of the geotechnical considerations is provided below in Table 6.

Table 6: Summary of Geotechnical Hazards

Geohazards:	
Highly Compressible Ground	Moderate risk
Collapseable Soils	Very low risk
Swelling Clay	Very low risk
Running Sand	Low risk
Ground Dissolution	Negligible risk
Landslip	Low risk
Mining & Quarrying	Historical unspecified pits for surface ground workings are located onsite suggesting mining may have taken place. The site is located within a Coal Mining Reporting Area but not within a Development High Risk Area. Therefore, the mining risk is considered low.
Geotechnical Design Considerations	
Site Clearance	Various piles of litter and fly tipped material will need to be removed from the site.
Trees	Multiple mature trees are present, generally around the western and northern site boundaries.
Existing Buildings/Obstructions	There are no buildings located on the site and relict foundations.
Foundations	The depth and type of proposed foundations would depend on the ground conditions present on site. Given former land uses made ground will be present underlain by weak alluvium and river terrace deposits. Piles may be required to support new building structures.

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 geotechnical investigation would be needed. However, it is recorded that the site is underlain by Secondary A aquifers. The highest risk of groundwater flooding on site is recorded as moderate.
Earthworks	It is unlikely that significant earthworks will be necessary onsite as it is generally low lying. Site levels however may need to be increased in order to be above future flood risk levels.
Slopes	The site is relatively flat lying, although has a steep gradient from the northern boundary towards the River Roch.
Retaining Walls	Retaining walls may be necessary to stabilise the river banking on the northern boundary of the site.
Chemically aggressive ground conditions	Chemically aggressive ground conditions are not expected at this site. However, an intrusive geotechnical investigation would be necessary to confirm this.

8.0 CONCLUSIONS & RECOMMENDATIONS

Conclusions

- 8.1 The site was historically a woollen mill; however, all onsite buildings were demolished by 1980.
- 8.2 Potential on-site sources of contamination were identified to be Made Ground and ground gas associated with onsite development, particularly due to the onsite mill and unspecified works formerly present.
- 8.3 Potential off-site sources of contamination include offsite developments, railway sidings from nearby railway lines, surface ground workings within the vicinity of the site and unspecified tanks within close proximity.
- 8.4 The proposed development of the site is the construction of a residential development with associated car parking spaces and soft landscaping.
- 8.5 The site is underlain by River Terrace Deposits comprising sand and gravel and Alluvium Deposits comprising clay, silt, sand, and gravel (Secondary A aquifers). The solid geology comprises the Pennine Lower Coal Measures Formation comprising coal seams, mudstone, siltstone, and sandstone (Secondary A Aquifer) comprising sandstone.
- 8.6 Given the potential contaminative land uses, the overall risk from soil contamination to end users and construction workers is concluded to be MODERATE.
- 8.7 The risk to controlled waters is concluded to be HIGH based on the underlying granular superficial soils and proximity to the Rover Roch.
- 8.8 The risk from ground gas to end users and construction workers is considered to be MODERATE given the anticipated extent of Made Ground and potential presence of gas from historical mills and unspecified works.
- 8.9 The site is partially (northern boundary) located within a Zone 2 or Zone 3 floodplain. The risk of groundwater flooding is MODERATE.

Recommendations

- 8.10 An intrusive investigation should be undertaken to obtain geotechnical parameters for the design of house foundations, floor slabs and pavement construction and roadways.
- 8.11 As part of the geotechnical investigation, it is recommended that the samples of soil and groundwater are recovered for contamination testing.
- 8.12 A ground gas risk assessment should also be provided.

APPENDIX 1

GROUNDSURE REPORTS

APPENDIX 2

SITE PHOTOGRAPHS

Earth Environmental & Geotechnical Ltd Tel: 0161 975 6088 Email: info@earthenvironmental.co.uk Web: www.earthenvironmental.co.uk	SITE PHOTOGRAPHS 
Job No.: A4301/21	Site: Waterfold Lane, Heywood
Plate 1 Viewing south, showing site access via Waterfold Lane. Note scar in the road may be a potential water supply.	Plate 2 Viewing south, showing areas of fly tipped material and litter on site.
	
Date: 25th October 2021	Date: 25th October 2021
Plate 3 Viewing northwest, showing western boundary. Note wooden fencing and mature trees running alongside the boundary.	Plate 4 Viewing north, showing an overview of the site. Note large areas of brambles and overgrown vegetation.
	
Date: 25th October 2021	Date: 25th October 2021

Earth Environmental & Geotechnical Ltd Tel: 0161 975 6088 Email: info@earthenvironmental.co.uk Web: www.earthenvironmental.co.uk	SITE PHOTOGRAPHS 
Job No.: A4301/21	Site: Waterfold Lane, Heywood
Plate 5 Viewing northwest showing a disused pylon located onsite.	Plate 6 Viewing east showing area of cobbled made ground located in the northwest corner of the site.
	
Date: 25th October 2021	Date: 25th October 2021
Plate 7 Viewing north, showing River Roch located on the northern boundary. Note the steeply dipping slope towards the river.	Plate 8 Viewing north showing large concrete slabs in the north of the site.
	
Date: 25th October 2021	Date: 25th October 2021

Figure 10 Site Walkover Photo Locations



APPENDIX 3

SITE WALKOVER NOTES

WALK OVER SURVEY REPORT

Site: Waterfold Lane, Heywood

Date: 25th October 2021

Job No: A4301/21

Undertaken By: Bethany Garratty

Purpose of Site Walkover:

- 1) Provide further information for the Desk Study Report;
- 2) Identify potential contamination sources, pathways, and receptors;
- 3) Identify geotechnical features and potential geohazards;
- 4) Determine locations for exploratory boreholes.

Desk Study features checked during site visit	Feature and Information required	Present	Description / Comments
Site Setting	Description required for: Town/Country/Suburb Setting Industrial/Residential/Retail Usage Current Site use (if undertaking security and access to the site)		Town passing into country setting. Surrounding areas are predominantly fields with some residential properties. The site is currently vacant.
Evidence of Past Activities	Are there: Any relevant street names in area? Features or relics which indicate past history?	Yes/No Yes/No	The site is located to the north of Waterfold Lane.
Geographic Setting	Description required for: Low lying flood plain/dry valley/rolling hills etc.		The site is located within rolling hills.
Ground Conditions	Is there any evidence of: Mining, Mine entries Subsidence Landslip/slope erosion Former investigation works	Yes/No Yes/No Yes/No Yes/No	Slope erosion is observed on the northern boundary due to the River Roch.

Desk Study features checked during site visit	Feature and Information required	Present	Description / Comments
Topography	Description required for: Are there apparent differences between site and surrounding area? (If yes describe the presence of retaining walls, and slopes). Is there evidence of Made Ground / Fill on site?	Yes/No Yes/No	The site is generally flat lying with some uneven areas, and a steep northwards dipping slope on the northern boundary. Large areas of concrete and cobbles are present onsite, particularly on the northern boundary.
Site Boundaries and Neighbours	Description required for: Type of boundary demarcation (if any) on each side of site, usage of adjacent land and name of industrial/commercial occupiers. Note any adjacent features such as water course and other potentially environmentally sensitive uses (residential, school, infirmary, SSSI etc)		The site is demarcated by a mixture of boundaries including wooden fencing/mature trees to the west, a soil embankment to the east and the River Roch to the north. The site is predominantly surrounded by agricultural fields and residential properties with the M66 motorway running parallel to the western boundary.
Vegetation	Are there any vegetation/trees on or close to site (if yes describe locations, type, maturity, etc) Is there any evidence of poor health / distress?	Yes/No Yes/No	Vegetation is located around the outside of the site, predominantly around the central area of the site. Mature trees are also located along the western and northern boundaries. N/A
Ground Surface	Are there areas of hardstanding and estimate the split between hard and soft cover? (If yes describe locations, types, and conditions). Is there any evidence of any spillages or staining?	Yes/No Yes/No	The site is 65% hardstanding (including concrete, cobbles, and gravel) and 35% soft cover. None visible on the site walkover.

Desk Study features checked during site visit	Feature and Information required	Present	Description / Comments
Site Drainage	Are there any drain covers / soakaways (if yes describe locations)	Yes/No	Water course observed running parallel to the northern boundary, expected run off from steep boundary. Scar also evident on Waterfold Lane, which may be a potential water supply.
	Are there any outfalls/water courses on site (note the condition of water courses in open water courses. discolouration, odour, eutrophication, oily sheen, gas bubbling water, clear or cloudy)	Yes/No	Water course relatively clean, silty water.
	Where a watercourse runs alongside or crosses a site are there any differences in visible water quality upstream and downstream of the site?	Yes/No	N/A
Electrical Equipment	Are there any electricity sub stations on or adjacent to the site? Are there any electrical transformers, capacitors, pylons etc on site?	Yes/No	A pylon is located on the western boundary of the site, although it is not connected and is assumed to be disused.
Buildings	Is there any evidence of asbestos construction materials e.g., roofing, insulation materials.	Yes/No	None visible on the site walkover, no buildings located on site.
	Do any buildings have basements?	Yes/No	
	Do any buildings have a boiler room (if yes, describe fuel type and storage arrangements)?	Yes/No	

Desk Study features checked during site visit	Feature and Information required	Present	Description / Comments
Landfilling	Is there any evidence of gas protection measures (gas membrane, gravel-filled trenches, venting pipes, etc)?	Yes/No	N/A
Process Air Emissions	Point Source: Are there any stacks / vents / cooling towers / abatement equipment? Fugitive Source: is there any stockpiled material / windblown dust / vapour process?	Yes/No Yes/No	N/A
Storage of fuels & Chemicals	Are there any drums / containers (if yes, describe quantity, full /empty, stored on hard standing / soft landscaping, bunding)? Are there any above ground fuel tanks (if yes, describe locations, volumes, how many, bunding, used / disused, condition?) Is there any evidence of underground fuel tanks (fuel pumps, covers, vent pipes, how many and how large, fill point, used / disused, and condition)?	Yes/No Yes/No Yes/No	N/A N/A N/A
Accidents	In the event of a large spillage would runoff affect any vulnerable watercourse/culverts? Are emergency procedures / equipment in place?	Yes/No Yes/No	

Desk Study features checked during site visit	Feature and Information required	Present	Description / Comments
Waste	Are there any waste skips present on site? Are waste storage facilities adequate? Is there any litter/fly tipped material?	Yes/No Yes/No Yes/No	N/A Litter and fly tipped material is evident, particularly towards the south of the site.
Atmospheric	Are there any fumes, odours originating from site or affecting site from neighbouring sites?	Yes/No	N/A
Access / Further Investigations	If a Phase 2 Investigation is likely to be required, describe any access problems including headroom where relevant, services, overhead cables, restricted access areas, confined spaces, trafficked areas, etc that are likely to affect investigation scope/techniques. Identify possible site office and storage locations. Identify possible water supply		Tight residential access roads are not ideal to transport large, heavy machinery to the site. Various mature trees are present which may reduce headroom. Scar across site entrance indicates service to the site (suspected water pipe.) On made ground on the north of the site. Water supply from a suspected water pipe located at the site entrance or from River Roch.
Site Environs	Are there any local features that could have a harmful influence e.g. landfill, industrial processes, railway land? Are there any sensitive water features/courses near to the site?	Yes/No Yes/No	M66 motorway located on the western boundary may have a potential harmful influence. River Roch located on the northern boundary will be sensitive to onsite works due to its close proximity.
Local Knowledge / Anecdotal Evidence			N/A
Site Dimensions	Describe shape of Site in plan and measure dimensions.		The maximum dimensions of the proposed site are 168.1m north to south and 88.1m west to east. The site occupies an area of approximately 1.11 hectares.

APPENDIX 4

REPORT LIMITATIONS

LIMITATIONS

This contract was completed by Earth Environmental & Geotechnical Ltd on the basis of 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 2021 and should be read in light of 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 from 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.